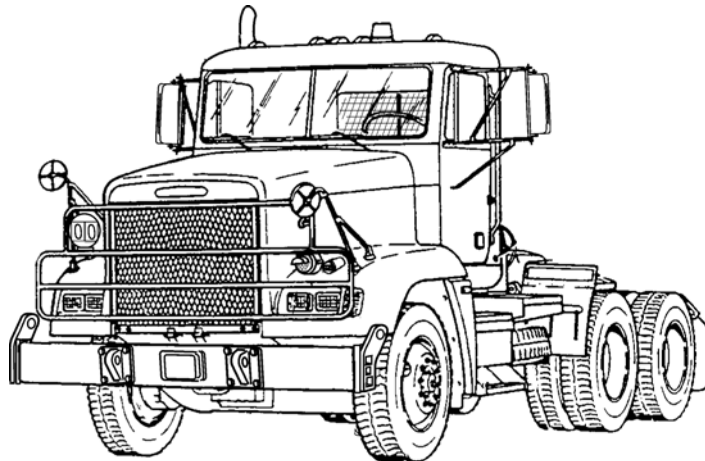
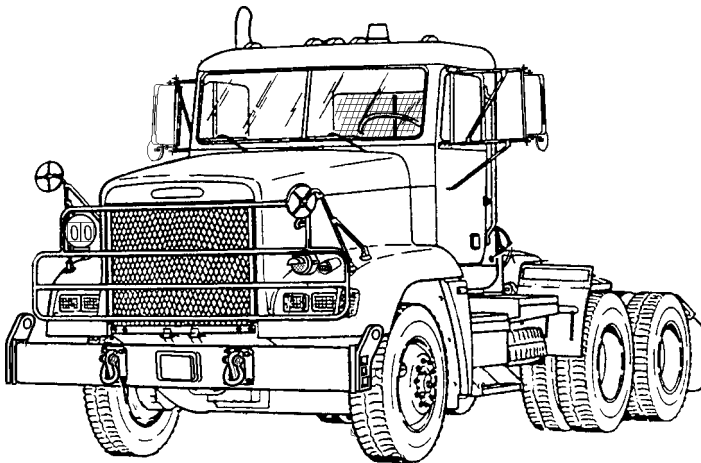


**UNIT, DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE MANUAL**

FOR

**TRUCK, TRACTOR, LINE HAUL:
52,000 GVWR, 6 X 4, M915A4
(NSN 2320-01-458-1207) (EIC: B4M)**

**TRUCK, TRACTOR, LINE HAUL:
54,000 GVWR, 6 X 4, M915A4R2
(NSN 2320-01-531-9962) (EIC: BFV)**



Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 2005

WARNING SUMMARY

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



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



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



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



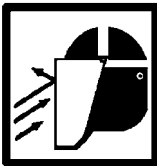
ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.



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



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



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



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



HEAVY PARTS - hand with heavy object on top shows that heavy parts can crush and harm.



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



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



SLIPPERY - feet and legs on surface shows slippery area that presents a danger of falling.



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

FOR INFORMATION ON FIRST AID, REFER TO FM 4-25.11.



WARNING

CARBON MONOXIDE (EXHAUST GASES) CAN KILL!

- Carbon monoxide is a colorless, odorless, deadly poison which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air containing carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, and coma. Permanent brain damage or death can result from severe exposure.
 - Carbon monoxide occurs in exhaust fumes of internal combustion engines. Carbon monoxide can become dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed to ensure safety of personnel when engine of truck is operated.
1. DO NOT operate vehicle in an enclosed area unless exhaust is vented to outside atmosphere.
 2. DO NOT drive truck with inspection plates or cover plates removed.
 3. BE ALERT for exhaust poisoning symptoms. They are:
 - Headache
 - Dizziness
 - Sleepiness
 - Loss of muscular control
 4. If you see another person with exhaust poisoning symptoms:
 - Remove person from area.
 - Expose to fresh air.
 - Keep person warm.
 - Do not permit physical exercise.
 - Administer cardiopulmonary resuscitation (CPR), if necessary.
 - Notify a medic.
 5. BE AWARE. The field protective mask for nuclear-biological-chemical (NBC) protection will not protect you from carbon monoxide poisoning.

The Best Defense Against Carbon Monoxide Poisoning Is Good Ventilation!



WARNING



ADHESIVES AND SEALING COMPOUNDS

Adhesives 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 a well-ventilated area. If adhesive or sealing compound contacts skin or clothing, wash immediately with soap and water.



WARNING

AIR LINES AND FITTINGS

- DO NOT disconnect any air system lines or fittings unless vehicle engine is shut down and air system pressure is relieved. Failure to follow this warning could result in serious injury to personnel.
- Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel and damage to equipment.
- Always wear eye protection when disconnecting air lines. Residual air will be expelled. Failure to follow this warning may result in serious eye injury.



WARNING

BATTERIES

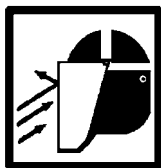


- To avoid eye injury, eye protection is required when working around batteries. DO NOT smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, injury to personnel, and damage to equipment.
 - Sulfuric acid contained in batteries can cause serious burns. Always wear goggles, gloves, and apron. If battery corrosion or electrolyte makes contact with skin, eyes or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in death or serious injury to personnel.
1. **Eyes.** Flush with cold water for no less than 15 minutes and seek medical attention immediately.
 2. **Skin.** Flush with large amounts of cold water until all acid is removed. Seek medical attention as required.
 3. **Internal.** If corrosion or electrolyte is ingested, drink large amounts of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Seek medical attention immediately.
 4. **Clothing/Equipment.** Wash area with large amounts of cold water. Neutralize acid with baking soda or household ammonia.

WARNING

BRAKES

- When caging brakes, block wheels to keep truck from moving when brakes are released. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- Brake chamber contains spring under great pressure. To prevent personnel injury, never work directly behind chamber. If caging bolt will not engage properly, spring may be broken.
- DO NOT remove clamp ring around spring brake chamber. It is under tension and can cause personnel injury if released.
- When spring brakes are applied, vehicle will stop quickly which could result in injury to personnel. Also, vehicle cannot be driven again until malfunction is repaired and enough air supply is present for operation of service brakes.
- Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.



WARNING

COMPRESSED AIR

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.



WARNING

DIESEL FUEL HANDLING



- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicle.
- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in a well-ventilated area. Failure to follow this warning could result in serious injury to personnel.
- Personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.



WARNING

ETHER QUICK-START SYSTEM



Ether fuel is extremely flammable and toxic. DO NOT smoke and make sure you are in a well-ventilated area away from heat, open flames or sparks. Wear goggles and chemical resistant gloves. Avoid contact with skin and eyes and avoid breathing vapors. If fluid enters or fumes irritate the eyes, wash immediately with large quantities of clean water for 15 minutes. Seek medical attention immediately if ether is inhaled or causes eye irritation. Failure to follow this warning may cause death or serious injury to personnel.



WARNING

FIRE EXTINGUISHER

Discharging large quantities of dry chemical fire extinguisher in cab may result in temporary breathing difficulty during and immediately after the discharge event. If at all possible, discharge fire extinguisher from outside the cab. Avoid unnecessary contact during use and cleanup. Contact local medical personnel to determine necessary personal protective equipment to wear during cleanup.



WARNING

HAZARDOUS WASTE DISPOSAL

When servicing this vehicle, performing maintenance, or disposing of materials such as engine coolant, transmission fluid, lubricants, battery acids or batteries, and 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.



WARNING

HEARING PROTECTION

Hearing protection is required when operating vehicle at more than 40 mph (64 kph) with windows open for an extended period of time. Hearing protection is also required when personnel are within 5.2 ft (1.57 m) of vehicle when operating at low engine idle (600 rpm) and within 16.5 ft (5 m) of vehicle when operating at high idle (1600 rpm). Failure to follow this warning may result in hearing damage.



WARNING

NBC EXPOSURE

If NBC exposure is suspected, all air cleaner media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.



To order this NBC decal use:

National Stock Number (NSN) - 7690-01-114-3702

Part Number (PN) - 12296626

Commercial and Government Entity Code (CAGEC) - 19207



WARNING

PRESSURIZED COOLING SYSTEM

DO NOT remove radiator cap or drain antifreeze unless engine is cold. Remove radiator cap in two steps. First, place a thick cloth over cap and slowly turn cap left to first stop. Pause and allow pressure to escape. Turn cap further left until it can be removed. This is a pressurized cooling system and escaping steam, hot water or coolant will cause serious burns.



WARNING

R-134A REFRIGERANT



- Liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Use care to prevent refrigerant from touching your skin or eyes. Serious injury or blindness may result if you come in contact with refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in a fire or explosion, which could cause personnel injury.
- DO NOT work in an area where refrigerant may contact an open flame or burning material such as a cigarette. When refrigerant contacts extreme heat, refrigerant breaks down into poisonous phosgene gas which, if breathed, causes severe respiratory irritation. DO NOT breathe fumes from an open flame leak detector.



WARNING
SLAVE STARTING

- When slave starting truck, use NATO slave cable that DOES NOT have loose or missing insulation.
- DO NOT proceed if suitable cable is not available.
- DO NOT use civilian-type jumper cables.
- Failure to follow this warning could result in injury to personnel and damage to equipment.

WARNING
TIRE CHANGING

Whenever wheel lug nuts require tightening or a wheel has been removed and replaced, lug nuts must be tightened to the required torque. Failure to follow this warning may result in serious injury to personnel and damage to equipment.

WARNING
TOWING

Brakes will be released when air is applied to a disabled vehicle. DO NOT connect air lines to a disabled vehicle without blocking wheels and connecting tow bar between vehicles. Failure to follow this warning could result in death or injury to personnel and damage to equipment.

WARNING
WORK SAFETY



- Hydraulic jack is intended only for lifting truck, not for supporting vehicle to perform maintenance. DO NOT get under truck after it is raised unless it is properly supported with blocks or jackstands. Failure to observe this warning may result in death or injury to personnel.



- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.



- Improper use of lifting equipment and improper attachment of cables to vehicle can result in serious personnel injury and equipment damage. Observe all standard rules of safety.



- ALWAYS install hood prop after opening hood. Failure to follow this warning could result in severe injury to personnel.

TECHNICAL MANUAL
TM 9-2320-303-24-1
Change No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 28 February 2007

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

**TRUCK, TRACTOR, LINE HAUL:
52,000 GVWR, 6 X 4, M915A4
(NSN 2320-01-458-1207) (EIC: B4M)**

**TRUCK, TRACTOR, LINE HAUL:
54,000 GVWR, 6 X 4, M915A4R2
(NSN 2320-01-531-9962) (EIC: BFV)**

TM 9-2320-303-24-1, dated 30 December 2005, is updated as follows:

Remove old pages and insert new pages:

Remove Pages

*Cover
A and B
i thru vi*

Insert Pages

*Cover
A and B
i thru xii*

1. Replace the following work packages with their revised version:

Work Package Number
WP 0001 00 thru WP 0003 00
WP 0021 00
WP 0058 00
WP 0081 00
WP 0083 00 and WP 0084 00
WP 0094 00 and WP 0095 00
WP 0107 00
WP 0110 00
WP 0116 00 and WP 0117 00
WP 0151 00
WP 0171 00
WP 0197 00
WP 0220 00
Foldouts
.
.
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2. Add the following new work packages:

Work Package Number
WP 0021 01
WP 0058 01 and WP 0058 02
WP 0081 01
WP 0083 01 and WP 0084 01
WP 0087 01 and WP 0087 02
WP 0107 01
WP 0116 01
WP 0151 01
WP 0170 01


TM 9-2320-303-24-1
C1

WP 0173 01
WP 0197 01

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:


JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0609501

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LIST OF EFFECTIVE PAGES/WORK PACKAGES

NOTE

Dates of issue for original and change pages/work packages are:

Original 30 December 2005
 Change 28 February 2007

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 32 AND TOTAL NUMBER OF WORK PACKAGES IS 228 CONSISTING OF THE FOLLOWING:

Page/WP No.	*Change No.
Cover (Back Blank)	1
a to h	0
A (B Blank)	1
i to xii	1
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WP 0005 00 thru 0020 00	0
WP 0021 00 thru 0024 00	1
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* Zero in this column indicates an original page or work package.

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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 Publications and Blank Forms*), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <https://aeeps.ria.army.mil/>. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or e-mail your letter or DA Form 2028 direct to: AMSTA-LC-LPIT/TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is: ROCK-TACOM-TECH-PUBS@conus.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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VOLUME III TRANSMISSION TROUBLESHOOTING (M915A4R2) (GENERATION 4 TRANSMISSION)

HOW TO USE THIS MANUAL

INTRODUCTION

This manual is designed to help you maintain the M915A4 and M915A4R2. There are three volumes.

Volume I contains introductory information and Unit Maintenance troubleshooting and maintenance. Volume II contains Direct and General Support Maintenance troubleshooting and maintenance. Volume III contains troubleshooting procedures for the Generation 4 transmission used in the M915A4R2.

FEATURES OF THIS MANUAL

- A Table of Contents is provided at the beginning of this manual.
- WARNINGS, CAUTIONS, NOTES, subject headings, and other important information are highlighted in **BOLD** print as a visual aid.

WARNING

A WARNING indicates a hazard which results in death or serious injury.

CAUTION

A CAUTION is a reminder of safety practices or directs attention to usage practices that may result in damage to equipment.

NOTE

A NOTE is a statement containing information that will make the procedures easier to perform.

- Statements and words of particular importance are printed in CAPITAL LETTERS to create emphasis.
- Instructions are located with illustrations that show the specific task on which the mechanic is working.
- Numbers located at lower right corner of art (e.g., 402-001, 426-001, etc.) are art control numbers and are used for tracking purposes. Disregard these numbers.
- Dashed leader lines used in illustrations indicate that called out items are not visible (i.e. they are located within the structure). Dashed leader lines in the Lubrication Chart indicate that lubrication is required on BOTH sides of the equipment.
- Technical instructions include metric units in addition to standard units. A metric conversion chart is provided on the inside back cover.
- An alphabetical index is provided at the end of the manual to assist in locating information not readily found in the Table of Contents.

FOLLOW THESE GUIDELINES WHEN YOU USE THIS MANUAL

- Read through this manual and become familiar with its contents before attempting to maintain the vehicle.
- A Warning Summary is provided at the beginning of this manual and should be read before attempting to maintain the vehicle.

CHAPTER 1
GENERAL INFORMATION, EQUIPMENT DESCRIPTION
AND THEORY OF OPERATION

GENERAL INFORMATION

0001 00

OVERVIEW

This section contains information that may be useful when performing unit and direct support maintenance tasks on both models. For additional information, refer to TM 9-2320-303-10.

SCOPE

1. **Type of Manual.** This manual is for use in operating and maintaining the M915A4 and M915A4R2 truck tractor.
2. **Equipment Name and Model Number.** Truck, Tractor, Line Haul: 52,000 GVWR, 6X4, M915A4; Truck, Tractor, Line Haul: 54,000 GVWR, 6 X 4, M915A4R2.
3. **Purpose of Equipment.** The M915A4 and M915A4R2 truck tractors are 6 X 4 prime movers of semitrailers used primarily to transport containers, bulk cargo, and petroleum products over primary and secondary roads under worldwide climatic conditions in a military environment.

MAINTENANCE FORMS AND PROCEDURES

Department of the Army forms and procedures used for the equipment will be those prescribed by DA Pam 750-8, *The Army Maintenance Management System (TAMMS) Users Manual*, as contained in the Maintenance Management Update.

CORROSION PREVENTION AND CONTROL (CPC)

1. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.
2. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.
3. If a corrosion problem is identified, it can be reported using SF Form 368 (*Product Quality Deficiency Report*). Use of key words such as “corrosion,” “rust,” “deterioration,” or “cracking” will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 750-8.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For destruction of Army materiel to prevent enemy use, refer to TM 750-244-6.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS)

If your truck 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 or performance. Put it on an SF Form 368 (*Product Quality Deficiency Report*). Mail it to us at: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-LPIT, Rock Island, Illinois 61299-7630. We'll send you a reply.

WARRANTY INFORMATION

The vehicles are warranted by Freightliner Corporation in accordance with TB 9-2320-303-15. Warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your Unit Maintenance shop.

PREPARATION FOR SHIPMENT OR STORAGE

Before loading an M915A4 or M915A4R2 coupled to a trailer onto a Roll-on/Roll-off (RO/RO) ship, if degree transition exceeds 10 degrees, remove fuel tank step assembly (WP 0161 00) and fifth wheel rear tilt stops (WP 0170 01). For additional preparation for storage or shipment procedures, refer to TM 740-90-1 and MIL-V-62038E.

NOMENCLATURE CROSS-REFERENCE LIST

COMMON NAME	OFFICIAL NOMENCLATURE
Cold Start System	Ether Quick-Start System
Differential Lock/Unlock	Interaxle Lockout
Engine Coolant	Antifreeze, Ethylene Glycol Mixture
Gladhand	Quick Disconnect Coupling
Jake Brake	Engine Brake
Komfort Loc®	Seat Belt Adjustment
No Spin®	Automatic Locking Positive Traction Differential

LIST OF ABBREVIATIONS

NOTE

Refer to ASME Y14.38-1999 for standard abbreviations.

ABBREVIATION	DEFINITION
ABS	Anti-Lock Brake System
C	Centigrade or Celsius
CID	Cubic Inch Displacement
cm	Centimeter
CPU	Central Processing Unit
CWS	Collision Warning System
DDU	Driver's Display Unit
ECU	Electronic Control Unit
F	Fahrenheit
GCWR	Gross Combination Weight Rating
GVWR	Gross Vehicle Weight Rating
HVAC	Heating, Ventilating, Air Conditioning
kg	Kilogram
kph	Kilometers per Hour
km	Kilometer
kPa	Kilopascal
KW	Kilowatt
L	Liter
lb	Pound
lb-ft	Pound foot
lb-in	Pound inch
lph	Liters per Hour
m	Meter
mm	Millimeter
MSD	Maintenance Support Device
Ncm	Newton Centimeter

GENERAL INFORMATION - CONTINUED

0001 00

LIST OF ABBREVIATIONS - CONTINUED

ABBREVIATION	DEFINITION
Nm.....	Newton Meter
PMCS	Preventive Maintenance Checks and Service
psi	Pounds per Square Inch
rpm	Revolutions per Minute
TCM	Transmission Control Module
TMDE	Test, Measurement, and Diagnostic Equipment

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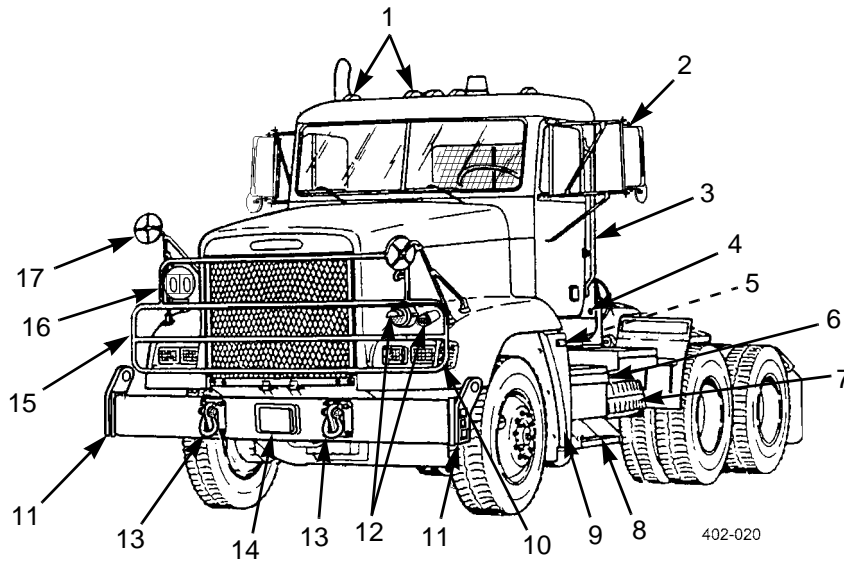
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES1. **Characteristics.**

- a. Both models are used to transport M871, M872, M967/M969/M970 5,000 gallon fuel tankers, and M1062 7,500 gallon fuel tankers on line haul missions.
- b. The M915A4 has a Gross Vehicle Weight Rating (GVWR) of 52,000 lb (23,608 kg), 54,000 lb (24,516 kg) for M915A4R2, and are equipped with a two-way oscillating, sliding fifth wheel compatible with a two-inch kingpin. Maximum towed load on kingpin is 30,000 lb (13,620 kg).

2. **Capabilities and Features.**

- a. While operating on Class I roads, a fully loaded M915A4 or M915A4R2 can maintain a speed of 65 mph (105 km) and 29 mph (47 kph) while ascending a 3 percent grade. It has a minimum turning diameter, curb-to-curb, of 53 ft 9 in. (16.4 m).
- b. Average cruising ranges at Gross Combination Weight Rating (GCWR) with a full tank of fuel will vary based on conditions (e.g., varying loads, prolonged idle, and climatic conditions). Cruising range is optimally 300 miles (483 km).
- c. Both models are equipped with an instrument panel mounted speedometer and tachometer which register truck ground speed and engine speed.
- d. Both models have the following capabilities and features:
 - (1) air-activated front and rear non-asbestos cam brakes with a four-channel anti-lock brake system (ABS) to provide significantly improved handling and braking during emergency stops;
 - (2) operation in temperatures from -25°F (-32°C) to +125°F (+52°C), and to -40°F (-40°C) with arctic kit installed;
 - (3) start and climb capability of a 20 percent grade at GCWR in both forward and reverse directions;
 - (4) fording capability up to 20 in. (51 cm) deep for 5 minutes without damage or requiring maintenance before operations can continue;
 - (5) two-passenger aluminum corrosion-proof cab with a 90 degree tilt-forward hood for service accessibility;
 - (6) six cylinder, 14 liter, 400 horsepower, in-line turbocharged diesel engine built by Cummins;
 - (7) Allison HD 4560P four-speed (or five-speed if equipped) (M915A4) or 4500SP five-speed (M915A4R2) automatic transmission.
- e. When operating in arctic conditions, both models can be equipped with an arctic heater, mounted under the cab, above the battery box. This provides heat for the cab and the engine cooling system. The arctic heater may be operated prior to starting the engine to provide preheating of engine block.
- f. Collision Warning System (CWS) that warns the driver of potentially dangerous driving situations by activating visual and audible alerts.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

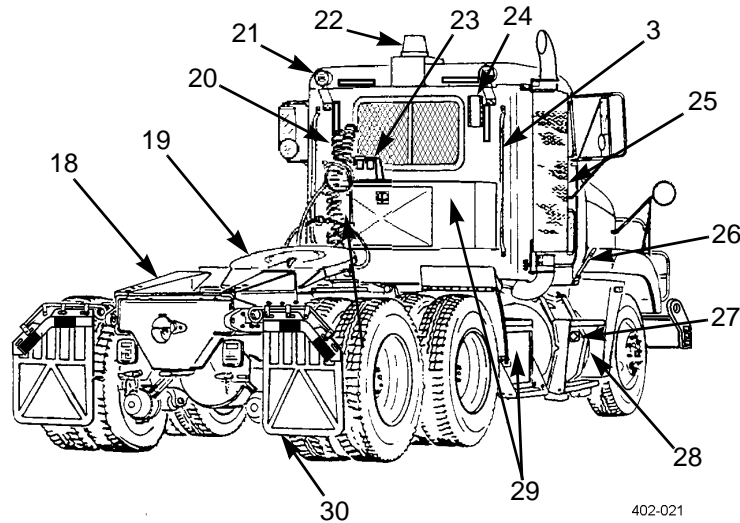


Key	Component	Description
1	Marker Clearance Lights	Indicate outline of truck.
2	Side Mirrors (Heated, M915A4 or Heated/Remote Controlled, M915A4R2)	Provide driver with a view of sides of truck.
3	Grabhandles	Provide a hand hold for personnel climbing on truck.
4	Utility Power Receptacle	Supplies power for work lights. Located on both sides of truck.
5	Air Horn	Provides an audible alert.
6	Master Battery Switch	Provides battery power to truck.
7	Spare Wheel and Tire	Extra wheel and tire used in case of a flat tire.
8	Battery Box and Steps	Holds vehicle batteries and provides steps to access cab.
9	NATO Slave Receptacle	Provides connection point for NATO cable to slave start vehicle.
10	Front Service Lights	Include headlights and turn signals.
11	Bumper Extensions	Provide adjustable attachment point for slings.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED

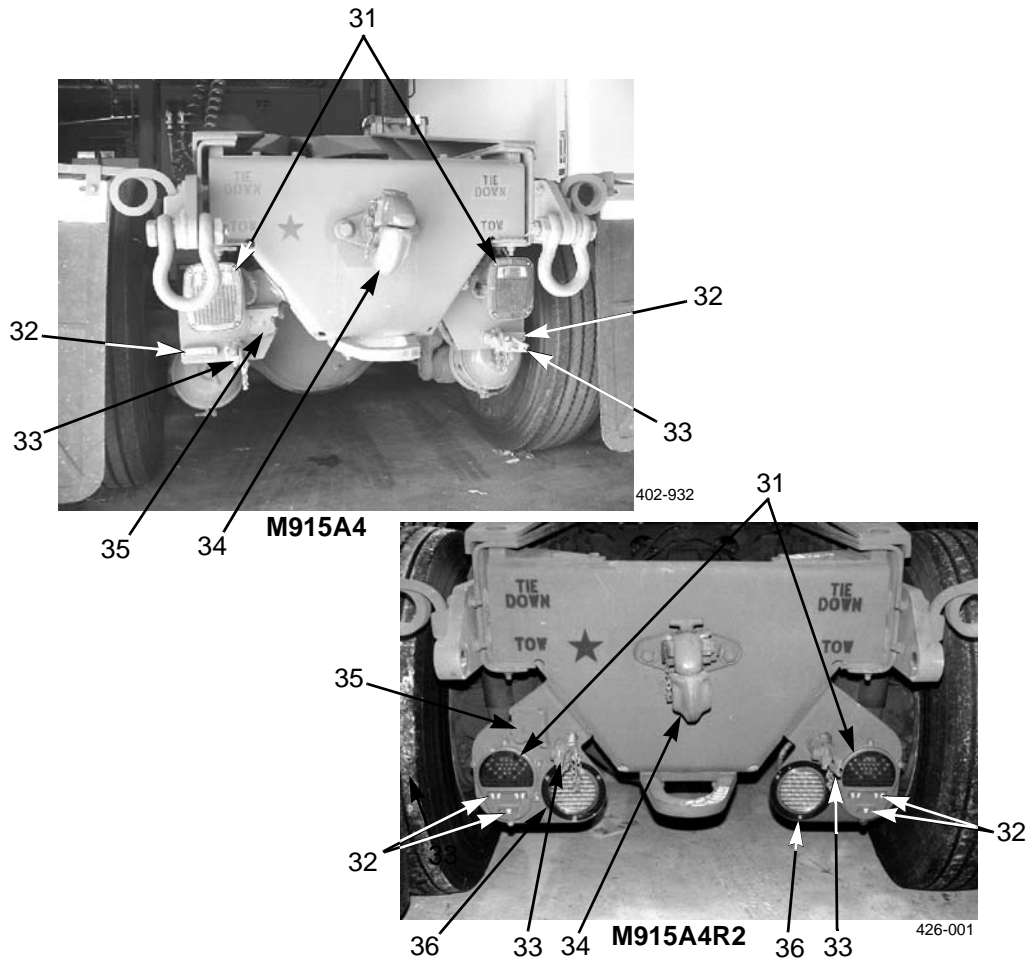
Key	Component	Description
12	Blackout Lights	Used during blackout conditions. Includes marker and drive lights.
13	Towing Eyes	Provide attachment points for towing device.
14	CWS Antenna	Forward looking collision warning system antenna.
15	Brush Guard	Protects front of hood and components under hood from damage.
16	Military Classification Sign	Placard used to display military weight classification.
17	Spotting Mirrors	Provide added visibility to sides of truck and semitrailer if towing.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



Key	Component	Description
3	Grabhandles	Provide a hand hold for personnel climbing on truck.
18	Ramp	Sloped surface serves as an approach to fifth wheel and facilitates coupling of semitrailer.
19	Fifth Wheel	Coupling device for semitrailers with kingpins.
20	Air Lines	Provide air supply for trailer brakes.
21	Utility Lights	Illuminate area in back of cab. There is one light on each side of cab.
22	Beacon Warning Light	Amber rotating light alerts other vehicles of presence of truck.
23	Intervhicular Receptacles	Contains 12-volt commercial, 24-volt military, and trailer ABS receptacles.
24	Antenna Mount	Mount for radio antenna.
25	Exhaust Muffler	Deadens noise of engine exhaust.
26	Hood Latch	Locks hood closed. Located on both sides of hood.
27	CWS Side Sensor	Side looking collision warning system sensor.
28	Fuel Tank	Holds fuel. Steps mounted to tank provide access to cab.
29	Storage Boxes	Provide stowage area for BII and other items.
30	Mud Flaps	Prevent water and debris from spraying up on passers by or towed semitrailer.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



Key	Component	Description
31	Taillights	Contain composite tail, stop, backup, and turn signal lights.
32	Blackout Lights	Used during blackout conditions. Includes marker and stop lights.
33	Trailer Gladhands	Provide air supply for brakes of trailer.
34	Pintle Hook	Coupling device for trailers with lunettes.
35	Power Receptacle	24V electrical receptacle used for lunette towing.
36	Backup Lights (M915A4R2)	Lights come on when R (Reverse) is selected.

DIFFERENCE BETWEEN MODELS

ITEM	VEHICLE MODEL	
	M915A4	M915A4R2
Transmission	Allison HD 4560P 4-speed (or 5-speed if equipped)	Allison (Gen4) 4500SP 5-speed
Shift Selector	Floor-mounted	Dash-mounted
Side Mirrors	Heated	Heated/Remote controlled
Front Axle (Loaded)	12,000 lb (5448 kg)	14,000 lb (6356 kg)
Electrical	Alternator-mounted voltage regulator	Alternator w/remote-mounted voltage regulator
Diagnostic Connector	6-pin	9-pin
Rear Electrical	12V/24V/ABS	12V/24V (ABS built-in)
Daytime Running Lights	No	Yes
Tire Size	Front: XZE 11R22.5 Rear: XZE 11R22.5	Front: XZE 12R22.5 Rear: XZE 11R22.5
Tire Ply Rating	14PR	16PR
Fifth Wheel	Holland Lo-Lube	Holland Lo-Lube w/removable tilt stops

EQUIPMENT DESCRIPTION AND DATA

0002 00

EQUIPMENT DATA

Dimensions:

Length (Overall).....	275.5 in. (700 cm)
Height (Overall).....	119 in. (302 cm)
Width (Overall).....	98 in. (249 cm)
Wheelbase.....	162 in. (411 cm)
Ground Clearance.....	.9 in. (23 cm)
Angle of Approach.....	27°

Weights:

Curb.....	18,680 lb (8481 kg)
GVWR (M915A4).....	.52,000 lb (23,608 kg)
GVWR (M915A4R2).....	.54,000 lb (24,516 kg)
GCWR.....	105,000 lb (46,670 kg)
Front Axle (Loaded).....	12,000 lb (5448 kg)
	(M915A4) or 14,000 lb (6356 kg) (M915A4R2)
Rear Axle (Loaded).....	40,000 lb (18,160 kg)

Capacities:

Engine Oil (Refill w/Filters).....	46 qt (43.5 l)
Cooling System.....	17.25 gal. (65.3 l)
Fuel Tank.....	100 gal. (378.5 l)
Power Steering Reservoir.....	2 qt (1.9 l)
Transmission.....	51 qt (48 l)
	(M915A4) or 48 qt (45 l) (M915A4R2)
Rear Axle (Forward/Rear).....	40/36 pts (19/17 l)

Engine:

Manufacturer.....	Cummins
Type.....	4-stroke, in-line turbocharged diesel
Model.....	NTC-400
Cylinders.....	6
Displacement.....	855 CID (14 l)
Torque @ 1500 rpm.....	1150 lb.-ft. (1559 Nm)
Maximum Horsepower @ 2100 rpm.....	400 (298.3 kW)
Maximum Governed Speed.....	2100 rpm
Oil Filter Type.....	1 bypass, 1 primary, replaceable elements
Oil Filter Quantity.....	2

EQUIPMENT DESCRIPTION AND DATA

0002 00

EQUIPMENT DATA - CONTINUED

Towing Eyes:

Quantity 2 front, 2 rear
 Maximum Load Capacity, Each 60,000 lb (27,240 kg)
 (Up to 45 ° Angle Front Long. Axis)

Fifth Wheel:

Manufacturer Holland
 Type 36 in. (91.4 cm)
 diameter, 2-way
 oscillating, low lube
 Capacity 30,000 lb (13,620 kg)
 Height (Empty) 51 in. (129.5 cm)
 Pitch (Fwd/Aft) 15/10°
 Kingpin Size 2 in. (5.1 cm)

Cab:

Manufacturer Freightliner
 Construction aluminum
 Type 2-passenger,
 tilt-forward hood

Accessories:

Utility Lights 2 fixed, top rear of cab
 Air Horn 1, under cab

Military Load Classification:

Vehicle w/o Trailer 8
 Vehicle w/Trailer:
 M871 14/35
 (unloaded/loaded)
 M872 14/46
 (unloaded/loaded)
 M1062 11/34
 (unloaded/loaded)
 M967 13/29
 unloaded/loaded
 M969 14/30
 (unloaded/loaded)
 M970 6/21
 (unloaded/loaded)

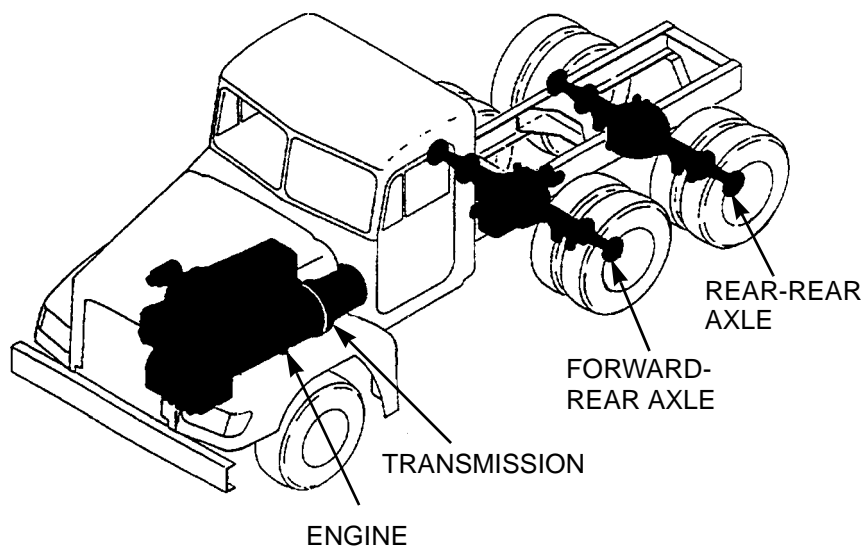
END OF WORK PACKAGE

INTRODUCTION

1. Both models consist of twelve functional systems: drive train, fuel system, exhaust system, cooling system, electrical system, air system, brakes, steering, air conditioning, collision warning system, traction control system, and suspension system.
2. This section explains the overall operation of these systems.

DRIVE TRAIN

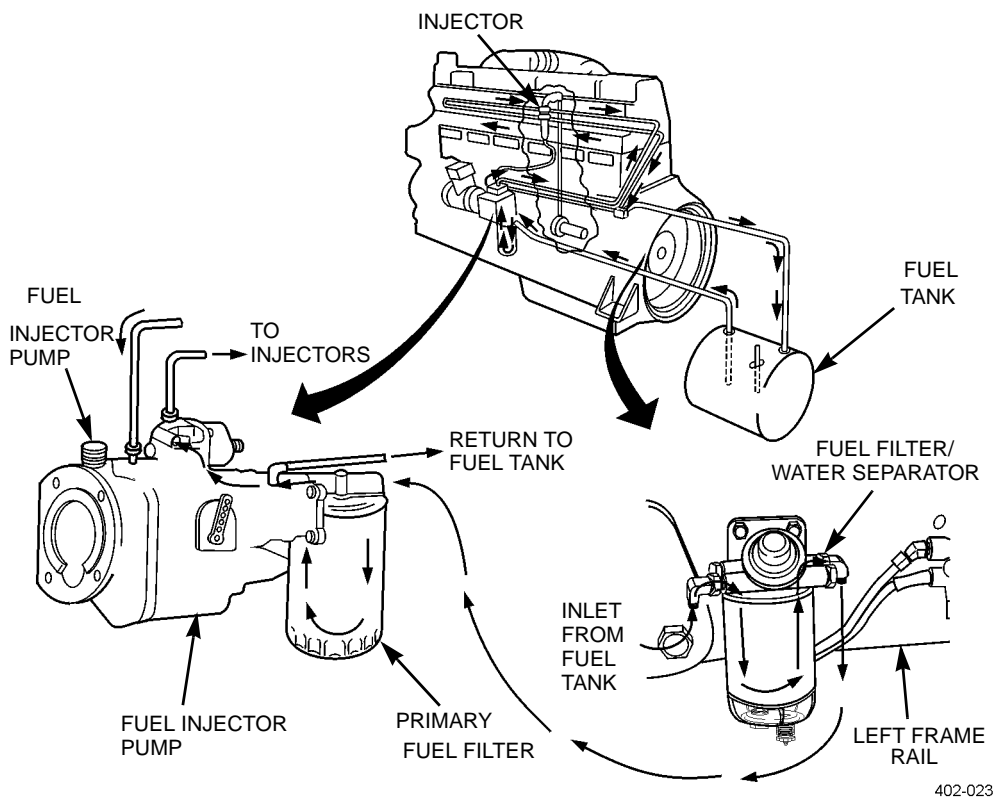
The drive train consists of a Cummins NTC-400 engine and an Allison 4-speed (or 5-speed, if equipped) (M915A4) HD 4560P or 5-speed (M915A4R2) 4500SP automatic transmission connected to Rockwell SQHP rear tandem axles.



402-022

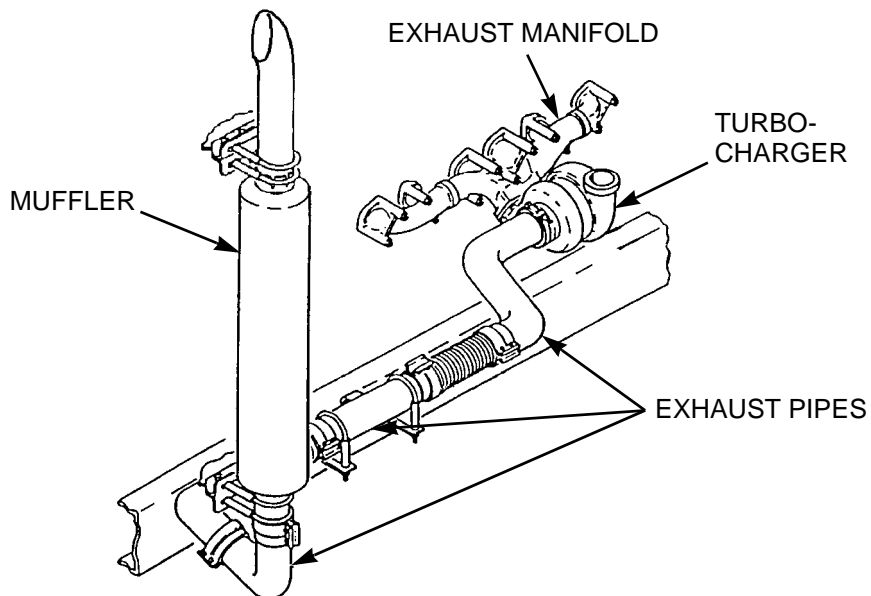
FUEL SYSTEM

1. Fuel to power the engine is pumped out of the fuel tank by an engine-mounted fuel injector pump.
2. The engine fuel system consists of one fuel injector pump, one injector per cylinder, fuel lines, a primary fuel filter, and a fuel filter/water separator.
3. The engine is governed by fuel injector pump built-in governor. The system controls idle speed and limits engine maximum speed. The driver controls engine speed through the position of the foot pedal assembly.
4. Fuel filters are spin-on types. The primary fuel filter has a water drain. The fuel filter/water separator has a hand fuel primer pump and a water drain.
5. Fuel may be drained from the tank through the drain port located on the bottom of the tank.
6. There is an ether quick-start system for use in cold weather. It is manually controlled via a pushbutton on the instrument panel in the cab.



EXHAUST SYSTEM

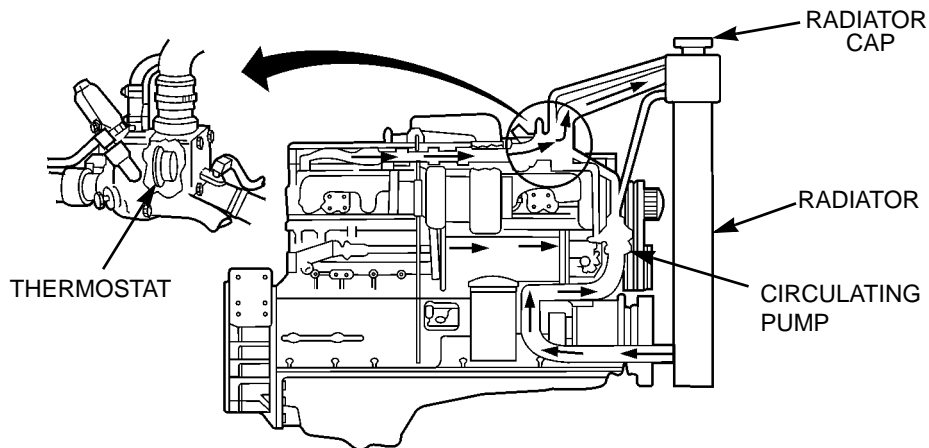
The exhaust system removes exhaust gases from the engine through the exhaust manifold and turbocharger. The gases flow into exhaust pipes and a muffler to the atmosphere above the cab.



402-001

COOLING SYSTEM

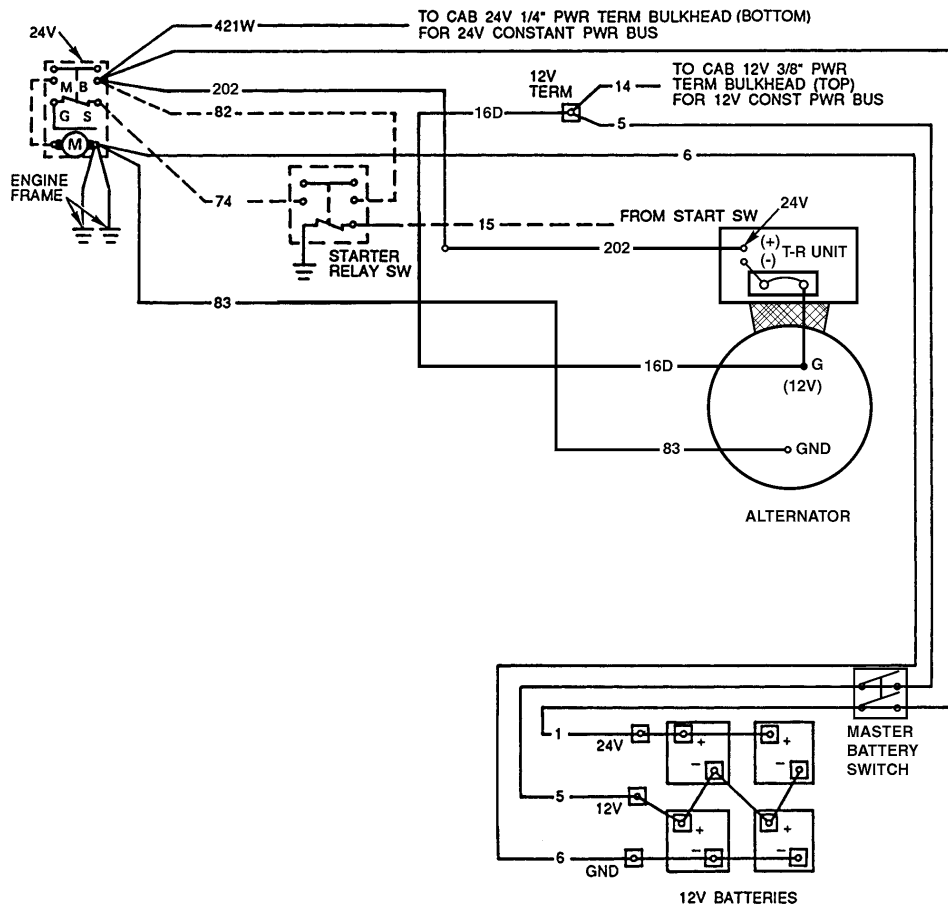
The cooling system consists of one circulating pump, a remote-mounted coolant filter, one 180°F thermostat for controlling fluid flow, a transmission oil cooler, a radiator, and a belt-driven fan. The cooling system cools the engine by means of circulating pressurized ethylene-glycol based coolant through the engine and radiator.



402-024

ELECTRICAL SYSTEM

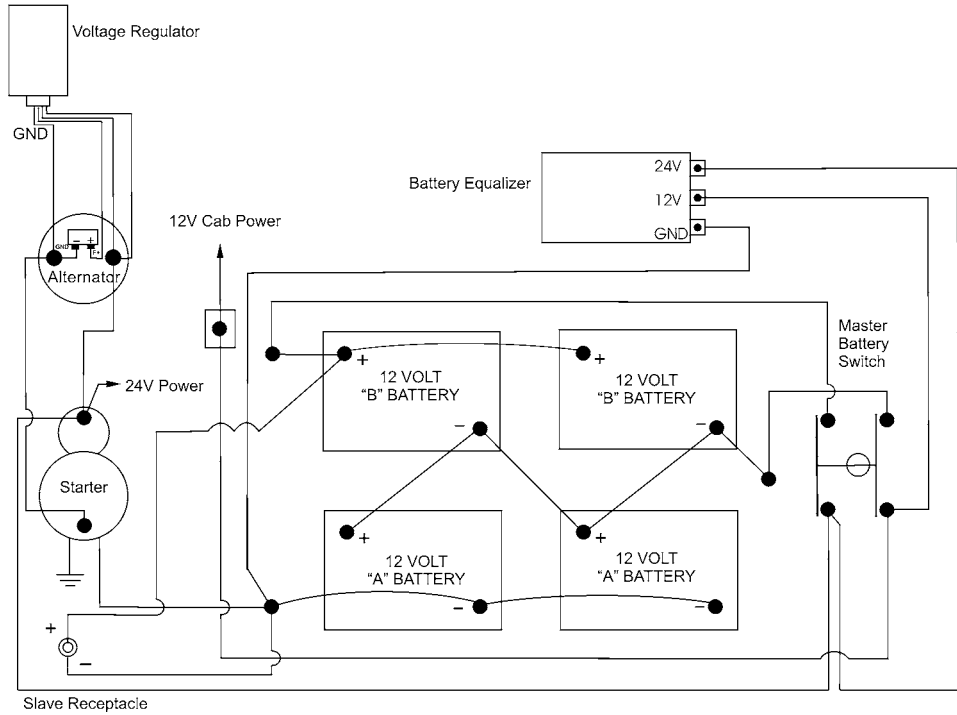
1. Four 12-volt batteries connected in series-parallel supply the 12-volt electrical system and provide 24 volts for the starter motor, blackout lights, accessories, and trailer connectors.
2. The voltage regulator regulates system voltage.



M915A4

402-096

ELECTRICAL SYSTEM - CONTINUED

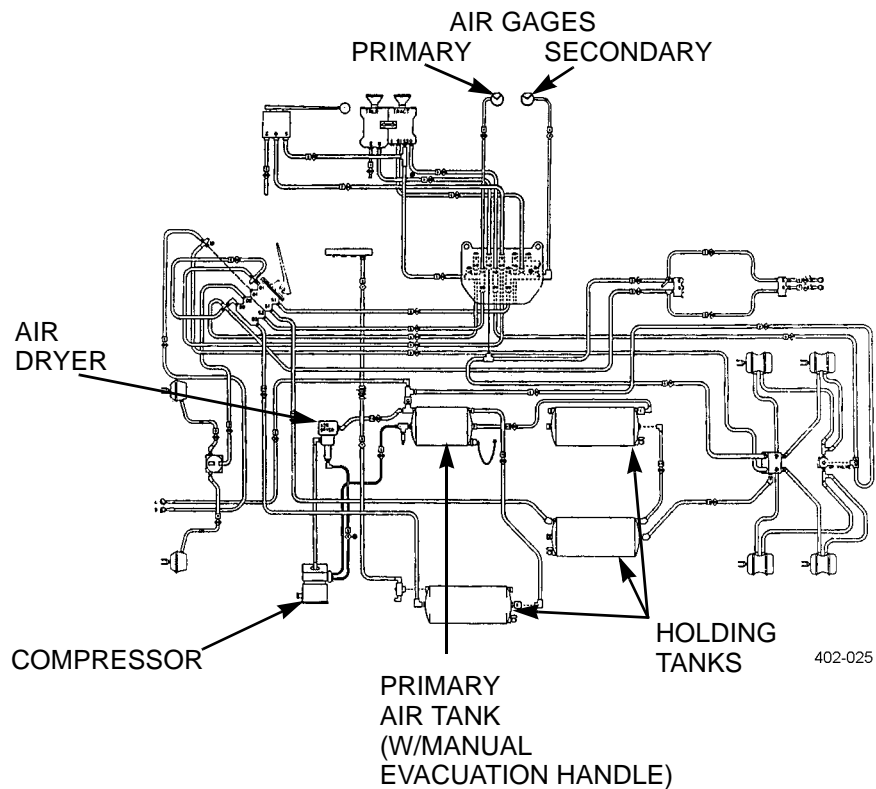


M915A4R2

426-030

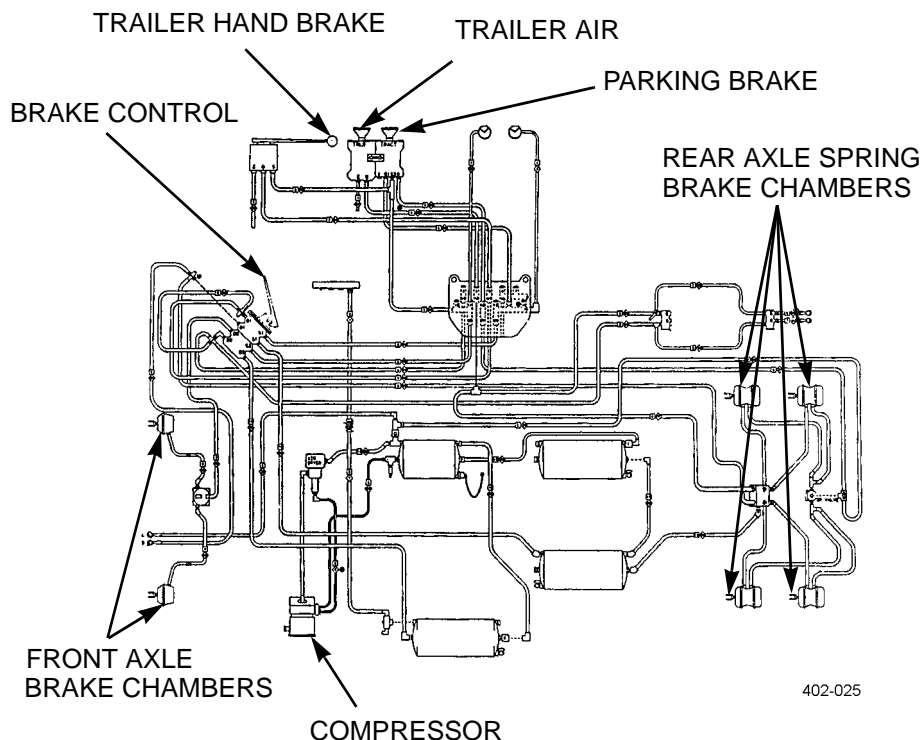
AIR SYSTEM

The air system consists of the air compressor, air dryer, air reservoirs, and various air lines. Also included in the air system are air pressure gages located on the dashboard which are used for monitoring air pressure for safe operation of all air-operated components of the vehicle. Each air tank has an automatic air/water evacuation valve. The primary air tank (wet tank) also has a pull lanyard attached for manual evacuation.



BRAKE SYSTEM

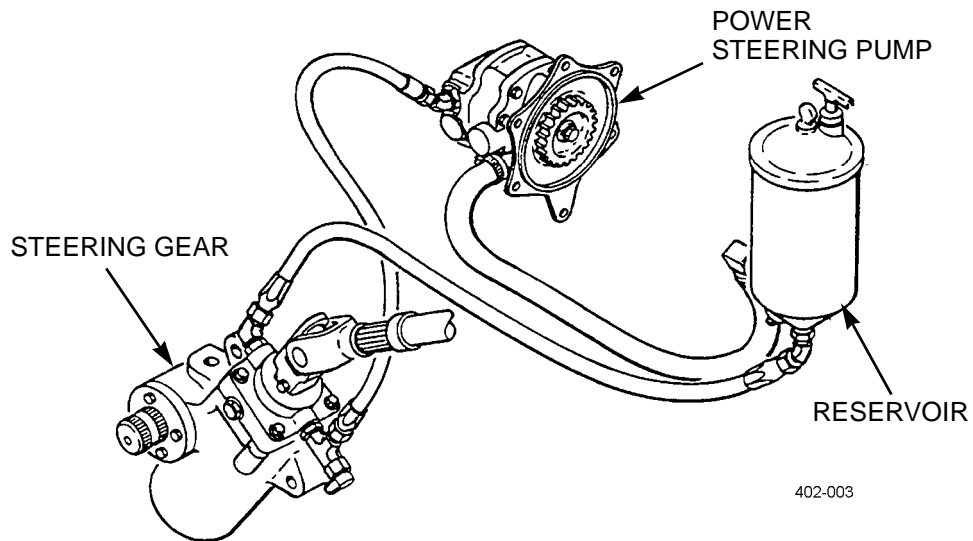
1. The dual air brake system consists of two independent air brake systems that use a single set of brake controls. Each system has its own reservoirs, plumbing, and brake chambers. The primary system operates the service brakes on the rear axle; the secondary system operates the service brakes on the front axle. On tractor-trailer configurations, service brake signals from both systems are sent to the trailer.
2. Loss of air pressure in the primary system causes the spring parking brakes to apply and stop the vehicle; front brakes will continue to be operated by secondary system air pressure. In addition, trailer brakes will be operated by the secondary system. Loss of secondary system air pressure causes the front axle brakes to become inoperative; rear service brakes and trailer brakes will be operated by the primary system.
3. The warning light and buzzer inside the cab come on if air pressure drops below 64 psi (441 kPa) in either system. If this happens, check the air pressure gages to determine which system has low air pressure. Although the vehicle's speed can be reduced using the foot brake control pedal, either the front or rear service brakes will not be operating, causing a longer stopping distance. Bring the vehicle to a safe stop and have the air system repaired before continuing.
4. If the primary system become inoperative, the spring parking brakes will automatically apply when air pressure drops to 35-45 psi (241-310 kPa).
5. The vehicle has a four-channel anti-lock brake system (ABS) and cam-operated service brakes with non-asbestos brake-shoes.
6. Both models have automatically adjusting slack adjusters. On all axles, brake chambers have a stroke alert indicator which allows the operator to monitor brakeshoe wear.



402-025

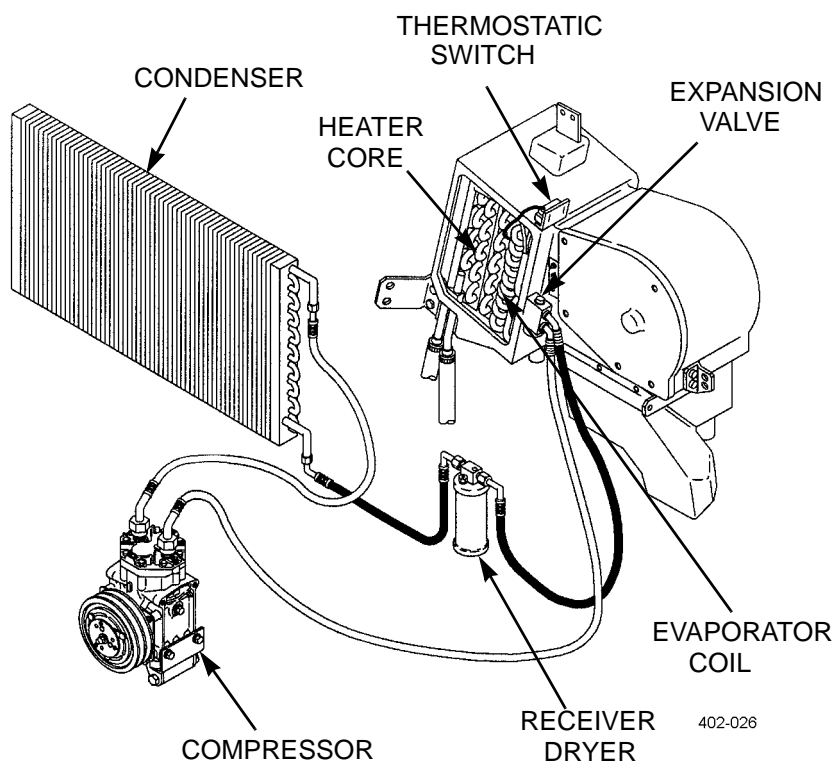
STEERING SYSTEM

1. The power steering system consists of an integral steering gear (which includes a manual steering mechanism and hydraulic control valve), hydraulic hoses, power steering pump, reservoir, and other components.
2. The power steering pump, driven by the engine, provides the power-assist for the steering system.



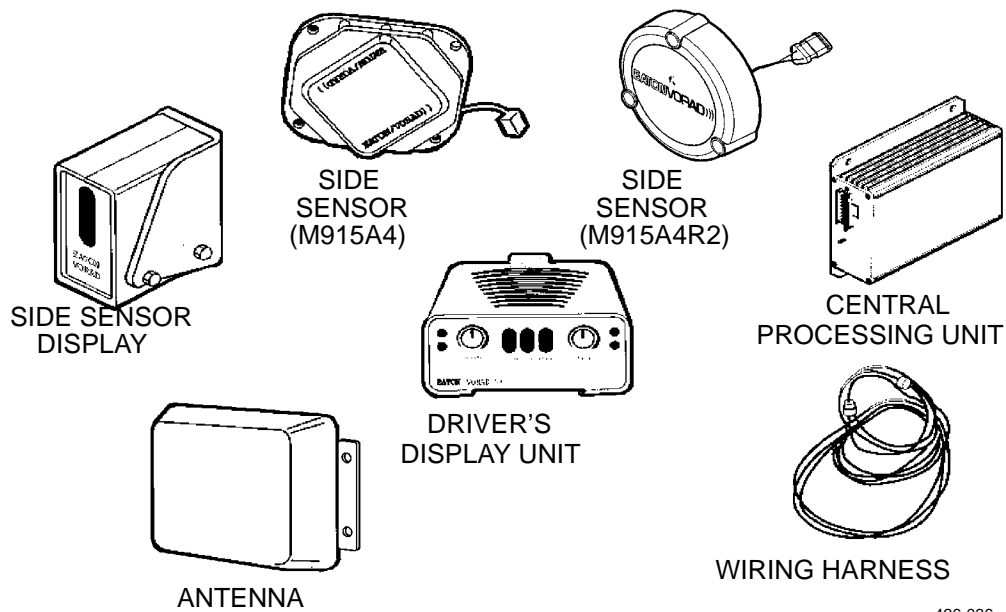
AIR CONDITIONING SYSTEM

1. The air conditioning unit is part of the heater and is mounted under the glove compartment. It is a single unit consisting of heater core, air conditioning evaporator coil, blower motor, control valves, condenser, and air ducts.
2. The system is turned on by the mode control lever on instrument panel in cab. The four-speed blower switch controls flow rate.
3. An even cab temperature is maintained by controlling the coolant flow through the heater core, or refrigerant flow through the evaporator coil.



COLLISION WARNING SYSTEM (CWS)

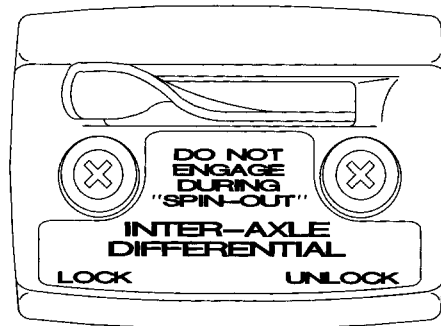
1. The CWS consists of an antenna assembly, central processing unit, driver display unit, side sensor, side sensor display, and wiring harness.
2. The CWS is a forward and side looking radar system that transmits and receives signals reflected off of objects to the front and side of the tractor.
3. The forward looking antenna assembly determines distance, azimuth, and approximate speed of vehicle forward of the tractor.
4. The side sensor detects vehicles or objects from two to ten feet, moving or stationary, alongside the tractor.



426-036

TRACTION CONTROL SYSTEM

The inter-axle differential lock is controlled by the air operated lever labeled INTER-AXLE DIFFERENTIAL on the driver's instrument panel. Under normal driving conditions, the control lever should be in the UNLOCK position. During poor driving conditions the control lever may be moved to the LOCK position to improve traction. When the inter-axle differential lock is applied, the drive shaft becomes a solid connection between the two rear axles.



402-028

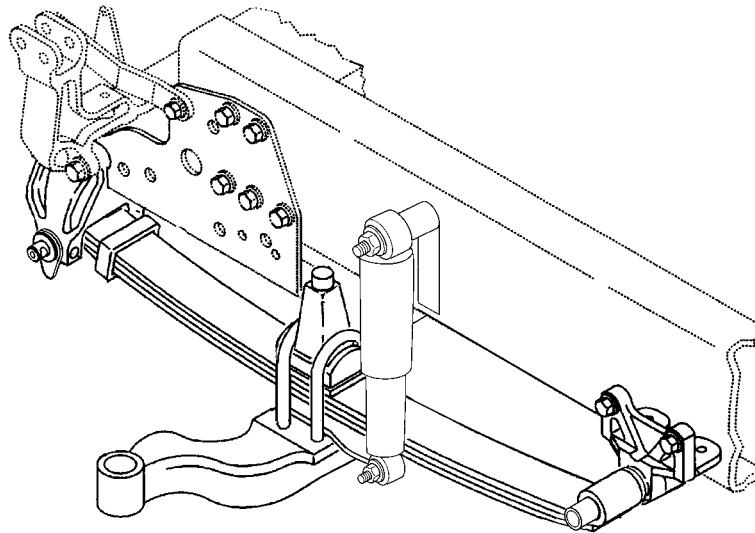
SUSPENSION SYSTEM

The suspension system is designed to provide a high degree of ground clearance and articulation while maintaining an equal load over each wheel. Ride characteristics are similar, whether loaded or unloaded.



**FRONT SUSPENSION
(M915A4)**

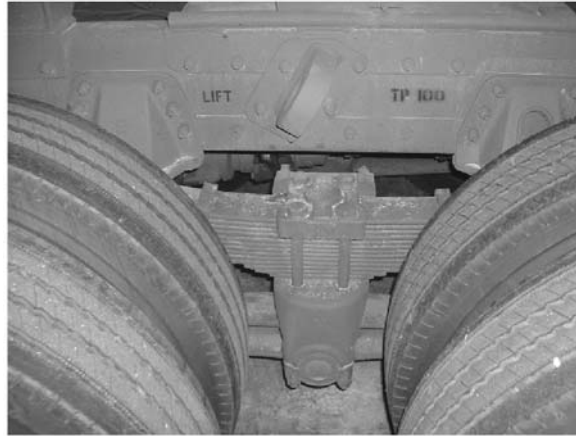
402-931



**FRONT SUSPENSION
(M915A4R2)**

426-031

SUSPENSION SYSTEM - CONTINUED



REAR SUSPENSION

402-014

END OF WORK PACKAGE

CHAPTER 2
UNIT TROUBLESHOOTING PROCEDURES

THIS WORK PACKAGE COVERS

Introduction, Preliminary Troubleshooting Procedures, Electrical Troubleshooting, SPORT/MSD Connection and Startup

INTRODUCTION

Troubleshooting procedures are grouped by work packages, containing information you need to fault locate malfunctions on both models. A troubleshooting symptom index in WP 0005 00 is provided to aid in locating a malfunction or symptom and direct you to the appropriate troubleshooting table (work package) containing a listing of malfunctions, test and inspection procedures, and corrective actions. The corrective action column further directs you to the required corrective maintenance procedure within this manual by work package number. However, if the required maintenance procedure is beyond Unit Maintenance capabilities, the direction is to notify Direct Support Maintenance.

PRELIMINARY TROUBLESHOOTING PROCEDURES**NOTE**

Fluid leaks are classified as either Class I, Class II or Class III.

- 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 drip from item being checked/inspected.
- Class III:* Leakage of fluid great enough to form drops that fall from item being checked/inspected.

Before starting any specific troubleshooting procedures, perform the following:

- a. Visually check for ruptured oil hoses or tubes and for Class II or Class III leaks.
- b. Check for mechanical jamming or binding caused by rocks or other foreign matter.
- c. Check fluid levels in subject area and service as required (WP 0024 00).

ELECTRICAL TROUBLESHOOTING

1. Analyze the symptoms and conditions and use common sense and logic to determine the most likely cause for the problem, then troubleshoot that circuit first. The more information you have concerning the problem, the easier it will be to troubleshoot.
2. Isolate to the subsystem level (in cases where more than one subsystem is involved); next isolate the problem to a single circuit within the subsystem; then, isolate the problem to the faulty component using the troubleshooting symptom index (WP 0005 00).
3. Frayed, broken, loose or corroded wiring is a common source of problems in any electrical circuit. Always make visual inspection before starting detail troubleshooting. Check for loose or damaged ground wires and repair as necessary (WP 0098 00). Observe in particular contacts to ground. Components with case grounds are especially troublesome.

CAUTION

When making continuity checks, make sure the test equipment is isolated from power source.

4. Most of the checks are made by voltage checks. Pay particular attention to the voltages being checked in the procedures. This equipment has a combination of 12 and 24 volt systems. Instructions prior to the step instruct to disconnect at test point from the potential malfunctioning component. Once the check has been made, either repair the component or go to the referenced step. If going to another step, reconnect connection or do as otherwise instructed, such as install jumper wires using Jumper Wire Kit. When ready to make the prescribed check, apply power to the circuit (if required). A helper may be required if the switch or power source is out of reach. Release the power function prior to going on, to avoid damage to equipment.

SPORT/MSD CONNECTION AND STARTUP

1. Connect AC cable to battery pack and AC power source.
2. Connect battery pack cable to SPORT/MSD computer.
3. From SPORT/MSD storage container, remove DPA adapter, J1709 6-pin cable, and SPORT/DPA cable.
4. Connect J1709 cable to DPA adapter.
5. Connect SPORT/MSD/DPA cable (labels next to each connector) to DPA adapter and SPORT.
6. Connect J1709 cable to J1939 diagnostic connector under dashboard.
7. Turn SPORT/MSD to ON.
8. Allow SPORT/MSD to boot up.
9. Enter password or press ESC.
10. Click on EMS-2 VIEWER icon.
11. Click on OPTIONS, then HARDWARE CONFIGURATION, then CONFIGURE INTERFACE HARDWARE.
12. On EMS-2 Application screen, click on OK.
13. On EMS-2 Application screen, select CUSTOM, then J1939 Interface DPA, then click on OK.
14. On SELECT MANUAL TO OPEN menu, select desired manual and press ENTER.
15. On SELECT MANUAL TO OPEN menu, select desired vehicle model and press ENTER.
16. Enter PIN, and press NEXT.
17. Enter PIN, DODACC, and ADMIN info and press OK.
18. Selected manual is presented.
19. Select TROUBLESHOOTING and press ENTER.
20. Follow instructions on screen (ignition ON and perform hardware test).
21. SELECT SYSTEM menu will appear. Ensure DDEC engine listed is DDEC engine for your vehicle.
22. Select desired system.

ELECTRICAL SYMBOLS

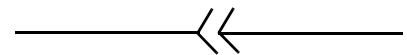
The following symbols are used in the troubleshooting schematics:



CONNECTORS



REFERENCE ONLY



BLADES

END OF WORK PACKAGE

TROUBLESHOOTING SYMPTOM INDEX

0005 00

Malfunction Page Number

ENGINE

- 1. Engine Fails To Crank Or Cranks Slowly..... 0006 00-2
- 2. Engine Will Not Crank. 0006 00-2
- 3. Engine Will Crank But Not Start. 0006 00-3
- 4. Engine Stops, Not Seized. 0006 00-3
- 5. Engine Stops, Seized..... 0006 00-3
- 6. High Oil Consumption. 0006 00-3
- 7. Intermittent Loss of Power. 0006 00-3
- 8. Sudden Loss of Power..... 0006 00-3
- 9. Gradual Loss of Power, No Smoke..... 0006 00-4
- 10. Slow Deceleration, Engine “Floats”..... 0006 00-4
- 11. Erratic Idle Speed. 0006 00-4
- 12. Excessive Exhaust Smoke During Acceleration..... 0006 00-4
- 13. Excessive Exhaust Smoke Throughout Speed Range..... 0006 00-4
- 14. High Fuel Consumption. 0006 00-4
- 15. Low Oil Pressure..... 0006 00-4
- 16. Engine Overheats. 0006 00-5

AIR/FUEL SYSTEM

- 1. Restricted Air Flow to Turbocharger. 0007 00-1
- 2. Fuel Contamination..... 0007 00-1
- 3. Restricted Fuel Supply. 0007 00-1

EXHAUST SYSTEM

- Exhaust Gases Enter Passenger Compartment..... 0008 00-1

COOLING SYSTEM

- Loss of Coolant. 0009 00-1

ELECTRICAL SYSTEM

Charging Circuits

- 1. Batteries Not Charging (Either Voltage), Voltmeter Indicates Voltage..... 0010 00-3
- 2. Batteries Not Charging, Voltmeter Does Not Indicate Voltage..... 0010 00-3
- 3. +12 VDC Circuits Not Charging, +24 VDC Circuits Normal. 0010 00-3
- 4. +24 VDC Circuits Not Charging, +12 VDC Circuits Normal. 0010 00-3

Engine Brake Retarder Circuits

- 1. Engine Brake Retarder (Jake Brake) Not Operating, Transmission Lockup Operating Normally..... 0010 00-4
- 2. Engine Brake Retarder (Jake Brake) Two-Cylinder Brake Not Operating, Four-Cylinder Brake Operating Normally 0010 00-4
- 3. Engine Brake Retarder (Jake Brake) Four-Cylinder Brake Not Operating, Two-Cylinder Brake Operating Normally 0010 00-5

Malfunction

Page Number

ELECTRICAL SYSTEM - CONTINUED

Engine Fan Circuit

- 1. Engine Fan Fails to Operate When Coolant Temperature is 190°F to 210°F (87°C To 98°C). 0010 00-6
- 2. Lack of Fan Clutch Disengagement. 0010 00-6

Headlight Circuits

- 1. Neither Headlight Operates When Switch Is Turned On. 0010 00-8
- 2. Left Headlight Fails To Operate When Switch Is Turned On.. . . . 0010 00-8
- 3. Right Headlight Fails To Operate When Switch Is Turned On. 0010 00-9
- 4. Neither Headlight Low/High Beam Operates When Turn Signal Switch Lever Is Set. 0010 00-9
- 5. Left High-Beam Does Not Operate. 0010 00-10
- 6. Left Low-Beam Does Not Operate.. . . . 0010 00-10
- 7. Right High-Beam Does Not Operate. 0010 00-10
- 8. Right Low-Beam Does Not Operate.. . . . 0010 00-10

Marker and Taillight Circuits

- 1. None Of The Marker Lights And Taillights Operate. 0010 00-12
- 2. Left Front Marker Light Not Operating. 0010 00-12
- 3. Right Front Marker Light Not Operating. 0010 00-12
- 4. One Or More Cab Marker Lights Not Operating. 0010 00-12
- 5. Both Taillights Not Operating, All Marker Lights Operating. 0010 00-13

Blackout Light Circuits

- 1. None Of The Blackout (B/O) Lights Operate.. . . . 0010 00-14
- 2. None Of The Blackout (B/O) Stoplights Operate.. . . . 0010 00-14
- 3. One Or More Blackout (B/O) Stoplights Not Operating. 0010 00-15
- 4. None Of The Blackout (B/O) Marker Lights Operate. 0010 00-15
- 5. One Or More Blackout (B/O) Marker Lights Not Operating. 0010 00-16
- 6. None Of The Blackout (B/O) Drive Lights Operate.. . . . 0010 00-16
- 7. One Or More Blackout (B/O) Drive Lights Not Operating. 0010 00-16

Turn Signal and Stoplight Circuits

- 1. Neither Stoplight Operates. 0010 00-18
- 2. Left Stoplight Not Operating. 0010 00-18
- 3. Right Stoplight Not Operating. 0010 00-18
- 4. None Of The Left Flasher Lights (24 V) Operating. 0010 00-19
- 5. One Of The Left Turn Signal Lights Not Operating.. . . . 0010 00-19
- 6. Left Turn Signal Indicator Light Not Operating, Turn Signals Operating Normally. 0010 00-19

Dome Light Circuits

- 1. Neither Dome Light Operates.. . . . 0010 00-20
- 2. One Dome Light Operates, The Other Does Not In Either Mode. 0010 00-20
- 3. Dome Light Operates In One Switch Mode Only.. . . . 0010 00-20

Malfunction **Page Number**

ELECTRICAL SYSTEM - CONTINUED

Auxiliary Circuits

- 1. None Of The Auxiliary Lights Or Accessory Circuits Operate. 0010 00-21
- 2. No Power To Auxiliary Heater Fan Power Relay. 0010 00-22

Worklight Power Receptacle Circuits

- 1. Neither Worklight Power Receptacle Operates. 0010 00-23
- 2. One Worklight Power Receptacle Not Operating, The Other Receptacle Operating Normally. 0010 00-23

Backup Light Circuits

- 1. Neither Backup Light Operates. 0010 00-24
- 2. Right Or Left Backup Light Not Operating. 0010 00-25

Utility Light Circuits

- 1. Neither Utility Light Operates. 0010 00-26
- 2. Only One Utility Light Operating. 0010 00-26
- 3. Utility Light Indicator Light Not Operating, Utility Lights Operating Normally. 0010 00-26

Electric Horn Circuits

- Electric Horn Does Not Operate. 0010 00-27

Tractor Beacon Light Circuits

- Tractor Beacon Light Not Operating. 0010 00-29

Panel Light Circuits

- 1. None Of The Panel Lights Operating. 0010 00-30
- 2. Heater Control Light Not Operating, Other Heater Circuits Operating Normally. 0010 00-31
- 3. One or more gage lights not operating. 0010 00-31
- 4. Fiber optics not operating 0010 00-31
- 5. Panel lights do not dim. 0010 00-31
- 6. Panel lights do not brighten 0010 00-31

Radio Circuits

- Power Source For 24 VDC Radio Does Not Operate. 0010 00-32

Instrument Wiring Harness Circuits

- 1. None Of The Instruments On Dashboard Operating. 0010 00-33
- 2. Water Temperature Gage Does Not Operate. 0010 00-34
- 3. Transmission Oil Temperature Gage Does Not Operate. 0010 00-34
- 4. Fuel Level Gage Does Not Operate. 0010 00-34
- 5. Voltmeter Does Not Operate, Warning Light Operating Normally. 0010 00-35

Axle Lock Circuit

- Axle Lock Does Not Engage. 0010 00-35

Malfunction Page Number

ELECTRICAL SYSTEM - CONTINUED

Ether Quick-Start Circuit

Ether Quick-start Not Operating, Container Has Ether In It. 0010 00-36

Air Dryer Heater Circuit

Air Dryer Heater Not Operating. 0010 00-37

Standard Heater Circuits

- 1. Heater Fan Does Not Operate In Any Speed. 0010 00-38
- 2. None Of The Lower Variable Speeds Operate. 0010 00-40
- 3. High Speed Does Not Operate. 0010 00-40
- 4. Medium-high Speed Does Not Operate. 0010 00-41
- 5. Medium Speed Does Not Operate. 0010 00-41
- 6. Low Speed Does Not Operate. 0010 00-41

INTERMEDIATE AXLE AND REAR AXLE DRIVELINE ASSEMBLIES

- 1. No Drive At Forward-Rear Axle And/or Rear-rear Axle. 0011 00-1
- 2. Vibration Or Noise During On-road Operation. 0011 00-1

BRAKES

- 1. Vehicle Does Not Slow Down Quickly Enough When Brakes Are Applied. 0012 00-1
- 2. Brakes Do Not Release or Release Too Slowly. 0012 00-1
- 3. Brakes Are Uneven, Drag or Pull When Applied. 0012 00-2
- 4. ABS Indicator Light stays on After 5-10 Seconds. 0012 00-2

AIR SYSTEM

- 1. Loss Of Air Pressure. 0013 00-1
- 2. Loss Of Air Supply Function. 0013 00-1
- 3. Air Dryer Leaks. 0013 00-1
- 4. Air Dryer Fails To Absorb Pollutants. 0013 00-1

STEERING SYSTEM

- 1. Loss Of Steering Control. 0014 00-1
- 2. Universal Shaft Fails. 0014 00-1
- 3. Tie Rod And/Or Anchor Drag Link And/Or Pitman Arm Fails. 0014 00-1
- 4. Hose Assembly Fails (Leaks). 0014 00-1
- 5. Power Steering Reservoir Leaks. 0014 00-2

CHASSIS

- 1. Assembly Loose Or Missing. 0015 00-1
- 2. Loose Or Missing Fender Extension. 0015 00-1
- 3. Pintle Hook Eye Not Locked. 0015 00-1

TROUBLESHOOTING SYMPTOM INDEX - CONTINUED

0005 00

Malfunction

Page Number

CHASSIS - CONTINUED

- 4. Pintle Does Not Swivel..... 0015 00-1

FIFTH WHEEL

- 1. Trailer Will Not Couple Or Becomes Uncoupled..... 0016 00-1
- 2. Restricted Relative Motion Between Tractor and Trailer..... 0016 00-1

CAB

- 1. Loss Of Vehicle Instrumentation..... 0017 00-1
- 2. Vehicle Heater Assembly Leaks Coolant..... 0017 00-1
- 3. No Air Circulation..... 0017 00-1
- 4. Impeded Or Blocked Air Flow..... 0017 00-1

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Engine Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools - Continued

SPORT (Item 92, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0312 00)

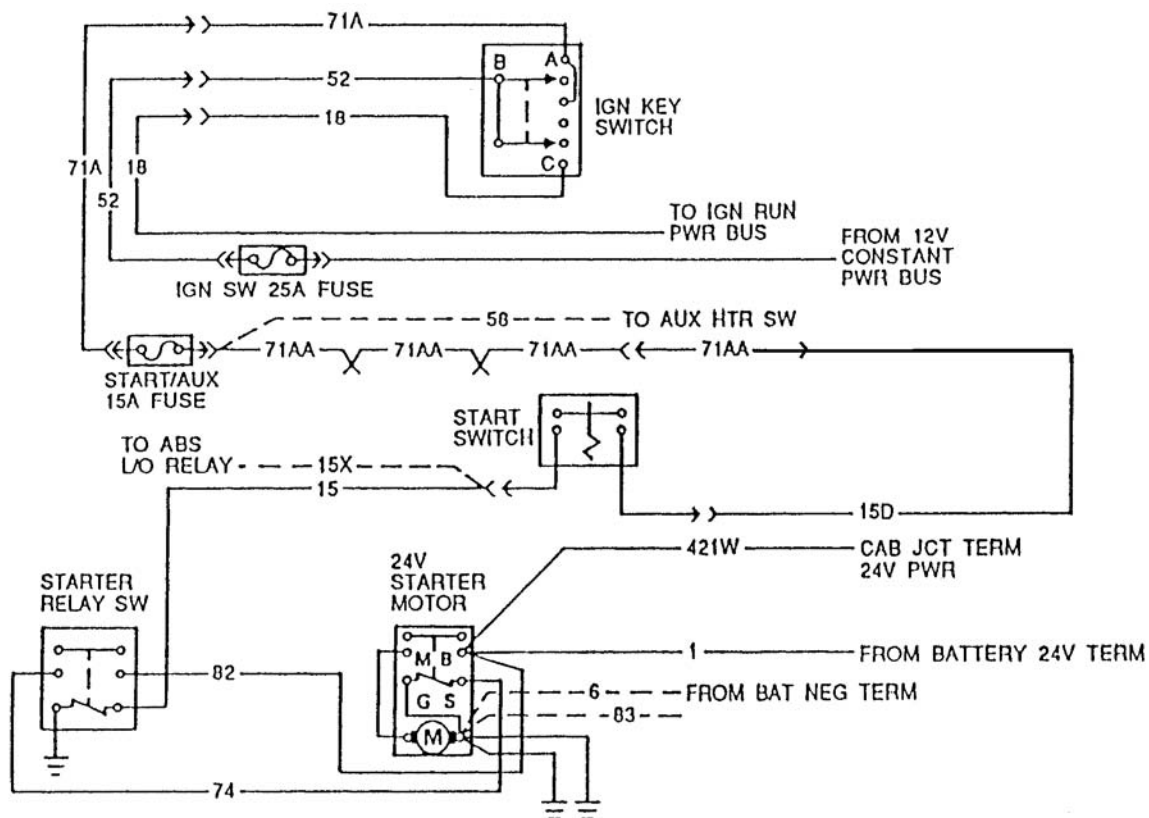
MSD (Item 58, WP 0313 00)

References

TM 9-2815-225-34&P

TM 9-2320-303-10

TM 9-6140-200-14



402-095

Table 1. Engine Troubleshooting Procedures .

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Engine Fails To Crank Or Cranks Slowly.</p>	<p>1. Check that transmission indicator is in N.</p> <p>2. Check for damaged or loose battery connections.</p> <p>3. Check for voltage at batteries for 22-26 volts.</p> <p>4. Check ignition switch 25A fuse for damage.</p> <p>5. Check start/auxiliary 15A fuse for damage.</p> <p>6. Check ignition key switch for loose or damaged connections.</p> <p>7. Check engine start button for loose or damaged connections.</p> <p>8. Check starter relay switch (magnetic) for 11-16 volts with ignition switch in start position.</p> <p>9. Check lead 15 for continuity.</p> <p>10. Check starter relay switch (magnetic) for 22-26 volts.</p> <p>11. Check starter relay switch (magnetic) for 22-28 volts with ignition switch in start position and start button engaged.</p> <p>12. Check starter for loose or damaged connections.</p> <p>13. If engine still fails to crank, notify direct support maintenance.</p>	<p>Select N.</p> <p>Tighten or repair as required (WP 0095 00).</p> <p>If voltage is below 22 volts, service batteries (TM 9-6140-200-14).</p> <p>Replace as necessary (WP 0072 00).</p> <p>Replace as necessary (WP 0072 00).</p> <p>Tighten or replace as necessary (WP 0066 00).</p> <p>Tighten or replace as necessary (WP 0066 00).</p> <p>If no voltage is present, go to step 9.</p> <p>If no continuity is noted, repair lead 15 or notify direct support maintenance.</p> <p>If no voltage is present, check lead 82 for continuity.</p> <p>If no voltage is present at lead 74, replace starter relay switch (magnetic) (WP 0061 00).</p> <p>Tighten or replace as necessary.</p>
<p>2. Engine Will Not Crank.</p>	<p>1. Check battery condition.</p> <p>2. Check battery cables and terminals for loose or dirty connections.</p> <p>3. Check starting motor connections.</p>	<p>Test, charge, or replace as indicated by hydrometer (TM 9-6140-200-14).</p> <p>Clean and tighten connections (WP 0095 00).</p> <p>Clean and tighten connections at the starter (WP 0060 00).</p> <p>Replace starter (WP 0060 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>3. Engine Will Crank But Not Start.</p>	<p>1. Check fuel level in tank. 2. Check fuel solenoid shutoff valve. 3. Check for leaking fuel lines. 4. Check for air cleaner element restriction. 5. Check for white exhaust smoke. 6. Check for dirty fuel filter. 7. Check for congealed fuel (cold weather).</p>	<p>Add fuel, if required. Replace, if required (WP 0030 00). Tighten connections or replace fuel lines and hoses as required (WP 0038 00). Service air cleaner element (WP 0031 00). Use cold weather starting aid (TM 9-2320-303-10). Service fuel filter (WP 0035 00 and WP 0036 00). Check fuel specifications (TM 9-2320-303-10).</p>
<p>4. Engine Stops, Not Seized.</p>	<p>1. Refer to steps 1 through 7 of Malfunction 3. 2. Check for obstructed air vent in fuel tank cap.</p>	<p>Remove cap, then clean (TM 9-2320-303-10).</p>
<p>5. Engine Stops, Seized.</p>	<p>Refer to TM 9-2815-225-34&P.</p>	
<p>6. High Oil Consumption.</p>	<p>1. Check for overfilling. 2. Check service records to determine that proper viscosity of oil is in use (TM 9-2320-303-10). 3. Check engine for external oil leaks with engine running.</p>	<p>Check oil level (TM 9-2320-303-10). Refer to TM 9-2815-225-34&P for repair of oil leaks.</p>
<p>7. Intermittent Loss of Power.</p>	<p>1. Refer to steps 1, 3, and 4 of Malfunction 3. 2. Check fuel tank cap air vent. 3. Refer to step 6 of Malfunction 3.</p>	<p>Remove cap, then clean (TM 9-2320-303-10). Service fuel filters (WP 0035 00 and WP 0036 00).</p>
<p>8. Sudden Loss of Power.</p>	<p>1. Check fuel level in tank. 2. Check for exhaust restriction.</p>	<p>1. Check for loose baffles. Replace muffler if damaged (WP 0042 00). 2. Check for damaged exhaust stack. Replace (WP 0042 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
8. Sudden Loss of Power - Continued.	3. Check for dirty fuel filter. 4. Check for leaking fuel lines. 5. Check for air cleaner element restriction. 6. Check for congealed fuel (cold weather).	Service fuel filter (WP 0035 00 and WP 0036 00). Tighten connections or replace fuel lines and hoses as required (WP 0038 00). Service air cleaner element as necessary (WP 0031 00). Check fuel specification (TM 9-2320-303-10).
9. Gradual Loss of Power, No Smoke.	1. Check for leaking fuel lines. 2. Check for air intake restriction. 3. Check for worn accelerator rod linkage. 4. Check for congealed fuel (cold weather).	Tighten connections or replace fuel lines and hoses as required (WP 0038 00). Service air intake as necessary (WP 0032 00). Adjust and replace worn parts (WP 0041 00). Check fuel specification (TM 9-2320-303-10).
10. Slow Deceleration, Engine "Floats".	Check for air leaks in fuel pump supply lines and hoses.	Service supply lines and hoses as necessary (WP 0038 00).
11. Erratic Idle Speed.	Check for air leaks in fuel pump supply lines and hoses.	Service supply lines and hoses as necessary (WP 0038 00).
12. Excessive Exhaust Smoke During Acceleration.	1. Check for dirty fuel filter. 2. Check for air crossover tube leaks.	Service fuel filter (WP 0035 00 and WP 0036 00). Repair air crossover tube leaks or damage (TM 9-2815-225-34&P).
13. Excessive Exhaust Smoke Throughout Speed Range.	1. Check for dirty air cleaner element. 2. Check for poor quality fuel.	Clean or replace element (WP 0031 00). Check fuel specification (TM 9-2320-303-10). Refer to TM 9-2815-225-34&P.
14. High Fuel Consumption.	Check for poor quality fuel.	Check fuel specification (TM 9-2320-303-10). Refer to TM 9-2815-225-34&P.
15. Low Oil Pressure.	1. Check oil level. 2. Check filter. 3. Check if oil pressure line and gage orifices are restricted.	Fill to proper level (TM 9-2320-303-10). Replace filter (WP 0028 00). If unrestricted, replace oil pressure gage (WP 0062 00).

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>16. Engine Overheats.</p>	<ol style="list-style-type: none"> 1. Check coolant level. 2. Check for loose or broken fan belts. 3. Check thermostat. 4. Allow engine to cool. With engine running and radiator cap removed, check for proper coolant flow. 5. Check fan clutch actuator. 	<p>Add coolant until full.</p> <p>Tighten or replace belts (WP 0059 00).</p> <p>Replace thermostat (WP 0047 00).</p> <ol style="list-style-type: none"> 1. Check for clogged radiator hose. Clean or replace hoses (WP 0050 00). 2. Replace water pump (WP 0052 00). <ol style="list-style-type: none"> 1. Check actuator tubes. Replace if necessary (WP 0048 00). 2. Replace fan clutch (WP 0049 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Air/Fuel System Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Air/Fuel Troubleshooting Procedures .

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Restricted Air Flow to Turbocharger.</p>	<p>1. Check for clogged or faulty filter element.</p> <p>2. Check for collapsed duct assembly or tubing.</p> <p>3. Check for damaged or faulty air cleaner housing.</p>	<p>Replace filter element (WP 0031 00).</p> <p>Replace damaged duct assembly (WP 0032 00).</p> <p>Replace air cleaner housing (WP 0032 00).</p>
<p>2. Fuel Contamination.</p>	<p>1. Check for loose, faulty, or missing filler cap.</p> <p>2. Check for dirty or corroded fuel tank.</p>	<p>Replace as necessary (WP 0037 00).</p> <p>Purge or clean fuel tank.</p>
<p>3. Restricted Fuel Supply.</p>	<p>1. Check for faulty fuel tank or lines.</p> <p>2. Check for clogged or faulty filter element.</p>	<p>Clean fuel lines or replace fuel tank (WP 0037 00) or lines (WP 0038 00).</p> <p>Replace filter element (WP 0031 00).</p>

END OF WORK PACKAGE

EXHAUST SYSTEM TROUBLESHOOTING

0008 00

THIS WORK PACKAGE COVERS

Exhaust System Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Exhaust System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>Exhaust Gases Enter Passenger Compartment.</p>	<ol style="list-style-type: none"> 1. Check for faulty muffler. 2. Check for loose, broken clamp or fasteners. 3. Check for broken exhaust pipe(s) or engine exhaust manifold. 	<p>Replace muffler (WP 0042 00).</p> <p>Replace clamps and/or fasteners (WP 0043 00).</p> <p>Replace exhaust pipe(s) if broken (WP 0043 00). If engine exhaust manifold is broken, notify Direct Support Maintenance.</p>

END OF WORK PACKAGE

COOLING SYSTEM TROUBLESHOOTING

0009 00

THIS WORK PACKAGE COVERS

Cooling System Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Cooling System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
Loss of Coolant.	<ol style="list-style-type: none"> 1. Check for deteriorated or collapsed hose(s). 2. Check for structural cracks or fracture of radiator. 3. Check for leaking water pump. 	<p>Replace as required (WP 0050 00).</p> <p>Replace radiator (WP 0044 00).</p> <p>Replace water pump (WP 0052 00).</p>

END OF WORK PACKAGE

ELECTRICAL SYSTEM TROUBLESHOOTING

0010 00

THIS WORK PACKAGE COVERS

Charging Circuits, Engine Brake Retarder Circuits, Engine Fan Circuit, Headlight Circuits, Marker and Taillight Circuits, Blackout Light Circuits, Turn Signal and Stoplight Circuits, Dome Light Circuits, Auxiliary Light Circuits, Worklight Power Receptacle Circuits, Backup Light Circuits, Utility Light Circuits, Electric Horn Circuits, Tractor Beacon Light Circuits, Panel Light Circuits, Radio Circuits, Instrument Wiring Harness Circuits, Axle Lock Circuits, Ether Quick Start Circuit, Air Dryer Heater Circuit, and Standard Heater Circuits Troubleshooting Procedures.

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Tools and Special Tools - Continued

Multimeter, digital (Item 60, WP 0313 00)

Equipment Conditions

Master battery switch in OFF position (TM 9-2320-303-10)

Table 1. Charging Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>The diagram illustrates the electrical connections for a 24V/12V charging system. Key components include:</p> <ul style="list-style-type: none"> 24V Power Source: Connected to terminal 421W, which leads to a 24V constant power bus. 12V Power Source: Connected to terminal 14, which leads to a 12V constant power bus. Master Battery Switch: Controls the 12V battery bank, with terminals 1, 5, and 6. Starter Relay Switch (STARTER RELAY SW): Controls the 24V system, with terminals 74 and 83. T-R Unit (24V): A transformer-rectifier unit connected to the 24V bus and the 12V battery bank. Alternator (12V): Provides 12V output, connected to terminal 16D and the 12V battery bank. Grounding: The engine frame is grounded (GND), and the 12V battery bank is also grounded. 		

402-096

Table 1. Charging Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Batteries Not Charging (Either Voltage), Voltmeter Indicates Voltage.</p>	<p>1. Check and clean battery terminals for corrosion and make sure connections are tight.</p> <p>2. Disconnect lead 6 from ground connection from batteries. Check for continuity between leads 6 and ground.</p>	<p>If continuity is indicated, repair ground connection. If no continuity is indicated, repair lead 6.</p>
<p>2. Batteries Not Charging, Voltmeter Does Not Indicate Voltage.</p>	<p>1. Disconnect lead 83 from negative (-) terminal or alternator. Check for continuity between lead 83 and ground.</p> <p>2. Check for continuity between negative (-) terminal and negative field (F-) terminal or alternator.</p> <p>3. Disconnect lead 16D from positive (+) terminal or alternator. Check for +24 VDC at positive (+) terminal or alternator.</p> <p>4. Disconnect lead 16D from dual voltage control unit. Check for +24 VDC at lead 16D.</p> <p>5. Disconnect lead 123 from positive field (F+) connector on alternator. Check for +24 VDC at positive field (F+) connector.</p>	<p>If continuity is indicated, go to step 2. If no continuity is indicated, repair lead 83.</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, replace alternator (WP 0058 00).</p> <p>If +24 VDC is present, go to step 4. If no voltage is present, replace alternator (WP 0058 00).</p> <p>If +24 VDC is present, go to step 5. If no voltage is present, repair lead 16D.</p> <p>If +24 VDC is present, go to step 6. If no voltage is present, replace alternator (WP 0058 00).</p>
<p>3. +12 VDC Circuits Not Charging, +24 VDC Circuits Normal.</p>	<p>1. Disconnect lead 16D from connector No.1 on alternator. Check for +12 VDC at alternator.</p> <p>2. Disconnect lead 16D from 12 V junction terminal. Check for +12 VDC at lead 16D.</p>	<p>If +12VDC is present, go to step 2. If no voltage is present, replace alternator (WP 0058 00).</p> <p>If +12 VDC is present, repair lead 5. If no voltage is present, repair lead 16D.</p>
<p>4. +24 VDC Circuits Not Charging, +12 VDC Circuits Normal.</p>	<p>1. Disconnect lead 202 from connector No. 2 on alternator. Check for +24 VDC.</p> <p>2. Disconnect lead 202 from connector at starter motor. Check for +24 VDC at lead 202.</p>	<p>If +24 VDC is present, go to step 2. If no voltage is present, replace alternator (WP 0058 00).</p> <p>If +24 VDC is present, repair lead 1. If no voltage is present, repair lead 202.</p>

Table 1. Engine Brake Retarder Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	<p>402-097</p>	
<p>1. Engine Brake Retarder (Jake Brake) Not Operating, Transmission Lockup Operating Normally.</p> <p>2. Engine Brake Retarder (Jake Brake) Two-cylinder Brake Not Operating, Four-cylinder Brake Operating Normally.</p>	<p>1. Check engine brake 15A fuse.</p> <p>2. Disconnect lead 121B from two-cylinder brake switch. Check for +12 VDC at switch end of lead 121B.</p> <p>1. Disconnect lead 121C from two-cylinder brake switch. Check for +12 VDC at two-cylinder brake switch.</p> <p>2. Disconnect lead 121C from line disconnect from two-cylinder brake switch. Check for +12 VDC at lead 121C.</p>	<p>If +12 VDC is present, repair lead 121B at switch connector. If no voltage is present, repair lead 121B at connector 87 on engine brake lockout relay.</p> <p>If +12 VDC is present, go to step 2. If no voltage is present, replace two-cylinder brake switch (WP 0065 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 121C.</p>

Table 1. Engine Brake Retarder Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. Engine Brake Retarder (Jake Brake) Two-cylinder Brake Not Operating, Four-cylinder Brake Operating Normally - Continued.</p>	<p>3. Disconnect lead 121C from line disconnect to center cylinders engine brake solenoid valve. Check for +12 VDC at lead 121C.</p> <p>4. Check for continuity between contact of center cylinders engine brake solenoid valve and ground.</p>	<p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 121C.</p> <p>If continuity is indicated, notify direct support maintenance. If no continuity is indicated, repair ground.</p>
<p>3. Engine Brake Retarder (Jake Brake) Four-cylinder Brake Not Operating, Two-cylinder Brake Operating Normally.</p>	<p>1. Disconnect lead 121B from four-cylinder brake switch. Check for +12 VDC at lead 121B to four-cylinder brake switch.</p> <p>2. Disconnect lead 121D from four-cylinder brake switch. Check for +12 VDC at lead 121D to four-cylinder brake switch.</p> <p>3. Disconnect lead 121D from line disconnect from two-cylinder brake switch. Check for +12 VDC at lead 121D.</p> <p>4. Disconnect lead 121D from line disconnect to rear cylinders engine brake solenoid valve. Check for +12 VDC at lead 121D.</p> <p>5. Check for continuity between contact or rear cylinders engine brake solenoid valve to ground, and contact of front cylinders engine brake solenoid valve to ground.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 121B.</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 121D.</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 121D.</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 121D.</p> <p>If continuity is indicated, notify direct support maintenance. If no continuity is indicated, repair faulty ground.</p>

Table 1. Engine Fan Circuit Troubleshooting Procedures.

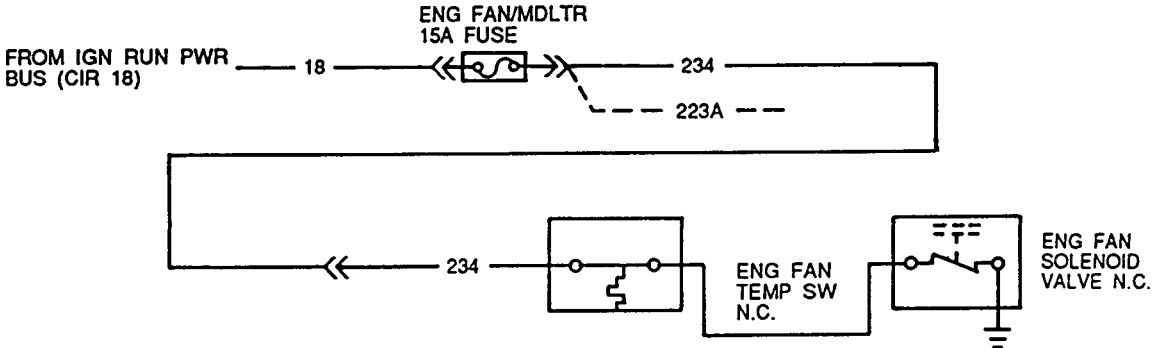
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Engine Fan Fails to Operate When Coolant Temperature is 190°F to 210°F (87°C To 98°C).</p> <p>2. Lack of Fan Clutch Disengagement.</p>	 <p style="text-align: right;">402-098</p>	<p>Check that engine fan operates within 190°F to 210°F (87°C to 98°C) temperature range.</p> <ol style="list-style-type: none"> 1. Check for air leaks. 2. Check engine fan/modulator 15A fuse. 3. Check for +12 VDC at engine fan temperature switch and engine fan solenoid valve. 4. Check for +12 VDC at circuit 18 from ignition run power bus. 5. Disconnect lead 234 at line disconnect. Check for +12 VDC at lead 234. 6. Check for continuity between contacts of engine fan temperature switch. 7. Check for continuity between contacts of engine fan solenoid valve and ground. <p>Replace failed air tube from air supply reservoir to fan clutch (WP 0049 00).</p> <p>If burned out, replace engine fan/modulator 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair circuit 18 from ignition run power bus.</p> <p>If +12 VDC is present, go to step 6. If no voltage is present, repair lead 234.</p> <p>If continuity is indicated, go to step 7. If no continuity is indicated, replace engine fan temperature switch.</p> <p>If continuity is indicated, repair ground lead. If no continuity is indicated, replace engine fan solenoid valve (WP 0048 00).</p>

Table 1. Headlight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>The diagram illustrates the electrical circuit for the headlight system. It features four relays: LH HDLT PWR RELAY, LH LO/HI BEAM RELAY, RH HDLT PWR RELAY, and RH LO/HI BEAM RELAY. Each relay has five terminals labeled 30, 85, 86, 87, and 87A. Power for the left side is supplied from a 12V constant power bus (terminal 14) through a 15A fuse to terminal 20, which then connects to terminal 30 of the LH HDLT PWR RELAY. A 420M wire connects terminal 20 to terminal 30 of the RH HDLT PWR RELAY. The right side is powered from a 12V constant power bus (terminal 14) through a 15A fuse to terminal 20A, which connects to terminal 30 of the RH HDLT PWR RELAY. A 420M wire connects terminal 20A to terminal 30 of the LH HDLT PWR RELAY. Ground connections are shown at terminals 86 and 87A of each relay. The LH LO/HI BEAM RELAY and RH LO/HI BEAM RELAY are controlled by a common 222 wire. The LH LO/HI BEAM RELAY also has terminals 21B and 21. The RH LO/HI BEAM RELAY has terminals 21D and 22D. A HDLT DIMMER SW ON TURN SIG SW LEVER is connected to terminal 22 of both beam relays. The dimmer switch also has a connection to PIN C16 OF WARN LT BAR FOR HI BEAM IND LT. The output of the LH LO/HI BEAM RELAY is connected to the HI and LOW terminals of the LH HDLT. The output of the RH LO/HI BEAM RELAY is connected to the HI and LOW terminals of the RH HDLT. Ground connections are shown for the dimmer switch and the low beam outputs.</p>		

402-099

Table 1. Headlight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Neither Headlight Operates When Switch Is Turned On.</p>	<p>1. Check left and right headlight 15A fuses.</p> <p>2. Disconnect lead 420M from vehicular light switch. Check for +12 VDC at pin M.</p> <p>3. Disconnect left headlight power relay from connector. Check for +12 VDC at connector 85.</p>	<p>If +12 VDC is present at vehicular light switch, go to step 3. If no voltage is present at vehicular light switch, replace vehicular light switch (WP 0065 00).</p> <p>If +12 VDC is present, replace left and right headlight power relay (WP 0072 00). If no voltage is present at connector 85, repair lead 420M.</p>
<p>2. Left Headlight Fails To Operate When Switch Is Turned On.</p>	<p>1. Inspect headlight bulb.</p> <p>2. Check left headlight 15A fuse.</p> <p>3. Disconnect lead 14 from left headlight 15A fuse. Check for +12 VDC at lead 14.</p> <p>4. Disconnect ground lead from left headlight. Check for +12 VDC at ground lead to left headlight.</p> <p>5. Disconnect left headlight power relay from connector. Check for continuity between connector 86 and ground.</p> <p>6. Disconnect left headlight power relay from connector. Check for +12 VDC at connector 30.</p> <p>7. Disconnect left low/high beam relay from connector. Check for +12 VDC at connector 30.</p> <p>8. Check for continuity between connector 87 from left headlight power relay and connector 30 from left low/high beam relay.</p>	<p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead.</p> <p>If +12 VDC is present, repair ground lead. If no voltage is present, go to step 5.</p> <p>If continuity is indicated, go to step 6. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, go to step 7. If no voltage is present, repair lead 20.</p> <p>If +12 VDC is present, replace left low/high beam relay (WP 0072 00). If no voltage is present, go to step 8.</p> <p>If continuity is present, replace left headlight power relay (WP 0072 00). If no continuity is indicated, repair lead 20L.</p>

Table 1. Headlight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>3. Right Headlight Fails To Operate When Switch Is Turned On.</p>	<ol style="list-style-type: none"> 1. Inspect headlight bulb. 2. Check right headlight 15A fuse. 3. Disconnect lead 14 from right headlight 15A fuse. Check for +12VDC at lead 14. 4. Disconnect ground lead from right headlight. Check for +12 VDC at ground lead to right headlight. 5. Disconnect right headlight power relay from connector. Check for continuity between connector 86 and ground. 6. Disconnect right headlight power relay from connector. Check for +12 VDC at connector 30. 7. Disconnect left headlight power relay from connector. Check for continuity between connector 85 from right headlight power relay and connector 85 from left headlight power relay. 8. Disconnect right low/high beam relay from connector. Check for +12 VDC at connector 30. 9. Disconnect left low/high beam relay from connector. Check for continuity between connector 86 from right low/high beam relay and connector 86 from left low/high beam relay. 	<p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 14.</p> <p>If +12 VDC is present, repair ground lead. If no voltage is present, go to step 5.</p> <p>If continuity is indicated, go to step 6. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, go to step 7. If no voltage is present, repair lead 20A.</p> <p>If continuity is present, go to step 8. If no continuity is indicated, repair lead 420M between left headlight power relay and right headlight power relay.</p> <p>If +12 VDC is present, go to step 9. If no voltage is present, repair lead 20R.</p> <p>If continuity is present, replace right low/high beam relay (WP 0072 00). If no continuity is indicated, repair lead 222 between left low/high beam relay and right low/high beam relay.</p>
<p>4. Neither Headlight Low/High Beam Operates When Turn Signal Switch Lever Is Set.</p>	<ol style="list-style-type: none"> 1. Disconnect ground lead from dimmer switch lever. Check for continuity between lead and ground. 2. Disconnect lead 222 from dimmer switch lever. Check for continuity between terminals of switch in both positions. 	<p>If continuity is present, go to step 2. If no continuity is indicated, repair ground lead.</p> <p>If continuity is present, go to step 3. If no continuity is indicated, replace dimmer switch lever (WP 0070 00).</p>

Table 1. Headlight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>4. Neither Headlight Low/High Beam Operates When Turn Signal Switch Lever Is Set - Continued.</p>	<p>3. Disconnect left low/high beam relay from connector. Check for continuity between connector 86 and lead 222.</p>	<p>If continuity is present, replace left low/high beam relay (WP 0072 00). If no continuity is indicated, repair lead 222.</p>
<p>5. Left High-Beam Does Not Operate.</p>	<p>1. Inspect headlight bulb.</p> <p>2. Disconnect connector from left headlight. Check for continuity between ground and connector on left headlight at lead 21.</p> <p>3. Disconnect left low/high beam relay from connector. Check for continuity between lead 21 and connector 87.</p>	<p>If continuity is present, go to step 3. If no continuity is indicated, replace left headlight (WP 0080 00).</p> <p>If continuity is present, replace left low/high beam relay. If no continuity is indicated, repair lead 21.</p>
<p>6. Left Low-Beam Does Not Operate.</p>	<p>1. Inspect headlight bulb.</p> <p>2. Disconnect connector from left headlight. Check for continuity between ground and connector on left headlight at lead 22.</p> <p>3. Disconnect left low/high beam relay from connector. Check for continuity between lead 22 and connector 87A.</p>	<p>If continuity is present, go to step 3. If no continuity is indicated, replace left headlight (WP 0080 00).</p> <p>If continuity is present, replace left low/high beam relay. If no continuity is indicated, repair lead 22.</p>
<p>7. Right High-Beam Does Not Operate.</p>	<p>1. Inspect headlight bulb.</p> <p>2. Disconnect connector from right headlight. Check for continuity between ground and connector on right headlight at lead 21D.</p> <p>3. Disconnect right low/high beam relay from connector. Check for continuity between lead 21D and connector 87.</p>	<p>If continuity is present, go to step 3. If no continuity is indicated, replace right headlight (WP 0080 00).</p> <p>If continuity is present, replace right low/high beam relay. If no continuity is indicated, repair lead 21D.</p>
<p>8. Right Low-Beam Does Not Operate.</p>	<p>1. Inspect headlight bulb.</p> <p>2. Disconnect connector from right headlight. Check for continuity between ground and connector on right headlight at lead 22D.</p> <p>3. Disconnect right low/high beam relay from connector. Check for continuity between lead 22D and connector 87A.</p>	<p>If continuity is present, go to step 3. If no continuity is indicated, replace right headlight (WP 0080 00).</p> <p>If continuity is present, replace right low/high beam relay. If no continuity is indicated, repair lead 22D.</p>

Table 1. Marker and Taillight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>The diagram illustrates the electrical circuit for marker and taillight systems. It features three relays: a 24V TRLR MKR LTS RELAY, a TRLR TAIL LTS RELAY, and a TRLR MKR LTS RELAY. Each relay has terminals 30, 85, 86, 87, and 87A. Power is supplied from a 24V constant power bus (lines 421W and 14) and a vehicular light switch terminal (line 420H). The circuit includes three 25A circuit breakers (TRLR LTS, TRLR TAILS, TRLR MKR LTS) and a 15A fuse (TRCTR TAIL MKR). The relays control the LH and RH front marker lights, the top of cab marker lights, and the taillights. Connections are also shown to 7-way and 12-way receptacle cables.</p>		
402-100		

Table 1. Marker and Taillight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. None Of The Marker Lights And Taillights Operate.</p>	<p>1. Check tractor tail marker 15A fuse.</p> <p>2. Disconnect connector on vehicular light switch.</p>	<p>Install jumper wire between connector 420F and pin F on switch. Check for +12 VDC at pin H.</p> <p>If +12 VDC is present, repair lead 420H. If no voltage is present at vehicular light switch, replace vehicular light switch (WP 0065 00).</p>
<p>2. Left Front Marker Light Not Operating.</p>	<p>1. Inspect light bulb.</p> <p>2. Remove lamp from socket (WP 0083 00). Check for continuity between contacts of lamp.</p> <p>3. Check for continuity between socket and ground.</p> <p>4. Disconnect lead 46E from lead 46. Check for +12 VDC at lead 46.</p>	<p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp (WP 0083 00).</p> <p>If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, repair lead 46E. If no voltage is present, repair lead 46.</p>
<p>3. Right Front Marker Light Not Operating.</p>	<p>1. Inspect light bulb.</p> <p>2. Remove lamp from socket (WP 0083 00). Check for continuity between contacts of lamp.</p> <p>3. Check for continuity between socket and ground.</p> <p>4. Disconnect lead 46F from lead 46. Check for +12 VDC at lead 46.</p>	<p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp (WP 0083 00).</p> <p>If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, repair lead 46E. If no voltage is present, repair lead 46.</p>
<p>4. One Or More Cab Marker Lights Not Operating.</p>	<p>1. Inspect light bulbs.</p> <p>2. Remove lamp(s) from defective circuit(s) (WP 0083 00). Check for continuity between socket and ground.</p> <p>3. Disconnect ground lead from marker light(s). Check for continuity between ground lead(s) and ground.</p>	<p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp(s) (WP 0083 00).</p> <p>If continuity is indicated, repair lead(s) 46. If no continuity is indicated, repair ground lead(s).</p>

Table 1. Marker and Taillight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Both Taillights Not Operating, All Marker Lights Operating.</p>	<ol style="list-style-type: none"> 1. Inspect light bulbs. 2. Disconnect lead 23A from taillight terminal. Check for +12 VDC at lead 23A. 	<p>If +12 VDC is present, repair terminal connector. If no voltage is present, repair lead 23A.</p>

Table 1. Blackout Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. None Of The Blackout (B/O) Lights Operate.</p> <p>2. None Of The Blackout (B/O) Stoplights Operate.</p>	<p>Check B/O 15A fuse.</p> <p>1. Inspect light bulbs.</p> <p>2. Disconnect B/O stoplights relay from connector. Check for +24 VDC at connector 30.</p>	<p>402-101</p> <p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If +24 VDC is present, go to step 3. If no voltage is present, repair lead connector 421V.</p>

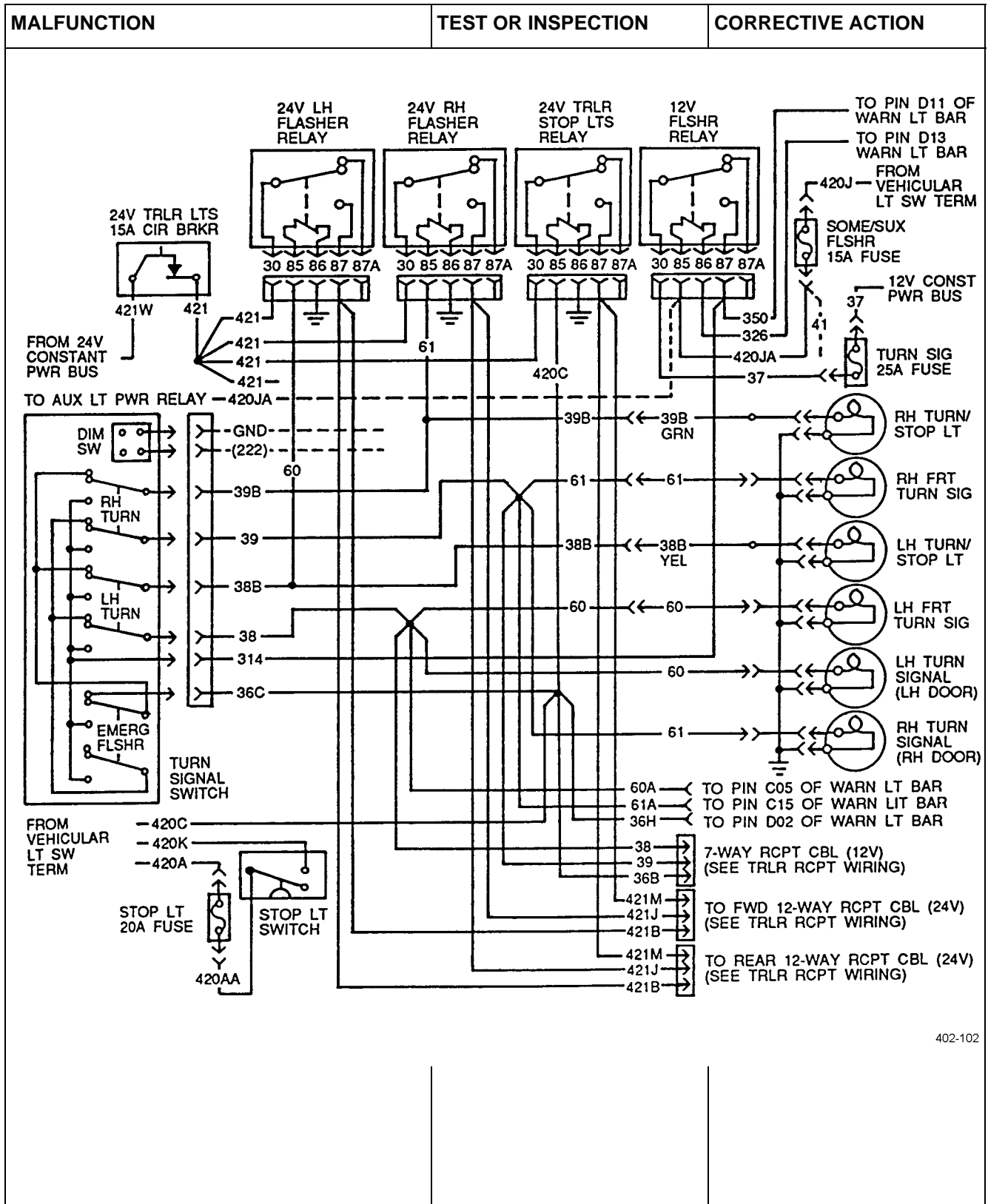
Table 1. Blackout Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. None Of The Blackout (B/O) Stoplights Operate - Continued.</p>	<p>3. Check for +24 VDC at connector 85.</p> <p>4. Check for continuity between connector 86 and ground.</p> <p>5. Install jumper wires between connector 30 and stoplights relay, connector 85 and stoplights relay, and connector 86 and stoplights relay. Check for +24 VDC at stoplights relay contact 87.</p>	<p>If +24 VDC is present, go to step 4. If no voltage is present, repair lead 420N.</p> <p>If continuity is indicated, go to step 5. If no continuity is indicated, repair ground lead.</p> <p>If +24 VDC is present, repair lead 421F. If no voltage is present, replace B/O stoplights relay.</p>
<p>3. One Or More Blackout (B/O) Stoplights Not Operating.</p>	<p>1. Inspect light bulb(s).</p> <p>2. Remove lamp(s) from defective circuit(s) (WP 0082 00). Check for continuity between socket and ground.</p> <p>3. Disconnect ground (B/O) stoplight(s). Check for continuity between ground lead(s) and ground.</p>	<p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp(s) (WP 0082 00).</p> <p>If continuity is indicated, repair lead(s) 421F. If no continuity is indicated, repair ground lead(s).</p>
<p>4. None Of The Blackout (B/O) Marker Lights Operate.</p>	<p>1. Inspect light bulbs.</p> <p>2. Disconnect B/O marker lights relay from connector. Check for +24 VDC at connector 30.</p> <p>3. Check for +24 VDC at connector 85.</p> <p>4. Check for continuity between connector 86 and ground.</p> <p>5. Install jumper wires between connector 30 and stoplights relay, connector 85 and stoplights relay, and connector 86 and stoplights relay. Check for +24 VDC at stoplights relay contact 87.</p>	<p>If +24 VDC is present, go to step 3. If no voltage is present, repair lead 421V.</p> <p>If +24 VDC is present, go to step 4. If no voltage is present, repair lead 420E.</p> <p>If continuity is indicated, go to step 5. If no continuity is indicated, repair ground lead.</p> <p>If +24 VDC is present, repair lead 421A. If no voltage is present, replace B/O marker lights relay (WP 0072 00).</p>

Table 1. Blackout Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. One Or More Blackout (B/O) Marker Lights Not Operating.</p>	<p>1. Inspect light bulbs.</p> <p>2. Remove lamp(s) from defective circuit(s). Check for continuity between socket and ground.</p> <p>3. Disconnect ground (B/O) marker light(s). Check for continuity between ground lead(s) and ground.</p>	<p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp(s) (WP 0082 00).</p> <p>If continuity is indicated, repair lead(s) 421A. If no continuity is indicated, repair ground lead(s).</p>
<p>6. None Of The Blackout (B/O) Drive Lights Operate.</p>	<p>1. Inspect light bulbs.</p> <p>2. Disconnect B/O drive lights relay from connector. Check for +24 VDC at connector 30.</p> <p>3. Check for +24 VDC at connector 85.</p> <p>4. Check for continuity between connector 86 and ground.</p> <p>5. Install jumper wires between connector 30 and stoplights relay, connector 85 and stoplights relay, and connector 86 and stoplights relay. Check for +24 VDC at stoplights relay contact 87.</p>	<p>If +24 VDC is present, go to step 3. If no voltage is present, repair lead 421V.</p> <p>If +24 VDC is present, go to step 4. If no voltage is present, repair lead 420D.</p> <p>If continuity is indicated, go to step 5. If no continuity is indicated, repair ground lead.</p> <p>If +24 VDC is present, repair lead 421P or lead 421K. If no voltage is present, replace B/O drive lights relay (WP 0072 00).</p>
<p>7. One Or More Blackout (B/O) Drive Lights Not Operating.</p>	<p>1. Inspect light bulb(s).</p> <p>2. Remove lamp from defective circuit. Check for continuity between socket and ground.</p> <p>3. Disconnect ground (B/O) drive lights. Check for continuity between ground lead(s) and ground.</p> <p>4. Check for +24 VDC at connector 421K at trailer receptacle(s).</p>	<p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp (WP 0082 00).</p> <p>If continuity is indicated, repair lead 421P. If no continuity is indicated, repair ground lead(s).</p> <p>If +24 VDC is present, troubleshoot trailer circuit(s). If no voltage is present, repair lead(s) 421K.</p>

Table 1. Turn Signal and StopLight Circuits Troubleshooting Procedures.



402-102

Table 1. Turn Signal and StopLight Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Neither Stoplight Operates.</p> <p>2. Left Stoplight Not Operating.</p> <p>3. Right Stoplight Not Operating.</p>	<p>1. Check stoplight 20A fuse.</p> <p>2. Inspect light bulbs.</p> <p>3. Disconnect leads 420A and 420K from stoplight switch. Check for continuity between switch contacts while pressing switch.</p> <p>4. Disconnect leads 420A and 420K from vehicular light switch. Check for continuity between leads 420A and 420K with stoplight switch closed.</p> <p>5. Disconnect lead 420C from vehicular light switch. Disconnect lead 36C from turn signal switch. Check for continuity between lead 420C and 36C.</p> <p>6. Disconnect lead 36C from vehicular light switch. Check for +12 VDC in lead 36C with stoplight switch closed.</p> <p>1. Inspect light bulb.</p> <p>2. Remove lamp from left stoplight (WP 0081 00). Check for continuity between contact points.</p> <p>3. Remove left stoplight lamp. Check for continuity between socket and ground.</p> <p>4. Check for +24 VDC at turn signal switch at lead 38B contact point.</p> <p>1. Inspect light bulb.</p> <p>2. Remove lamp from right stoplight (WP 0081 00). Check for continuity between contact points.</p> <p>3. Remove right stoplight lamp. Check for continuity between socket and ground.</p>	<p>If continuity is indicated, go to step 4. If no continuity is indicated, replace stoplight switch.</p> <p>If continuity is indicated, go to step 5. If no continuity is indicated, repair lead 420A or 420K.</p> <p>If continuity is indicated, go to step 6. If no continuity is indicated, repair lead 420C or lead 36C.</p> <p>If +12 VDC is present, replace turn signal switch (WP 0070 00). If no voltage is present, replace vehicular light switch (WP 0065 00).</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp (WP 0081 00).</p> <p>If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead.</p> <p>If +24 VDC is present, replace turn signal switch (WP 0070 00). If no voltage is present, repair lead 38B.</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp (WP 0081 00).</p> <p>If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead.</p>

Table 1. Turn Signal and StopLight Circuits Troubleshooting Procedures.

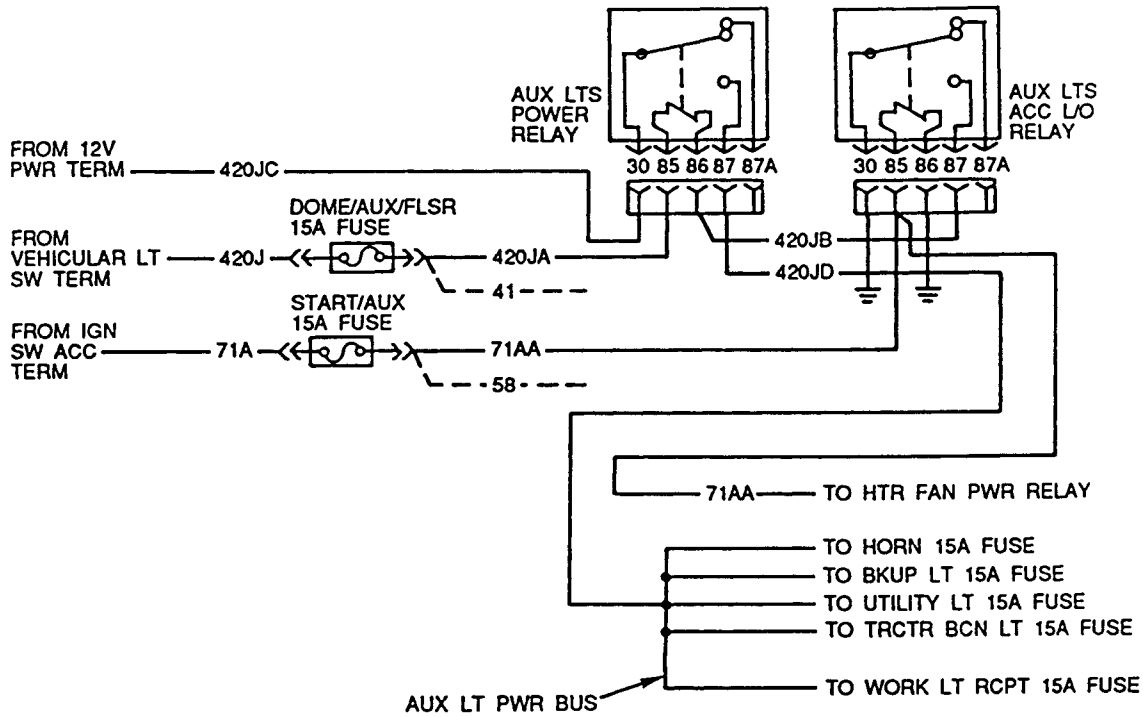
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
3. Right Stoplight Not Operating - Continued.	4. Check for +24 VDC at turn signal switch at lead 39B contact point.	If +24 VDC is present, replace turn signal switch (WP 0070 00). If no voltage is present, repair lead 39B.
4. None Of The Left Flasher Lights (24 V) Operating.	1. Inspect light bulbs. 2. Disconnect left flasher relay from connector. Check for +24 VDC at connector 30. 3. Check for continuity between connector 86 and ground. 4. Check for +12 VDC T connector 85. 5. Set turn signal switch in left turn mode. Install jumper leads between connectors 30, 85, and 86 to their respective connectors at left flasher relay. Check for +24 VDC at left flasher relay connection 87. 6. Set turn signal switch in left turn mode. Check for +24 VDC at trailer receptacle connectors 421B.	If +24 VDC is present, go to step 3. If no voltage is present, repair lead 421. If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead. If +12 VDC is present, go to step 5. If no voltage is present, repair lead 60. If +24 VDC is present, go to step 6. If no voltage is present, replace left flasher relay (WP 0072 00).
5. One Of The Left Turn Signal Lights Not Operating.	1. Inspect light bulb. 2. Remove lamp from defective left turn signal light (WP 0083 00). Check for continuity between contact points. 3. Remove signal light lamp. Check for continuity between socket and ground.	If continuity is indicated, go to step 3. If no continuity is indicated, replace lamp (WP 0083 00). If continuity is indicated, repair lead 60. If no continuity is indicated, repair ground lead.
6. Left Turn Signal Indicator Light Not Operating, Turn Signals Operating Normally.	1. Inspect light bulb. 2. Disconnect lead 60A from warning light bar. Check for +24 VDC at lead 60A.	If +24 VDC is present, troubleshoot warning light circuit. If no voltage is present, repair lead 60A.

Table 1. Dome Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p style="text-align: right;">402-103</p>		
<p>1. Neither Dome Light Operates.</p>	<ol style="list-style-type: none"> 1. Check dome/auxiliary/flasher lights 15A fuse. 2. Disconnect lead 420J from dome/auxiliary/flasher 15A fuse. Check for +12 VDC at lead 420J. 3. Disconnect connector from vehicular light switch. Check for +12 VDC at pin J. 	<p>If +12 VDC is present, repair lead 41. If no voltage is present, go to step 3.</p> <p>If +12 VDC is present, repair lead 420J. If no voltage is present, replace vehicular light switch (WP 0065 00).</p>
<p>2. One Dome Light Operates, The Other Does Not In Either Mode.</p>	<ol style="list-style-type: none"> 1. Inspect light bulb. 2. Disconnect lead 41 from defective dome light. Check for continuity from dome light ground lead to ground. 3. Disconnect lead 41 from defective dome light. Check for +12 VDC at lead 41. 	<p>If continuity is indicated, go to step 3. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, replace dome light assembly (WP 0086 00). If no voltage is present, repair lead 41.</p>
<p>3. Dome Light Operates In One Switch Mode Only.</p>	<ol style="list-style-type: none"> 1. Inspect dome light lamp. 2. Check for continuity between socket and ground. 	<p>If continuity is indicated, replace dome light assembly (WP 0086 00).</p>

Table 1. Auxiliary Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. None Of The Auxiliary Lights Or Accessory Circuits Operate.</p>	<ol style="list-style-type: none"> 1. Check for +12 VDC at auxiliary light power bus. 2. Disconnect auxiliary lights power relay. Check for +12 VDC at connector 30. 3. Check for +12 VDC at auxiliary lights power relay connector 85. 	<p>If +12 VDC is present, repair auxiliary light power bus. If no voltage is present, go to step 2.</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 420JC.</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, check dome/auxiliary/flasher 15A fuse. If defective, replace 15A fuse (WP 0072 00). Check for continuity in lead 420JA and lead 420J. If no continuity is indicated, repair lead 420JA or 420J. If +12 VDC is still not present at connector 85, replace vehicular light switch (WP 0065 00).</p>



402-104

Table 1. Auxiliary Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. None Of The Auxiliary Lights Or Accessory Circuits Operate - Continued.</p>	<p>4. Disconnect auxiliary lights accessory lockout relay. Check for +12 VDC at connector 87.</p> <p>5. Disconnect auxiliary lights accessory lockout relay. Check for +12 VDC at connector 85.</p> <p>6. Disconnect auxiliary lights accessory lockout relay. Check for continuity from connectors 30 and 86 to ground.</p> <p>7. Check for +12 VDC at auxiliary light power bus.</p>	<p>If +12 VDC is present, go to step 5. If no voltage is present, check lead 420JB for continuity. If no continuity is indicated, repair lead 420JB. If voltage is still not present at connector 87, replace auxiliary lights power relay (WP 0072 00).</p> <p>If +12 VDC is present, go to step 6. If no voltage is present, check start/auxiliary 15A fuse. If defective, replace 15A fuse (WP 0072 00). Check for continuity in lead 71AA and lead 71A. If no continuity is indicated, repair lead 71AA and lead 71A. If voltage is still not present at connector 85, replace vehicular light switch (WP 0065 00).</p> <p>If continuity is indicated, go to step 7. If no continuity is indicated, repair connector lead 30 or connector lead 86 to ground.</p> <p>If +12 VDC is not present, check for continuity in lead 420JD. If continuity is indicated, replace auxiliary lights power relay (WP 0072 00).</p>
<p>2. No Power To Auxiliary Heater Fan Power Relay.</p>	<p>Disconnect auxiliary lights accessory lockout relay and heater fan power relay. Check for continuity in lead 71AA.</p>	<p>If no continuity is indicated, repair lead 71AA.</p>

Table 1. Worklight Power Circuits Troubleshooting Procedures.

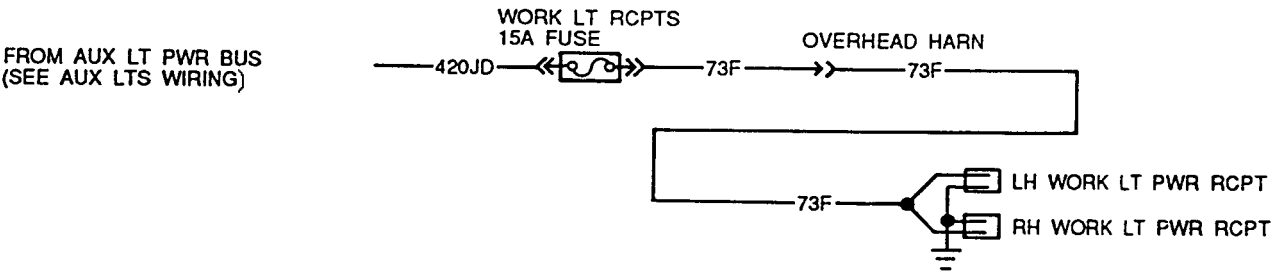
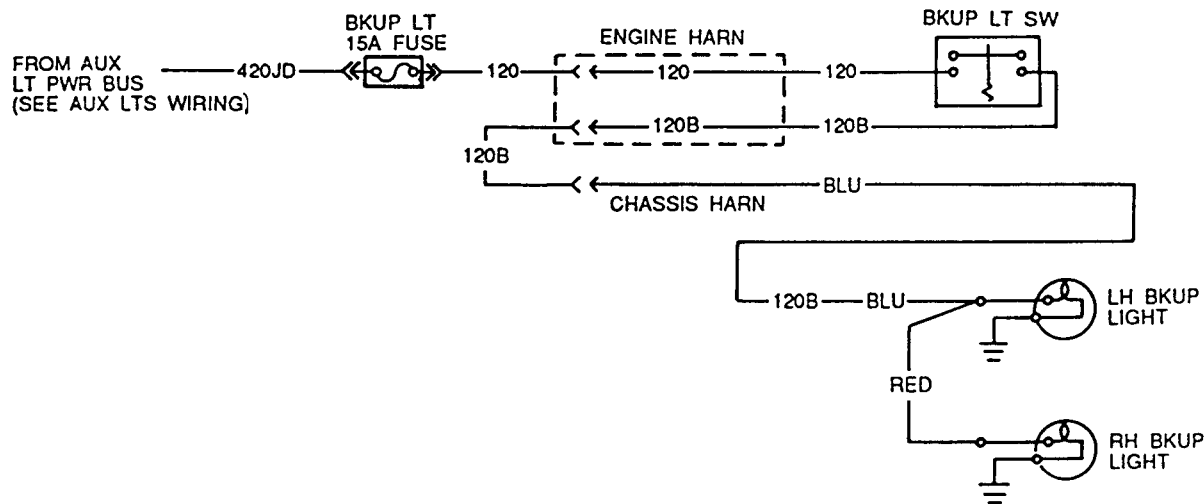
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>FROM AUX LT PWR BUS (SEE AUX LTS WIRING)</p>  <p style="text-align: right;">402-105</p>	<ol style="list-style-type: none"> 1. Check worklight receptacles 15A fuse. 2. Check for +12 VDC at lead 420JD from auxiliary light power bus. 3. Check for +12 VDC at lead 73F for left and right worklight power receptacles. <ol style="list-style-type: none"> 1. Check for +12 VDC at lead 73F to worklight power receptacle. 2. Check for continuity between receptacle and ground. 	<p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 420JD.</p> <p>If +12 VDC is present, repair ground lead from worklight power receptacles. If no voltage is present, repair lead 73F.</p> <p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 73F.</p> <p>If continuity is indicated, replace defective receptacle. If no continuity is indicated, repair ground lead.</p>
<p>1. Neither Worklight Power Receptacle Operates.</p>		
<p>2. One Worklight Power Receptacle Not Operating, The Other Receptacle Operating Normally.</p>		

Table 1. Backup Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Neither Backup Light Operates.</p>	<ol style="list-style-type: none"> 1. Check backup light 15A fuse. 2. Inspect light bulbs. 3. Disconnect lead 420JD from backup light 15A fuse. Check for +12 VDC at lead 420JD. 4. Disconnect lead 120 from backup light switch. Check for +12 VDC at lead 120. 5. Disconnect lead 120B from backup light switch. Press backup light switch. Check for continuity between switch contacts. 6. Disconnect lead 120B from chassis harness. Check for +12 VDC at lead 120B. 7. Check for +12 VDC at backup receptacle socket 120B connector. 	<p>If defective, replace 15A fuse (WP 0072 00).</p> <p>Replace if broken or defective (WP 0081 00).</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 420JD.</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 120.</p> <p>If continuity is indicated, go to step 6. If no continuity is indicated, replace backup light switch.</p> <p>If +12 VDC is present, go to step 7. If no voltage is present, repair lead 120B between chassis and backup light switch.</p> <p>If +12 VDC is present, repair receptacle socket ground leads to ground. If no voltage is present, repair lead 120B to chassis wiring harness.</p>



402-106

Table 1. Backup Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. Right Or Left Backup Light Not Operating.</p>	<ol style="list-style-type: none"> 1. Check backup light lamp. 2. Check for continuity between socket and ground. 3. Disconnect red lead from backup light. Check for +12 VDC at red lead (for light on right side only.) 	<p>If defective, replace lamp (WP 0081 00).</p> <p>If continuity is indicated, replace backup light (WP 0081 00). If no continuity is indicated, repair ground lead.</p> <p>If no voltage is present, repair red lead.</p>

Table 1. Utility Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<div> </div> <p style="text-align: right;">402-107</p> <p>1. Neither Utility Light Operates.</p> <p>2. Only One Utility Light Operating.</p> <p>3. Utility Light Indicator Light Not Operating, Utility Lights Operating Normally.</p>	<p>1. Inspect light bulbs.</p> <p>2. Disconnect leads 420JD and 73 from 15A fuse. Check for continuity between contacts of 15A fuse.</p> <p>3. Check for +12 VDC at lead 420JD from auxiliary light power bus.</p> <p>4. Disconnect lead 73 from utility light switch. Check for +12 VDC at lead 73.</p> <p>5. Disconnect lead 73B from utility light switch. Activate switch. Check for continuity between switch contacts.</p> <p>1. Disconnect lead 73B from defective utility light. Check for +12 VDC at lead 73B.</p> <p>2. Check for continuity between socket and ground.</p> <p>Disconnect lead 73A from pin D16 of warning light bar. Check for +12 VDC at lead 73A.</p>	<p>Replace if broken or defective (WP 0085 00).</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, replace 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 420JD.</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 73.</p> <p>If continuity is indicated, repair lead 73B. If no continuity is indicated, replace utility light switch (WP 0066 00).</p> <p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 73B.</p> <p>If continuity is indicated, replace utility light (WP 0085 00). If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, troubleshoot warning light circuit. If no voltage is present, repair lead 73A.</p>

Table 1. Electric Horn Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<div style="text-align: center;"> </div> <p style="text-align: right;">402-108</p> <p>Electric Horn Does Not Operate.</p>	<ol style="list-style-type: none"> 1. Check horn 15A fuse. 2. Check for +12 VDC at lead 420JD from auxiliary light power bus. 3. Disconnect horn relay from connector. Check for +12 VDC at connector 30. 4. Disconnect horn relay. Check for +12 VDC at connector 85. 5. Disconnect lead 25 from horn button. Check for +12 VDC at lead 25. 6. Disconnect ground lead from horn button. Check for continuity between ground lead and ground. 7. Disconnect lead 25 from horn button. Press horn switch. Check for continuity between switch contacts. 8. Disconnect lead 26 from horn. Check for +12 VDC at lead 26 with horn button pressed. 	<p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 420JD.</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 24.</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 24.</p> <p>If +12 VDC is present, go to step 6. If no voltage is present, replace horn relay (WP 0072 00).</p> <p>If continuity is indicated, go to step 7. If no continuity is indicated, repair ground lead.</p> <p>If continuity is indicated, go to step 8. If no continuity is indicated, replace horn button (WP 0156 00).</p> <p>If +12 VDC is present, go to step 9. If no voltage is present, disconnect horn relay and check for continuity between connector 87 and lead 26. If continuity is indicated, replace horn relay (WP 0072 00). If no continuity is indicated, repair lead 26.</p>

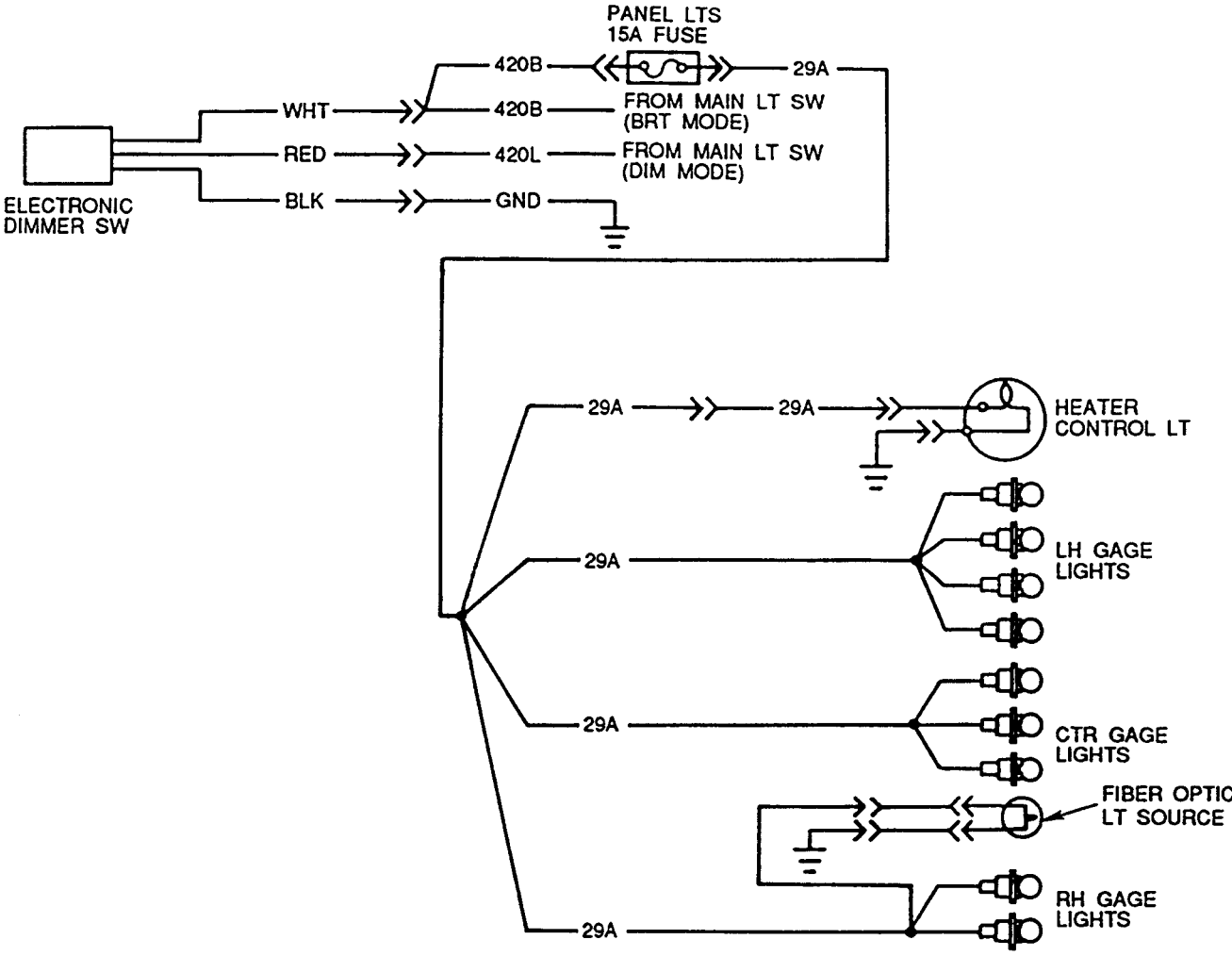
Table 1. Electric Horn Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>Electric Horn Does Not Operate - Continued.</p>	<p>9. Disconnect ground lead from horn. Check for continuity between ground lead and ground.</p>	<p>If continuity is indicated, replace horn (WP 0093 00). If no continuity is indicated, repair ground lead.</p>

Table 1. Tractor Beacon Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p style="text-align: center;"> </p> <p style="text-align: right;">402-109</p> <p>Tractor Beacon Light Not Operating.</p>	<ol style="list-style-type: none"> 1. Check tractor beacon light 15A fuse. 2. Remove lamp from tractor beacon light. Check for continuity between contacts on lamp. 3. Disconnect lead 254A from tractor beacon light. Check for +12 VDC at lead 254A with beacon light switch in on position. 4. Remove tractor beacon light 15A fuse. Check for +12 VDC at lead 420JD fuse connector from auxiliary light power bus. 5. Disconnect lead 254 from beacon light switch. Check for +12 VDC at lead 254. 6. Disconnect lead 254 and lead 254A from switch. Activate switch. Check for continuity between contacts of switch. 7. Disconnect lead 254A from tractor beacon light. Check for +12 VDC at lead 254A. 	<p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, replace tractor beacon light.</p> <p>If no voltage is present, go to step 4. If +12 VDC is present, check for continuity between socket and ground. If continuity is indicated, replace tractor beacon light, If continuity is not indicated, repair ground lead.</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 420JD.</p> <p>If +12 VDC is present, go to step 6. If no voltage is present, repair lead 254.</p> <p>If continuity is indicated, go to step 7. If no continuity is indicated, replace beacon light switch (WP 0067 00).</p> <p>If no voltage is present, repair lead 254A between beacon lights and beacon light switch.</p>

Table 1. Panel Light Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
	<ol style="list-style-type: none"> 1. Check panel lights 15A fuse. 2. Disconnect lead 420B from electronic dimmer switch. Check for +12 VDC at lead 420B from dimmer switch. 3. Disconnect ground lead from dimmer switch. Check for continuity between ground lead and ground. 	<p>If defective, replace 15A fuse (WP 0067 00).</p> <p>If +12 VDC is present, repair lead 420B. If no voltage is present, go to step 3.</p> <p>If continuity is indicated, replace electronic dimmer switch (WP 0067 00). If no continuity is indicated, repair ground lead.</p>

402-110

Table 1. Panel Light Circuits Troubleshooting Procedures.

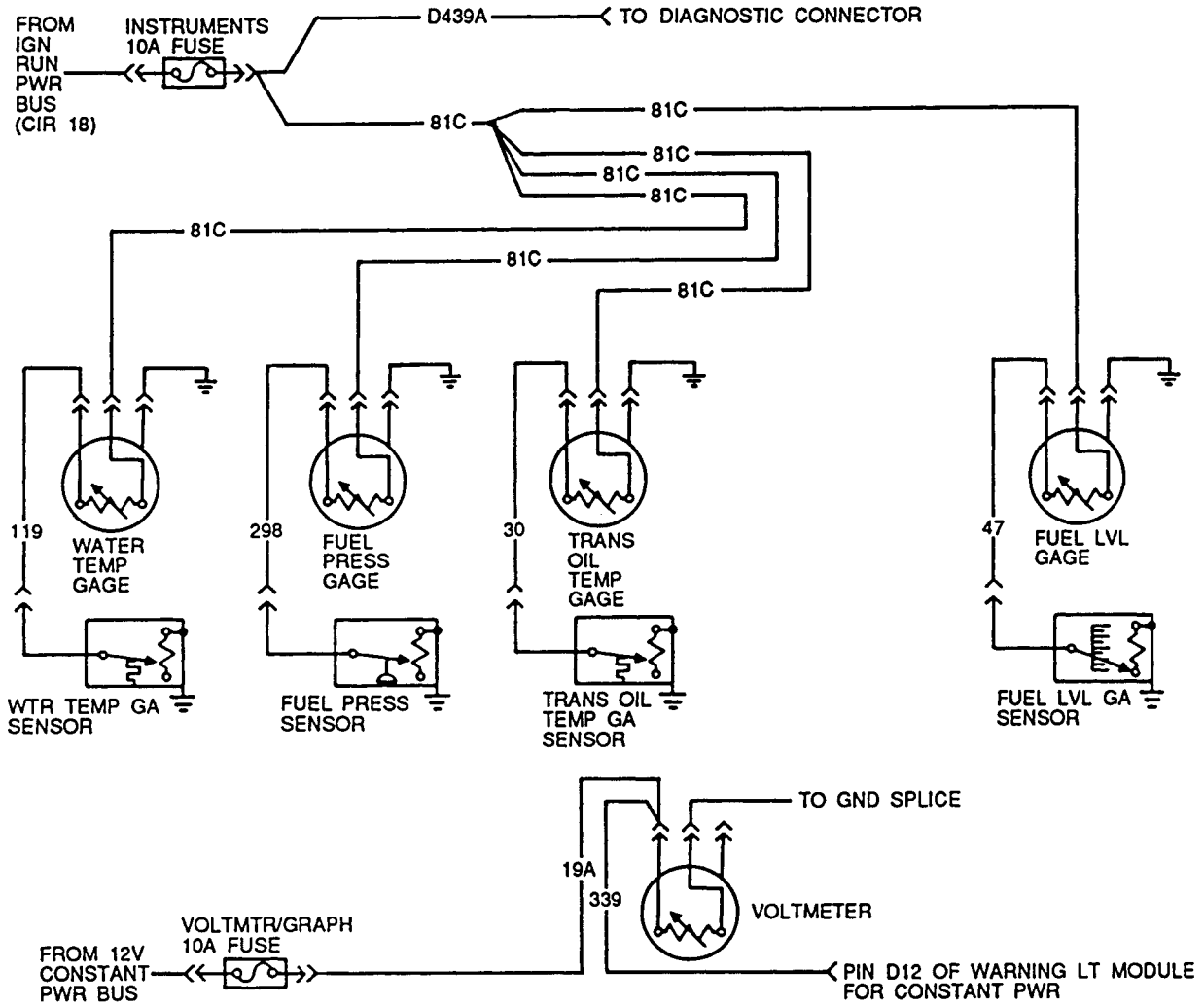
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. Heater Control Light Not Operating, Other Heater Circuits Operating Normally.</p>	<p>1. Check heater control lamp.</p> <p>2. Check for continuity between socket and ground.</p> <p>3. Disconnect lead 29A from heater control light. Check for +12 VDC at lead 29A from panel fuse.</p>	<p>If defective, replace lamp (WP 0069 00).</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, repair lead 29A to heater control light. If no voltage is present, repair lead 29A from fuse.</p>
<p>3. One Or More Gage Lights Not Operating.</p>	<p>Check panel gage lamp(s).</p>	<p>If defective, replace lamp(s) (WP 0062 00, WP 0063 00, and WP 0064 00).</p>
<p>4. Fiber Optics Not Operating.</p>	<p>1. Check fiber optic light source lamp.</p> <p>2. Check for continuity between lamp socket and ground.</p> <p>3. Disconnect power lead to fiber optic light source. Check for +12 VDC at power lead.</p>	<p>If damaged, replace lamp (WP 0071 00).</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, replace fiber optic light source light (WP 0071 00). If no voltage is present, repair power lead.</p>
<p>5. Panel Lights Do Not Dim.</p>	<p>Disconnect lead 420B from electronic dimmer switch. Check for +12 VDC at lead 420B with main light switch in dim mode.</p>	<p>If +12 VDC is present, replace main light switch (WP 0065 00). If no voltage is present, replace electronic dimmer switch (WP 0067 00).</p>
<p>6. Panel Lights Do Not Brighten.</p>	<p>Disconnect lead 420B from electronic dimmer switch. Check for +12 VDC at lead 420B with main light switch in bright mode.</p>	<p>If +12 VDC is present, replace main light switch (WP 0065 00).</p>

Table 1. Radio Circuits Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p> </p> <p>402-111</p> <p>Power Source For 24 VDC Radio Does Not Operate.</p>	<ol style="list-style-type: none"> 1. Check 24 VDC 25A radio fuse. 2. Remove 24 VDC 25A radio fuse. Check for +24 VDC at lead 421W fuse connector. 3. Check for continuity between ground lead and ground. 4. Check for +24 VDC at lead 421R from radio power source connector. 	<p>If defective, replace 25A fuse (WP 0072 00).</p> <p>If +24 VDC is present, go to step 3. If no voltage is present, repair lead 421W to 24 VDC constant power bus.</p> <p>If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead.</p> <p>If defective, replace 10A fuse (WP 0072 00).</p>

Table 1. Instrument Wiring Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. None Of The Instruments On Dashboard Operating.</p>	<ol style="list-style-type: none"> 1. Check instruments 10A fuse. 2. Check for +12 VDC at ignition run power bus connector. 	<p>If defective, replace 10A fuse (WP 0072 00).</p> <p>If +12 VDC is present, repair lead 81C. If no voltage is present, repair connector on ignition run power bus.</p>



402-112

Table 1. Instrument Wiring Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. Water Temperature Gage Does Not Operate.</p>	<ol style="list-style-type: none"> 1. Disconnect lead 81C from water temperature gage. Check for +12 VDC at lead 81C. 2. Disconnect ground lead from water temperature gage. Check for continuity between lead and ground. 3. Disconnect lead 119 from water temperature gage. Check for +8 to +12 VDC at water temperature gage. 4. Disconnect lead 119 from water temperature gage sensor. Check for +8 to +12 VDC at lead 119. 	<p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 81C.</p> <p>If continuity is present, go to step 3. If no continuity is indicated, repair ground lead.</p> <p>If +8 to +12 VDC is present, go to step 4. If no voltage is present, replace water temperature gage (WP 0062 00).</p> <p>If +8 to +12 VDC is present, replace water temperature gage sensor (TM 9-2815-222-34&P). If no voltage is present, repair lead 119.</p>
<p>3. Transmission Oil Temperature Gage Does Not Operate.</p>	<ol style="list-style-type: none"> 1. Disconnect lead 81C from transmission oil temperature gage. Check for +12 VDC at lead 81C. 2. Disconnect ground lead from transmission oil temperature gage. Check for continuity between lead and ground. 3. Disconnect lead 30 from transmission oil temperature gage. Check for +8 to +12 VDC at transmission oil temperature gage. 4. Disconnect lead 30 from transmission oil temperature gage sensor. Check for +8 to +12 VDC at lead 30. 	<p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 81C.</p> <p>If continuity is present, go to step 3. If no continuity is indicated, repair ground lead.</p> <p>If +8 to +12 VDC is present, go to step 4. If no voltage is present, replace transmission oil temperature gage (WP 0064 00).</p> <p>If +8 to +12 VDC is present, replace transmission oil temperature gage sensor (notify direct support maintenance). If no voltage is present, repair lead 30.</p>
<p>4. Fuel Level Gage Does Not Operate.</p>	<ol style="list-style-type: none"> 1. Disconnect lead 81C from fuel level gage. Check for +12 VDC at lead 81C. 2. Disconnect ground lead from fuel level gage. Check for continuity between ground lead and ground. 3. Disconnect lead 47 from fuel level gage. Check for +8 to +12 VDC at fuel level gage. 	<p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 81C.</p> <p>If continuity is present, go to step 3. If no continuity is indicated, repair ground lead.</p> <p>If +8 to +12 VDC is present, go to step 4. If no voltage is present, replace fuel level gage (WP 0064 00).</p>

Table 1. Instrument Wiring Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
4. Fuel Level Gage Does Not Operate - Continued.	4. Disconnect lead 47 from fuel level sensor. Check for +8 to +12 VDC at lead 47.	If +8 to +12 VDC is present, replace fuel level gage sensor (WP 0090 00). If no voltage is present, repair lead 47.
5. Voltmeter Does Not Operate, Warning Light Operating Normally.	1. Disconnect lead 19A from voltmeter. Check for +12 VDC at lead 19A. 2. Disconnect ground lead from voltmeter. Check for continuity between ground lead and ground.	If +12 VDC is present, go to step 2. If no voltage is present, repair lead 19A. If continuity is indicated, replace voltmeter (WP 0062 00). If no continuity is indicated, repair ground lead.

Table 1. Axle Lock Circuit Troubleshooting Procedures.

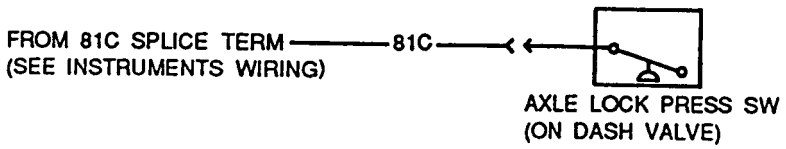
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION	
<p style="text-align: center;">  </p> <p style="text-align: right;">402-113</p>	<p>Axle Lock Does Not Engage.</p>	<p>1. Disconnect lead 81C from axle lock pressure switch. Check for +12 VDC at lead 81C.</p> <p>2. Disconnect leads 87 and 81C from axle lock pressure switch. Check for continuity between contacts of switch.</p> <p>Disconnect lead 87 from axle lock pressure switch. Check for continuity between lead 87 and ground.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, repair lead 81C.</p> <p>If continuity is indicated, go to step 3. If no continuity is indicated, replace axle lock pressure switch (WP 0065 00).</p> <p>If no continuity is indicated, repair lead 87.</p>

Table 1. Ether Quick-Start Circuit Troubleshooting Procedures.

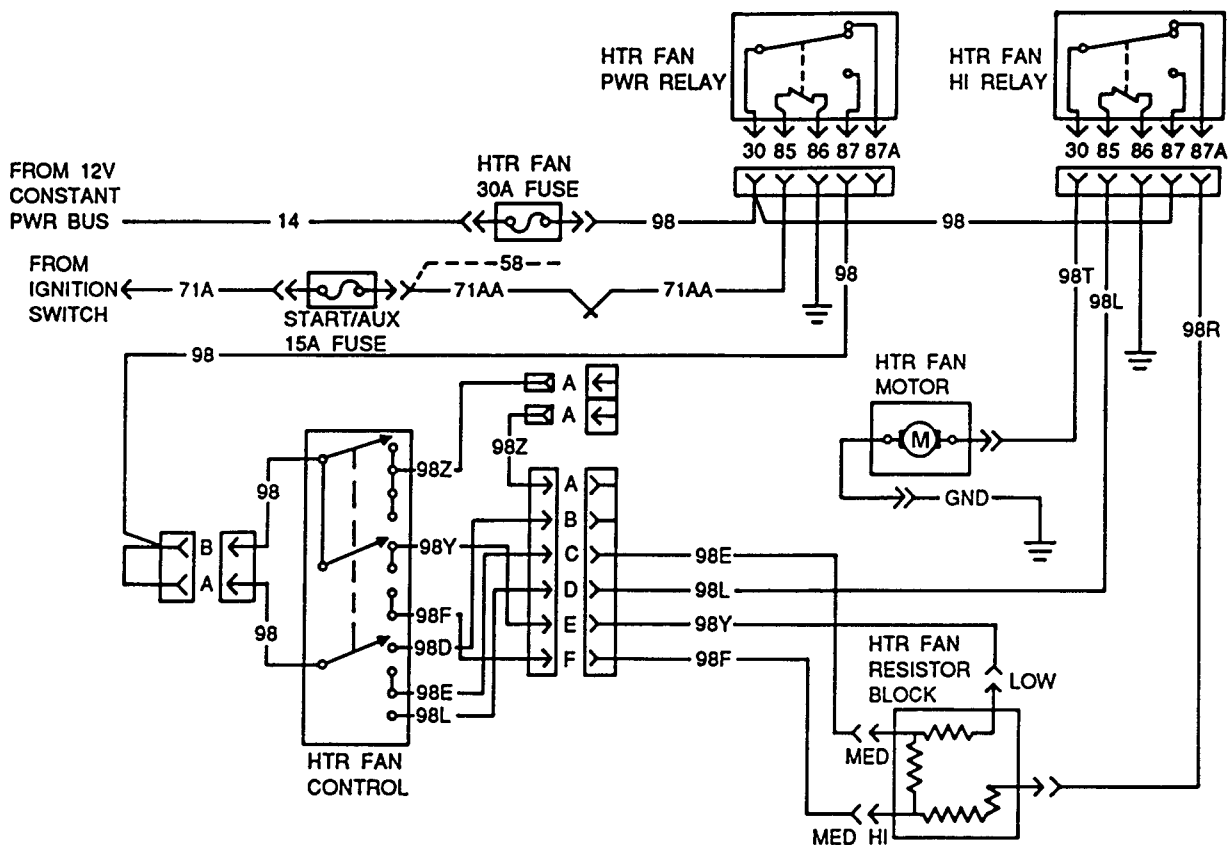
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<div> </div> <p>402-114</p> <p>Ether Quick-start Not Operating, Container Has Ether In It.</p>	<ol style="list-style-type: none"> <li>1. Check ether 15A fuse. <li>2. Remove ether 15A fuse. Check for +12 VDC at fuse connector from ignition run power bus. <li>3. Disconnect lead 166 from ether switch. Check for +12 VDC at lead 166. <li>4. Disconnect lead 166 and lead 166A from ether switch. Check for continuity between contacts of switch with switch activated. <li>5. Disconnect lead 166A at cab/chassis connection. Check for +12 VDC at lead 166A. <li>6. Disconnect lead 166A from ether solenoid. Check for +12 VDC at lead 166A. <li>7. Disconnect ground lead from ether solenoid. Check for continuity between ground lead and ground. 	<p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair circuit 18.</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 166.</p> <p>If continuity is present, go to step 5. If no continuity is indicated, replace ether switch (WP 0066 00).</p> <p>If +12 VDC is present, go to step 6. If no voltage is present, repair lead 166A.</p> <p>If +12 VDC is present, go to step 7. If no voltage is present, repair lead 166A.</p> <p>If continuity is indicated, replace ether solenoid (WP 0039 00). If no continuity is indicated, repair ground lead.</p>

Table 1. Air Dryer Heater Circuit Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p style="text-align: center;"> </p>	<p style="text-align: right;">402-115</p> <p>Air Dryer Heater Not Operating.</p> <ol style="list-style-type: none"> 1. Check reservoir heater/power take-off 15A fuse. 2. Remove reservoir heater/power take-off 15A fuse. Check for +12 VDC at lead 18 fuse connector. 3. Disconnect lead 94 from air dryer drain valve heater. Check for +12 VDC at lead 94. 4. Disconnect ground lead from air dryer drain valve heater. Check for continuity between lead and ground. 	<p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 18 to ignition run power bus.</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 94.</p> <p>If continuity is indicated, replace air dryer drain valve heater (WP 0262 00). If no continuity is indicated, repair ground lead.</p>

Table 1. Standard Heater Circuit Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Heater Fan Does Not Operate In Any Speed.</p>	<ol style="list-style-type: none"> 1. Check heater fan 30A fuse. 2. Check start/auxiliary 15A fuse. 3. Remove heater fan 30A fuse. Check for +12 VDC at lead 14 fuse connector. 4. Remove start/auxiliary 15A fuse. Check for +12 VDC at lead 71A fuse connector. 5. Disconnect heater fan power relay from connector. Check for +12 VDC at connector 30. 	<p>If defective, replace 30A fuse (WP 0072 00).</p> <p>If defective, replace 15A fuse (WP 0072 00).</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, repair lead 14 to 12-volt constant power bus.</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 71A.</p> <p>If +12 VDC is present, go to step 6. If no voltage is present, repair lead 98.</p>



402-116

Table 1. Standard Heater Circuit Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Heater Fan Does Not Operate In Any Speed - Continued</p>	<p>6. Disconnect heater fan high relay from connector. Check for +12 VDC at connector 87.</p> <p>7. Check for continuity between connector 86 and ground for both relays.</p> <p>8. Disconnect heater fan power relay from connector. Check for +12 VDC at connector 85.</p> <p>9. Disconnect lead 98 from heater fan control. Check for +12 VDC at lead 98.</p> <p>10. Disconnect lead 98L from heater fan control. Check for +12 VDC at heater fan control connector (D) with heater fan control in high mode.</p> <p>11. Disconnect heater fan high relay from connector. Check for +12 VDC at connector 85 with heater fan control in high mode.</p> <p>12. Disconnect lead 98T from heater fan motor. Check for +12 VDC at lead 98T with heater fan control in high mode.</p> <p>13. Disconnect ground lead from heater fan motor. Check for continuity between ground lead and ground.</p>	<p>If +12 VDC is present, go to step 7. If no voltage is present, repair lead 98.</p> <p>If continuity is indicated, go to step 8. If no continuity is indicated, repair ground lead.</p> <p>If +12 VDC is present, go to step 9. If no voltage is present, repair lead 71AA.</p> <p>If +12 VDC is present, go to step 10. If no voltage is present, disconnect heater fan power relay. Check for continuity in lead 98. If continuity is indicated, replace heater fan power relay (WP 0072 00). If no continuity is indicated, repair lead 98.</p> <p>If +12 VDC is present, go to step 11. If no voltage is present, replace heater fan control (WP 0069 00).</p> <p>If +12 VDC is present, go to step 12. If no voltage is present, repair lead 98L.</p> <p>If +12 VDC is present, go to step 13. If no voltage is present, disconnect heater fan high relay from connector. Check for continuity in lead 98T between connector 30 and heater fan motor. If continuity is indicated, replace heater fan high relay (WP 0072 00). If no continuity is indicated, repair lead 98T.</p> <p>If continuity is indicated, replace heater fan motor (WP 0211 00). If no continuity is indicated, repair ground lead.</p>

Table 1. Standard Heater Circuit Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. None Of The Lower Variable Speeds Operate.</p>	<p>1. Disconnect leads 98Y, 98E, and 98F from heater fan control. Check for +12 VDC at connector (E) with heater fan control in low mode, at connector (C) with heater fan control in medium mode, and at connector (F) with heater fan control in medium-high mode.</p> <p>2. Disconnect lead 98L from heater fan control. Check for +12 VDC with heater fan control in low, medium, and medium-high mode.</p> <p>3. Disconnect lead 98R from heater fan resistor block. Check for +12 VDC with heater fan control in low mode.</p> <p>4. Disconnect heater fan high relay from connector. Check for +12 VDC at connector 87A.</p> <p>5. Disconnect lead 98T from heater fan motor. Check for +12 VDC at lead 98.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, replace heater fan control (WP 0069 00).</p> <p>If +12 VDC is present, replace heater fan control (WP 0069 00). If no voltage is present, go to step 3.</p> <p>If +12 VDC is present, go to step 4. If no voltage is present, replace heater fan resistor block (WP 0213 00).</p> <p>If +12 VDC is present, go to step 5. If no voltage is present, repair lead 98R.</p> <p>If no voltage is present, replace heater fan high relay (WP 0072 00).</p>
<p>3. High Speed Does Not Operate.</p>	<p>1. Disconnect lead 98L from heater fan control. Check for +12 VDC at connector (D) with heater fan control in high mode.</p> <p>2. Disconnect heater fan high relay from connector. Check for +12 VDC at connector 85 with heater fan control in high mode.</p> <p>3. Disconnect heater fan high relay from connector. Check for continuity between connector 86 and ground.</p> <p>4. Disconnect lead 98T from heater fan motor. Check for +12 VDC at lead 98T.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, replace heater fan control (WP 0069 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 98L.</p> <p>If continuity is indicated, go to step 4. If no continuity is indicated, repair ground lead.</p> <p>If no voltage is present, replace heater fan high relay (WP 0069 00).</p>

Table 1. Standard Heater Circuit Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>4. Medium-high Speed Does Not Operate.</p>	<p>1. Disconnect lead 98F from heater fan control. Check for +12 VDC at heater fan control connector (F) with heater fan control in medium-high mode.</p> <p>2. Disconnect lead 98F from heater fan resistor block. Check for +12 VDC at lead 98F.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, replace heater fan control (WP 0069 00).</p> <p>If no voltage is present, repair lead 98F.</p>
<p>5. Medium Speed Does Not Operate.</p>	<p>1. Disconnect lead 98E from heater fan control. Check for +12 VDC at heater fan control connector (C) with heater fan control in medium mode.</p> <p>2. Disconnect lead 98E from resistor block. Check for +12 VDC at lead 98E.</p> <p>3. Disconnect leads 98E and 98F from heater fan resistor block. Check for continuity between contacts of heater resistor block.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, replace heater fan control (WP 0069 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 98E.</p> <p>If no continuity is indicated, replace resistor block (WP 0213 00).</p>
<p>6. Low Speed Does Not Operate.</p>	<p>1. Disconnect lead 98Y from heater fan control. Check for +12 VDC at heater fan control connector (E) with heater fan control in low mode.</p> <p>2. Disconnect lead 98Y from heater fan resistor block. Check for +12 VDC at lead 98Y.</p> <p>3. Disconnect leads 98Y and 98E from heater fan resistor block. Check for continuity between contacts of resistor block.</p>	<p>If +12 VDC is present, go to step 2. If no voltage is present, replace heater fan control (WP 0069 00).</p> <p>If +12 VDC is present, go to step 3. If no voltage is present, repair lead 98Y.</p> <p>If no continuity is indicated, replace heater fan resistor block (WP 0213 00).</p>

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Intermediate and Rear Axle Driveline Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Intermediate and Rear Axle Driveline Assemblies Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. No Drive At Forward-Rear Axle And/or Rear-rear Axle.</p>	<p>1. Check propeller shaft and universal joints from transfer rear output to forward-rear axle for broken universal joint(s) and broken or damaged tube, splines, or yoke(s).</p> <p>2. Check propeller shaft and universal joints from forward-rear axle to rear-rear axle for broken universal joint(s) and broken or damaged tubes, splines, or yoke(s).</p> <p>3. Check forward-rear axle and rear-rear axle for broken axle shaft(s).</p> <p>4. If problem still exists, notify direct support maintenance.</p>	<p>1. Replace any defective universal joint(s) (WP 0117 00).</p> <p>2. Replace defective propeller shaft (WP 0116 00).</p> <p>1. Replace any defective universal joint(s) (WP 0117 00).</p> <p>2. Replace defective propeller shaft (WP 0116 00).</p> <p>Replace any broken axle shaft(s) (WP 0116 00).</p>
<p>2. Vibration Or Noise During On-road Operation.</p>	<p>1. Check propeller shafts and universal joints for obvious wear or damage.</p> <p>2. Check wheels for looseness and obvious damage.</p>	<p>1. Replace any defective universal joint(s) (WP 0117 00).</p> <p>2. Replace defective propeller shaft (WP 0116 00).</p> <p>1. Tighten any loose wheel lug nuts (WP 0153 00).</p> <p>2. Replace any damaged wheel(s).</p>

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Brake System Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Brake System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Vehicle Does Not Slow Down Quickly Enough When Brakes Are Applied.	1. Check for proper lubrication.	Lubricate brake system (WP 0024 00); adjust brakes.
	2. Check for heat-damaged or glazed brakeshoe linings.	Replace any damaged or glazed brakeshoes (all brakeshoes must be replaced on an axle) (WP 0122 00 or WP 0124 00).
	3. Check brake drums for excessive heat damage, cracks, scoring, and out-of-roundness.	Replace damaged brake drums (WP 0263 00).
	4. Check for faulty air chambers.	Replace faulty air chamber(s) (WP 0123 00 or WP 0125 00).
	5. Check for air pressure leakage to air chambers.	Replace air compressor (WP 0302 00).
2. Brakes Do Not Release or Release Too Slowly.	1. Check for proper lubrication of brake system.	Lubricate brake system (WP 0024 00).
	2. Check that foot valve returns to fully released position.	Remove any debris interfering with pedal travel or adjust stop bolt (WP 0126 00).
	3. Check exhaust ports on foot brake valve, quick release valve, and gladhand vent holes for blockage.	Clear obstructions from exhaust port(s) and vents (WP 0146 00, WP 0147 00, and WP 0148 00).
	4. Check for weak and broken brakeshoe return springs.	Replace weak or broken springs (WP 0122 00 or WP 0124 00).
	5. Check for frozen brakeshoe anchor pins.	Clean and lubricate sticking pins or replace pins if damaged (WP 0122 00 or WP 0124 00).

Table 1. Brake System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
2. Brakes Do Not Release or Release Too Slowly - Continued.	6. Check for broken spring in air chamber.	Replace air chamber (WP 0123 00 or WP 0125 00).
3. Brakes Are Uneven, Drag or Pull When Applied.	1. Check for uneven adjustment between axles.	Adjust brakes (WP 0122 00 or WP 0124 00).
	2. Check for proper wheel bearing adjustment.	Adjust wheel bearings (WP 0154 00 or WP 0155 00).
	3. Check for grease-saturated or worn brake linings.	Replace brake linings (WP 0122 00 or WP 0124 00).
	4. Check for out-of-round brakedrum(s).	Replace brakedrum(s) (WP 0268 00).
	5. Check for worn s-cam or roller.	Replace s-cam or roller (WP 0127 00).
	6. Check for broken spring in air chamber.	Replace air chamber (WP 0123 00 or WP 0125 00).
4. ABS Indicator Light stays on After 5-10 Seconds.	1. Road test vehicle.	
	2. Perform ABS troubleshooting (WP 0019 00).	

END OF WORK PACKAGE

AIR SYSTEM TROUBLESHOOTING

0013 00

THIS WORK PACKAGE COVERS

Air System Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Air System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Loss Of Air Pressure.	1. Check for leaks in lines and fittings.	Replace damaged components (WP 0138 00).
	2. Check for faulty air supply tanks or components.	Replace damaged components (WP 0129 00, WP 0130 00, WP 0131 00, or WP 0132 00).
2. Loss Of Air Supply Function.	1. Check for blocked or kinked lines.	Replace damaged lines (WP 0138 00).
	2. Check for faulty valves.	Replace faulty valves (WP 0133 00).
3. Air Dryer Leaks.	Check for faulty seal.	Replace filter seal (WP 0135 00).
4. Air Dryer Fails To Absorb Pollutants.	1. Check for dirty filter(s).	Service (WP 0135 00) or replace air dryer (WP 0134 00).
	2. Check for contaminated desiccant beads (drying beads).	Service (WP 0135 00) or replace air dryer (WP 0134 00).
	3. Check for faulty purge valve.	Service (WP 0135 00) or replace air dryer (WP 0134 00).

END OF WORK PACKAGE

STEERING SYSTEM TROUBLESHOOTING

0014 00

THIS WORK PACKAGE COVERS

Steering System Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 2. Steering System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Loss Of Steering Control.	1. Check for failed mounting of steering wheel to steering column shaft.	Replace steering wheel or column shaft (WP 0156 00 or WP 0157 00).
	2. Check for faulty steering wheel or column.	Replace steering wheel or column (WP 0156 00 or WP 0272 00).
	3. Check for faulty universal joint.	Replace universal joint (WP 0157 00).
	4. Check for faulty tie rod, pitman arm, or drag link.	Replace tie rod, pitman arm, or drag link (WP 0158 00 or WP 0251 00).
2. Universal Shaft Fails.	1. Check for faulty universal shaft.	Replace universal shaft (WP 0157 00).
	2. Check for faulty yoke assembly.	Replace universal shaft (WP 0157 00).
	3. Check for faulty attaching hardware.	Tighten or replace attaching hardware (WP 0157 00).
3. Tie Rod And/Or Anchor Drag Link And/Or Pitman Arm Fails.	1. Check for lack of lubrication.	Replace tie rod assembly (WP 0251 00).
	2. Check for corrosion.	Replace tie rod assembly (WP 0251 00).
4. Hose Assembly Fails (Leaks).	1. Check for loose or damaged fittings.	Tighten or replace fittings (WP 0159 00).
	2. Check for cracked or brittle hose.	Replace hose assembly (WP 0159 00).
	3. Check for extreme temperature conditions.	Replace hose assembly (WP 0159 00).

Table 1. Steering System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Power Steering Reservoir Leaks.</p>	<ol style="list-style-type: none"> 1. Check for dirty filter/contamination. 2. Check for faulty fitting connection(s). 3. Check for damaged cover assembly and loose or damaged wing screw. 4. Check for faulty or cracked power steering reservoir. 	<p>Replace filter (WP 0160 00).</p> <p>Replace (WP 0160 00) or repair power steering fitting (WP 0159 00).</p> <p>Tighten or replace cover assembly and/or wing screw (WP 0160 00).</p> <p>Replace power steering reservoir (WP 0159 00).</p>

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Chassis Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Chassis Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Assembly Loose Or Missing.	1. Check for loose or faulty attaching hardware. 2. Check for failed brackets.	Tighten or replace attaching hardware (WP 0024 00). Replace brackets (WP 0024 00).
2. Loose Or Missing Fender Extension.	1. Check for loose or missing attaching hardware. 2. Check for faulty mounting brackets.	Tighten or replace attaching hardware (WP 0024 00). Replace faulty mounting brackets (WP 0024 00).
3. Pintle Hook Eye Not Locked.	Check for faulty or missing lock pin.	Replace or repair pintle hook (WP 0168 00).
4. Pintle Does Not Swivel.	1. Check for lack of lubrication. 2. Check for faulty assembly.	Lubricate pintle (WP 0024 00). Replace or repair pintle hook (WP 0168 00).

END OF WORK PACKAGE

FIFTH WHEEL TROUBLESHOOTING

0016 00

THIS WORK PACKAGE COVERS

Fifth Wheel Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Fifth Wheel Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Trailer Will Not Couple Or Becomes Uncoupled.</p>	<p>1. Check for proper coupling by visually inspecting fifth wheel throat.</p> <p>2. Check fifth wheel for worn or damaged parts.</p> <p>3. Check operation of fifth wheel locking device.</p>	<p>Reposition tractor.</p> <p>Replace worn or damaged parts (WP 0270 00).</p> <p>Adjust locking mechanism (WP 0170 00).</p>
<p>2. Restricted Relative Motion Between Tractor and Trailer.</p>	<p>Check for faulty slide bracket.</p>	<p>Replace slide bracket (WP 0268 00).</p>

END OF WORK PACKAGE

CAB TROUBLESHOOTING

0017 00

THIS WORK PACKAGE COVERS

Cab Troubleshooting Procedures

INITIAL SETUP

Maintenance Level

Unit

Tools and Specials

Tool kit, general mechanic's (Item 102, WP 0313 00)

Table 1. Cab Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTION ACTION
1. Loss Of Vehicle Instrumentation.	1. Check for faulty instrument panel.	Repair instrument panel (WP 0062 00 through WP 0067 00).
	2. Check for faulty tachometer and speedometer.	Replace tachometer or speedometer (WP 0063 00).
2. Vehicle Heater Assembly Leaks Coolant.	1. Check for faulty or loose clamps.	Tighten or replace clamps (WP 0212 00).
	2. Check for faulty heater hoses.	Replace heater hoses (WP 0212 00).
	3. Check for leaking heater core.	Replace heater assembly (WP 0212 00).
3. No Air Circulation.	Check for faulty blower motor.	Replace blower motor (WP 0211 00).
4. Impeded Or Blocked Air Flow.	1. Check for damaged ducts.	Replace duct assembly (WP 0296 00).
	2. Check for faulty air cylinder.	Replace duct air cylinder (WP 0210 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Preliminary Checks, Performance Tests, Safety Precautions, Air Conditioning Troubleshooting

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Gloves (Item 27, WP 0313 00)

Tools and Special Tools - Continued

Goggles (Item 30, WP 0313 00)

Leak detector (Item 54, WP 0313 00)

PRELIMINARY CHECKS

Before testing the operation of the air conditioning system, make the following checks:

1. Make sure the refrigerant compressor's drive belt is not damaged and is correctly tensioned. Also check the compressor mountings for tightness.
 - a. Check for broken, burst, or cut hoses; also check for loose fittings on all parts.
 - b. Check for road debris build-up on the condenser coil fins. Using air pressure and a whiskbroom or a soapy spray of water, carefully clean off the condenser; be careful not to bend the fins.
 - c. Check the color of the moisture indicator sight glass. If the color is a deep cobalt blue, the refrigerant charge is dry. If the indicator is *not* blue, the system is contaminated with moisture. Notify your supervisor.
 - d. If there is not enough airflow, make sure that leaves or other debris has not entered the fresh air ports under the windshield. If debris has entered, it could clog the fins of the evaporator core, and block airflow. Also, be sure that all ducts are connected to the dash louvers and that the air-control flaps in the heater housing are moving properly (this requires removal of the right and center dash panel).

PERFORMANCE TESTS

Following is a brief description of symptoms or conditions that could exist if something goes wrong with a refrigerant part.

1. **Receiver-Drier.**
 - a. The receiver-drier is normally at outside temperature. To the touch, the entire length of the unit should be the same temperature. If noticeable cool spots exist, notify your supervisor.
 - b. A blockage at the inlet of the unit will cause high head pressures; outlet blockages will cause low head pressures and little or no cooling.
 - c. If the moisture indicator is pink or white (showing that the system is wet), the receiver-drier is saturated with moisture and must be replaced. Notify your supervisor.

PERFORMANCE TESTS - CONTINUED**2. Cooling System:**

- a. Although they are not physically connected, there is a close tie between a vehicle's air conditioner and its cooling system. Poor air conditioner cooling can be the result of a problem in the cooling system.
- b. If the cooling system does not work correctly, the heat of the engine will rise to abnormal levels. The added heat will transfer to the air conditioner, other underhood parts, and maybe make its way into the cab. The added heat makes it necessary for the air conditioner to work harder and, at the same time, it reduces the air conditioner's ability to cool down the air in the cab. Also, if the water regulating valve isn't closing all the way, heat will enter the cab, giving the impression that the air conditioning system is not working.

(1) Expansion Valve:

- (a) Problems that start in the expansion valve show up as follows: when stuck closed, the evaporator coil and the expansion valve will be at outside temperature; when stuck open, both the coil and the valve will be extremely cold with frost or ice build-up.
- (b) Because the expansion valve channels are very small, blockages in the system tend to be found here (the valve is very sensitive to contamination). Usually, the contaminant is water; less than a drop of water is all it takes to make the valve inoperative. When water reaches the valve, the extreme cold that results from the pressure drop freezes the water, forming a block of ice in the valve. After the system shuts down and the valve warms up, the ice melts, and the valve operates again, only to freeze up when the moisture returns.
- (c) On-and-off operation of the expansion valve means that the receiver-drier is not removing moisture from the system. These contaminants should cause the moisture indicator's element to turn white and then pink.

(2) Refrigerant Compressor:

- (a) Compressor problems usually show in one of four ways: abnormal noise; seizure; leakage; or low suction and discharge pressures.
- (b) Resonant compressor noises are not causes for alarm; irregular noise or rattles are likely to be caused by broken parts.

(3) Evaporator:

- (a) The evaporator coils are basically trouble-free when airflow over the fins is not blocked. External or, less often, internal blockages will cause low suction pressure as well as little or no cooling.
- (b) If a leak exists in the system, and it cannot be traced to other parts or fittings, suspect damage to one of the evaporator coils. Notify your supervisor.

(4) Condenser:

- (a) The condenser is usually trouble-free. Normally, the temperature of the condenser outlet line is noticeably cooler than the inlet line. However, when road debris (such as leaves or dirt buildup) cakes up, airflow over the condenser fins is blocked; air is not able to absorb enough heat to turn the hot refrigerant gas into a liquid. High head pressures will result. In these cases, carefully clean off the outer surfaces of the condenser with compressed air or a soap and water solution; be careful not to bend the fins.
- (b) High head pressures will also occur if the condenser's tubing is abnormally bent, blocking the flow of refrigerant. Frost will appear at the point where the flow is restricted.
- (c) Less common internal blockages (bits of foreign material or metallic grit build-up) will stop the flow of refrigerant.

PERFORMANCE TESTS - CONTINUED

- (d) A quick test to check that poor system performance is caused by the condenser is to direct a spray of water onto the condenser while the system is running. If the air conditioner cools better because of the assist provided by the water, it is a sign that the condenser is not working.
 - (e) When troubleshooting a suspected condenser problem, remember that the problem may be caused by the radiator transferring high levels of heat to the condenser.
- (5) **Thermostatic Switch:**
- (a) **IMPORTANT:** Before troubleshooting the thermo-static switch, notify your supervisor to check for a full charge of refrigerant in the system. The compressor will not operate, or will cycle too often, if there is not enough refrigerant in the system.
 - (b) Quick or delayed cycling of the compressor may be caused by a thermostatic switch that is working, but is out of adjustment. If, after doing the tests below, the switch seems to be out of adjustment, replace it (the thermostatic switch cannot be recalibrated).
- c. Be sure the compressor clutch is operating correctly.
 - d. Expose the evaporator coil.
 - e. Start the engine. Place the air conditioner control at its coldest setting; turn on the air conditioner and the fan.
 - f. Place an accurate thermometer in contact with a tube on the evaporator coil. Be sure the thermometer is in good contact with the tube, or you will get a wrong reading.
 - When the temperature drops below 31°F to 36°F (-1°C to 2°C), the compressor clutch should disengage and remain this way until the temperature rises to 39°F to 44°F (4°C to 7°C).
 - g. If the compressor did not engage when the temperature was above the accepted high range, do the following test:
 - (1) Connect a voltmeter or a test light from one of the terminals on the thermostatic switch to ground. Repeat this test with the other terminal on the switch.
 - (2) With the engine running and the air conditioner and blower on, both terminals will show voltage when the compressor should be engaged; one terminal will show voltage when the compressor should be disengaged.
 - (a) If there is no voltage, there is a problem in the electrical system from the batteries to the thermostatic switch. Check all circuits for the cause, and repair or replace the wiring or parts.
 - (b) In all other cases where the compressor is not engaging and disengaging properly, the thermostatic switch is the cause. Replace it with a new switch.
 - a. Shut down the engine and, to prevent accidental electric shock or shorting during dash assembling, disconnect the batteries.
 - b. Assemble the dash.
3. **Line Restrictions:**
- a. A restricted suction line causes low suction pressure at the compressor and little or no cooling. A restriction in a line between the compressor and the expansion valve can cause high discharge and low suction pressure, and insufficient cooling.
 - b. Usually, areas of ice or frost build-up mean a blockage. Parts that often freeze up are probably corroded or inoperative and should be replaced. Parts (such as the expansion valve) that freeze up once in a while may do so because of moisture in the system, which will cause the moisture indicator's element to turn white or pink; if this happens, notify your supervisor.

SAFETY PRECAUTIONS

1. Whenever repairs are made to any air conditioner parts that hold refrigerant, you must discharge, purge or flush (if contaminated), evacuate, charge and leak test the system. In a good system, refrigerant lines are always under pressure and you should disconnect them only after the air conditioning system has been discharged to a refrigerant recovery unit through the service valves on the compressor.
2. Refrigerants are safe when used under the right conditions. Always wear safety goggles and non-leather gloves while discharging, purging, flushing, evacuating, charging, and leak testing the system. Do not wear leather gloves; when refrigerant gas or liquid contacts leather, the leather will stick to your skin.

WARNING

Use care to prevent refrigerant from touching your skin or eyes, because liquid refrigerant, when exposed to the air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.

3. Refrigerant splashed in the eyes should first be treated with a few drops of sterile mineral oil in the eyes, then rinsed with a weak boric acid solution. Do not rub the eyes. Call a doctor right away.
4. Refrigerant splashed on the skin should be treated the same as for frostbite: gently pour cool water on the area, but do not rub the skin. Keep the skin warm with layers of soft, sterile cloth. Call a doctor right away.
5. Even though refrigerant does not burn, when it contacts extreme heat or flame, poisonous phosgene gas is created. This gas is also produced when an open flame leak detector is used. Phosgene fumes have an acrid (bitter) smell.

WARNING

Do not work in an area where refrigerant may contact an open flame or any burning material, such as a cigarette. When it contacts extreme heat, refrigerant breaks down into poisonous phosgene gas which, if breathed, causes severe respiratory irritation. Do not breathe the fumes from an open flame leak detector.

6. You must work in an area where there is a constant flow of fresh air when the system is discharged, flushed, charged, and leak tested using an open flame leak detector.
7. Changes in both federal and state laws will affect the way dealerships service air conditioning systems. Under current federal laws, refrigerant must be recovered and recycled by all users to protect the environment, and not released into the atmosphere. Many service operations not directly involving the air-conditioning system require the release of the refrigerant charge. Under the new regulations, dealerships not having the required recovery and recycling equipment (and properly trained and certified personnel) will not be allowed to do any of this service work.
8. Because of its very low boiling point, refrigerant must be stored under pressure. To prevent the refrigerant cans from exploding, never expose them to temperatures higher than 125°F (52°C). Never leave refrigerant cans in the sun, and do not store them in sun-exposed areas where heat can build up, such as in glove boxes, automobile trunks, etc.

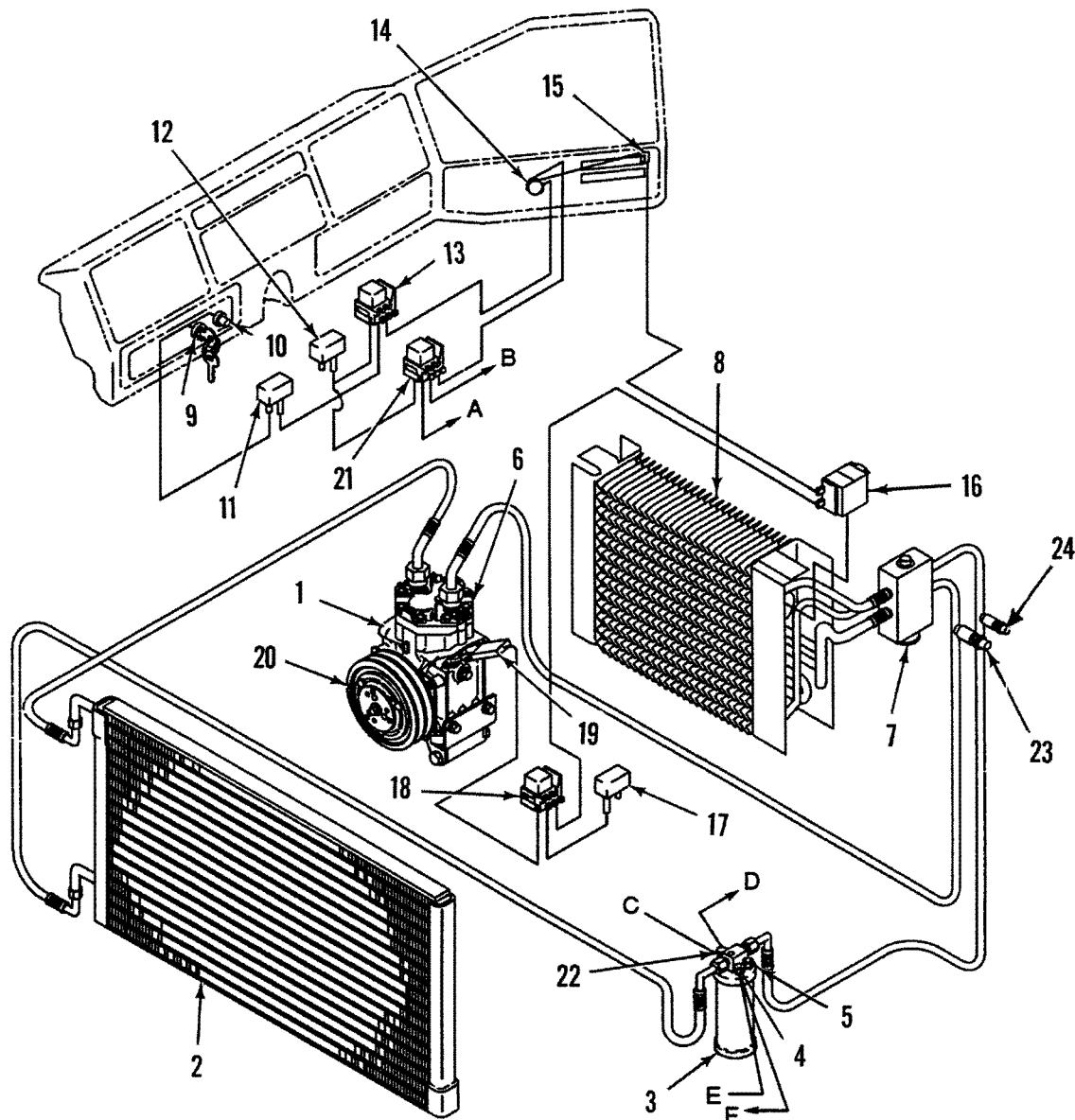
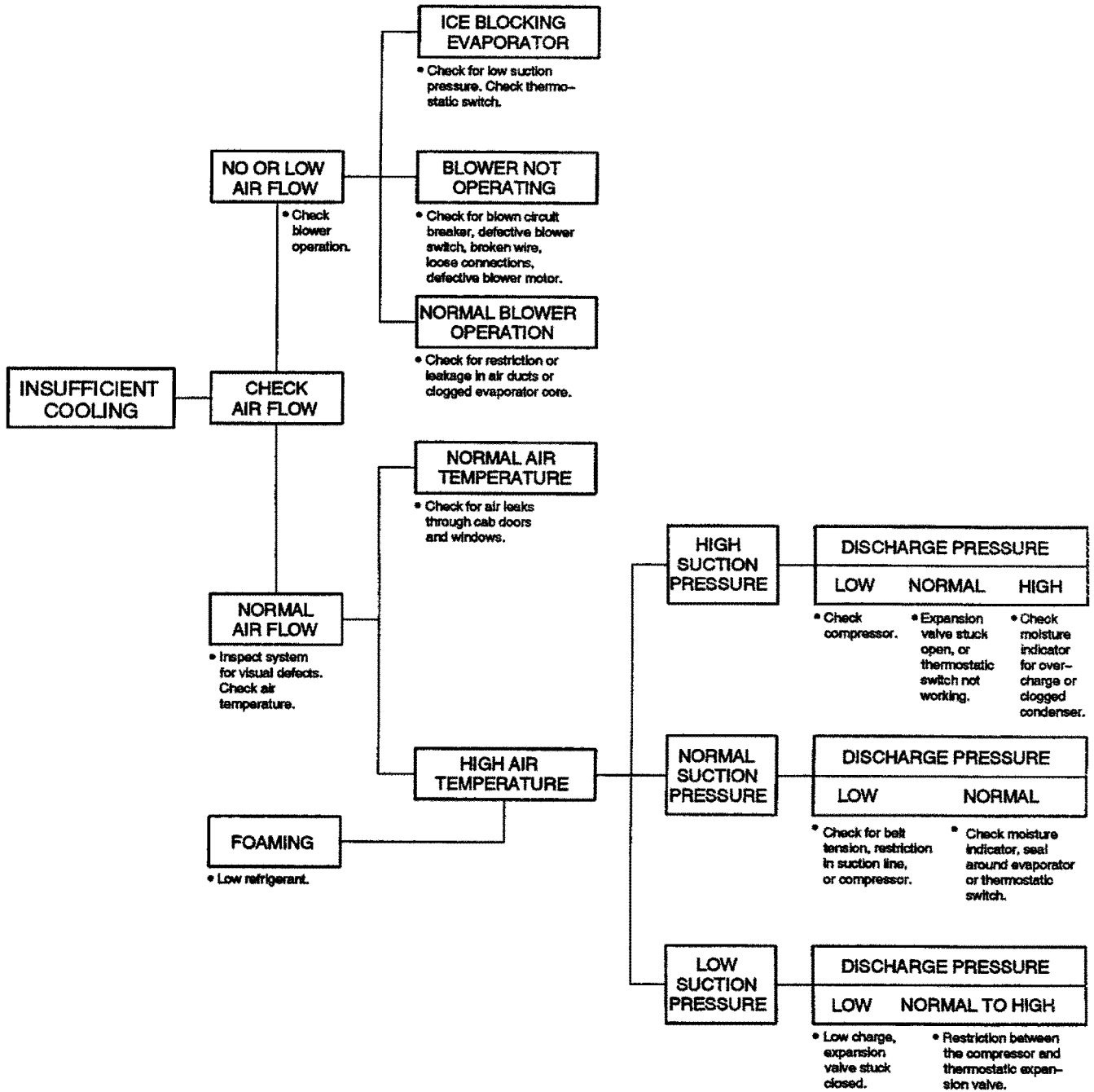


Figure 1. Air Conditioning System Components.

A. To resistor block		D. To engine fan thermal switch
B. To blower motor		E. From A/C clutch relay
C. From engine fan thermal switch		F. To compressor clutch
1. Compressor	9. Ignition Switch	17. Circuit Breaker (15A)
2. Condenser	10. Start Button	18. A/C Clutch Relay
3. Receiver-drier	11. Circuit Breaker (10A)	19. Diode
4. Binary Switch	12. Circuit Breaker (30A)	20. Compressor Clutch
5. Moisture Indicator	13. Power Relay	21. High-Speed Relay
6. High Pressure Relief Valve	14. Blower Switch	22. Fan Cycling Switch
7. Expansion Valve	15. "On-Off" Microswitch	23. Discharger Service Valve
8. Evaporator	16. Thermostatic Switch	24. Suction Service Valve



PROBLEM - LITTLE OR NO AIRFLOW

POSSIBLE CAUSE	REMEDY
The blower is not operating.	Check for an open circuit breaker. An open circuit indicates a short in the electrical system, which must be located and repaired.
	Check the air conditioner relays for operation. Replace as necessary.
	Make sure the blower motor switch is working. Replace if necessary.
	Check the wiring to the blower motor. If any connections are loose, securely tighten them.
	Check the blower motor for operation. Replace if sticking or otherwise inoperative.
	Check the resistor block. Replace if necessary.
	CAUTION: Never try to bypass the fuse in the resistor block. To do so could cause the blower motor to overheat, resulting in serious damage to the heater/air-conditioning system.
There are restrictions or leaks in the air ducts.	Examine all air ducts and remove any blockages. Stop any leaks or replace any portion where the leaks cannot be stopped.
Ice has formed on the evaporator coil.	Defrost the evaporator coil before resuming operation of the air conditioner.

PROBLEM - WARM AIRFLOW WHEN AIR CONDITIONER IS ON

POSSIBLE CAUSE	REMEDY
There is no refrigerant charge in the system.	Perform a leak test.
The refrigerant compressor is not operating.	Leak test the system. Drive belt needs repair or replacement.
The air conditioner microswitch is not working.	Replace the microswitch.
Ice has formed on the evaporator coil.	Defrost the evaporator coil before resuming operation of the air conditioner.

PROBLEM - HIGH COMPRESSOR DISCHARGE PRESSURE

POSSIBLE CAUSE	REMEDY
Airflow through the condenser is restricted.	Remove the debris from the condenser.
Air is present in the system.	Perform a leak test.
Heavy frosting on the suction line suggests that the evaporator coil is flooded.	Defrost the evaporator coil before resuming operation of the air conditioner.

AIR CONDITIONING SYSTEM TROUBLESHOOTING AND TESTING - CONTINUED

0018 00

PROBLEM - EVAPORATOR OUTLET AIR TEMPERATURE INCREASES AS COMPRESSOR DISCHARGE PRESSURE DROPS

POSSIBLE CAUSE	REMEDY
There are leaks in the system.	Leak test the system.
Too much oil is in the system. An indication of this is clutch or belt slippage at governed engine speed.	Check and remove excess refrigerant oil. For instructions, refer to the refrigerant compressor section elsewhere in this group.

PROBLEM - COMPRESSOR OPERATES TOO OFTEN OR CONTINUOUSLY

POSSIBLE CAUSE	REMEDY
There is too little refrigerant in the system.	Perform a leak test.
Ice has formed on the evaporator coil.	Defrost the evaporator coil before resuming operation of the air conditioner. Check the operation of the thermostatic switch, and replace as necessary.
Dirt and debris are clogging the condenser fins.	Remove all dirt and debris from the condenser fins.
The thermostatic switch isn't working.	Replace the thermostatic switch.

PROBLEM - QUICK OR DELAYED CYCLING OF COMPRESSOR

POSSIBLE CAUSE	REMEDY
The thermostatic switch operates, but is out of adjustment.	Replace the thermostatic switch. Do not attempt to adjust it.
Loss of refrigerant is causing a delayed cycling of the compressor.	Leak test.

PROBLEM - TEMPERATURE IN CAB TOO LOW OR NO HEAT

POSSIBLE CAUSE	REMEDY
The water regulating valve is not opened.	Slide the temperature lever slide control toward "warm".
The water regulating valve is not opening all the way.	Adjust the water regulating valve cable.
The water regulating valve isn't working.	Replace the water regulating valve.
A heater hose is pinched or twisted.	Repair or replace the heater hose.
Coolant is leaking from the system.	Check for leakage at the heater core, and at all hose connections from the heater core to the engine. Check the radiator coolant level, and add coolant, if necessary. Check and repair any leaks at the radiator.
Dust or dirt is clogging the heater core fins.	Remove and clean the heater core.

PROBLEM - CONDENSED WATER IS LEAKING FROM AIR CONDITIONER

POSSIBLE CAUSE	REMEDY
The drain tubes are plugged.	Clean the drain holes and drain tubes.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Introduction, Pretest Inspection, General Information, System Components, Diagnostics, Diagnostic and Testing Procedure, Pro-link Screens, Wiring Diagrams

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Adapter, test, ABS (item 1 WP 0313 00)

MSD/ICE (Item 58, WP 0313 00)

Multimeter, digital (Item 60, WP 0313 00)

Tools and Special Tools - Continued

PC Card, ABS (Item 64, WP 0313 00)

SPORT/ICE (Item 92, WP 0313 00)

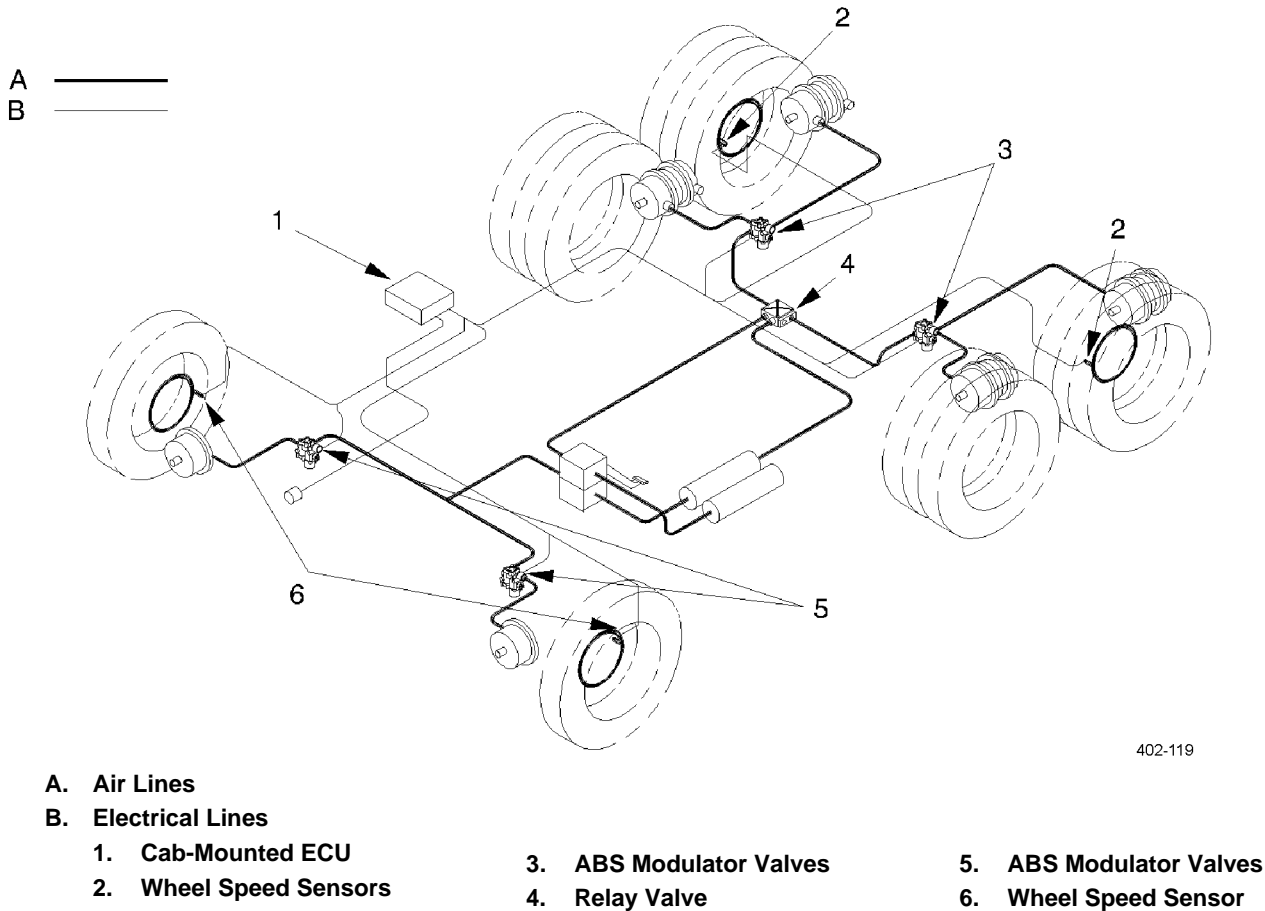
Tester, Pro-link, diagnostic reader (Item 99, WP 0313 00)

INTRODUCTION

This section contains information on troubleshooting and testing the Anti-lock Brake System (ABS) using blink code diagnostics and Pro-Link. The ABS is an electronic system that monitors and controls braking only during emergency situations. The ABS controls the braking of each wheel separately, which prevents wheel locking, maintains steer ability, and reduces stopping distance. The ABS has two diagonal circuits. Each circuit connects the front wheel of one side of the tractor to the rear wheels of the opposite side. In case of a system fault, only half of the ABS stops working. Control of that half is returned to the standard braking system. The ABS uses a tone ring and sensor on the hub of each monitored wheel. The sensor sends wheel speed information to the Electronic Control Unit (ECU). The ECU signals the modulator valve for that wheel to increase, reduce, or maintain pressure in the brake chamber. See **Fig 1**.

PRETEST INSPECTION

Prior to performing the tractor test ensure that the daily preventive maintenance inspections and procedures have been performed on the tractor.



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Fig 1. Location of ABS Components in the Tractor

GENERAL INFORMATION

1. Rockwell WABCO ABS E-Version is an electronic system that monitors and controls wheel speed during braking. The system works with standard air brake systems. ABS monitors wheel speeds at all times and controls braking during wheel lock situations. The system improves vehicle stability and control by reducing wheel lock during braking.
2. The ECU receives and processes signals from the wheel speed sensors. When the ECU detects a wheel lockup, the unit activates the appropriate modulator valve, and air pressure is controlled. In the event of a malfunction in the system, the ABS in the affected wheel(s) is disabled; that wheel still has normal brakes. The other wheels keep the ABS function.
3. An ABS warning lamp lets the driver know the status of the system. If the ECU senses a fault during normal vehicle operation, the ABS warning lamp will come on. This lamp is also used to display blink code diagnostics.

ABS WARNING LAMP

The ABS warning lamp works as shown in Table 1. If the ECU senses a fault during normal vehicle operation, the ABS warning lamp will come on and stay on.

Table 1. Warning Lamp Operation.

WHAT YOU DO	WHAT HAPPENS	WHAT IT MEANS
Turn the ignition on.	The ABS lamp comes on momentarily for a bulb check, then goes out.	The system is okay.
	The ABS lamp does not go out at ignition.	If the bulbs go out when the vehicle is driven above 4 mph (6 km/h), the system is okay. If the lamp does not go out after 5-10 second self-test, the ECU senses a fault in the ABS system.

ABS MODULATOR VALVES

1. Modulator Valves control the air pressure to each affected brake during an ABS function.
2. To make sure the ABS valves are working, listen to them as follows:
 - a. Turn on the ignition.
 - b. Wait for the ABS light.

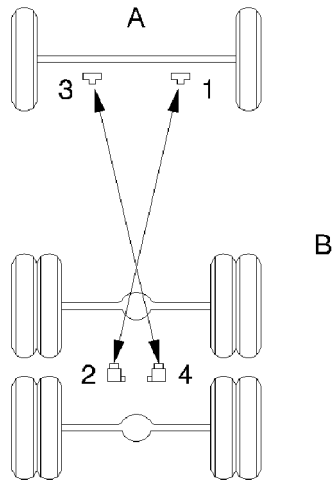
NOTE

The valves will cycle in 1-2-3-4 order, then diagonally in 1-2 and 3-4 order.

- c. Listen for the valves to cycle one by one, then together diagonally. See **Fig 2**.

ABS MODULATOR VALVES - CONTINUED**NOTE**

The valves will cycle in 1-2-3-4 order, then diagonally in 1-2 and 3-4 order.



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- A. Cab**
B. Curbside

Fig 2. Modulator Valve Checking

ABS SENSORS

ABS sensor systems consist of a tooth wheel mounted on the hub of each monitored wheel and a sensor installed so that its end is against the tooth wheel. The sensor continuously sends wheel speed information to the ECU. A sensor clip holds the sensor in place at the tooth wheel.

The type of axle determines the sensor mounting location:

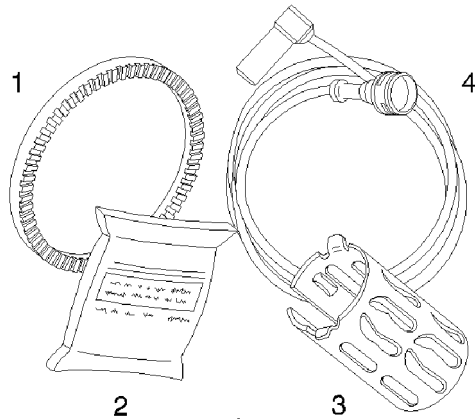
1. Steering axle sensors are installed in the steering knuckle or in a bolted-on bracket.
2. Drive axle sensors are mounted in a block attached to the axle housing or in a bolted-on bracket.

SYSTEM COMPONENTS

The ECU is the brain of the ABS system. It receives information from the sensors and sends signals to the ABS valves. See Fig 1.

SYSTEM COMPONENTS - CONTINUED

A tooth wheel (see **Fig 3**) is mounted at the hub of each sensed wheel, with a sensor installed so that its end is against the tooth wheel. A sensor clip holds the sensor in place at the tooth wheel. The sensor and clip must be greased with Rockwell WABCO recommended lubricant.

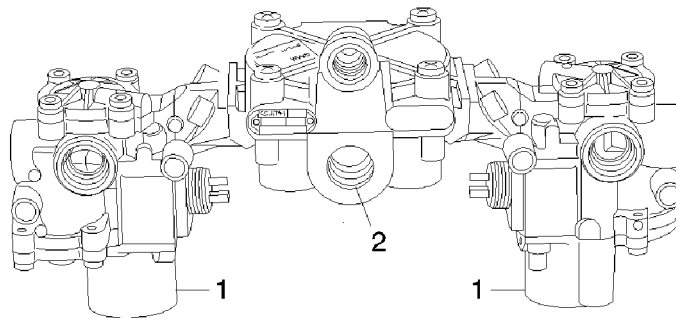


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- 1. Tooth Wheel
- 2. Lubricant
- 3. Sensor Clip
- 4. Sensor

Fig 3. Sensor Components

The ABS valve package is an alternative to individual valves on the rear axles. It combines two ABS modulator valves and one service relay valve. See **Fig 4**.



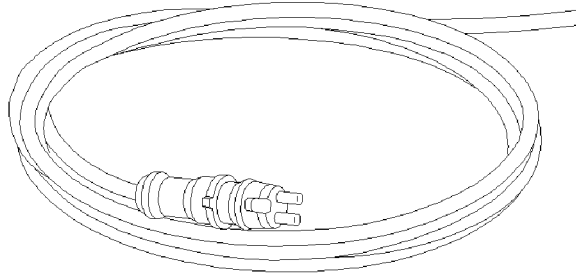
402-122

- 1. Modulator
- 2. Relay Valve

Fig 4. ABS Valve Package

SYSTEM COMPONENTS - CONTINUED

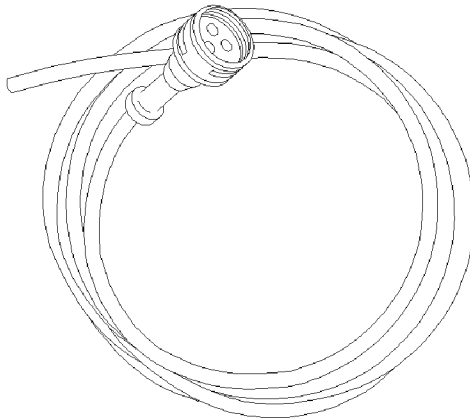
Sensor cables connect the sensor to the ECU. See **Fig. 5**.



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Fig 5. ABS Sensor Cable

ABS modulator valve cables connect the modulator valve to the ECU. See **Fig 6**.



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Fig 6. ABS Modulator Valve Cable

LAMP BULB CHECK

To make sure the ABS lamp is operating, drivers should check the lamp every time the vehicle is started. When the vehicle is started, the ABS lamp should come on momentarily. If it does not come on, it could mean a burned out bulb.

DIAGNOSTICS

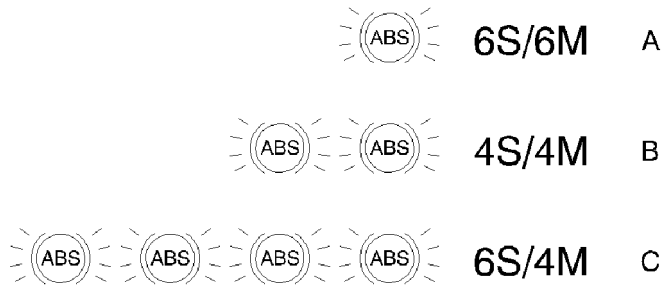
You can troubleshoot the system in the following ways:

- Blink Code Diagnostics
- Pro-Link 9000
- a. **Blink Code Diagnostics.**

Before using blink code diagnostics, you should be familiar with a few basic terms. If you used previous versions of Rockwell WABCO's blink code diagnostics, review these definitions to identify major changes.

- **ABS Warning Lamp:** This lamp serves two purposes: it alerts drivers to an ABS fault and it is used during diagnostics to display the blink code.
- **Blink Code:** A series of blinks or flashes that describe a particular ABS system fault or condition.
- **Blink Code Cycle:** A set of two flashes with each flash separated by a one-and-one-half second pause. Blink codes are defined in **Table 2**.
- **Blink Code Switch:** A switch that activates blink code diagnostic capabilities. Switch types and locations vary, depending on the vehicle.
- **Clear:** The process of erasing faults from the ECU.
- **Diagnostics:** The process of using blink codes to determine ABS system faults.
- **Fault:** An ABS malfunction detected and stored in memory by the Rockwell WABCO ECU. System faults may be Active or Stored.
- **Active Fault:** A condition that currently exists in the ABS system; for example, a sensor circuit malfunction on the left front steering axle. An active fault must be repaired before it can be cleared from memory and before you can display additional codes.
- **Stored Fault:** There are two types of stored faults: One type is a repaired fault that has not been cleared from the ECU. The other type is a fault that occurred but no longer exists. For example, a loose wire that makes intermittent contact. Because stored faults are not currently active they do not have to be repaired before they can be cleared from memory.
- **System Configuration Code:** A one digit code (Blink Code: 2) is displayed during the clear mode. Blink codes for common ABS system configurations are shown in **Fig 7**.

DIAGNOSTICS - CONTINUED



1. **Blink Code: 1**
2. **Blink Code: 2**
3. **Blink Code: 3**

Fig 7. System Configuration Codes

Table 2. Blink Code Identification.

FIRST DIGIT (TYPE OF FAULT)	SECOND DIGIT (SPECIFIC LOCATION OF FAULT)
1 No Faults	1 No Faults
2 ABS modulator valve 3 Too much sensor gap 4 Sensor short or open 5 Sensor signal erratic 6 Tooth wheel	1 Right front steer axle (curb side) 2 Left front steer axle (driver's side) 3 Right forward/rear tandem drive axle (curb side) 4 Left forward/rear tandem drive axle (driver's side) 5 Right rear-most tandem drive axle (curb side) 6 Left rear-most tandem drive axle (driver's side)
7 System function	1 J1922 or J1939 datalink 2 ATC valve (Not Used) 3 Retarder relay (third brake) 4 ABS warning lamp 5 ATC configuration (Not Used) 6 Reserved for future use
8 ECU	1 Low power supply 2 High power supply 3 Internal fault 4 System configuration error 5 Ground

NOTE

Blink code switch is located on ABS Electronic Control Unit (ECU) behind passenger's seat.

b. **Diagnostic Mode:**

To enter the diagnostic mode, press and hold the blink code switch for one second, then release.

c. **Clear Mode:**

To erase faults from the ECU, you must be in the clear mode. To enter the clear mode, press and hold the blink code switch for at least three seconds, then release.

If the system displays eight quick flashes followed by a system configuration code, the clear was successful. The ABS fault has been cleared from memory.

DIAGNOSTICS - CONTINUED

If you do not receive eight flashes, there are still active faults that must be repaired before they can be cleared.

d. **Blink Code Diagnostic Procedures:**

For the step-by-step blink code diagnostic procedure, see **Table 3**.

Table 3. Blink Code Diagnostic Procedure.

MODE	PROCEDURE	SYSTEM RESPONSE	ACTION
Diagnostic	Step 1. Turn the ignition on.	The ABS warning lamp comes on momentarily then goes out, indicating System Okay.	No recognizable faults in the ABS. No action required.
		The ABS warning lamp does not light, indicating possible wiring fault or burned out bulb.	Inspect the wiring. Inspect the bulb. Make necessary repairs.
		The ABS warning lamp stays on, indicating there is a fault, or faults, in the system.	Continue with the blink code diagnostics. Go to the next step.
	Step 2. Press and hold the Blink Code Switch for one second, then release.	The ABS warning lamp begins flashing two-digit blink codes(s).	Determine if the fault is active or stored: Active Fault: The lamp will repeatedly display one code. Stored Fault: The lamp will display the code for each stored fault then stop blinking. Faults will be displayed <i>one at a time</i> .
	Step 3. Count the flashes to determine the blink code.	First Digit: 1 to 8 flashes, Pause (1 1/2 seconds). Second Digit: 1 to 6 flashes, Pause (4 seconds).	Turn the ignition off. Find the definition for the blink code on the blink code chart.
	Step 4. Repair and record the faults.	Active Fault.	Make the necessary repairs. Repeat the first three steps of this procedure until System Okay Code (1-1) received.
Stored Faults.		Record for future reference. NOTE: The last fault code stored is the first fault code displayed.	
Clear	Step 5. Clear faults from the memory: Press and hold the blink code switch for at least three seconds, then release.	The ABS warning lamp flashes eight times.	All faults are successfully cleared. Turn the ignition off.
		Eight flashes are not received.	Active faults still exist, repeat the first four steps of this procedure.

DIAGNOSTICS - CONTINUED

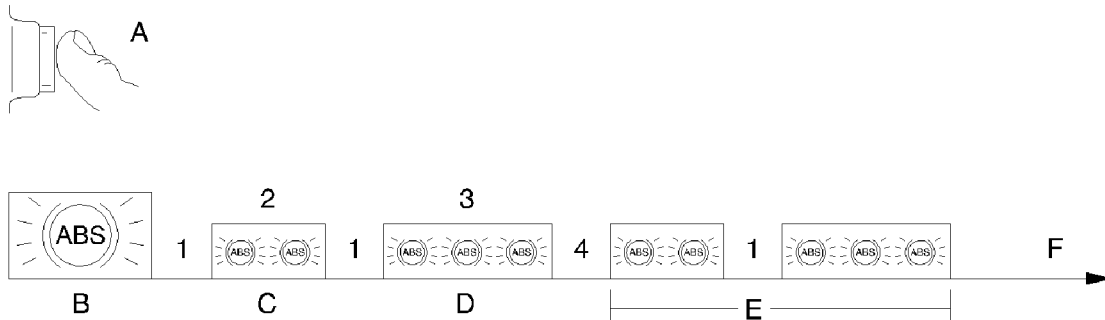
e. **Blink Codes Illustrated:**

Refer to the following figures for examples of typical blink codes:

- For a typical Active Fault code, see **Fig 8**.
- For typical Stored Fault codes, see **Fig 9**.
- For the System Okay code, see **Fig 10**.
- For the Faults Cleared code, see **Fig 11**.
- For the Faults not Cleared (active faults exist) code, see **Fig 12**.

NOTE

Blink Code 2-3 is shown here: Fault in the ABS modulator valve, right side of forward-rear axle.



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- | | |
|--|--|
| <p>A. Hold 1 Second.</p> <p>B. Light On.</p> <p>C. First Digit (2).</p> <p>1. Pause of 1.5 Seconds</p> <p>2. 1 to 8 Flashes</p> <p>3. 1 to 6 Flashes</p> <p>4. Pause of 4 Seconds</p> | <p>D. Second Digit (3).</p> <p>E. Repeat of blink code.</p> <p>F. Continues until the ignition is turned off.</p> |
|--|--|

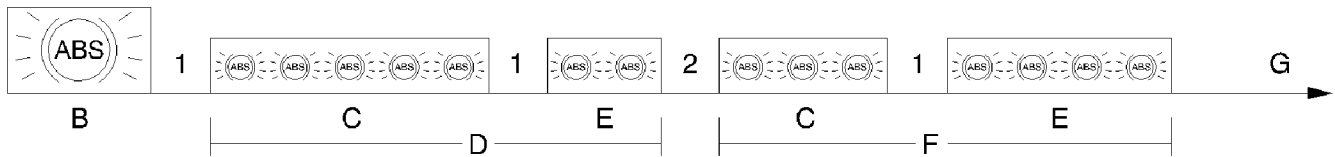
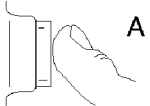
Fig 8. Typical Active Fault Code

DIAGNOSTICS - CONTINUED

NOTE

Blink Codes 5-2 and 3-4 are shown here:

- Code 5-2: Sensor signal erratic, left-front steer axle;
- Code 3-4: Too much sensor gap, left side of forward-rear axle.



402-127

A. Hold 1 Second.

C. First Digit.

E. Second Digit.

B. Light On.

D. First Stored Fault.

F. Second Stored Fault.

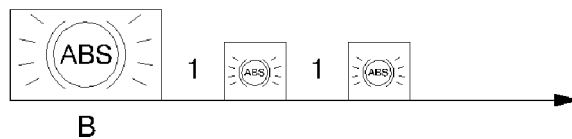
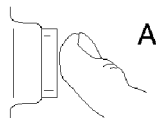
1. Pause of 1.5 Seconds

2. Pause of 4 Seconds

Fig 9. Stored Fault Codes

NOTE

Blink Code 1-1 is shown here: System okay.



402-128

A. Hold 1 Second.

B. Light On.

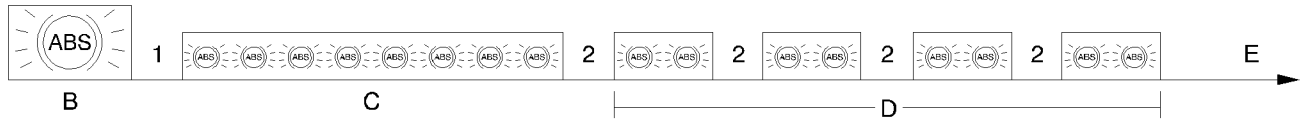
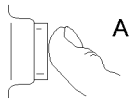
1. Pause of 1.5 Seconds

Fig 10. System Okay Code

DIAGNOSTICS - CONTINUED

NOTE

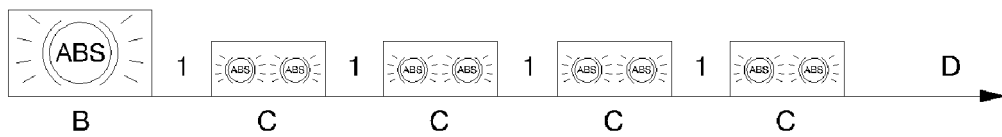
System configuration code 2 shown: 4S/4M. After the faults are cleared and the vehicle is started, the ABS lamp will stay on until the vehicle is driven over 4 mph (6 km/h).



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- A. Hold 3 Seconds.
- B. Light On.
- 1. Pause of 1.5 Seconds
- 2. Pause of 4 Seconds
- C. 8 Quick Blinks - Fault Cleared.
- D. System Identification.
- E. Continues until the ignition is turned off.

Fig 11. Stored Fault Cleared Codes



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- A. Hold 3 Seconds.
- B. Light On.
- 1. Pause of 4 Seconds
- C. System Identification.
- D. Continues until the ignition is turned off.

Fig 12. Faults Not Cleared Code

DIAGNOSTICS - CONTINUEDf. **Working with Blink Codes:**

If problems occur while working with blink codes, see **Table 4**.

Table 4. Blink Code Conditions.

CONDITION	REASON	ACTION
ABS lamp does not come on at ignition.	Loose or burned out bulb.	Check the bulb. Check the connections. Make necessary repairs.
	Voltage not within acceptable range (11 to 15 volts)	Make necessary repairs.
Can't use blink code diagnostics; ABS lamp will not go off when blink code is activated.	Switch not held for the proper length of time. 1 Second - Diagnostics Mode 3 Seconds - Clear All Mode	Repeat procedure, hold the switch for the proper length of time.
	Improper or faulty wiring.	Inspect and repair the wiring.
Eight flashes not received after blink code switch is pressed for at least three seconds, then released.	Active faults still exist.	Identify the active faults, then make necessary repairs. Turn the ignition off, then repeat the Blink Code Diagnostics.

DIAGNOSTICS - CONTINUED

g. **Repairs Required by Blink Codes:**

For the specific tests or repairs required by each blink code, see **Table 5**.

Table 5. Troubleshooting and Repair.

BLINK CODE	ACTION REQUIRED	REFERENCE
2-1 2-2 2-3 2-4 2-5 2-6	Check the ABS modulator valve, valve cable, and connections.	Do the Resistance Check.
3-1 3-2 3-3 3-4 3-5 3-6	Adjust the wheel sensor to touch the tooth wheel. Check the sensor gap. Check for loose wheel bearings or excessive hub runout.	Do the Sensor Adjustment, Sensor Voltage Test, or Pro-Link Component Test.
4-1 4-2 4-3 4-4 4-5 4-6	Check sensor, sensor cable, and connectors.	Do the Resistance Check.
5-1 5-2 5-3 5-4 5-5 5-6	Check for tire size mismatch or tooth wheel difference.	Review the Tire Size Range.
6-1 6-2 6-3 6-4 6-5 6-6	Check for damaged tooth wheel.	
7-1	Check for proper data link connection (J1922 and J1939)	Refer to the wiring diagrams.
7-2	Check the ATC valve, valve cables, and connectors. (Not used)	Do the Resistance Check.
7-3	Check the brake relay connections.	Refer to the wiring diagrams.
7-4	Check the ABS warning light connections.	
7-5	Verify proper ATC set up. (Not used)	
7-6	Verify the accuracy of the blink code and clear it from the ECU memory.	Review Blink Code Diagnostics.

DIAGNOSTICS - CONTINUED**Table 5. Troubleshooting and Repair - Continued.**

BLINK CODE	ACTION REQUIRED	REFERENCE
8-1	Check vehicle voltage and supply to the ECU (11 to 14 volts).	Refer to the wiring diagrams. Do the Voltage Check.
8-2	Check the vehicle voltage (11 to 14 volts). Verify the accuracy of the blink code and clear it from the ECU memory.	Do the Voltage Check. Review Blink Code Diagnostics.
8-3 8-4	Verify the accuracy of the blink code and clear it from the ECU memory.	Review Blink Code Diagnostics.
8-4	Verify the accuracy of the blink code and clear it from the ECU memory. <i>If the code does not clear, it may be necessary to replace the ECU.</i>	Contact Rockwell Customer Service at 1-800-535-5560.
8-5	Check the ABS ground connections.	Refer to the wiring diagrams.

MPSI PRO-LINK 9000**NOTE**

You must use the E-version cartridge with E-version ECUs.

Use the Pro-Link 9000 to:

- Diagnose system faults on ABS or ABS/ATC systems.
- Perform component measurement and function tests.

NOTE

The Pro-Link 9000 may be used in place of blink code diagnostic procedures.

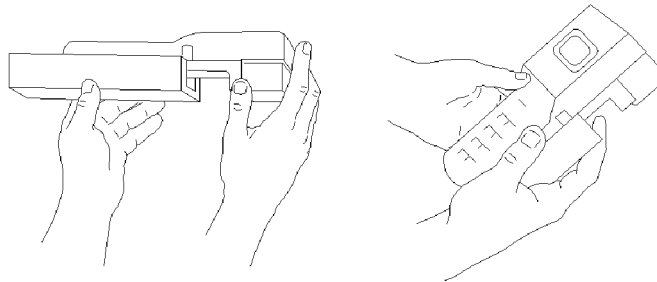
COMPONENT TESTS

Components that may be tested with the Pro-Link 9000 are:

- Vehicle Voltages
- ABS Modulator Valves
- ABS Lamps
- Sensors
- ABS Switches

DIAGNOSTIC AND TESTING PROCEDURE

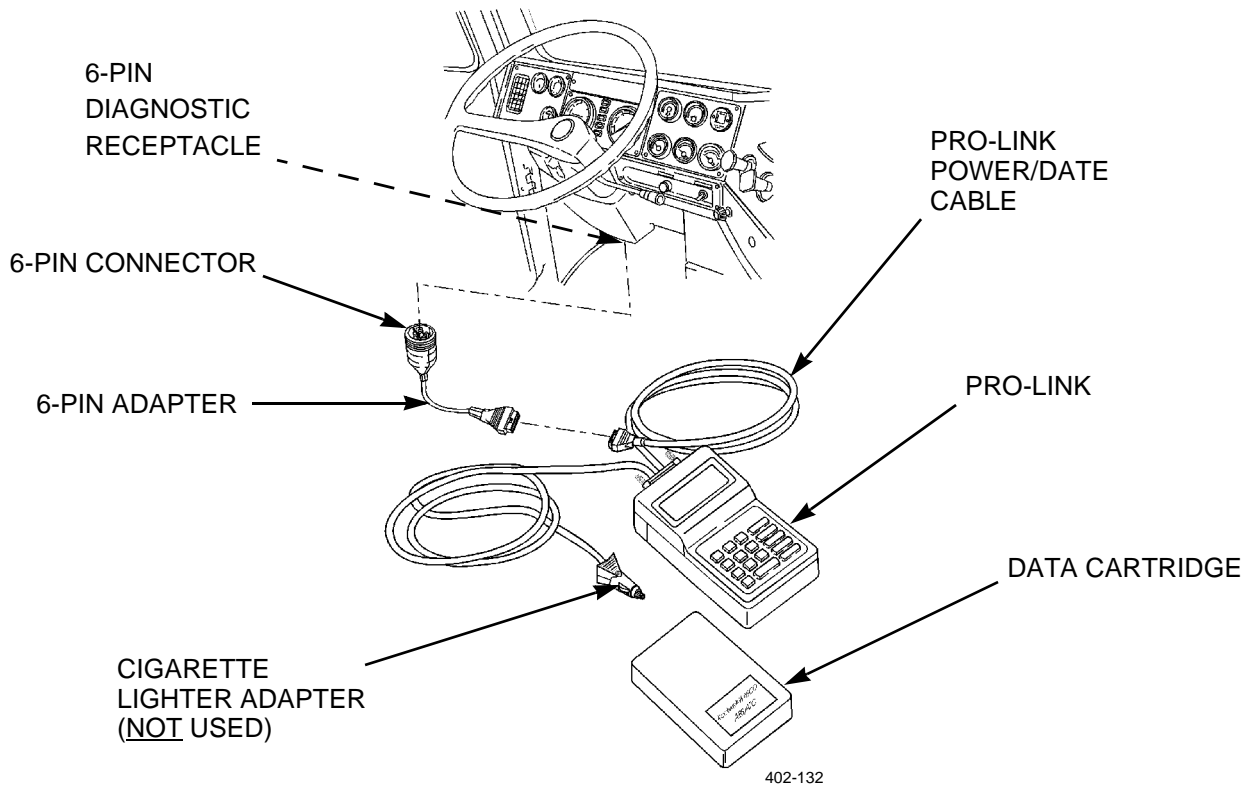
1. Slide the Rockwell WABCO D-version cartridge into the Pro-Link keypad until the connection is tight. See **Fig 13**.



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Fig 13. Pro-Link Cartridge Replacement

2. Chock the wheels, apply the parking brake, and make sure the ignition power is off.
3. Locate the 6-pin diagnostic receptacle in the vehicle cab. Insert the 6-pin connector from the Pro-Link into the receptacle. See **Fig 14**.



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Fig 14. Pro-Link Hook-up to Vehicle

DIAGNOSTIC AND TESTING PROCEDURE - CONTINUED

4. Turn the ignition to the ON/RUN position. The Pro-Link screen should power up. If the Pro-Link does not power up, or if the screen indicates NO DATA RECEIVED:
 - Check connections.
 - Make sure the cartridge is properly connected to the Pro-Link keypad.
 - Verify 12 volts DC power and ground at the connector and ABS ECU.
 - Check the fuse panel for a blown fuse.
 - Check for proper wiring in the diagnostic connector.

PRO-LINK SCREENS

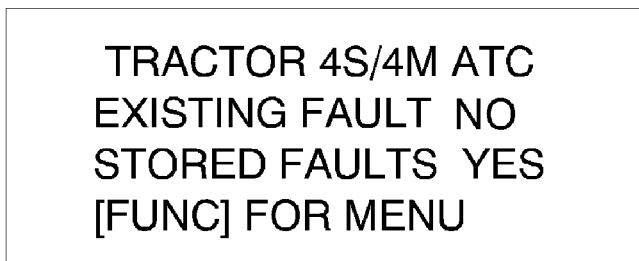
This paragraph provides basic screen explanations for the Pro-Link 9000 with a Rockwell WABCO E-version cartridge. For complete operating instructions and test information, refer to the Pro-Link manual. The most commonly used types of screens are the Fault Information screens and the Component Test screens.

1. **Fault Information Screens:**

- a. **Existing Faults:** Use these screens to identify existing faults. The Pro-Link screen displays a written description of the fault, including the location on the vehicle where each exists. As long as there is an active (existing) fault in the system, the Pro-Link will not let you clear faults.
- b. **Stored Faults:** Use these screens to identify faults stored in the ECU memory. Stored faults may be existing faults that have been repaired, or faults that existed for a short time, then corrected themselves. After displaying the stored faults, the Pro-Link lets you erase them from memory. All stored faults are cleared at one time.

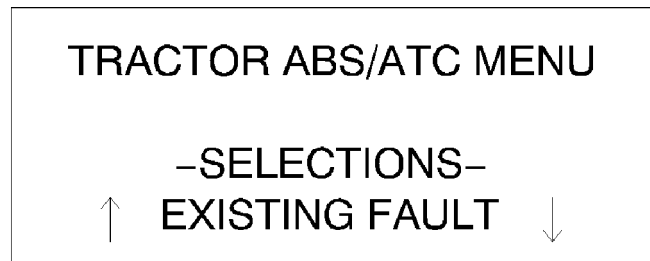
2. **Using Pro-Link:**

- a. The following illustrates a typical fault screen sequence for a 4S/4M ABS system with an existing fault.
 - (1) **Fig 15** indicates existing and stored faults in the system. Press FUNC to display the menu shown in **Fig 16**.



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Fig 15. Pro-Link Screen One



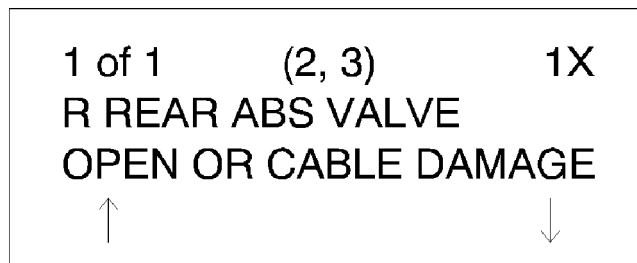
402-134

Fig 16. Pro-link Screen Two

PRO-LINK SCREENS - CONTINUED

- (2) Select Existing Fault to display the active fault. Press ENTER to select and the screen shown in **Fig 17** should appear.

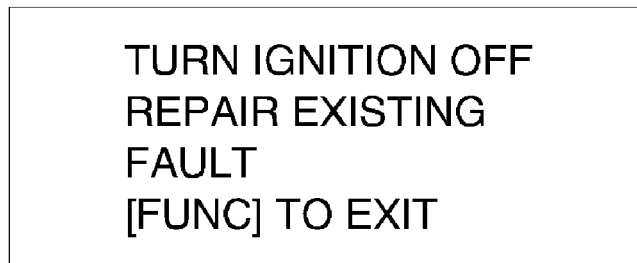
The first line displays the number of existing faults (1 of 1), the blink code (2-3), and the number of times the fault occurred (1 time). Lines two and three provide a written description of the fault.



402-135

Fig 17. Pro-Link Screen Three

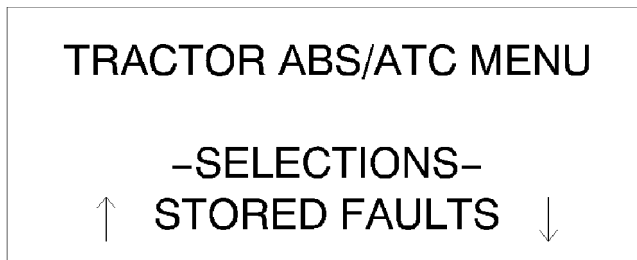
- (3) Press FUNC to exit. The screen shown in **Fig 18** should appear. Remove power from the ECU, make necessary repairs, and recycle the ECU.



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Fig 18. Pro-Link Screen Four

- (4) Press FUNC to return to the Tractor ABS/ATC menu shown in **Fig 19**.

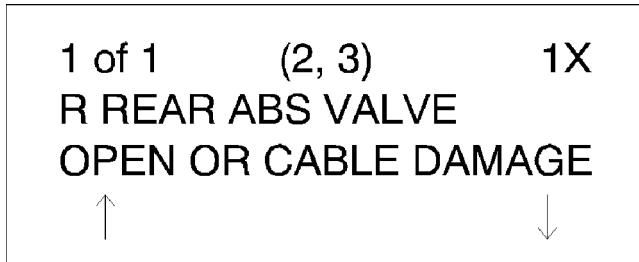


402-137

Fig 19. Pro-Link Screen Five

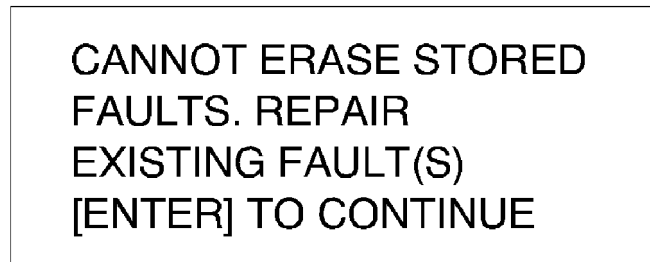
PRO-LINK SCREENS - CONTINUED

- (5) Press ENTER to display stored faults as shown in **Fig 20**. A description of the stored fault appears. In this example, only one fault is stored in memory, as indicated on line one. The blink code and number of times the fault occurred also appear on line one. Lines two and three provide a written description of the fault. Press FUNC to exit. The screen shown in **Fig 21** appears if you try to clear a stored code with an existing fault present.



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Fig 20. Pro-Link Screen Six



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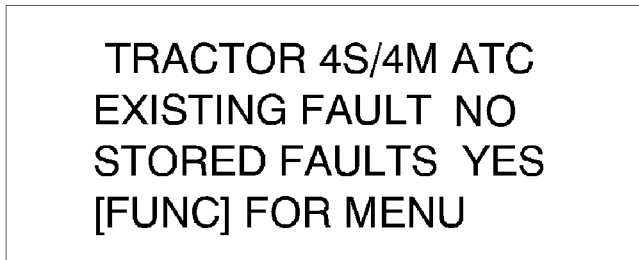
Fig 21. Pro-Link Screen Seven

- (6) Remove the power from the ECU, make necessary repairs, and recycle the ECU.

b. Clearing Stored Faults:

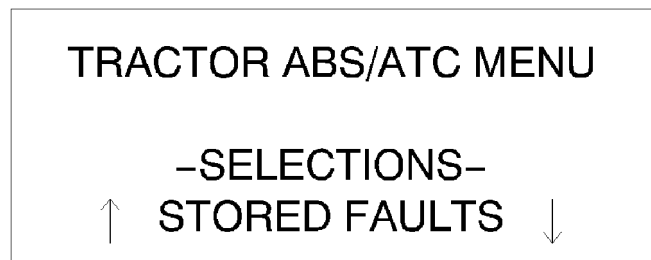
The screens you will see when clearing stored faults are illustrated in **Figs 17 and 18**.

- (1) **Fig 22** shows there are no existing faults. Select stored faults to view and clear the memory. Press FUNC to display the menu shown in **Fig 23**.



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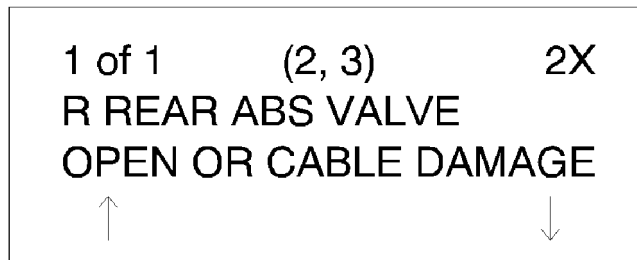
Fig 22. Pro-Link Screen Eight



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Fig 23. Pro-Link Screen Nine

- (2) Select Stored Faults, then press ENTER to display the stored faults shown in **Fig 24**. Pro-Link displays number, blink code, number of occurrences, and written description of the stored faults.

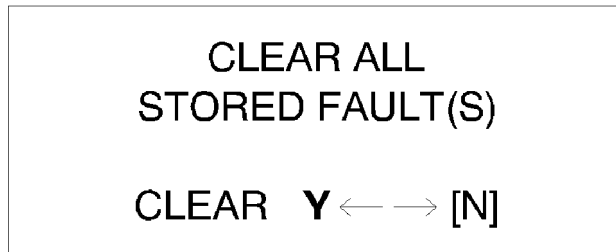


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Fig 24. Pro-Link Screen Ten

PRO-LINK SCREENS - CONTINUED

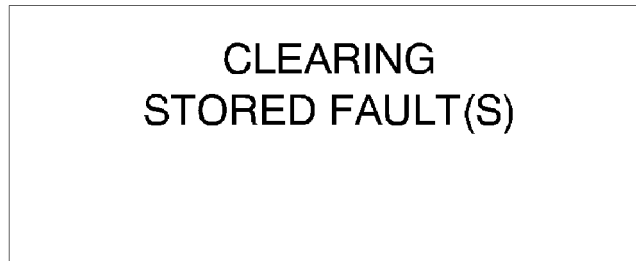
- (3) Press FUNC, and the screen shown in **Fig 25** will appear.



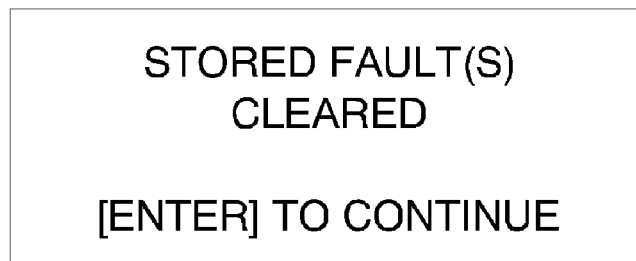
402-143

Fig 25. Pro-Link Screen Eleven

- (4) When the faults are cleared, Pro-Link will prompt you to continue. See **Fig 26** and **Fig 27**.



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Fig 26. Pro-Link Screen Twelve

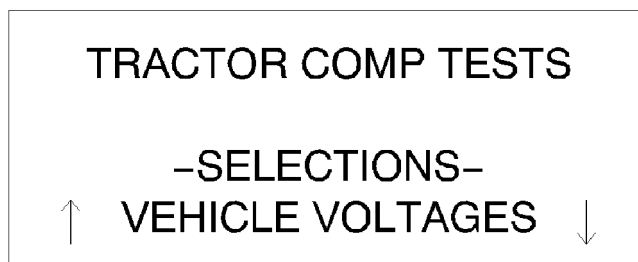
402-145

Fig 27. Pro-Link Screen Thirteen

- (5) Press ENTER to return to the ABS menu.

PRO-LINK SCREENS - CONTINUEDc. **Component Test Screens:**

These screens help you test ABS components. Select this function from the Tractor ABS/ATC menu. See **Fig 28**. Select the appropriate function. Each screen has instructions to guide you through the test. Refer to the Pro-Link service information for complete instructions.



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Fig 28. Typical Component Test Screen

You can test the following components:

- ABS Valves
- ABS Lamp
- ABS Switches
- Sensors

See **Table 6** for definitions that explain the function of each test.

Table 6. Test Functions.

COMPONENT TEST	FUNCTION
Vehicle Voltages	Monitors the two voltage signals powering the ECU.
ABS Valves	Cycles the valves, one at a time. You will hear each valve cycle. A menu selection lets you choose from four or six valves. This test may also be used to verify valve locations. NOTE: The treadle may be applied to put air in the chambers.
ABS Lamp	Monitors the commanded (on/off) states of the ATC lamp. Follow screen prompts (1 On, 2 Off) to change the status of the lamp on the instrument panel.
Sensors	Monitors the input to the ECU from the wheel. Wheels must be rotated during this test.

COMPONENT TESTING**WARNING**

When troubleshooting and testing the ABS system, do not damage the connector terminals. Damaged terminals can result in the system not functioning correctly and subsequent vehicle accidents resulting in personal injury and property damage.

a. **Voltage Check:**

The voltage must be between 11 and 14 volts. The ignition must be turned on for this test. Measure the voltage between pins 7 and 10, pins 8 and 11, and pins 9 and 12 on cab-mounted systems at bulkhead connector.

b. **Sensor Adjustment:**

- (1) Push the sensor in until it contacts the tooth wheel.
- (2) Do not pry or push sensors with sharp objects. Sensor will self-adjust after wheel rotation.
- (3) On steering axles, the sensor is accessible on the in-board side of the steering knuckle.
- (4) On drive axles, the drum assembly may have to be pulled to gain access to the sensor.

c. **Sensor Output Voltage Test:**

The voltage must be at least 0.200 volts AC at 30 rpm. Check sensor voltage as follows:

- Turn off the ignition.
- Rotate the wheel by hand at 30 rpm (2 revolutions per second).
- Measure voltage at the points shown in **Table 7**.

Table 7. Voltage Test Points

ECU	SENSOR	CONNECTOR	PINS
Cab-Mounted	LF	6-Pin	4 and 5
	RF	9-Pin	4 and 5
	LR	15-Pin	5 and 6
	RR	15-Pin	8 and 9

TIRE SIZE RANGE

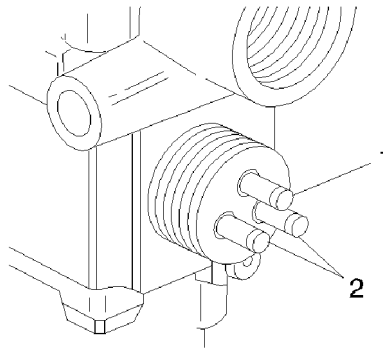
For proper ABS operation with the standard ECU, front and rear tire sizes must be within $\pm 14\%$ of each other. When the tire size range is exceeded without electronically modifying the ECU, the system performance can be affected and the warning lamp can illuminate.

Call Rockwell WABCO at 1-800-535-5560 if you plan a tire size difference greater than 14%. Calculate the tire size with the following equation:

- $\% \text{ Difference} = \{ \text{RPM Steer divided by RPM Drive minus } 1 \} \times 100$ (in this equation RPM means tire revolutions per mile)

VALVE TESTSa. **ABS Modulator Valve:**

- (1) Measure the resistance across each valve solenoid coil terminal and ground on the ABS valve to ensure 4.0 to 8.0 ohms. See **Fig 29**.



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1. **Pause of 1.5 Seconds**
2. **Pause of 4 Seconds**

Fig 29. ABS Modulator Valve

- (2) If the resistance is greater than 8.0 ohms, clean the electrical contacts in the solenoid. Check the resistance again.
- (3) To check the cable and the ABS valve as one unit, measure the resistance across the pins on the ECU connector of the harness. Check the wiring diagrams of the system you are testing. See **Figs 30, 31, 32, and 33**.

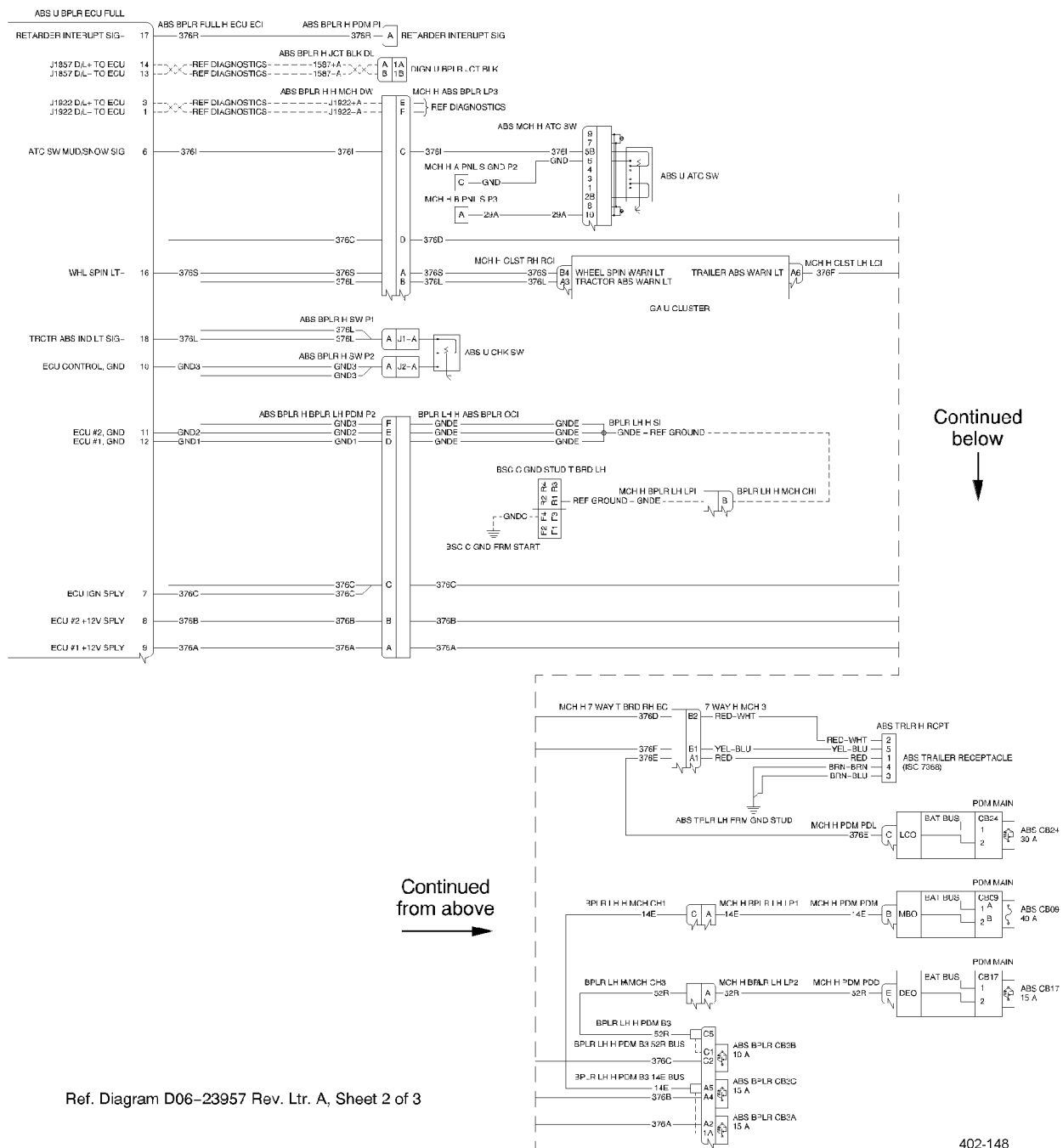
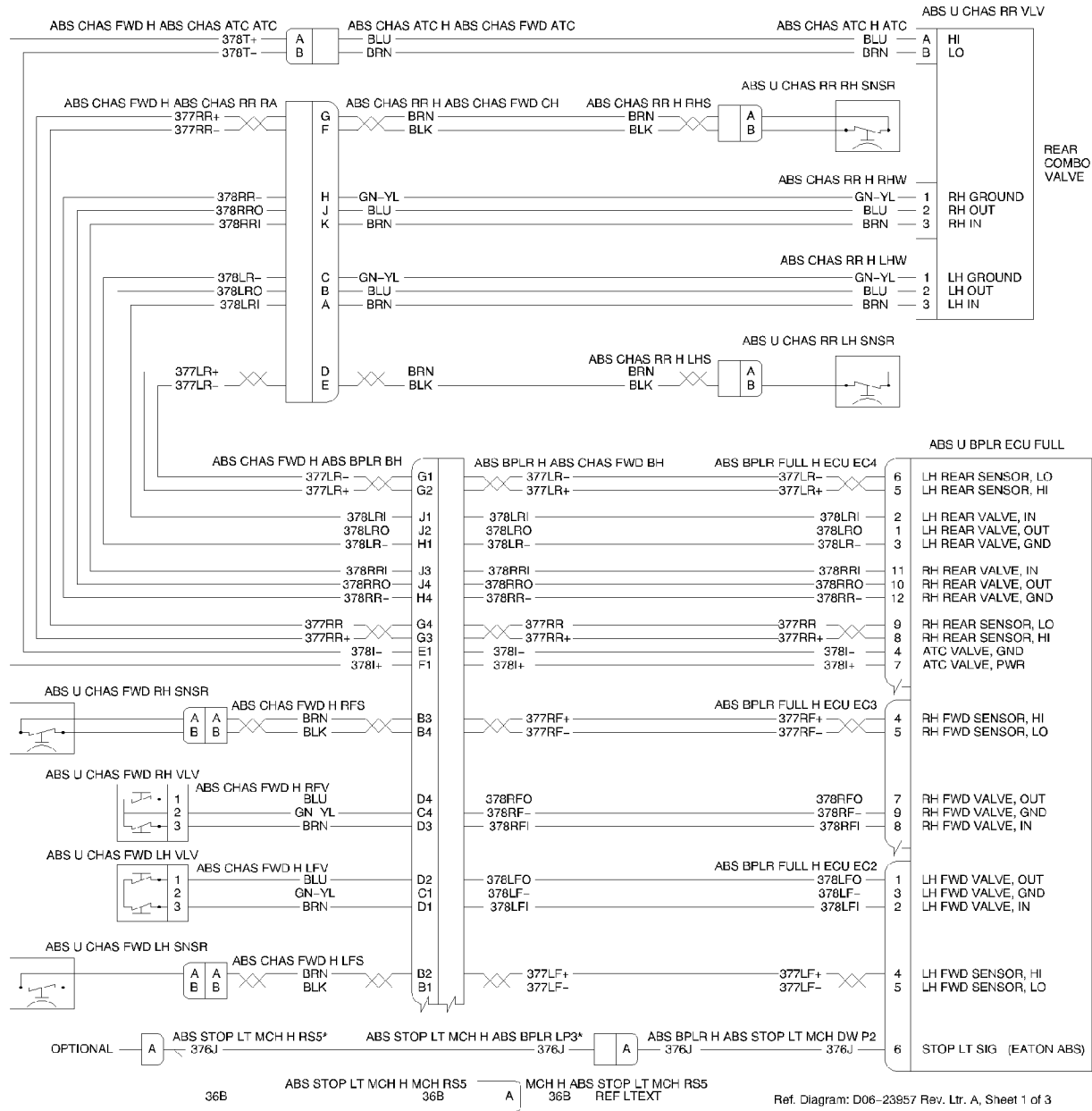


Fig 30. Wiring Diagram, Power and Control Wiring

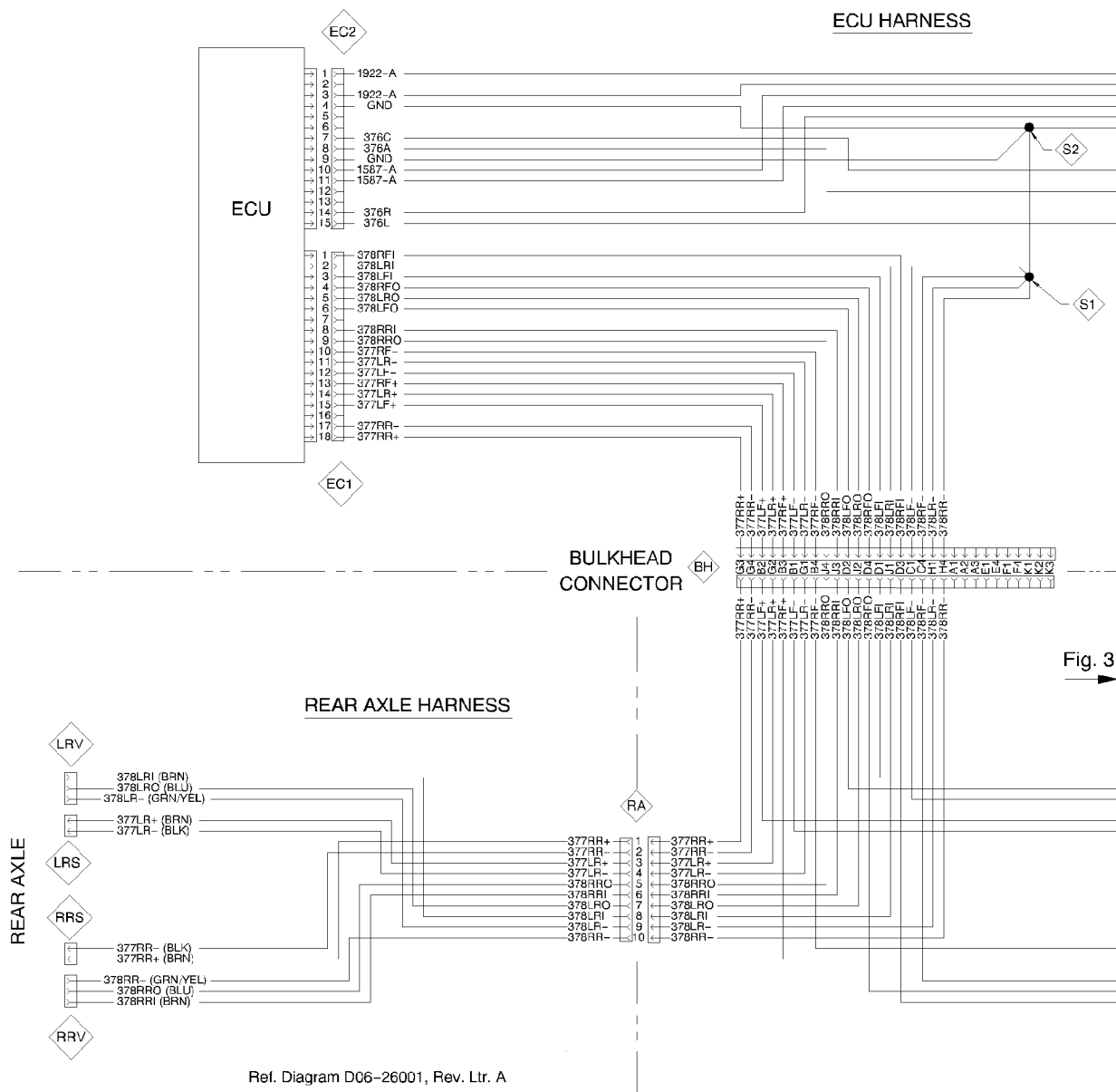


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402-149

Fig 31. Wiring Diagram, Sensor and Valve Wiring

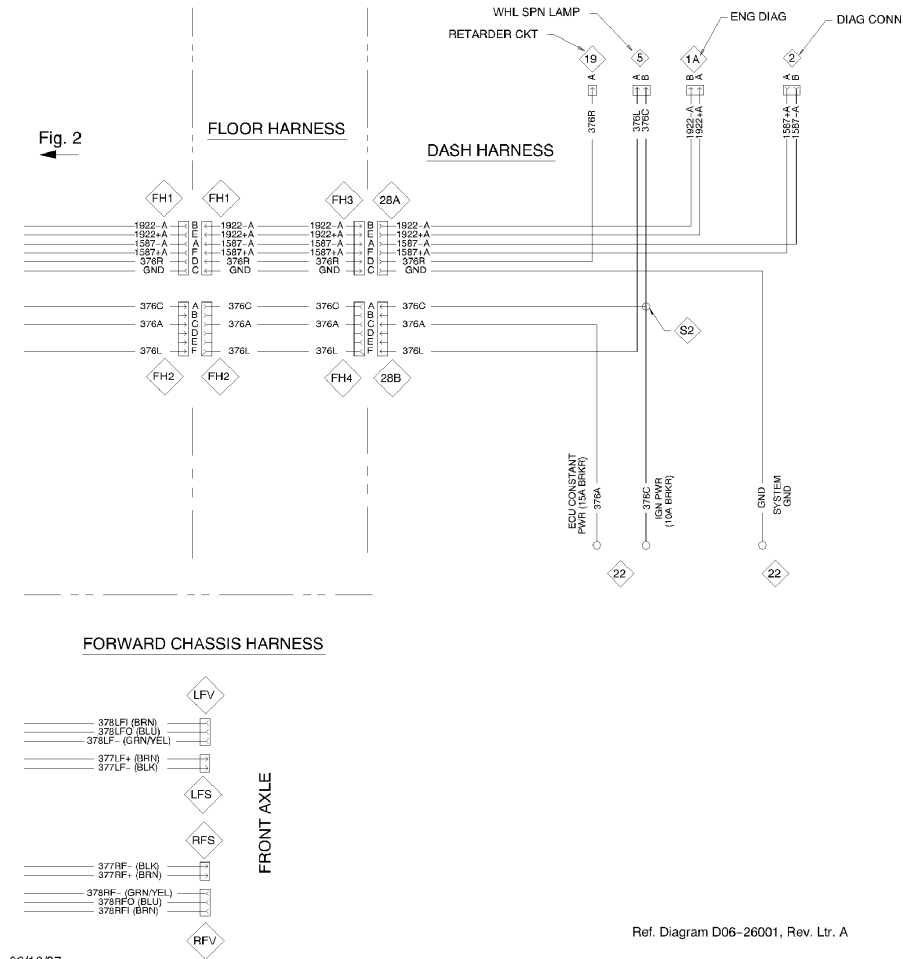


Ref. Diagram D06-26001, Rev. Ltr. A

Fig. 3

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Fig 32. Wiring Diagram, Basic WABCO Wiring (partial view)



06/16/97

Ref. Diagram D06-26001, Rev. Ltr. A

1421577

402-151

Fig 33. Wiring Diagram, Basic WABCO Wiring (partial view)

END OF WORK PACKAGE

COLLISION WARNING SYSTEM (CWS) TROUBLESHOOTING**0020 00****THIS WORK PACKAGE COVERS**

Initial System Troubleshooting, Driver's Display Unit Diagnostics Features, Activating/Clearing Failure Display Mode, ProLink Diagnostic Features, CWS Troubleshooting Procedures

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools - Continued

SPORT/ICE (Item 92, WP 0313 00)

Tools and Special Tools

MSD/ICE (Item 58, WP 0313 00)

PC card, CTIS/CWS (Item 65, WP 0313 00)

Multimeter, digital (Item 60, WP 0313 00)

Tester, Pro-link, diagnostic reader (Item 99, WP 0313 00)

References

WP 0098 00

INITIAL SYSTEM TROUBLESHOOTING

1. Check CWS components and wiring harness for obvious damage.
2. Check all connectors for corrosion, damage, and missing pins. Repair connectors as necessary (WP 0098 00).
3. Check that all electrical connections and ground wires are secure.
4. Check that other vehicle components are not causing interference.

DRIVER'S DISPLAY UNIT (DDU) DIAGNOSTIC FEATURES

1. Red failure light on DDU illuminates until cause of failure is corrected.
2. Fault codes are indicated by a pattern of flashes blinked out on Driver Display Unit (DDU) red "FAIL" light indicator. Each fault code consists of a two digit number.
3. A pause of 3/4 of one second separates blinking of first and second digit of fault code. Example: Fault code 32 is indicated by 3 blinks, a 3/4 second pause, and 2 more blinks.
4. A pause of 3 seconds exists between each flash code fault.
5. Code 41 is flashed if there are no faults OR after all faults have been displayed.

ACTIVATING/CLEARING FAILURE DISPLAY MODE

1. Press in and hold DDU "VOLUME" knob for a minimum of five seconds. If knob is released before five seconds has elapsed, system will turn off.
2. After five seconds, DDU red "FAIL" indicator will begin to blink out fault codes.
3. Code 41 is flashed if there are no faults OR after all faults have been displayed.
4. To read active fault codes, position DDU "RANGE" knob to left of center; only active fault codes will flash.
5. To read inactive fault codes, position "RANGE" knob to right of center; only inactive fault codes will flash.
6. To clear fault codes, push and hold DDU "RANGE" knob while system is in self-test (when ignition key is turned on).

ACTIVATING/CLEARING FAILURE DISPLAY MODE - CONTINUED**Table 1. Fault Codes.**

FAULT CODE	SUSPECT FAILURE
11	Central Processing Unit (CPU)
13	Driver Display Unit (DDU)
14	Antenna assembly
15	Right side sensor
21	Right turn signal
23	Brake
24	Speed
31	J1587
32	J1939
33	VBUS
34	DDU communications
35	Antenna assembly communications
41	End of Codes/No Codes

PROLINK DIAGNOSTIC FEATURES

1. Connect Pro-link tester with CTIS/CWS PC Card to vehicle.
2. Follow instructions on Pro-link tester display.

CWS TROUBLESHOOTING PROCEDURES

NOTE

- Perform Initial System Troubleshooting prior to replacing any component.
- Asterisk (*) indicates step requiring Pro-link tester w/CTIS/CWS PC Card.

Table 2. CWS Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Red Fail Light on Driver’s Display Unit or Side Sensor Display Illuminates Continuously.</p>	<p>1. While performing side sensor test, wave hand in front of side sensor and verify that correct signal is received.*</p> <p>2. Verify a 5-volt output at side sensor signal wire at side sensor connector, with a target present.</p>	<p>If OK, proceed to next step. If NOT OK, replace side sensor (WP 0220 00).</p> <p>If OK, replace CPU (WP 0220 00). If NOT OK, replace side sensor (WP 0220 00).</p>
<p>2. Warnings Tones Not Audible.</p>	<p>1. Verify volume control knob is turned fully clockwise.</p> <p>2. Turn system off and back on. Turn volume control knob and listen for tone.</p> <p>3. Perform speaker test and verify audible tone is heard from DDU speaker.*</p> <p>4. Verify speed input.</p> <p>5. Perform brake test and verify correct signal is received when brake pedal is depressed.*</p>	<p>Turn volume control knob fully clockwise.</p> <p>If tone is not heard, proceed to next step.</p> <p>If tone is not heard, proceed to next step.</p> <p>If OK, proceed to next step. If NOT OK, replace DDU (WP 0220 00).</p> <p>If OK, replace CPU (WP 0220 00). If NOT OK, replace DDU (WP 0220 00).</p>
<p>3. Warning Tones Audible When Brakes Are Applied.</p>	<p>1. Perform brake test and confirm receipt of correct signal when brake pedal is depressed.*</p> <p>2. Verify brake mode setting is correctly configured in CPU.*</p> <p>3. Verify brake logic is correctly configured.*</p>	<p>If OK, proceed to next step. If NOT OK, replace DDU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, replace DDU (WP 0220 00). If NOT OK, replace CPU (WP 0220 00).</p>

Table 2. CWS Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>4. Side Sensor Warning Tone Audible When Brakes Are Applied.</p>	<p>1. Verify tone is not audible when hand is waved in front of side sensor with only brake pedal depressed (turn signal not activated).</p> <p>2. Verify turn signal setting is correctly configured in CPU.*</p> <p>3. Perform turn signal test and confirm receipt of correct signal when turn signal is applied.*</p>	<p>If tone is heard, replace side sensor (WP 0220 00). If tone is not heard, proceed to next step.</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, replace CPU (WP 0220 00). If NOT OK, replace DDU (WP 0220 00).</p>
<p>5. Volume Knob Does Not Reduce Volume.</p>	<p>1. Verify MIN VOL setting is zero.*</p> <p>2. Perform DDU test and confirm proper operation of volume knob.*</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, replace CPU (WP 0220 00). If NOT OK, replace DDU (WP 0220 00).</p>
<p>6. Range Knob Does Not Change Alert Levels.</p>	<p>1. Verify RANGE ENABLE configuration is ON.*</p> <p>2. Perform DDU test and confirm proper operation of range knob.*</p>	<p>If OK, proceed to next step. If NOT OK, notify supervisor.</p> <p>If OK, replace CPU (WP 0220 00). If NOT OK, replace DDU (WP 0220 00).</p>
<p>7. Front Antenna Detects Vehicles in an Adjacent Lane With No Vehicle in Front of Host Vehicle.</p>	<p>1. Confirm radar beam path is obstructed.</p> <p>2. Confirm antenna is secure and check alignment (WP 0219 00).</p>	<p>Clear radar beam path if obstructed. If radar beam path is not obstructed, proceed to next step.</p> <p>If antenna is secure and proper alignment is confirmed and fault still exists, replace CPU (WP 0220 00).</p>
<p>8. Front Antenna Detects Vehicle in Both Left and Right Adjacent Lanes with No Vehicles in Front of Host Vehicle.</p>	<p>1. Confirm radar beam path is unobstructed.</p> <p>2. Confirm antenna is secure and check alignment (WP 0219 00).</p>	<p>Clear radar beam path if obstructed. If radar beam path is not obstructed, proceed to next step.</p> <p>If antenna is secure and proper alignment is confirmed and fault still exists, replace CPU (WP 0220 00).</p>

Table 2. CWS Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>9. Front Antenna Loses or Ignores Detected Vehicles within 100 Feet in Front of Host Vehicle.</p>	<p>1. Confirm radar beam path is unobstructed.</p> <p>2. Confirm antenna is secure and check alignment (WP 0219 00).</p>	<p>Clear radar beam path if obstructed. If radar beam path is not obstructed, proceed to next step.</p> <p>If antenna is secure and proper alignment is confirmed and fault still exists, replace CPU (WP 0220 00).</p>
<p>10. Side Sensor Display Does Not Indicate Power, or a Detected Object.</p>	<p>1. Verify side sensor display operation.*</p> <p>2. Check for correct continuity and supplied voltage readings at connector.</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>1. If OK, replace CPU (WP 0220 00). If NOT OK, replace side sensor (WP 0220 00).</p> <p>2. If fault still exists, replace CPU (WP 0220 00).</p>
<p>11. DDU Blinks Out Fault Code 11 (Central Processing Unit).</p>		<p>Replace CPU (WP 0220 00)</p>
<p>12. DDU Blinks Out Fault Code 13 (Driver's Display Unit).</p>		<p>Replace DDU (WP 0220 00).</p>
<p>13. DDU Blinks Out Fault Code 14 (Antenna Assembly).</p>		<p>1. Replace antenna (WP 0220 00).</p>
<p>14. DDU Blinks Out Fault Code 15 (Right Side Sensor).</p>	<p>1. While performing side sensor test, wave hand in front of side sensor and verify that correct signal is received.*</p> <p>2. Verify a 5-volt output at side sensor signal wire at side sensor connector, with a target present.</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace side sensor (WP 0220 00).</p>
<p>15. DDU Blinks Out Fault Code 21 (Right Turn Signal).</p>	<p>1. Confirm operation of exterior turn signals.</p> <p>2. Confirm operation of turn signal switch.</p> <p>3. Check that right turn signal input is connected to right turn signal lead.</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p>

Table 2. CWS Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>15. DDU Blinks Out Fault Code 21 (Right Turn Signal) - Continued.</p>	<p>4. Perform turn signal test to confirm correct input is received when right turn signal is activated.*</p> <p>5. Verify pin number 15, on top row of main harness connector, receives 12 volts when right signal is activated.</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, replace CPU (WP 0220 00). If NOT OK, replace connector (WP 0098 00).</p>
<p>16. DDU Blinks Out Fault Code 23 (Brake).</p>	<p>1. Confirm brake source is correctly configured in CPU.*</p> <p>2. Confirm operation of exterior brake lights.</p> <p>3. Confirm operation of brake switch.</p> <p>4. Perform brake test and confirm correct signal is received when brake pedal is depressed.*</p> <p>5. Confirm brake logic is correctly configured.*</p> <p>6. Confirm brake input wire is connected to proper source.</p> <p>7. Verify pin number 9, on top row of main harness connector, receives 12 volts when brake is applied.</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>Replace CPU (WP 0220 00).</p>
<p>17. DDU Blinks Out Fault Code 24 (Speed).</p>	<p>1. Confirm that SPEEDO BIT setting is correctly configured in CPU.*</p> <p>2. Confirm speed mode is correctly configured.*</p> <p>3. Perform speedometer test to confirm speedometer accuracy against vehicle speed.*</p>	<p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>If OK, proceed to next step. If NOT OK, replace CPU (WP 0220 00).</p> <p>Replace CPU (WP 0220 00).</p>
<p>18. DDU Blinks Out Fault Code 31 (J1587).</p>	<p>Confirm proper connection of J1587 wires at pin #7 positive and pin #8 negative on top row of CPU connector.</p>	<p>If OK, replace CPU (WP 0220 00). If NOT OK, replace connector (WP 0098 00).</p>

Table 2. CWS Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
19. DDU Blinks Out Fault Code 32 (J1939).	Confirm proper connection of J1939 wires at pin #7 positive and pin #8 negative on bottom row of CPU connector.	If OK, replace CPU (WP 0220 00). If NOT OK, replace connector (WP 0098 00).
20. DDU Blinks Out Fault Code 33 (VBUS).	Check connection of J1587 wires to vehicle harness.	If OK, replace CPU (WP 0220 00). If NOT OK, replace connector (WP 0098 00).
21. DDU Blinks Out Fault Code 34 (DDU Communications).	Check connection of J1587 wires to vehicle harness.	If OK, replace CPU (WP 0220 00). If NOT OK, replace connector (WP 0098 00).
22. DDU Blinks Out Fault Code 35 (Antenna Assembly Communications).	Check connection of J1587 wires to vehicle harness.	If OK, replace CPU (WP 0220 00). If NOT OK, replace connector (WP 0098 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Transmission Troubleshooting Procedures, WTEC III Electronic Controls Troubleshooting Manual

INITIAL SETUP

Tools and Special Tools

MSD/ICE (Item 58, WP 0313 00)
SPORT/ICE (Item 92, WP 0313 00)

Tools and Special Tools - Continued

PC Card, transmission (Item 66, WP 0313 00)
Tester, Pro-link, diagnostic reader (Item 99, WP 0313 00)

NOTE

In addition to the transmission troubleshooting located in Table 1 below, the *WTEC III Electronic Controls Troubleshooting Manual* is duplicated in its entirety and is located beginning on page 0021 00-7. An index of troubleshooting diagnostic codes is on page 0021 00-36.

Table 1. Transmission Troubleshooting Procedures

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
TRANSMISSION		
1. Shift Selector Display Is Blank.	1. Check if VIM fuse is blown.	Replace VIM fuse (WP 0072 00).
	2. Check for damaged or loose battery connections.	Tighten or repair battery connections (WP 0095 00).
	3. Check for blown fuse or fusible link at battery.	Replace battery fuse or fusible link (WP 0073 00).
2. Vehicle Does Not Start (Engine Does Not Crank).	1. Check that shift selector is in N (Neutral).	Press N (Neutral) on shift selector and restart vehicle (TM 9-2320-303-10).
	2. Check for dead battery.	Recharge battery as necessary (TM 9-6140-200-14).
	3. Check for damaged or loose battery connections.	Tighten or repair battery connections (WP 0095 00).
	4. Faulty starter circuit.	Repair vehicle starter circuit (WP 0010 00).
	5. Faulty neutral start relay.	Replace neutral start relay (WP 0072 00).
	6. Faulty wiring in neutral start circuit.	Repair wiring (WP 0098 00).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
TRANSMISSION - CONTINUED		
2. Vehicle Does Not Start (Engine Does Not Crank) - Continued.	7. Voltage to ECU too low. 8. Faulty shift selector. 9. Lack of battery voltage on circuit 123 from ECU when in neutral.	Check battery and charging system voltage (WP 0010 00). Replace shift selector (WP 0107 00). Repair circuit 123 (WP 0072 00) or replace ECU (WP 0110 00).
3. All Display Segments on Both Sides of Display Lighted.	No calibration installed in ECU. Voltage to ECU too low.	Check battery and charging system voltage (WP 0010 00).
TRANSMISSION SHIFTING		
1. ECU Will Not Turn Off When Ignition Switch Is Turned Off.	Faulty ignition switch.	Replace ignition switch (WP 0066 00).
2. Transmission Will Not Shift to Forward or Reverse (Stays In Neutral).	1. Engine RPM too high. 2. Low transmission fluid level. 3. Transmission fluid temperature too low. 4. Throttle position sensor set-up is incorrect. 5. Voltage to ECU too low. 6. Shift selector is not functioning properly. 7. Disconnected or dirty connectors. 8. Faulty wiring harnesses. 9. Faulty ECU.	Reduce engine RPM. Add fluid to proper level (TM 9-2320-303-10). Warm transmission fluid. Refer to throttle position sensor for correct set-up (WP 0006 00). Check vehicle battery and charging system (WP 0010 00). Replace shift selector (WP 0107 00). Perform connector checkout. Repair harness (WP 0098 00). Replace ECU (WP 0110 00).
3. Transmission Will Not Stay in Forward or Reverse.	Auto-neutral or quick-to-neutral circuit (input function) faulty.	Repair transmission (WP 0248 00).
4. Transmission Will Not Make a Specific Shift.	1. Low engine power. 2. Incorrect transmission fluid level. 3. Extreme transmission fluid temperature. 4. Faulty shift selector.	Correct engine problem (WP 0006 00). Correct fluid level (TM 9-2320-303-10). Inspect cooling system and fluid level (WP 0009 00). Replace shift selector (WP 0107 00).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
TRANSMISSION SHIFTING - CONTINUED		
4. Transmission Will Not Make a Specific Shift - Continued.	5. Faulty ECU.	Replace ECU (WP 0110 00).
5. Transmission Does Not Shift Properly (Rough Shifts, Shifts Occurring at Too Low or Too High Speed).	1. Engine idle speed too fast (neutral to range shift).	Adjust engine idle speed (WP 0006 00).
	2. ECU input voltage low.	Check power, ground, charging system, and battery function (WP 0010 00).
	3. Incorrect transmission fluid level	Correct fluid level (TM 9-2320-303-10).
	4. Intermittent problems.	Check wiring harnesses and connectors (WP 0072 00).
ABNORMAL ACTIVITIES OR RESPONSES FROM TRANSMISSION		
1. Excessive Creep in First and Reverse Gears.	Engine idle speed too high.	Adjust to correct idle speed between 500-800 RPM (WP 0006 00).
2. No Response to Shift Selector.	1. Shift selector not properly connected.	Check shift selector response with diagnostic tool. If no response, check remote connection and replace if necessary (WP 0107 00).
	2. Faulty shift selector.	Replace shift selector (WP 0107 00).
	3. Incorrect transmission fluid level.	Correct fluid level (TM 9-2320-303-10).
3. Vehicle Moves Forward in Neutral.	C1 clutch failed or not released.	Repair transmission (WP 0248 00).
4. Vehicle Moves Backward in Neutral.	C3 clutch failed or not released.	Repair transmission (WP 0248 00).
5. Engine Overspeed on Full-throttle Upshifts.	1. TPS adjustment: - Overstroke	Adjust TPS (WP 0006 00).
	2. ECU input voltage low.	Check electrical system and all connections from battery and ECU (WP 0010 00).
	3. Incorrect transmission fluid level.	Correct fluid level (TM 9-2320-303-10).
	4. Piston seals leaking or clutch plates slipping in range involved.	Repair transmission (WP 0248 00).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
ABNORMAL ACTIVITIES OR RESPONSES FROM TRANSMISSION - CONTINUED		
6. Excessive Slippage and Clutch Chatter.	1. Incorrect calibration. 2. ECU input voltage low. 3. Throttle position sensor out of adjustment or failed. 4. Incorrect transmission fluid level.	Verify calibration. Check power, ground, charging system, and battery functions (WP 0010 00). Adjust or replace throttle position sensor (WP 0006 00). Add fluid to proper level (TM 9-2320-303-10).
7. Abnormal Stall Speeds (Stall in All Ranges). High Stall Speeds.	1. 2. Low fluid level, aerated fluid. 3. Clutch slipping.	Select D (Drive). Add fluid to proper level (TM 9-2320-303-10). Repair transmission (WP 0248 00).
Low Stall Speeds.	Engine not performing efficiently (may be due to plugged or restricted injectors, high altitude conditions, dirty air filters, out of time, throttle linkage, electronic engine controls problem).	Refer to Engine Troubleshooting (WP 0006 00). Notify Direct Support Maintenance.
8. Overheating in All Ranges.	1. Aerated fluid - incorrect fluid level. 2. Engine overheat. 3. Inaccurate temperature gage. 4. Fluid cooler lines restricted.	Adjust fluid to proper level (TM 9-2320-303-10). Correct overheat situation (WP 0006 00). Replace gage (WP 0065 00). Remove restrictions, clean or replace lines (WP 0115 00).
9. Fluid Comes out Fluid Fill Tube and/or Breather.	1. Dipstick loose. 2. Transmission fluid level too high. 3. Transmission fluid level too low. 4. Breather clogged. 5. Transmission fluid contaminated with foreign liquid. 6. Dipstick or fill tube seal worn.	Tighten cap. Replace if necessary (WP 0108 00). Drain to proper level (TM 9-2320-303-10). Add fluid to proper level (TM 9-2320-303-10). Clean or replace breather (WP 0113 00). Drain and replace fluid (WP 0024 00). Locate and repair source of contaminating fluid. Replace seals or dipstick (WP 0108 00).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<i>ABNORMAL ACTIVITIES OR RESPONSES FROM TRANSMISSION - CONTINUED</i>		
10.Noise Occurring Intermittently (Buzzing).	<ol style="list-style-type: none"> 1. Low transmission fluid level. 2. Air leak in oil suction screen canister. 3. Clogged filters. 4. Aerated fluid causes noisy pump. 	<p>Add fluid to proper level (TM 9-2320-303-10).</p> <p>Replace oil suction screen canister (WP 0109 00).</p> <p>Replace filters (WP 0109 00).</p> <p>Add fluid to proper level (TM 9-2320-303-10).</p>
11.Leaking Fluid (Output Shaft).	Faulty or missing seal at output flange.	Repair transmission (WP 0248 00).
12.Transmission Leaks (Input).	<ol style="list-style-type: none"> 1. Front seal leaks 2. Converter leaks. 	<p>Repair transmission (WP 0248 00).</p> <p>Repair transmission (WP 0248 00).</p>
13.Dirty Transmission Fluid.	<ol style="list-style-type: none"> 1. Failure to change fluid and filters. 2. Damaged fluid filter/seals. 	<p>Change fluid and install new filters (WP 0109 00).</p> <p>Replace oil filter/seals (WP 0109 00).</p>

END OF WORK PACKAGE

FOREWORD — How to Use This Manual

This manual provides troubleshooting information for Allison Transmission Division, MD/HD/B Series On-Highway Transmissions. Service Manuals SM2148EN and SM2457EN, plus Parts Catalogs PC2150EN and PC2456EN may be used in conjunction with this manual.

This manual includes:

- Description of the WTEC III electronic control system.
- Description of the electronic control system components.
- Description of diagnostic codes, system responses to faults, and troubleshooting.
- Wire, terminal, and connector repair information.

Specific instructions for using many of the available or required service tools and equipment are not included in this manual. The service tool manufacturer will furnish instructions for using the tools or equipment.

Additional information may be published from time to time in Service Information Letters (SIL) and will be included in future revisions of this and other manuals. Please use these SILs to obtain up-to-date information concerning Allison Transmission products.

This publication is revised periodically to include improvements, new models, special tools, and procedures. A revision is indicated by a letter suffix added to the publication number. Check with your Allison Transmission service outlet for the currently applicable publication. Additional copies of this publication may be purchased from authorized Allison Transmission service outlets. Look in your telephone directory under the heading of Transmissions — Truck, Tractor, etc.

Take time to review the Table of Contents and the manual. Reviewing the Table of Contents will aid you in quickly locating information.

NOTE: *Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:*

- Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.
- Repair parts for the external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes ATD, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI will have parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:

St. Clair Technologies, Inc.
1050 Old Glass Road
Wallaceburg, Ontario, Canada, N8A 3T2
Phone: (519) 627-1673
Fax: (519) 627-4227

St. Clair Technologies, Inc.
1111 Mikesell Street
Charlotte, Michigan 48813
Phone: (517) 541-8166
Fax: (517) 541-8167

St. Clair Technologies, Inc.
c/o Mequilas Tetakawi
Carr. Internacional KM 1969
Guadalajara – Nogales, KM2
Empalme, Sonora, Mexico
Phone: 011-52-622-34661
Fax: 011-52-622-34662

- St. Clair Technologies, Inc. stocks a WTEC III external harness repair kit, P/N 29532362, as a source for some external harness repair parts. SCTI is the source for external harness repair parts.

TRADEMARKS USED IN THIS MANUAL

IMPORTANT SAFETY NOTICE

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions used in this manual. These warnings and cautions advise against using specific service procedures that can result in personal injury, equipment damage, or cause the equipment to become unsafe. These warnings and cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, or advise the service trade of all conceivable procedures by which service might be performed or of the possible hazardous consequences of each procedure. Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, **ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST** first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service procedures used.

Also, be sure to review and observe **WARNINGS, CAUTIONS, and NOTES** provided by the vehicle manufacturer and/or body builder before servicing the Allison transmission in that vehicle.

Proper service and repair is important to the safe and reliable operation of the equipment. The service procedures recommended by Allison Transmission and described in this manual are effective methods for performing troubleshooting operations. Some procedures require using specially designed tools. Use special tools when and in the manner recommended.

The **WARNINGS, CAUTIONS, and NOTES** in this manual apply only to the Allison transmission and not to other vehicle systems which may interact with the transmission. Be sure to review and observe any vehicle system information provided by the vehicle manufacturer and/or body builder at all times the Allison transmission is being serviced.

WARNINGS, CAUTIONS, AND NOTES

Three types of headings are used in this manual to attract your attention:

WARNING! Is used when an operating procedure, practice, etc., which, if not correctly followed, could result in injury or loss of life.

CAUTION: Is used when an operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE: *Is used when an operating procedure, practice, etc., is essential to highlight.*

Trademarks Used In This Manual

The following trademarks are the property of the companies indicated:

- DEXRON® is a registered trademark of General Motors Corporation.
- LPS® Cleaner is a registered trademark of LPS Laboratories.
- Loctite® is a registered trademark of the Loctite Corporation.
- Teflon® is a registered trademark of the DuPont Corporation.
- Pro-Link® is a registered trademark of MicroProcessor Systems, Inc.

SHIFT SELECTOR TERMS AND DISPLAY INDICATIONS

Shift selector terms and displays are represented in this manual as follows:

- Button Names — \uparrow , \downarrow , “display mode”, **MODE**, etc.
- Transmission Ranges — **D** (Drive), **N** (Neutral), **R** (Reverse), **1** (First), **2** (Second), etc.
- Displays — “**o, L**”; “**o, K**”, etc. (Display occurs one character at a time.)

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SECTION 1 — GENERAL DESCRIPTION

1-1. TRANSMISSION

The World Transmission Electronic Controls (WTEC III) system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. MD 3000, HD 4000, and B Series configurations can be programmed to have up to six forward ranges, neutral, and one reverse range. The MD 3070 and HD 4070 have up to seven forward ranges and one reverse range.

Figure 1-1 is a block diagram of the basic system inputs and outputs.

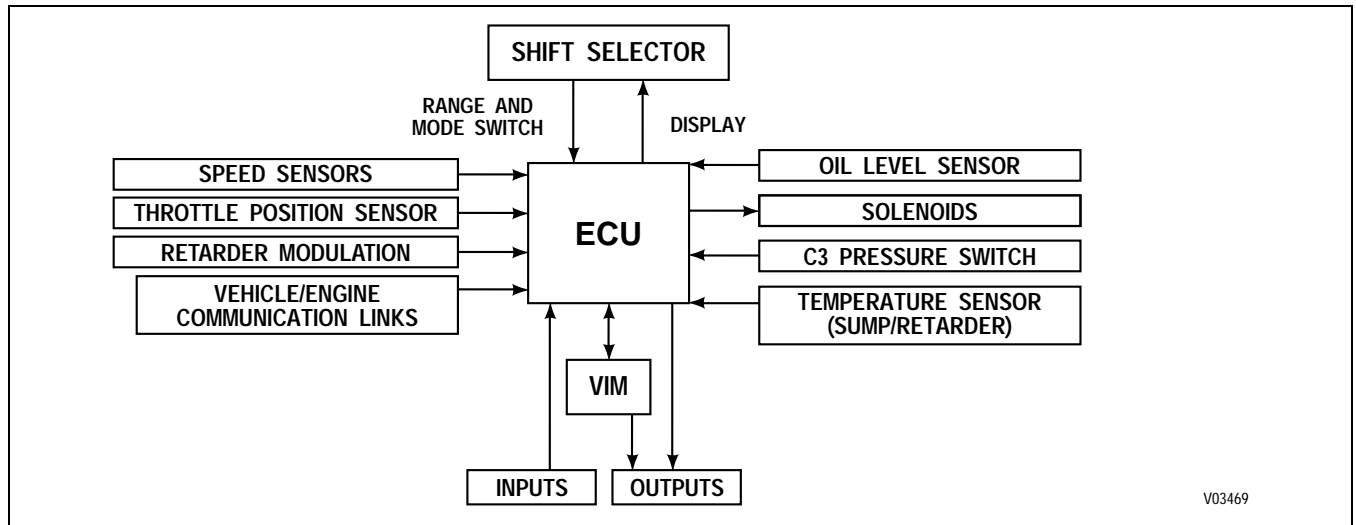


Figure 1-1. Electronic Control Unit Block Diagram

Figure 1-2 shows WTEC III electronic control components.

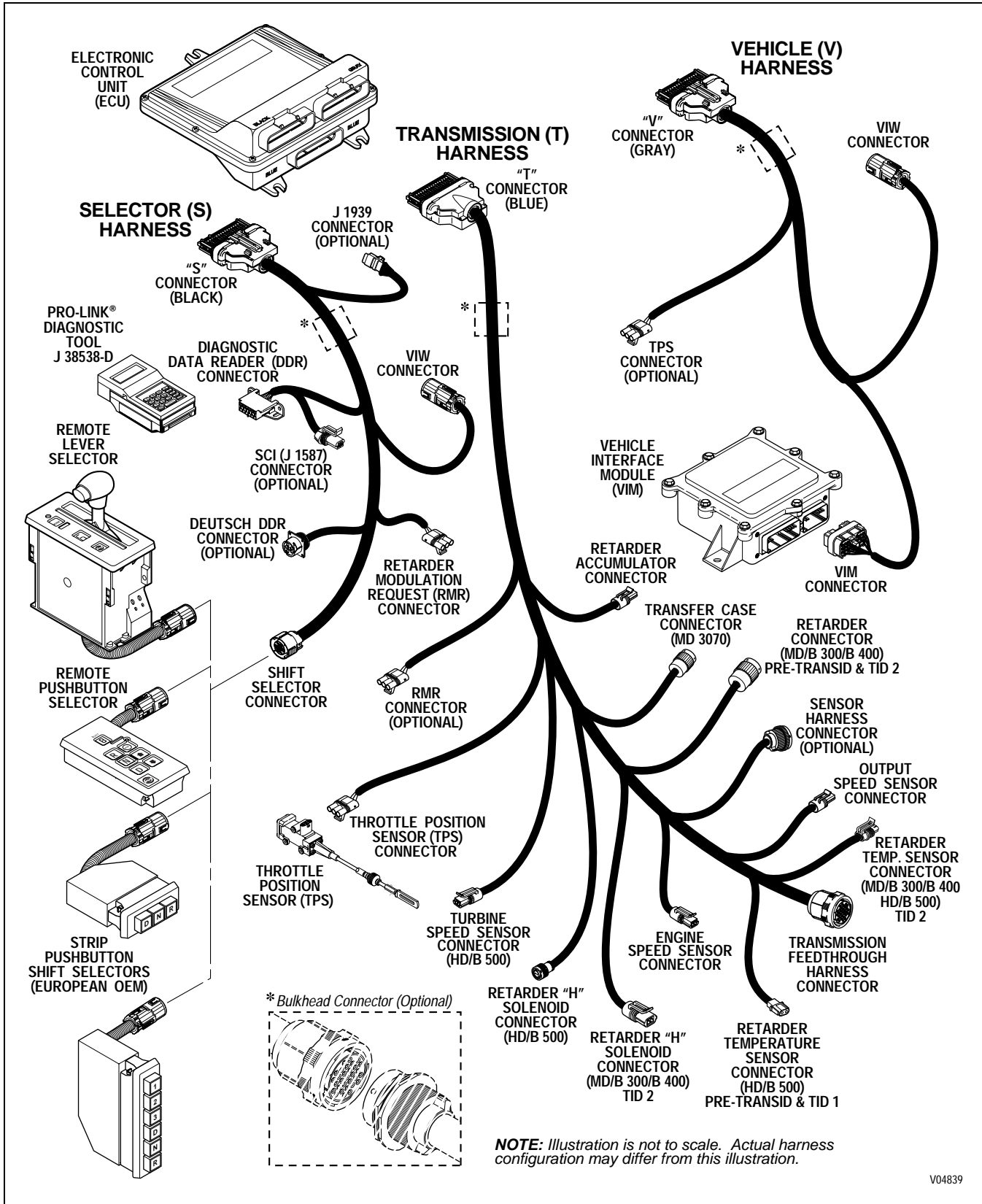
WTEC III Electronic Controls consist of the following elements:

- Remote 12/24V Max Feature Sealed Electronic Control Unit (ECU)
- Remote Pushbutton or Lever Shift Selector
- Optional Secondary Shift Selector
- Throttle Position Sensor (TPS) (or electronic engine throttle data or PWM signal)
- Engine, Turbine, and Output Speed Sensors
- Control Module (Electro-Hydraulic Valve Body)
- Wiring Harnesses
- Vehicle Interface Module (VIM)
- Autodetect Feature
- TransID Feature
- Optional Retarder Controls
- Optional Engine Coolant Temperature Input

NOTE:

- *All external harnesses are OEM supplied*
- *Some OEMs may supply their own shift selector*
- *The VIM is an OEM option*

GENERAL DESCRIPTION



V04839

Figure 1-2. WTEC III Electronic Control Components

GENERAL DESCRIPTION

1-2. ELECTRONIC CONTROL UNIT (ECU)

The ECU (Figure 1-3) contains the microcomputer which is the brain of the control system. The ECU receives and processes information defining: shift selector position, throttle position, sump/retarder temperature, engine speed, turbine speed, and transmission output speed. The ECU uses the information to control transmission solenoids and valves, supply system status, and provide diagnostic information.

Each ECU has a date code stamped on the label which is attached to the outer case of the ECU. This is the date when the ECU passed final test. This date is commonly used to denote the change configuration level of the ECU. It is normal for the ECU date displayed electronically to be a few days prior to the date shown on the label.

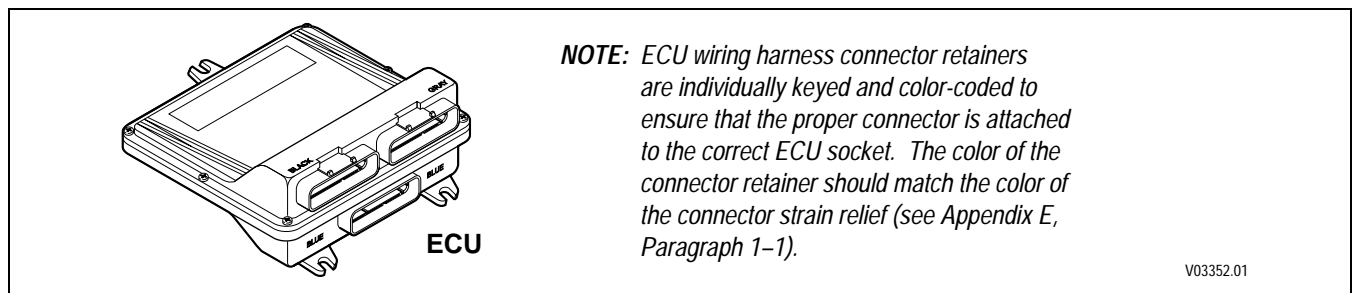


Figure 1-3. Electronic Control Unit (ECU)

1-3. SHIFT SELECTOR

Pushbutton and lever shift selectors for the WTEC III Series are remote mounted from the ECU and connected to the ECU by a wiring harness. Both of these shift selectors have a single digit LED display and a mode indicator (LED). During normal transmission operation, illumination of the LED indicator shows that a secondary or special operating condition has been selected by pressing the **MODE** button. During diagnostic display mode, illumination of the LED indicator shows that the displayed diagnostic code is active. Display brightness is regulated by the same vehicle potentiometer that controls dash light display brightness. More information on both types of shift selectors is continued below.

A. Pushbutton Shift Selector (Figure 1-4)

There is a full-function pushbutton shift selector and a strip pushbutton shift selector. Strip pushbutton shift selectors are used by European OEMs. A full-function shift selector has a **MODE** button and diagnostic display capability through the single digit LED display. The strip pushbutton shift selector does not have a **MODE** button, diagnostic capability, or adjustable illumination. The full-function pushbutton shift selector has six (6) pushbuttons which are **R** (Reverse), **N** (Neutral), **D** (Drive), ↓ (Down), ↑ (Up), and **MODE**. Manual forward range downshifts and upshifts are made by pressing the ↓ (Down) or ↑ (Up) arrow buttons after selecting **D** (Drive). The **N** (Neutral) button has a raised lip to aid in finding it by touch. The **MODE** button is pressed to select a secondary or special operating condition, such as **ECONOMY** shift schedule. Diagnostic information is obtained by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time. The strip pushbutton shift selector has either three or six range selection positions as shown in Figure 1-4. When a strip pushbutton shift selector is used, diagnostic information must be obtained by using the Pro-Link® 9000 or a customer-furnished remote display.

GENERAL DESCRIPTION

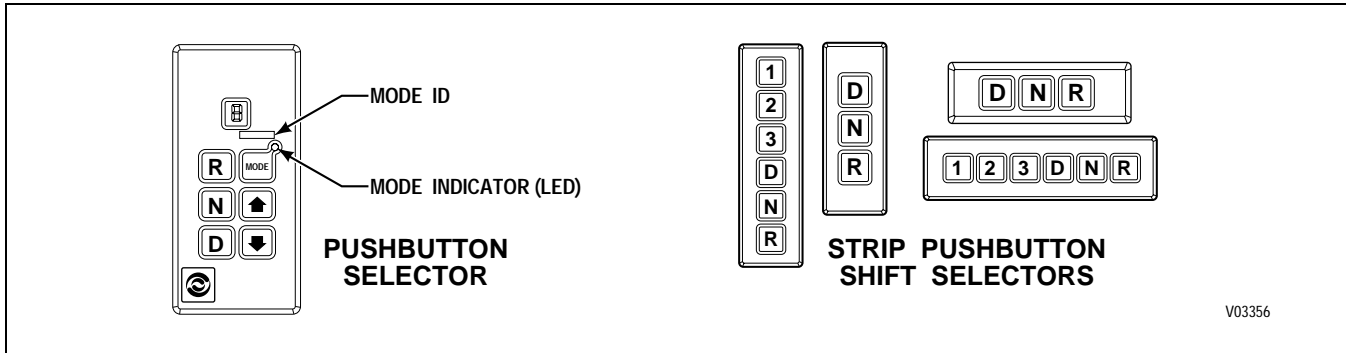


Figure 1-4. Pushbutton Shift Selectors

1-4. SPEED SENSORS (Figure 1-5)

Three speed sensors — engine speed, turbine speed, and output speed — provide information to the ECU. The engine speed signal is generated by ribs on the shell of the torque converter pump. The turbine speed signal is generated by the rotating-clutch housing spline contours. The output speed signal is generated by a toothed member attached to the output shaft (except for the MD 3070, where the toothed member is the transfer case idler gear). The speed ratios between the various speed sensors allow the ECU to determine if the transmission is in the selected range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the smoothest shifts possible. Hydraulic problems are detected by comparing the speed sensor information for the current range to that range's speed sensor information stored in the ECU memory.

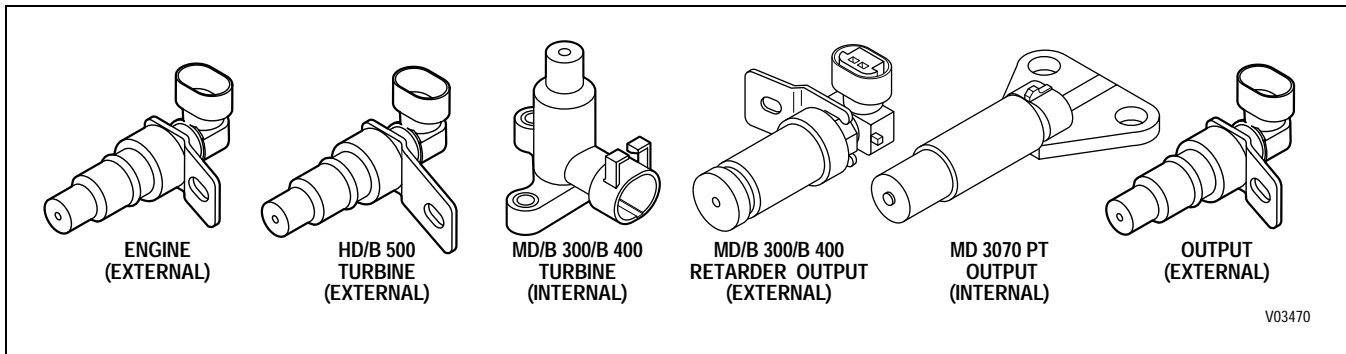


Figure 1-5. Speed Sensors

GENERAL DESCRIPTION

1-5. CONTROL MODULE (Figure 1-6)

The WT Series transmission control module contains a channel plate on which is mounted: the main valve body assembly, the stationary-clutch valve body assembly, and the rotating-clutch valve body assembly. For valve locations, refer to SIL 27-WT-93, Rev. A. Pulse width modulated solenoids are used in the valve bodies. The rotating-clutch valve body assembly contains A (C1), B (C2), and F (lockup) solenoids, solenoid regulator valves controlled by the solenoids, and the C3 pressure switch. The stationary-clutch valve body assembly contains C (C3), D (C4), and E (C5) solenoids and solenoid regulator valves controlled by the solenoids and the C3 accumulator relay valve. The main valve body assembly contains G solenoid and the C1 and C2 latch valves controlled by the solenoid, the main and lube regulator valves, the control main and converter regulator valves, and the converter flow valve and exhaust backfill valves. The low valve body assembly (MD 3070PT and HD 4070) contains N and J solenoids.

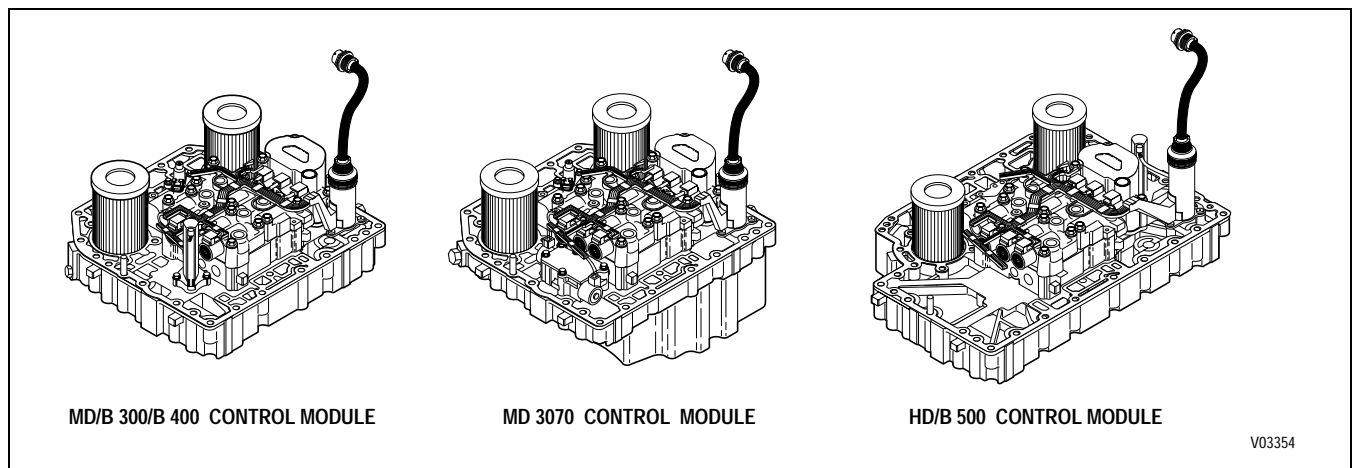


Figure 1-6. WTEC III Control Module

A temperature sensor (thermistor) is located in the internal wiring harness. Changes in sump fluid temperature are indicated by changes in sensor resistance which changes the signal sent to the ECU (see chart in Section 5, Code 24).

The oil level sensor is a float type device, mounted on the control module channel plate, which senses transmission fluid level by electronically measuring the buoyancy forces on the float. The sensor operates on 5 VDC supplied by the ECU. The oil level sensor is required on all models with a shallow sump but is optional on other models. The oil level sensor is not available on the MD 3070.

The C3 pressure switch is mounted on the rotating-clutch valve body assembly and indicates when pressure exists in the C3 clutch-apply passage. An accumulator/relay valve is in-line ahead of the C3 pressure switch and prevents high frequency hydraulic pulses generated by the C3 solenoid from cycling the C3 pressure switch.

Also mounted in the control module is the turbine speed sensor for the MD/B 300/B 400 models. The turbine speed sensor is directed at the rotating-clutch housing. (The turbine speed sensor on the HD/B 500 models is located on the outside of the main housing.)

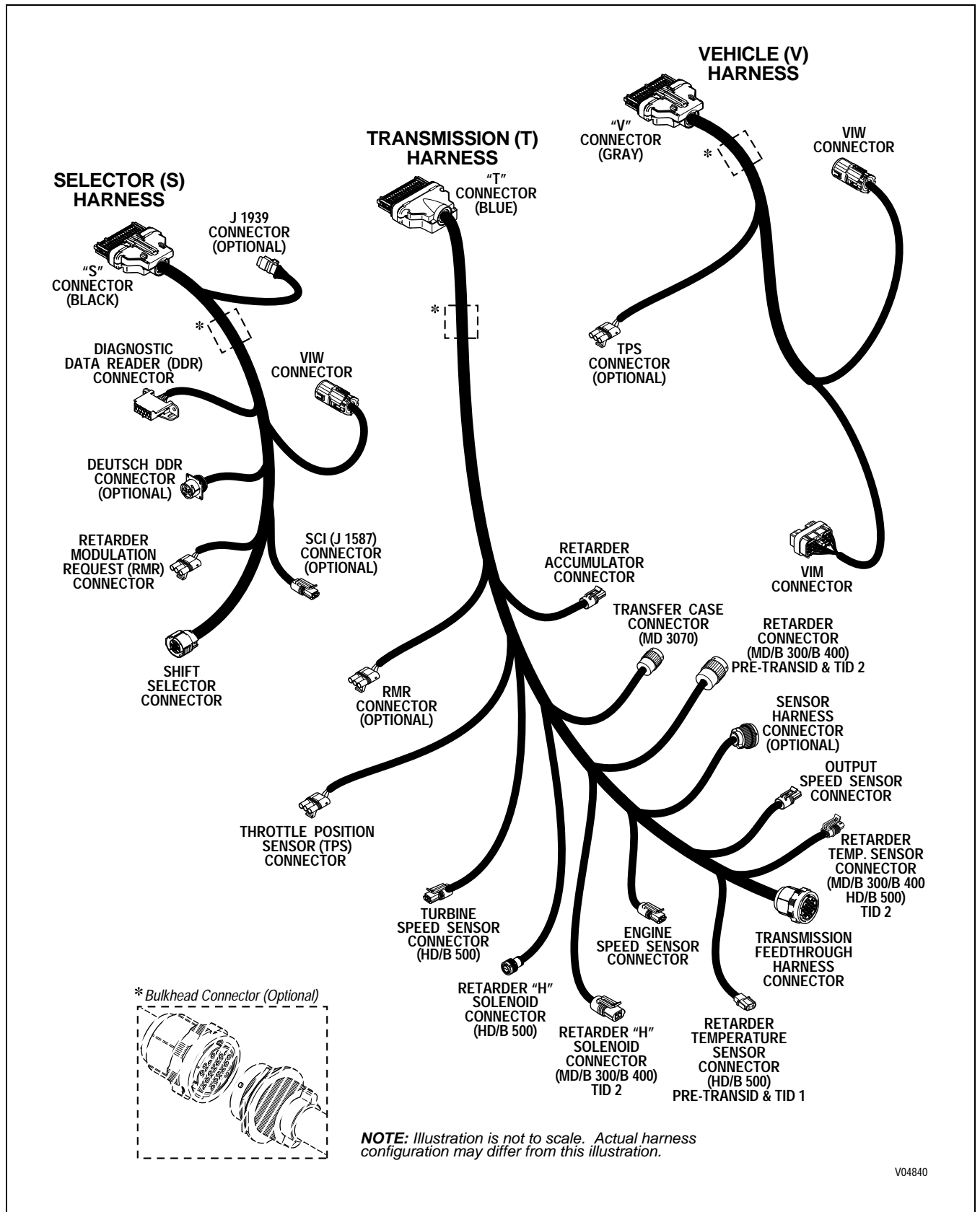
GENERAL DESCRIPTION

1-6. WIRING HARNESES

A. External Wiring Harness (*Figure 1-7*)

WTEC III uses three external wiring harnesses to provide a connection between the ECU, the transmission (including engine, turbine, and output speed sensors), the throttle position sensor, the vehicle interface module (VIM), retarder control module, shift selectors, diagnostic tool connector, retarder, retarder temperature sensor, accumulator, and vehicle interface. Many harnesses will include a bulkhead fitting to separate cab and chassis components. Also, many different styles and materials for harnesses are likely to be encountered.

GENERAL DESCRIPTION



V04840

Figure 1-7. WTEC III External Wiring Harnesses

GENERAL DESCRIPTION

B. Internal Wiring Harness (Figure 1-8)

The internal wiring harness provides connection between the external harness, the pulse width modulated solenoids, oil level sensor, C3 pressure switch, and the temperature sensor.

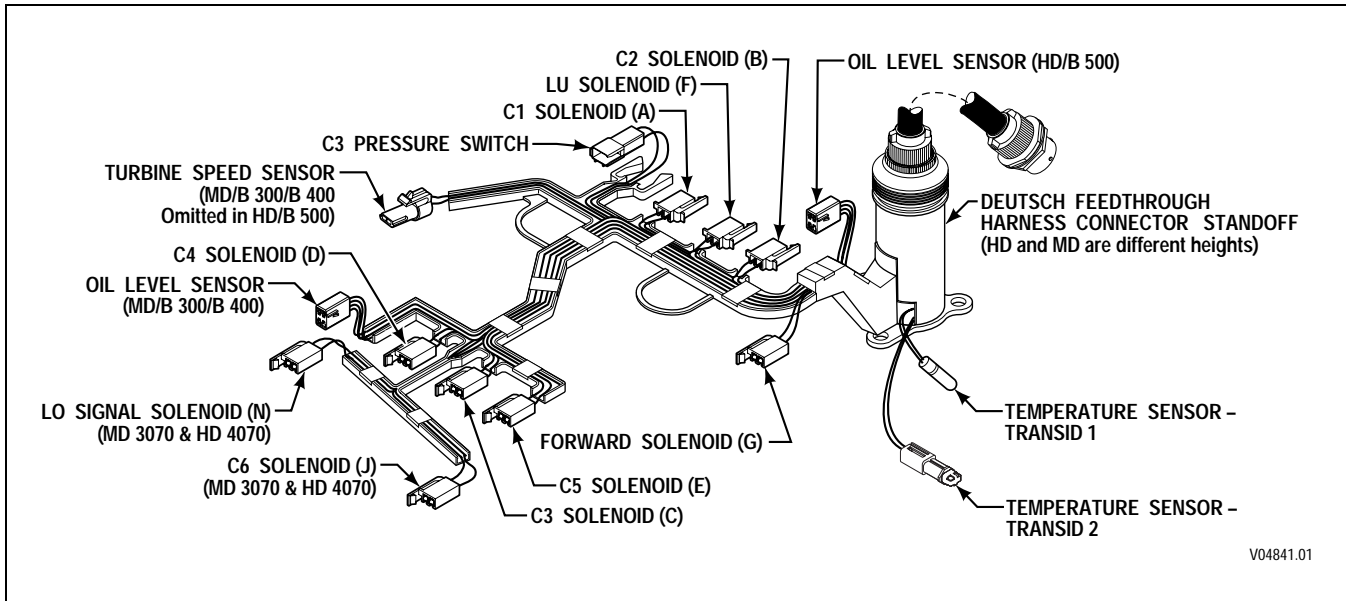


Figure 1-8. WTEC III Internal Wiring Harness

1-7. VEHICLE INTERFACE MODULE (Figure 1-9)

The vehicle interface module (VIM) provides relays, fuses, and connection points for interface with the output side of the vehicle electrical system. VIMs are available for both 12V and 24V electrical systems. The VIM for 12V systems uses all 12V relays. The VIM for 24V systems has all 24V relays. Refer to the Parts Catalog for the transmission assembly number that you are servicing for detailed parts information. Refer to Pages D-23 and D-24 for VIM wire number and terminal information.

Some OEMs may provide their own equivalent for the VIM which performs the same functions as the VIM shown in Figure 1-9.

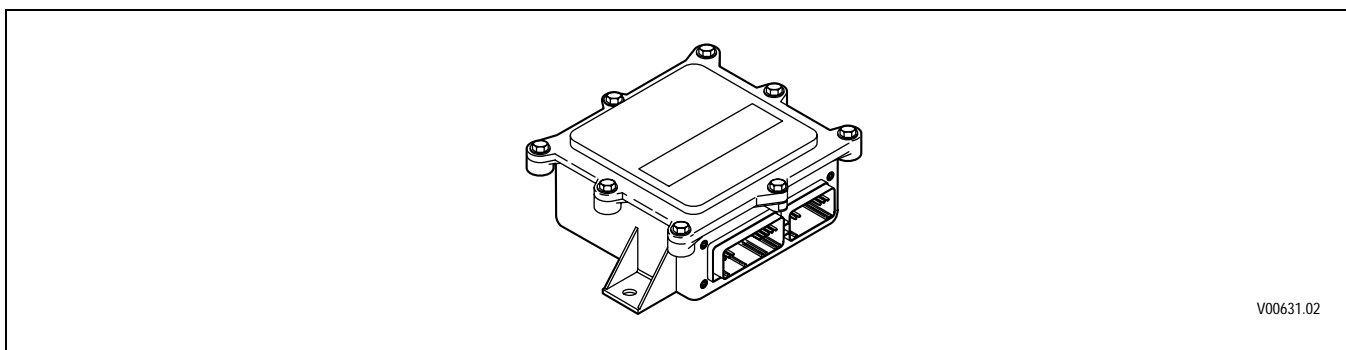


Figure 1-9. Vehicle Interface Module (VIM)

SECTION 2 — DEFINITIONS AND ABBREVIATIONS

2-1. CHECK TRANS LIGHT

When the ECU detects a serious fault, the **CHECK TRANS** light (usually located on the vehicle instrument panel) illuminates and action is automatically taken to protect operator, vehicle, and the transmission. A diagnostic code will nearly always be registered when the **CHECK TRANS** light is on; however, not all diagnostic codes will turn on the **CHECK TRANS** light. Codes related to the **CHECK TRANS** light are detailed in the code chart (refer to Section 6).

Illumination of the **CHECK TRANS** light indicates that a condition was detected that requires service attention. Operation may or may not be restricted but even when restricted will allow the vehicle to reach a service assistance location. Depending upon the cause for the **CHECK TRANS** light illumination, the ECU may or may not respond to shift selector requests. The transmission may be locked in a range. That range will be shown on the shift selector display. Both upshifts and downshifts may be restricted when the **CHECK TRANS** light is illuminated. Seek service assistance as soon as possible.

Each time the engine is started, the **CHECK TRANS** light illuminates briefly and then goes off. This momentary lighting shows the light circuit is working properly. If the light does not come on during engine start, request service immediately.

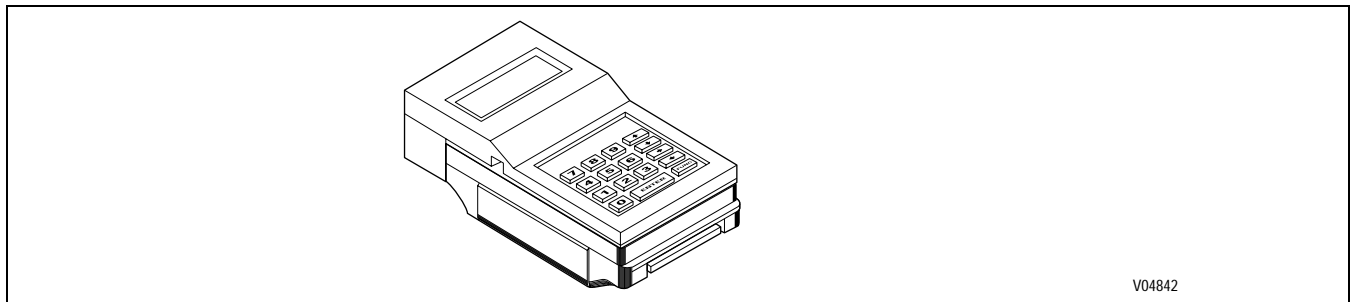
2-2. DIAGNOSTIC DATA READER (Figure 2-1)

The current Diagnostic Data Reader (DDR) is the Pro-Link® 9000 diagnostic tool which is available through Kent-Moore Heavy-Duty Division. A portable microcomputer-based receiver/transmitter/display unit, the Pro-Link® transmits and receives data to and from the ECU, processes the data, and displays appropriate information. Use the Pro-Link® during installation checkout and troubleshooting. There is a new Pro-Link® cartridge needed for use with WTEC III controls. The new Multi-Protocol Cartridge (MPC) contains a programmed PCMCIA card which allows for reprogramming of GPI/GPO packages. Reprogramming includes selection of a GPI/GPO package, enabling/disabling of wires and modification of certain data parameters. Operating instructions are supplied with each Pro-Link® and further information is also included in Appendix N of this manual. Connect the Pro-Link® 9000 to the diagnostic connector provided in the selector wiring harness.

Tool part numbers for the Pro-Link® are as follows:

- Diagnostic Kit J 38538D + J 38500-313 (PROM Update) = J 38538E
- Diagnostic Cartridge J 38500-302 + J 38500-313 = J 38500-303
- MPC J 38500-1500C
- PCMCIA (Diagnostic And Reprogramming) J 38500-1700B
- PCMCIA (Diagnostic Only) J 38500-1800A

NOTE: *The new MPC is usable with WTEC II controls but the old WTEC II reprogramming cartridge will not display the WTEC III new information. The new MPC must be used to reprogram WTEC III systems.*



V04842

Figure 2-1. Pro-Link® 9000 Diagnostic Tool

DEFINITIONS AND ABBREVIATIONS

2-3. ABBREVIATIONS

A/N	Assembly Number
ABS	Anti-lock Brake System — OEM-provided means to detect and prevent wheel stoppage to enhance vehicle handling. Retarder and engine brakes will not apply when ABS is active.
Amp	Unit of electrical current.
C3PS	C3 Pressure Switch — Pressure switch to signal the presence or absence of pressure in the C3 clutch-apply circuit.
CAN	Controller Area Network — A network for all SAE J1939 communications in a vehicle (engine, transmission, ABS, etc.)
COP	Computer Operating Properly — Hardware protection which causes the ECU to reset if software gets lost.
CT	Closed Throttle
DDR	Diagnostic Data Reader — Diagnostic tool; most current version is the Pro-Link® 9000 made by MicroProcessor Systems, Inc. Used to interrogate the ECU for diagnostic information and for reprogramming I/O packages in a calibration.
DNA	Does Not Adapt — Adaptive shift control is disabled.
DNS	DO NOT SHIFT — Refers to the DO NOT SHIFT diagnostic response during which the CHECK TRANS light is illuminated and the transmission will not shift and will not respond to the Shift Selector.
DVOM	Digital volt/ohmmeter
ECU	Electronic Control Unit (also commonly referred to as the “computer”)
GPI	General Purpose Input — Input signal to the ECU to request a special operating mode or condition.
GPO	General Purpose Output — Output signal from the ECU to control vehicle components (such as PTOs, backup lights, etc.) or allow a special operating mode or condition.
J1587	Engine/transmission serial data communications link.
J1939	High-speed vehicle serial data communications link.
LED	Light-Emitting Diode — Electronic device used for illumination.
NNC	Neutral No Clutches — Neutral commanded with no clutches applied.
NVL	Neutral Very Low — The ECU has sensed turbine speed below 150 rpm when output speed is below 100 rpm and engine speed is above 400 rpm when N (Neutral) was selected. This is usually caused by a dragging C1 or C3 clutch or a failed turbine speed sensor. NVL is attained by turning D solenoid “ON” (in addition to E solenoid) and the C4 and C5 clutches are applied to lock the transmission output.
OEM	Original Equipment Manufacturer — Maker of vehicle or equipment.
Ohm	Unit of electrical resistance.
OL	Over Limit or Oil Level — For Over Limit see “×”. Indicates Oil Level is being displayed on a shift selector.

DEFINITIONS AND ABBREVIATIONS

2-3. ABBREVIATIONS (CONTINUED)

OLS	Oil Level Sensor — Electronic device (optional) on control module for indicating transmission fluid level.
PCCS	PROM Calibration Configurator System
PCMCIA	Personal Computer Memory Card International Association — Memory device for use with Pro-Link® containing Allison Transmission programming and diagnostics.
PROM	Programmable Read Only Memory
PSS	Primary Shift Selector — Main shift selector in a two-selector control system.
PTO	Power Takeoff
PWM Solenoid	Pulse Width Modulated Solenoid — Solenoids are controlled by pulse width modulation. Solenoid control of clutch pressures is based on the solenoid's duty cycle. Duty cycle is determined by the ratio of solenoid's on-time to off-time.
RMR	Retarder Modulation Request — Signal from a retarder control device.
RPR	Return to Previous Range — Diagnostic response in which the transmission is commanded to return to previously commanded range.
SCI	Serial Communication Interface — Used to transmit data and messages between the diagnostic tool and the ECU and other systems such as electronically-controlled engines.
SOL OFF	All SOL enoids OFF
SPI	Serial Peripheral Interface — The means of communication between the microprocessor and the interface circuits.
SSS	Secondary Shift Selector — Alternate shift selector in a two-selector control system.
TID	TransID — A feature which allows the ECU to know the transmission configuration and provide the corresponding calibration required.
TPS	Throttle Position Sensor — Potentiometer for signaling the position of the engine fuel control lever.
V	Version — Abbreviation used in describing ECU software levels.
VDC	Volts Direct Current (DC)
VIM	Vehicle Interface Module — A watertight box containing relays and fuses — interfaces the transmission electronic control system with components on the vehicle.
VIW	Vehicle Interface Wiring — Interfaces ECU programmed input and output functions with the vehicle wiring.
Volt	Unit of electrical force.
VOM	Volt/ohmmeter
WOT	Wide Open Throttle
WT	World Transmission
×	Infinity — Condition of a circuit with higher resistance than can be measured, effectively an open circuit.

DEFINITIONS AND ABBREVIATIONS

SECTION 3 — BASIC KNOWLEDGE

3-1. BASIC KNOWLEDGE REQUIRED

To service WTEC III Electronic Controls, the technician must understand basic electrical concepts. Technicians need to know how to use a volt/ohmmeter (VOM) to make resistance and continuity checks. Most troubleshooting checks consist of checking resistance, continuity, and checking for shorts between wires and to ground. The technician should be able to use jumper wires and breakout harnesses and connectors. Technicians unsure of making the required checks should ask questions of experienced personnel or find instruction.

The technician should also have the mechanical aptitude required to connect pressure gauges or transducers to identified pressure ports used in the troubleshooting process. Pressure tap locations and pressure values are shown in Appendix B — Checking Clutch Pressures.

Input power, ground, neutral start circuitry, etc., can cause problems with electronic controls or vehicle functioning and may not generate a diagnostic code. A working knowledge of WT Series Electronic Controls vehicle installation is necessary in troubleshooting installation-related problems.

Refer to Section 8 for information concerning performance complaints (non-code) troubleshooting. A complete wiring schematic is shown in Appendix J. Refer to the WTEC III Controls and General Information Sales Tech Data Book for information concerning electronic controls installation and the Installation Checklist. Reliable transmission operation and performance depend upon a correctly installed transmission. Review the Installation Checklist in the MD, HD, B 300/B 400, and B 500 Sales Tech Data Books to ensure proper installation.

3-2. USING THE TROUBLESHOOTING MANUAL

Use this manual as an aid to troubleshooting the WTEC III Electronic Controls. Every possible problem and its solution cannot be encompassed by any manual. However, this manual does provide a starting point from which most problems can be resolved.

Once a problem solution is discovered in the manual do not look further for other solutions. It is necessary to determine *why* a problem occurred. For example, taping a wire that has been rubbing on a frame rail will not correct the problem unless the rubbing contact is eliminated.

3-3. SYSTEM OVERVIEW

WTEC III Electronic Control functions are controlled by the ECU. The ECU reads shift selector range selection, output speed, and throttle position to determine when to command a shift. When a shift occurs, the ECU monitors turbine speed, output speed, and throttle position to control the oncoming and off-going clutches during the shift.

When the ECU detects an electrical fault, it logs a diagnostic code indicating the faulty circuit and may alter the transmission operation to prevent or reduce damage.

When the ECU detects a non-electrical problem while trying to make a shift, the ECU may try that shift a second or third time before setting a diagnostic code. Once that shift has been retried, and a fault is still detected, the ECU sets a diagnostic code and holds the transmission in a fail-to-range mode of operation.

BASIC KNOWLEDGE

3-4. IMPORTANT INFORMATION IN THE TROUBLESHOOTING PROCESS

Before beginning the troubleshooting process, read and understand the following:

- WTEC III wire identification presents the wire number followed by the ECU terminal source (i.e., 157-S30). If there is a letter suffix following the wire number, there is a splice between the ECU source and wire destination (i.e., 136A-S16).
- Shut off the engine and ignition before any harness connectors are disconnected or connected.
- Remember to do the following when checking for shorts and opens:
 - Minimize movement of wiring harnesses when looking for shorts. Shorts involve wire-to-wire or wire-to-ground contacts and moving the harnesses may eliminate the problem.
 - Wiggle connectors, harnesses, and splices when looking for opens. This simulates vehicle movements which occur during actual operation.
- When disconnecting a harness connector, be sure that pulling force is applied to the connector itself and **not the wires** extending from the connector.
- Resistance checks involving the wiring between the ECU connectors and other components adds about one ohm of resistance to the component resistance shown.

BASIC KNOWLEDGE

- Inspect all connector terminals for damage. Terminals may have bent or lost the necessary tension to maintain firm contact.
- Clean dirty terminals or connectors with isopropyl alcohol and a cotton swab, or a good quality, non-residue, non-lubricating, cleaning solvent such as LPS Electro Contact Cleaner® or LPS NoFlash Electro Contact Cleaner®.

CAUTION:

The cleaning solvent must not be chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. (Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.)

CAUTION:

Care should be taken when welding on a vehicle equipped with electronic controls. Refer to Appendix E, Paragraph 1–1.

- Diagnostic codes displayed after system power is turned on with a harness connector disconnected, can be ignored and cleared from memory. Refer to Section 5, Diagnostic Codes, for the code clearing procedure.

3–5. BEGINNING THE TROUBLESHOOTING PROCESS

NOTE: *Whenever a transmission is overhauled, exchanged, or has undergone internal repairs, the Electronic Control Unit (ECU) must be “RESET TO UNADAPTED SHIFTS.” See Service Information Letter 16-WT-96, Revision A availability from Freightliner dealer for further details.*

1. Begin troubleshooting by checking the transmission fluid level and ECU input voltage. Remember that some problems may be temperature related. Do troubleshooting at the temperature level where the problem occurs. Check diagnostic codes by:
 - Using the shift selector display. (See Paragraph 5–2 for code reading.)
 - Using the Pro-Link® 9000 diagnostic tool.
2. When a problem exists but a diagnostic code is not indicated, refer to Transmission and Driveline Troubleshooting WP 0011 00 for a listing of various problems, their causes, and remedies.
3. If a diagnostic code is found in the ECU memory, record all available code information and clear the active indicator (refer to Section 5).
4. Test drive the vehicle to confirm a diagnostic code or performance complaint.
 - If the code reappears, refer to the Diagnostic Code section (Section 5) and the appropriate code chart. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.

BASIC KNOWLEDGE

- If the code does not reappear, it may be an intermittent problem. Use the Pro-Link® and the code display procedure described in Section 5. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for possible cause(s) of the problem.
- Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

SECTION 4 — WIRE CHECK PROCEDURES

4-1. CHECKING OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND
(Use Digital Volt/Ohmmeter J 34520-A and Jumper Wire Set J 39197)

NOTE: Please refer to Paragraph 3-5 to begin the troubleshooting process.

1. Make sure all connectors are tightly connected and re-check the circuit.
2. Disconnect and inspect all connectors.
3. Thoroughly clean corroded or dirty terminals. If dirty or corroded terminals are the probable cause of the problems, reconnect the clean connectors and operate the vehicle normally. If the problem recurs, proceed with Step (4).

CAUTION:

The cleaning solvent must not be chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware.

4. Review the WTEC III wire numbering system described in Paragraph 3-4.
5. If all connectors are clean and connected correctly, determine which wires in the chassis harness are indicated by the diagnostic code. For example, Code 41 12, indicates an open or short-to-ground in the solenoid A circuit — wires 102-T1 and 120-T4.
 - a. Check continuity of wires 102-T1 and 120-T4 by performing the following (refer to Figure 4-1):
 - (1) Disconnect the blue “T” connector from the ECU and disconnect the harness from the transmission main connector. At one end of the harness, using jumper wire kit J 39197 and connector probes in J 39775-CP, connect wire 102-T1 and 120-T4 to each other, being careful not to distort the terminals. Jumping the wires together creates a circuit between wires 102-T1 and 120-T4.

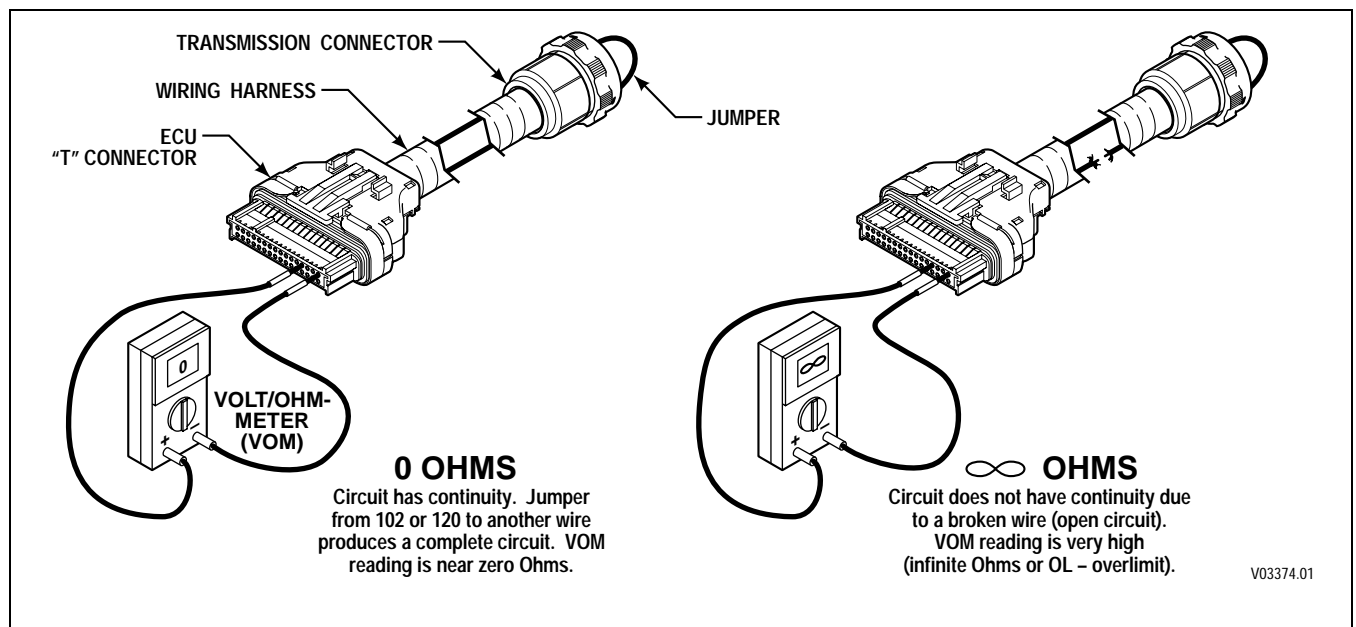


Figure 4-1. Open Circuit

WIRE CHECK PROCEDURES

- (2) On the opposite end of the harness, check the continuity of the jumpered pair. No continuity in a jumpered pair circuit (infinite resistance reading) indicates an open in the wire being tested. Locate and repair the damaged portion of the wire.
- b. If the continuity check is good (0–2 Ohms resistance), remove the jumpers. Check the harness for shorts between wires and shorts-to-ground by performing the following (refer to Figure 4–2):
- (1) At the ECU end of the harness, touch one VOM probe to one wire of the circuit being tested and touch the other probe to each terminal in the same connector, then touch the probe to chassis ground and to the transmission main housing. Do this for both wires in the circuit being tested.
 - (2) If at any time the VOM shows zero to low resistance, or the meter’s continuity beeper sounds, there is a short between the two points being probed — wire-to-wire or wire-to-ground. Isolate and repair the short.

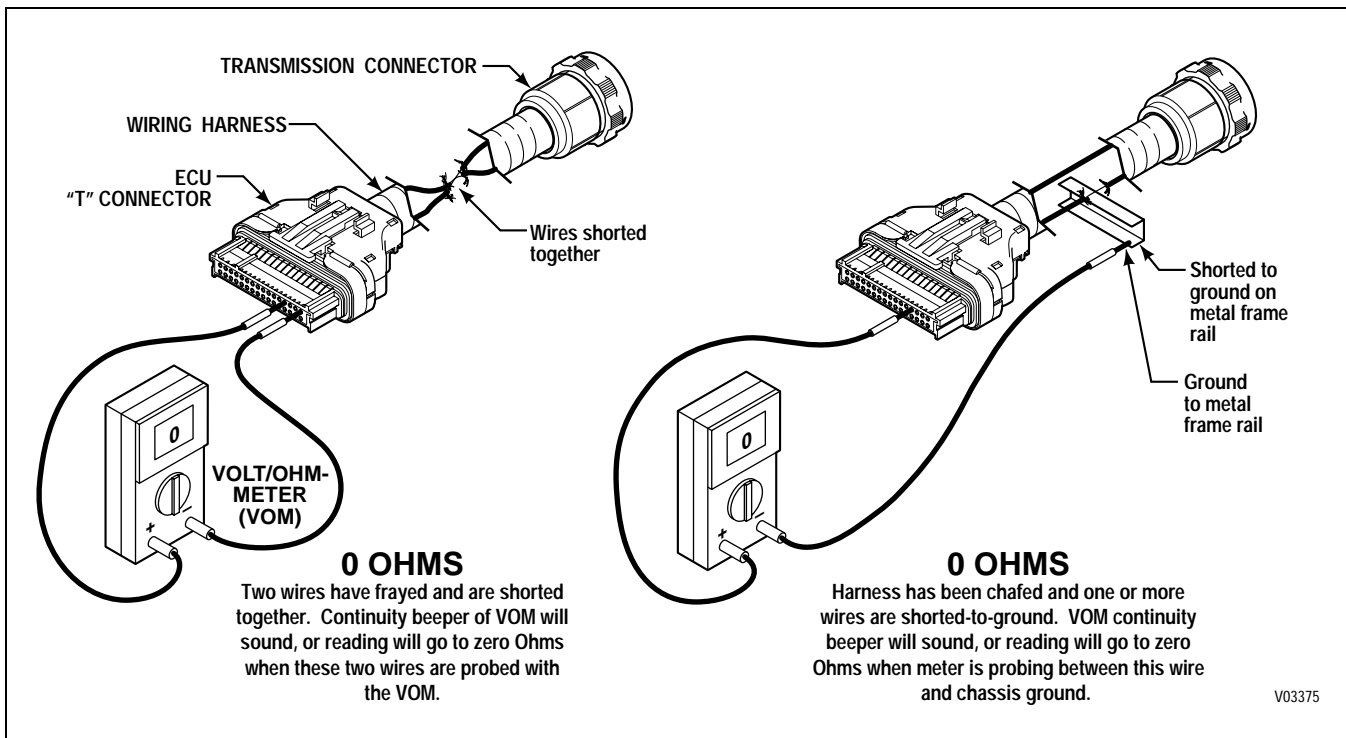


Figure 4–2. Short Between Wires and to Ground

4–2. CHECKING AT TRANSMISSION CONNECTOR AND THE INTERNAL HARNESS FOR OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

1. Disconnect the external wiring harness from the transmission.
2. Inspect the connectors. Any terminals which are corroded or dirty must be thoroughly cleaned.
3. If the connectors are clean and connected correctly, determine which wires in the harness to test. Use the diagnostic code system schematic to locate the wire terminals. For this example, Code 41 12 indicates an open or short-to-ground in solenoid “A” circuit — wires 102-T1 and 120-T4 (refer to Figure 4–3 and 4–4).

WIRE CHECK PROCEDURES

CAUTION:

The cleaning solvent must not be chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal.

- a. At the transmission connector, check the resistance of the A solenoid circuit. Resistance of a solenoid circuit should be 2.4–5 Ohms — covering a temperature range of -18°C to 149°C (0°F to 300°F). No continuity in the circuit (infinite resistance) indicates an open in the internal harness, the feedthrough connector, or the solenoid coil. Locate and repair the open in the internal harness or replace the internal harness, replace the feedthrough connector, or replace the solenoid.

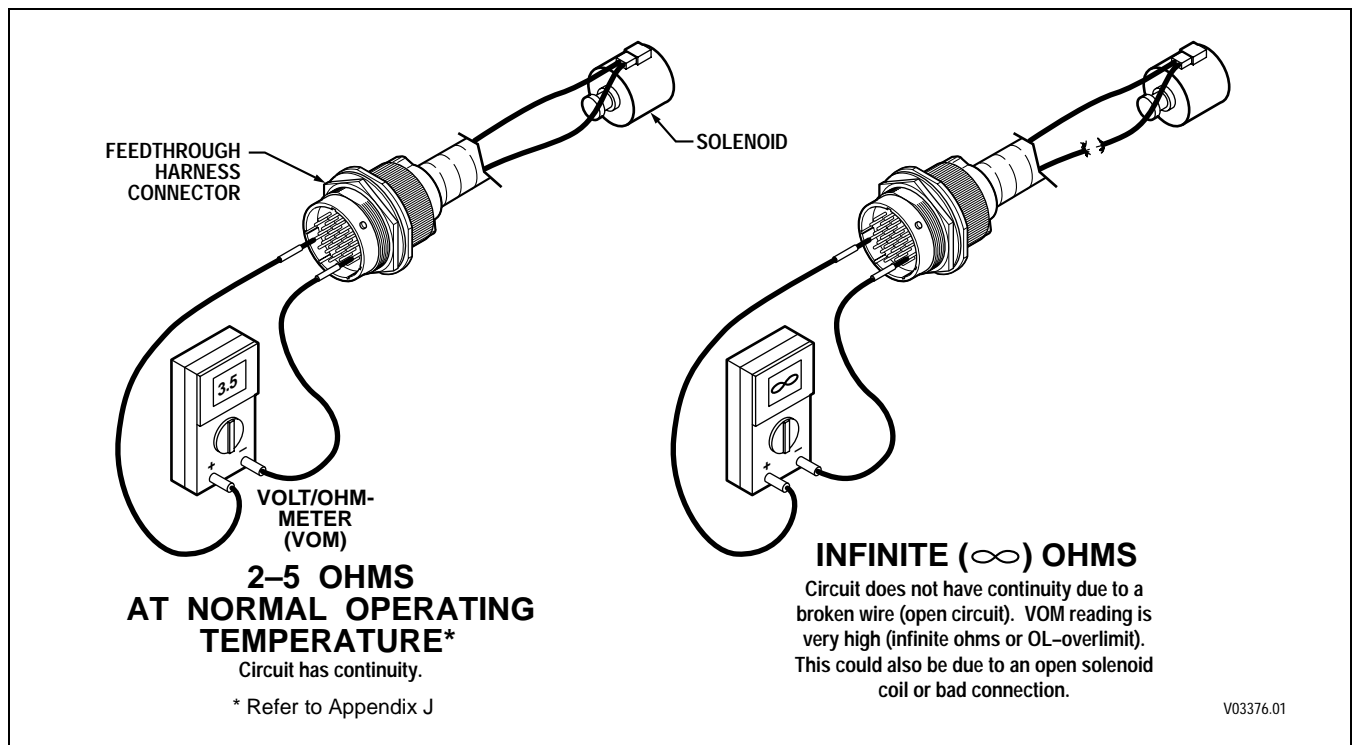


Figure 4-3. Checking Continuity

- b. If the resistance check is good, check the harness for shorts between wires and to ground by performing the following (refer to Figure 4-4):
- (1) At the transmission connector, touch one probe of the VOM to one wire of the circuit being tested and touch the other probe to each terminal in the connector and to chassis ground and the transmission main housing. Do this for both wires in the circuit being tested.
 - (2) If the VOM shows zero to low resistance, or the continuity beeper sounds, there is a short between the two points being probed, wire-to-wire or wire-to-ground. An indication of a short may be caused by a splice to the wire being checked. Check the wiring diagram in Appendix J for splice locations. If the short is not a splice, then isolate and repair the short.

WIRE CHECK PROCEDURES

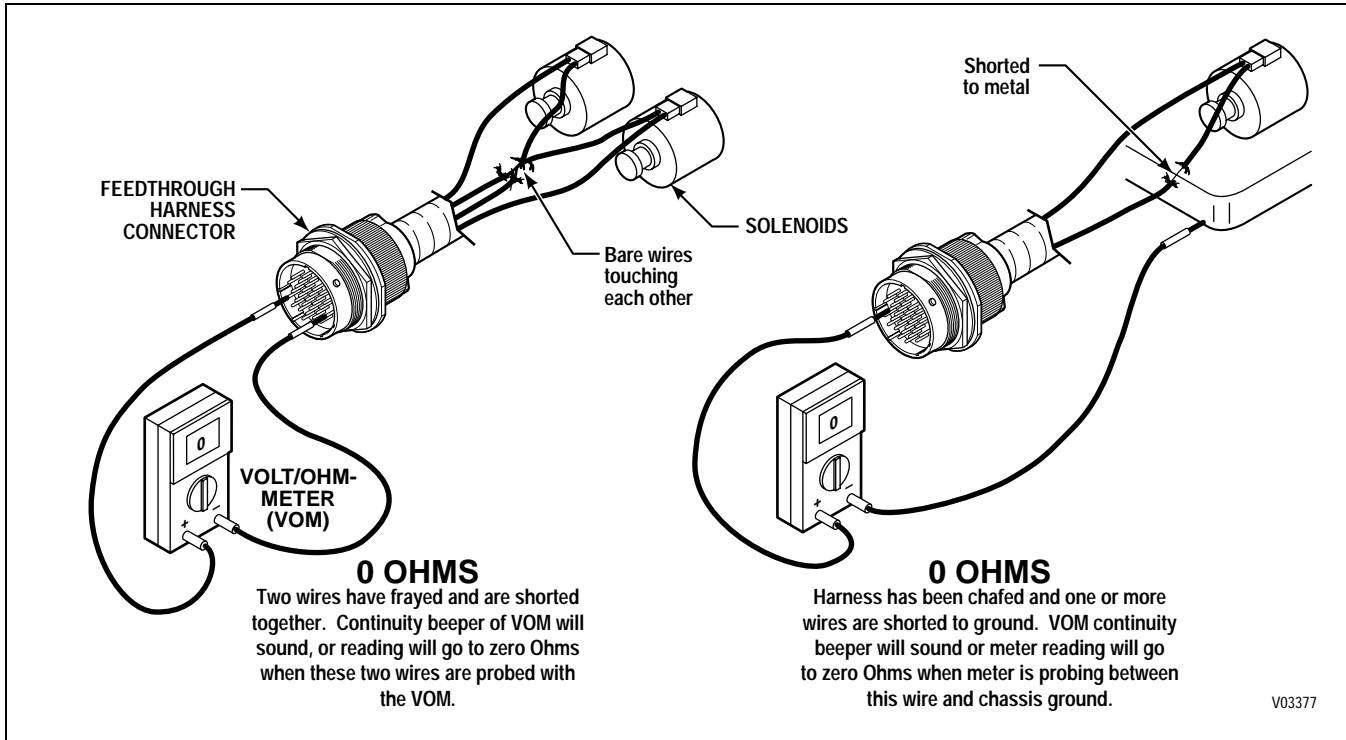


Figure 4-4. Short Between Wires and to Ground

NOTE: *When conducting circuit checks that include the external harness, add one (1) Ohm to the values shown. Speed sensor resistance is 270–330 Ohms. C3 pressure switch resistance is two (2) Ohms maximum when switch is closed and 20,000 Ohms minimum when switch is open.*

SECTION 5 — DIAGNOSTIC CODES

5-1 DIAGNOSTIC CODE MEMORY

Diagnostic codes are logged in a list in memory (sometimes referred to as the queue), listing the most recently occurring code first and logging up to five codes. The codes contained in the list have information recorded as shown in the table below (codes are examples). Access to the code list position, main code, subcode and active indicator is through either the shift selector display or the Pro-Link[®] diagnostic tool. Access to ignition cycle counter and event counter information is through the diagnostic tool only. Further detail on the use of Pro-Link[®] 9000 DDR is presented in Appendix G of this manual.

Table 5-1. Code List

Code List Position	Main Code	Subcode	Active Indicator	Ignition Cycle Counter	Event Counter
d1	21	12	YES	00	10
d2	41	12	YES	00	04
d3	23	12	NO	08	02
d4	34	12	NO	13	01
d5	56	11	NO	22	02
Displayed on shift selector and diagnostic tool d = "diagnostic"			YES = LED indicator illuminated	Not available on shift selector display	

The following paragraphs define the different parts of the code list.

- A. Code List Position.** The position which a code occupies in the code list. Positions are displayed as "d1" through "d5" (Code List Position #1 through Code List Position #5).
- B. Main Code.** The general condition or area of fault detected by the ECU.
- C. Subcode.** The specific area or condition related to the main code in which a fault is detected.
- D. Active Indicator.** Indicates when a diagnostic code is active. The MODE indicator LED on the shift selector is illuminated or the diagnostic tool displays **YES**.
- E. Ignition Cycle Counter.** Determines when inactive diagnostic codes are automatically cleared from the code list. The counter is increased by one each time a normal ECU power down occurs (ignition turned off). Inactive codes are cleared from the code list after the counter exceeds 25.
- F. Event Counter.** Counts the number of occurrences of a diagnostic code. If a code is already in the code list and the code is again detected, that code is moved to position d1, the active indicator is turned on, the Ignition Cycle Counter is cleared, and 1 is added to the Event Counter.

5-2. CODE READING AND CODE CLEARING

Diagnostic codes can be read and cleared by two methods: by using the Pro-Link[®] 9000 diagnostic tool or by entering the diagnostic display mode and using the shift selector display. The use of the Pro-Link[®] 9000 diagnostic tool is described in the instruction manual furnished with each tool and briefly in Appendix G of this manual. The method of reading and clearing codes described in this section refers to entering the diagnostic display mode by the proper button movements on the shift selector.

DIAGNOSTIC CODES

The diagnostic display mode may be entered for viewing of codes at any speed. Active codes can only be cleared when the output speed = 0 and no output speed sensor failure is active.

- A. Reading Codes.** Enter the diagnostic display mode by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time on a pushbutton selector, or by momentarily pressing the “display mode” button on a lever shift selector.

NOTE: *If a DO NOT SHIFT condition is present (CHECK TRANS light illuminated) at this time, the shift selector may or may not respond to requested range changes.*

NOTE: *If an oil level sensor is present, then fluid level will be displayed first. Diagnostic code display is achieved by simultaneously depressing the ↑ (Up) and ↓ (Down) arrow buttons a second time or the “display mode” button a second time.*

The code list or queue position is the first item displayed, followed by the main code and the subcode. Each item is displayed for about one second. The display cycles continuously until the next code list position is accessed by pressing the **MODE** button. The following list represents the display cycle using code 25 11 as an example:

1. Code list position — **d, 1**
2. Main code — **2, 5**
3. Subcode — **1, 1**
4. Cycle repeats — **d, 1, 2, 5, 1, 1**

To view the second, third, fourth, and fifth positions (d2, d3, d4, and d5), momentarily press the **MODE** button as explained above.

Momentarily press the **MODE** button after the fifth position is displayed to restart the sequence of code list positions.

An active code is indicated by the illumination of the LED indicator when a code position is displayed while in the diagnostic display mode. In the normal operating mode, the LED indicator illuminates to show a secondary mode operation.

Any code position which does not have a diagnostic code logged will display “–” for both the main and subcodes. No diagnostic codes are logged after an empty code position.

- B. Clearing Active Indicators.** A diagnostic code’s active indicator can be cleared, which allows the code inhibit to be cleared but remains in the queue as inactive.

The active indicator clearing methods are:

1. Power down — All active indicators, except code 69 34 (refer to the code chart), are cleared at ECU power down.
2. Self-clearing — Some codes will clear their active indicator when the condition causing the code is no longer detected by the ECU.

DIAGNOSTIC CODES

- Manual — Some active indicators can be cleared manually, while in the diagnostic display mode, after the condition causing the code is corrected.

CAUTION:

If an active indicator is cleared while the transmission is locked in a forward range or reverse (fail-to-range), the transmission will remain in the forward range or reverse after the clearing procedure is completed. Neutral must be manually selected.

- Manually Clearing Codes and Active Indicators from the Code List.** To clear active indicators or all codes:
 - Enter the diagnostic display mode.
 - Press and hold the **MODE** button for approximately three seconds until the LED indicator flashes. All active indicators are cleared. To remove all inactive codes, press and hold the **MODE** button for about ten seconds until the LED indicator flashes again. All active indicators will be cleared at ECU power down.
 - Codes that cannot be manually cleared will remain.
- Exiting the diagnostic display mode.** Exit the diagnostic display mode using one of the following procedures:
 - On a pushbutton shift selector, press the \uparrow (Up) and \downarrow (Down) arrow buttons at the same time or press any range button, **D**, **N**, or **R**. The shift (**D**, **N**, or **R**) is commanded if not inhibited by an active code.
 - On a lever shift selector, momentarily press the “display mode” button or move the shift lever to any shift position other than the one it was in when the diagnostic display mode was activated. If the shift is inhibited, the ECU will continue to command the current transmission range attained and the lever should be returned to its original position.
 - Wait until timeout (approximately 10 minutes) and the system will automatically return to the normal operating mode.
 - Turn off power to the ECU (turn off the vehicle engine at the ignition switch).

5-3. DIAGNOSTIC CODE RESPONSE

The following ECU responses to a fault provide for safe transmission operation:

- **Do Not Shift (DNS) Response**
 - Release lockup clutch and inhibit lockup operation.
 - Inhibit all shifts.
 - Turn on the **CHECK TRANS** light.
 - Display the range attained.
 - Ignore any range selection inputs from the pushbutton or lever shift selector.
- **Do Not Adapt (DNA) Response**
 - The ECU stops adaptive shift control while the code is active. Do not adapt shifts when a code with the DNA response is active.

DIAGNOSTIC CODES

- **SOLenoid OFF (SOL OFF) Response**
 - All solenoids are commanded off (turning solenoids “A” and “B” off electrically causes them to be on hydraulically).
- **Return to Previous Range (RPR) Response**
 - When the speed sensor ratio or C3 pressure switch tests associated with a shift are not successful, the ECU commands the same range as commanded before the shift.
- **Neutral No Clutches (NNC) Response**
 - When certain speed sensor ratio or C3 pressure switch tests are not successful, the ECU commands a neutral condition with no clutches applied.

5-4. SHIFT SELECTOR DISPLAYS RELATED TO ACTIVE CODES

- “Cateye” — The forward slash segments and the middle horizontal segments (-\-) may be on under the following conditions:
 - RSI link fault is active (code 23 12 or 23 14)
 - When two COP timeouts occur within two seconds of each other (reference code 69 33)
 - Shift selector display line fault is active (23 16)
- All Segments Displayed — All display segments will be illuminated if a severity 1 diagnostic code is present during initialization, or if an electrical code for solenoids A, B, C, D, E, or G is logged before initialization completes.

5-5. DIAGNOSTIC CODE LIST AND DESCRIPTION

Table 5-2. WT Series Diagnostic Codes

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
13 (0011 00-50)	12	ECU input voltage, low	Yes	DNS, DNA, SOL OFF (hydraulic default)
	13	ECU input voltage, medium low	No	DNA
	23	ECU input voltage, high	Yes	DNS, SOL OFF (hydraulic default)
14 (0011 00-53)	12	Oil level sensor, failed low	No	None
	23	Oil level sensor, failed high	No	None
21 (0011 00-56)	12	Throttle position sensor, failed low	No	Use throttle default values, DNA
	23	Throttle position sensor, failed high	No	Use throttle default values, DNA
22 (0011 00-59)	14	Engine speed sensor reasonableness test	No	Use default engine speed, DNA
	15	Turbine speed sensor reasonableness test	Yes	DNS, lock in current range, DNA
	16	Output speed sensor reasonableness test	Yes ⁽¹⁾	DNS, lock in current range, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
23 (0011 00-62)	12	Primary shift selector or RSI link fault	No	Hold in last valid direction. May cause “cateye” display.
	13	Primary shift selector mode function fault	No	Mode change not permitted
	14	Secondary shift selector or RSI link fault	No	Hold in last valid direction. May cause “cateye” display.
	15	Secondary shift selector mode function fault	No	Mode change not permitted
	16	Shift Selector display line fault	No	None. May cause “cateye” display.
24 (0011 00-64)	12	Sump fluid temperature, cold	Yes	DNS, lock in neutral
	23	Sump fluid temperature, hot	No	No upshifts above a calibration range
25 (011 00-69)	00	Output speed sensor, detected at 0 output rpm, Low	Yes ⁽¹⁾	DNS, lock in current range (Low), DNA
	11	Output speed sensor, detected at 0 output rpm, 1st	Yes ⁽¹⁾	DNS, lock in current range (1st), DNA
	22	Output speed sensor, detected at 0 output rpm, 2nd	Yes ⁽¹⁾	DNS, lock in current range (2nd), DNA
	33	Output speed sensor, detected at 0 output rpm, 3rd	Yes ⁽¹⁾	DNS, lock in current range (3rd), DNA
	44	Output speed sensor, detected at 0 output rpm, 4th	Yes ⁽¹⁾	DNS, lock in current range (4th), DNA
	55	Output speed sensor, detected at 0 output rpm, 5th	Yes ⁽¹⁾	DNS, lock in current range (5th), DNA
	66	Output speed sensor, detected at 0 output rpm, 6th	Yes ⁽¹⁾	DNS, lock in current range (6th), DNA
	77	Output speed sensor, detected at 0 output rpm, Reverse range	Yes ⁽¹⁾	DNS, lock in current range (R), DNA
26 (0011 00-71)	00	Throttle source not detected	No	Use throttle default values, DNA
	11	Engine coolant source not detected	No	Use default value of –18°C (0°F)
32 (0011 00-73)	00	C3 pressure switch open, Low range	Yes	DNS, lock in current range (Low), DNA
	33	C3 pressure switch open, 3rd range	Yes	DNS, lock in current range (3rd), DNA
	55	C3 pressure switch open, 5th range	Yes	DNS, lock in current range (5th), DNA
	77	C3 pressure switch open, Reverse range	Yes	DNS, lock in current range (R), DNA
33 (0011 0-75)	12	Sump oil temperature sensor failed low	No	Use default value of 93°C (200°F)
	23	Sump oil temperature sensor failed high	No	Use default value of 93°C (200°F)

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
34 (0011 00-77)	12	Factory calibration compatibility number wrong	Yes ⁽⁵⁾	DNS, SOL OFF (hydraulic default), DNA
	13	Factory calibration block checksum	Yes ⁽⁵⁾	DNS, SOL OFF (hydraulic default), DNA
	14	Power off block checksum	No	Use previous location, or factory calibration and reset adaptive, DNA
	15	Diagnostic queue block checksum	No	Use previous location, or clear diagnostic queue, DNA
	16	Real time block checksum	Yes	DNS, SOL OFF (hydraulic default), DNA
	17	Customer modifiable constants checksum	Yes ⁽⁵⁾	DNS, SOL OFF (hydraulic default), DNA
35 (0011 00-79)	00	Power interruption (code set after power restored)	No	None (hydraulic default during interruption)
	16	Real time write interruption	Yes	DNS, SOL OFF (hydraulic default), DNA
36 (0011 00-80)	00	Hardware/software not compatible	Yes ⁽²⁾	DNS, SOL OFF (hydraulic default), DNA
	01	TID not compatible with hardware/software	No ⁽²⁾	Use TIDCAP cal
	02	TID did not complete	No	Use TIDCAP cal, code 42 XX or 69 XX may be logged
42 (0011 00-82)	12	Short-to-battery, A solenoid circuit	Yes	DNS, SOL OFF, DNA
	13	Short-to-battery, B solenoid circuit	Yes	DNS, SOL OFF, DNA
	14	Short-to-battery, C solenoid circuit	Yes	DNS, SOL OFF, DNA
	15	Short-to-battery, D solenoid circuit	Yes	DNS, SOL OFF, DNA
	16	Short-to-battery, E solenoid circuit	Yes	DNS, SOL OFF, DNA
	21	Short-to-battery, F solenoid circuit	No	Lockup inhibited, DNA
	22	Short-to-battery, G solenoid circuit	Yes	DNS, SOL OFF, DNA
	23	Short-to-battery, H solenoid circuit	No	Differential lock inhibited (3070 only), retarder inhibited
	24	Short-to-battery, J solenoid circuit	No	Low and 1st inhibited
26	Short-to-battery, N solenoid circuit	No	Low and 1st inhibited, allow retarder	
44 (0011 00-86)	12	Short-to-ground, A solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	13	Short-to-ground, B solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	14	Short-to-ground, C solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	15	Short-to-ground, D solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	16	Short-to-ground, E solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	21	Short-to-ground, F solenoid circuit	No	Lockup inhibited, DNA
	22	Short-to-ground, G solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
44 (<i>cont'd</i>)	23	Short-to-ground, H solenoid circuit	No	Differential lock inhibited (3070 only), retarder operation inhibited
	24	Short-to-ground, J solenoid circuit	No	Low and 1st inhibited
	26	Short-to-ground, N solenoid circuit	No	Low and 1st inhibited, retarder allowed
45 (0011 00-90)	12	Open circuit, A solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	13	Open circuit, B solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	14	Open circuit, C solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	15	Open circuit, D solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	16	Open circuit, E solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	21	Open circuit, F solenoid circuit	No	Lockup inhibited, DNA
	22	Open circuit, G solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
	23	Open circuit, H solenoid circuit	No	Differential lock inhibited (3070 only), retarder inhibited
	24	Open circuit, J solenoid circuit	No	Low and 1st inhibited
	26	Open circuit, N solenoid circuit	No	Low and 1st inhibited, retarder allowed
46 (0011 00-94)	21	Overcurrent, F solenoid circuit	No	Lockup inhibited, DNA
	26	Overcurrent, N and H solenoid circuit	No	Low and first inhibited or retarder inhibited, DNA
	27	Overcurrent, A-Hi solenoid circuit	Yes	DNS, SOL OFF (hydraulic default), DNA
51 (0011 00-95)	01	Offgoing ratio test (during shift), Low to 1	Yes	DNS, RPR, DNA
	10	Offgoing ratio test (during shift), 1 to Low	Yes	DNS, RPR, DNA
	12	Offgoing ratio test (during shift), 1 to 2	Yes	DNS, RPR, DNA
	21	Offgoing ratio test (during shift), 2 to 1	Yes	DNS, RPR, DNA
	23	Offgoing ratio test (during shift), 2 to 3	Yes	DNS, RPR, DNA
	24	Offgoing ratio test (during shift), 2 to 4	Yes	DNS, RPR, DNA
	35	Offgoing ratio test (during shift), 3 to 5	Yes	DNS, RPR, DNA
	42	Offgoing ratio test (during shift), 4 to 2	Yes	DNS, RPR, DNA
	43	Offgoing ratio test (during shift), 4 to 3	Yes ⁽¹⁾	DNS, RPR, DNA
	45	Offgoing ratio test (during shift), 4 to 5	Yes ⁽¹⁾	DNS, RPR, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
51 (<i>cont'd</i>)	46	Offgoing ratio test (during shift), 4 to 6	Yes	DNS, RPR, DNA
	53	Offgoing ratio test (during shift), 5 to 3	Yes	DNS, RPR, DNA
	64	Offgoing ratio test (during shift), 6 to 4	Yes	DNS, RPR, DNA
	65	Offgoing ratio test (during shift), 6 to 5	Yes	DNS, RPR, DNA
	XY	Offgoing ratio test, X to Y ⁽³⁾		
52 (0011 00-97)	01	Offgoing C3PS test (during shift), Low to 1	Yes	DNS, RPR, DNA
	08	Offgoing C3PS test (during shift), Low to N1	Yes	DNS, NNC, DNA
	32	Offgoing C3PS test (during shift), 3 to 2	Yes	DNS, RPR, DNA
	34	Offgoing C3PS test (during shift), 3 to 4	Yes	DNS, RPR, DNA
	54	Offgoing C3PS test (during shift), 5 to 4	Yes	DNS, RPR, DNA
	56	Offgoing C3PS test (during shift), 5 to 6	Yes	DNS, RPR, DNA
	71	Offgoing C3PS test (during shift), R to 1	Yes	DNS, NNC, DNA
	72	Offgoing C3PS test (during shift), R to 2	Yes	DNS, NNC, DNA
	78	Offgoing C3PS test (during shift), R to N1	Yes	DNS, NNC, DNA
	99	Offgoing C3PS test (during shift), N3 to N2	Yes	DNS, RPR, DNA
XY	Offgoing C3PS test, X to Y ⁽³⁾			
53 (0011 00-99)	08	Offgoing speed test (during shift), L to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	18	Offgoing speed test (during shift), 1 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	28	Offgoing speed test (during shift), 2 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	29	Offgoing speed test (during shift), 2 to N2	Yes ⁽¹⁾	DNS, RPR, DNA
	38	Offgoing speed test (during shift), 3 to N1	Yes ⁽¹⁾	DNS, NNC, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
53 (<i>cont'd</i>)	39	Offgoing speed test (during shift), 3 to N3	Yes ⁽¹⁾	DNS, RPR, DNA
	48	Offgoing speed test (during shift), 4 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	49	Offgoing speed test (during shift), 4 to N3	Yes ⁽¹⁾	DNS, RPR, DNA
	58	Offgoing speed test (during shift), 5 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	59	Offgoing speed test (during shift), 5 to N3	Yes ⁽¹⁾	DNS, RPR, DNA
	68	Offgoing speed test (during shift), 6 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	69	Offgoing speed test (during shift), 6 to N4	Yes ⁽¹⁾	DNS, RPR, DNA
	78	Offgoing speed test (during shift), R to N1	Yes	DNS, NNC, DNA
	99	Offgoing speed test (during shift), N2 to N3 or N3 to N2	Yes	DNS, RPR, DNA
	XY	Offgoing speed test (during shift), X to Y ⁽³⁾		
54 (0011 00- 101)	01	Oncoming ratio test (after shift), L to 1	Yes	DNS, RPR, DNA
	07	Oncoming ratio test (after shift), L to R	Yes	DNS, NNC, DNA
	10	Oncoming ratio test (after shift), 1 to L	Yes	DNS, RPR, DNA
	12	Oncoming ratio test (after shift), 1 to 2	Yes	DNS, RPR, DNA
	17	Oncoming ratio test (after shift), 1 to R	Yes	DNS, NNC, DNA
	21	Oncoming ratio test (after shift), 2 to 1	Yes	DNS, RPR, DNA
	23	Oncoming ratio test (after shift), 2 to 3	Yes	DNS, RPR, DNA
	24	Oncoming ratio test (during shift), 2 to 4	Yes	DNS, RPR, DNA
	27	Oncoming ratio test (after shift), 2 to R	Yes	DNS, RPR, DNA
	32	Oncoming ratio test (after shift), 3 to 2	Yes	DNS, RPR, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
54 (<i>cont'd</i>)	34	Oncoming ratio test (after shift), 3 to 4	Yes	DNS, RPR, DNA
	35	Oncoming ratio test (during shift), 3 to 5	Yes	DNS, RPR, DNA
	42	Oncoming ratio test (during shift), 4 to 2	Yes	DNS, RPR, DNA
	43	Oncoming ratio test (after shift), 4 to 3	Yes	DNS, RPR, DNA
	45	Oncoming ratio test (after shift), 4 to 5	Yes	DNS, RPR or SOL OFF (hydraulic default), DNA
	46	Oncoming ratio test (during shift), 4 to 6	Yes	DNS, RPR, DNA
	53	Oncoming ratio test (during shift), 5 to 3	Yes	DNS, RPR, DNA
	54	Oncoming ratio test (after shift), 5 to 4	Yes	DNS, RPR, DNA
	56	Oncoming ratio test (after shift), 5 to 6	Yes	DNS, RPR, DNA
	64	Oncoming ratio test (after shift), 6 to 4	Yes	DNS, RPR, DNA
	65	Oncoming ratio test (after shift), 6 to 5	Yes	DNS, RPR, DNA
	70	Oncoming ratio test (after shift), R to L	Yes	DNS, NNC, DNA
	71	Oncoming ratio test (after shift), R to 1	Yes	DNS, NNC, DNA
	72	Oncoming ratio test (after shift), R to 2	Yes	DNS, NNC, DNA
	80	Oncoming ratio test (after shift), N1 to L	Yes	DNS, RPR, DNA
	81	Oncoming ratio test (after shift), N1 to 1	Yes	DNS, RPR, DNA
	82	Oncoming ratio test (after shift), N1 to 2	Yes	DNS, RPR, DNA
	83	Oncoming ratio test (after shift), N1 to 3	Yes	DNS, RPR, DNA
	85	Oncoming ratio test (after shift), N1 to 5	Yes	DNS, RPR, DNA
	86	Oncoming ratio test (after shift), N1 to 6	Yes	DNS, RPR, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
54 (<i>cont'd</i>)	92	Oncoming ratio test (after shift), N2 to 2	Yes	DNS, RPR, DNA
	93	Oncoming ratio test (after shift), N3 to 3	Yes	DNS, RPR, DNA
	95	Oncoming ratio test (after shift), N3 to 5	Yes	DNS, RPR, DNA
	96	Oncoming ratio test (after shift), N4 to 6	Yes	DNS, RPR, DNA
	XY	Oncoming ratio test (after shift), X to Y ⁽³⁾		
55 (0011 00-103)	07	Oncoming C3PS test (after shift), Low to R	Yes ⁽¹⁾	DNS, NNC, DNA
	17	Oncoming C3PS test (after shift), 1 to R	Yes ⁽¹⁾	DNS, NNC, DNA
	27	Oncoming C3PS test (after shift), 2 to R	Yes ⁽¹⁾	DNS, NNC, DNA
	87	Oncoming C3PS test (after shift), N1 to R	Yes	DNS, RPR, DNA
	97	Oncoming C3PS test (after shift), NVL to R	Yes ⁽¹⁾	DNS, NNC, DNA
	XY	Oncoming C3PS test (after shift), X to Y ⁽³⁾		
56 (0011 00-105)	00	Range verification test, L	Yes ⁽¹⁾	DNS, 1st, Low, or SOL OFF (Low), DNA
	11	Range verification ratio test, 1st	Yes	DNS, 6th, DNA
	22	Range verification ratio test, 2nd	Yes ⁽¹⁾	DNS, 6th or 5th, DNA
	33	Range verification ratio test, 3rd	Yes ⁽¹⁾	DNS, 5th or SOL OFF (4th), DNA
	44	Range verification ratio test, 4th	Yes	DNS, 3rd or 5th, DNA
	55	Range verification ratio test, 5th	Yes ⁽¹⁾	DNS, SOL OFF (5th) or 3rd, DNA
	66	Range verification ratio test, 6th	Yes	DNS, 5th, 3rd, or SOL OFF (3rd), DNA
	77	Range verification ratio test, R	Yes	DNS, N2 or N3, DNA
57 (0011 00-107)	11	Range verification C3PS test, 1st	Yes	DNS, SOL OFF (3rd), DNA
	22	Range verification C3PS test, 2nd	Yes	DNS, 3rd, DNA
	44	Range verification C3PS test, 4th	Yes	DNS, 5th or SOL OFF (3rd), DNA
	66	Range verification C3PS test, 6th	Yes	DNS, SOL OFF (5th), DNA
	88	Range verification C3PS test, N1	Yes	DNS, N3, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
	99	Range verification C3PS test, N2 or N4	Yes	DNS, N3, DNA
61 (0011 00-108)	00	Retarder oil temperature, hot	No	None
62 (0011 00-110)	12	Retarder temperature sensor failed low	No	None
	23	Retarder temperature sensor failed high	No	None
	32	Engine coolant sensor failed low	No	Use default value of 0°F
	33	Engine coolant sensor failed high	No	Use default value of 0°F
63 (0011 00-113)	00	Input function fault	No	Does not prevent neutral to range shifts for Aux Function Range Inhibit-Special when two signals required are not “on” within 120 seconds of each other.
	26	Kickdown input failed on	No	Kickdown operation inhibited
	40	Service brake status input failed on	No	No auto Neutral to Drive shifts for refuse packer. (I/O package #41). No retarder if a TPS code is also active
	41	Pump/pack and a neutral general purpose input	No	No auto N–D shifts for refuse packer (I/O package #41)
64 (0011 00-114)	12	Retarder modulation request sensor failed low	No	Retarder operation inhibited
	23	Retarder modulation request sensor failed high	No	Retarder operation inhibited
		Engine rating too high	Yes	DNS, Lock-in-neutral, DNA
65 (0011 00-117)	00	Engine rating too high	Yes	DNS, Lock-in-neutral
66 (0011 00-118)	00	Serial communications interface fault	No	Use default throttle values, DNA
	11	SCI engine coolant source fault	No	Use default value of 0°F
69 (0011 00-120)	27	ECU, inoperative A-Hi switch	Yes	DNS, NNC, DNA
	28	ECU, inoperative F-Hi switch	Yes	Lockup inhibited, DNA
	29	ECU, inoperative N and H-Hi switch	No	Low and first inhibited, retarder inhibited, DNA

DIAGNOSTIC CODES

Table 5–2. WT Series Diagnostic Codes (Continued)

Main Code	Sub-code	Description	CHECK TRANS Light	Inhibited Operation Description
69 (<i>cont'd</i>)	33	ECU, Computer Operating Properly (COP) timeout	No	Reset ECU, shutdown ECU on 2nd occurrence (power loss; hydraulic defaults). May cause “cateye” display or all segments blank display, DNA ⁽⁴⁾
	34	ECU, write timeout	Yes	DNS, SOL OFF (hydraulic default), DNA
	35	ECU, checksum test	No	Induce COP timeout (reset ECU), DNA ⁽⁴⁾
	36	ECU, RAM self test	No	Induce COP timeout (reset ECU), DNA ⁽⁴⁾
	39	Communication chip addressing error	No	Use defaults for J1939 data, DNA
	41	ECU, I/O ASIC addressing test	No	Induce COP timeout (reset ECU), DNA ⁽⁴⁾
	42	SPI output failure	Yes	GPO 1–8 and reverse warning inoperable
	43	SPI input failure	Yes	DNS, lock-in-range, DNA
70	12	Software, minor loop overrun	No	Induce COP timeout (reset ECU)
	13	Illegal write to address \$0000	No	Induce COP timeout (reset ECU)
	14	Software, major loop overrun	No	Induce COP timeout (reset ECU)

NOTES

- (1) This code is logged to real time to protect the transmission in case a loss of power to the ECU (Power Interruption, code 35 00) occurs.
- (2) The ECU hardware or software must be changed so that they are compatible.
- (3) Additional codes could be logged for other shifts where X indicates range shifted from and Y indicates range shifted to.
- (4) The COP reset will clear the active inhibit.
- (5) The factory calibration must be rewritten to the ECU, or a different factory calibration is required to match the software in the ECU.

**TRANSMISSION
COMPONENT
WIRING DIAGRAMS
AND
DIAGNOSTICS**

DIAGNOSTIC CODES

5-6. DIAGNOSTIC CODE TROUBLESHOOTING

A. Beginning The Troubleshooting Process

1. Begin troubleshooting by checking the transmission fluid level and ECU input voltage. Check diagnostic codes by:
 - Using the shift selector display.
 - Using the Pro-Link[®] 9000 diagnostic tool.
2. When a problem exists but a diagnostic code is not indicated, refer to the Performance Complaint Section for a listing of various electrical and hydraulic problems, their causes, and remedies.
3. If a diagnostic code is found in the ECU memory, record all available code information and clear the active indicator (refer to Paragraph 5-2).
4. Test drive the vehicle to confirm a diagnostic code or performance complaint.
 - If the code reappears, refer to the Diagnostic Code section (Section 6) and the appropriate code chart. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.
 - If the code does not reappear, it may be an intermittent problem. Use the Pro-Link[®] and the code display procedure described in Section 5. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for possible cause(s) of the problem.
 - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

NOTE: *Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.*

B. Solenoid Locations

Solenoid locations in the control module are as illustrated in Figure 5-1. Refer to Figure 5-1 as necessary when using the diagnostic code schematics.

C. Diagnostic Code Schematics

The diagnostic code schematics in this section show wiring for both the optional oil level sensor and retarder, where applicable. If your transmission is not equipped with an oil level sensor or retarder, disregard the portions of the schematic pertaining to those optional pieces of equipment. Refer to the appropriate transmission Service Manual for solenoid replacement procedures.

D. Wire/Terminal Numbering Scheme

WTEC III wire identification presents the wire number followed by the ECU terminal source (i.e., 157-S30). This is done to retain the wire number/function assignments from WTEC II and indicate the ECU connector and terminal origination for WTEC III. If there is a letter suffix following the wire number, there is a splice between the ECU source and wire destination (i.e., 136A-S16).

DIAGNOSTIC CODES

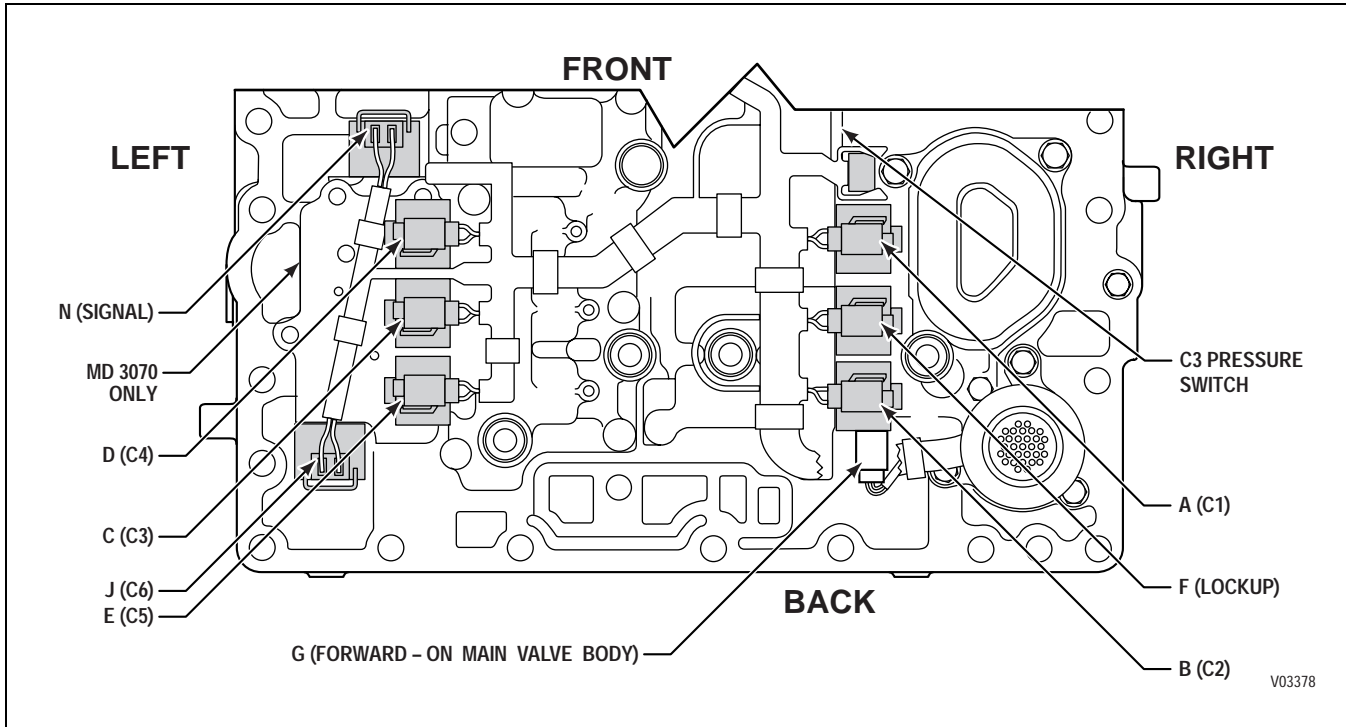
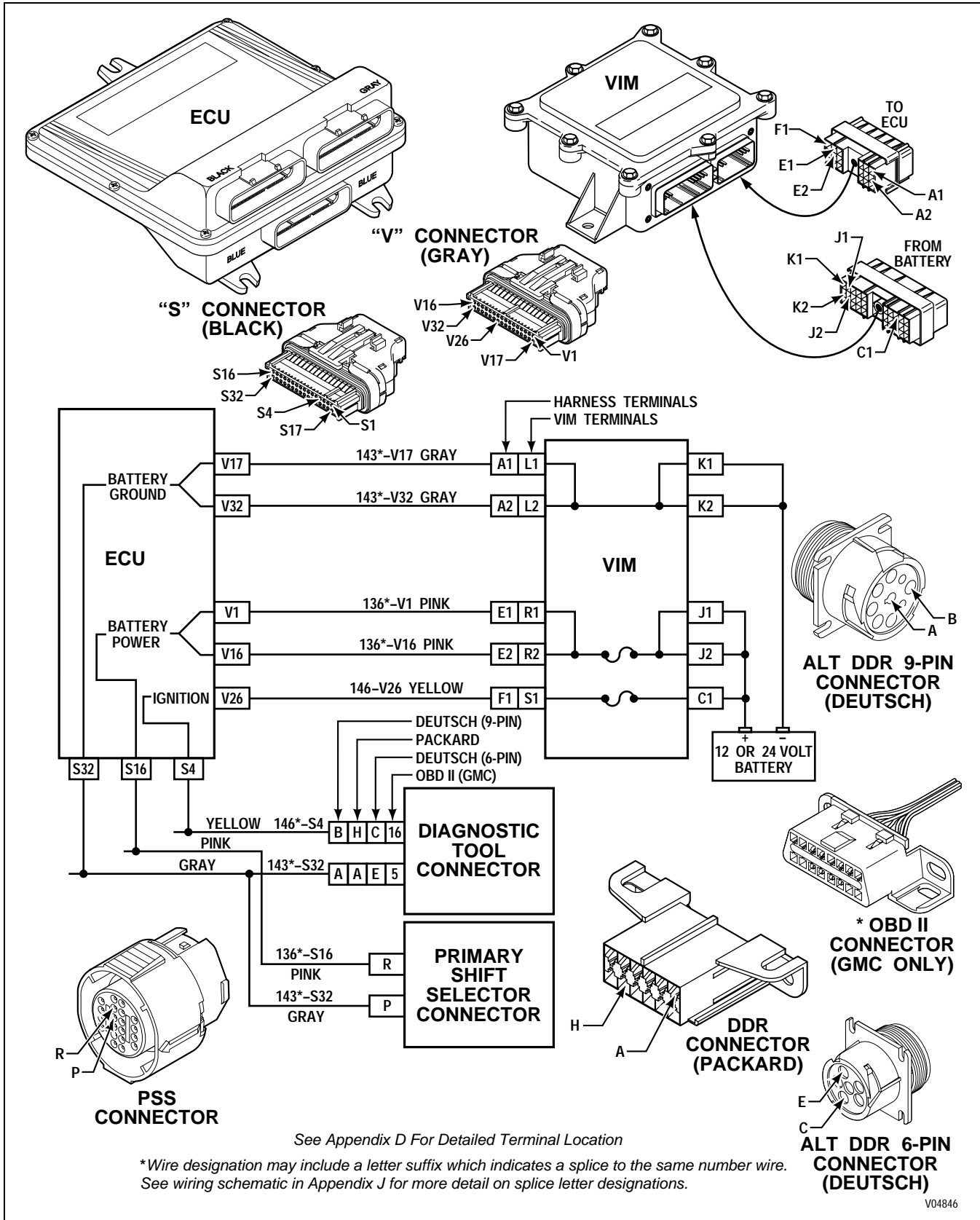


Figure 5-1. Control Module Solenoid Location

CODE 13 XX — ECU INPUT VOLTAGE



V04846

Figure 5-2. Code 13 Schematic Drawing

CODE 13 XX — ECU INPUT VOLTAGE *(Figure 5-2)*

Main code 13 indicates either a high or low input voltage. Low voltage is less than 8 volts. High voltage is over 33 volts.

Common causes for a low voltage code are:

- Bad batteries
- Faulty vehicle charging system
- No dedicated power and ground connection directly to the battery or through an electronic bus bar to the battery

Common causes for the high voltage code are:

- Faulty vehicle alternator
- Faulty vehicle voltage regulator

In the event of a power loss, the transmission fails to the ranges indicated in the following, depending upon which latch valve releases first:

Attained Range	Fail to Range
Reverse and neutral	Neutral
Low, 1	3C
2, 3, 4	4C usually, 3C sometimes
5	4C usually, 5C sometimes
6	5C

Main Code	Subcode	Meaning
13	12	Battery voltage to the ECU too low
13	13	Battery voltage to the ECU too low (medium)
13	23	Battery voltage to the ECU too high

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

B. Troubleshooting:

1. Connect the diagnostic tool and turn on vehicle ignition. Select Diagnostic Data to find input voltage. Record reading.
2. Turn off vehicle ignition and remove the connectors from the ECU.
3. Check system voltage at wire 136A and 136C, pin V1 and V16. If power is low or high at this point, and the diagnostic tool reading is also low or high, the vehicle wiring is suspect. Check for fuse problems, lack of battery-direct power and ground, faulty charging system/batteries, and loose or dirty connections (see Appendix A). Power may also be low or high at pins V1 and V16 (system power) if the batteries/charging system is faulty. Bad grounds may also cause incorrect input power readings.

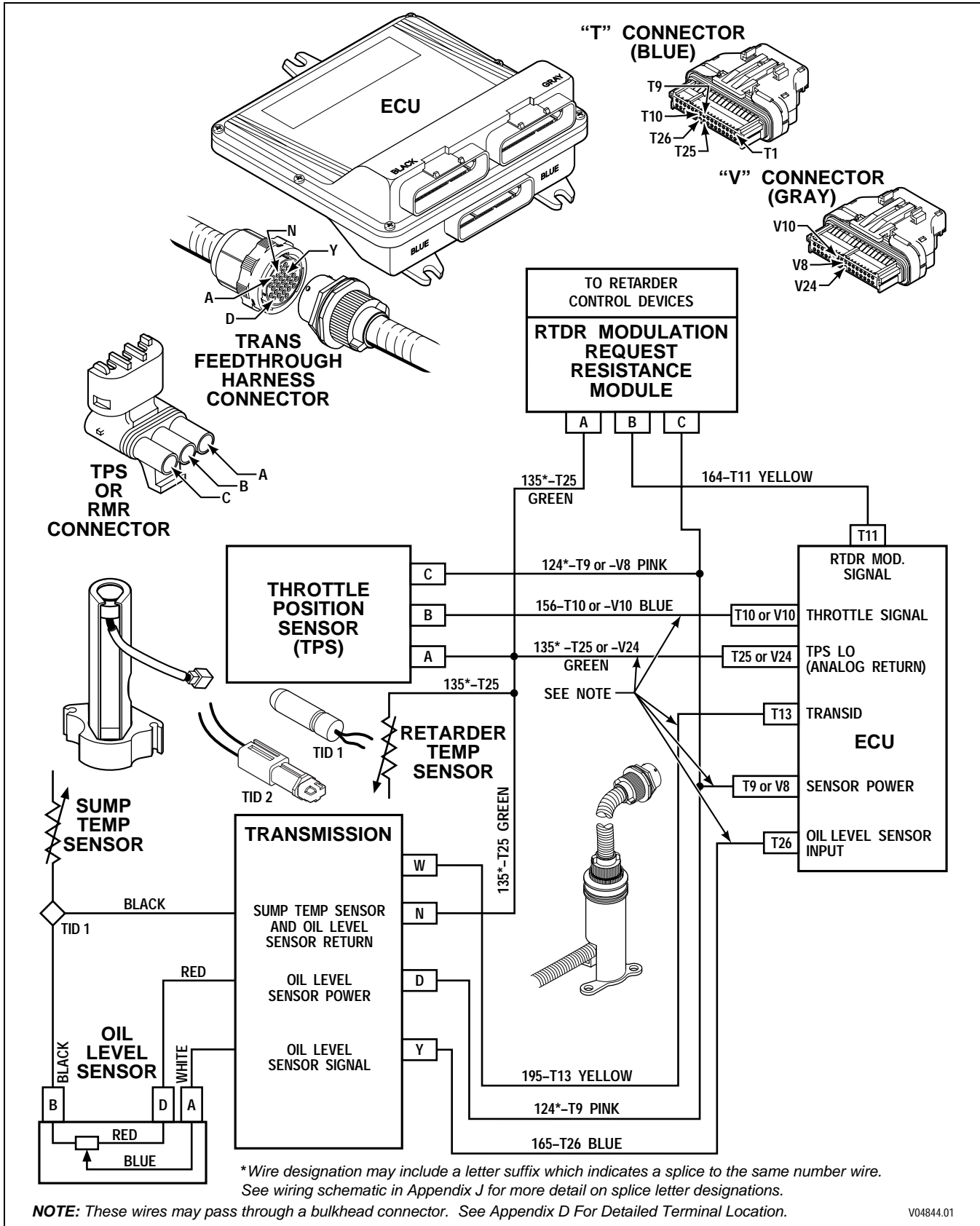
CODE 13 XX — ECU INPUT VOLTAGE *(Figure 5–2)*

4. If power is correct but the diagnostic tool reading indicates incorrect voltage, closely inspect terminals V1 and V16 or S16; make sure they are not corroded or deformed. Clean or replace as necessary.
5. If the voltage condition is intermittent, closely inspect the vehicle wiring for transmission system power and grounds. Check for loose, dirty, or painted connections. Check the VIM for loose, incorrect, or overheating relays or fuses (refer to Appendix E). Check for wires that are chafed and touching other components.
6. If no other cause is found, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

Table 5–3. Voltage Chart

Voltage	Condition
33.0 (High Set Point)	High Fail Limit
32.0	Maximum Continuous ECU Voltage
10.0 (Medium Low Set Point)	Cannot Compensate With Sub-Modulation (Bad Shifts). Adaptive logic stops functioning
8.0	Low Voltage Fail Limit, Set Code, DNS
7.0 (Low Set Point)	Software Off (ECU loses power)
4.5	Neutral Start Off

CODE 14 XX — OIL LEVEL SENSOR (OLS)



V04844.01

Figure 5-3. Code 14 Schematic Drawing

CODE 14 XX — OIL LEVEL SENSOR (OLS) (Figure 5-3)

The oil level sensor (OLS) must have been recognized by autodetect or manually selected using the Pro-Link® (see WTEC III Pro-Link® Manual) before these codes can be logged.

Code 14 12 indicates the ECU has detected a voltage signal in the low error zone.

Code 14 12 can be caused by:

- Faulty wiring to the OLS
- A faulty OLS
- A faulty ECU

CAUTION: Never use a volt/ohmmeter to measure any parameters on the OLS. Damage to the OLS will result.

OLS ground wire 135B is common to the TPS and the RMR devices. A power wire short-to-ground for any of these devices will cause “sensor failed low” codes (21 12 and 64 12) and shutdown of the electronic pushbutton or lever selector. An OLS signal open or short-to-ground results in a code 14 12 only. Code 14 23 is programmed out of all calibrations.

A permanent maximum voltage signal generates a steady OLS sensor maximum count and a maximum fluid level overflow indication. A maximum overflow indication occurs if signal wire 165 or power wire 124 is shorted to battery or the ground wire (wire 135) is open between the OLS and the sump temperature sensor branch. An open in the ground circuit wire 135 in the portion common to the OLS, TPS and RMR devices results in code 14 12, 21 23, and 64 23.

If the ECU software supports it, Oil Level Sensor counts can be read by a DDR with Pro-Link® version 3.0 (or later). For a complete description of fluid level checking procedures using the oil level sensor, see Section 5. Normal operation of the OLS can be checked as follows: Attach the DDR and display OIL LEVEL COUNTS. Read the number of counts when the engine is not running, but the ignition is ON. The count reading should be near 255. Start the engine and observe the counts. In normal operation, the count should be 100–200 because the oil level drops when the engine starts and oil from the sump is delivered to other parts of the transmission.

NOTE: *Intermittent connections or lack of battery-direct power and ground connections can cause this and other electronic control codes.*

Main Code	Subcode	Meaning
14	12	Oil level sensor failed low
14	23	Oil level sensor failed high (not used)

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

CODE 14 XX — OIL LEVEL SENSOR (OLS) (*Figure 5-3*)

NOTE: *Before troubleshooting, read Paragraph 5-6. Also, check the following:*

- *Fluid level, using dipstick*
- *Battery voltage*
- *ECU input voltage*
- *Other diagnostic codes*

B. Troubleshooting:

The following procedure is to find the cause for an OLS problem. The procedure is sequential. Follow the procedure until the cause for the OLS problem is found and repaired. Once the problem is found and repaired, STOP. For example, if the problem is fixed in step 3, there is no need to continue to the other steps.

1. Disconnect the external wiring harness at the transmission feedthrough connector. With the ignition ON, verify there is 5.0 VDC between the OLS power and ground pins (see page D-10) on the external harness connector. This is to verify that power and ground are getting to the OLS. If the 5.0 VDC is not present, check the wiring for the OLS power and ground circuits (wires 124-T9 and 135-T25, respectively). If there are no wiring problems (opens, shorts-to-ground, shorts-to-battery), and if the 5.0 VDC is present, go to Step 2.
2. Observe the OIL LEVEL COUNTS on the DDR while jumpering the OLS power pin to the OLS signal pin. If the count jumps from 0 to 250+, the OLS signal line is good and the ECU function is good. Continue to Step 3. If the count remains at zero, locate and repair problems in the wiring of OLS signal (wire 165-T26). If there are no wiring problems, and the count still remains at zero, the ECU may be bad. Go to Step 5.
3. If all checks prior to this have been normal, the problem is either in the OLS itself, the internal harness wires or the transmission side of the feedthrough harness connection. Inspect the transmission feedthrough harness connector to be sure that the OLS power, ground and signal pins are not loose or out of position. Correct any connector problems found. Reconnect the external harness to the transmission feedthrough harness connector. See if Code 14 12 recurs before continuing to Step 4.
4. Consult the appropriate transmission Service Manual for proper procedure and remove the control module from the transmission. Remove the OLS from the channel plate. Reconnect the external harness to the transmission feedthrough connector, if not done in Step 3. With the ignition ON, observe OIL LEVEL COUNTS on the DDR. With the OLS in normal position, the count should be 8-35. Invert the OLS and the count should be 192-255. If the counts are abnormal, replace the sensor. Check the new sensor in both normal and inverted positions. If the counts respond correctly, the problem should be resolved. Attach the new OLS to the channel plate and reinstall the control module using the appropriate transmission Service Manual for proper procedure.
5. Replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 21 XX — THROTTLE OR PWM FAULT

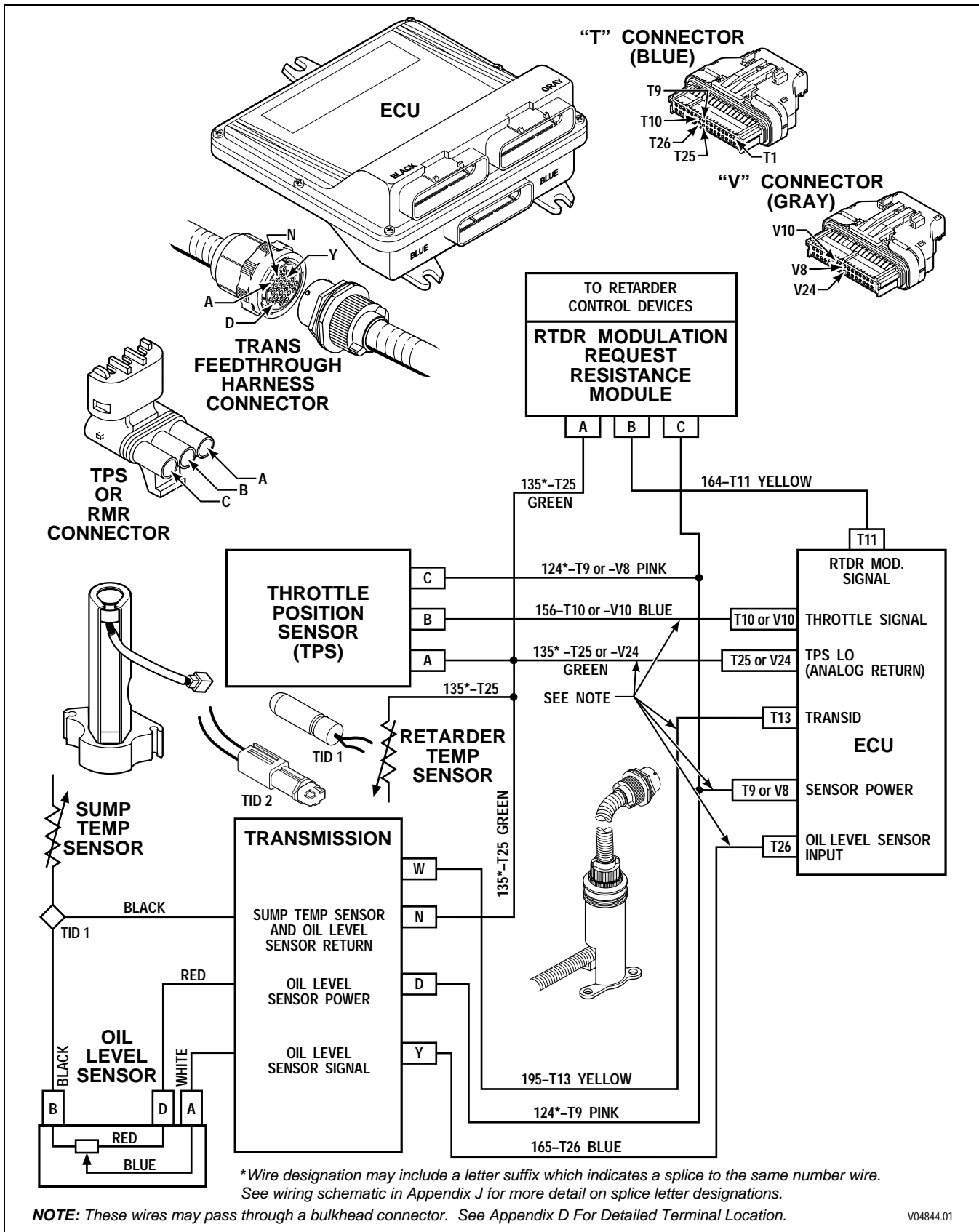


Figure 5-4. Code 21 Schematic Drawing

CODE 21 XX — THROTTLE OR PWM FAULT (Figure 5-4)

The throttle sensor must have been recognized by autodetect or manually selected using the Pro-Link® (see WTEC III Pro-Link® Manual) before these codes can be logged. See Paragraph 1-9 for further information.

Main code 21 indicates the throttle position sensor has been retracted or extended by its linkage into an error zone. This may be due to a fault with the sensor, or a fault in the wiring to the sensor or to the ECU. This code may also indicate a PWM signal problem. A PWM signal is proportional to throttle position and comes from some source other than an analog throttle position sensor. Code 21 12 is set when the ECU receives TPS counts of 14 or less. Code 21 23 is set when the ECU senses TPS counts of 233-255. Whenever a code 21 XX condition is detected, the system uses default throttle values and shifts will not adapt.

NOTE: Code 21 XX in conjunction with code 33 XX or code 14 XX indicates the potential loss of common ground wire 135 between the throttle, temperature sensor, and oil level sensor.

Main Code	Subcode	Meaning
21	12	Throttle position sensor failed low and ECU signals throttle default value
21	23	Throttle position sensor failed high and ECU signals a throttle default value

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: Before troubleshooting, read Paragraph 5-6. Also, check the ECU input voltage.

B. Troubleshooting:

1. Plug in the DDR, select Diagnostic Data, and read throttle counts and percent. If the TPS failed high (code 21 23), the problem may be toward the full throttle end of the TPS travel. If the TPS failed low (code 21 12), the problem may be at the closed throttle end of the TPS travel.

NOTE: Code 21 12 may occur when the throttle source is J1587 or J1939 and an analog throttle source is falsely detected. This condition may be due to a problem in an unused TPS branch of a universal external harness. To prevent this occurrence, remove wire 156 from the ECU connector and insert a cavity plug in the space vacated by the wire. Be sure that the unused TPS branch is routed away from potential induced voltage sources and the connector is protected from external contamination.

NOTE: Code 21 12 can result when the +5V line (wire 124) which powers the analog sensor is shorted to ground. Wire 124 also powers the OLS, RMR, retarder temperature sensor, sump temperature sensor, and shift selector and is present in all three ECU connectors.

2. If counts are high but the percentage never reaches 100 percent, TPS linkage may have bound up and overstroked the TPS to set a false 100 percent reading. After TPS overstroking ceases, the TPS will not automatically return to 100 percent. After the TPS is correctly installed and adjusted, use the Pro-Link® to reset throttle calibration or cycle the ignition 5 times to reset the 0 percent and 100 percent settings.

CODE 21 XX — THROTTLE OR PWM FAULT (*Figure 5-4*)

3. If the throttle counts do not change or are erratic, check the throttle sensor wiring for opens, shorts between wires, or shorts-to-ground. Also check for correct TPS voltages using test wiring harness J 41339. If wiring problems are found, isolate and repair the fault.
4. If the wiring is satisfactory, replace the throttle position sensor and adjust its linkage so the counts are not in the error zones.
5. If the throttle sensor and its linkage adjustment are correct and the wiring to the sensor is satisfactory, the condition is intermittent. Replace the sensor and properly adjust the new sensor.
6. If the condition recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the throttle sensor circuit.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

NOTE: *A good throttle position sensor should have resistance of:*

- (3) *9000–15,000 Ohms across terminals A and C.*
- (4) *500 Ohms, moving to 9000–15,000 Ohms as TPS is stroked (measured across terminals A and B).*

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT

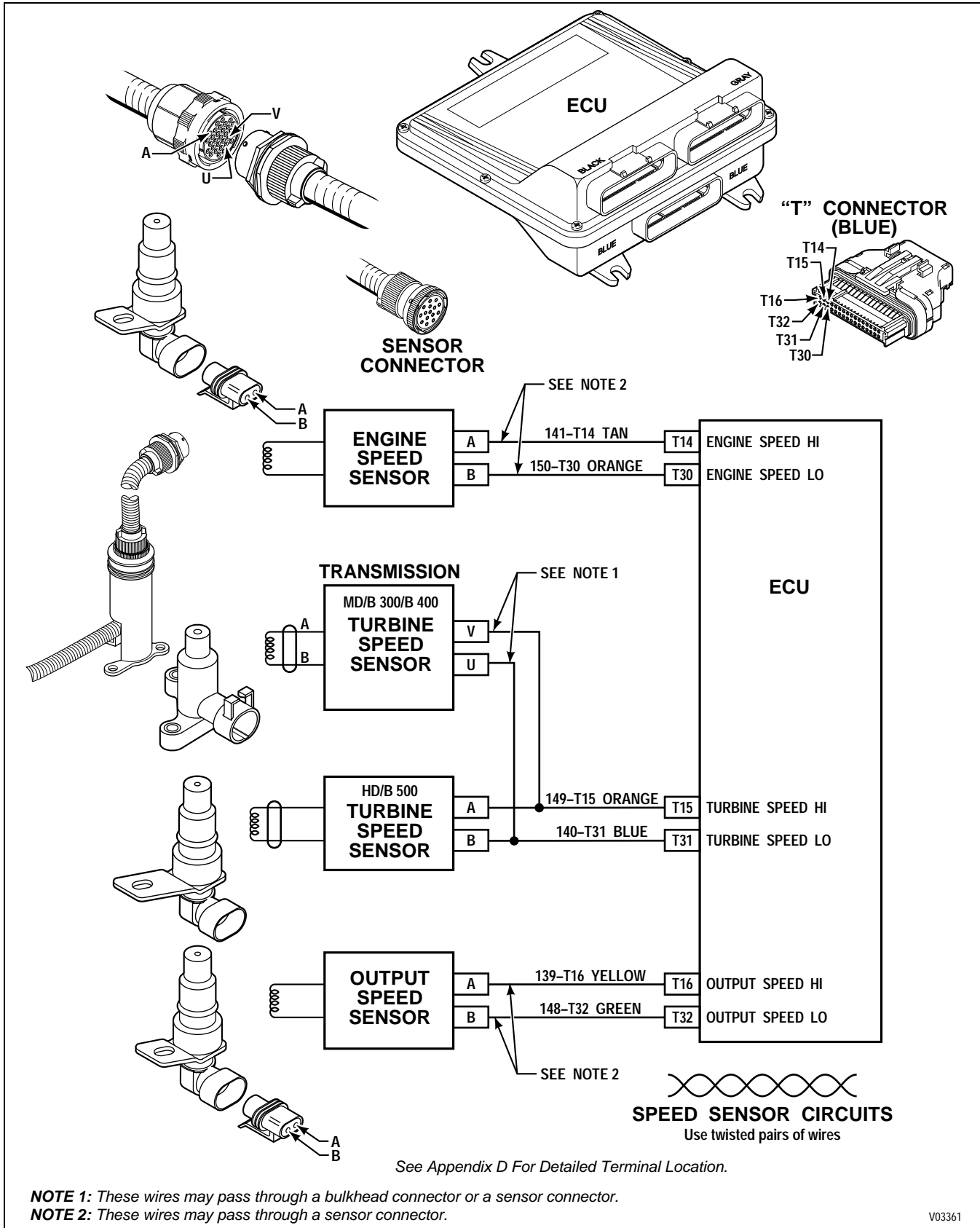


Figure 5-5. Code 22 Schematic Drawing

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT (Figure 5-5)

Main code 22 indicates a fault within a speed sensor, the wiring to a speed sensor, incorrect speed sensor gap, or damaged bumps or teeth which create the speed signal. This fault is determined by the reasonableness of a speed sensor signal when compared with the other two speed sensors and the commanded range. A speed sensor will not pass the reasonableness test if there is no signal at all from that sensor when a signal should be present.

NOTE: *If turbine speed is below 150 rpm when output speed is below 100 rpm and engine speed is above 400 rpm, Neutral Very Low (NVL) is commanded when N (Neutral) is the range selected. NVL is attained by turning D solenoid “ON” in addition to E solenoid. This causes the output to be locked (C4 and C5 clutch applied).*

NOTE: *If the engine speed sensor code (22 14) is active and a range verification test is failed, the range verification code will not be set but a DO NOT SHIFT response is commanded.*

Main Code	Subcode	Failed Sensor
22	14	Engine Speed
22	15	Turbine Speed
22	16	Output Speed

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5-6. Also, check the ECU input voltage.*

B. Troubleshooting:

1. Check to see if the sensor is loose, missing, or disconnected. If not, disconnect the wiring harness from the sensor and measure the resistance of the sensor (see chart below). Also check the terminals for dirt, corrosion, or damage. If resistance is not correct, replace the sensor.

Resistance	Temp °C	Temp °F
200 $\frac{3}{4}$	-40	-40
300 $\frac{3}{4}$	20	68
400 $\frac{3}{4}$	110	230

2. Remove the transmission harness connector from the ECU. Check the sensor circuit (in the external harness) for open wires, shorts between wires, or shorts-to-ground. Isolate and repair any faults.
3. If no opens or shorts are found, the condition must be intermittent. Replace the sensor indicated by the trouble code. Before replacing a speed sensor, check the sensor for physical damage or contamination. Refer to the appropriate transmission Service Manual for proper replacement procedure.
4. If the condition recurs, install new wiring (twisted-pair) for the sensor circuit between the ECU and the transmission. Use St. Clair P/N 200153 Service Harness Twisted Pair for this purpose.

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT (*Figure 5-5*)

5. If the condition again recurs, connect the diagnostic tool and select the speed signal indicated by the trouble code. Drive the vehicle and watch the speed reading on the diagnostic tool. If the signal is erratic, sensor gap, vehicle vibration, an external AC signal source, or intermittent connector contact may be inducing the erratic signal. Inspect the sensor and its surroundings for irregularities that would affect sensor gap. Isolate and correct any abnormal vehicle vibrations (particularly driveline and abnormal engine torsionals). Recheck the sensor wiring for intermittent conditions (see Appendix A).
6. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 23 XX — SHIFT SELECTOR

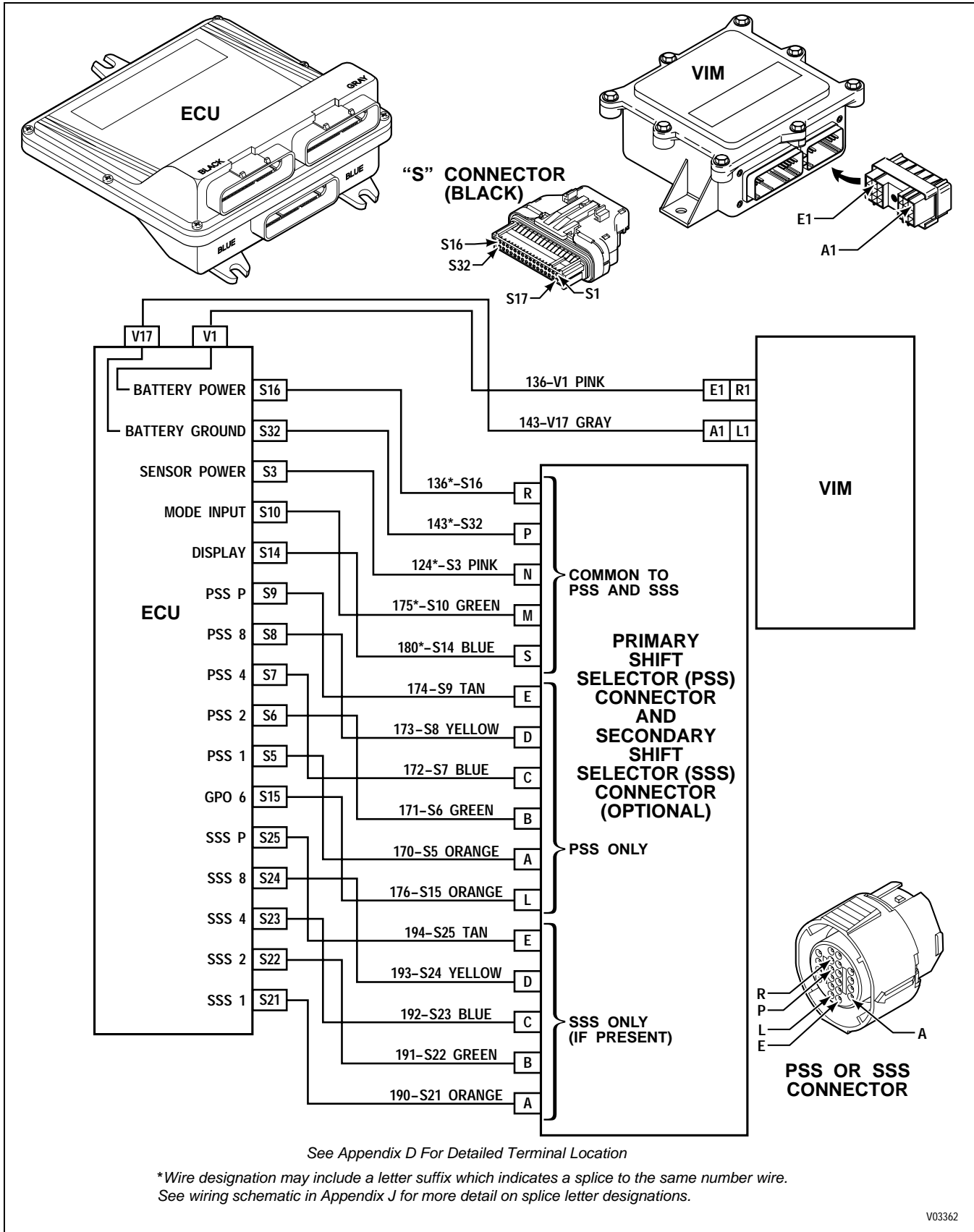


Figure 5-6. Code 23 Schematic Drawing

CODE 23 XX — SHIFT SELECTOR *(Figure 5-6)*

Main code 23 indicates a fault with a shift selector or the wiring between a shift selector and the ECU.

Main Code	Subcode	Meaning
23	12	Primary shift selector fault — a “cateye” type display may occur
23	13	Primary shift selector mode function fault. Mode change not permitted
23	14	Secondary shift selector fault — a “cateye” type display may occur
23	15	Secondary shift selector mode function fault. Mode change not permitted
23	16	Shift selector display line fault

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5-6.*

B. Troubleshooting:

1. Clear the active indicator for code 23 XX. If code recurs, continue to Step (2).
2. Check for a poor connection at the shift selector.

NOTE: *Code 23 12 can result when the +5V line (wire 124) which powers the shift selector is shorted to ground. Wire 124 also powers the TPS, OLS, RMR, retarder temperature sensor, and sump oil temperature sensor and is present in all three ECU connectors.*

3. Disconnect the selector “S” harness connector from the ECU and from the shift selector and check for opens, shorts, and shorts-to-ground between the shift selector and ECU (refer to Section 4).
4. If no problem is found with the shift selector connection or wiring, replace the shift selector.
5. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 24 XX — SUMP FLUID TEMPERATURE

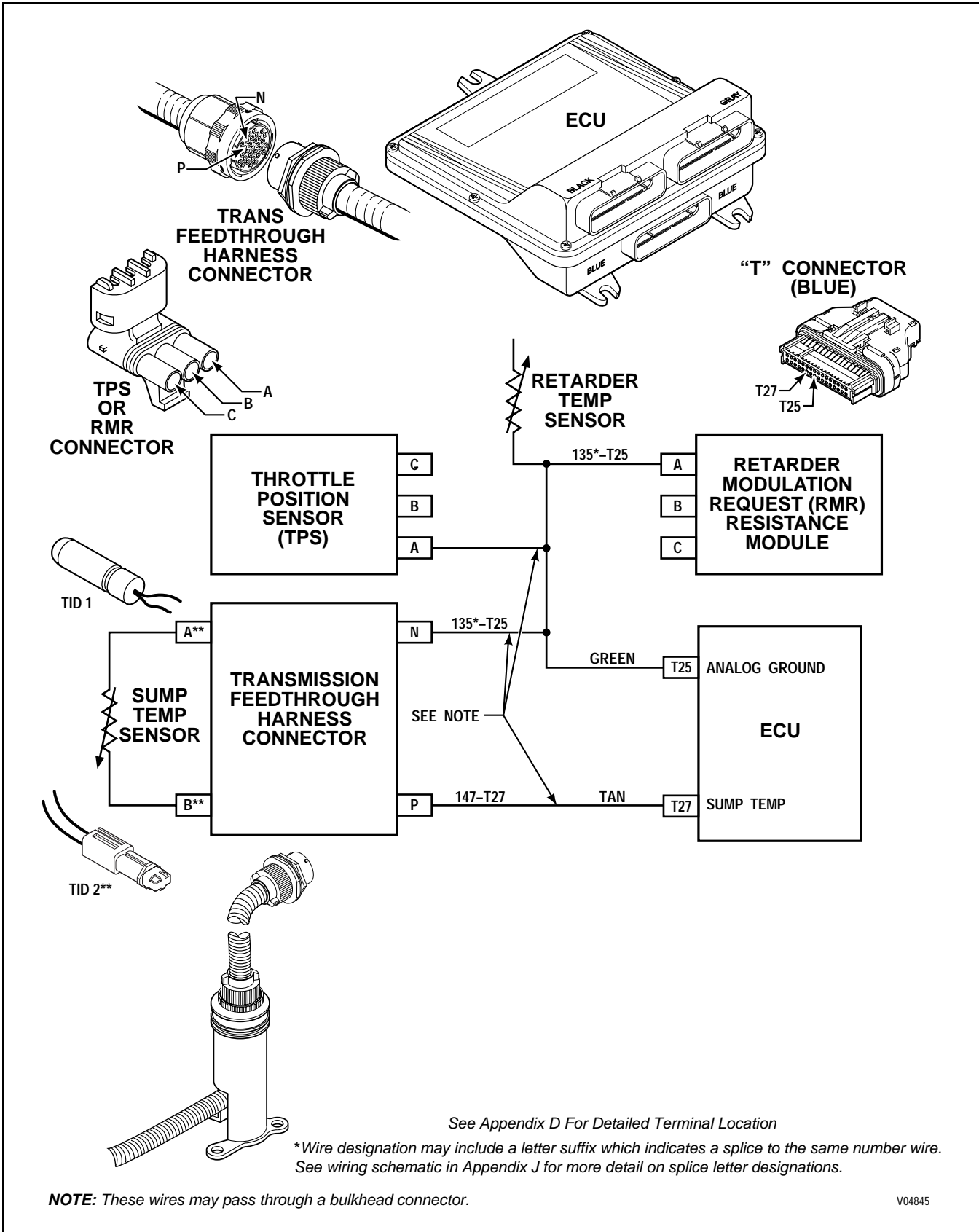


Figure 5-7. Code 24 Schematic Drawing

CODE 24 XX — SUMP FLUID TEMPERATURE *(Figure 5–7)*

Main code 24 indicates the ECU has detected either a high or low fluid temperature in the transmission sump (via the sump temperature sensor in the internal harness). All shifts are inhibited when code 24 12 is set (only Neutral range operation is allowed). No upshifts are allowed above a calibration range when code 24 23 is set. All inhibits are cleared when the temperature conditions are normal. A related code is 33 12 which indicates a temperature reading outside the usable range of the sensor and indicates a probable sensor failure.

NOTE: *When an ECU with a version 8 calibration (CIN=0A...) is used with a TransID 2 transmission, 24 XX codes are set because the ECU does not have the proper calibrations for the TID 2 thermistors. The ECU calibration must be updated to version 8A or later (CIN=0B).*

Main Code	Subcode	Meaning
24	12	Sump fluid temperature cold
24	23	Sump fluid temperature hot

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check the ECU input voltage.*

B. Troubleshooting:

Code 24 12:

1. If the outside temperature is between -32°C (-26°F) and -7°C ($+19^{\circ}\text{F}$), the ECU will allow reverse, neutral, and second-range start operation. Only hold override upshifts are allowed. (See Table 6–4 on next page.) The sump must be warmed to an acceptable temperature to avoid logging codes and transmission diagnostic response.

NOTE: *Code 24 12 can result when the +5V line (wire 124) which powers the sump temperature sensor is shorted to ground. Wire 124 also powers the TPS, OLS, RMR, retarder temperature sensor, and shift selectors and is present in all three ECU connectors.*

2. After allowing the temperatures to normalize, if ambient temperature does not match the sump temperature reading (check using diagnostic tool), compare resistance versus sump fluid temperature. Refer to Figure 5–8 for TID 1 thermistors and Appendix Q for TID 2 thermistors. If resistance check is acceptable, then check the sensor wiring for opens, shorts, or shorts-to-ground.
3. If the sensor wiring is satisfactory, drain the fluid, remove the control module, and replace the temperature sensor.
4. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage that may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 24 XX — SUMP FLUID TEMPERATURE (Figure 5-7)

Table 5-4. Transmission Operation as a Function of Temperature

Condition	Version 8 Software	
	°C	°F
Temperature sensor failed high (refer to code 33 23)	177	350
Hot fluid (code 24 23) adaptive turned off; maximum range limited (not limited in “emergency” calibration)	128	262
Output function “on” for sump over temp above this temperature	121	250
Output function “off” for sump over temp below this temperature	116	240
Cool/cold fluid; adaptive turned off	34	93
Turbine reasonableness and speed tie-up tests turned off	0	32
Medium cold fluid R, N, D allowed, 2nd range start (hold override upshifts only)	-7	19
All C3 Pressure Switch tests turned off	-32	-25
Temperature sensor failed low (refer to code 33 12)	-45	-49

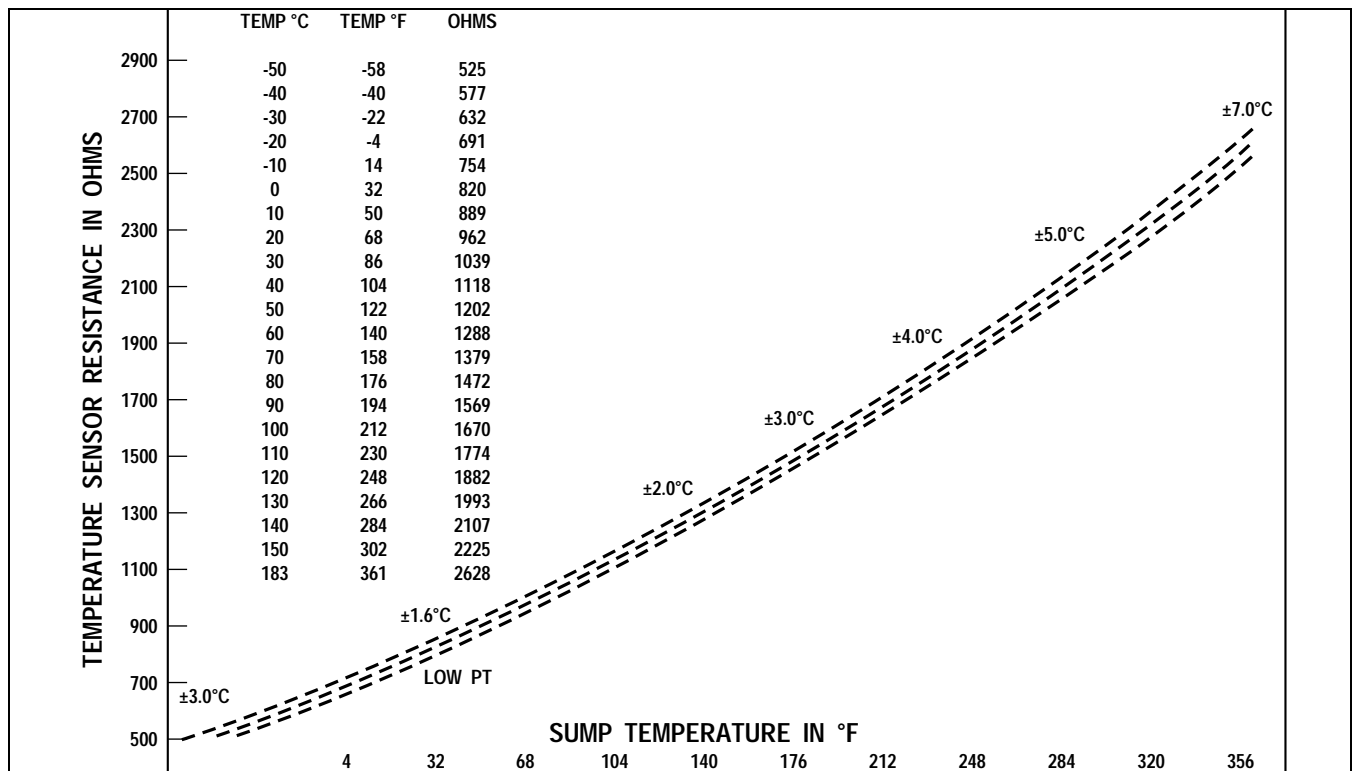


Figure 5-8. TransID 1 Temperature Sensor Chart

Code 24 23:

1. Install temperature gauges for transmission temperature and engine water temperature. Drive the vehicle. Verify that the code can be reproduced and verify the reading shown on the diagnostic tool. Observe the gauges and check for hot fluid when the code is produced.
2. If the fluid is not hot when the code is produced, remove the transmission “T” harness connector at the ECU and the transmission. Check the fluid temperature sensor wiring for opens, shorts, and shorts-to-ground. Compare the resistance readings of the sensor and the actual temperature

CODE 24 XX — SUMP FLUID TEMPERATURE (Figure 5–7)

as shown on the gauge with Figure 5–8 for TID 1 thermistors and Appendix Q for TID 2 thermistors. If wiring problems or a great difference between temperature and resistance compared with the chart are found, drain the fluid, remove the control module, and replace the temperature sensor. If wiring problems are found, repair or replace as necessary.

3. If the fluid is hot when the code is produced, observe the gauges to see if the engine became hot before the transmission. If the engine cooling system is overheating and heating the transmission, the problem is with the engine or its cooling system.
4. If the transmission became hot before the engine, allow the vehicle to idle for 3–5 minutes and check the transmission fluid level. Correct the fluid level if necessary.
5. Attach pressure gauges to the cooling system (from a “to cooler” connection to a point after the cooling circuit filter) and check for pressure drop problems. If pressure drop is excessive (refer to Table 5–5), check for a plugged cooler filter, collapsed lines, obstructions, etc.
6. If the fluid level is correct and the cooling circuits satisfactory, drain the fluid, remove the control module, and inspect for damaged valve body gaskets. Replace any damaged gaskets.
7. If no problems are found in the control module area, remove the transmission and disassemble, inspecting for causes of overheating (stuck stator, plugged orifices, dragging clutches, etc.).

**Table 5–5. External Hydraulic Circuit Characteristics
Basic, PTO, 93°C (200°F) Sump Temperature**

HD/B 500

CONVERTER OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.22	3.4	0	0
900	0.38	6.1	0	0
1200	0.55	8.7	0	0
1500	0.80	12.7	0	0
1800	1.03	16.4	0	0
2100	1.13	18.0	0	0
2300	1.20	19.0	0	0

CONVERTER OPERATION COOLER FLOW AT MAXIMUM ALLOWABLE PRESSURE DROP				
Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.20	3.2	31	4.5
900	0.37	5.8	63	9.1
1200	0.55	8.7	108	15.7
1500	0.77	12.2	167	24.2
1800	0.92	14.5	213	30.9
2100	0.97	15.3	238	34.5
2300	1.00	15.9	250	36.3

CODE 24 XX — SUMP FLUID TEMPERATURE (Figure 5–7)

Table 5–6. External Hydraulic Circuit Characteristics
Basic, PTO, 93°C (200°F) Sump Temperature

MD/B 300/B 400

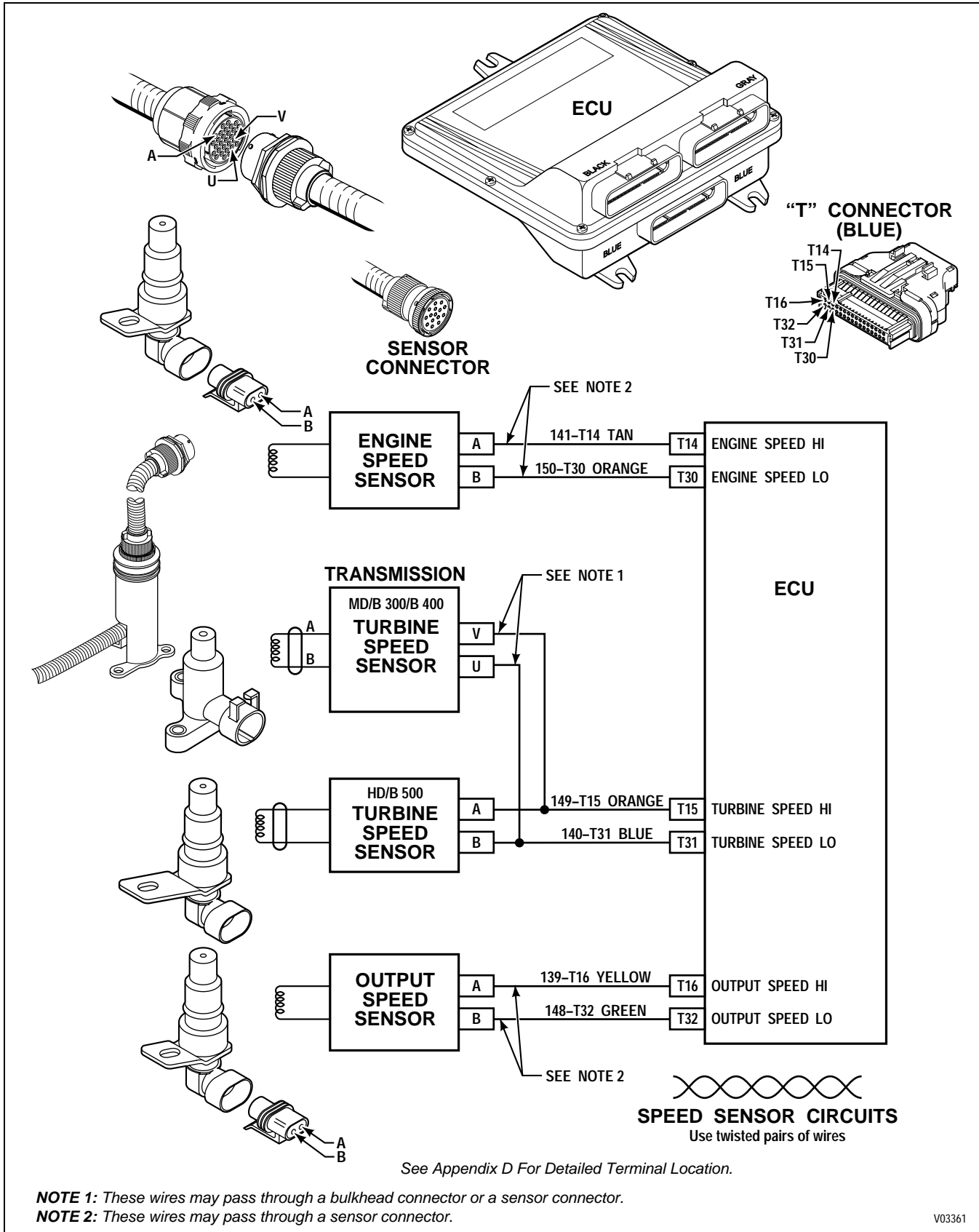
CONVERTER OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.47	7.4	0	0
1400	0.61	9.7	0	0
1600	0.74	11.7	0	0
2000	0.94	14.9	0	0
2400	1.19	18.9	0	0
3200	1.28	20.3	0	0

LOCKUP OPERATION MAXIMUM COOLER FLOW AT MINIMUM PRESSURE DROP				
Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.50	7.9	0	0
1400	0.63	10.0	0	0
1600	0.77	12.2	0	0
2000	0.95	15.1	0	0
2400	1.12	17.8	0	0
2800	1.22	19.3	0	0
3200	1.28	20.3	0	0

CONVERTER OPERATION MAXIMUM ALLOWABLE PRESSURE DROP				
Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	10	1.5
800	0.22	3.5	40	5.8
1200	0.45	7.1	159	23.1
1400	0.57	9.0	252	36.5
1600	0.67	10.6	338	49.0
2000	0.80	12.7	481	69.8
2400	0.85	13.5	549	79.6
3200	0.85	13.5	549	79.6

LOCKUP OPERATION MAXIMUM ALLOWABLE PRESSURE DROP				
Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	5	0.7
800	0.23	3.7	46	6.7
1200	0.48	7.6	148	21.5
1400	0.62	9.8	247	35.8
1600	0.73	11.6	346	50.2
2000	0.90	14.3	561	81.4
2400	1.07	17.0	737	106.9
2800	1.10	17.4	770	111.7
3200	1.10	17.4	791	114.7

CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE



CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE *(Figure 5–9)*

Figure 5–9. Code 25 Schematic Drawing

Main code 25 occurs if the output speed sensor reports a zero speed reading while both engine and turbine speeds are approximately equal, turbine speed is above a calibration value, and neutral is not selected or commanded. Main code 25 indicates either the output speed sensor has failed or the required oncoming clutch or clutches did not come on. Code 25 11 can be generated by a false turbine speed reading. This may be due to crosstalk between solenoid and turbine speed sensor circuits caused by direct wire-to-wire short or by water in the electrical connectors. See Section 4 for corrective action.

NOTE: *If code 25 XX is in memory at ECU initialization (ignition on), all display segments are illuminated.*

Main Code	Subcode	Meaning	Applied Clutches
25	00	Output speed sensor, detected at zero speed, Low range	C3, C6
25	11	Output speed sensor, detected at zero speed, 1st range	C1, C5
25	22	Output speed sensor, detected at zero speed, 2nd range	C1, C4
25	33	Output speed sensor, detected at zero speed, 3rd range	C1, C3
25	44	Output speed sensor, detected at zero speed, 4th range	C1, C2
25	55	Output speed sensor, detected at zero speed, 5th range	C2, C3
25	66	Output speed sensor, detected at zero speed, 6th range	C2, C4
25	77	Output speed sensor, detected at zero speed, Reverse	C3, C5

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections can cause this and other codes.*

B. Troubleshooting:

1. Check the transmission fluid level and ensure correct fluid level.
2. Check for the presence of code 22 16. If code 22 16 is in the code list, go to code 22 XX section and follow troubleshooting steps for code 22 16.
3. Connect the Pro-Link® 9000 with ignition on, engine off; check for indication of turbine speed. If turbine speed is indicated, refer to Paragraph 4–2 for corrective action.
4. If the output speed sensor and wiring are satisfactory, install pressure gauges into the appropriate clutch pressure taps (see Appendix B in this manual) and make the shift again. See if either of the clutches has low or no pressure. Lack of pressure in C1 in first range may be due to a G solenoid stuck closed. Lack of pressure in C5 in first range may be due to an E solenoid stuck closed.
5. If a clutch is leaking pressure, drain the fluid, remove the control module and check for damaged valve body gaskets and stuck or sticky valves. If no problems are found, replace the solenoids for the clutches used in the range indicated by the code (refer to Figure 5–1). Refer to the appropriate transmission Service Manual for replacement procedure.

CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE (*Figure 5-9*)

6. If, after detecting leaking pressure and replacing solenoids, the problem persists, check for worn clutch or piston seals. Remove the transmission and repair or replace as necessary.
7. This code requires accurate output and turbine speed readings. If there were no transmission problems detected, use the diagnostic tool and watch the speed readings for noise (erratic signals) from low speed to high speed in the range indicated by the code.
8. If a noisy sensor is found, check the sensor resistance (refer to the sensor resistance chart below) and check its wiring for opens, shorts, and shorts-to-ground (see code 22 XX). Also closely check the terminals in the connectors for corrosion, contamination, or damage. Ensure the wiring to the sensors is a properly twisted wire pair. Remove sensor and check for damage at the tone wheel end. Check for looseness of the tone wheel. Replace the sensor if it is damaged or if its resistance (refer to Service Manual for proper procedure) is incorrect and isolate and repair any noted wiring problems. (Use St. Clair P/N 200153 Service Harness Twisted Pair for this procedure.)

Resistance	Temp. °C	Temp. °F
200 $\frac{3}{4}$	-40	-40
300 $\frac{3}{4}$	20	68
400 $\frac{3}{4}$	110	230

9. If no apparent cause for the code can be located, replace the turbine and output speed sensors. Refer to the appropriate transmission Service Manual for proper procedure.
10. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 26 XX — THROTTLE SOURCE/ENGINE COOLANT SOURCE NOT DETECTED

Main code 26 occurs when the ECU has not detected either a throttle source or an engine coolant source.

Main Code	Subcode	Meaning
26	00	Throttle source not detected
26	11	Engine coolant source not detected

Code 26 00 means that the ECU has not detected the presence of engine throttle data or analog circuitry. For details about or using Pro-Link[®] to select a throttle source, see WTEC III Pro-Link[®] Manual.

Code 26 11 means that the ECU has not detected the presence of engine coolant temperature data or analog circuitry. For details about or using Pro-Link[®] to select an engine coolant temperature source, see WTEC III Pro-Link[®] Manual.

A. Active Indicator Clearing Procedure

- Power down
- Manual

B. Troubleshooting

1. When code 26 00 is logged and an analog TPS is known to be installed, refer to code 21 XX for troubleshooting steps. If a J1587 or J1939 throttle signal is used, refer to code 66 00 for troubleshooting steps.
2. When code 26 11 is logged and if an analog engine coolant temperature sensor is being used, refer to code 62 XX for troubleshooting steps. If a J1587 or J1939 engine coolant temperature signal is being used, refer to code 66 00 for troubleshooting steps.

CODE 32 XX — C3 PRESSURE SWITCH

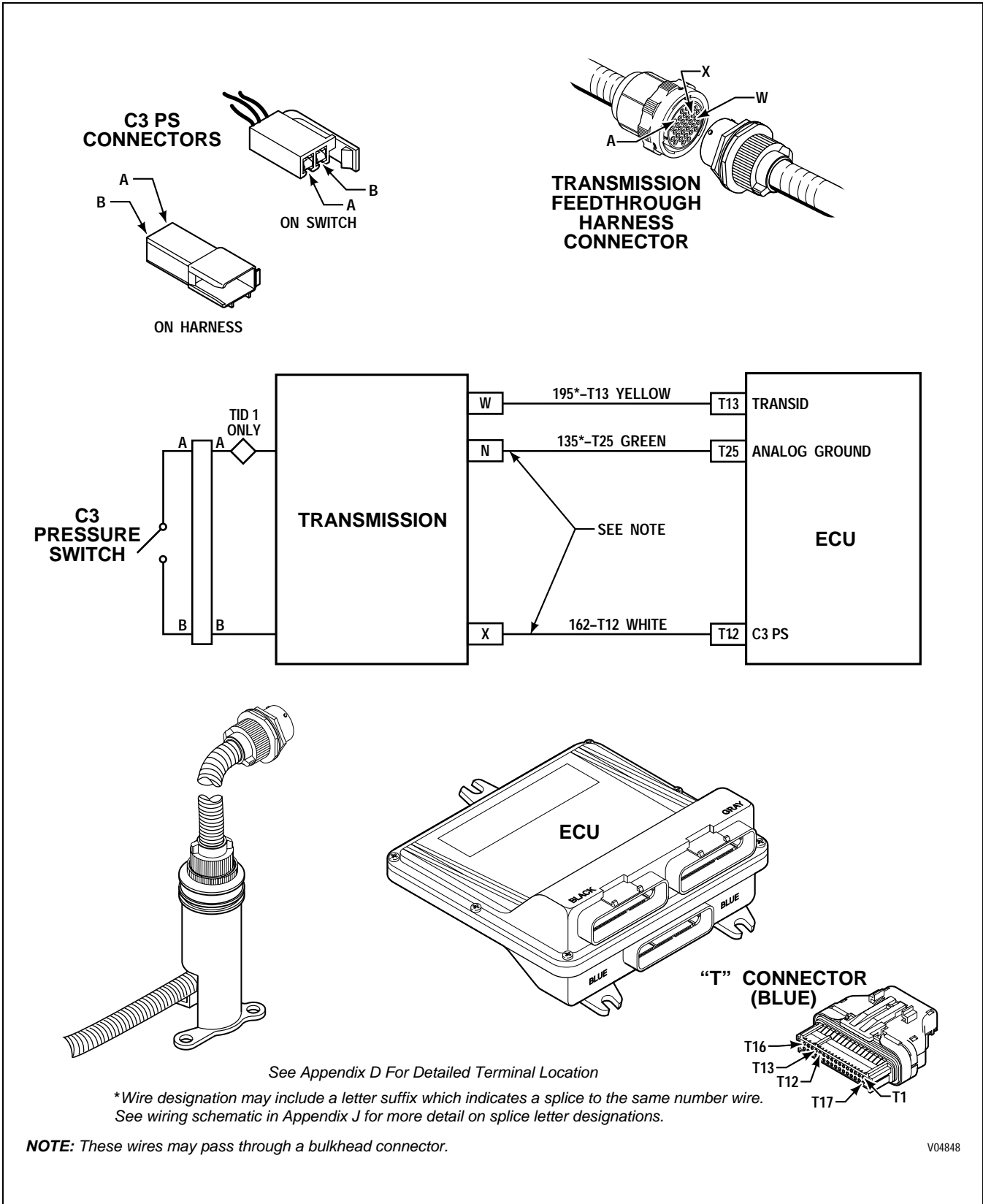


Figure 5-10. Code 32 Schematic Drawing

CODE 32 XX — C3 PRESSURE SWITCH (*Figure 5–10*)

Main code 32 indicates the transmission gear ratio is correct, but the C3 pressure switch is open when it should be closed.

NOTE: *When an ECU with a version 8 or 8A calibration is used with a pre-TransID transmission, 32 XX codes are set because the ECU sees wire 195 is open. To correct this condition, convert to a TID 1 internal harness or install Adapter P/N 200100 available from St. Clair Technologies.*

Main Code	Subcode	Meaning
32	00	C3 switch open in low range (MD 3070 or HD 4070 only)
32	33	C3 switch open in third range
32	55	C3 switch open in fifth range
32	77	C3 switch open in reverse range

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

B. Troubleshooting:

1. Disconnect the transmission “T” harness connector at the ECU and the transmission. Check the C3 switch circuit for opens, shorts to other wires, shorts-to-ground, or short-to-battery. If wiring problems are found, isolate and repair. The C3 pressure switch closes at 206.8 ± 48 kPa (30 ± 7 psi); resistance should be 2 Ohms maximum when the switch is closed and 20,000 to infinity when the switch is open. Infinity is often indicated as OL (over limit) on a DVOM.
2. If problems are not found in the external harness, drain the fluid, remove the control module, and check the internal harness for opens, shorts between wires, or shorts-to-ground (refer to the proper transmission Service Manual). If wiring problems are found, isolate and repair.
3. If no wiring problems are found, replace the C3 pressure switch.
4. If the problem recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the C3 pressure switch circuit.
5. If the problem recurs again, replace the internal harness.
6. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR

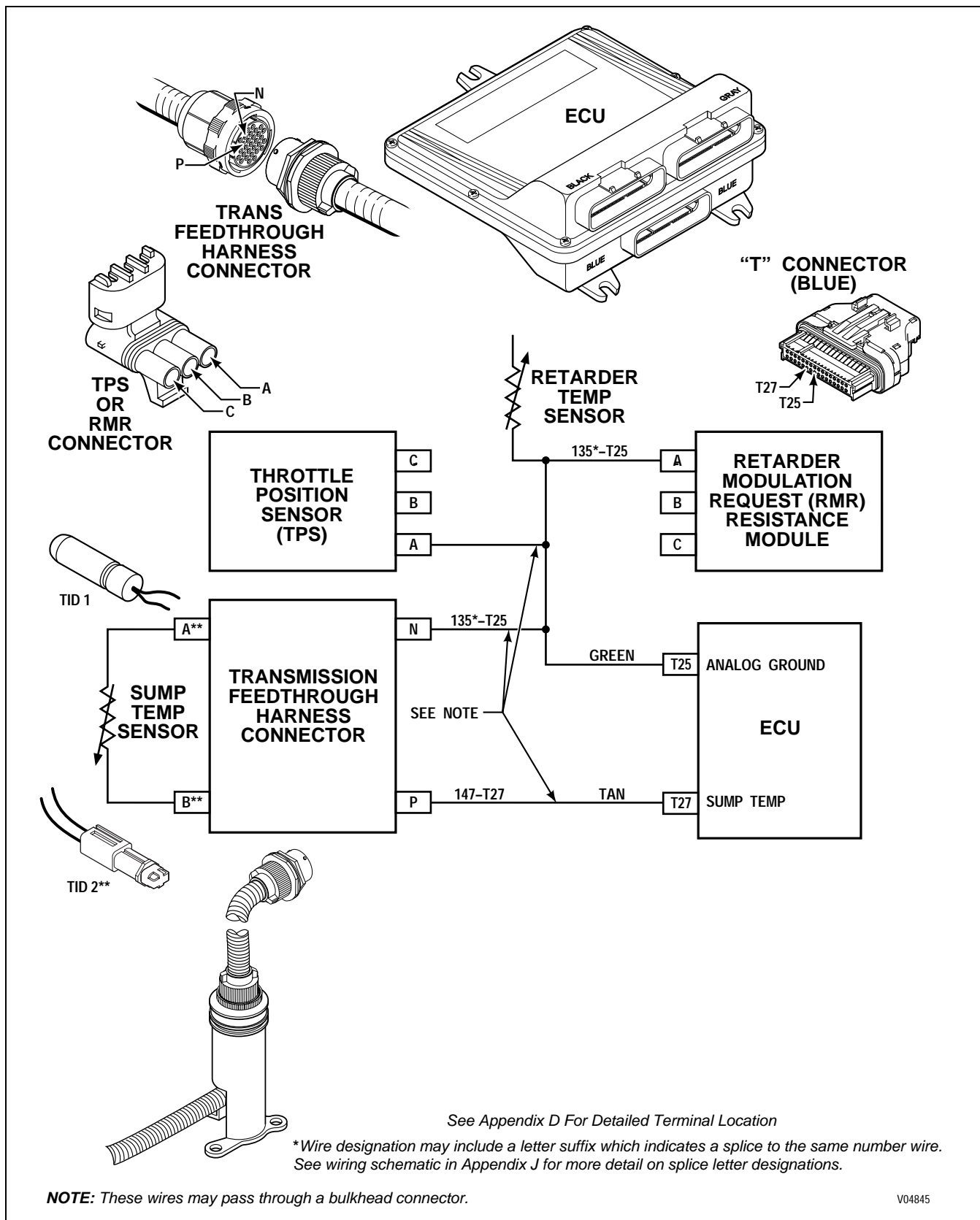


Figure 5-11. Code 33 Schematic Drawing

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR *(Figure 5–11)*

NOTE: *When an ECU with a version 8 calibration (CIN=0A...) is used with a Trans ID 2 transmission, 33 XX codes are set because the ECU does not have the proper calibrations for the TID 2 thermistors. The ECU calibration must be updated to version 8A or later (CIN=0B...).*

Main code 33 indicates the sump temperature sensor is providing a signal outside the usable range of the ECU. This code indicates the sensor failed showing abnormally high or low temperature readings. Main code 33 can be caused by a component or circuit failure or by extremely high or low temperatures. There are no operational inhibits related to main code 33. The ECU assumes a hardware failure and that transmission temperatures are normal (93°C; 200°F). Temperatures above or below normal cause poor shift quality.

NOTE: *Code 33 23 in conjunction with code 21p23 indicates the loss of common ground (wire 135) between the throttle and temperature sensors.*

Main Code	Subcode	Meaning
33	12	Sump oil temperature sensor failed low
33	23	Sump oil temperature sensor failed high

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check the transmission fluid level.*

B. Troubleshooting:

NOTE: *Code 33 12 can be caused when the +5V power line (wire 124) is shorted to ground or open. Wire 124 also provides power for the OLS, TPS, RMR, retarder temperature sensor, and shift selectors and is present in all three ECU connectors.*

1. If possible, check the sump temperature with a DDR. Use the fastest sample rate available on the DDR. This is necessary to catch momentary changes due to an intermittent open or short to ground. If a DDR is not available, use the shift selector display to determine if the code is active (refer to Paragraph 5–2). Disconnect the transmission “T” harness at the ECU and check resistance of the sensor and compare with Figure 6–12 for TID 1 for TID 2.
2. If Step (1) reveals that the extreme temperature indication is no longer present, the temperature limit could have been reached due to operational or ambient temperature extremes. Also, you may be experiencing an intermittent problem and the code will not be active. Proceed cautiously, it is unlikely there is a sensor hardware fault.

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR (Figure 5-11)

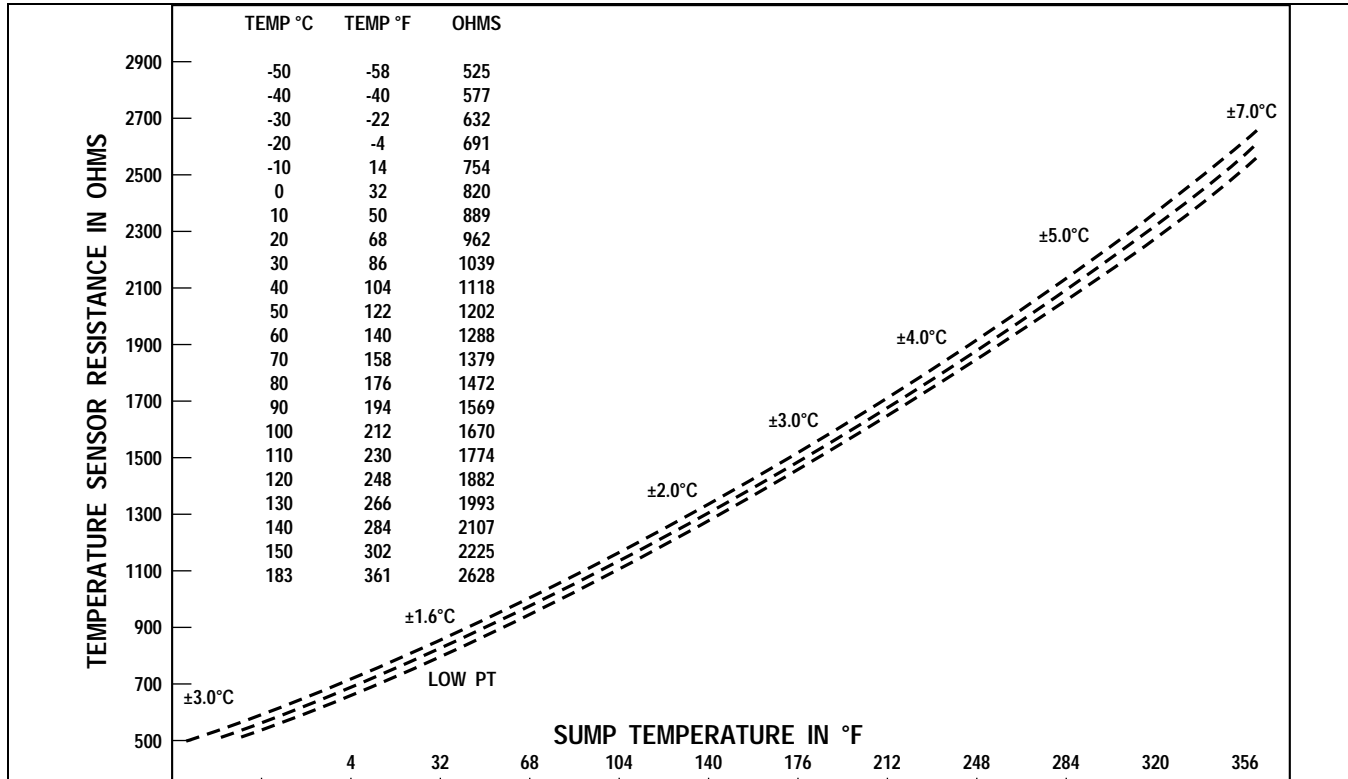


Figure 5-12. Temperature Sensor Chart

3. Disconnect the external harness at the transmission. Check the connectors and terminals for dirt, corrosion, or damage. Clean or replace as necessary.
4. Check the sensor wires in the external harness for opens (code 33 23), shorts between wires, or shorts-to-ground (code 33 12 — refer to Section 4). If wiring problems are found, isolate and repair.
5. If no harness problems are found, check the feedthrough harness for damage. If the feedthrough harness connector is satisfactory, drain the fluid and remove the control module. Check for chafing of the sensor wires, especially near the separator plate. Eliminate the chafe point. If no chafe point is found, replace the sensor.
6. If the problem recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the temperature sensor circuit.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 34 XX — CALIBRATION COMPATIBILITY OR CHECKSUM FAULT

Main code 34 indicates there is a problem with the calibration.

Main Code	Subcode	Meaning
34	12	Factory calibration compatibility number wrong
34	13	Factory calibration checksum
34	14	Power off block checksum
34	15	Diagnostic queue block checksum
34	16	Real-time block checksum
34	17	Customer modifiable constants checksum

A. Active Indicator Clearing Procedure:

- Power down

NOTE: *Copying the current calibration from the ECU and reloading it will not correct the fault. The calibration must be downloaded directly from PCCS.*

B. Troubleshooting:

1. If the code set is 34 14 and it occurs in conjunction with code 35 00, proceed to find the cause for code 35 00 and correct it.
2. After the cause for code 35 00 has been corrected, drive the vehicle to see if code 34 14 recurs. If code 34 14 recurs, proceed to Step (3).
3. Reprogram the correct calibration. Contact your nearest Allison distributor/dealer location qualified to do recalibration. Be certain the calibration and the software level are compatible.
4. If the code recurs after reprogramming, replace the ECU.
5. If the code set is 34 17, reprogram the GPI/GPO package after re-calibration of the ECU.

CODE 35 XX — POWER INTERRUPTION

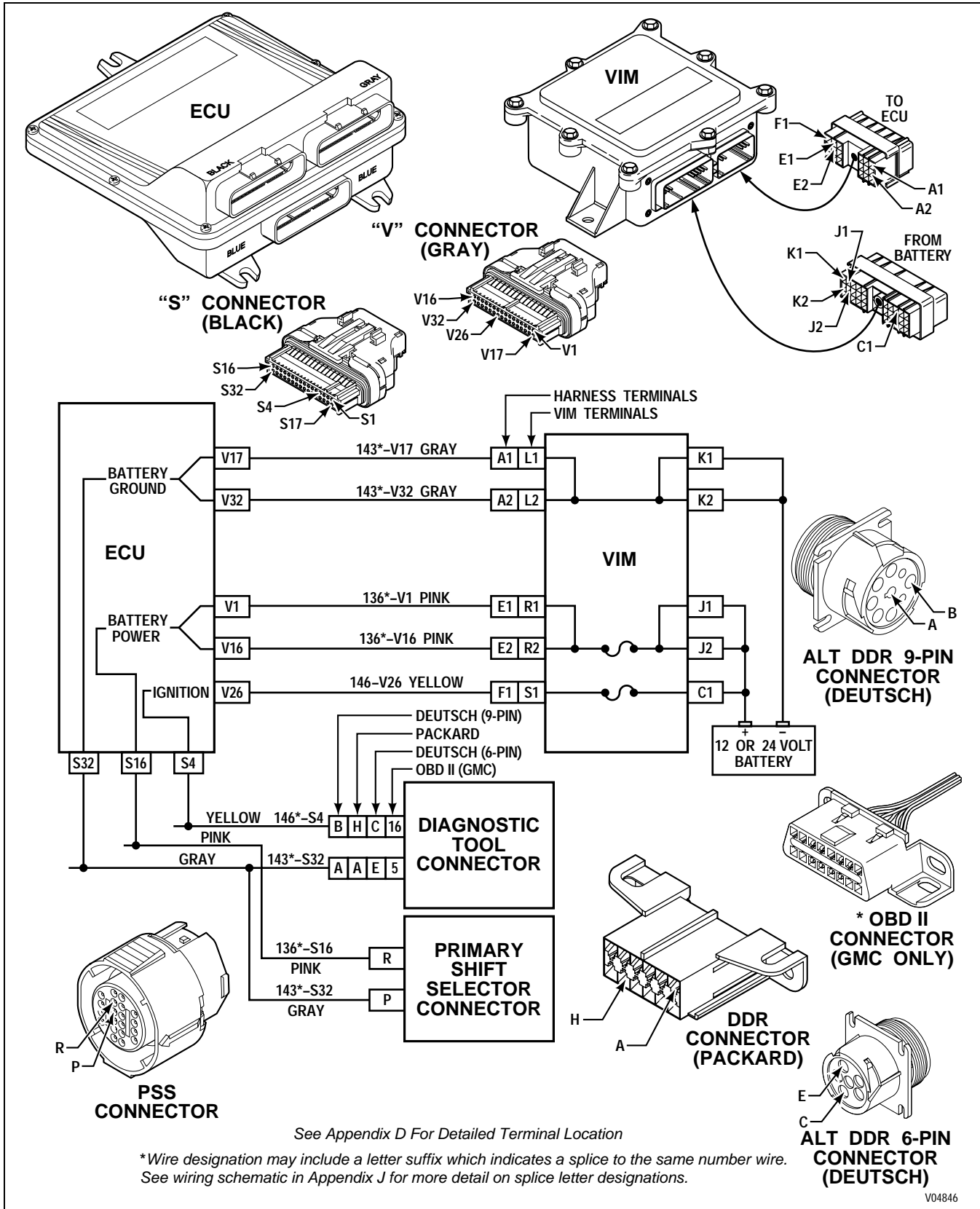


Figure 5-13. Code 35 Schematic Drawing

CODE 35 XX — POWER INTERRUPTION *(Figure 5-13)*

Main code 35 indicates the ECU has detected a complete power loss before the ignition was turned off or before ECU shutdown is completed. When this happens, the ECU is not able to save the current operating parameters in memory before turning itself off.

Main Code	Subcode	Meaning
35	00	Power interruption. (Not an active code; only appears after power is restored.) During power interruption, DNS light is not illuminated and the transmission will not shift.
35	16	Real-time write interruption. (Power interruption at the same time the ECU is recording a critical code to the real-time section.)

A. Active Indicator Clearing Procedure:

- Power down
- Manual — except code 35 16

NOTE: *Before troubleshooting, read Paragraph 5-6. Also, check battery and ECU input voltages.*

B. Troubleshooting:

1. If the vehicle has a master switch controlling battery power to the ECU and an ignition switch, turning the master switch off before turning the ignition switch off can cause this code. Turning the master switch off before ECU shutdown is completed will also cause this code. No troubleshooting is necessary.
2. If improper switch sequencing is not the cause, check ECU power and ground for opens, shorts, and shorts-to-ground. Not using battery-direct power and battery ground connections can cause this code. A defective charging system, or open battery fuse or fusible link can also cause this code. The battery fuse or fusible link may be at the battery or in the VIM. Dirty, corroded, or painted power and ground connections can also cause this code.
3. If all system power and ground connections are satisfactory and the problem persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem reoccurs, reinstall the replacement ECU.

Main code 36 indicates the system has detected a mismatch between the ECU hardware and the ECU software or that there is a TransID (TID) problem.

Main Code	Subcode	Meaning
36	00	Mismatch between ECU hardware and software
36	01	TransID not compatible with hardware/software
36	02	TransID did not complete

A. Active Indicator Clearing Procedure:

- Power down

CODE 36 XX — HARDWARE AND SOFTWARE NOT COMPATIBLE

B. Troubleshooting:

1. Correction for code 36 00 requires the installation of software that is compatible with the ECU hardware involved. (If a different calibration is required, update the ECU hardware to be compatible.)
2. Correction for code 36 01 is to update the ECU calibration. Installation of the latest calibration makes the ECU compatible with the latest TransID configuration.
3. Correction for code 36 02 is to troubleshoot TransID wire 195 for short-to-battery. Codes 42 XX or 69 XX may be associated with this code.

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT

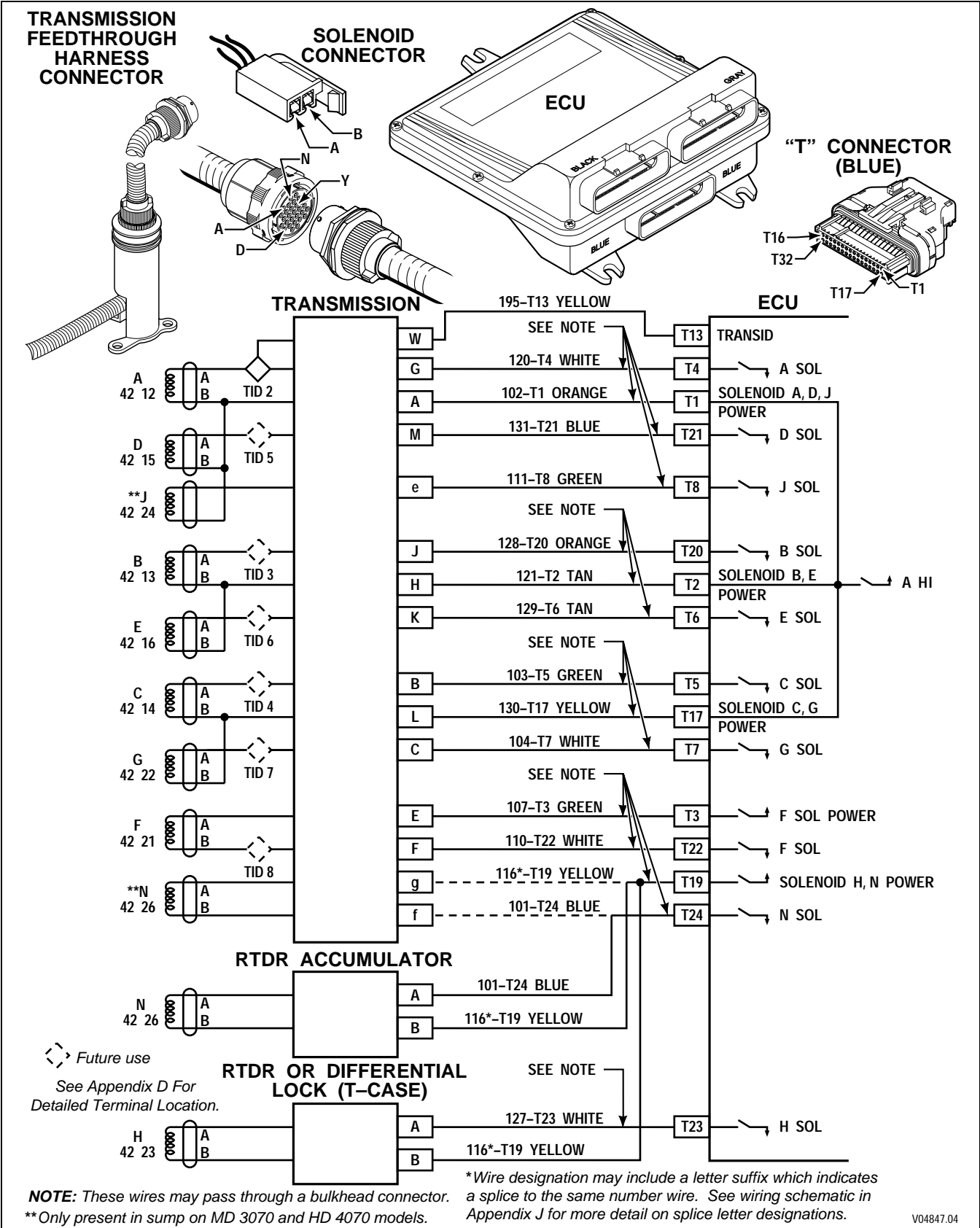


Figure 5-14. Code 42 Schematic Drawing

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT *(Figure 5–14)*

Main code 42 indicates the ECU has detected a short-to-battery condition in a solenoid wiring circuit. The **DO NOT SHIFT** response is activated when some subcodes are detected, all solenoids are turned off and the **CHECK TRANS** light is illuminated. All solenoids have a driver on the low (ground) side which can turn off the solenoid. All solenoids also have a driver on the high (power) side of the solenoid. Even though the high side driver can be turned off, a short-to-battery means the solenoid is continuously powered at an unregulated 12V or 24V instead of a regulated (pulse width modulated) voltage. The low side driver will not tolerate direct battery current and will open, causing the solenoid to be deenergized.

NOTE: *For subcodes 12, 13, 14, 15, 16, 22 — neutral start is inoperable; all display segments are on if the code is logged during ECU initialization (ignition on). Subcodes 21, 23, 24, and 26 will not trigger the CHECK TRANS light.*

Main Code	Subcode	Meaning
42	12	Short-to-battery A Solenoid Circuit
42	13	Short-to-battery B Solenoid Circuit
42	14	Short-to-battery C Solenoid Circuit
42	15	Short-to-battery D Solenoid Circuit
42	16	Short-to-battery E Solenoid Circuit
42	21	Short-to-battery F Solenoid Circuit
42	22	Short-to-battery G Solenoid Circuit
42	23	Short-to-battery H Solenoid Circuit
42	24	Short-to-battery J Solenoid Circuit
42	26	Short-to-battery N Solenoid Circuit

A. Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

NOTE: *“N” solenoid on the retarder accumulator has either a 12.5 ± 1.5 Ohm coil or a 23.5 ± 2.4 Ohm coil and is not correlated to sump temperature.*

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, the resistance of each solenoid can be measured by using a VOM. Refer to Figure 5–15 for solenoid resistance versus temperature.

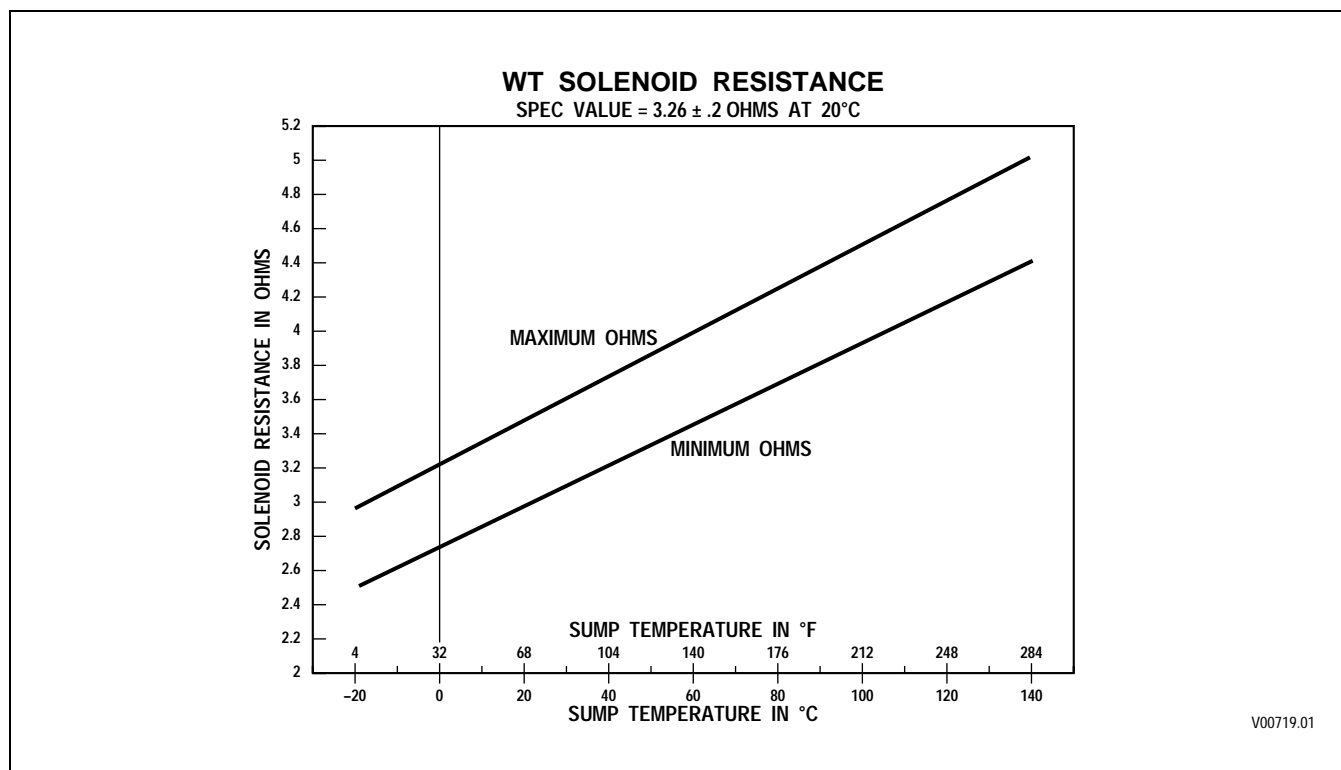
CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT (Figure 5-15)

Figure 5-15. Solenoid Resistance vs. Temperature

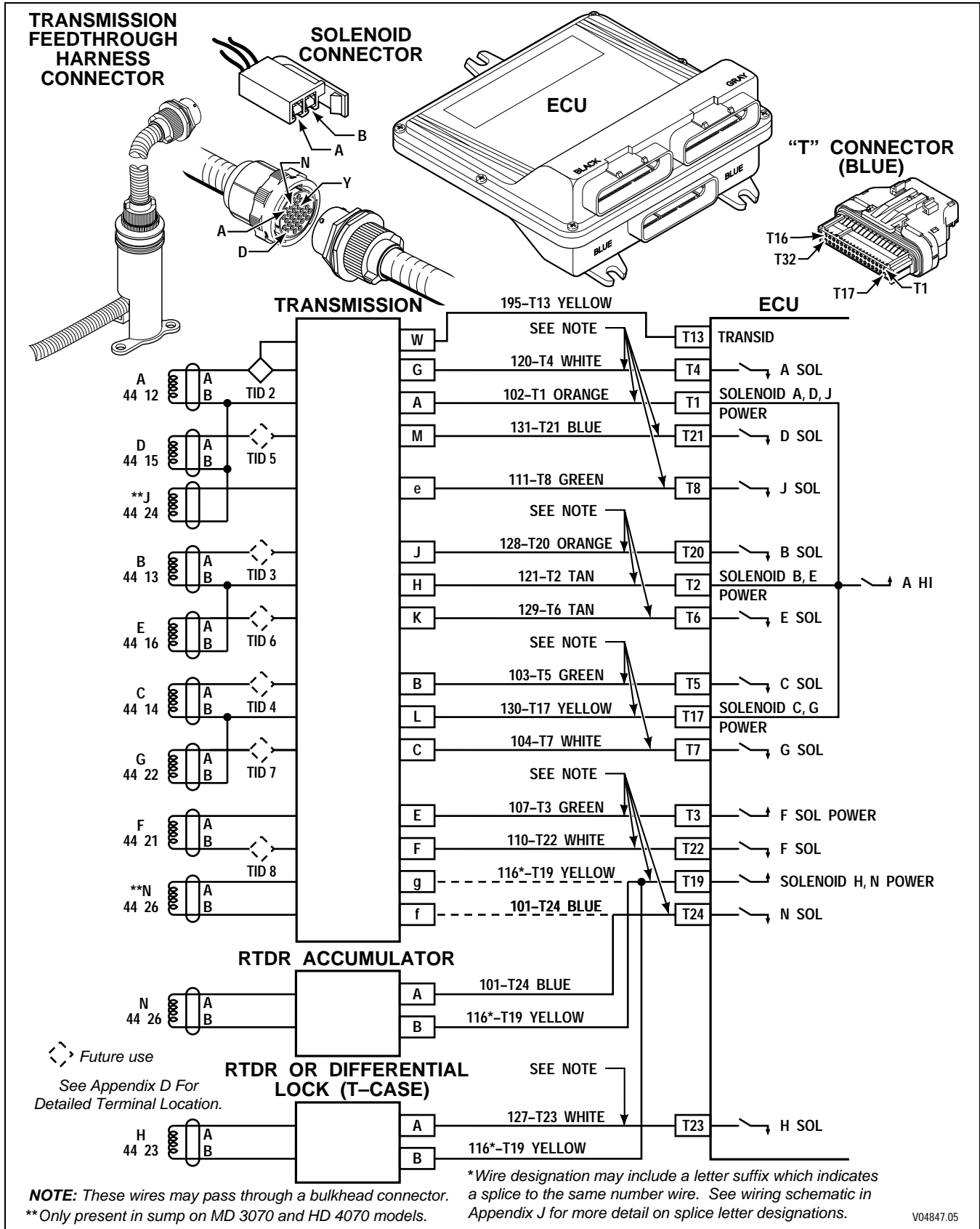
B. Troubleshooting:

1. Make sure the transmission connector is tightly connected. If the connector is properly connected, disconnect the wiring harness at the transmission. Check the connector for corroded or damaged terminals. Clean or replace as necessary.
2. Test each solenoid circuit at the transmission connector for shorts between the solenoid circuit being diagnosed and all other terminals in the connector. This test may be simplified by using the J 41612 test tool. Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If a short is found, isolate and repair the short. The short will probably be in the internal wiring harness.
3. If multiple code 42s occur (42 12, 42 13, 42 14, 42 15, 42 16, 42 22, and 42 24), and wiring and solenoids check okay, the A-Hi driver is probably failed open.
4. Replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the problem recurs, reinstall the new ECU to complete the repair.
5. If code 42 21 occurs repeatedly and the F solenoid and wiring checks okay, the F-Hi or F-Lo driver may be failed open. Follow Step (4) above.
6. If codes 42 23 and 42 26 occur repeatedly and solenoids and wiring check okay, the H and N-Hi driver may be failed open. Follow Step (4) above.
7. If the short is not found at the transmission connector, disconnect the transmission "T" harness connector at the ECU and check the wires of the solenoid circuit for shorts between the solenoid wires. If the short is found in one of the wires, isolate and repair it. Use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose).

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT (*Figure 5-15*)

8. If the short is not found in either the transmission or the harness, the condition must be intermittent.
9. Drain the fluid, remove the control module and closely inspect the internal harness for damage. Repair or replace as necessary.
10. If the condition recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the solenoid circuit indicated by the trouble code.
11. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT



CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT *(Figure 5–16)*

Figure 5–16. Code 44 Schematic Drawing

Main code 44 indicates the ECU has detected a short-to-ground in a solenoid or its wiring. The **DO NOT SHIFT** response is activated when some subcodes are detected, all solenoids are turned off, and the **CHECK TRANS** light is illuminated.

NOTE: *For subcodes 12, 13, 14, 15, 16, 22 — neutral start is inoperable. Subcodes 21, 23, 24, and 26 do not trigger the CHECK TRANS light.*

Main Code	Subcode	Meaning
44	12	Short-to-ground A Solenoid Circuit
44	13	Short-to-ground B Solenoid Circuit
44	14	Short-to-ground C Solenoid Circuit
44	15	Short-to-ground D Solenoid Circuit
44	16	Short-to-ground E Solenoid Circuit
44	21	Short-to-ground F Solenoid Circuit
44	22	Short-to-ground G Solenoid Circuit
44	23	Short-to-ground H Solenoid Circuit
44	24	Short-to-ground J Solenoid Circuit
44	26	Short-to-ground N Solenoid Circuit

A. Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, the resistance of each solenoid can be checked using a VOM. Refer to Figure 5–17 for resistance values versus temperature.

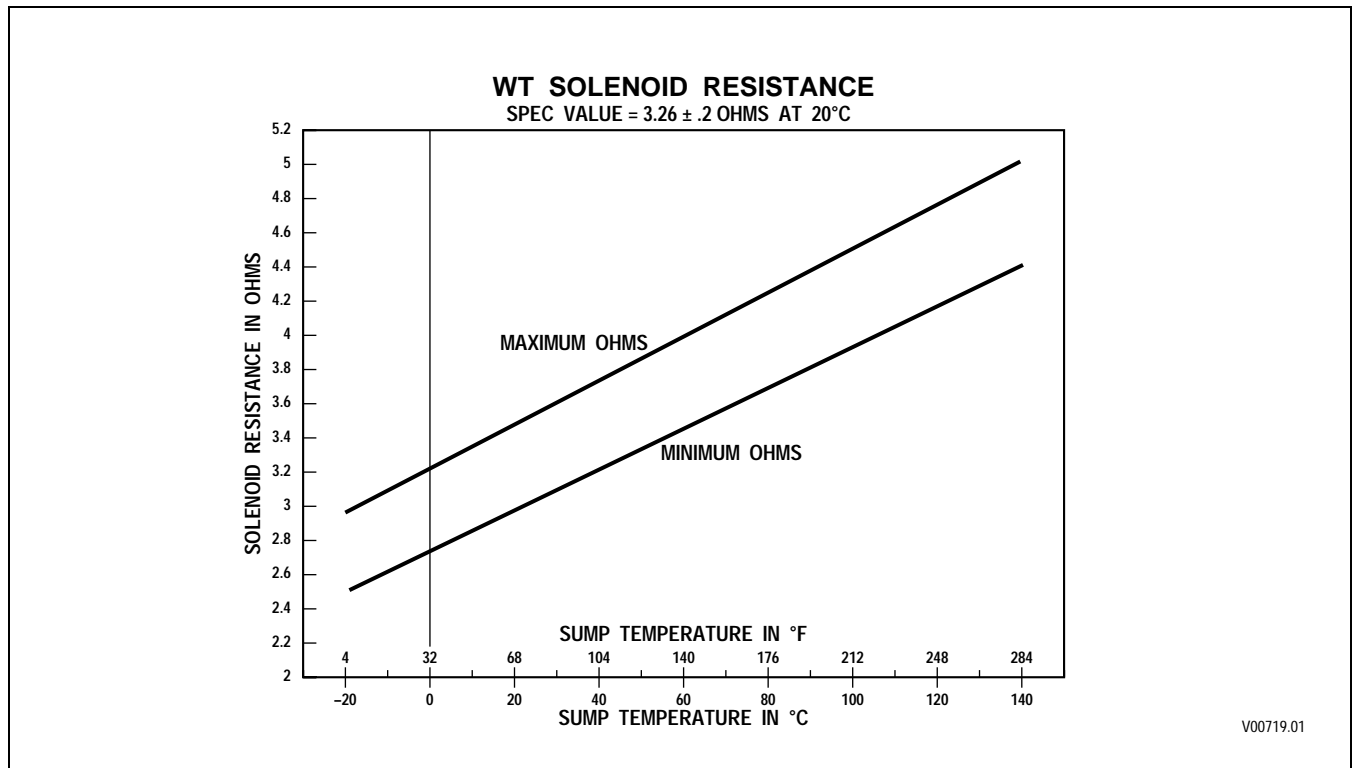
CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT (Figure 5-17)

Figure 5-17. Solenoid Resistance vs. Temperature

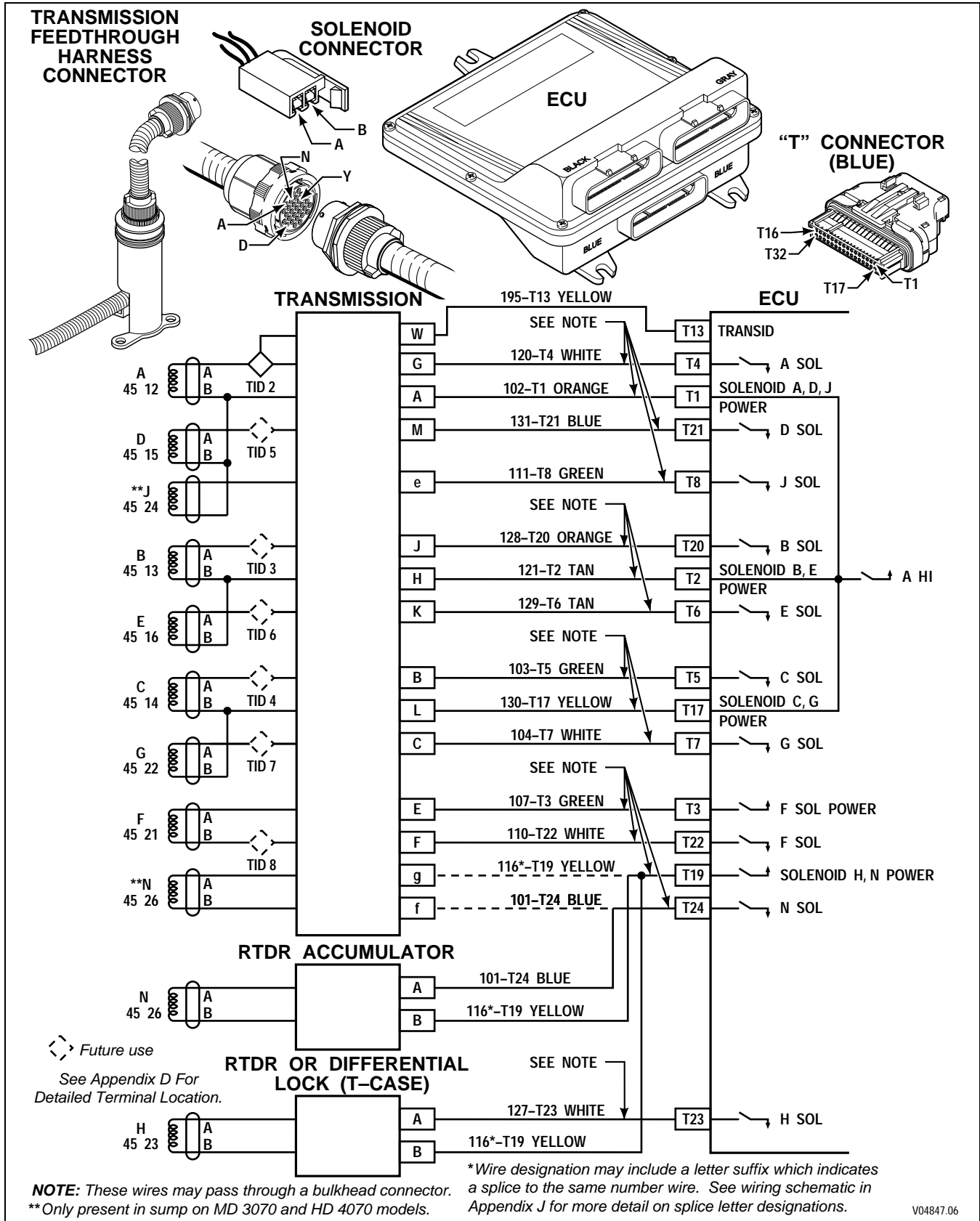
B. Troubleshooting:

1. Check the transmission connector and make sure it is tightly connected. If the connector is properly connected, disconnect the harness at the transmission and inspect the terminals in the transmission harness and feedthrough harness connectors. Clean or replace as necessary (Appendix D).
2. If the connector is connected, clean, and not damaged, check the solenoid circuit in the transmission for shorts to other wires. (Tool J 41612 may be useful in making this test.) Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If the short circuit is found, drain the fluid, remove the control module (refer to the transmission Service Manual), and isolate the short. The short is probably in the feedthrough harness, or the solenoid itself (refer to Figure 5-1 for solenoid locations).
3. If the short is not found in the transmission, disconnect the transmission harness connector at the ECU and inspect the terminals for damage or contamination. Clean or replace as necessary. If the terminals are satisfactory, check the wires of the solenoid circuit in the transmission harness for shorts-to-ground or shorts between wires. If a short is found in one of the wires, isolate and repair it or use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) in the external harness. Refer to Appendix E for connector/terminal repair information.
4. If the short is not found in either the transmission or the harness, the condition must be intermittent.
5. Drain the fluid, remove the control module, and closely inspect the solenoid and internal harness for damage. Repair or replace as necessary.

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT (*Figure 5-17*)

6. If the condition recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the solenoid circuit indicated by the diagnostic code.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT



V04847.06

Figure 5-18. Code 45 Schematic Drawing

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT (*Figure 5-18*)

Main code 45 indicates the ECU has detected either an open circuit condition in a solenoid coil or the wiring to that solenoid. The **DO NOT SHIFT** response is activated when some subcodes are detected, all solenoids are turned off, and the **CHECK TRANS** light is illuminated.

Main Code	Subcode	Meaning
45	12	Open Circuit A Solenoid Circuit
45	13	Open Circuit B Solenoid Circuit
45	14	Open Circuit C Solenoid Circuit
45	15	Open Circuit D Solenoid Circuit
45	16	Open Circuit E Solenoid Circuit
45	21	Open Circuit F Solenoid Circuit
45	22	Open Circuit G Solenoid Circuit
45	23	Open Circuit H Solenoid Circuit
45	24	Open Circuit J Solenoid Circuit
45	26	Open Circuit N Solenoid Circuit

A. Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Before troubleshooting, read Paragraph 5-6. Also, check battery and ECU input voltages.*

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, the resistance of each solenoid can be checked using a VOM. Refer to Figure 5-19 for solenoid resistance values versus temperature.

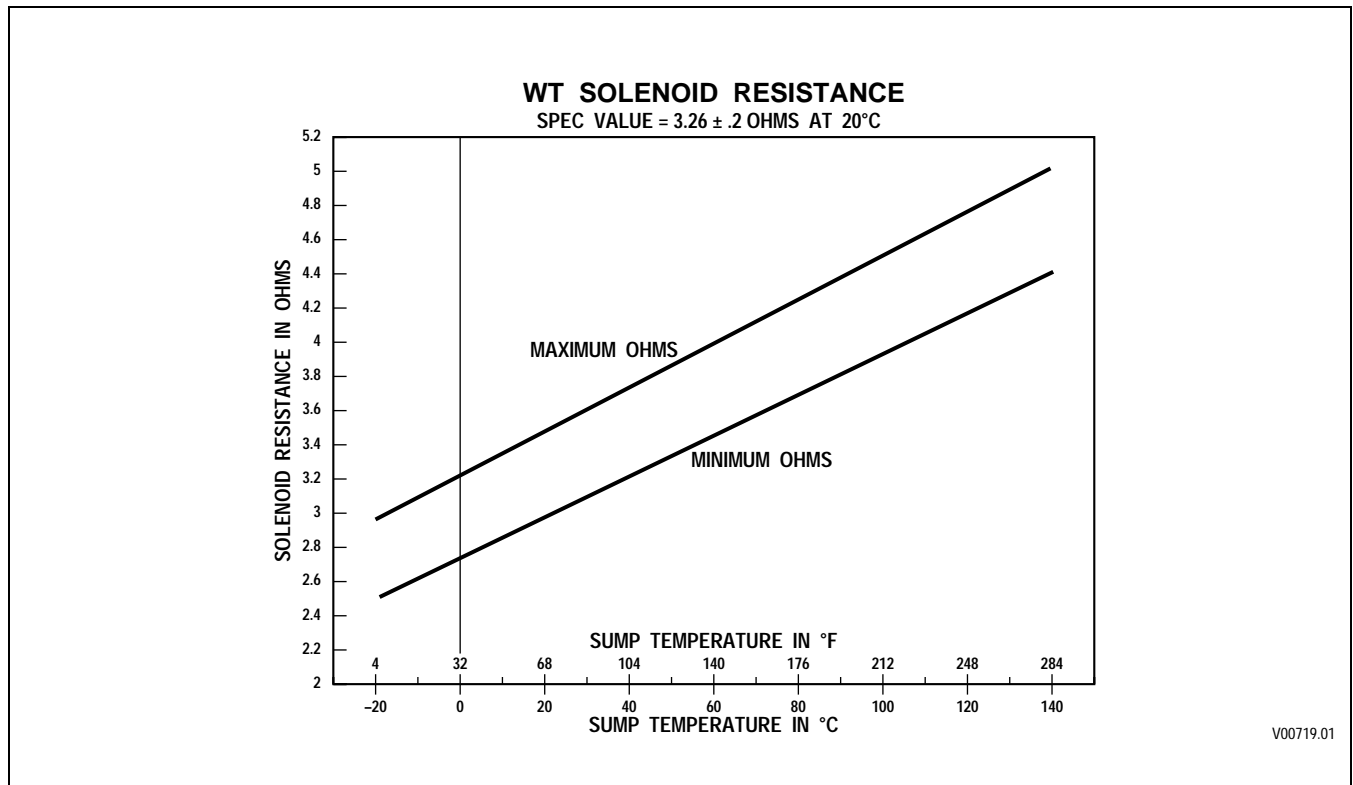
CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT (Figure 5-19)

Figure 5-19. Solenoid Resistance vs. Temperature

B. Troubleshooting:

1. Check the transmission connector and make sure it is tightly connected. If the connector is properly connected, disconnect the harness at the feedthrough harness connector and check the terminals in the transmission harness and feedthrough harness connectors.
2. If the connector is connected, clean, and not damaged, check the solenoid circuit in the transmission for opens. Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If the open circuit is found, drain the fluid, remove the control module (see the transmission Service Manual), and isolate the open. The fault will be in the feedthrough harness or the solenoid itself (see Figure 5-1 for solenoid locations).
3. If the open is not found at the transmission connector, disconnect the transmission harness connector at the ECU and inspect the terminals in the connector and the ECU for damage or contamination. Clean or replace as necessary. If the terminals are satisfactory, check the wires of the solenoid circuit in the transmission harness for continuity. If the open is found in one of the wires, isolate and repair it. If this is not feasible, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose).
4. If multiple code 45s occur (45 12, 45 13, 45 14, 45 15, 45 16, 45 22, and 45 24), and wiring and solenoids check okay, the A-Hi driver is probably failed open.
5. Replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the problem recurs, reinstall the new ECU to complete the repair.
6. If code 45 21 occurs repeatedly and the F solenoid and wiring checks okay, the F-Hi or F-Lo driver may be failed open. Follow Step (5) above.

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT (*Figure 5-19*)

7. If codes 45 23 and 45 26 occur repeatedly and solenoids and wiring check okay, the H and N-Hi driver may be failed open. Follow Step (5) above.
8. If the open is not found in either the transmission or the harness or the ECU drivers, the condition must be intermittent.
9. Drain the fluid, remove the control module, and closely inspect the solenoid and internal harness for damage. Repair or replace as necessary.
10. If the condition recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the solenoid circuit indicated by the diagnostic code.
11. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 46 XX — OVERCURRENT TO SOLENOIDS

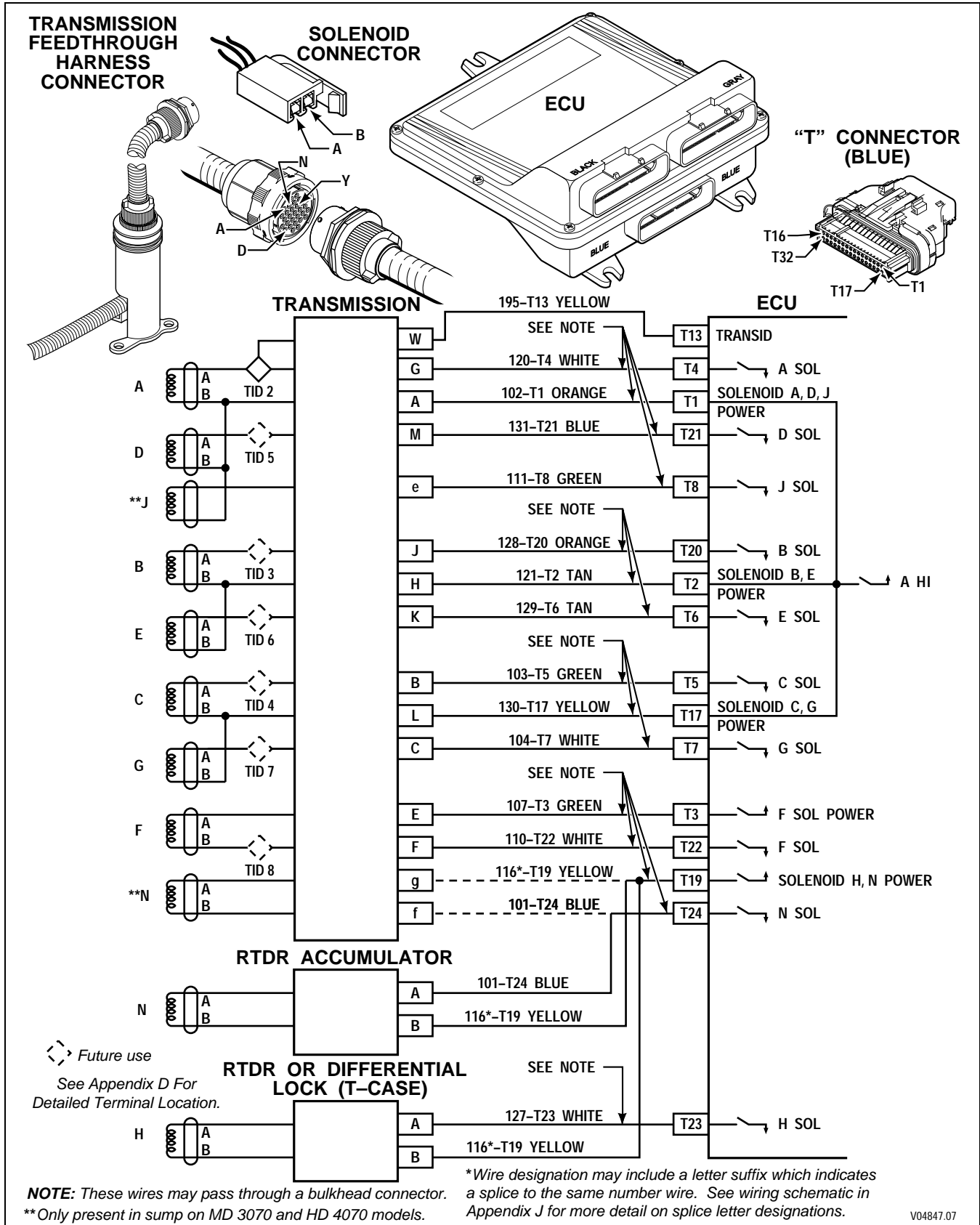


Figure 5-20. Code 46 Schematic Drawing

CODE 46 XX — OVERCURRENT TO SOLENOIDS *(Figure 5-20)*

Main code 46 indicates that an overcurrent condition exists in one of the switches sending power to the transmission control solenoids.

Main Code	Subcode	Meaning
46	21	Overcurrent, F-High solenoid circuit
46	26	Overcurrent, N and H-High solenoid circuit
46	27	Overcurrent, A-High solenoid circuit

A. Active Indicator Clearing Procedure:

- Power down
- Manual

B. Troubleshooting:

1. Probable cause is a wiring problem. A solenoid wire is probably shorted to ground or the solenoid has a shorted coil which would cause an overcurrent condition. May also be an ECU problem.
2. Follow the troubleshooting steps for code 44 XX.

CODE 51 XX — OFFGOING RATIO TEST DURING SHIFT (TIE-UP TEST)

Main code 51 indicates a failed offgoing ratio test. An offgoing ratio test occurs during a shift and uses turbine and output speed sensor readings to calculate the ratio between them. The calculated speed sensor ratio is then compared to the programmed speed sensor ratio of the commanded range. After a shift is commanded, the ECU, after a period of time, expects the old ratio to be gone. If the ratio does not change properly, the ECU assumes the offgoing clutch did not release. The shift is retried if conditions still exist to schedule the shift. If the second shift is not successfully completed, code 51 XX is set and the ECU returns the transmission to the previous range. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *This test is not performed below a calibrated transmission output speed of 200 rpm.*

Main Code	Subcode	Meaning
51	01	Low-1 upshift
51	10	1-Low downshift
51	12	1-2 upshift
51	21	2-1 downshift
51	23	2-3 upshift
51	24	2-4 upshift
51	35	3-5 upshift
51	42	4-2 downshift
51	43	4-3 downshift
51	45	4-5 upshift
51	46	4-6 upshift
51	53	5-3 downshift
51	64	6-4 downshift
51	65	6-5 downshift
51	XY	X-Y upshift or downshift

A. Active Indicator Clearing Procedure:

- Power down
- Manual — except subcodes 35, 42, 43, 45, 53

NOTE: *Before troubleshooting, read Paragraph 5-6. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

B. Troubleshooting:

1. Incorrect fluid level can cause 51 series codes. Allow the vehicle to idle for 3-4 minutes and check the transmission fluid level. If level is not correct, add or drain fluid to correct level.
2. If the fluid level is correct, connect a pressure gauge into the pressure tap for the offgoing clutch indicated by the code (refer to solenoid and clutch chart, Appendix C). Make the shift indicated by the subcode or use the Pro-Link[®] diagnostic tool clutch test mode to put the transmission in the off-going and oncoming ranges (refer to Appendix B for clutch pressure check information).

CODE 51 XX — OFFGOING RATIO TEST DURING SHIFT (TIE-UP TEST)

3. If the offgoing clutch stays pressurized, drain the fluid, remove the control module, disassemble the control module and clean it, inspecting for damaged valve body gaskets and stuck or sticky valves. Inspect the transmission for signs of clutch damage indicating the need to remove and overhaul the transmission.
4. If the problem has not been isolated, replace the solenoid for the offgoing clutch.
5. If after replacing the solenoid the problem persists, install another ECU. If this corrects the problem, temporarily reinstall the old ECU to verify the repair.
6. If this does not correct the problem, reinstall the original ECU and check for mechanical problems. The clutch may be mechanically held (coned, burned and welded, etc.). It may be necessary to remove the transmission and repair or rebuild as required.

CODE 52 XX — OFFGOING C3 PRESSURE SWITCH TEST DURING SHIFT

Main code 52 indicates a failed C3 pressure switch test. When a shift is commanded and C3 is the offgoing clutch, the ECU expects the C3 pressure switch to open within a period of time after the shift is commanded. If the ECU does not see the switch open, it assumes C3 has not released. If conditions for a shift exist, the shift is retried. If the C3 pressure switch still remains closed, the code is logged and the **DO NOT SHIFT** response is commanded. If the code is set during a direction change, neutral with no clutches is commanded, otherwise the transmission is commanded to the previous range. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: C3 tests are turned off below a calibrated temperature of -32°C (-25°F).

Main Code	Subcode	Meaning
52	01	L-1 upshift
52	08	L-N1 shift
52	32	3-2 downshift
52	34	3-4 upshift
52	54	5-4 downshift
52	56	5-6 upshift
52	71	R-1 shift
52	72	R-2 shift
52	78	R-N1 shift
52	79	R-2 shift (R to NNC to 2)
52	99	N3-N2 shift
52	XY	X-Y shift

A. Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: Before troubleshooting, read Paragraph 5-6. Also, check battery and ECU input voltages.

NOTE: Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.

B. Troubleshooting:

1. Use the Pro-Link[®] diagnostic tool to check the state of the C3 pressure switch.
2. Check the C3 pressure switch wiring for a short-to-ground or a switch stuck closed (refer to code 32 XX). If a short is found, isolate and repair; or replace the switch if it is stuck closed.
3. If a fault is not found with the C3 pressure switch or circuitry, connect a pressure gauge to the C3 pressure tap.
4. Drive the vehicle to make the shift indicated by the subcode or use the DDR clutch test mode. Compare actual C3 pressure value with the table of specifications in Appendix B.

CODE 52 XX — OFFGOING C3 PRESSURE SWITCH TEST DURING SHIFT

5. If C3 is being held on hydraulically (C3 remains pressurized), drain the fluid, remove the control module, disassemble and clean the control module, checking for damaged valve body gaskets or stuck and sticky valves.
6. If the problem recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the C3 pressure switch in the external harness.
7. If the problem again recurs, replace the C solenoid.
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 53 XX — OFFGOING SPEED TEST (DURING SHIFT)

Main code 53 indicates a failed offgoing speed test. The speed test during a shift is designed to ensure neutral is attained during shifts to neutral. This test compares engine speed to turbine speed. If neutral is selected and turbine speed is found to be much lower than engine speed, the ECU sees this as neutral not being attained. The transmission is commanded to Neutral with No Clutches and code 53 XX is set. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *This test is not performed if neutral output is below 200 rpm or when temperatures are below a calibrated 0°C (32°F).*

Main Code	Subcode	Meaning
53	08	L–N1 shift
53	18	1–N1 shift
53	28	2–N1 shift
53	29	2–N2 shift
53	38	3–N1 shift
53	39	3–N3 shift
53	48	4–N1 shift
53	49	4–N3 shift
53	58	5–N1 shift
53	59	5–N3 shift
53	68	6–N1 shift
53	69	6–N4 shift
53	78	R–N1 shift
53	99	N3–N2 or N2–N3 shift
53	XY	X–Y shift

A. Active Indicator Clearing Procedure:

- Power down
- Manual — subcodes 78 and 99 only

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

B. Troubleshooting:

1. Be sure the transmission is warm and the fluid level is correct. Correct transmission fluid level as necessary.
2. Using the DDR, check the engine and turbine speed sensor signals under steady conditions. If a tachometer is available, compare the tachometer reading with the engine rpm reading on the diagnostic tool. Check signals in neutral, at idle, high idle, and maximum no load rpm. If a signal is erratic, check sensor wiring for opens, shorts, and shorts-to-ground (refer to code 22pXX). Check all connections for dirt and corrosion. If wiring problems are found, repair or replace as necessary.

CODE 53 XX — OFFGOING SPEED TEST (DURING SHIFT)

3. If fluid and wiring are satisfactory, install a pressure gauge in the pressure tap for the offgoing clutch. Make the shift indicated by the subcode using the clutch test mode of the Pro-Link[®] diagnostic tool. If the pressure gauge shows clutch pressure (above 55 kPa or 8 psi) remains in the offgoing clutch, drain the fluid and remove the control module (see the transmission Service Manual). Disassemble and clean the control module and check for damaged valve body gaskets and stuck or sticky valves, particularly latch valves and solenoid second-stage valves.
4. If excessive clutch pressure is not remaining in the offgoing clutch, replace the engine speed sensor and the turbine speed sensor.
5. If the control module is removed to replace the turbine speed sensor (MD, B 300, B 400), clean the control module and inspect for stuck or sticky valves (particularly the latch valves and solenoid G second stage valve). Check the rotating clutch drum to which the turbine speed sensor is directed for damage, contamination, or signs of contact between the drum and the sensor.
6. If the problem recurs, replace the solenoid(s) for the offgoing clutch(es).
7. If the problem again recurs, the offgoing clutch must be held on mechanically (coned, burned, etc.). Remove the transmission and repair or rebuild as necessary.
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 54 XX — ONCOMING SPEED TEST (AFTER SHIFT)

Main code 54 indicates a failed oncoming ratio test. The ratio test after a shift is failed when the ECU has commanded the end of a shift and has not seen the transmission shift into the target range (comparing turbine and output speeds). Erratic readings from speed sensors are a likely cause of an oncoming ratio test failure. If conditions for a shift still exist, the shift will be retried one more time. If the ratio test is still not met, a code is logged and the **DO NOT SHIFT** response is commanded. If the code is set during a direction change, Neutral with No Clutches is commanded, otherwise the transmission is commanded to the previous range. **Code 54 12 can also be caused by the ECU being calibrated for a close ratio transmission and installed with a wide ratio transmission, or vice versa.** Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *This test is not performed below a calibrated transmission output speed of 200 rpm.*

Main Code	Subcode	Meaning
54	01	L-1 upshift
54	07	L-R shift
54	10	1-L downshift
54	12	1-2 upshift — incorrect calibration, wide ratio vs. close ratio
54	17	1-R shift
54	21	2-1 downshift
54	23	2-3 upshift
54	24	2-4 upshift
54	27	2-R shift
54	32	3-2 downshift
54	34	3-4 upshift
54	35	3-5 upshift
54	42	4-2 downshift
54	43	4-3 downshift
54	45	4-5 upshift
54	46	4-6 downshift
54	53	5-3 downshift
54	54	5-4 downshift
54	56	5-6 upshift
54	64	6-4 downshift
54	65	6-5 downshift
54	70	R-L shift
54	71	R-1 shift
54	72	R-2 shift
54	80	N1-L shift
54	81	N1-1 shift
54	82	N1-2 shift
54	83	N1-3 shift
54	85	N1-5 shift
54	86	N1-6 shift
54	92	N2-2 shift
54	93	N3-3 shift
54	95	N3-5 shift
54	96	N4-6 shift
54	XY	X to Y shift

CODE 54 XX — ONCOMING SPEED TEST (AFTER SHIFT)**A. Active Indicator Clearing Procedure:**

- Power down
- Manual

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

B. Troubleshooting:

1. After the transmission is at operating temperature, allow the vehicle to idle on level ground for 3–4 minutes. Check transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code (not enough or too much fluid may produce inadequate clutch pressure).
2. Connect a pressure gauge and check main pressure. If pressure is not adequate, the pump is possibly worn. See Appendix B for main pressure specifications.
3. If the fluid level is correct, check the turbine and output speed sensors for accurate, steady signals using the diagnostic tool (check with vehicle stopped and in range to confirm a zero speed reading from the turbine and output speed sensors). Check the wiring for opens and shorts (refer to code 22 XX) and the sensor coils for proper resistance. If problems are found, repair or replace as necessary. Remove speed sensor and check for loose tone wheel.
4. If sensor and wiring resistance are acceptable, connect a pressure gauge(s) to the pressure tap for the oncoming clutches indicated by the subcode (refer to solenoid and clutch chart in Appendix C). Make the shift indicated by the code by operating the vehicle or by using the diagnostic tool's clutch test mode.
5. If the clutch pressure does not show on the gauge(s), the control module is probably not commanding the clutch on. Drain the fluid and remove the control module. Disassemble and clean the control module, inspect for stuck or sticking valves.
6. Internal leakage is indicated by the clutch pressure gauge showing that pressure is being sent to the clutch but the clutch fails to hold. The fault may be: missing or damaged face seals, burnt clutch, leaking piston sealrings, or damaged control module gaskets. Drain the fluid, remove the control module, and inspect the face seals and control module gaskets. If the seals and gaskets are satisfactory, replace the solenoid(s) indicated by the code. If replacing the solenoid does not eliminate the code, remove the transmission and repair as necessary.
7. If clutch pressures are correct and the clutch appears to be holding, replace the output and turbine speed sensors.
8. If the problem recurs, use the diagnostic tool to check the speed sensor signals for erratic readings. Possible causes of erratic speed readings are: loose sensors, intermittent contact in the wiring, vehicle-induced vibrations, or speed sensor wiring that is not a properly twisted-pair. If necessary, use a twisted-pair for a new speed sensor circuit — Service Harness Twisted Pair P/N 200153 is available from St. Clair Technologies for this purpose.
9. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 55 XX — ONCOMING C3 PRESSURE SWITCH (AFTER SHIFT)

Main code 55 indicates the C3 clutch is the oncoming clutch in a shift and the C3 pressure switch did not close at the end of the shift. When this code is set, the **DO NOT SHIFT** response and **Neutral with No Clutches** is commanded. On the N1 to R shift the transmission is commanded to the previous range. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *When an ECU with a version 8 or 8A calibration is used with a pre-TransID transmission, 55 XX codes are set because the ECU sees wire 195 is open. To correct this condition, convert to a TID 1 internal harness or install Adapter P/N 200100 available from St. Clair Technologies.*

Main Code	Subcode	Meaning
55	07*	Oncoming C3PS (after shift), L–R shift
55	17*	Oncoming C3PS (after shift), 1–R shift
55	27*	Oncoming C3PS (after shift), 2–R shift
55	87	Oncoming C3PS (after shift), N1–R shift
55	97	Oncoming C3PS (after shift), N1–L to R shift
55	XY	Oncoming C3PS (after shift), X to Y shift

***NOTE:** *When sump temperature is below 10°C (50°F), and transmission fluid is C4 (not DEXRON®), follow this procedure when making directional change shifts:*

- *To shift from forward to reverse; select N (Neutral) and then R (Reverse).*
- *Failure to follow this procedure may cause illumination of the CHECK TRANS light and then transmission operation will be restricted to N (Neutral).*

A. Active Indicator Clearing Procedure:

- Power down
- Manual — subcode 87 only

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Check battery and ECU input voltages before troubleshooting.*

B. Troubleshooting:

NOTE: *Do not bring the transmission to operating temperature if the problem occurs at sump temperatures below that level. Do troubleshooting at the temperature level where the problem occurs.*

1. After the transmission is at operating temperature, allow vehicle engine to idle on level ground for 3–4 minutes. Check transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code (not enough or too much fluid may produce inadequate clutch pressure).
2. Connect a pressure gauge and check main pressure. If pressure is not adequate, the pump is possibly worn. See Appendix B for main pressure specifications.

CODE 55 XX — ONCOMING C3 PRESSURE SWITCH (AFTER SHIFT)

3. If fluid level and main pressure are adequate, connect a pressure gauge to the C3 pressure tap on the transmission and make the shift indicated by operating the vehicle using the Pro-Link[®] diagnostic tool's CLUTCH TEST MODE.

NOTE: *When using the CLUTCH TEST MODE on the Pro-Link[®], be sure to use the correct pressure specification. If testing is done with the vehicle stopped, the lockup clutch is not applied, so use the clutch pressure specification for converter operation (see Appendix B; pressure in 3C would be the same as in 2C). If testing is done with the vehicle moving, the lockup clutch may be applied depending upon the vehicle speed and throttle position. Be sure to use the clutch pressure specification for lockup operation (see Appendix B).*

4. If, when making the shift and producing the code, the C3 clutch does not show any pressure, drain the fluid and remove the control module. Disassemble, clean, and inspect the control module for stuck or sticky valves (particularly the "C" solenoid second stage valve and C-1 latch valve). If no obvious problems are found, replace the "C" solenoid and reassemble (see Figure 5-1 for location of the "C" solenoid).
5. If the gauge shows inadequate pressure being sent to the clutch, the clutch is probably worn, has leaking piston or face seals, or the control module gaskets are damaged. See Appendix B for clutch pressure specification. Drain the fluid, remove the control module and inspect the face seals and valve body gaskets. If the face seals or control module gaskets are not damaged, remove and repair the transmission (refer to the transmission Service Manual for repair procedure).
6. If the gauge shows adequate clutch apply pressure, the problem is with the C3 pressure switch or its wires. Check the C3 pressure switch wires in the transmission harness for opens, shorts, or shorts-to-ground (see code 32pXX). If found, isolate and repair the C3 pressure switch circuit.

NOTE: *A leakage problem may be temperature related. Be sure to check pressures at the sump temperature where the problem occurred.*

7. If the problem is not in the transmission harness, drain the fluid and remove the control module. Check the feedthrough harness assembly for opens. If wiring problems are found, repair as necessary. If no wiring problems are found, replace the C3 pressure switch (see Figure 5-1 for the location).
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 56 XX — RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

Main code 56 indicates a failed range verification speed sensor ratio test. The ratio test occurs after a shift and determines if a clutch has lost torque carrying capability. If output speed is above programmed output speed for a range but the correct speed sensor ratio is not present, the **DO NOT SHIFT** response is commanded and a range which can carry the torque without damage is commanded or attempted. Turbine and output speed sensor readings are used to calculate the actual ratio that is compared to the commanded ratio. **Main code 56 can also be caused by the ECU being calibrated for a close ratio transmission and installed with a wide ratio transmission, or vice versa.**

Main Code	Subcode	Meaning
56	00	Range verification ratio test (between shifts) L
56	11	Range verification ratio test (between shifts) 1
56	22	Range verification ratio test (between shifts) 2
56	33	Range verification ratio test (between shifts) 3
56	44	Range verification ratio test (between shifts) 4
56	55	Range verification ratio test (between shifts) 5
56	66	Range verification ratio test (between shifts) 6
56	77	Range verification ratio test (between shifts) R

A. Active Indicator Clearing Procedure:

- Power down
- Manual — subcodes 11, 44, 66, 77 only

NOTE: *When a code 22 16 (output speed fault) is also present, follow the troubleshooting sequence for code 22 16 first. After completing the 22 16 sequence, drive the vehicle to see if a code 56 XX recurs.*

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

B. Troubleshooting:

1. After the transmission is at operating temperature, allow vehicle engine to idle on level ground for 3–4 minutes. Check the transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code. Not enough or too much fluid may produce inadequate clutch pressure.
2. Connect a pressure gauge and check main pressure. If the pressure is not adequate, the pump is probably worn. See Appendix B for main pressure specifications.
3. If main pressure is adequate, check clutch pressure for the range indicated by following the procedure in Appendix B. The transmission range indicated by the trouble code can be found by referring to the solenoid and clutch chart in Appendix C. Drive the vehicle or use the diagnostic tool's clutch test mode and check clutch pressure.
4. If a clutch is leaking pressure, drain the fluid, remove the control module and check for damaged control module gaskets and stuck or sticking valves. Also look for damaged or missing face seals. If no problems are found, replace the solenoids for the clutches used in the range indicated by the code.

CODE 56 XX — RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

5. If replacing solenoids does not correct the pressure problem, a worn clutch or worn piston seals are probably the source of the pressure leak. Remove the transmission and repair or replace as necessary.
6. This code requires accurate output and turbine speed readings. If there were no transmission problems detected, use the diagnostic tool and check the speed sensor signals for noise (erratic signals) from low speed to high speed in the range indicated by the code.
7. If a noisy sensor is found, check the resistance of the sensor (300 ± 30 Ohms, refer to the code 22 XX temperature variation chart) and its wiring for opens, shorts, and shorts-to-ground (refer to code 22 XX). Carefully check the terminals in the connectors for corrosion, contamination, or damage. Ensure the wiring to the sensors is a properly twisted wire pair. Replace a speed sensor if its resistance is incorrect. Isolate and repair any wiring problems. (Use a twisted-pair if a new speed sensor circuit is needed — Service Harness Twisted Pair P/N 200153 is available from St. Clair Technologies for this purpose.)
8. If no apparent cause for the code can be found, replace the turbine and output speed sensors.
9. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 57 XX — RANGE VERIFICATION C3 PRESSURE TEST (BETWEEN SHIFTS)

Main code 57 indicates failure of the range verification C3 pressure switch test. This test determines if the C3 pressure switch is closed when it should be open. The test occurs when a range is commanded that does not use the C3 clutch (neutral, 1, 2, 4, and 6). The code is set if the C3 pressure switch is closed when it should be open. If C3 clutch comes on when not needed, three clutches are applied and a transmission tie-up occurs. The ECU will command a range which does use the C3 clutch and activate the **DO NOT SHIFT** response.

Main Code	Subcode	Meaning	Replace Solenoid
57	11	Range verification C3 pressure switch while in 1st	B
57	22	Range verification C3 pressure switch while in 2nd	C
57	44	Range verification C3 pressure switch while in 4th	C
57	66	Range verification C3 pressure switch while in 6th	A
57	88	Range verification C3 pressure switch while in N1	C
57	99	Range verification C3 pressure switch while in N2 or N4	C

A. Active Indicator Clearing Procedure:

- Power down
- Manual

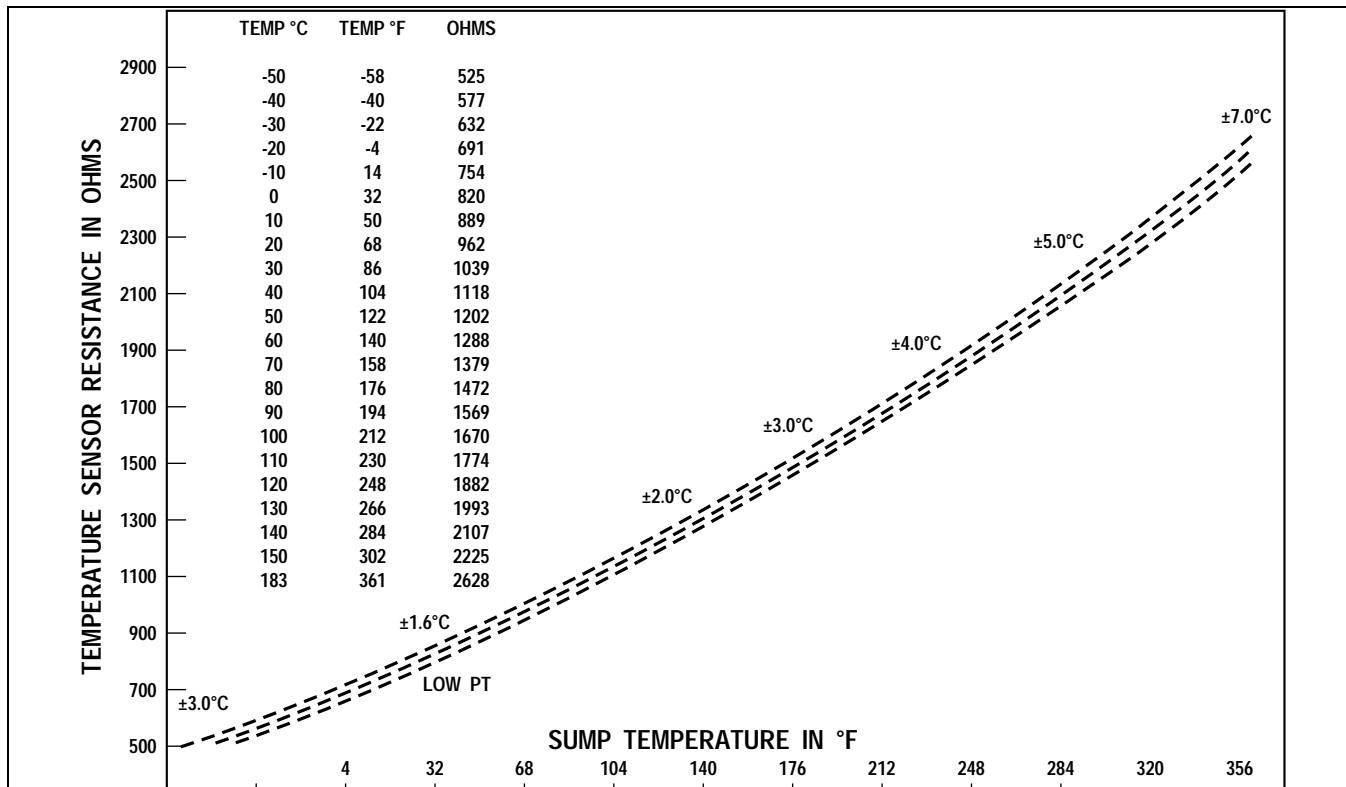
NOTE: Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.

NOTE: Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.

B. Troubleshooting:

1. Disconnect the harness from the transmission. Check the C3 pressure switch circuit at the feedthrough harness connector for continuity (refer to code 32 XX).
2. Continuity at the feedthrough harness connector indicates the C3 pressure switch is closed or the C3 circuit is shorted together. Drain the fluid, remove the control module, and isolate the short. The fault is either a shorted feedthrough harness or stuck C3 pressure switch. Repair or replace as necessary.
3. If there is no continuity at the transmission, disconnect the transmission harness connector from the ECU and check the C3 pressure switch wires in the transmission harness for shorts. Use the system wiring diagram to identify wires which are connected. If a shorted C3 pressure switch circuit in the external harness is found, isolate and repair.
4. If the C3 pressure switch or circuit is not shorted either in the transmission or the external harness, connect a pressure gauge in the C3 pressure tap (refer to Appendix B for pressure tap location). Drive the vehicle in the range indicated by the code or use the diagnostic tool's clutch test mode to attain that range.
5. If the gauge shows C3 pressure is present in the range indicated by the subcode, drain the fluid and remove the control module. Check for damaged valve body gaskets or stuck or sticking valves. Repair or replace as necessary. If no obvious defects are found, replace the listed solenoid.
6. If the gauge shows C3 pressure is not present in the range indicated by the subcode, drain the fluid and remove the control module. Replace the C3 pressure switch.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem reoccurs, reinstall the replacement ECU.

CODE 61 XX — RETARDER OIL TEMPERATURE HOT



Main code 61 indicates the ECU has detected a hot fluid condition in the output retarder. Table 5–7 shows what actions are taken by the ECU at elevated retarder temperatures.

Possible causes (but not all causes) for hot fluid are:

1. Prolonged retarder use.
2. TID 2 transmission with ECU prior to Version 8A.
3. Low fluid level.
4. High fluid level.
5. A retarder apply system that allows the throttle and retarder to be applied simultaneously.
6. Cooler inadequately sized for retarder.

If the validity of the hot fluid diagnosis is in question, temperature can be checked by using a temperature gauge at the retarder-out port or by reading retarder temperature with the Pro-Link® diagnostic tool. Another method of checking retarder temperature is to remove the “T” connector at the ECU and measure resistance (Ohms) between terminals T28 and T25. Compare the resistance value to the value in Figure 6–21 to see if the result is within the expected operating range.

NOTE: Use the Pro-Link® diagnostic tool to determine the software version being used.

The retarder temperature sensor is located externally on the HD retarder housing and under the plate on the MD retarder housing. When retarder temperature reaches a preset level, a retarder hot temperature light is illuminated.

NOTE: When an ECU with a version 8 calibration is used with a TransID 2 transmission, 62 XX codes are set because the ECU does not have the proper calibrations for the TID 2 thermistors. The ECU calibration must be updated to version 8A.

CODE 61 XX — RETARDER OIL TEMPERATURE HOT

Main code 62 indicates the retarder temperature sensor or engine coolant sensor or circuitry is providing a signal outside the usable range of the ECU. Main code 62 can be the result of a hardware failure or an actual extremely high or low temperature condition.

Main Code	Subcode	Meaning
62	12	Retarder temperature sensor failed low (−45°C; −49°F)
62	23	Retarder temperature sensor failed high (178°C; 352°F)
62	32	Engine coolant sensor failed low
62	33	Engine coolant sensor failed high

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check the transmission fluid level.*

B. Troubleshooting:

NOTE: *A combination of codes 62 23, 33 23, and 21 23 indicates a problem with one of the branches of the common ground wire (wire 135) between the throttle and temperature sensors.*

NOTE: *Code 62 12 can be caused when the +5V power line (wire 124) is shorted to ground or open. Wire 124 also provides power for the OLS, TPS, RMR, sump temperature sensor, and shift selectors and is present in all three ECU connectors.*

1. Check the retarder temperature or engine coolant temperature with a DDR. If a DDR is not available, use the shift selector display to determine if the code is active (cycle the ignition on and off at least once since the code was logged to clear the code's active indicator). If a condition that is unreasonable for the current conditions exists, go to Step (3).
2. If Step (1) reveals that the extreme temperature indication is no longer present, the temperature limit could have been reached due to operational or ambient temperature extremes. Proceed cautiously as it is unlikely there is a sensor hardware fault.
3. Remove the connector at the ECU. Measure resistance between harness terminals T25 and T28 or between harness terminals V9 and V24. Compare resistance value to chart (see Figure 5–21) to see if reading is within expected operating range.
4. Disconnect the sensor connector and remove the connector at the ECU. Check the sensor and the ECU terminals for dirt, corrosion, and damage. Clean or replace as necessary.
5. Check the temperature sensor circuit for opens (code 62 23 or 62 33), shorts between wires, and short-to-ground (code 62 12 or 62 32). If a wiring problem is found, isolate and repair.
6. If no wiring problem is found, replace the retarder or engine coolant temperature sensor.
7. If the problem recurs, use a spare wire, if available, or provide a new wire (St. Clair P/N 200153 may be used for this purpose) for the retarder or engine coolant temperature circuit.

CODE 62 XX — RETARDER TEMPERATURE SENSOR

8. If the condition continues to recur, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

Code 63 00 is set when one of the two inputs for an input function Auxiliary Function Range Inhibit (Special) is in a different state (on or off) from the other input for longer than two minutes. When this condition is detected, code 63 00 is set. The transmission will not be inhibited in shifting from neutral to range.

Main Code	Subcode	Meaning
63	00	Auxiliary Function Range Inhibit (Special) inputs states are different
63	26	Kickdown input failed on (software version 8 only)
63	40	Service brake status failed on
63	41	Pump/pack and a neutral general purpose input

Subcode 26 is set when this function (Kickdown) is selected by calibration, the calibration designated input is active for a calibration time, and throttle position is less than the calibration value defined. The kickdown shift schedule is inhibited when subcode 26 is active. The service indicator will be turned on if it is selected by the calibration. The kickdown shift schedule is not inhibited, the code is cleared and the service indicator will be turned off if the kickdown input remains inactive for the calibration time period while throttle position is less than the calibration value. This diagnostic and code has been removed from software version 8A.

Subcode 40 is set when this function (Service Brake Status) is selected by calibration, and the specified input remains active for a calibration number of consecutive acceleration events. The service indicator will be turned on if it is selected by the calibration. A vehicle acceleration event is defined as an increase in transmission output speed from 1 rpm to a calibration value. The operation of the Automatic Neutral For Refuse Packer will be limited when this code is active. The active inhibit for this code is self-cleared and the service indicator will be turned off if the designated input for the Service Brake Status function becomes inactive.

Subcode 41 is set when the states of the calibration inputs are different for a calibration number of consecutive updates. The inputs in this case are Pump/Pack Enable and Automatic Neutral For Refuse Packer. The service display will also be turned ON if selected by calibration.

A. Active Indicator Clearing Procedure:

- Power down
- Manual — subcodes 26, 40, and 41
- Self-clearing — subcodes 26 and 40

B. Troubleshooting:

1. Code 63 00
 - a. Use the DDR to identify the two input wires programmed with Auxiliary Function Range Inhibit (Special). Inspect the input wiring, connectors, and switches to determine why the input states are different. Correct any problems which are found.
 - b. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.
2. Code 63 26

Inspect kickdown switch circuit.

CODE 62 XX — RETARDER TEMPERATURE SENSOR (*Figure 5-21*)

3. Code 63 40

Inspect service brake status switch circuit.

4. Use the DDR to identify the two wires associated with the input functions for Pump/Pack Enable and Automatic Neutral For Refuse Packer. Inspect the input wiring, connectors, and switches to determine why the input states are different. Correct problems which are found. There is further information on these input functions on pages H-25, H-26, H-29, and H-30.

CODE 62 XX — RETARDER TEMPERATURE SENSOR (Figure 5-21)

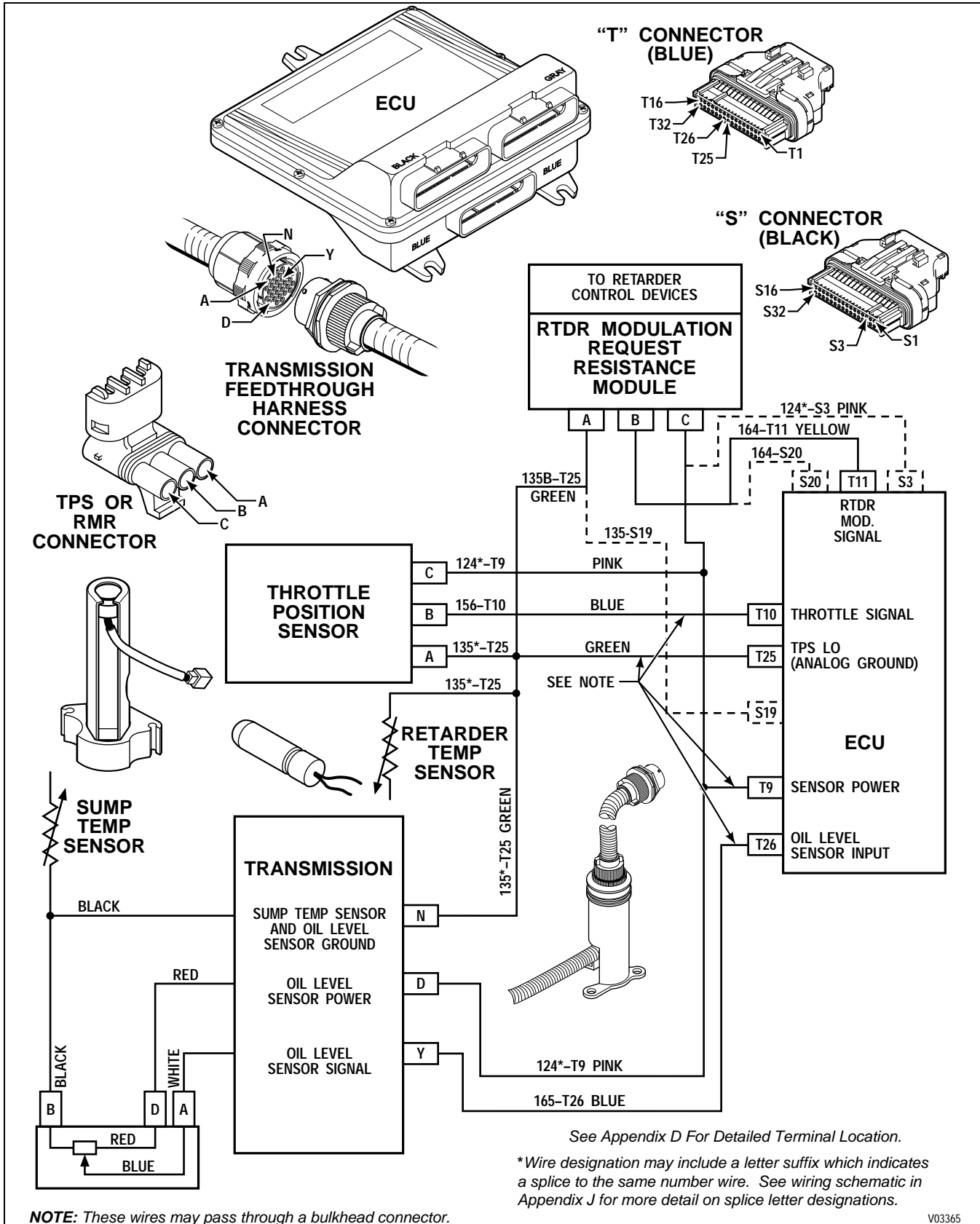


Figure 5-21. Code 64 Schematic Drawing

CODE 63 XX — INPUT FUNCTION FAULT

Main code 64 indicates the ECU has detected a voltage signal from the retarder modulation request sensor (consisting of a module and a retarder control device) in either the high or low error zone. These codes can be caused by faulty wiring, faulty connections to the resistance module or retarder control device, a faulty resistance module, a faulty retarder control device, or a faulty ECU. Power wire 124 and ground wire 135 for the retarder modulation request sensor are a common power and ground with the TPS and OLS devices. A short-to-ground on the common power wire causes a “sensor failed low” code for the other devices (codes 21 12, and 14 12). An open or a short-to-ground on retarder modulation request sensor signal wire 164 results in a code 64 12 only.

A TPS failure changes the status of the output retarder. The retarder is enabled by the Service Brake Status (wire 137) when a TPS code is active (21 XX). If a code 63 40 is also active, the Service Brake Status (wire 137) is ignored and the retarder will not work. Retarder response problems may not cause retarder modulation request sensor diagnostic codes. If response questions occur, test the retarder control devices for proper voltage signals at each of the percentage of retarder application settings. Table 5–8 contains the voltage measurements for each device’s application percentage and resistances measured across terminals A and C of the retarder request sensor. **Use test wiring harness J 41339 when conducting voltage tests.**

Main Code	Subcode	Meaning
64	12	Retarder Modulation Request sensor failed Low (14 counts and below)
64	23	Retarder Modulation Request sensor failed High (232 counts and above)

A. Active Indicator Clearing Procedure:

- Power down

NOTE: *Before troubleshooting, read Paragraph 5–6. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections can cause this and other electronic control codes.*

B. Troubleshooting:

NOTE: *Code 64 12 can be caused when the +5V power line (wire 124) is shorted to ground or open. Wire 124 also provides power for the OLS, TPS, sump temperature sensor, retarder temperature sensor, and shift selectors and is present in all three ECU connectors.*

1. Plug in the DDR and set to read retarder counts and percent (0 percent will be between 15 and 60 counts and 100 percent will be between 150 and 233 counts). A retarder request sensor failed high code can be caused by a short-to-battery of either signal wire 164 or power wire 124 or an open on ground wire 135. An open in the portion of the ground circuit common to the TPS and OLS devices will also result in a code 21 23 and a high fluid level reading. A retarder request sensor failed low code can be caused by an open or short-to-ground on either signal wire 164 or power wire 124.
2. Isolate and repair any wiring problems found.
3. If no wiring or connector problems are found, check the retarder request sensor voltages for each position on each of the retarder request sensors used on the vehicle. If two resistance modules are used, disconnect one of them when measuring voltage signals from the other. If problems are found, replace the resistance modules or retarder control devices.
4. If the problem persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT

Table 5–1. RMR Device Resistance Checks

Description	Resistance Check in Resistance Module*		Voltage Signal **		Wiring to Control Device
	Terminals	Resistance ± 5%	% Retarder Application	Voltage ± 0.2 v	Device Terminal
Auto Full On	A to C	12K	100	3.6	No connections
Pressure Switch Full On High	A to C	32K	0	1.1	A
			100	3.6	B
3-Step E-10R Bendix Pedal	A to C	32K	0	1.1	A
			32	1.9	B
			58	2.8	C
			100	3.6	D
6-Step Hand Lever — Off Position 1 Position 2 Position 3 Position 4 Position 5 Position 6	A to C	32K	0	1.1	+
			14	1.5	1
			28	1.9	2
			45	2.3	3
			65	2.8	4
			82	3.2	5
100	3.6	6			
Auto ½ On	A to C	12K	50	2.4	No connections
3 Pressure Switches — Low Medium High	A to C	32K	0	1.1	A
			32	1.9	B
			68	2.8	A
Auto ⅓ On 2 Pressure Switches Auto Medium High	A to C	21.4K	32	1.9	B
			68	2.8	A
			100	3.6	B
Dedicated Pedal	No Checks	Interface not a resistance module	0	0.7 – 1.2	A
			100	3.4 – 3.5	B C

* Resistance module must be disconnected from the wiring harness and retarder control devices
 ** These voltages must be measured between terminals A and B.

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT (Figure 5-22)

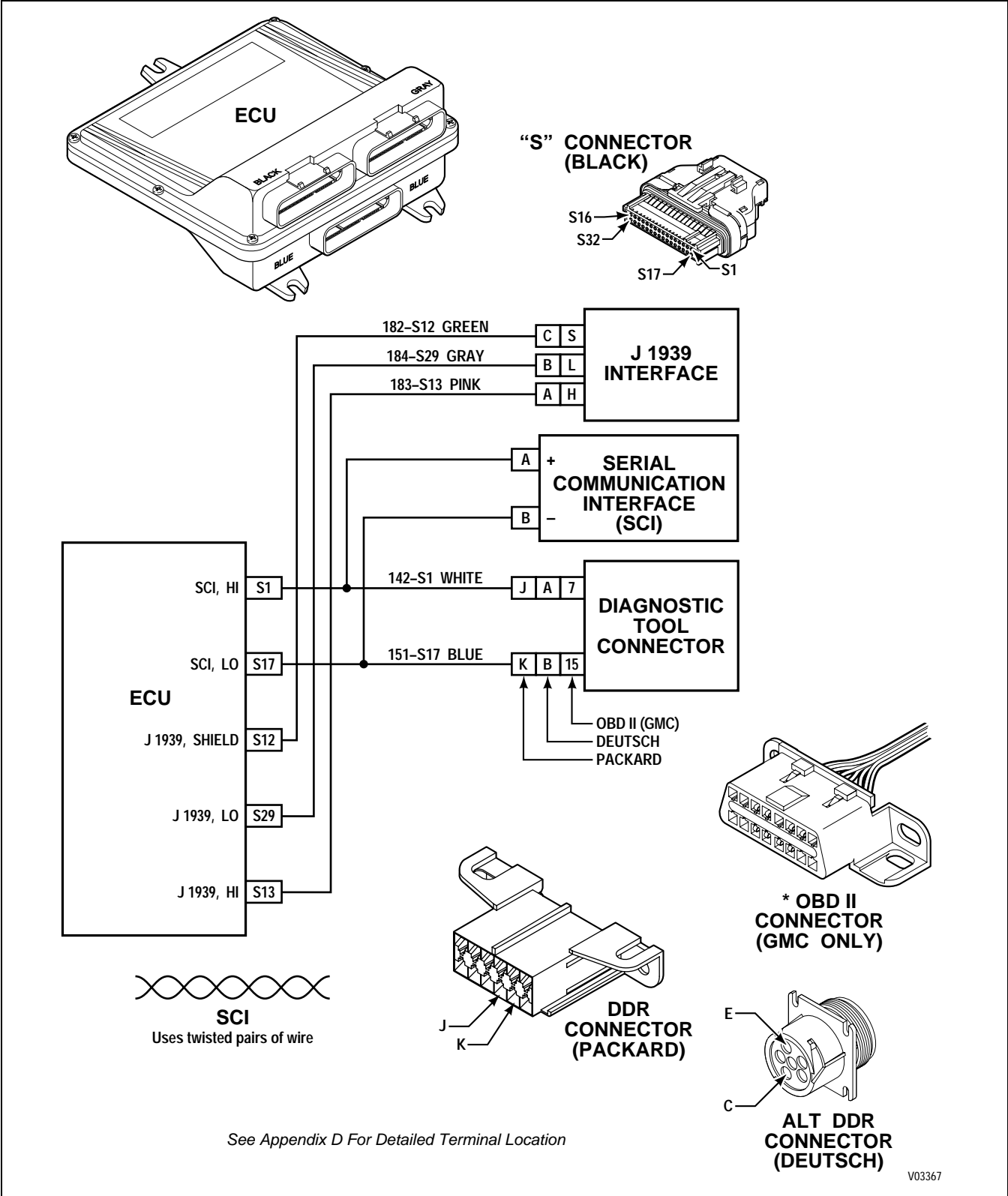


Figure 5-22. Code 66 Schematic Drawing

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT

The datalink for throttle sensor or engine coolant temperature must have been recognized by auto detect or manually selected using the Pro-Link® (see WTEC III Pro-Link® Manual) before these codes can be logged.

Main code 66 indicates the ECU is expecting to get its throttle position signal or engine coolant signal across a serial communication interface from a computer-controlled engine. Either the engine computer is not sending the throttle or engine coolant information or the wiring between the engine and transmission computers has failed.

Code 66 00 can occur when the transmission ECU remains powered when the engine ECM is powered down. The transmission sees this as a communication link failure.

Main Code	Subcode	Meaning
66	00	SCI (Serial Communication Interface) fault
66	11	SCI Engine coolant source fault

A. Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

B. Troubleshooting:

1. Check for a throttle signal or engine coolant signal from the engine to the transmission, an engine computer malfunction, an engine throttle fault, or an engine coolant fault.

NOTE: *Throttle position data sent from a computer-controlled engine may register a low number of counts on the DDR, but the counts will not change as throttle percentage is changed.*

2. Check wires 142 and 151 between the engine and transmission ECU for an open or short. Check that all connectors are clean and tightly connected.

NOTE: *These codes can also be set if J1939 communications fail. Check wires 183-S13, 184-S29, and 182-S12 for opens or shorts.*

3. Use the Pro-Link® to see if the ECU is receiving power when it should not.

CODE 65 XX — ENGINE RATING HIGH

Main code 65 indicates the vehicle's engine horsepower/governor speed rating is too high. This code is set only when computer-controlled engines are used. Code 65 means the engine computer is able to tell the transmission, the engine horsepower and/or governor speed is beyond the transmission rating or does not match the transmission shift calibration.

When a code 65 is set, no shifts out of neutral are allowed. It is possible the transmission calibration selected for this engine is improper. Contact local Allison Transmission Division distributor for assistance in selecting a proper calibration.

If the engine is beyond transmission ratings, contact the vehicle OEM for correction. The local ATD regional representative may also be contacted for assistance.

This code cannot be cleared until the proper level engine is installed or the transmission is properly calibrated.

CODE 66 XX — SCI (SERIAL COMMUNICATION INTERFACE) FAULT

Main code 69 indicates a problem which has been identified as being from within the ECU.

A “cateye” display or a blank display may occur with subcode 33.

Main Code	Subcode	Meaning
69	27	ECU, Inoperative A-Hi switch
69	28	ECU, Inoperative F-Hi switch
69	29	ECU, Inoperative N-Hi and H-Hi switch
69	33	ECU, computer operating properly timeout
69	34	ECU, write timeout
69	35	ECU, checksum
69	36	ECU, RAM self-check failure
69	39	Communication chip addressing error
69	41	ECU, I/O ASIC addressing test
69	42	SPI output failure
69	43	SPI input failure

A. Active Indicator Clearing Procedure:

- Power down
- Manual — except subcodes 33, 35, 36, 41, 42, and 43
- Self-clearing — subcode 42 and subcodes 33, 35, 36, and 41; after an ECU reset

NOTE: *Subcode 34 cannot be cleared.*

B. Troubleshooting:

1. For subcodes 27, 28, and 29, check for shorts to battery before replacing the ECU. Follow the troubleshooting steps for code 42 XX for checking shorts to battery. If no shorts are found, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the problem recurs, reinstall the new ECU to complete the repair.
2. For all other subcodes, replace the ECU.

APPENDICES

Appendix A	Identification of Potential Circuit Problems
Appendix B	Checking Clutch and Retarder Pressures
Appendix C	Solenoid and Clutch Chart
Appendix D	Wire/Connector Chart
Appendix E	Welding on Vehicle/Vehicle Interface Module
Appendix F	Diagnostic Tree — WT Series Hydraulic System
Appendix G	Pro-Link [®] 9000 Diagnostic Data Reader Information
Appendix H	Input/Output Function Wiring Schematics

APPENDIX A — IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

Intermittent codes are a result of faults that are detected, logged, and then disappear, only to recur later. If, when troubleshooting, a code is cleared in anticipation of it recurring and it does not, check the items in the following list for the fault's source.

A. Circuit Inspection

1. Intermittent power/ground problems — can cause voltage problems during ECU diagnostic checks which can set various codes depending upon where the ECU was in the diagnostic process.
2. Damaged terminals.
3. Dirty or corroded terminals.
4. Terminals not fully seated in the connector. Check indicated wires by uncoupling connector and gently pulling on the wire at the rear of the connector and checking for excessive terminal movement.
5. Connectors not fully mated. Check for missing or damaged locktabs.
6. Screws or other sharp pointed objects pushed into or through one of the harnesses.
7. Harnesses which have rubbed through and may be allowing intermittent electrical contact between two wires or between wires and vehicle frame members.
8. Broken wires within the braiding and insulation.

B. Finding an Intermittent Fault Condition

To find a fault, like one of those listed, examine all connectors and the external wiring harnesses. Harness routing may make it difficult to see or feel the complete harness. However, it is important to thoroughly check each harness for chafed or damaged areas. Road vibrations and bumps can damage a poorly installed harness by moving it against sharp edges and cause some of the faults. If a visual inspection does not identify a cause, move and wiggle the harness by hand until the fault is duplicated.

The next most probable cause of an intermittent code is an electronic part exposed to excessive vibration, heat, or moisture. Examples of this are:

1. Exposed harness wires subjected to moisture.
2. A defective connector seal allows moisture to enter the connector or part.
3. An electronic part (ECU, shift selector, solenoid, or throttle sensor) affected by vibration, heat, or moisture may cause abnormal electrical conditions within the part.

When troubleshooting Item 3, eliminate all other possible causes before replacing any parts.

Another cause of intermittent codes is good parts in an abnormal environment. The abnormal environment will usually include excessive heat, moisture, or voltage. For example, an ECU that receives excessive voltage will generate a diagnostic code as it senses high voltage in a circuit. The code may not be repeated consistently because different circuits may have this condition on each check. The last step in finding an intermittent code is to observe if the code is set during sudden changes in the operating environment.

Troubleshooting an intermittent code requires looking for common conditions that are present whenever the code is diagnosed.

APPENDIX A — IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

C. Recurring Conditions

A recurring condition might be:

- Rain
- Outside temperature above or below a certain temperature
- Only on right-hand or left-hand turns
- When the vehicle hits a bump, etc.

If such a condition can be related to the code, it is easier to find the cause. If the time between code occurrences is very short, troubleshooting is easier than if it is several weeks or more between code occurrences.

DIAGNOSTIC CODES

APPENDIX B — CHECKING CLUTCH AND RETARDER PRESSURES

Checking individual clutch pressures helps to determine if a transmission malfunction is due to a mechanical or an electrical problem. Properly making these pressure checks requires transmission and vehicle (or test stand) preparation, recording of data, and comparing recorded data against specifications provided. These instructions are for all WT Series transmissions.

NOTE: Check to see if there are diagnostic codes set which are related to the transmission difficulty you are evaluating. Proceed to make mechanical preparations for checking clutch pressures after codes have first been evaluated.

A. Transmission and Vehicle Preparation

1. Remove the plugs from the pressure tap locations where measurement is desired (refer to Figure B-1).

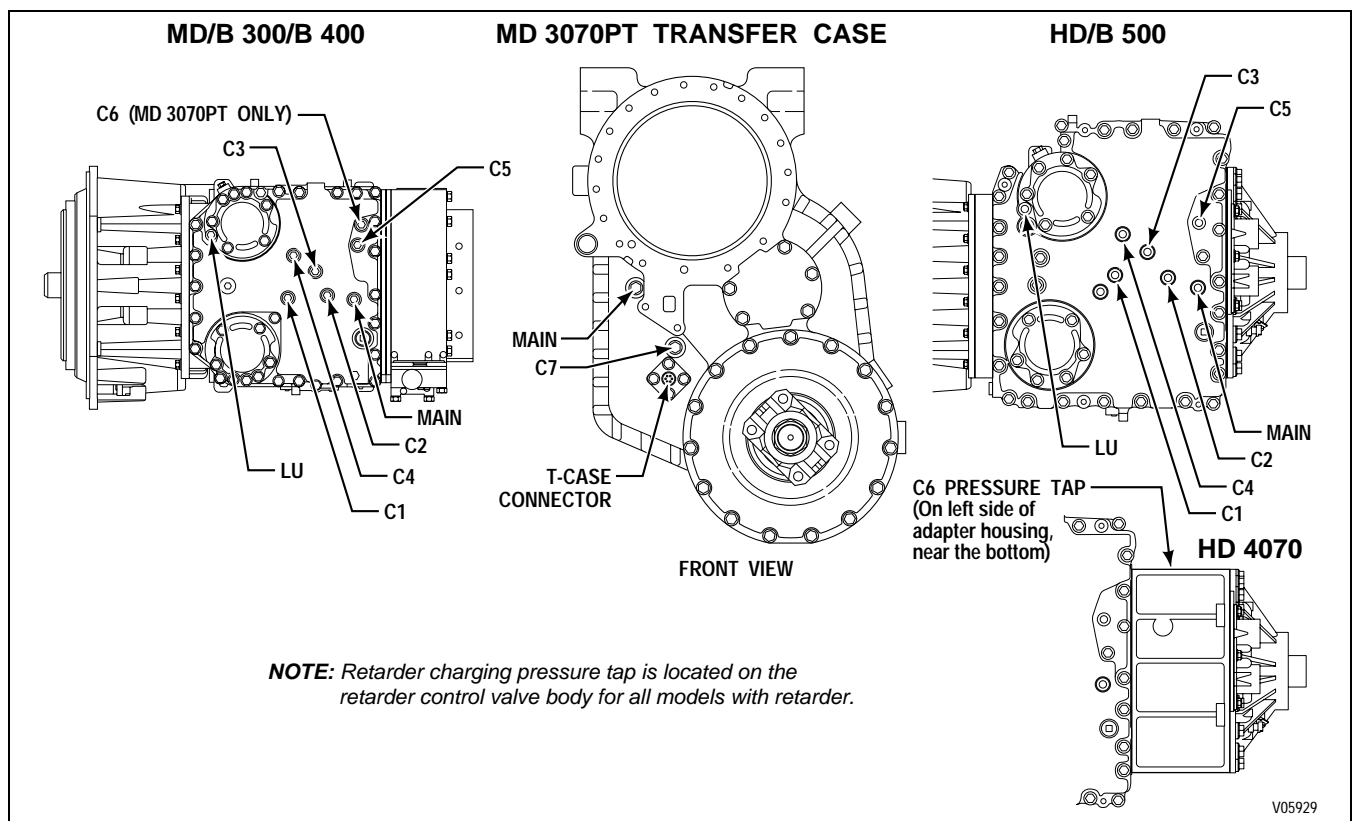


Figure B-1. Clutch Pressure Check Points

CAUTION: Be sure that the hydraulic fittings have the same thread as the plugs removed (7/16-20 UNF-2A). Also please note that these fittings must be straight thread, O-ring style. Failure to do this will result in damage to the control module.

2. Install hydraulic fittings suitable for attaching pressure gauges or transducers.
3. Connect pressure gauges or transducers. Pressure gauge set J 26417-A is available for this purpose. See Table B-2 for pressure levels expected.
4. Check that engine speed can be monitored (Pro-Link® 9000 diagnostic tool may be used for this purpose).

APPENDIX B — CHECKING CLUTCH AND RETARDER PRESSURES

5. Be sure that transmission sump fluid temperature can be measured (Pro-Link[®] 9000 diagnostic tool may be used for this purpose).
6. Be sure that the transmission has enough fluid for cold operation until an operating temperature fluid level can be set.
7. Bring the transmission to normal operating temperature of 71–93°C (160–200°F). Check for fluid leaks in the added pressure gauge/transducer lines. Repair leaks as needed. Be sure that fluid level is correct.

B. Recording Data

1. Use the Pro-Link[®] 9000 diagnostic tool, which allows checking of individual range clutch pressures, with the vehicle stationary. Consult Appendix G or the Pro-Link[®] 9000 operating instructions for Action Request and select Clutch Test Mode. Follow instructions to check clutch pressures in individual ranges.

NOTE: *Check lockup clutch pressure by driving the vehicle in a range where lockup can be obtained. Record the pressure values at the engine speed and sump fluid temperature values shown in Table B–1. The lockup clutch is functioning correctly when engine speed and turbine speed values are equal as recorded from the Pro-Link[®] 9000.*

2. Consult Table B–1 and locate the transmission model that you are testing.
3. Operate the transmission at the conditions shown in Table B–1 and record engine speed, transmission sump fluid temperature, main hydraulic pressure, and clutch pressures in the ranges where a problem is suspected.

Table B–1. Clutch Pressure Test Conditions

Transmission Model/ Test Type	Engine rpm	Sump Fluid Temperature	Range	Clutches Pressurized
All (except MD 3070) — Idle Check	580–620	71–93°C (160–200°F)	Neutral Reverse 1C 2C (2nd range start)	C5 C3 C5 C1 C5 C1 C4
MD 3070 — Idle Check	580–620	71–93°C (160–200°F)	Neutral Reverse LowC 1C	C5 C3 C5 C3 C6 C1 C5
MD (except 3070) B 300/B 400 — High Speed	2080–2120	71–93°C (160–200°F)	Reverse Neutral 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU

APPENDIX B — CHECKING CLUTCH AND RETARDER PRESSURES

Table B-1. Clutch Pressure Test Conditions (Continued)

Transmission Model/ Test Type	Engine rpm	Sump Fluid Temperature	Range	Clutches Pressurized
MD 3070 — High Speed	2080–2120	71–93°C (160–200°F)	Reverse Neutral LowC 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C3 C6 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU
HD/B 500 — High Speed	1780–1820	71–93°C (160–200°F)	Reverse Neutral LowC** 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C1 C6 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU
** Only applies to HD 4070.				

C. Comparing Recorded Data to Specifications

1. Be sure that engine speed and transmission sump fluid temperatures were within the values specified in Table B-1.
2. Compare the main pressure and clutch pressure data, recorded in Step B, with the specifications in Table B-2.
3. If clutch pressures are within specifications, return the transmission and vehicle to their original configuration and proceed with electrical troubleshooting.
4. If clutch pressures are not within specification, take corrective action to replace the internal parts of the transmission necessary to correct the problem. (Refer to the Transmission Service Manual for the model being checked.)
5. Recheck pressure values after the transmission has been repaired.
6. Return the transmission to its original configuration. (Remove instrumentation and reinstall any components removed for the pressure testing.)

**Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1)**

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa [psi]	Range Clutch Press. Spec* kPa [psi]	Conv. Out Press. Spec kPa [psi]	Lube Press. Spec kPa [psi]	LU Clutch Press. Spec* kPa [psi]	D'BOX MAIN Press. Spec* kPa [psi]
MD — Idle (except 3070)	580–620	Neutral	C5	1400–2000 [203–290]	0–40 (C5) [0–5.8]		—		
		Reverse	C3 C5	1400–2000 [203–290]	0–40 (C3 And C5) [0–5.8]		3.5 min. [0.5 min.]		
		1C	C1 C5	1300–1970 [189–286]	0–70 (C1) [0–10] 0–40 (C5) [0–5.8]		3.5 min. [0.5 min.]		
		2C	C1 C4	1300–1970 [189–286]	0–70 (C1) [0–10] 0–40 (C4) [0–5.8]		3.5 min. [0.5 min.]		
MD 3070 — Idle		Neutral	C5	1400–2000 [203–290]	0–40 (C5) [0–5.8]		—		1400–2000 [203–290]
		Reverse	C3 C5	1400–2000 [203–290]	0–40 (C3 And C5) [0–5.8]		3.5 min. [0.5 min.]		1400–2000 [203–290]
		LowC	C3 C6	1300–1970 [189–286]	0–40 (C3 And C6) [0–5.8]		3.5 min. [0.5 min.]		1300–1970 [189–286]
		1C	C1 C5	1300–1970 [189–286]	0–70 (C1) [0–10] 0–40 (C5) [0–5.8]		3.5 min. [0.5 min.]		1300–1970 [189–286]
MD — High Speed (except 3070)	2080–2120	Neutral	C5	1825–1965 [265–285]	0–40 (C5) [0–5.8]	310–410 [45–60]	150–190 [22–28]		
		Reverse	C3 C5	1825–1965 [265–285]	0–40 (C3 And C5) [0–5.8]	310–410 [45–60]	150–190 [22–28]		
		1C	C1 C5	1550–1690 [225–245]	0–70 (C1) [0–10] 0–40 (C5) [0–5.8]	310–410 [45–60]	150–190 [22–28]		

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

**Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (Continued)**

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa [psi]	Range Clutch Press. Spec* kPa [psi]	Conv. Out Press. Spec kPa [psi]	Lube Press. Spec kPa [psi]	LU Clutch Press. Spec* kPa [psi]	D'BOX MAIN Press. Spec* kPa [psi]
MD — High Speed (except 3070) (<i>cont'd</i>)	2080-2120	2C	C1 C4	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		2L	C1 C4 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		3C	C1 C3	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		3L	C1 C3 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		4C	C1 C2	1550-1690 [225-245]	0-70 (C1) [0-10] 0-70 (C2) [0-10]	310-410 [45-60]	150-190 [22-28]		
		4L	C1 C2 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-70 (C2) [0-10]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		5C	C2 C3	1550-1690 [225-245]	0-70 (C2) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		5L	C2 C3 LU	1100-1240 [160-180]	0-70 (C2) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		6C	C2 C4	1550-1690 [225-245]	0-70 (C2) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		6L	C2 C4 LU	1100-1240 [160-180]	0-70 (C2) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

**Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (Continued)**

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa [psi]	Range Clutch Press. Spec* kPa [psi]	Conv. Out Press. Spec kPa [psi]	Lube Press. Spec kPa [psi]	LU Clutch Press. Spec* kPa [psi]	D'BOX MAIN Press. Spec* kPa [psi]
MD 3070 — High Speed	2080-2120	Neutral	C5	1825-1965 [265-285]	0-40 (C5) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		Reverse	C3 C5	1825-1965 [265-285]	0-40 (C3 And C5) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		LowC	C3 C6	1550-1690 [225-245]	0-40 (C3 And C6) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		1C	C1 C5	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C5) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		2C	C1 C4	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		2L	C1 C4 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	1440-1700 [209-247]
		3C	C1 C3	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		3L	C1 C3 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	1440-1700 [209-247]
		4C	C1 C2	1550-1690 [225-245]	0-70 (C1 And C2) [0-10]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		4L	C1 C2 LU	1100-1240 [160-180]	0-70 (C1 And C2) [0-10]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	1440-1700 [209-247]
		5C	C2 C3	1550-1690 [225-245]	0-70 (C2) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

**Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (Continued)**

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa [psi]	Range Clutch Press. Spec* kPa [psi]	Conv. Out Press. Spec kPa [psi]	Lube Press. Spec kPa [psi]	LU Clutch Press. Spec* kPa [psi]	D'BOX MAIN Press. Spec* kPa [psi]
MD 3070 — High Speed (cont'd)	2080-2120	5L	C2 C3 LU	1100-1240 [160-180]	0-70 (C2) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	1440-1700 [209-247]
		6C	C2 C4	1550-1690 [225-245]	0-70 (C2) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]		1440-1700 [209-247]
		6L	C2 C4 LU	1100-1240 [160-180]	0-70 (C2) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	1440-1700 [209-247]
HD — Idle	580-620	Neutral	C5	1400-2000 [203-290]	0-40 (C5) [0-5.8]		—		
		Reverse	C3 C5	1400-2000 [203-290]	0-40 (C3 And C5) [0-5.8]		3.5 min. [0.5 min.]		
		IC	C1 C5	1300-1970 [189-286]	0-70 (C1) [0-10] 0-40 (C5) [0-5.8]		3.5 min. [0.5 min.]		
HD — High Speed	1780-1820	2C	C1 C4	1300-1970 [189-286]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]		3.5 min. [0.5 min.]		
		Neutral	C5	1825-1965 [265-285]	0-40 (C5) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		Reverse	C3 C5	1825-1965 [265-285]	0-40 (C3 And C5) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
HD — High Speed	1780-1820	LowC**	C3 C6	1550-1690 [225-245]	0-40 (C3 And C6) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		IC	C1 C5	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C5) [0-5.8]	310-410 [45-60]	150-190 [22-28]		

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

** HD 4070 Only.

**Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (Continued)**

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa [psi]	Range Clutch Press. Spec* kPa [psi]	Conv. Out Press. Spec kPa [psi]	Lube Press. Spec kPa [psi]	LU Clutch Press. Spec* kPa [psi]	D'BOX MAIN Press. Spec* kPa [psi]
HD — High Speed (cont'd)	1780-1820	2C	C1 C4	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		2L	C1 C4 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		3C	C1 C3	1550-1690 [225-245]	0-70 (C1) [0-10] 0-40(C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		3L	C1 C3 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		4C	C1 C2	1550-1690 [225-245]	0-70 (C1) [0-10] 0-70 (C2) [0-10]	310-410 [45-60]	150-190 [22-28]		
		4L	C1 C2 LU	1100-1240 [160-180]	0-70 (C1) [0-10] 0-70 (C2) [0-10]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		5C	C2 C3	1550-1690 [225-245]	0-70 (C2) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		5L	C2 C3 LU	1100-1240 [160-180]	0-70 (C2) [0-10] 0-40 (C3) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	
		6C	C2 C4	1550-1690 [225-245]	0-70 (C2) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]		
		6L	C2 C4 LU	1100-1240 [160-180]	0-70 (C2) [0-10] 0-40 (C4) [0-5.8]	310-410 [45-60]	150-190 [22-28]	0-60 [0-8.7]	

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

APPENDIX B — CHECKING CLUTCH AND RETARDER PRESSURES

D. Retarder Pressure Checks — MD/B 300/B 400 And HD/B 500

1. MD 3060/3066, B 300, B 400 Test Conditions:

Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 1075–1125 rpm

2. MD 3560 Test Conditions:

Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 1350–1400 rpm

Table B–3. Retarder Specifications At Above Test Conditions

Parameter To Check	High Capacity	Medium Capacity	Low Capacity
Main Pressure–kPa [psi]	1200–1260 [174–183]	1200–1260 [174–183]	1200–1260 [174–183]
Retarder Charge Pressure–kPa [psi]	250–370 [36–54]	215–280 [31–41]	140–240 [20–35]
Cooler In Pressure–kPa [psi]	250–340 [36–49]	210–300 [30–44]	140–255 [20–37]
Cooler In Temperature–°C [°F]	150 [300] Max (Ref)	150 [300] Max (Ref)	150 [300] Max (Ref)

3. HD 4060/4070/B 500 Test Conditions:

Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 800–850 rpm

4. HD 4560 Test Conditions:

Second Range Lockup, 100 Percent Retarder Apply, Input Speed = 965–1015 rpm

Table B–4. Retarder Specifications At Above Test Conditions

Parameter To Check	High Capacity	Medium Capacity	Low Capacity
Main Pressure–kPa [psi]	1120–1270 [162–184]	1120–1270 [162–184]	1120–1270 [162–184]
Retarder Charge Pressure–kPa [psi]	375–480 [54–70]	345–450 [50–65]	325–420 [47–61]
Cooler In Pressure–kPa [psi]	360–530 [52–77]	310–510 [45–74]	290–480 [42–70]
Cooler In Temperature–°C [°F]	150 [300] Max (Ref)	150 [300] Max (Ref)	150 [300] Max (Ref)

APPENDIX B — CHECKING CLUTCH AND RETARDER PRESSURES

APPENDIX C — SOLENOID AND CLUTCH CHART

BASIC CONFIGURATION

Range	Solenoid Non-Latching Modulating							Clutches					
	A N/O	B N/O	C N/C	D N/C	E N/C	F N/C	G N/C	C1	C2	C3	C4	C5	LU
6	X			X		0			Y		Y		0
5	X		X			0	X		Y	Y			0
4						0	X	Y	Y				0
3		X	X			0	X	Y		Y			0
2		X		X		0	X	Y			Y		0
1		X			X	0		Y				Y	0
N1	X	X		*	X	0					*	Y	0
NVL	X	X		X	X						Y	Y	
N2	X	X		X							Y		
N3	X	X	X							Y			
N4	X	X		X							Y		
R	X	X	X		X						Y		Y

NOTE: See Page C-2 for legend.

7-SPEED CONFIGURATION (MD 3070 AND HD 4070)

Range	Solenoid Non-Latching Modulating										Clutches								
	N/O	N/O	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C									
	C1	C2	C3	C4	C5	LU	FWD	LOW	C6	DIF	C1	C2	C3	C4	C5	LU	C6	DIF	
	A	B	C	D	E	F	G	N	J	H									
6	X			X		0				0		Y		Y		0			0
5	X		X			0	X			0		Y	Y			0			0
4						0	X			0	Y	Y				0			0
3		X	X			0	X			0	Y		Y			0			0
2		X		X		0	X			0	Y			Y		0			0
1		X			X	0				0	Y				Y	0			0
LO	X					0	X	X	X	0			Y			0	Y		0
N1	X	X		*	X					0					Y				0
N2	X	X		X			X			0				Y					0
N3	X	X	X				X			0			Y						0
N4	X	X		X			X			0				Y					0
R	X	X	X		X					0			Y		Y				0

NOTE: See Page C-2 for legend.

APPENDIX C — SOLENOID AND CLUTCH CHART

LEGEND

- X Indicates solenoid is electrically ON.
- Y Indicates clutch is hydraulically applied.
- Blank Indicates solenoid is electrically OFF or clutch is not hydraulically applied.
- 0 Optional ON or OFF.
- * See NVL explanation below.
- NVL** **As a diagnostic response:**
If Turbine Speed is below 150 rpm when Output Speed is below 100 rpm and Engine Speed is above 400 rpm, Neutral Very Low (**NVL**) is commanded when **N1** (Neutral) is the selected range. **NVL** is achieved by turning D solenoid “on” in addition to E solenoid being “on,” which locks the output. Otherwise, D solenoid is turned off in **N1** (Neutral).

APPENDIX D — WIRE/CONNECTOR CHART

The connector information in this appendix is provided for the convenience of the servicing technician. The connector illustration and pin identifications for connection to Allison Transmission components will be accurate. Allison Transmission components are the ECU, speed sensors, retarder connectors, transmission connectors, and shift selectors. Other kinds of connectors for optional or customer-furnished components are provided based on typical past practice for an Allison-designed system.

Contact St. Clair Technologies, Inc. or your vehicle manufacturer for information on connectors not found in this appendix.

NOTE: *The following abbreviation guide should be used to locate connector termination points for wires in the WTEC III wiring harness(es).*

Table D-1. Appendix D Abbreviation Guide

Termination Point Abbreviation	Connector Name
AGND	Analog Ground
ASOL	Solenoid A — Transmission Control Module
BSOL	Solenoid B — Transmission Control Module
C3PS	C3 Pressure Switch — Control Module
CSOL	Solenoid C — Transmission Control Module
DDRD	Diagnostic Connector — Deutsch
DDRP	Diagnostic Connector — Packard
DSOL	Solenoid D — Transmission Control Module
ECU-S	Electronic Control Unit — Selector (S) Connector
ECU-S	Electronic Control Unit — Vehicle (V) Connector
ECU-T	Electronic Control Unit — Transmission (T) Connector
ESOL	Solenoid E — Transmission Control Module
GSOL	Solenoid F — Transmission Control Module
GSOL	Solenoid G — Transmission Control Module
HSOL	Retarder H Solenoid — Retarder Housing Or Retarder Valve Body
J1939	J1939 Datalink From ECU Selector (S) Harness
JSOL	Solenoid J — Transmission Control Module (7-Speed Only)
NE	Engine Speed Sensor
NO	Output Speed Sensor
NSOL	Retarder Accumulator Solenoid
NSOL	Solenoid N — Transmission Control Module (7-Speed Only)
NT	Turbine Speed Sensor
OBDII	Diagnostic Connector — GMC On Board Diagnostics
OLS	Oil Level Sensor
PSS	Primary Shift Selector
RMOD	Retarder Module (Units Built Prior To 1/98)
RMR	Retarder Modulation Request Device
RNGTRM	Chassis Ground Ring Terminal
RTEMP	Retarder Temperature — Retarder Housing

APPENDIX D — WIRE/CONNECTOR CHART

Table D-1. Appendix D Abbreviation Guide (Continued)

Termination Point Abbreviation	Connector Name
SCI	Serial Communication Interface
SSS	Secondary Shift Selector
TCASE	MD 3070 Transfer Case
TPS	Throttle Position Sensor
TRANS	Transmission Feedthrough Harness
VIM	Vehicle Interface Module
VIWS	Vehicle Interface Wiring — ECU Selector (S) Harness
VIWV	Vehicle Interface Wiring — ECU Vehicle (V) Harness

APPENDIX D — WIRE/CONNECTOR CHART

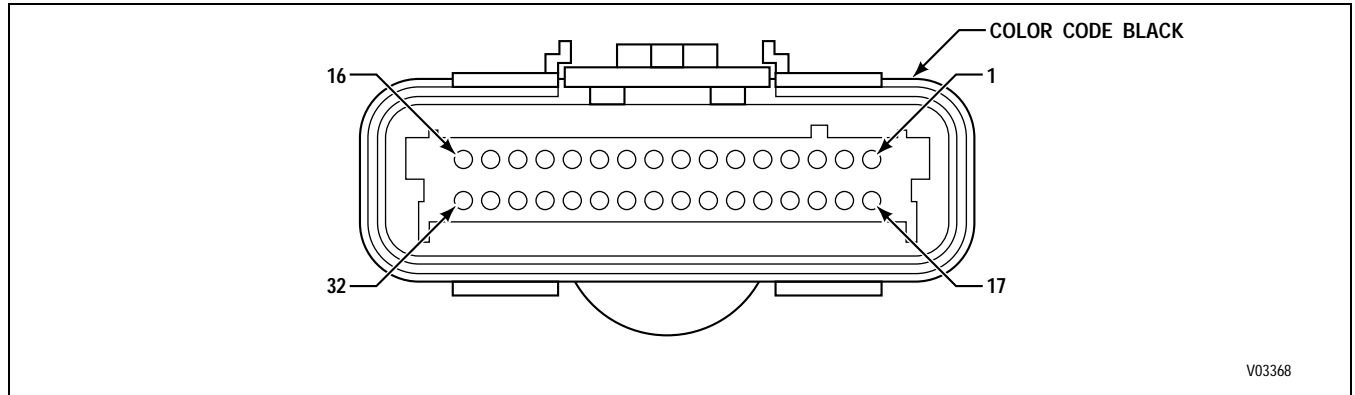


Figure D-1. ECU Connector “S”

ECU CONNECTOR “S” (BLACK)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1	White	142-S1	Serial Communication Interface, High	DDRP-J, DDRD-A, OBDII-7
2	Tan	159-S2	Diagnostic Communication Link (ISO9141)	VIWS-A
3	Pink	124-S3	Sensor Power	RMR-C, PSS-N, SSS-N
4	Yellow	146-S4	Ignition Sense	VIWS-E, DDRP-H, DDRD-C, OBDII-16
5	Orange	170-S5	Primary Shift Selector, Data Bit 1	PSS-A
6	Green	171-S6	Primary Shift Selector, Data Bit 2	PSS-B
7	Blue	172-S7	Primary Shift Selector, Data Bit 4	PSS-C
8	Yellow	173-S8	Primary Shift Selector, Data Bit 8	PSS-D
9	Tan	174-S9	Primary Shift Selector, Parity	PSS-E
10	Green	175-S10	Shift Selector Mode Input	PSS-M, SSS-M
11	Yellow	119-S11	General Purpose Input 4	VIWS-M
12	Green	182-S12	CAN Controller Shield (J1939)	J1939C
13	Pink	183-S13	CAN Controller, High (J1939)	J1939A
14	Blue	180-S14	Shift Selector Display	PSS-S, SSS-S
15	Orange	176-S15	General Purpose Output 6	PSS-L, SSS-L, VIWS-L
16	Pink	136-S16	Battery Power	PSS-R, SSS-R
17	Blue	151-S17	Serial Communication Interface, Low	DDRP-K, DDRD-B, OBDII-15
18	Tan	166-S18	General Purpose Output 7	VIWS-N
19	Green	135-S19	Analog Ground	RMR-A
20	Yellow	164-S20	Retarder Modulation Request	RMR-B
21	Orange	190-S21	Secondary Shift Selector, Data Bit 1	SSS-A
22	Green	191-S22	Secondary Shift Selector, Data Bit 2	SSS-B
23	Blue	192-S23	Secondary Shift Selector, Data Bit 4	SSS-C
24	Yellow	193-S24	Secondary Shift Selector, Data Bit 8	SSS-D
25	Tan	194-S25	Secondary Shift Selector, Parity	SSS-E
26	Blue	169-S26	General Purpose Input 12	VIWS-S
27	Blue	163-S27	General Purpose Input 6	VIWS-R
28	Yellow	126-S28	General Purpose Input 9	VIWS-C
29	Gray	184-S29	CAN Controller, Low (J1939)	J1939-B
30	Tan	157-S30	Vehicle Speed	VIWS-D
31	Green	115-S31	Check Transmission	VIWS-B
32	Gray	143-S32	Battery Ground	PSS-P, SSS-P, VIWS-P, DDRP-A, DDRD-E, OBDII-5

APPENDIX D — WIRE/CONNECTOR CHART

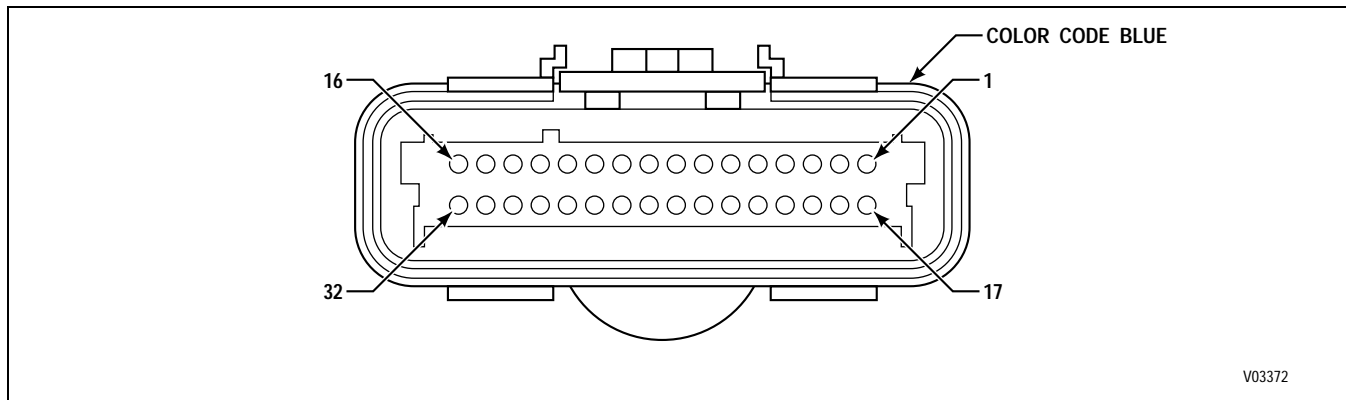


Figure D-2. ECU Connector "T"

ECU CONNECTOR "T" (BLUE)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1	Orange	102-T1	Solenoid Power, Solenoids A, D, and J (MD 3070 only)	TRANS-A
2	Tan	121-T2	Solenoid Power, Solenoids B and E	TRANS-H
3	Green	107-T3	Solenoid Power, Solenoid F	TRANS-E
4	White	120-T4	A Solenoid, Low	TRANS-G
5	Green	103-T5	C Solenoid, Low	TRANS-B
6	Tan	129-T6	E Solenoid, Low	TRANS-K
7	White	104-T7	G Solenoid, Low	TRANS-C
8	Blue	111-T8	J Solenoid, Low	TRANS-e
9	Pink	124-T9	Sensor Power	TRANS-D, TPS-C, RMR-C
10	Blue	156-T10	Throttle Position Sensor	TPS-B
11	Yellow	164-T11	Retarder Modulation Request	RMR-B
12	White	162-T12	C3 Pressure Switch Input	TRANS-X
13	Yellow	195-T13	Transmission Identification	TRANS-W
14	Tan	141-T14	Engine Speed Sensor, High	NE-A
15	Orange	149-T15	Turbine Speed Sensor, High	NT-A (HD), TRANS-V (MD)
16	Yellow	139-T16	Output Speed Sensor, High	NO-A, TCASE-C (MD 3070), RMOD-C (MDR)
17	Yellow	130-T17	Solenoid Power, Solenoids C and G	TRANS-L
18				
19	Yellow	116-T19	Solenoid Power, Solenoids H and N	HSOL-B, NSOL-B, TRANS-g, TCASE-B (MD 3070), RMOD-B (MDR)
20	Orange	128-T20	B Solenoid, Low	TRANS-J
21	Blue	131-T21	D Solenoid, Low	TRANS-M
22	White	110-T22	F Solenoid, Low	TRANS-F
23	White	127-T23	H Solenoid, Low	HSOL-A (HD), RMOD-A (MDR), TCASE-A (MD 3070)
24	Blue	101-T24	N Solenoid, Low	NSOL-A (HD and MD), TRANS-f (MD 3070)
25	Green	135-T25	Analog Ground	RMR-A, RTEMP-B (HD), RMOD-F (MD)
26	Blue	165-T26	Oil Level Sensor Input	TRANS-Y
27	Tan	147-T27	Sump Temperature Sensor Input	TRANS-P
28	Orange	138-T28	Retarder Temperature Sensor Input	RTEMP-A (HD), RMOD-E (MD)
29				
30	Orange	150-T30	Engine Speed Sensor, Low	NE-B
31	Blue	140-T31	Turbine Speed Sensor, Low	NT-B, TRANS-U (MD)
32	Green	148-T32	Output Speed Sensor, Low	NO-B, TCASE-D (MD 3070), RMOD-D (MDR)

APPENDIX D — WIRE/CONNECTOR CHART

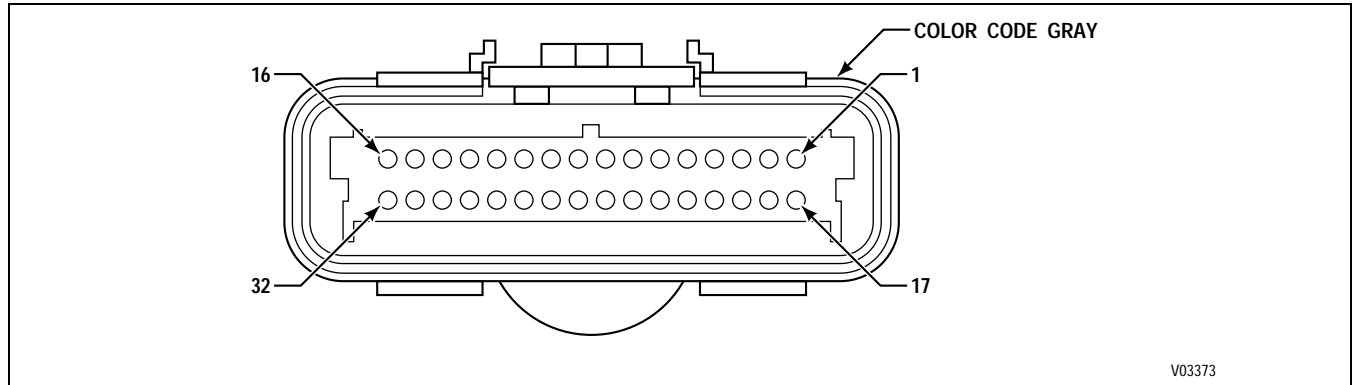


Figure D-3. ECU Connector "V"

ECU CONNECTOR "V" (GRAY)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1	Pink	136-V1	Battery Power	VIM-E1
2	White	114-V2	General Purpose Output 1	VIM-F3
3	Orange	132-V3	General Purpose Output 2	VIM-B1
4	White	113-V4	Reverse Warning	VIM-F2
5	White	167-V5	General Purpose Output 8	VIWV-V
6	Tan	123-V6	Neutral Start	VIM-D1
7				
8	Pink	124-V8	Sensor Power	TPS-C
9	Blue	179-V9	Engine Water Temperature	VIWV-M
10	Blue	156-V10	Throttle Position Sensor	TPS-B
11	Green	155-V11	General Purpose Input 1	VIWV-A
12	Yellow	153-V12	General Purpose Input 2	VIWV-B
13	Blue	118-V13	General Purpose Input 3	VIWV-C
14	Tan	177-V14	General Purpose Input 10	VIWV-S
15				
16	Pink	136-V16	Battery Power	VIM-E2
17	Gray	143-V17	Battery Ground	VIM-A1
18	White	125-V18	General Purpose Output 4	VIM-C2
19	Green	105-V19	General Purpose Output 5	VIWV-E
20	Tan	157-V20	Vehicle Speed	VIM-B2
21				
22	Tan	112-V22	General Purpose Output 3	VIM-D2
23				
24	Green	135-V24	Analog Ground	TPS-A, VIWV-N
25	Gray	144-V25	Chassis Ground	RNGTRM
26	Yellow	146-V26	Ignition Sense	VIM-F1
27	White	154-V27	General Purpose Input 5	VIWV-D
28	Orange	178-V28	General Purpose Input 11	VIWV-R
29	Orange	137-V29	General Purpose Input 7	VIWV-U
30	Green	117-V30	General Purpose Input 8	VIWV-P
31	Yellow	161-V31	Digital Ground (GPI)	VIWV-L
32	Gray	143-V32	Battery Ground	VIM-A2

APPENDIX D — WIRE/CONNECTOR CHART

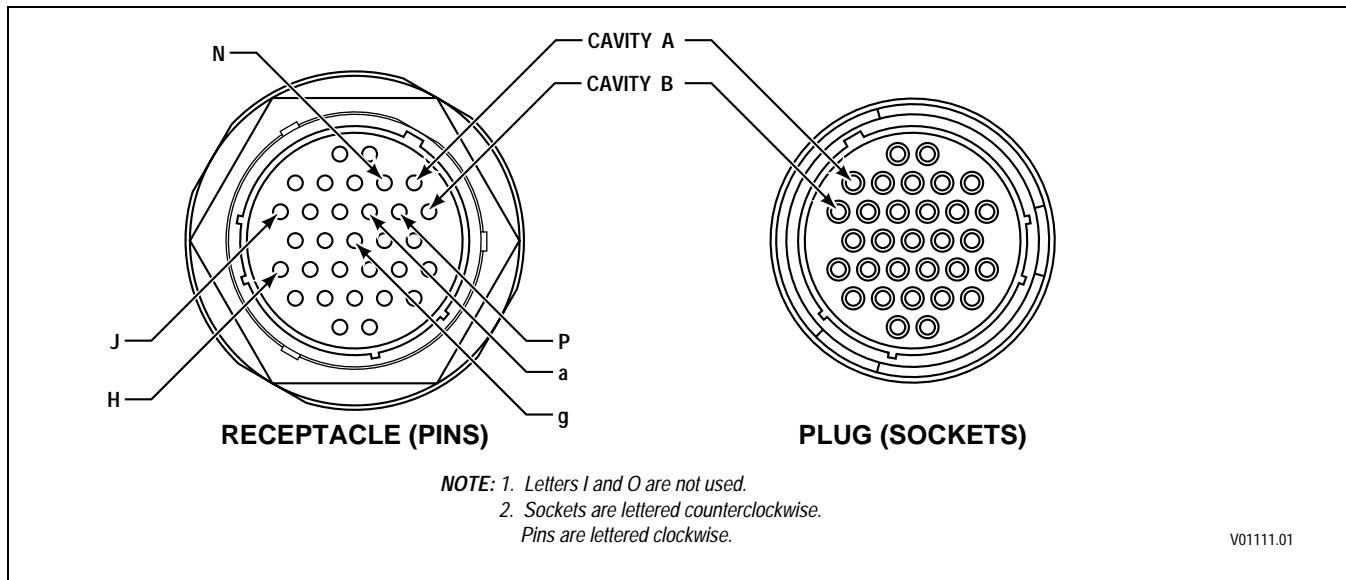


Figure D-4. Deutsch Bulkhead Connector, ECD

BULKHEAD CONNECTOR FOR “S” HARNESS (Plug With Sockets, Receptacle With Pins)

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Tan	159-S2	Diagnostic Communication Link (ISO 9141)	ECU-S2, VIWS-A
B	Green	115-S31	Check Transmission	ECU-S31, VIWS-B
C	Yellow	126-S28	General Purpose Input 9	ECU-S28, VIWS-C
D	Pink	124-S3	Sensor Power	ECU-S3, RMR-C, PSS-N, SSS-N
E	Yellow	146-S4	Ignition Sense	ECU-S4, VIWS-E, DDRP-H, DDRD-C, OBDII-16
F	Orange	170-S5	Primary Shift Selector, Data Bit 1	ECU-S5, PSS-A
G	Pink	136-S16	Battery Power	ECU-S16, PSS-R, SSS-R
H	White	142-S1	Serial Communication Interface, High	ECU-S1, DDRP-J, DDRD-A, OBDII-7, SCI-A
J	Blue	172-S7	Primary Shift Selector, Data Bit 4	ECU-S7, PSS-C
K	Blue	151-S17	Serial Communication Interface, Low	ECU-S17, DDRP-K, DDRD-B, OBDII-15, SCI-B
L	Orange	176-S15	General Purpose Output 6	ECU-S15, PSS-L, SSS-L, VIWS-L
M	Yellow	119-S11	General Purpose Input 4	ECU-S11, VIWS-M
N	Green	135-S19	Analog Ground	ECU-S19, RMR-A
P	Gray	143-S32	Battery Ground	ECU-S32, PSS-P, SSS-P, VIWS-P, DDRP-A, DDRD-E, OBDII-5
Q	Green	171-S6	Primary Shift Selector, Data Bit 2	ECU-S6, PSS-B
R	Blue	163-S27	General Purpose Input 6	ECU-S27, VIWS-R
S	Yellow	173-S8	Primary Shift Selector, Data Bit 8	ECU-S8, PSS-D
T	Tan	174-S9	Primary Shift Selector, Parity	ECU-S9, PSS-E
U	Green	175-S10	Shift Selector Mode Input	ECU-S10, PSS-M, SSS-M
V	Blue	180-S14	Shift Selector Display	ECU-S14, PSS-S, SSS-S
W	Tan	166-S18	General Purpose Output 7	ECU-S18, VIWS-N
X	Blue	169-S26	General Purpose Input 12	ECU-S26, VIWS-S
Y	Orange	190-S21	Secondary Shift Selector, Data Bit 1	ECU-S21, SSS-A

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

BULKHEAD CONNECTOR FOR “S” HARNESS (Plug With Sockets, Receptacle With Pins) (Contin-

Terminal No.*	Color	Wire No.	Description	Termination Points*
Z				
a	Yellow	164-S20	Retarder Modulation Request	ECU-S20, RMR-B
b	Green	191-S22	Secondary Shift Selector, Data Bit 2	ECU-S22, SSS-B
c	Blue	192-S23	Secondary Shift Selector, Data Bit 4	ECU-S23, SSS-C
d	Tan	157-S30	Vehicle Speed	ECU-S30, VIWS-D
e	Yellow	193-S24	Secondary Shift Selector, Data Bit 8	ECU-S24, SSS-D
f	Tan	194-S25	Secondary Shift Selector, Parity	ECU-S25, SSS-E
g				

BULKHEAD CONNECTOR FOR “T” HARNESS (Receptacle With Sockets, Plug With Pins)

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Orange	102-T1	Solenoid Power, Solenoids A, D, and J (MD 3070 only)	ECU-T1, TRANS-A
B	Green	103-T5	C Solenoid, Low	ECU-T5, TRANS-B
C	White	104-T7	G Solenoid, Low	ECU-T7, TRANS-C
D	Pink	124-T9	Sensor Power	ECU-T9, TRANS-D, TPS-C, RMR-C
E	Green	107-T3	Solenoid Power, Solenoid F	ECU-T3, TRANS-E
F	White	110-T22	F Solenoid, Low	ECU-T22, TRANS-F
G	White	120-T4	A Solenoid, Low	ECU-T4, TRANS-G
H	Tan	121-T2	Solenoid Power, Solenoids B and E	ECU-T2, TRANS-H
J	Orange	128-T20	B Solenoid, Low	ECU-T20, TRANS-J
K	Tan	129-T6	E Solenoid, Low	ECU-T6, TRANS-K
L	Yellow	130-T17	Solenoid Power, Solenoids C and G	ECU-T17, TRANS-L
M	Blue	131-T21	D Solenoid, Low	ECU-T21, TRANS-M
N	Green	135-T25	Analog Ground	ECU-T25, TRANS-N, TPS-A, RMR-A, RTEMP-B (HD), RMOD-F (MD)
P	Tan	147-T27	Sump Temperature Sensor Input	ECU-T27, TRANS-P
Q	Green	148-T32	Output Speed Sensor, Low	ECU-T32, NO-B, TCASE-D (MD 3070), RMOD-D (MDR)
R	Yellow	139-T16	Output Speed Sensor, High	ECU-T16, NO-A, TCASE-C (MD 3070), RMOD-C (MDR)
S	Orange	150-T30	Engine Speed Sensor, Low	ECU-T30, NE-B
T	Tan	141-T14	Engine Speed Sensor, High	ECU-T14, NE-A
U	Blue	140-T31	Turbine Speed Sensor, Low	ECU-T31, NT-B (HD), TRANS-U (MD)
V	Orange	149-T15	Turbine Speed Sensor, High	ECU-T15, NT-A (HD), TRANS-V (MD)
W	Yellow	195-T13	Transmission Identification	ECU-T13, TRANS-W
X	White	162-T12	C3 Pressure Switch Input	ECU-T12, TRANS-X
Y	Blue	165-T26	Oil Level Sensor Input	ECU-T26, TRANS-Y
Z				
a	Yellow	164-T11	Retarder Modulation Request	ECU-T11, RMR-B
b	Blue	156-T10	Throttle Position Sensor	ECU-T10, TPS-B
c	White	127-T23	H Solenoid, Low	ECU-T23, HSOL-A (HD), RMOD-A (MDR), TCASE-A (MD 3070)

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

BULKHEAD CONNECTOR FOR “T” HARNESS (Receptacle With Sockets, Plug With Pins) (Continued)

Terminal No.*	Color	Wire No.	Description	Termination Points*
d	Orange	138-T28	Retarder Temperature Sensor Input	ECU-T28, RTEMP-A (HD), RMOD-E (MD)
e	Blue	111-T8	J Solenoid, Low	ECU-T8, TRANS-e
f	Blue	101-T24	N Solenoid, Low	ECU-T24, NSOL-A (HD and MD), TRANS-f (MD 3070)
g	Yellow	116-T19	Solenoid Power, Solenoids H and N	ECU-T19, HSOL-B, NSOL-B, TRANS-g, TCASE-B (MD 3070), RMOD-B (MDR)

BULKHEAD CONNECTOR FOR “V” HARNESS (Receptacle With Sockets, Plug With Pins)

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Green	155-V11	General Purpose Input 1	ECU-V11, VIWV-A
B	Yellow	153-V12	General Purpose Input 2	ECU-V12, VIWV-B
C	Blue	118-V13	General Purpose Input 3	ECU-V13, VIWV-C
D	Pink	124-V8	Sensor Power	ECU-V8, TPS-C
E	Green	105-V19	General Purpose Output 5	ECU-V19, VIWV-E
F	Gray	143-V32	Battery Ground	ECU-V32, VIM-A2
G	Gray	143-V17	Battery Ground	ECU-V17, VIM-A1
H	Tan	112-V22	General Purpose Output 3	ECU-V22, VIM-D2
J	White	114-V2	General Purpose Output 1	ECU-V2, VIM-F3
K	Tan	123-V6	Neutral Start	ECU-V6, VIM-D1
L	Yellow	161-V31	Digital Ground (GPI)	ECU-V31, VIWV-L
M	Blue	179-V9	Engine Water Temperature	ECU-V9, VIWV-M
N	Green	135-V24	Analog Ground	ECU-V24, TPS-A, VIWV-N
P	Green	117-V30	General Purpose Input 8	ECU-V30, VIWV-P
Q	White	113-V4	Reverse Warning	ECU-V4, VIM-F2
R	Orange	178-V28	General Purpose Input 11	ECU-V28, VIWV-R
S	Tan	177-V14	General Purpose Input 10	ECU-V14, VIWV-S
T				
U	Orange	137-V29	General Purpose Input 7	ECU-V29, VIWV-U
V	White	167-V5	General Purpose Output 8	ECU-V5, VIWV-V
W	Pink	136-V16	Battery Power	ECU-V16, VIM-E2
X	Tan	157-V20	Vehicle Speed	ECU-V20, VIM-B2
Y	White	125-V18	General Purpose Output 4	ECU-V18, VIM-C2
Z				
a				
b	Blue	156-V10	Throttle Position Sensor	ECU-V10, TPS-B
c				
d	White	154-V27	General Purpose Input 5	ECU-V27, VIWV-D
e	Yellow	146-V26	Ignition Sense	ECU-V26, VIM-F1
f	Orange	132-V3	General Purpose Output 2	ECU-V3, VIM-B1
g	Pink	136-V1	Battery Power	ECU-V1, VIM-E1

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulkhead connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

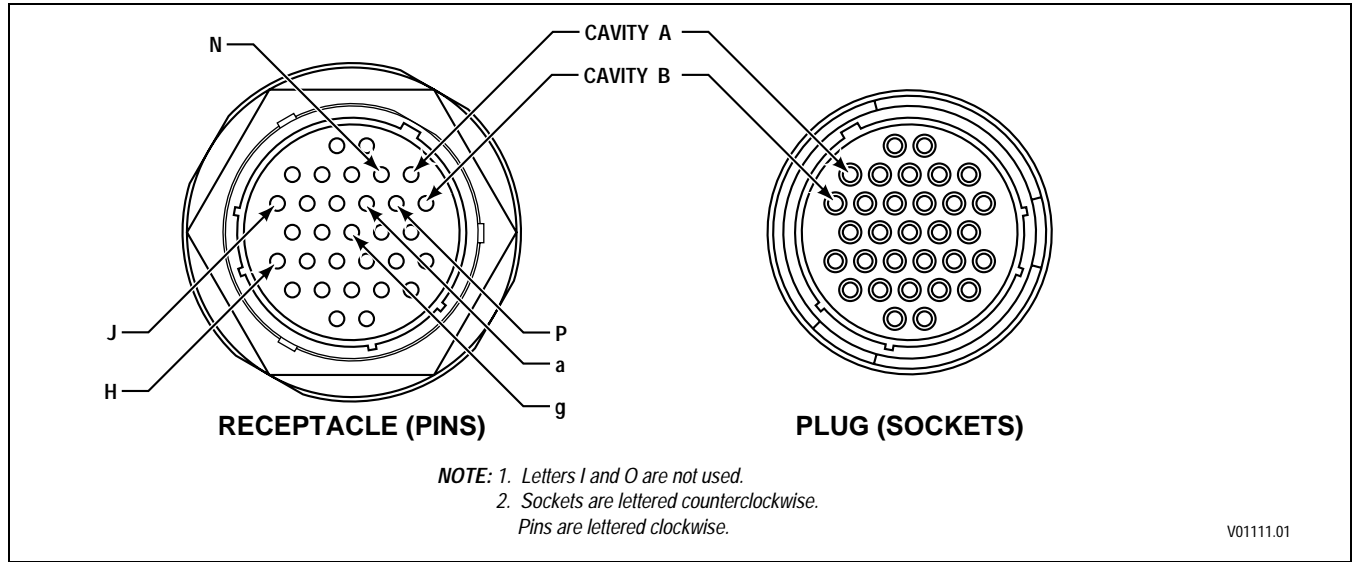


Figure D-5. Deutsch Transmission Connector, ECD

DEUTSCH TRANSMISSION CONNECTOR (Plugs With Sockets, Receptacles With Pins)

Terminal No.*	Color	Wire No.	Description	Termination Points*
A	Orange	102-T1	Solenoid Power, Solenoids A, D, and J	ECU-T1, ASOL-B, DSOL-B, JSOL-B
B	Green	103-T5	C Solenoid, Low	ECU-T5, CSOL-A
C	White	104-T7	G Solenoid, Low	ECU-T7, GSOL-A
D	Pink	124-T9	Sensor Power	ECU-T9, TPS-C, RMR-C, OLS-D
E	Green	107-T3	Solenoid Power, Solenoid F	ECU-T3, FSOL-A
F	White	110-T22	F Solenoid, Low	ECU-T22, FSOL-B
G	White	120-T4	A Solenoid, Low	ECU-T4, ASOL-A
H	Tan	121-T2	Solenoid Power, Solenoids B and E	ECU-T2, BSOL-B, ESOL-B
J	Orange	128-T20	B Solenoid, Low	ECU-T20, BSOL-A
K	Tan	129-T6	E Solenoid, Low	ECU-T6, ESOL-A
L	Yellow	130-T17	Solenoid Power, Solenoids C and G	ECU-T17, GSOL-B, CSOL-B
M	Blue	131-T21	D Solenoid, Low	ECU-T21, DSOL-A
N	Green	135-T25	Analog Ground	ECU-T25, TPS-A, RMR-A, RTEMP-B (HD), RMOD-F (MD), C3PS-B, OILT-LO, OLS-B
P	Tan	147-T27	Sump Temperature Sensor Input	ECU-T27, OILT-HI
Q				
R				
S				
T				
U	Blue	140-T31	Turbine Speed Sensor, Low (MD, MD7 only)	ECU-T31, NT-B
V	Orange	149-T15	Turbine Speed Sensor, High (MD, MD7 only)	ECU-T15, NT-A
W	Yellow	195-T13	Transmission Identification (TransID)	ECU-T13, AGND
X	White	162-T12	C3 Pressure Switch Input	ECU-T12, C3PS-A

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

DEUTSCH TRANSMISSION CONNECTOR (Plugs With Sockets, Receptacles With Pins) (Continued)

Terminal No.*	Color	Wire No.	Description	Termination Points*
Y	Blue	165-T26	Oil Level Sensor Input	ECU-T26, OLS-A
Z				
a				
b				
c				
d				
e	Blue	111-T8	J Solenoid, Low (MD7 or HD7 only)	ECU-T8, JSOL-A
f	Blue	101-T24	N Solenoid, Low (MD7 or HD7 only)	ECU-T24, NSOL-A
g	Yellow	116-T19	Solenoid Power, Solenoids H and N (MD7 only)	ECU-T19, HSOL-B, NSOL-B

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

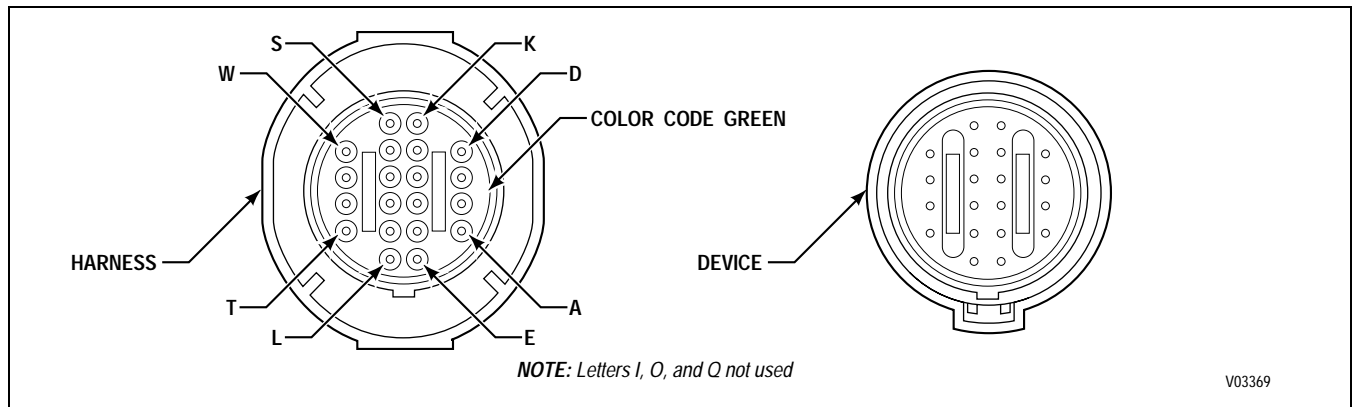


Figure D-6. Remote Selector Connector

REMOTE SHIFT SELECTOR CONNECTOR — PRIMARY SELECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Orange	170-S5	Primary Shift Selector, Data Bit 1	ECU, S5
B	Green	171-S6	Primary Shift Selector, Data Bit 2	ECU, S6
C	Blue	172-S7	Primary Shift Selector, Data Bit 4	ECU, S7
D	Yellow	173-S8	Primary Shift Selector, Data Bit 8	ECU, S8
E	Tan	174-S9	Primary Shift Selector, Parity	ECU, S9
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6	VIWS-L, SSS-L
M	Green	175-S10	Shift Selector Mode Output	SSS-M
N	Pink	124-S3	Sensor Power	RMR-C, SSS-N
P	Gray	143-S32	Battery Ground	VIWS-P, SSS-P, DDRP-A, DDRD-E, or OBDII-5
R	Pink	136-S16	Battery Power	SSS-R
S	Blue	180-S14	Shift Selector Display	SSS-S
T	White	186	Dimmer Input A	SSS-T
U	Yellow	187	Dimmer Input B	SSS-U
V	Gray	188	Dimmer Ground	SSS-V
W				

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

REMOTE SHIFT SELECTOR CONNECTOR — SECONDARY SELECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Orange	190-S5	Secondary Shift Selector, Data Bit 1	ECU, S21
B	Green	191-S6	Secondary Shift Selector, Data Bit 2	ECU, S22
C	Blue	192-S7	Secondary Shift Selector, Data Bit 4	ECU, S23
D	Yellow	193-S8	Secondary Shift Selector, Data Bit 8	ECU, S24
E	Tan	194-S9	Secondary Shift Selector, Parity	ECU, S25
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6	VIWS-L, SSS-L
M	Green	175-S10	Shift Selector Mode Output	SSS-M
N	Pink	124-S3	Sensor Power	RMR-C, SSS-N
P	Gray	143-S32	Battery Ground	VIWS-P, SSS-P, DDRP-A, DDRD-E, or OBDII-5
R	Pink	136-S16	Battery Power	SSS-R
S	Blue	180-S14	Shift Selector Display	SSS-S
T	White	186	Dimmer Input A	SSS-T
U	Yellow	187	Dimmer Input B	SSS-U
V	Gray	188	Dimmer Ground	SSS-V
W				

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

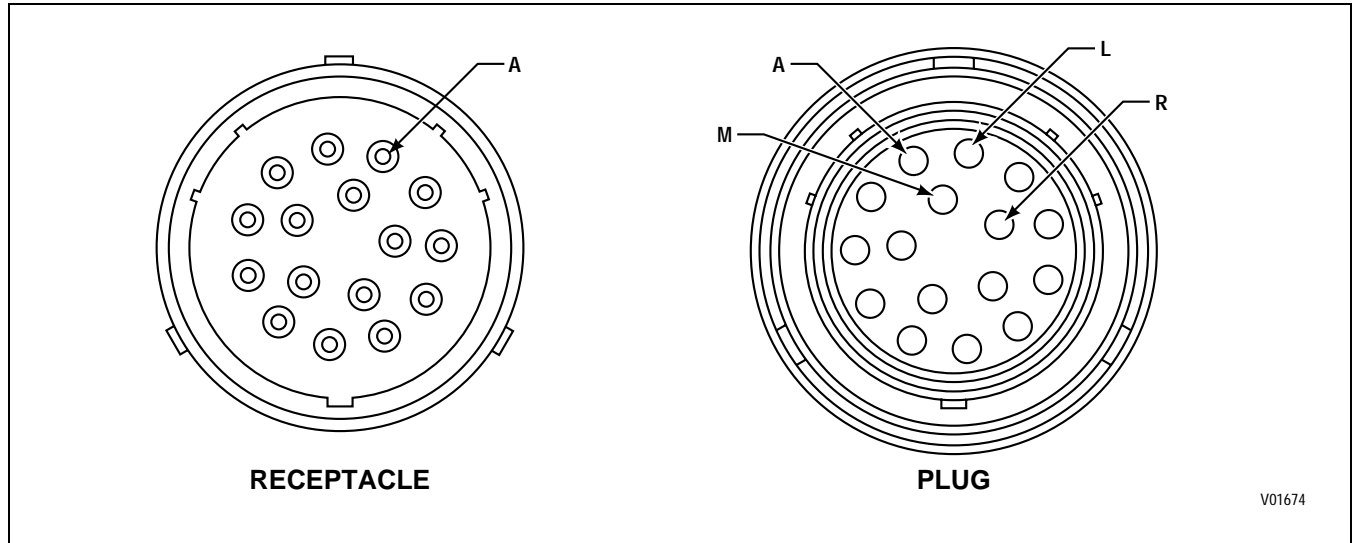


Figure D-7. Optional Deutsch Sensor Harness Connector

OPTIONAL DEUTSCH SENSOR HARNESS CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A				
B				
C	Green	135-T25	Analog Ground	ECU-T25, TRANS-N, RTEMP-B (HD), RMOD-F (MD), TPS-A, RMR-A
D	Orange	138-T28	Retarder Temperature Sensor Input	ECU-T28, RTEMP-A (HD), RMOD-E (MD)
E	Yellow	116-T19	Solenoid Power, Solenoids H and N	ECU-T19, HSOL-B, NSOL-B
F	White	127-T23	H Solenoid, Low	ECU-T23, HSOL-A
G	Yellow	116-T19	Solenoid Power, Solenoids H and N	ECU-T19, HSOL-B, NSOL-B
H	Blue	101-T24	N Solenoid, Low	ECU-T24, NSOL-B
J				
K				
L	Blue	140-T31	Turbine Speed Sensor, Low	ECU-T31, NT-B (HD)
M	Orange	149-T15	Turbine Speed Sensor, High	ECU-T15, NT-A (HD)
N	Orange	150-T30	Engine Speed Sensor, Low	ECU-T30, NE-B
P	Tan	141-T14	Engine Speed Sensor, High	ECU-T14, NE-A
R	Green	148-T32	Output Speed Sensor, Low	ECU-T32, NO-B
S	Yellow	139-T16	Output Speed Sensor, High	ECU-T16, NO-A

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

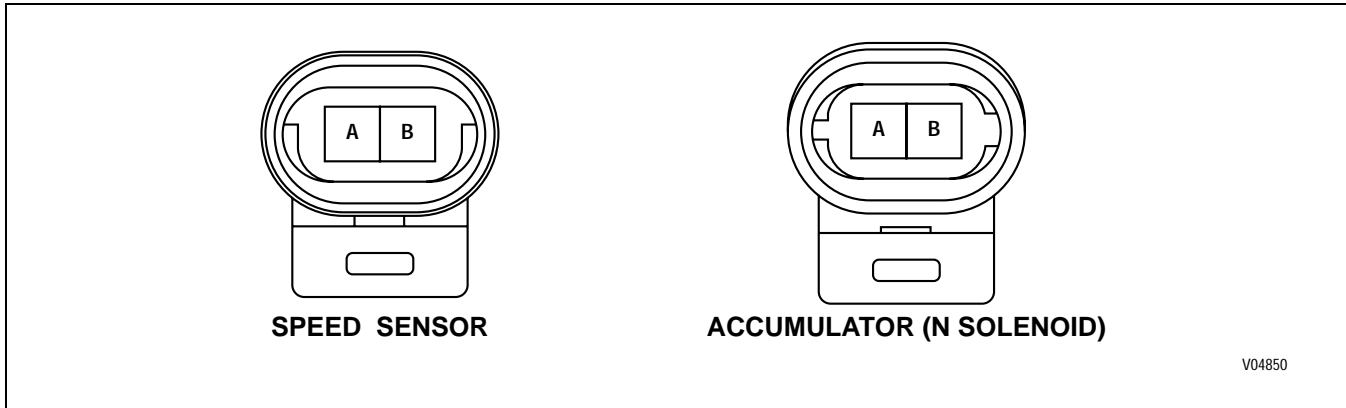


Figure D-8. Speed Sensor Connector

ENGINE SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Tan	141-T14	Engine Speed Sensor Hi	ECU-T14
B	Orange	150-T30	Engine Speed Sensor Lo	ECU-T30

TURBINE SPEED SENSOR CONNECTOR (HD/B 500 ONLY)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	149-T15	Turbine Speed Sensor Hi	ECU-T15
B	Blue	140-T31	Turbine Speed Sensor Lo	ECU-T31

OUTPUT SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	139-T16	Output Speed Sensor Hi	ECU-T16
B	Green	148-T32	Output Speed Sensor Lo	ECU-T32

ACCUMULATOR (N) SOLENOID

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Blue	101-T24	N Solenoid Lo	ECU-T24
B	Yellow	116-T19	N Solenoid Hi	ECU-T19

MD RETARDER (H SOLENOID, TID 2)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	127-T23	H Solenoid Lo	ECU-T23
B	Yellow	116C-T19	H Solenoid Hi	ECU-T19

APPENDIX D — WIRE/CONNECTOR CHART

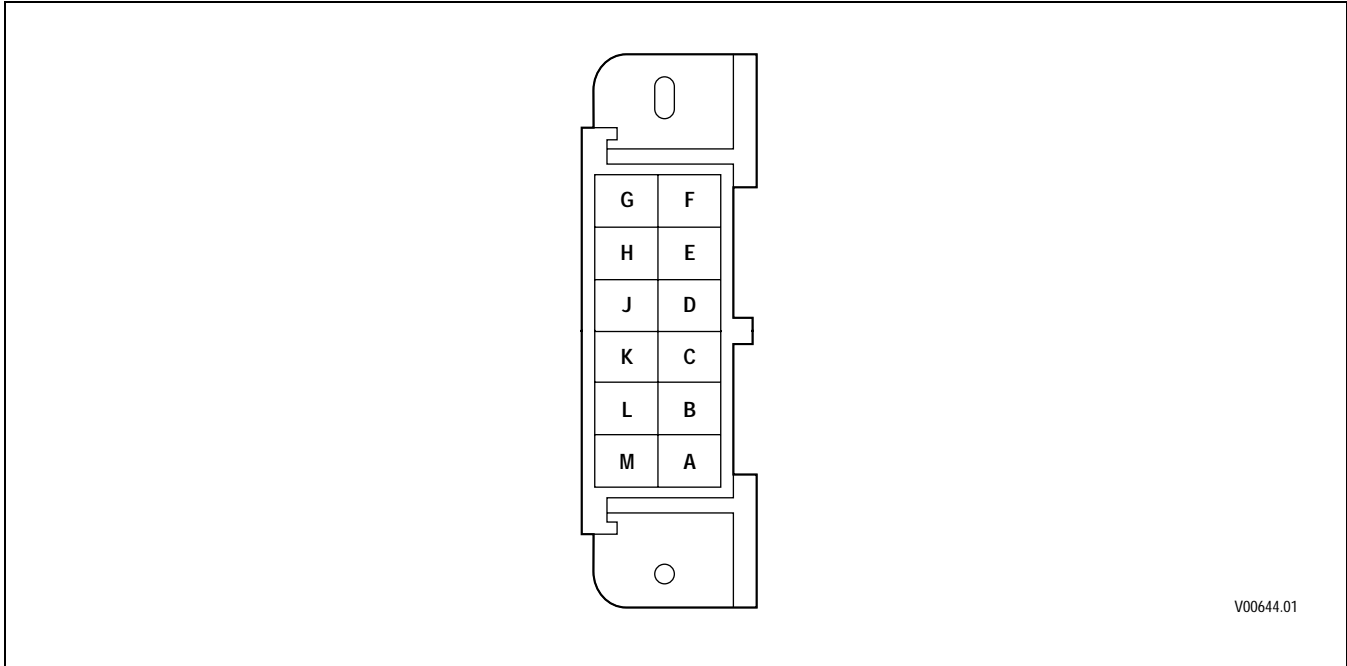


Figure D-9. Diagnostic Connector (Packard)

DIAGNOSTIC CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Gray	143-S32	Battery (-)	ECU-S32, VIWS-P, PSS-P, SSS-P
H	Yellow	146-S4	Ignition Signal (+)	ECU-S4, VIWS-E
J	White	142-S1	Serial Communication (+)	ECU-S1, SCI-A
K	Blue	151-S17	Serial Communication (-)	ECU-S17, SCI-B

APPENDIX D — WIRE/CONNECTOR CHART

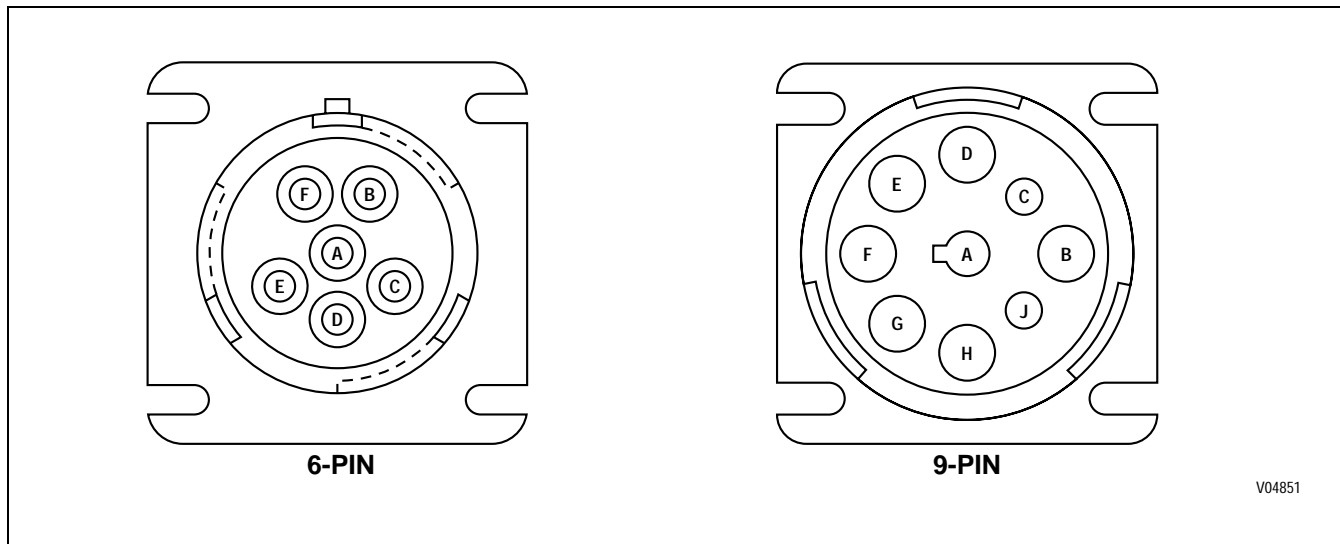


Figure D-10. Optional Deutsch DDR Connectors

OPTIONAL 6-PIN DIAGNOSTIC CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	142-S1	Serial Communication (+)	ECU-S1, SCI-A
B	Blue	151-S17	Serial Communication (-)	ECU-S17, SCI-B
C	Yellow	146-S4	Ignition Signal (+)	ECU-S4, VIWS-E
D			Open	
E	Gray	143-S32	Battery (-)	ECU-S32, VIWS-P, PSS-P, SSS-P
F			Open	

OPTIONAL 9-PIN DIAGNOSTIC CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Gray	143-S32	Battery Ground (-)	ECU-S32, VIWS-P, PSS-P, SSS-P
B	Yellow	146-S4	Ignition Power (+)	ECU-S4, VIWS-E
B (Optional)	Pink	136-S16	Battery Power (+)	ECU-S16, PSS-R, SSS-R
C	Pink	183-S13	J1939 High	ECU-S13, J1939-A/H
D	Gray	184-S29	J1939 Low	ECU-S29, J1939-B/L
E	Green	182-S12	J1939 Shield/Ground	ECU-S12, J1939-C/S
F	White	142-S1	Serial Communication (+)	ECU-S1, SCI-A
G	Blue	151-S17	Serial Communication (-)	ECU-S17, SCI-B

APPENDIX D — WIRE/CONNECTOR CHART

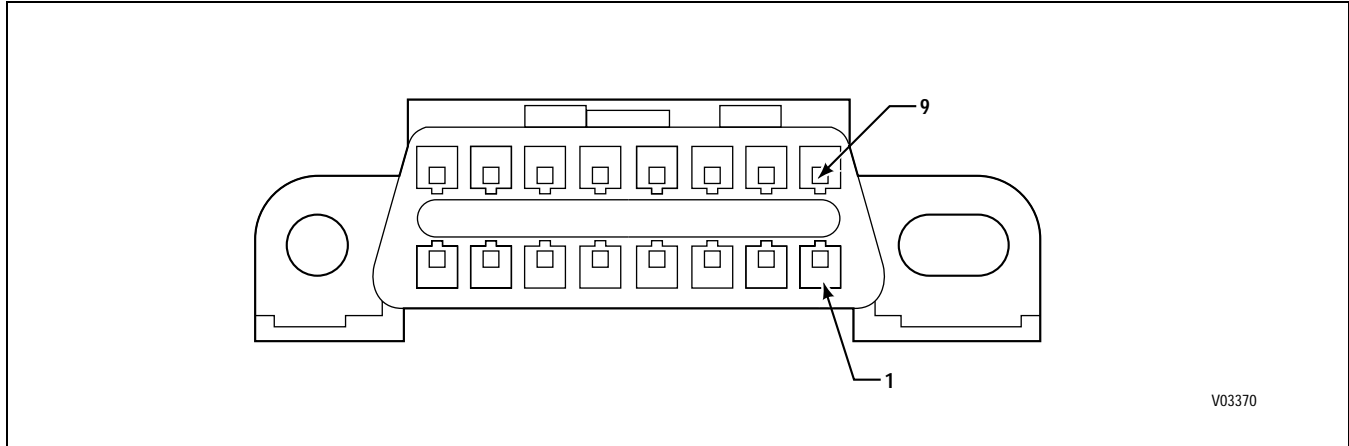


Figure D–11. GMC Connector for OBD-II DDR Adapter

OPTIONAL OBD–II DDR CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
1				
2				
3				
4				
5	Gray	143-S32	Battery Ground (–)	ECU-S32, VIWS-P, PSS-P, SSS-P
6				
7	White	142-S1	Serial Communication Interface, Hi	ECU-S1, SCI-A
8				
9				
10				
11				
12				
13				
14				
15	Blue	151-S17	Serial Communication Interface, Lo	ECU-S17, SCI-B
16	Yellow	146-S4	Ignition Sense (+)	ECU-S4, VIWS-E

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

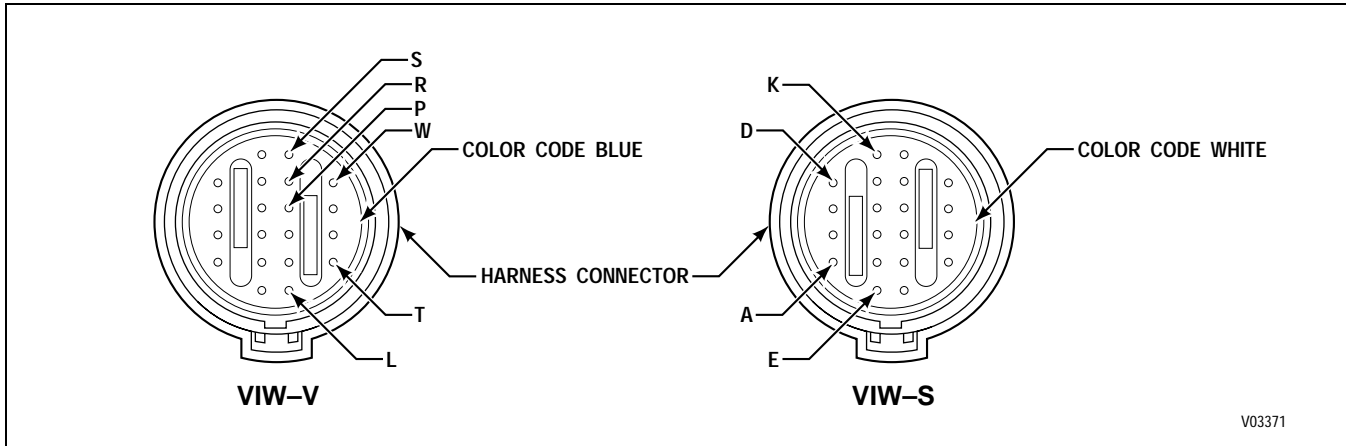


Figure D-12. VIW Connector (Packard Micro Pack)

VIW-V CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s)*
A	Green	155-V11	General Purpose Input 1	ECU-V11, VIWV-A
B	Yellow	153-V12	General Purpose Input 2	ECU-V12, VIWV-B
C	Blue	118-V13	General Purpose Input 3	ECU-V13, VIWV-C
D	White	154-V27	General Purpose Input 5	ECU-V27, VIWV-D
E	Green	105-V19	General Purpose Output 5	ECU-V19, VIWV-E
F				
G				
H				
J				
K				
L	Yellow	161-V31	Digital Ground (GPI)	ECU-V31, VIWV-L
M	Blue	179-V9	Engine Water Temperature	ECU-V9, VIWV-M
N	Green	135-V24	Analog Ground	ECU-V24, TPS-A, VIWV-N
P	Green	117-V30	General Purpose Input 8	ECU-V30, VIWV-P
R	Orange	178-V28	General Purpose Input 11	ECU-V28, VIWV-R
S	Tan	177-V14	General Purpose Input 10	ECU-V14, VIWV-S
T				
U	Orange	137-V29	General Purpose Input 7	ECU-V29, VIWV-U
V	White	167-V5	General Purpose Output 8	ECU-V5, VIWV-V
W				

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

VIW-S CONNECTOR

Terminal No.*	Color	Wire No.	Description	Termination Point(s) *
A	Tan	159-S2	Diagnostic Communication Link (ISO9141)	ECU-S2, VIWS-A
B	Green	115-S31	Check Transmission	ECU-S31, VIWS-B
C	Yellow	126-S28	General Purpose Input 9	ECU-S28, VIWS-C
D	Tan	157-S30	Vehicle Speed	ECU-S30, VIWS-D
E	Yellow	146-S4	Ignition Sense	ECU-S4, VIWS-E, DDRP-H, DDRD-C
F				
G				
H				
J				
K				
L	Orange	176-S15	General Purpose Output 6	ECU-S15, VIWS-L, PSS-L, SSS-L
M	Yellow	119-S11	General Purpose Input 4	ECU-S11, VIWS-M
N	Tan	166-S18	General Purpose Output 7	ECU-S18, VIWS-N
P	Gray	143-S32	Battery Ground	ECU-S32, VIWS-P, PSS-P, SSS-P, DDRP-A, DDRD-E
R	Blue	163-S27	General Purpose Input 6	ECU-S27, VIWS-R
S	Blue	169-S26	General Purpose Input 12	ECU-S26, VIWS-S
T	White	186	Dimmer Input A	VIWS-T, PSS-T, SSS-T
U	Yellow	187	Dimmer Input B	VIWS-U, PSS-U, SSS-U
V	Gray	188	Dimmer Ground	VIWS-V, PSS-V, SSS-V
W				

* Terminal number and termination points shown only apply when an Allison Transmission recommended harness configuration and bulk-head connector are used.

APPENDIX D — WIRE/CONNECTOR CHART

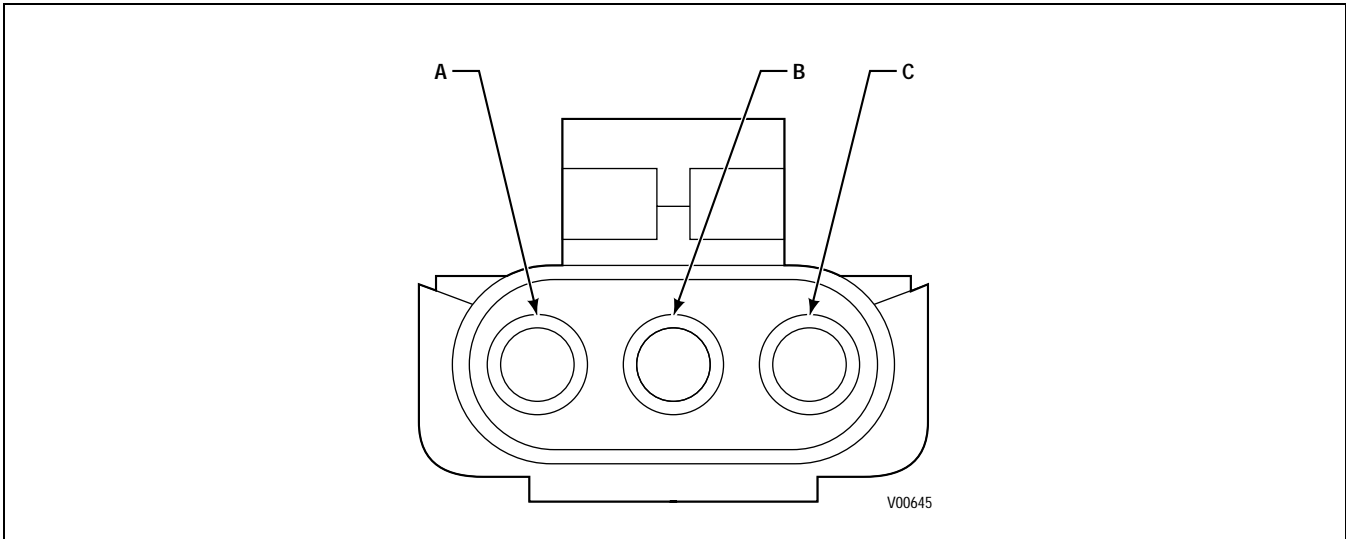


Figure D-13. TPS Connector

THROTTLE POSITION SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	135-T25 or 135-V24	Analog Ground	ECU-T25 or V24; TRANS-N; RMR-A, RMOD-F or B; VIWV-N
B	Blue	156-T10 or V10	TPS Signal	ECU-T10 or V10
C	Pink	124-T9 or V8	TPS Hi	ECU-T9 or V8; RMR-C

APPENDIX D — WIRE/CONNECTOR CHART

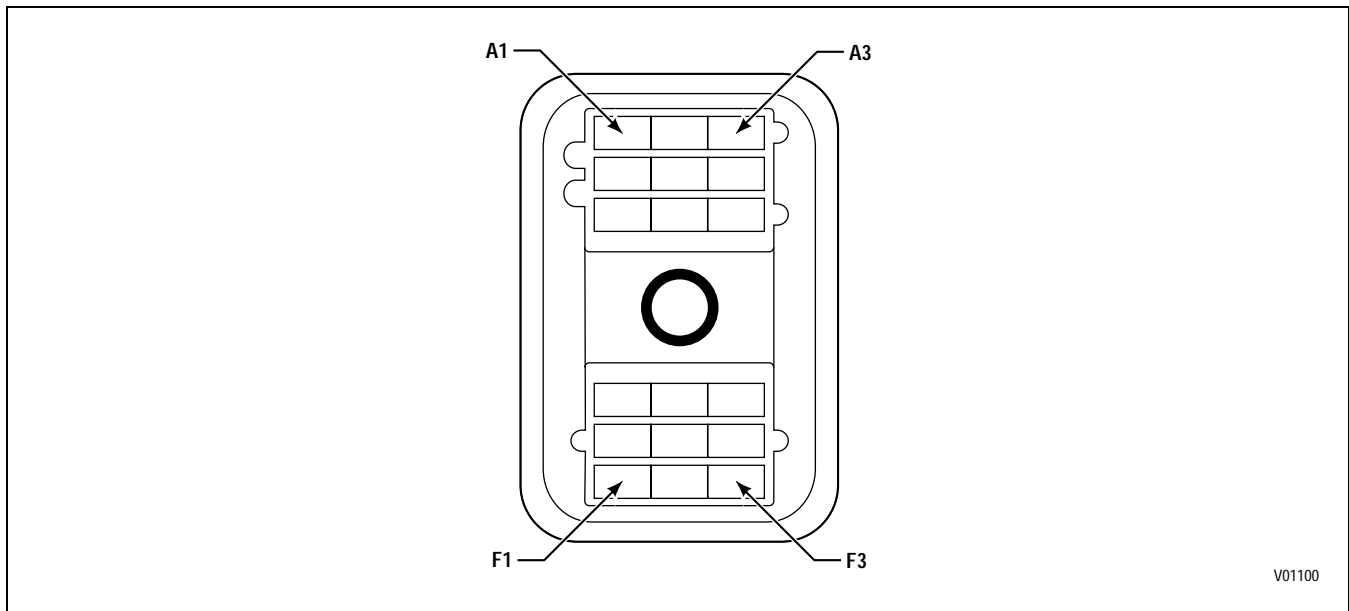


Figure D-14. VIM Connector (Harness)

VIM CONNECTOR (HARNESS)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A1	Gray	143-V17	Battery (-)	ECU-V17
A2	Gray	143-V32	Battery (-)	ECU-V32
A3			Reserved	
B1	Orange	132-V3	GPO 2	ECU-V3
B2	Tan	157-V20	Speedometer Signal	ECU-V20
B3			Reserved	
C1			Reserved	
C2	White	125-V18	GPO 4	ECU-V18
C3			Reserved	
D1	Tan	123-V6	Neutral Start	ECU-V6
D2	Tan	112-V22	GPO 3	ECU-V22
D3			Reserved	
E1	Pink	136-V1	Battery (+)	ECU-V1
E2	Pink	136-V16	Battery (+)	ECU-V16
E3			Reserved	
F1	Yellow	146-V26	Ignition Sense (+)	ECU-V26
F2	White	113-V4	Reverse Warning	ECU-V4
F3	White	114-V2	GPO 1	ECU-V2

APPENDIX D — WIRE/CONNECTOR CHART

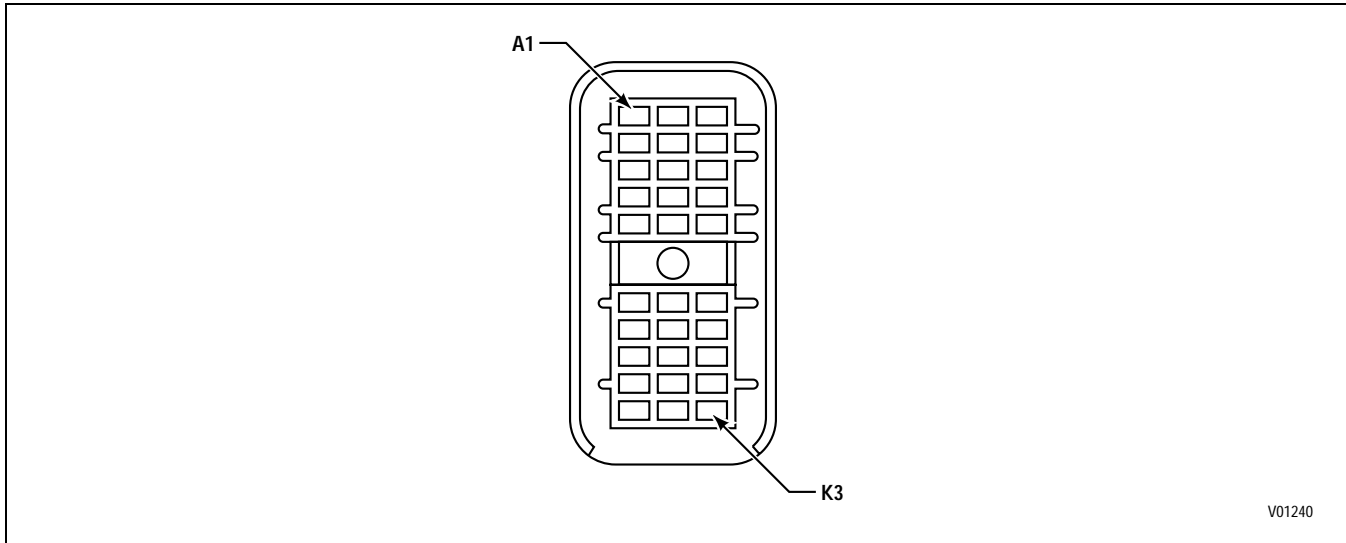


Figure D-15. VIM Connector (Harness)

VIM CONNECTOR (HARNESS 30-WAY)

Terminal No.	Color	Wire No.	Description	Termination Point(s)*
A1	Blue	313NO	Reverse Warning Relay — Normally Open	
A2	Yellow	314CM	Output Wire 114 Relay — Common	
A3	Blue	314NO	Output Wire 114 Relay — Normally Open	
B1	Yellow	313CM	Reverse Warning Relay — Common	
B2	Green	314NC	Output Wire 114 Relay — Normally Closed	
B3			Reserved	
C1	Orange	346	Ignition Power	
C2	Green	312NC	Output Wire 112 Relay — Normally Closed	
C3			Reserved	
D1	Green	325NC	Output Wire 125 Relay — Normally Closed	
D2	Green	332NC	Output Wire 132 Relay — Normally Closed	
D3			Reserved	
E1	Yellow	325CM	Output Wire 125 Relay — Common	
E2	Yellow	332CM	Output Wire 132 Relay — Common	
E3	Blue	332NO	Output Wire 132 Relay — Normally Open	
F1	Blue	323NO	Neutral Start Relay — Normally Open	
F2	Yellow	312CM	Output Wire 112 Relay — Common	
F3	Blue	312NO	Output Wire 112 Relay — Normally Open	
G1	Yellow	323CM	Neutral Start Relay — Common	
G2			Reserved	
G3			Reserved	
H1			Reserved	
H2	White	357UF	Speedometer — Unfiltered	
H3			Reserved	
J1	Pink	336A	Battery Power	
J2	Pink	336C	Battery Power	
J3			Reserved	
K1	Gray	343A	Battery Ground	
K2	Gray	343C	Battery Ground	
K3			Reserved	

* Termination Points are determined by OEM electrical system design.

APPENDIX D — WIRE/CONNECTOR CHART

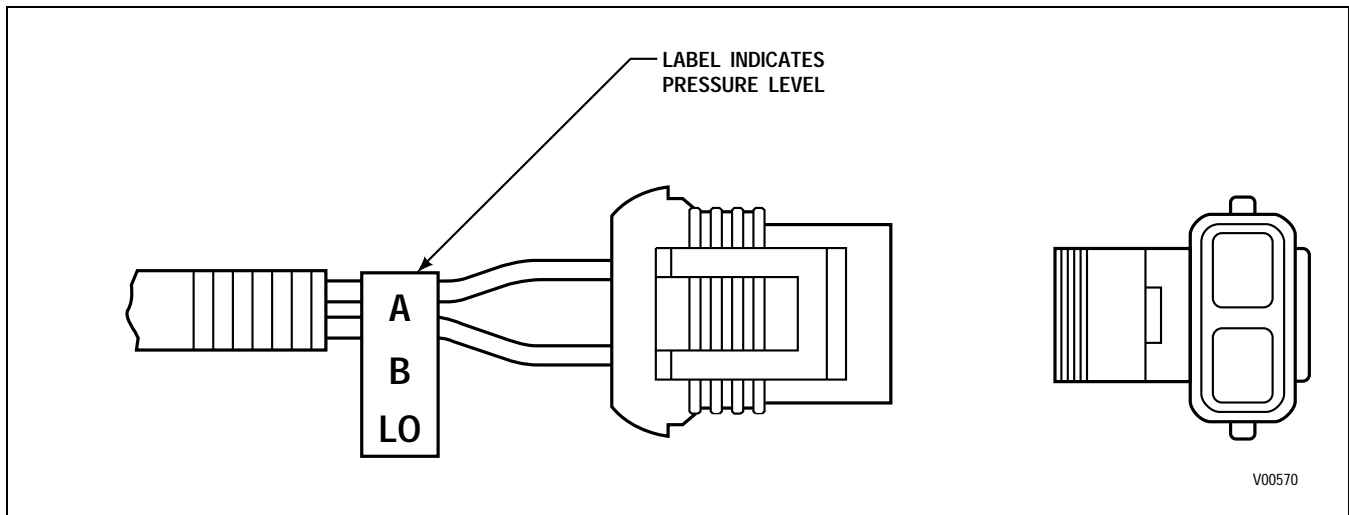


Figure D-16. Resistance Module Type 2 — Single Pressure Switch and SCI Interface

RESISTANCE MODULE TYPE 2

Terminal No.

- A
- B

SCI INTERFACE CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	142-S1	Serial Communication Interface, Hi	ECU-S1, DDRP-J, DDRD-A
B	Blue	151-S17	Serial Communication Interface, Lo	ECU-S17, DDRP-K, DDRD-B

APPENDIX D — WIRE/CONNECTOR CHART

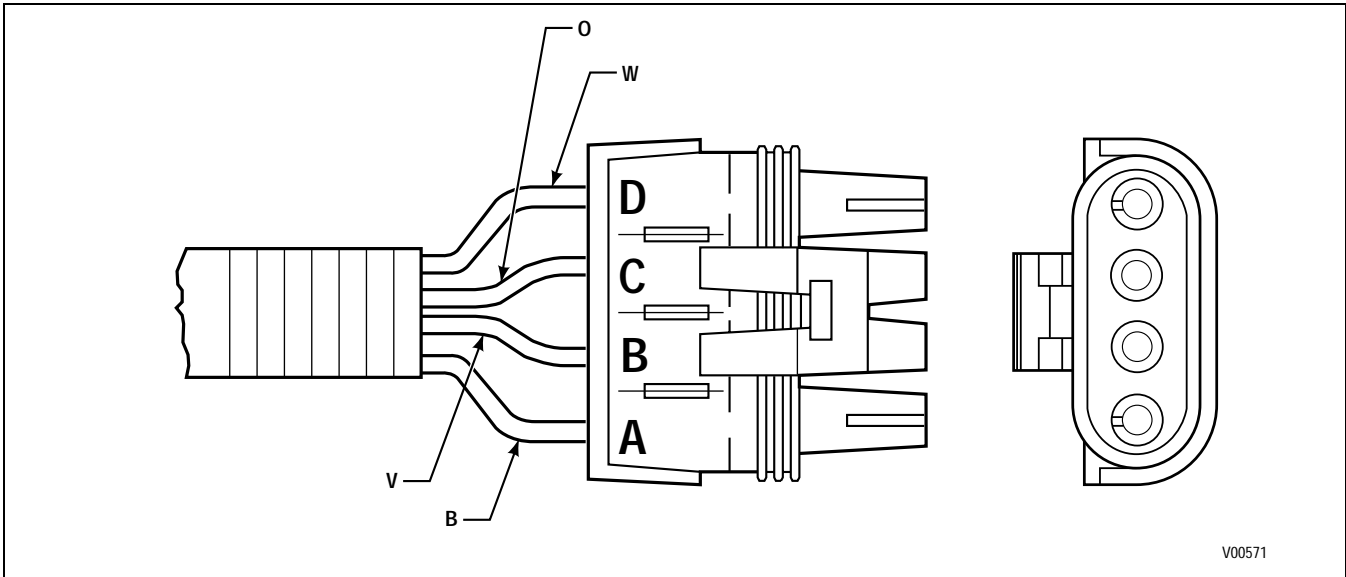


Figure D-17. Resistance Module Type 3 — Bendix E-10R Pedal

RESISTANCE MODULE TYPE 3

Terminal No.	Wire Color
A	Blue
B	Violet
C	Orange
D	White

APPENDIX D — WIRE/CONNECTOR CHART

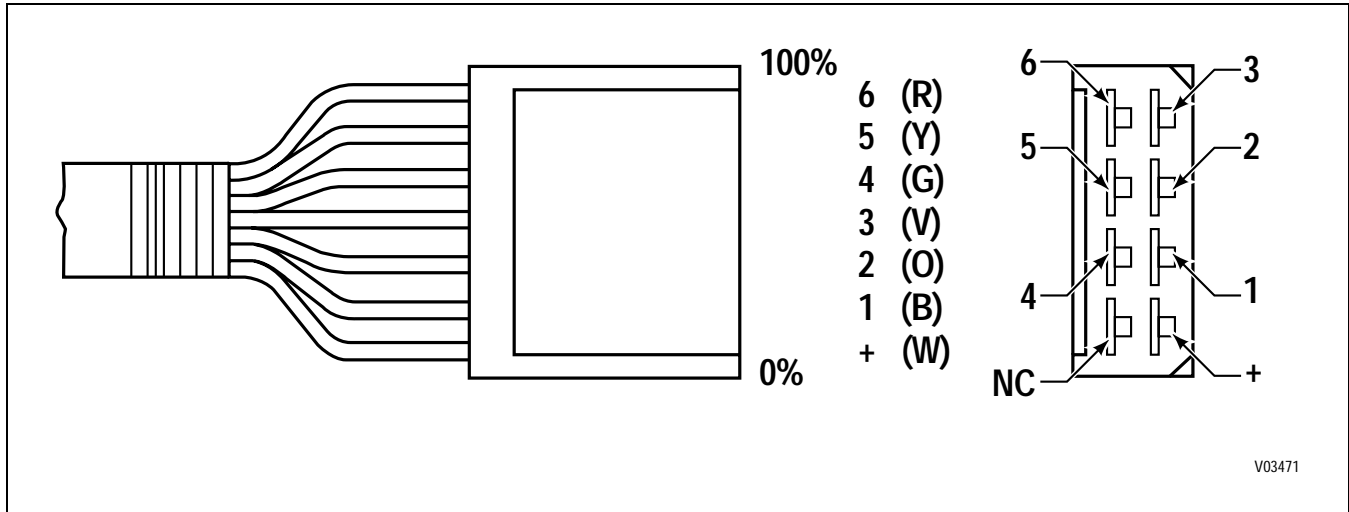
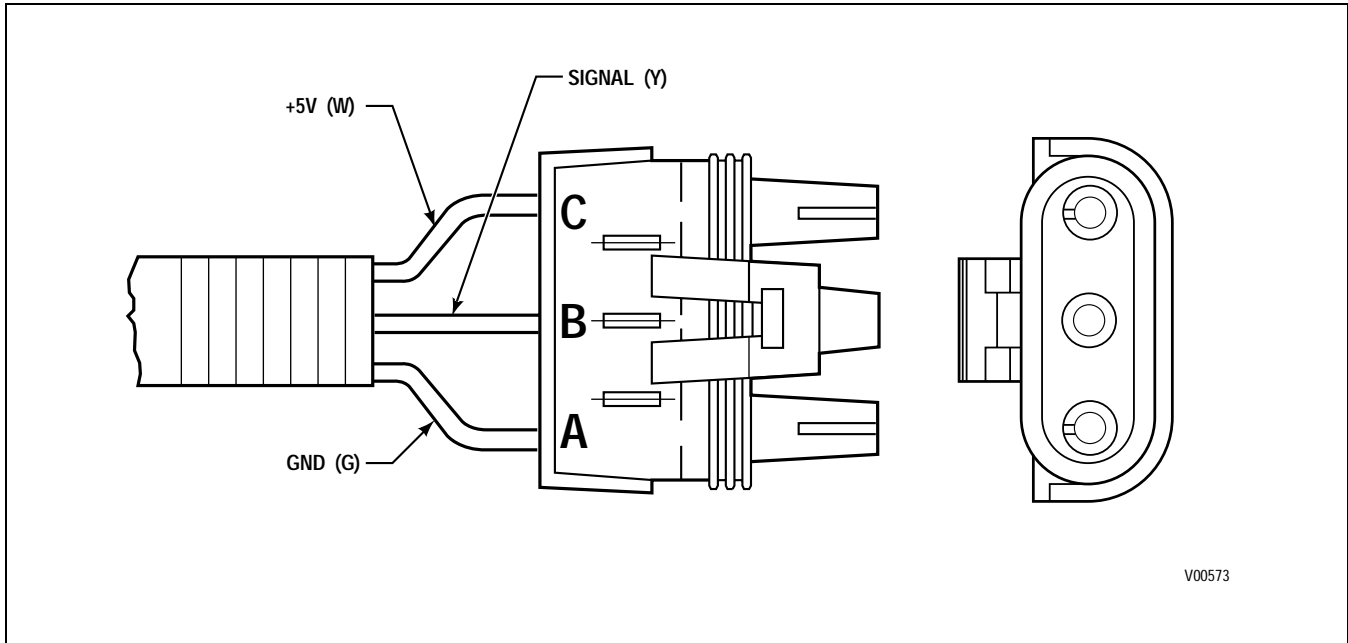


Figure D-18. Resistance Module Type 5 — Hand Lever

RESISTANCE MODULE TYPE 5

Terminal No.	Wire Color
+	White
1	Blue
2	Orange
3	Violet
4	Green
5	Yellow
6	Red

APPENDIX D — WIRE/CONNECTOR CHART



V00573

Figure D-19. Resistance Module Type 7 — Dedicated Pedal

RESISTANCE MODULE TYPE 7

Terminal No.	Wire Color
A	Green
B	Yellow
C	White

APPENDIX D — WIRE/CONNECTOR CHART

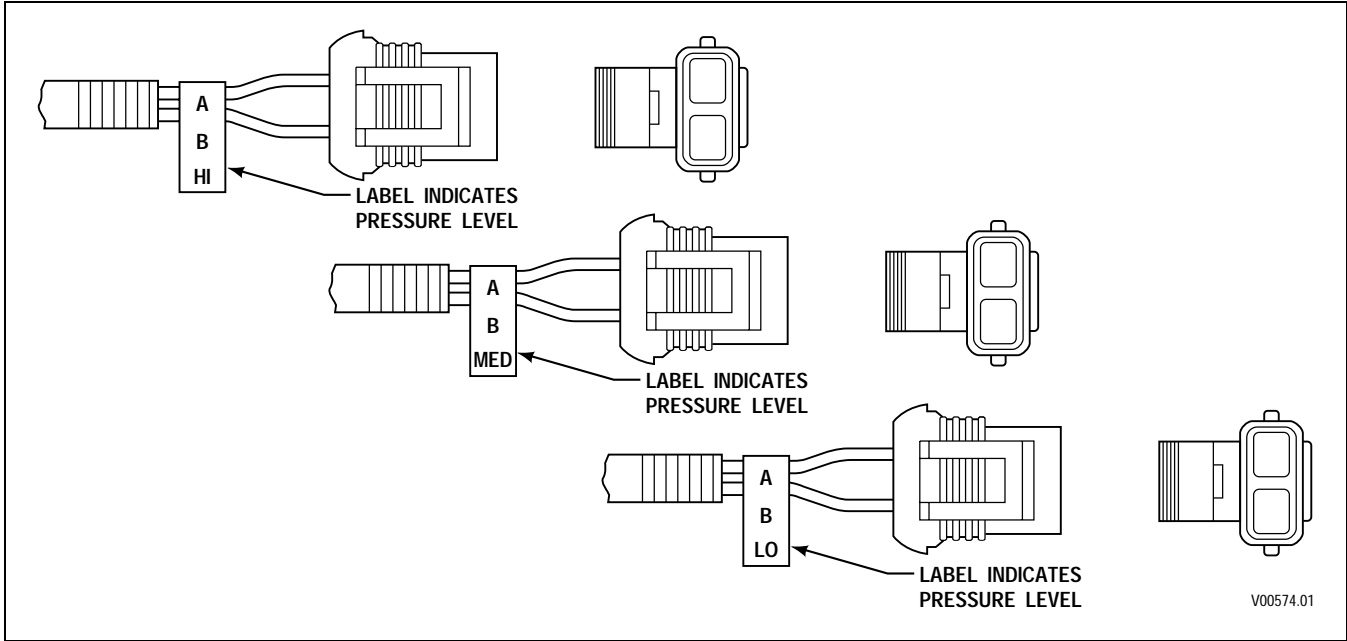


Figure D-20. Resistance Module Type 8 — Three Pressure Switch

RESISTANCE MODULE TYPE 8

LOW PRESSURE

Terminal No.	Wire Color
A	White
B	Blue

MEDIUM PRESSURE

Terminal No.	Wire Color
A	White
B	Orange

HIGH PRESSURE

Terminal No.	Wire Color
A	White
B	Violet

APPENDIX D — WIRE/CONNECTOR CHART

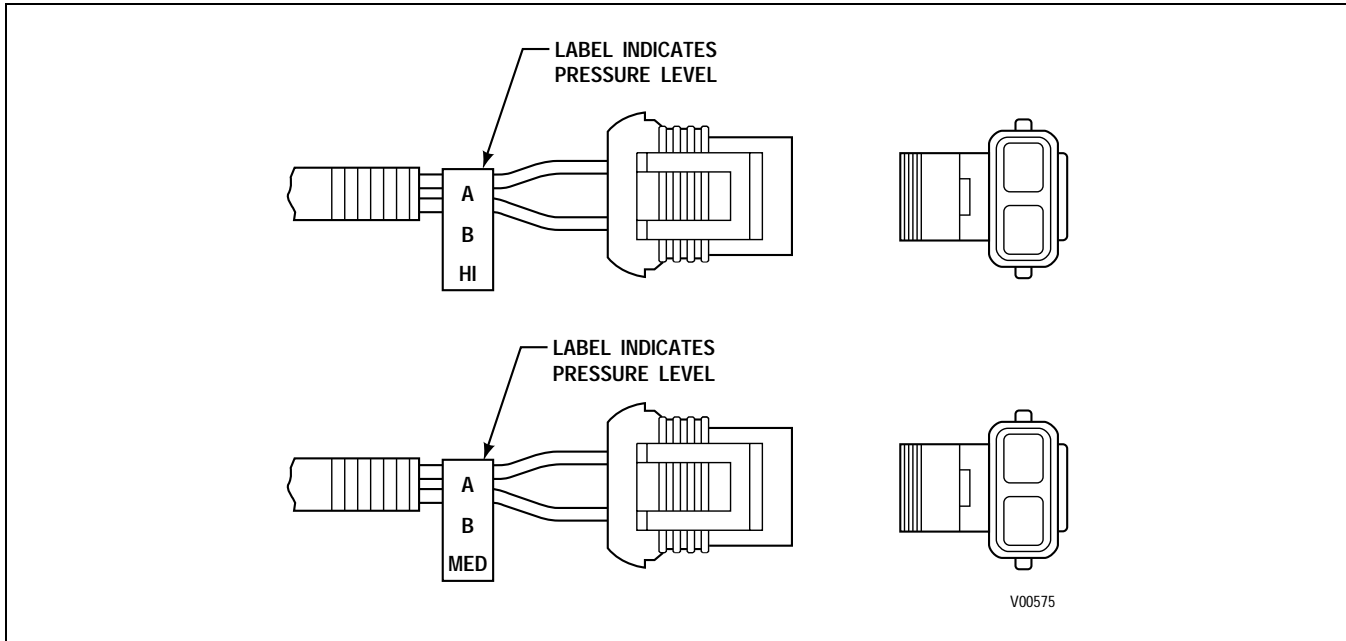


Figure D-21. Resistance Module Type 9 — Two Pressure Switch

RESISTANCE MODULE TYPE 9

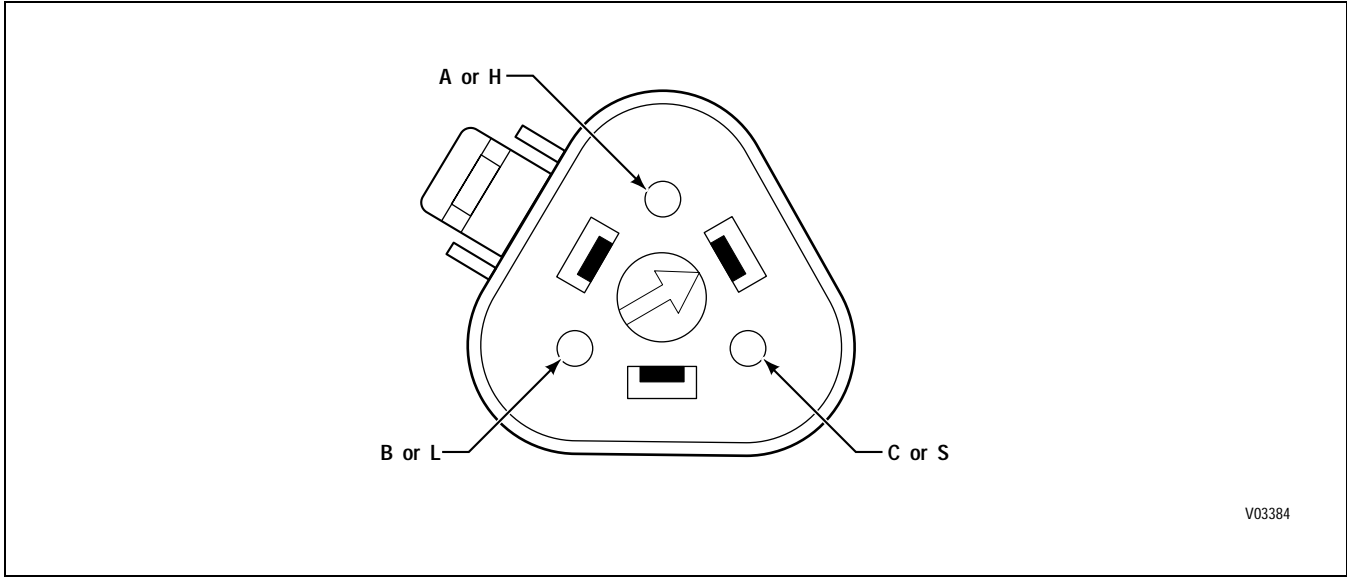
MEDIUM PRESSURE

Terminal No.	Wire Color
A	White
B	Orange

HIGH PRESSURE

Terminal No.	Wire Color
A	White
B	Violet

APPENDIX D — WIRE/CONNECTOR CHART



V03384

Figure D-22. J1939 Interface Connector

J1939 INTERFACE CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A or H	Pink	183-S13	J1939 Controller, Hi	ECU-S13
B or L	Gray	184-S29	J1939 Controller, Lo	ECU-S29
C or S	Green	182-S12	J1939 Shield	ECU-S12

APPENDIX D — WIRE/CONNECTOR CHART

APPENDIX E — WELDING ON VEHICLE/VEHICLE INTERFACE MODULE

1-3. WELDING ON VEHICLE

When frame or other welding is required on the vehicle, take the following precautions to protect the electronic control components:

1. Disconnect the wiring harness connectors at the transmission electronic control unit.
2. Disconnect the positive and negative battery connections, and any electronic control ground wires connected to the frame or chassis.
3. Cover electronic control components and wiring to protect them from hot sparks, etc.
4. Do not connect welding cables to electronic control components.

WARNING!

Do not jump start a vehicle with arc welding equipment. Arc welding equipment's dangerously high currents and voltages cannot be reduced to safe levels.

1-4. VEHICLE INTERFACE MODULE

The Allison Vehicle Interface Module (VIM) containing all Allison system relays and fuses must be used as the interface to all vehicle wiring. Refer to Figure E-2 for VIM component location and pin-out. To close an open VIM, tighten the bolts in the numerical order shown in Figure E-1 to provide a sealed, water-tight box. Torque the bolts to 5–8 Nm (4–6 lb ft).

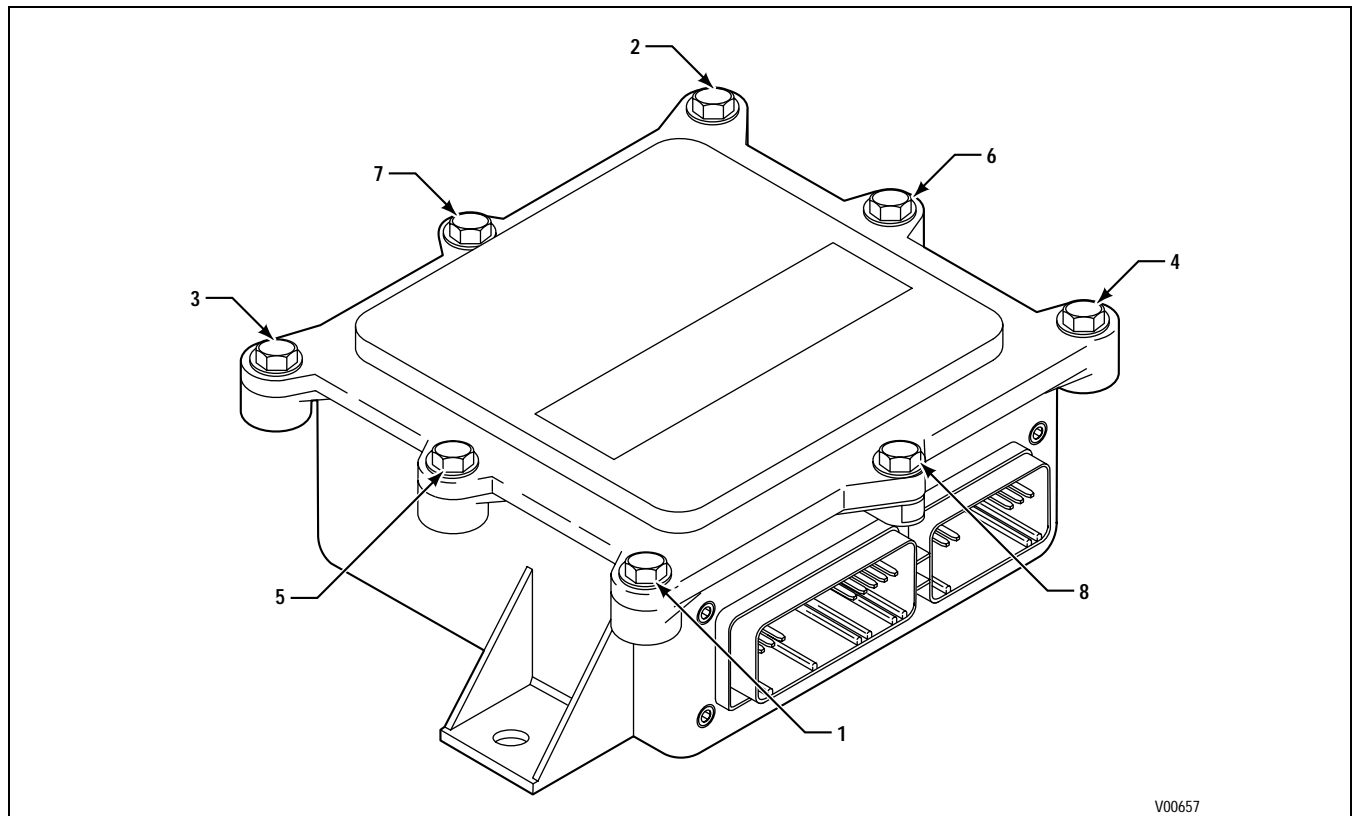
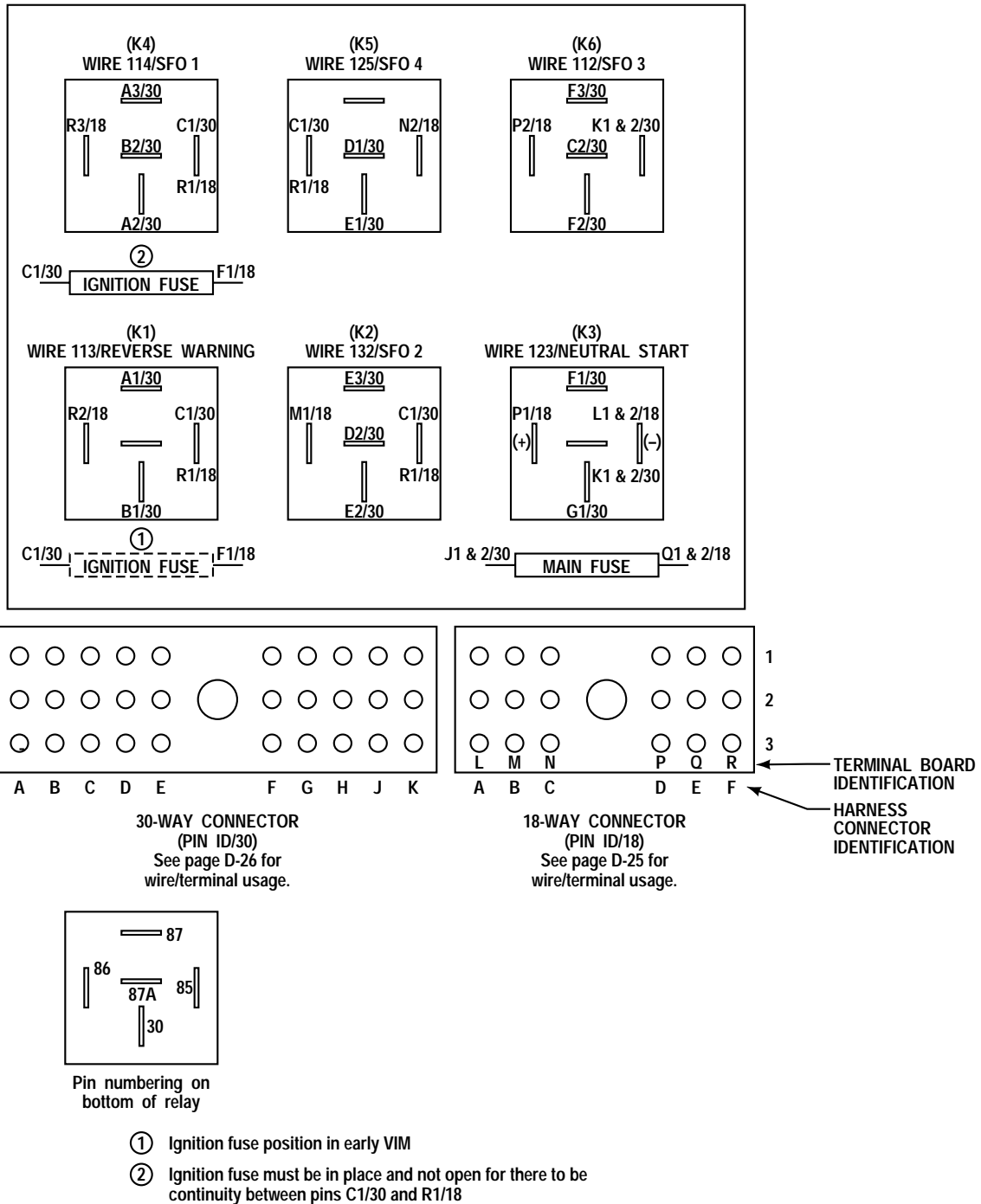


Figure E-1. Vehicle Interface Module

APPENDIX E — WELDING ON VEHICLE/VEHICLE INTERFACE MODULE



V03425

Figure E-2. VIM Components Location and Pin-Out Diagram

APPENDIX F — DIAGNOSTIC TREE — WT HYDRAULIC SYSTEM

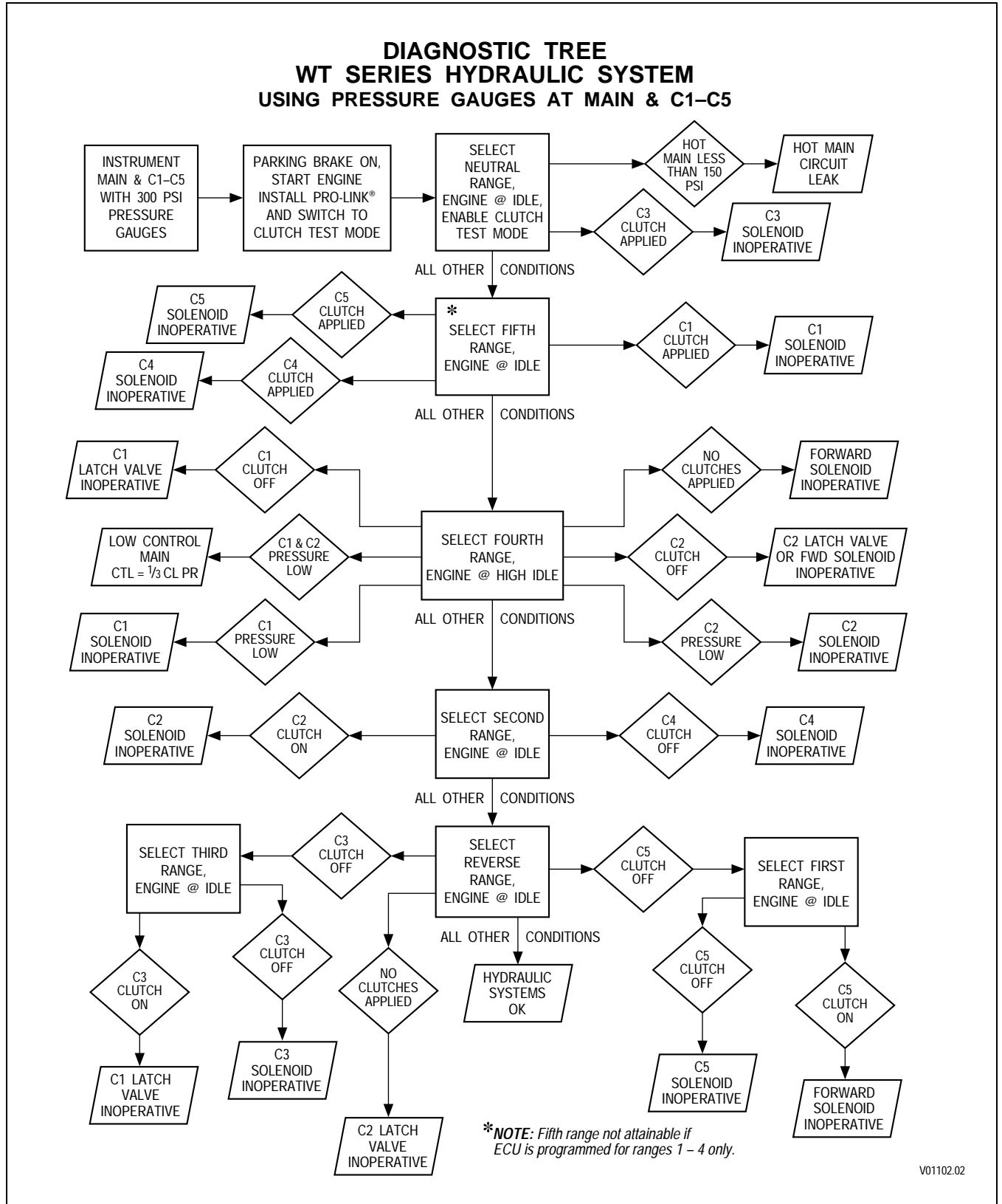
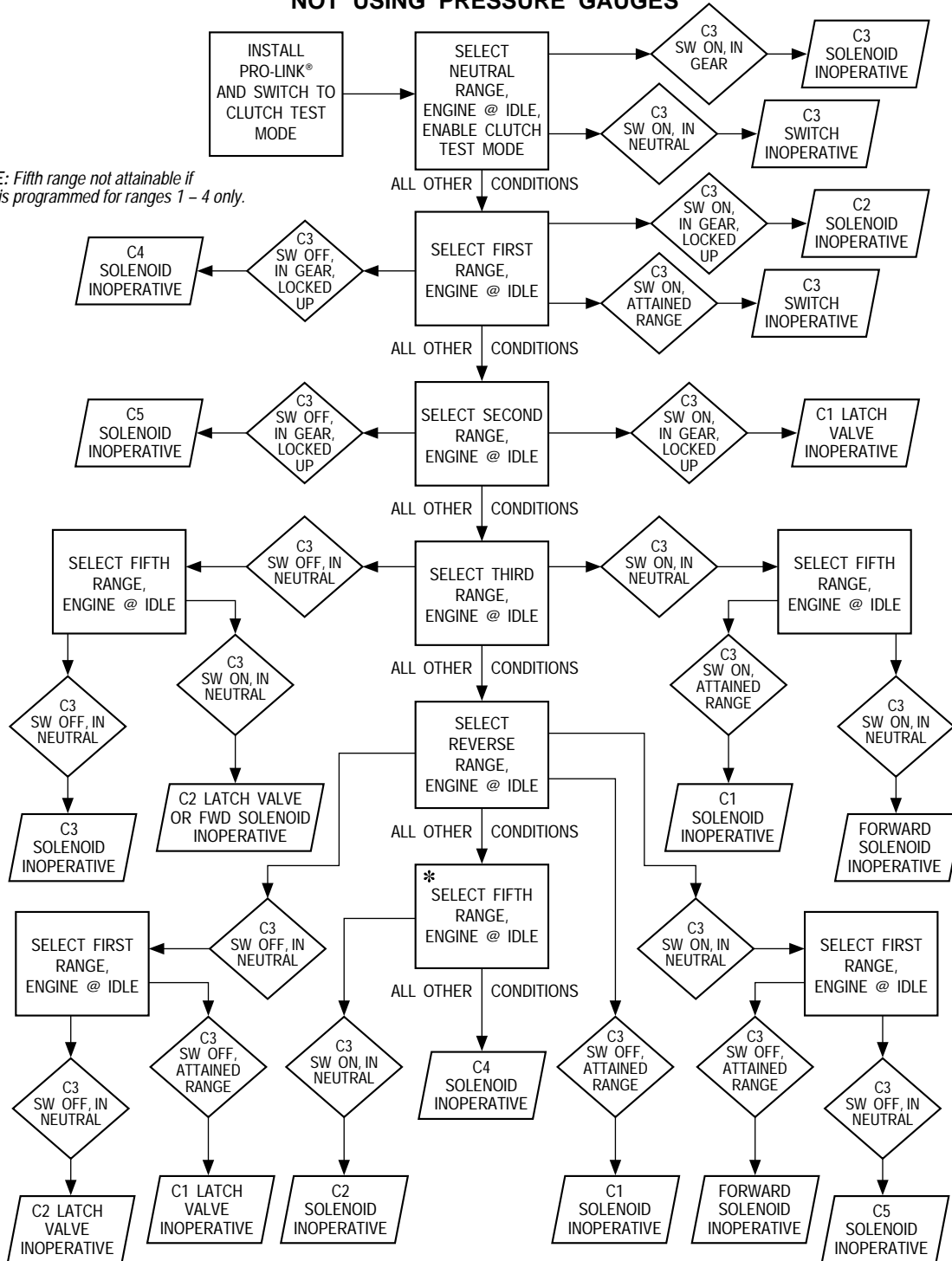


Figure F-1. Diagnostic Tree — WT Series Hydraulic System With Gauges

APPENDIX F — DIAGNOSTIC TREE — WT HYDRAULIC SYSTEM

**DIAGNOSTIC TREE
WT SERIES HYDRAULIC SYSTEM
NOT USING PRESSURE GAUGES**

**NOTE: Fifth range not attainable if ECU is programmed for ranges 1 - 4 only.*



V01103.02

Figure F-2. Diagnostic Tree — WT Series Hydraulic System Without Gages

APPENDIX G — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

Pro-link® 9000 Diagnostic Tools

The WTEC III system will require new Pro-Link® 9000 hardware for reprogramming and diagnostics. The following is a list of required updates to the current Pro-Link® 9000 hardware:

Hardware	Tool P/N
Diagnostic Cartridge	J38500-303
PROM Update Kit	J38500-313
MultiProtocol Cartridge (MPC)	J38500-1500A
Reprogramming PCMCIA Card*	J38500-1700
Diagnostic Card*	J38500-1800
* Requires J38500-1500A to function	

Limited diagnostic information for the WTEC III system can be accessed through the current WTEC II Pro-Link® 9000 hardware. This diagnostic information will however be limited to that information that is common to the WTEC II and WTEC III systems. Access to information described in this SIL can only be accessed through **either** the WTEC III Diagnostic Cartridge or by updating the current WTEC II Diagnostic Cartridge with the PROM update kit or the WTEC III Reprogramming Cartridge.

The MultiProtocol Cartridge (MPC) and the Reprogramming Card are required to modify customer constants and alter Calibration packages within the WTEC III ECU. After completing an ATD-approved training class, those ordering a reprogramming cartridge are required to submit a copy of their completion certificate with their order. This serves as proof of eligibility to purchase these items. Training is available from ATD and ATD distributors.

APPENDIX G — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

APPENDIX H — INPUT/OUTPUT FUNCTIONS

The schematics which follow were taken from the Sales Tech Data Book entitled “WTEC III Controls.” These schematics provide detail information needed to correctly perform input and output function connections.

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

A. SECONDARY SHIFT SCHEDULE

USES: Provides operator selection of dual shift schedules. Can be used for performance/economy, loaded/empty, or other shift schedule combinations.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

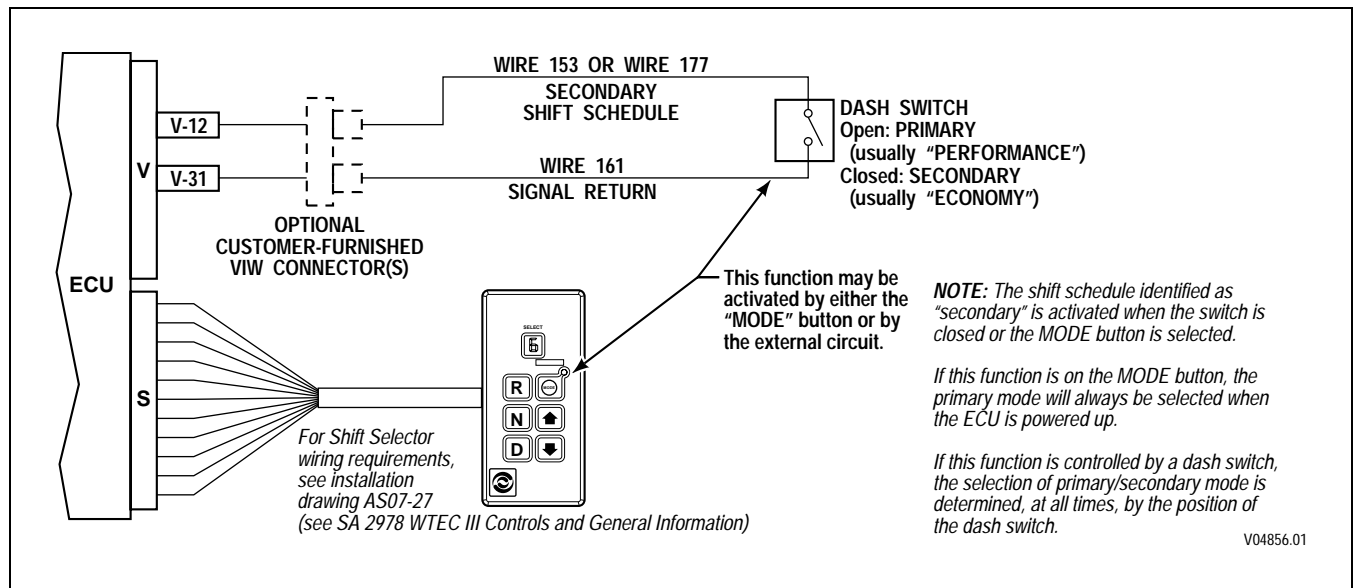


Figure H-1. Secondary Shift Schedule

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

B. D1 SELECTION

USES: Provides a convenient means of attaining 1st range hold for pushbutton shift selectors. Range to select is programmable for Primary and Secondary modes.

VARIABLES TO SPECIFY: Primary Mode selected range, Secondary Mode selected range (usually 1st range).
Can be used only on the MODE button.

VOCATIONS: Various

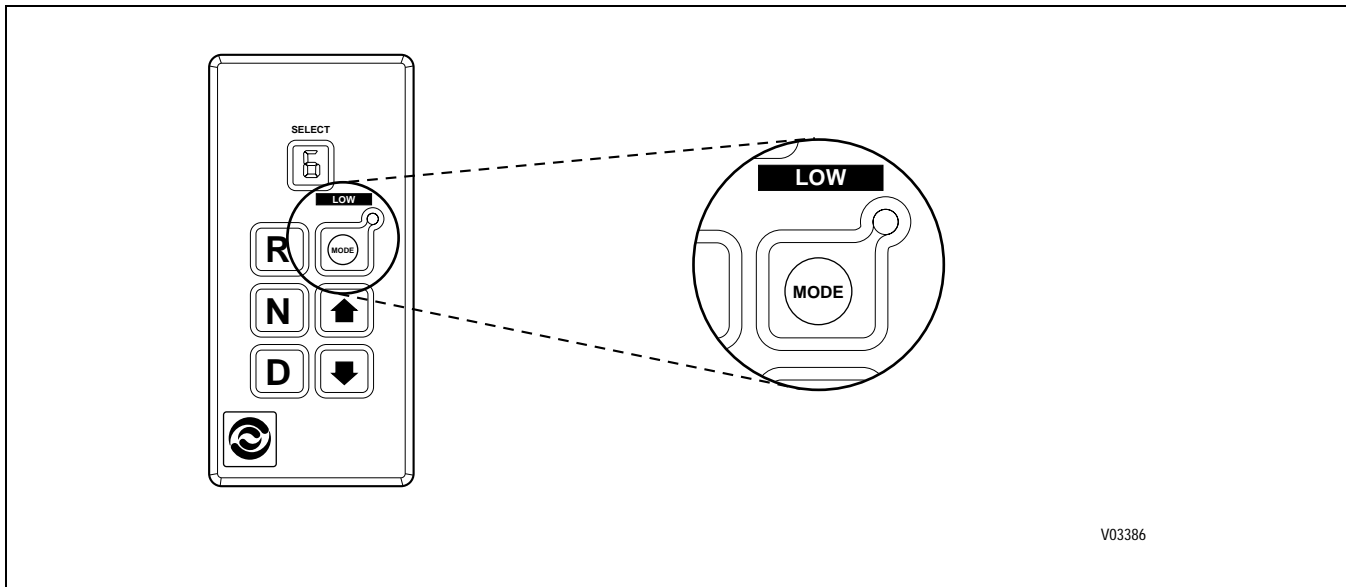


Figure H-2. D1 Selection

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

D. SHIFT SELECTOR TRANSITION

USES: When two shift selectors are used, to select which one is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

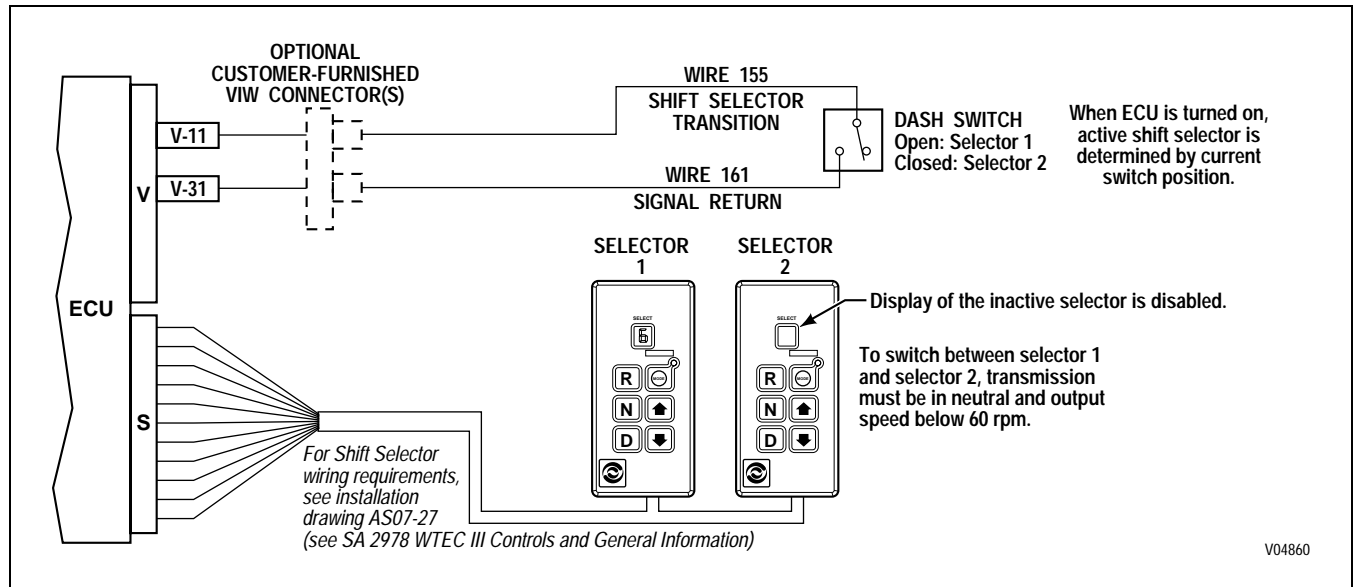


Figure H-3. Shift Selector Transition

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

H. ENGINE BRAKE/PRESELECT REQUEST AND ENGINE BRAKE ENABLE (EXHAUST BRAKE – OPTIONAL)

USES: Used with engine brakes controlled by electronic engines to signal the ECU that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range.

VOCATIONS: Various

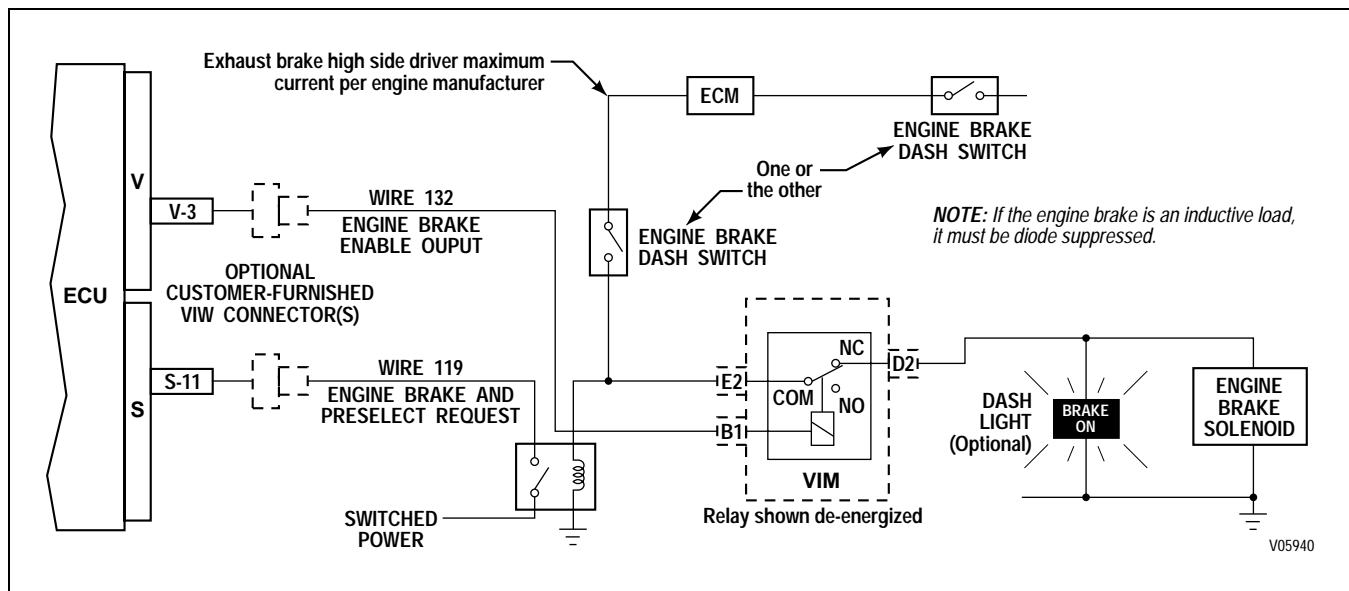


Figure H-4. Engine Brake/Preselect Request and Engine Brake Enable (Exhaust Brake — Optional)

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

H. ENGINE BRAKE/PRESELECT REQUEST AND ENGINE BRAKE ENABLE (COMPRESSION BRAKE)

USES: Used with single-level compression brakes to signal the ECU that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is fourth range.

VOCATIONS: Various

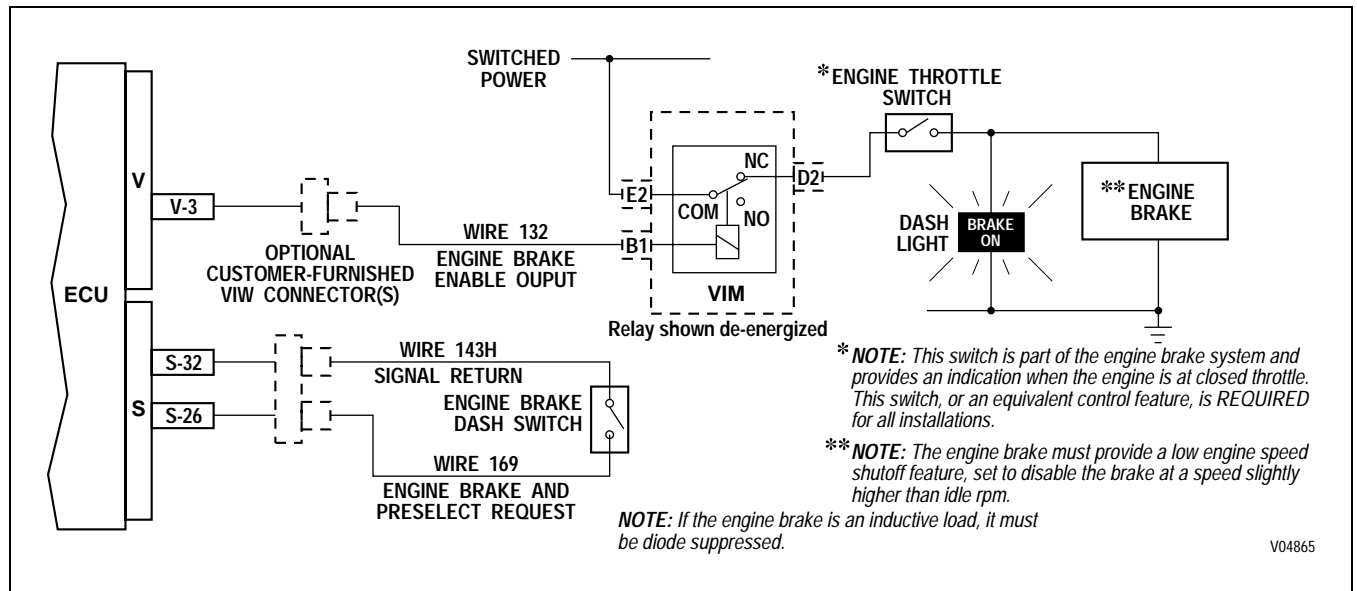


Figure H-5. Engine Brake/Preselect Request and Engine Brake Enable (Compression Brake)

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

I. ENGINE BRAKE/PRESELECT REQUEST AND ENGINE BRAKE ENABLE (EXHAUST BRAKE — SPECIAL)

USES: Used with engine brakes to provide a signal to the ECU that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range.

VOCATIONS: Various

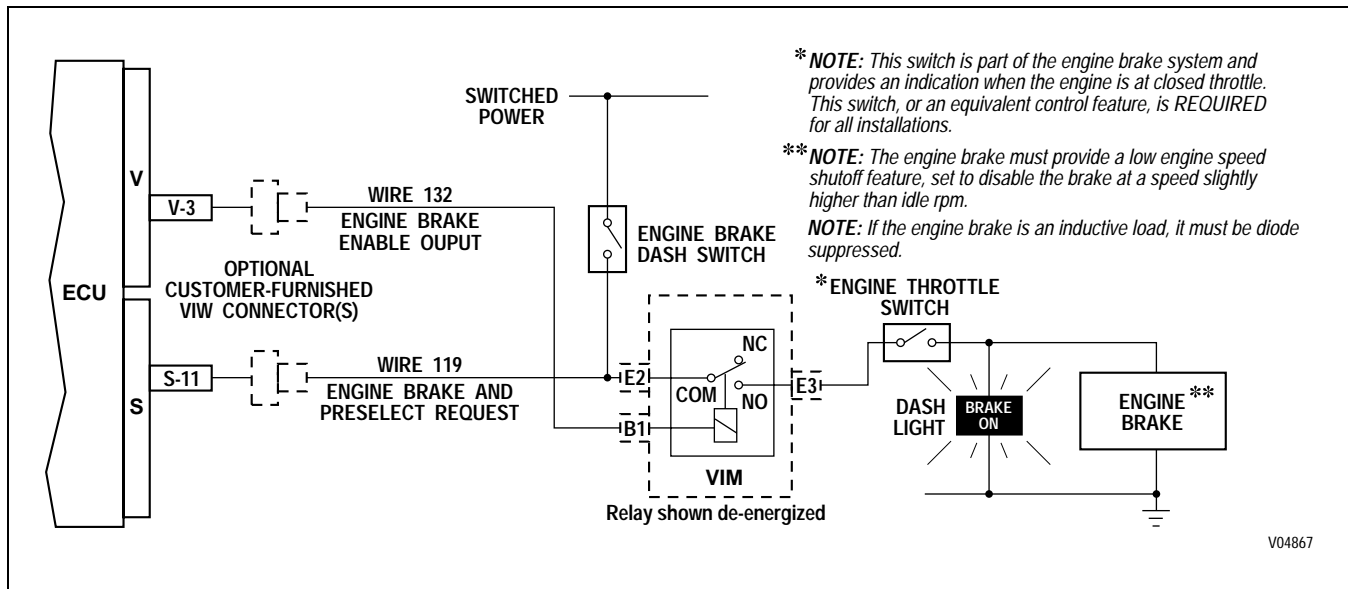


Figure H-6. Engine Brake/Preselect Request and Engine Brake Enable (Exhaust Brake — Special)

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

Y. ANTI-LOCK BRAKE RESPONSE

USES: Signals the ECU when ABS function is active, so that lockup clutch and retarder will be disabled.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

For schematics of this function, see the **ANTI-LOCK BRAKES** section located in Section C: Vehicle Electrical System Interface of SA2978, WTEC III Controls And General Information.

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

Y. ANTI-LOCK BRAKE RESPONSE (OPTIONAL)

USES: Provides for enhanced control of lockup and retarder during hard braking conditions. Can be used separately or in conjunction with ABS.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

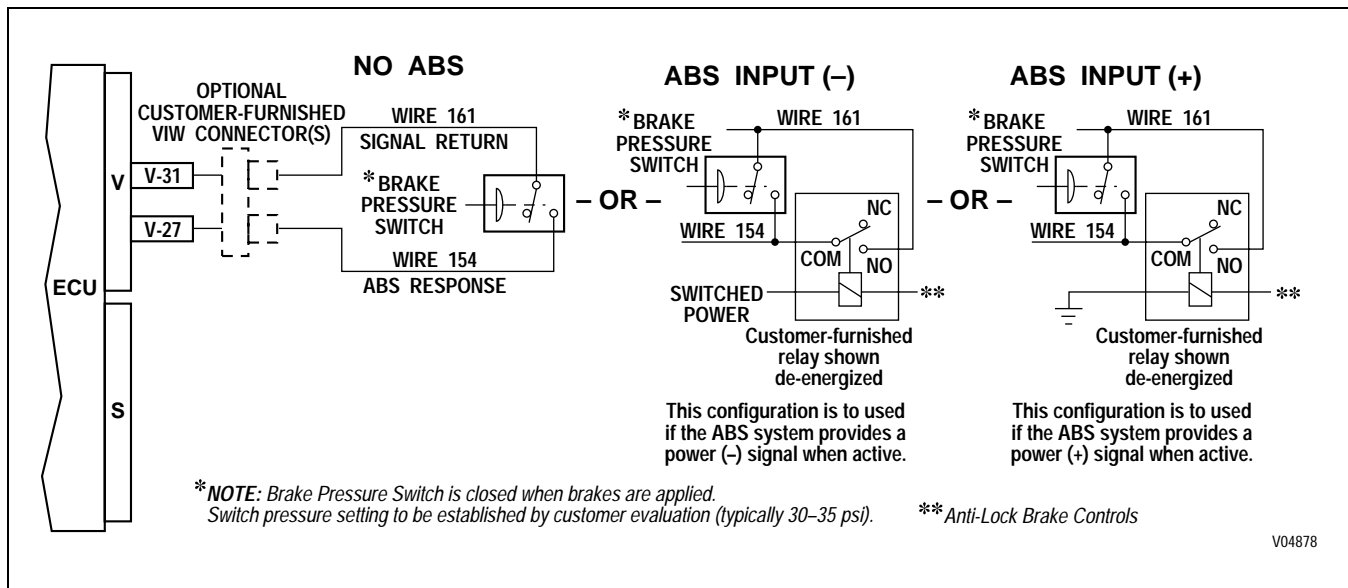


Figure H-7. Anti-Lock Brake Response (Optional)

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

AI. MILITARY AUXILIARY FUNCTION RANGE INHIBIT (STANDARD)

USES: Prevents inadvertent range selection when auxiliary equipment is operating.

VARIABLES TO SPECIFY: None

VOCATIONS: Military wheeled vehicles

WARNING!

If this function is turned “ON” in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be turned “OFF” in the calibration.

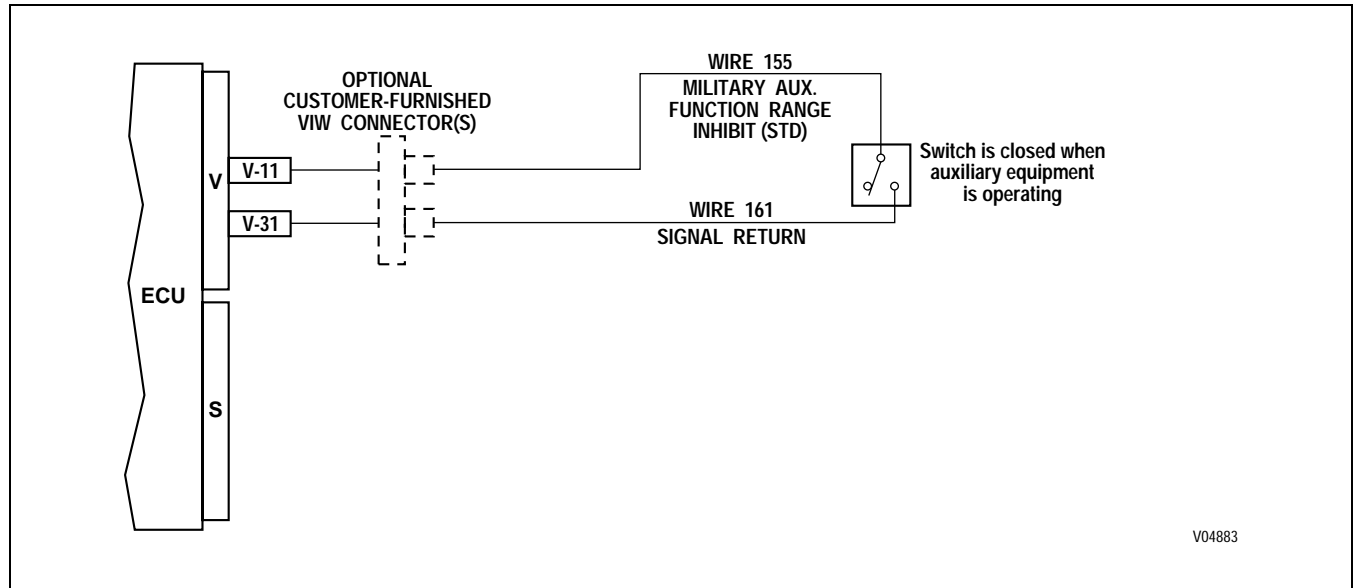


Figure H-8. Military Auxiliary Function Range Inhibit (Standard)

APPENDIX H — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AQ. SELECTOR DISPLAY BLANKING

USES: Blanks the digital display and mode on indicator on the lever or pushbutton shift selectors.

VARIABLES TO SPECIFY: None

VOCATIONS: Military wheeled vehicles

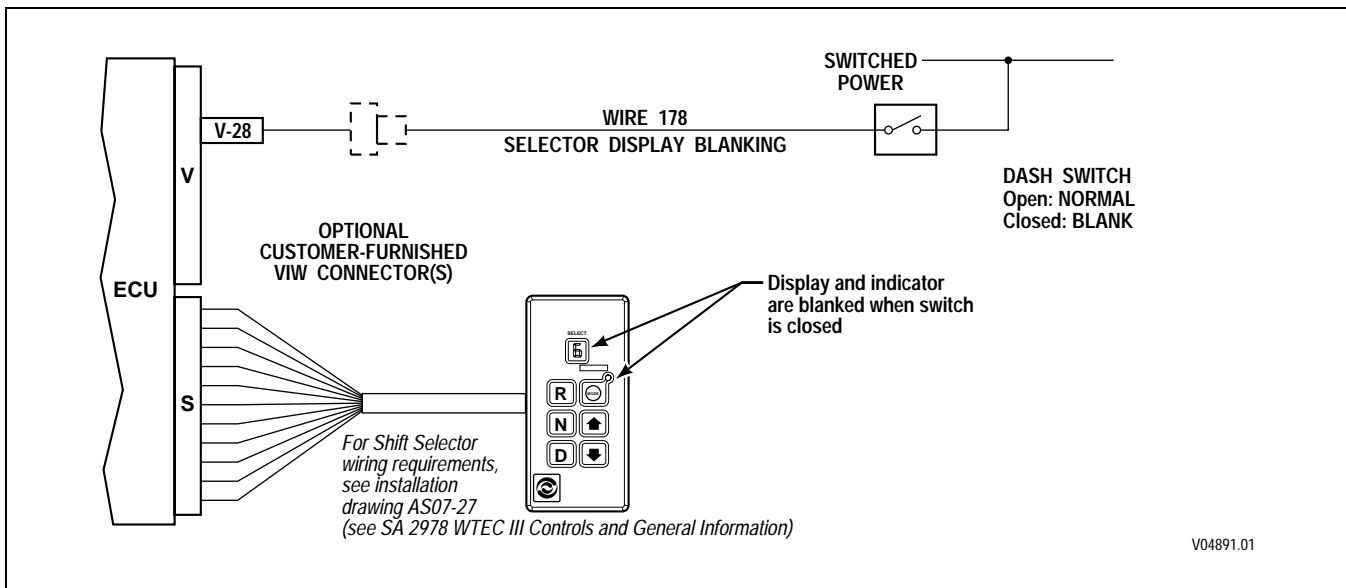


Figure H-9. Selector Display Blanking

THIS WORK PACKAGE COVERS

Transmission Troubleshooting Procedures

INITIAL SETUP

Tools and Special Tools

MSD/ICE (Item 58, WP 0313 00)
SPORT/ICE (Item 92, WP 0313 00)

Tools and Special Tools - Continued

PC Card, transmission (Item 66, WP 0313 00)
Tester, Pro-link, diagnostic reader (Item 99, WP 0313 00)

NOTE

In addition to the transmission troubleshooting located in Table 1 below, the *Allison 4th Generation Controls Troubleshooting Manual* is duplicated in its entirety and is located in Volume 3.

Table 1. Transmission Troubleshooting Procedures

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
TRANSMISSION		
<p>1. Shift Selector Display Is Blank.</p> <p>2. Vehicle Does Not Start (Engine Does Not Crank).</p>	<p>1. Check if VIM fuse is blown.</p> <p>2. Check for damaged or loose battery connections.</p> <p>3. Check for blown fuse or fusible link at battery.</p> <p>1. Check that shift selector is in N (Neutral).</p> <p>2. Check for dead battery.</p> <p>3. Check for damaged or loose battery connections.</p> <p>4. Faulty starter circuit.</p> <p>5. Faulty neutral start relay.</p> <p>6. Faulty wiring in neutral start circuit.</p> <p>7. Voltage to TCM too low.</p>	<p>Replace VIM fuse (WP 0072 00).</p> <p>Tighten or repair battery connections (WP 0095 00).</p> <p>Replace battery fuse or fusible link (WP 0073 00).</p> <p>Press N (Neutral) on shift selector and restart vehicle (TM 9-2320-303-10).</p> <p>Recharge battery as necessary TM 9-6140-200-14).</p> <p>Tighten or repair battery connections (WP 0095 00).</p> <p>Repair vehicle starter circuit (WP 0010 00).</p> <p>Replace neutral start relay (WP 0072 00).</p> <p>Repair wiring (WP 0098 00).</p> <p>Check battery and charging system voltage (WP 0010 00).</p>

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
TRANSMISSION - CONTINUED		
2. Vehicle Does Not Start (Engine Does Not Crank) - Continued.	8. Faulty shift selector. 9. Lack of battery voltage on circuit 123 from TCM when in neutral.	Replace shift selector (WP 0107 01). Repair circuit 123 (WP 0072 00) or replace ECU (WP 0110 00).
3. All Display Segments on Both Sides of Display Lighted.	No calibration installed in TCM. Voltage to TCM too low.	Check battery and charging system voltage (WP 0010 00).
TRANSMISSION SHIFTING		
1. ECU Will Not Turn Off When Ignition Switch Is Turned Off.	Faulty ignition switch.	Replace ignition switch (WP 0066 00).
2. Transmission Will Not Shift to Forward or Reverse (Stays In Neutral).	1. Engine RPM too high. 2. Low transmission fluid level. 3. Transmission fluid temperature too low. 4. Throttle position sensor set-up is incorrect. 5. Voltage to TCM too low. 6. Shift selector is not functioning properly. 7. Disconnected or dirty connectors. 8. Faulty wiring harnesses. 9. Faulty TCM.	Reduce engine RPM. Add fluid to proper level (TM 9-2320-303-10). Warm transmission fluid. Refer to throttle position sensor for correct set-up (WP 0006 00). Check vehicle battery and charging system (WP 0010 00). Replace shift selector (WP 0107 01). Perform connector checkout. Repair harness (WP 0098 00). Replace TCM (WP 0110 00).
3. Transmission Will Not Stay in Forward or Reverse.	Auto-neutral or quick-to-neutral circuit (input function) faulty.	Repair transmission (WP 0248 01).
4. Transmission Will Not Make a Specific Shift.	1. Low engine power. 2. Incorrect transmission fluid level. 3. Extreme transmission fluid temperature. 4. Faulty shift selector. 5. Faulty TCM.	Correct engine problem (WP 0006 00). Correct fluid level (TM 9-2320-303-10). Inspect cooling system and fluid level (WP 0009 00). Replace shift selector (WP 0107 01). Replace TCM (WP 0110 00).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
TRANSMISSION SHIFTING - CONTINUED		
5. Transmission Does Not Shift Properly (Rough Shifts, Shifts Occurring at Too Low or Too High Speed).	1. Engine idle speed too fast (neutral to range shift).	Adjust engine idle speed (WP 0006 00).
	2. TCM input voltage low.	Check power, ground, charging system, and battery function (WP 0010 00).
	3. Incorrect transmission fluid level	Correct fluid level (TM 9-2320-303-10).
	4. Intermittent problems.	Check wiring harnesses and connectors (WP 0072 00).
ABNORMAL ACTIVITIES OR RESPONSES FROM TRANSMISSION		
1. Excessive Creep in First and Reverse Gears.	Engine idle speed too high.	Adjust to correct idle speed between 500-800 RPM (WP 0006 00).
2. No Response to Shift Selector.	1. Shift selector not properly connected.	Check shift selector response with diagnostic tool. If no response, check remote connection and replace if necessary (WP 0107 01).
	2. Faulty shift selector.	Replace shift selector (WP 0107 01).
	3. Incorrect transmission fluid level.	Correct fluid level (TM 9-2320-303-10).
3. Vehicle Moves Forward in Neutral.	C1 clutch failed or not released.	Repair transmission (WP 0248 01).
4. Vehicle Moves Backward in Neutral.	C3 clutch failed or not released.	Repair transmission (WP 0248 01).
5. Engine Overspeed on Full-throttle Upshifts.	1. TPS adjustment: - Overstroke	Adjust TPS (WP 0006 00).
	2. TCM input voltage low.	Check electrical system and all connections from battery and TCM (WP 0010 00).
	3. Incorrect transmission fluid level.	Correct fluid level (TM 9-2320-303-10).
	4. Piston seals leaking or clutch plates slipping in range involved.	Repair transmission (WP 0248 01).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
ABNORMAL ACTIVITIES OR RESPONSES FROM TRANSMISSION - CONTINUED		
6. Excessive Slippage and Clutch Chatter.	1. Incorrect calibration. 2. TCM input voltage low. 3. Throttle position sensor out of adjustment or failed. 4. Incorrect transmission fluid level.	Verify calibration. Check power, ground, charging system, and battery functions (WP 0010 00). Adjust or replace throttle position sensor (WP 0006 00). Add fluid to proper level (TM 9-2320-303-10).
7. Abnormal Stall Speeds (Stall in All Ranges). High Stall Speeds. Low Stall Speeds.	1. Not in gear. 2. Low fluid level, aerated fluid. 3. Clutch slipping. Engine not performing efficiently (may be due to plugged or restricted injectors, high altitude conditions, dirty air filters, out of time, throttle linkage, electronic engine controls problem).	Select D (Drive). Add fluid to proper level (TM 9-2320-303-10). Repair transmission (WP 0248 01). Refer to Engine Troubleshooting (WP 0006 00). Notify Direct Support Maintenance.
8. Overheating in All Ranges.	1. Aerated fluid - incorrect fluid level. 2. Engine overheat. 3. Inaccurate temperature gage. 4. Fluid cooler lines restricted.	Adjust fluid to proper level (TM 9-2320-303-10). Correct overheat situation (WP 0006 00). Replace gage (WP 0065 00). Remove restrictions, clean or replace lines (WP 0115 00).
9. Fluid Comes out Fluid Fill Tube and/or Breather.	1. Dipstick loose. 2. Transmission fluid level too high. 3. Transmission fluid level too low. 4. Breather clogged. 5. Transmission fluid contaminated with foreign liquid. 6. Dipstick or fill tube seal worn.	Tighten cap. Replace if necessary (WP 0108 00). Drain to proper level (TM 9-2320-303-10). Add fluid to proper level (TM 9-2320-303-10). Clean or replace breather (WP 0113 00). Drain and replace fluid (WP 0024 00). Locate and repair source of contaminating fluid. Replace seals or dipstick (WP 0108 00).

Table 1. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<i>ABNORMAL ACTIVITIES OR RESPONSES FROM TRANSMISSION - CONTINUED</i>		
10.Noise Occurring Intermittently (Buzzing).	<ol style="list-style-type: none"> 1. Low transmission fluid level. 2. Air leak in oil suction screen canister. 3. Clogged filters. 4. Aerated fluid causes noisy pump. 	<p>Add fluid to proper level (TM 9-2320-303-10).</p> <p>Replace oil suction screen canister (WP 0109 00).</p> <p>Replace filters (WP 0109 00).</p> <p>Add fluid to proper level (TM 9-2320-303-10).</p>
11.Leaking Fluid (Output Shaft).	Faulty or missing seal at output flange.	Repair transmission (WP 0248 01).
12.Transmission Leaks (Input).	<ol style="list-style-type: none"> 1. Front seal leaks 2. Converter leaks. 	<p>Repair transmission (WP 0248 01).</p> <p>Repair transmission (WP 0248 01).</p>
13.Dirty Transmission Fluid.	<ol style="list-style-type: none"> 1. Failure to change fluid and filters. 2. Damaged fluid filter/seals. 	<p>Change fluid and install new filters (WP 0109 00).</p> <p>Replace oil filter/seals (WP 0109 00).</p>

END OF WORK PACKAGE

CHAPTER 3
UNIT MAINTENANCE INSTRUCTIONS

SERVICE UPON RECEIPT

0022 00**GENERAL**

1. When a new, used or reconditioned M915A4 or M915A4R2 is first received, determine whether it has been properly prepared for service and is in condition to perform its mission.
2. Follow the inspection and servicing instructions that follow.

INSPECTION INSTRUCTIONS

1. Read and follow all precautions and instructions on DD Form 1397.
2. Remove all packing and shipping material, such as tape, tie downs, protective covers, and shipping seals.
3. Inspect equipment for any damage incurred during shipment. Check if equipment has been modified.
4. Check equipment against packing slip to ensure that shipment is complete. Report any discrepancies on SF Form 364.
5. Remove all Basic Issue Item (BII), Additional Authorization List (AAL), and Components of End Item (COEI) equipment and store in accordance with TM 9-2320-303-10.

SERVICING INSTRUCTIONS

1. Service the vehicle in accordance with TM 9-2320-303-10 and Unit PMCS (WP 0024 00). Schedule the next PMCS on DD Form 314.
2. Refer to TM 9-2320-303-10 and perform functional checks of all major vehicle systems.

END OF WORK PACKAGE

GENERAL

To ensure that both models are ready for operation at all times, it must be lubricated and inspected on a regular basis so that defects may be found before they result in serious damage, equipment failure, or injury to personnel. This introduction lists the types, amounts, and temperature ranges of the lubricants required for specified intervals. Table 1 contains systematic instructions on lubrications, inspections, adjustments, and corrections to be performed by Unit Maintenance to keep the vehicle in good operating condition and ready for its primary mission.

EXPLANATION OF TABLE ENTRIES

- a. **Item Number (Item No.) Column.** Numbers in this column are for reference. When completing DA Form 2404 (*Equipment Inspection and Maintenance Worksheet*), include the item number for the check/service indicating a fault. Item numbers also appear in the order you must perform checks and services for the interval listed.
- b. **Interval Column.** This column tells you when you must perform the procedure in the procedure column. Intervals are based on calendar.
 - (1) *Quarterly* procedures must be done once every three months.
 - (2) *Semiannual* procedures must be done once every six months.
 - (3) *Annual* procedures must be done once each year.
- c. **Location, Item to Check/Service Column.** This column identifies the location and the item to be checked or serviced.

NOTE

The WARNINGS and CAUTIONS appearing in your PMCS table should always be observed. WARNINGS and CAUTIONS appear before applicable procedures. These WARNINGS and CAUTIONS must be observed to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

- d. **Procedure Column.** This column gives the procedure you must perform to check or service the item listed in the Item to Check/Service column to know if the equipment is ready or available for its intended mission or for operation. You must perform the procedure at the time stated in the interval column.
- e. **Not Fully Mission Capable if: Column.** Information in this column tells you what fault will keep your equipment from being capable of performing its primary mission. If you make check and service procedures that show faults listed in this column, the equipment is not mission-capable. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

GENERAL LUBRICATION PROCEDURES

- a. Recommended intervals are based on normal conditions of operation, temperature, and humidity. When operating under extreme conditions, such as high or low temperatures, fording in water over 20 inches deep, or exposure to sand or dust, lubricants should always be changed more frequently. Lubricants that have become contaminated will be changed regardless of interval. When in doubt, notify your supervisor.
- b. Keep all lubricants in a closed container and store in a clean, dry place away from extreme heat. Keep container covers clean and do not allow dust, dirt, or other foreign material to mix with lubricants. Keep all lubrication equipment clean and ready for use.
- c. Maintain a good record of all lubrication performed and report any problem noted during lubrication. Refer to DA Pam 738-750 for maintenance forms and procedures to record and report any findings.
- d. Keep all external parts of equipment not requiring lubrication free of lubricants. Before lubrication, wipe lubrication fittings with a clean rag. After lubrication, wipe off excess oil or grease to prevent accumulation of foreign matter.
- e. Refer to FM 9-207 for lubrication instructions in cold weather.
- f. Refer to AR 70-12 for use of standardized fuels and lubricants.

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION - CONTINUED

0023 00

- g. Oil filters will be changed when:
 - (1) they are known to be contaminated or clogged,
 - (2) at prescribed hardtime intervals.
- h. Engine oil, and transmission fluid, must be sampled initially at 90 days of operation as prescribed by DA Pam 738-750.
- i. For equipment under manufacturer’s warranty, hardtime oil service intervals shall be followed. Intervals shall be shortened if lubricants are known to be contaminated or if operation is under adverse conditions (i.e., longer than usual operating hours, extended idling periods, or extreme dust).
- j. Dashed leader lines on illustrations related to lubrication indicate that lubrication is required on both sides of the equipment.

GENERAL PMCS PROCEDURES

- a. Always perform PMCS in the same order so it gets to be a habit. Once you’ve had some practice, you’ll spot anything wrong in a hurry. If any deficiency is discovered, perform the appropriate troubleshooting task in Chapter 2 of this manual. If any component or system is not serviceable, or if the given service does not correct the deficiency, notify your supervisor.
- b. Before performing preventive maintenance, read all the checks required for the applicable interval and prepare all tools needed to make all checks. Have several clean rags handy. Perform ALL inspections at the applicable interval.
 - (1) **Keep It Clean.** Dirt, grease, oil, and debris get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent on all metal surfaces. Use detergent and water when you clean rubber, plastic, and painted surfaces.
 - (2) **Rust and Corrosion.** Check metal parts for rust and corrosion. If any bare metal or corrosion exists, clean and apply a light coat of lubricating oil. Report it to your supervisor.
 - (3) **Bolts, Nuts, and Screws.** Check bolts, nuts, and screws for obvious looseness, missing, bent, or broken condition. You can’t try them all with a tool, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it.
 - (4) **Welds.** Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.
 - (5) **Electric Wires and Connectors.** Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and ensure that the wires are in good condition.
 - (6) **Hydraulic Hoses and Lines.** Look for wear, damage, and signs of leaks. Ensure that clamps and fittings are tight. Wet spots indicate leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, correct it if authorized by the Maintenance Allocation Chart (WP 0316 00). If not authorized, notify your supervisor.
 - (7) **Fluid Leakage.** It is necessary for you to know how fluid leakage affects the status of your truck. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your truck. Learn and be familiar with them, and remember - when in doubt, notify your supervisor.

Leakage Definitions For PMCS

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 drip from item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from item being checked/inspected.

CAUTION

Operation is allowable with Class I and Class II leakage. **WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR.** When operating with Class I or Class II leaks, check fluid levels more frequently. Class III leaks must be reported immediately to your supervisor. Failure to do this will result in damage to vehicle and/or components.

PMCS INITIAL SETUP

a. **General.**

- (1) This paragraph lists tools, materials, and personnel required for PMCS and lubrication.
- (2) Mandatory replacement parts for PMCS are located at end of Unit PMCS (WP 0024 00) as tables 2 and 3.

b. **Tools.**

- (1) Common No. 1 shop set
- (2) General mechanic's tool kit.

c. **Materials.**

- (1) Antifreeze
- (2) Detergent
- (3) Dry cleaning solvent
- (4) GAA grease
- (5) Lubricating oil, OE/HDO 10
- (6) Lubricating oil, OE/HDO 40
- (7) Lubricating oil, OE/HDO 15/40
- (8) Lubricating oil, OE/HDO 30
- (9) Lubricating oil, OEA
- (10) Lubricating oil, GO 85/140
- (11) Lubricating oil, GO 80/90
- (12) Lubricating oil, GO 75
- (13) Rags

d. **Personnel.**

- (1) Driver/Operator
- (2) Unit Maintenance Mechanic

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION - CONTINUED

0023 00

Lubrication Data

Lubricant/ Component	Refill Capacity	Expected Temperatures*		
		+6°F to +122°F (-14°C to +50°C)	-4°F to +50°F (-20°C to +10°C)	-67°F to +32°F (-55°C to 0°C)
OE/HDO (MIL-L-2104) Lubricating Oil, ICE, Tactical				
OEA (MIL-L-46167) Lubricating Oil, ICE, Arctic				
Engine Crankcase w/Filters	46 qts (43.5 L)	See Chart A		
Transmission	51 qt (48 L)	See Chart B		
GO (MIL-L-2105) Lubricating Oil, Gear, Multipurpose				
Front Axle Wheel Bearings	As Req'd	See Chart C		
Rear Axle Differential, Forward-Rear	13 Qt (12.3 L)	See Chart C		
Rear Axle Differential, Rear-Rear	14.5 Qt (13.7 L)	See Chart C		
GAA (MIL-G-10924) Grease, Automotive and Artillery	As Req'd	All Temperatures		
ANTIFREEZE (MIL-A-46153) Ethylene Glycol, Inhibited, Heavy Duty				
ANTIFREEZE (MIL-A-11755) Ethylene Glycol, Arctic Grade				
Engine Radiator	69 qt (65.3 L)	See Chart D		
* For arctic operation, refer to FM 9-207				

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION - CONTINUED

0023 00

CHART A - ENGINE AND POWER STEERING RESERVOIR

Lubricant	EXPECTED TEMPERATURE																			
	°F	-70	-60	-50	-40	-30	-20	-10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100	+120
	°C	-57	-51	-46	-40	-34	-29	-23	-18	-12	-7	-1	+4	+10	+16	+21	+27	+32	+38	+49
OE/HDO (MIL-L-2104)	Lubricating Oil, ICE, Tactical																			
OEA (MIL-L-46167)	Lubricating Oil, ICE, Arctic																			
OE/HDO-15/40 (0 - 1236)																				
OE/HDO-10 * (0-237)																				
OE/HDO-30 (0 - 238)																				
OE/HDO-40 (N/A)																				
OEA * (0 - 183)																				

*If OEA lubricant is required to meet the low expected-temperature range, OEA lubricant is to be used in lieu of OE/HDO-10 lubricant for all expected temperatures where OE/HDO-10 is specified.

CHART B - TRANSMISSION

Lubricant	EXPECTED TEMPERATURES																			
	°F	-70	-60	-50	-40	-30	-20	-10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100	+120
	°C	-57	-51	-46	-40	-34	-29	-23	-18	-12	-7	-1	+4	+10	+16	+21	+27	+32	+38	+49
OE/HDO (MIL-L-2104)	Lubricating Oil, ICE, Tactical																			
OEA (MIL-L-46167)	Lubricating Oil, ICE, Arctic																			
OE/HDO-15/40 (0 - 1236)																				
OE/HDO-10 * (0 - 237)																				
OEA * (0 - 183)																				

*If OEA lubricant is required to meet the low expected-temperature range, OEA lubricant is to be used in lieu of OE/HDO-15/40 lubricant for all expected temperatures where OE/HDO-10 and OE/HDO-15/40 are specified.

UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION - CONTINUED

0023 00

CHART C - FRONT AXLE WHEEL BEARINGS AND AXLE DIFFERENTIALS

Lubricant	EXPECTED TEMPERATURES																			
	°F	-70	-60	-50	-40	-30	-20	-10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100	+120
	°C	-57	-51	-46	-40	-34	-29	-23	-18	-12	-7	-1	+4	+10	+16	+21	+27	+32	+38	+49
GO (MIL-L-2105)	Lubricating Oil, Gear, Multipurpose																			
GO-75 (O - 186)	_____																			
GO-80/90 (O - 226)	_____																			
GO-85/140 (O - 228)	_____																			

CHART D - ANTIFREEZE

Lubricant	EXPECTED TEMPERATURES																			
	°F	-90	-80	-70	-60	-50	-40	-30	-20	-10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90
	°C	-68	-62	-57	-51	-46	-40	-34	-29	-23	-18	-12	-7	-1	+4	+10	+16	+21	+27	+32
MIL-A-46153	Antifreeze, Ethylene Glycol, Inhibited, Heavy Duty																			
MIL-A-11755	Antifreeze, Arctic Grade																			
MIL-A-46153	_____																			
MIL-A-11755	_____																			

END OF WORK PACKAGE

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2.

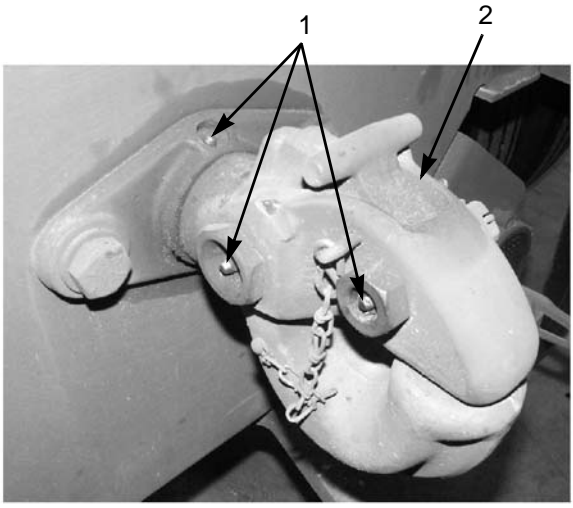
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
1	Quarterly	0.1	Rear of Vehicle, Pintle Hook	WARNING	
				<p>Unless otherwise specified, perform all lubrication and preventive maintenance checks and services with truck on level ground, transmission in N (Neutral), parking brake applied, and engine off. Failure to follow this warning may result in personnel injury.</p> <p style="text-align: center;">NOTE</p> <p>Perform all operator PMCS, as appropriate, while performing road test (TM 9-2320-303-10). Drive at least 5 mi (8 km) to give enough time to detect malfunctions.</p> <p>a. Lubricate three pintle hook grease fittings (1) with grease (Item 23, WP 0312 00).</p> <p>b. Check pintle hook (2) for proper operation. Ensure that mounting hardware is tight.</p>	
					
402-152					

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.


ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
4 (Con't)	Semi-annual		<u>Road Test, Brakes</u>	<p>f. While vehicle is moving, engage engine Jake brake and check operation in all switch positions (2, 4, and 6 cylinders braking power). Ensure that vehicle speed drops in each position, with maximum braking power with all 6 cylinders engaged in braking.</p> <div style="text-align: center;">  <p>WARNING</p> </div> <p>Cautiously feel each wheel hub and brakedrum. Wheel hubs and brakedrums may be hot. Failure to follow this warning may result in serious burns.</p>	
				<p>g. Immediately after road test, carefully check and compare each wheel hub and brakedrum for overheating, which could indicate a dragging brake. A cool wheel hub and brakedrum could mean improperly adjusted, defective or inoperative brakes.</p>	Any wheel hub or brakedrum is overheated.
5	Semi-annual		<u>Road Test, Interaxle Lockout</u>	Check operation of interaxle lockout (TM 9-2320-303-10).	If freeplay exceeds 2-1/2 in. in either direction.
6	Semi-annual		<u>Road Test, Steering</u>	Check vehicle response to steering wheel action. Vehicle should respond quickly. With vehicle on straight level ground, lightly hold steering wheel to check for pull or wander. With vehicle in motion, free play should be no more than 2 1/2 in (6.4 cm) in either direction.	
7	Semi-annual		<u>Road Test, Suspension</u>	Observe how vehicle responds to road shocks. Shifts, knocks or constant bouncing indicate possible malfunctions.	

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.


ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
8	Semi-annual		<u>Engine Compartment, Engine</u>	a. Check all oil lines, fittings, and hoses for leaks. b. Check oil filter housing, oil pan, and oil pan drain plug for leaks. Tighten or replace any damaged component, if authorized. c. Check rocker arm cover for leaks. Tighten or replace any damaged component, if authorized. d. Check mounting hardware and attaching hardware for looseness. Tighten or replace any damaged component, if authorized.	Class III oil leak is present.
9	Semi-annual	0.5	<u>Engine Compartment, Fuel System</u>	<div style="text-align: center;">  <p>WARNING</p> </div> DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flame or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicle. a. Replace all fuel filter elements (WP 0035 00 and WP 0036 00). b. Inspect fuel lines, fuel tank, and fuel system components for leaks and damage. If authorized, replace damaged components.	Class III oil leak is present.

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.


ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:	
			ITEM TO CHECK/SERVICE			
10	Semi-annual		Engine Compartment, Drive Belts and Pulleys	a. Check for loose, missing, worn, broken, frayed or cracked drive belts (3).	Missing or broken belt.	
				 <p style="text-align: center;">3</p> <p style="text-align: right; font-size: small;">426-177</p>		
				b. Check alternator and air conditioning compressor mounting for looseness. Inspect brackets and attaching hardware for cracks, bends, and loose mounting. Replace damaged components as needed. c. Check tension of alternator/ac compressor belt and fan belt at center of longest belt free-span by moving belts by hand. If either belt has 1/2 inch or more play, adjust belt tension. d. Check for cracked pulleys or pulleys out of alignment.		

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.


ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
11	Semi-annual		<u>Engine Compartment, Air Intake System</u>	 <p>WARNING</p> <p>If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.</p> <p>a. Check air cleaner, hoses, and air cleaner seal for proper installation, cracks, breaks or loose connections that could let unfiltered air into air intake system.</p> <p>b. Check air cooler intake screen for debris and damage.</p> <p>c. Check air intake filter element for clogging and wear.</p>	
12	Semi-annual		<u>Engine Compartment, Cooling System</u>	<p style="text-align: center;">NOTE</p> <p>Refer to TM 750-651 for cooling system service information.</p> <p>a. Remove debris from cooling fins and check for bent fins.</p> <p>b. Inspect radiator and charge air cooler for leaks.</p> <p>c. Check radiator hoses for cracks, bulges or soft spots. Ensure that hose clamps are tight.</p> <p>d. Check radiator cap, gaskets, and rubber isolator mounts and fan shroud for cracks and leaks.</p> <p>e. Inspect water pump for leaks.</p>	<p>Class III oil leak is present.</p> <p>Radiator cap is missing.</p> <p>Any leak is present.</p>

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
13	Semi-annual	0.4	<u>Engine Compartment, Power Steering Components</u>	a. Inspect power steering pump and reservoir (5) for leaks, cracks, loose hoses, or other damage. b. Remove plug (6) from reservoir (5) and drain fluid into a suitable container. c. Replace filter element (WP 0160 00). d. Install plug (6). Fill reservoir (5) through dipstick (4) opening with OE/HDO or OEA (Items 26 through 30, WP 0312 00). Capacity is approximately 2 qt (1.9 l). e. Start engine (TM 9-2320-303-10). Bring to operating temperature. Turn steering wheel in both directions to circulate power steering fluid. f. Check level of fluid on dipstick (4). Add fluid as required until level shows within correct range on dipstick.	Any leak is present.

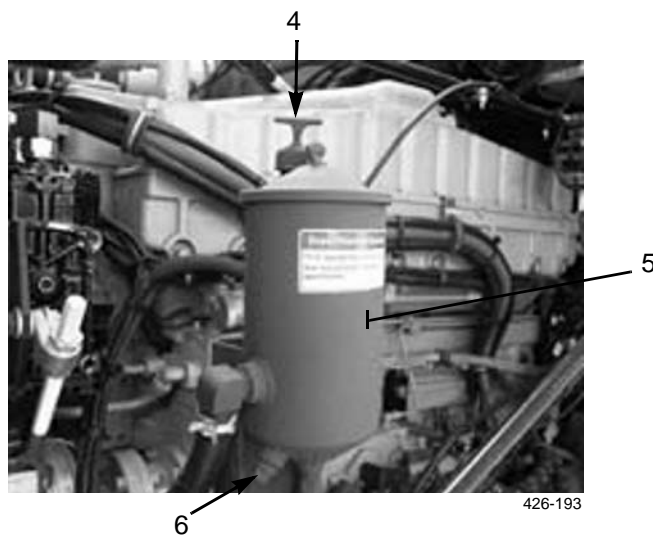


Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.


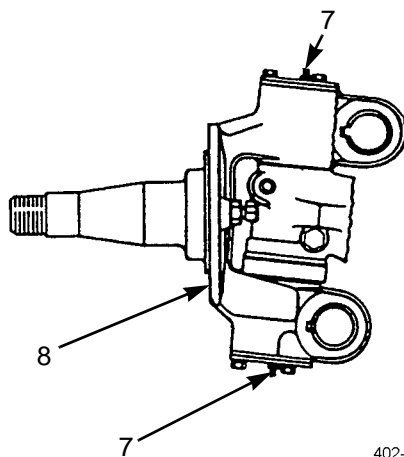
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
14	Semi-annual		<u>Engine Compartment, Electrical Components</u>	<p>a. Inspect wiring for frays, splits, missing insulation or poor connection. Make repairs as needed, if authorized.</p> <p>b. Check alternator wiring for frays, splits, missing insulation, and loose terminal connections. Make repairs as needed. (WP 0098 00)</p>	
15	Semi-annual	0.4	<u>Cab Floor and Engine Compartment Firewall, Foot Brake Valve</u>	<p>Remove foot brake valve from firewall. Lubricate sliding surfaces of plunger and adapter bore with silicone grease (Item 24, WP 0312 00). Install foot brake valve.</p> <div style="text-align: center;">  <p>WARNING</p> </div> <p>To avoid eye injury, eye protection is required when working around batteries. DO NOT smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, injury to personnel, and damage to equipment.</p> <p style="text-align: center;">CAUTION</p> <p>To reduce battery damage, do not remove batteries from battery box unless battery compartment is corroded (greenish/white powder) or during battery replacement. Do not jerk or pull on battery cables during visual inspection. Battery replacement will be performed only by Unit Maintenance personnel.</p>	
16	Semi-annual		<u>Battery Box, Batteries</u>	<p>a. Remove batteries from battery box (WP 0094 00).</p> <p>b. Check for damaged or missing filler caps.</p> <p>c. Check for damaged terminal posts.</p>	<p>b. Filler caps are damaged or missing.</p> <p>c. Terminal posts are damaged.</p>

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
16 (Con't)	Semi-annual		<u>Battery Box, Batteries</u>	d. Check electrolyte level (TM 9-6140-200-14). e. Check and record specific gravity of each cell in all batteries (TM 9-6140-200-14). f. Check battery cables for frays, splits, and breaks. g. Clean battery box. h. Install batteries. i. Coat terminals lightly with grease (Item 23, WP 0312 00).	d. Electrolyte is not at proper level. e. Specific gravity is not within standards. f. Cables are missing, frayed, split or broken.
17	Semi-annual		<u>Exhaust System</u>	Inspect exhaust manifold, exhaust pipes, muffler, and tailpipe for leaks. Check for damaged pipes, loose clamps, and damaged gaskets and seals. Replace damaged components as needed.	
18	Semi-annual		<u>Air System, Brakes</u>	a. Charge air system (TM 9-2320-303-10). b. Listen for sounds of leaks in all air lines and at valves and fittings. c. With air system pressurized, apply a solution of detergent (Item 18, WP 0312 00) and water to air lines, valves, and fittings. Tighten loose connections. Make repairs as needed. d. Ensure that all air lines are not kinked and that they are properly supported.	Damage of kinked air line(s).
19	Semi-annual		<u>Air Conditioning System</u>	Leak test air conditioning system (WP 0218 00).	
20	Semi-annual		<u>Under Vehicle, Frame and Crossmembers</u>	a. Inspect frame and side rails for cracks, breaks, bends, wear, deterioration, and loose bolts. b. Inspect crossmembers for weld breaks, wear, and missing or loose capscrews, huckbolts, and rivets.	Frame or side rail is damaged. Crossmember is damaged.

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
21	Semi-annual	0.6	Vehicle Exterior	a. Inspect for corrosion in accordance with TB 43-0213. b. Inspect cab glass and doors, fenders, stowage boxes, and brackets for damage.	Class III leak is present.
22	Semi-annual		Transmission	a. Check transmission for leaks, loose bolts, and obvious damage. b. Check transmission output shaft seal for damage or leaking.	Class III leak is present.
23	Semi-annual		<u>Front Axle Steering Components, Lubrication</u>	<p style="text-align: center;">NOTE</p> When lubricating front axle steering components, vehicle must be raised to take weight off the suspension to permit lubrication to reach all axle bearing surfaces. a. Apply grease (Item 23, WP 0312 00) to grease fittings (7) at top and bottom of steering knuckle (8) until old lubricant is purged and fresh grease comes out areas indicated by arrows. Perform service at both axle ends.	



402-157

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

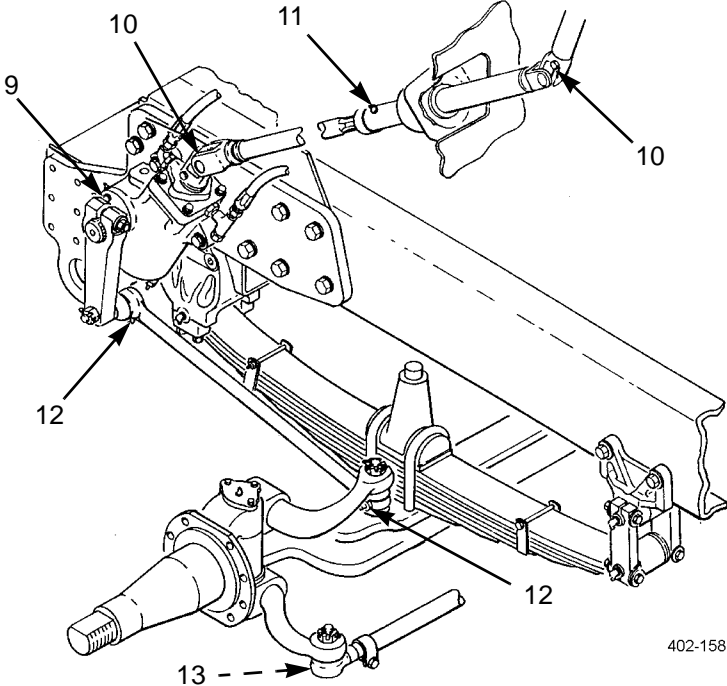
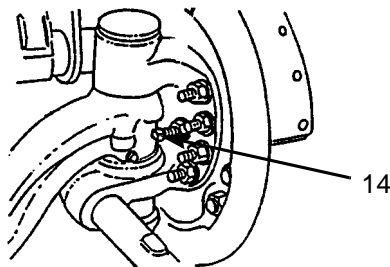
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:	
			ITEM TO CHECK/SERVICE			
23 (Con't)	Semi-annual	0.6	<u>Front Axle Steering Components, Lubrication</u>	<p>b. Lubricate two tie-rod end grease fittings (13) with grease (Item 23, WP 0312 00).</p> <p>c. Lubricate two drag link grease fittings (12) with grease (Item 23, WP 0312 00).</p> <p>d. Lubricate steering column fitting (11) and two U-joint grease fittings (10) with grease (Item 23, WP 0312 00). Observe purging from all seals until new grease comes out. If grease does not purge, manipulate U-joints until purging occurs.</p>		
 <p style="text-align: right; margin-right: 100px;">402-158</p>						
				<p>CAUTION</p> <p>DO NOT use an automatic or power grease gun on fitting on trunion side of steering gear because the rate of flow is too high. High flow rate could force grease inside high-pressure seal, contaminating hydraulic system and promoting seal leakage.</p>		

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
23 (Con't)	Semi-annual	0.6	<u>Front Axle Steering Components, Lubrication</u>	e. Lubricate grease fitting (9) on trunion side of steering gear, near output shaft, with grease (Item 23, WP 0312 00).	
24	Semi-annual		<u>Front Axle Steering Components, Inspection</u>	a. Check for looseness in steering column U-joints. b. Check steering gear for leaks and loose mounting bolts and components. Tighten or replace any damaged component, if authorized. c. Check tie-rod and drag link for movement by attempting to move by hand. Visually check ball joint ends for worn or damaged dust seals. If movement or damage is present, make repairs if authorized. d. Inspect all steering lines and fittings for looseness, damage or leaks. Tighten if loose or replace if damaged. e. Check adjustment of front axle steering stops (14). With brakes fully applied, turn steering wheel to one side to end of travel. Check both sides of vehicle for interference at tires and wheels. Minimum clearance is 1/2 in (1.3 cm) from any fixed object and 3/4 in (1.9 cm) from any moving object. Repeat for opposite end of steering wheel travel. Make adjustments as required.	Class III leak is present. Class III leak is present.



402-159

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
25	Semi-annual	0.2	Front Axle, Suspension	<p>a. Inspect spring leaves for cracks and breaks.</p> <p>b. Inspect spring clips, saddles, saddle caps, spring hangers, and attaching hardware for looseness, cracks or other damage. Tighten or replace any damaged component, if authorized.</p> <p>c. Check for loose screws and missing and damaged front axle mounting hardware.</p> <p style="text-align: center;">NOTE</p> <p>When lubricating front axle suspension components, vehicle must be raised to take weight off suspension to permit lubrication to reach bearing surfaces.</p> <p>d. Lubricate three spring grease fittings (15) with grease (Item 23, WP 0312 00).</p>	Spring leave(s) are cracked or broken.

The diagram shows a detailed view of a front axle suspension system. It includes a steering knuckle, a lower control arm, a coil spring, and a shock absorber. Three grease fittings, labeled '15', are indicated with arrows: one on the upper control arm, one on the lower control arm, and one on the shock absorber. A hand is shown applying grease to one of the fittings. The drawing is labeled '402-158' in the bottom right corner.

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

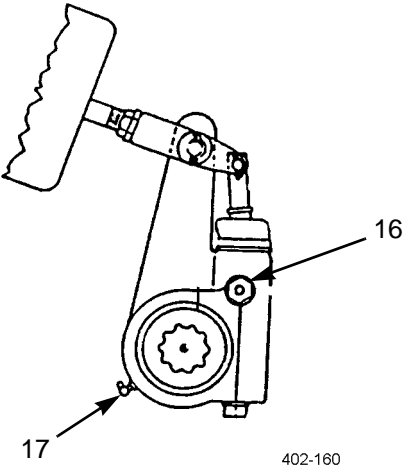
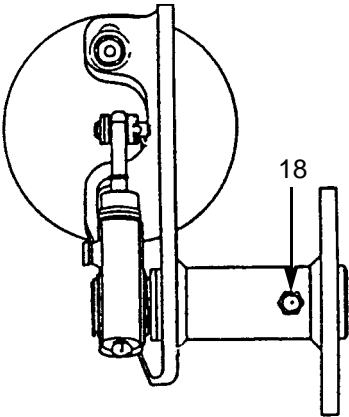
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
26	Semi-annual	0.1	<u>Front Axle Brake Components, Slack Adjusters</u>	Lubricate grease fitting (17) at each slack adjuster with grease (Item 23, WP 0312 00) until new grease flows from pressure relief valve in pawl capscrew (16).	
 <p style="text-align: center;">402-160</p>					
27	Semi-annual	0.1	<u>Front Axle Brake Components, Camshaft Bushings</u>	Lubricate grease fitting (18) at each camshaft bracket with grease (Item 23, WP 0312 00).	
 <p style="text-align: center;">402-161</p>					

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

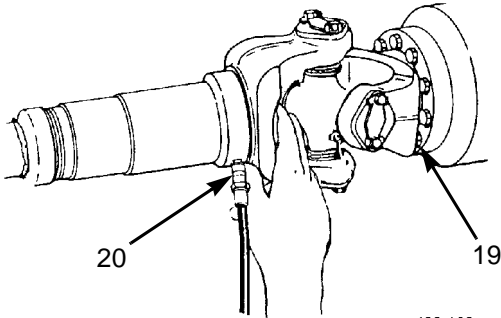
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
28	Semi-annual	0.1	Drivelines	<p>a. Check for looseness or side play in front and rear drivelines. There should be no play at U-joints. Check for bends, cracks, and missing weights. Make repairs as needed. (WP 0116 00 or WP 0117 00).</p> <p>b. Check that U-joint mounting screw torque is 33-38 lb-ft (44-52 Nm).</p> <p>c. Inspect for loose or worn bearings, damaged seals, and damaged or missing grease fittings. Make repairs as needed (WP 0116 00 or WP 0117 00).</p> <p>d. Using a hand-type grease gun, lubricate five grease fittings (20) at each driveline with grease until purging takes place at air hole in the end of the slip yoke. Cover pressure relief hole while lubricating.</p> <p>e. Inspect for damaged or leaking input or output shaft seals (19). If damaged or leaking, replace driveline (WP 0116 00).</p>	<p>Looseness or side play in drive-line(s) is present.</p> <p>Any leak is present.</p>
					

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

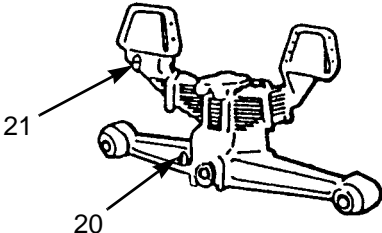
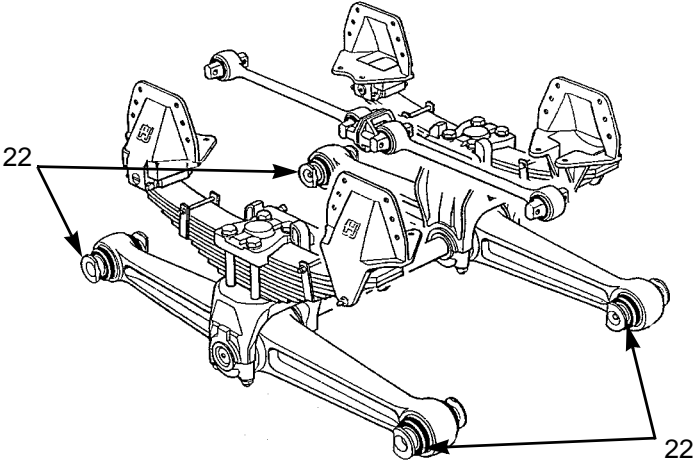
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
29	Semi-annual		<u>Rear Axles, Suspension</u>	a. Lubricate spring grease fitting (21) inside vehicle frame with grease. b. Lubricate equalizing beam grease fitting (20) with grease.	
				 <p style="text-align: center;">402-163</p> c. Inspect spring leaves for cracks or breaks. d. Inspect spring clips, saddles, saddle caps, spring hangers, and attaching hardware for looseness, cracks, or other damage. Tighten or replace damaged components if authorized.	Spring leave(s) are cracked or broken. Any cracked, broken, or missing component.
				 <p style="text-align: center;">402-164</p> e. Check equalizing beam rubber bushings (22) for splitting or deterioration. Replace if split or deteriorated (WP 0288 00).	

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

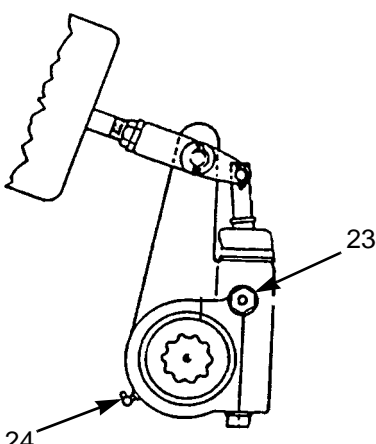
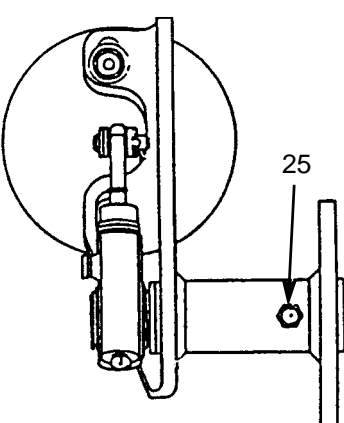
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
30	Semi-annual	0.1	<u>Rear Axle Brake Components, Slack Adjusters</u>	Lubricate grease fitting (24) at each slack adjuster with grease (Item 23, WP 0312 00) until new grease flows from pressure relief valve in pawl capscrew (23).	
 <p>402-160</p>					
31	Semi-annual	0.1	<u>Rear Axle Brake Components, Camshaft Bushings</u>	Lubricate grease fitting (25) at each camshaft bracket with grease (Item 23, WP 0312 00).	
 <p>402-161</p>					

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

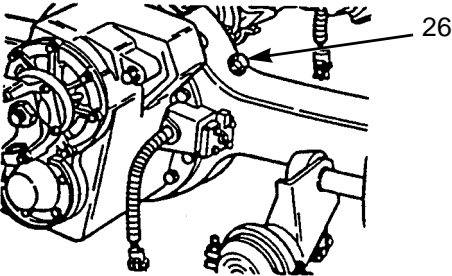
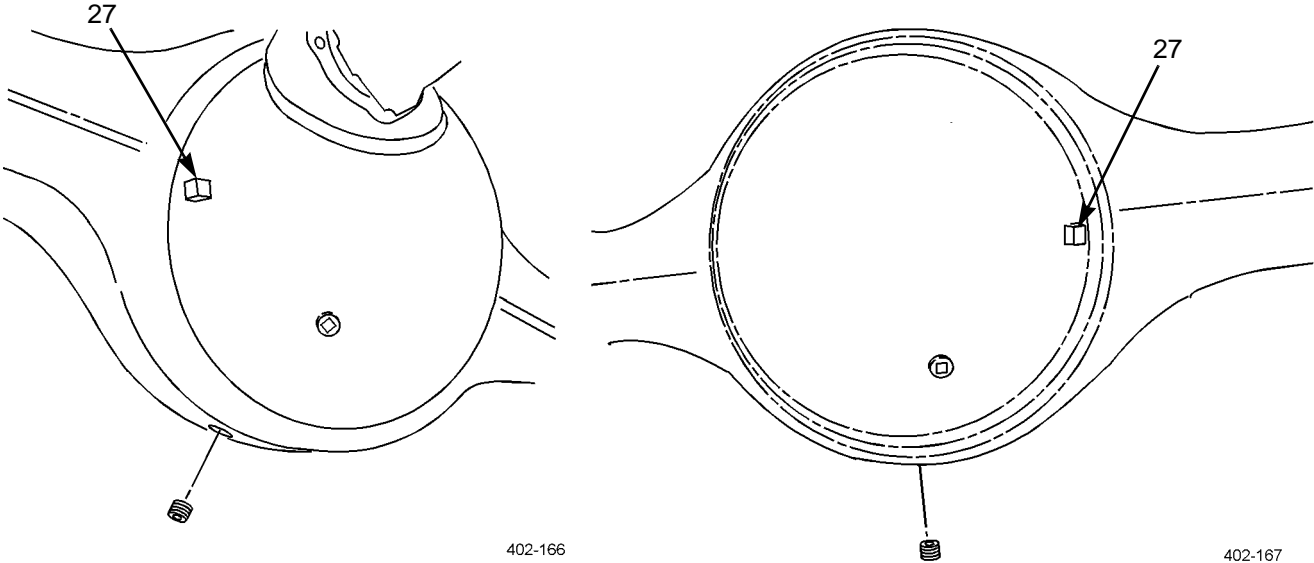
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
32	Semi-annual		<u>Rear Axles, Breathers</u>	<p>NOTE</p> <p>Reinstall breather with tube detent toward wheel end of axle to prevent leakage.</p> <p>Remove breather (26) from each axle. Clean and reinstall.</p>	
					
33	Semi-annual	0.3	<u>Rear Axles, Differentials</u>	<p>Remove filler plugs (27) and check level of fluid in differentials. When housing is cold, level should be even with bottom of filler plug opening. As required, add gear lubricating oil (Items 31 through 33, WP 0312 00). Install filler plugs.</p>	
					

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

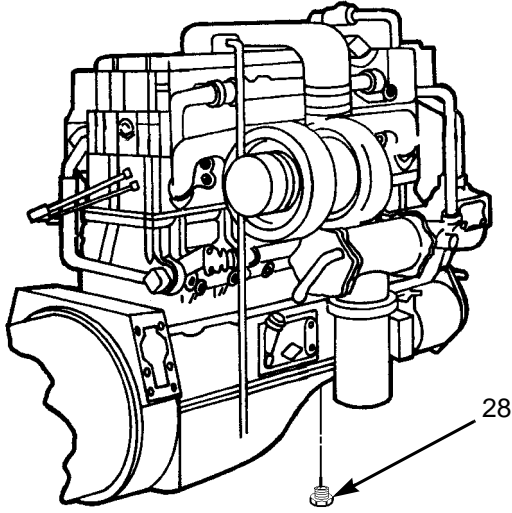
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
34	Semi-annual		<u>Cab</u> <u>Compartment,</u> <u>Seats and Seat Belts</u>	Check seats and seat belts for loose mountings and damage. Replace seat/seat mounts if damaged. Replace seat belts if any seat belt system shows cuts, fraying, extreme wear, abrasions to seat belt webbing or damage to buckle or latch plate retractor hardware.	Seat belt is damaged or inoperative.
35	Annual or 10,000 miles	1.0	<u>Engine</u> <u>Compartment,</u> <u>Engine</u> <u>Crankcase</u>	<p>a. With engine warm, remove drain plug (28) from oil pan and completely drain oil from crankcase.</p> <p>b. Replace all oil filters.</p> <p>c. Install drain plug (28).</p>	
				 <p style="text-align: right;">402-154</p>	
				<p>d. Fill crankcase with OE/HDO or OEA (Items 26 through 30, WP 0312 00) through filler tube (30) opening. Capacity with filters is approximately 46 qt (43.5).</p> <p>e. Run engine. Remove dipstick (29) and check level of oil on dipstick. Level should be between ADD and FULL marks on dipstick.</p>	

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

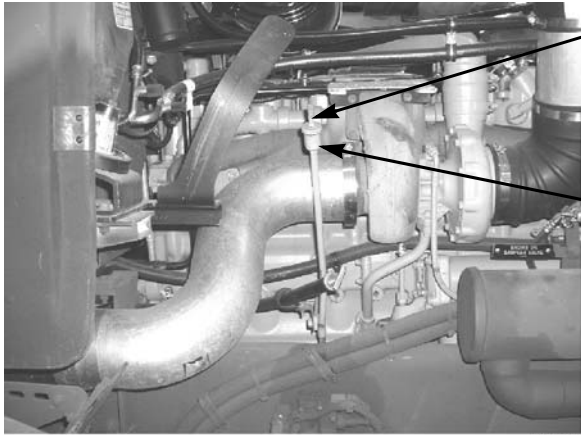
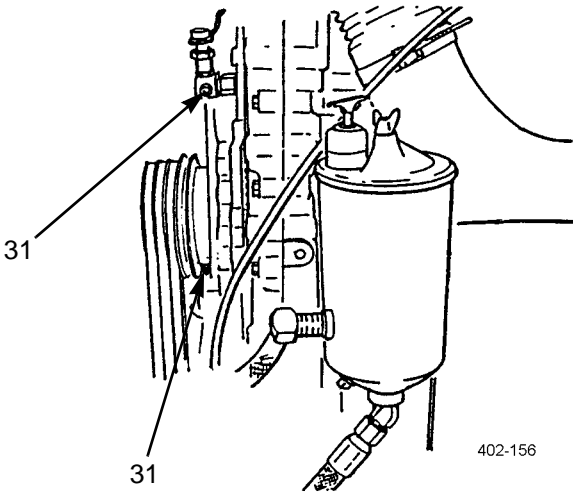
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
36 (Con't)	Annual or 10,000 miles	1.0	<u>Engine Compartment,</u> Engine Crankcase		
 <p style="text-align: right; margin-right: 100px;">29</p> <p style="text-align: right; margin-right: 100px;">30</p> <p style="text-align: right; margin-right: 100px;">402-017</p>					
36	Annual		<u>Engine Compartment</u>	Apply grease (Item 23, WP 0312 00) to fan hub grease fittings (31).	
 <p style="text-align: right; margin-right: 100px;">31</p> <p style="text-align: right; margin-right: 100px;">31</p> <p style="text-align: right; margin-right: 100px;">402-156</p>					

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
37	Annual	0.7	<u>Engine Compartment, Cooling System</u>	a. Test, drain, and refill cooling system in accordance with TB 750-651. b. Change water filter element (WP 0057 00). c. Check for presence of transmission oil in coolant.	Transmission oil is in coolant. Notify Direct Support Maintenance.
38	Annual	1.0	<u>Air Dryers</u>	Service air dryers (WP 0135 00).	If coolant is in transmission oil, replace transmission oil cooler (WP 0114 00) and replace transmission oil.
39	Annual or 10,000 miles		<u>Transmission</u>	a. Drain transmission fluid, replace filters, and refill (WP 0109 00). b. Check for presence of coolant in transmission oil.	
40	Annual or 10,000 miles	0.5	<u>Rear Axles, Differentials</u>	a. Remove plugs (33) and drain fluid while assemblies are still warm from operation. Check magnetic drain plugs for excessive metal particle buildup. Clean plugs.	If excessive metal particle buildup exists, repair differential(s) (WP 0257 00 and WP 0259 00).

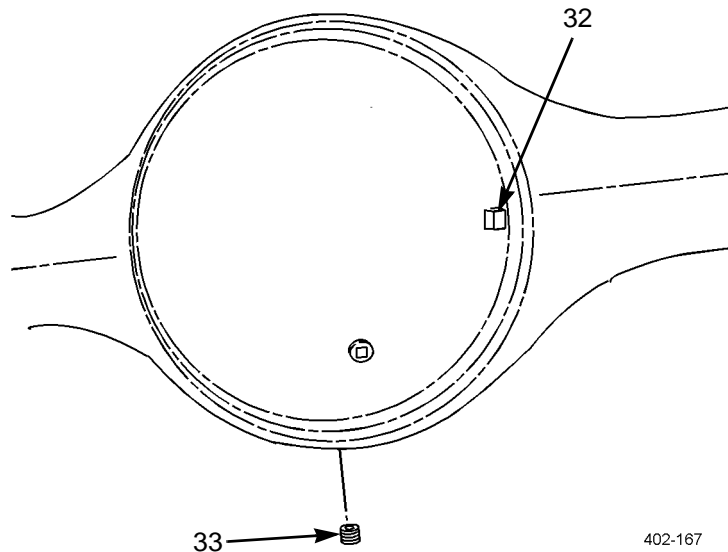
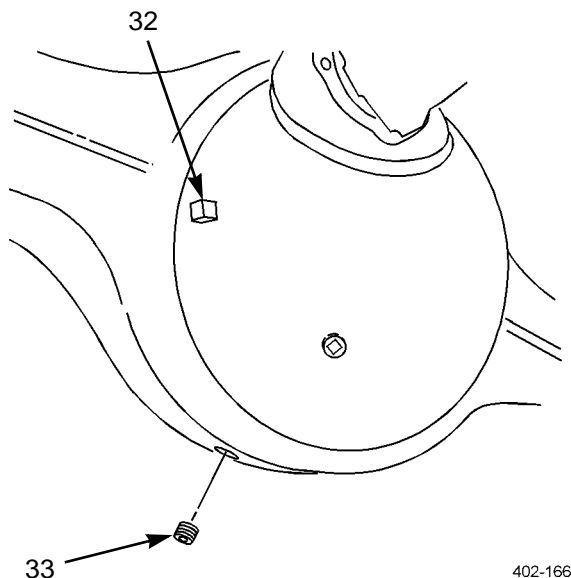


Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
40 (Con't)	Annual or 10,000 miles		<u>Rear Axles, Differentials</u>	<p style="text-align: center;">NOTE</p> <p>There may be approximately 1 pt (0.47 l) of lubricant remaining in filter element. Be careful not to spill it when removing element.</p> <p>b. Use a suitable filter strap wrench to replace filter element (34) from forward-rear axle differential.</p> <p>c. Install plugs (33) and fill differentials with gear lubricating oil (Items 31 through 33, WP 0312 00) until level is even with filler plug (32) openings. Use the following capacities as a guide. Do not overfill:</p> <p style="padding-left: 20px;">Forward-rear 13 qt (12.3 l) Rear-rear 14.5 qt (13.7 l)</p>	
<p style="text-align: right;">402-168</p>					
41	Annual		<u>Front and Rear Wheels, Wheel Bearings</u>	Remove, clean, inspect, pack, install, and adjust wheel bearings.	
42	Annual		<u>Front and Rear Wheels, Brakeshoe Linings</u>	Check brakeshoe linings for a minimum thickness of 1/4 in (6.5 mm). Replace worn or damaged brakeshoes.	Brakeshoe linings less than 1/4 in thick.
43	Annual		<u>Front Axle, Stop Cushions</u>	Check front axle stop cushions for wear or deterioration.	
44	Annual		<u>Data Plates</u>	Check data plates to ensure legibility.	

Table 1. Unit Preventive Maintenance Checks and Services (PMCS) for the M915A4 and M915A4R2 - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			ITEM TO CHECK/SERVICE		
45	Annual		<u>Collision Warning System (CWS)</u>	Align CWS antenna (WP 021900).	

Table 2. PMCS Mandatory Replacement Parts List - Semiannual.

ITEM NO.	PART NUMBER	NSN	NOMENCLATURE	QTY
1	83213D	4330-01-330-8203	Power steering reservoir, filter element	1
2	BM78793	2910-00-304-3427	Fuel filter, filter elements	2

Table 3. PMCS Mandatory Replacement Parts List - Annual.

ITEM NO.	PART NUMBER	NSN	NOMENCLATURE	QTY
1	PER49	2940-00-221-3470	Forward-rear differential, filter element	1
2	A-1205-W-1895	5330-01-268-9003	Forward-rear axle, oil seal	2
3	A-1205-H-2426	5330-01-269-4327	Rear-rear axle, oil seal	2
4	R950011	4440-01-443-9031	Canister, air dryer	1
5	29509723	2910-01-431-1324	Filter element, transmission	2
6	29524448	5331-01-439-6677	O-ring, filter, transmission	1
7	29507437	5331-01-360-7725	O-ring, filter, transmission	1

END OF WORK PACKAGE

BREATHER TUBE MAINTENANCE

0025 00

THIS WORK PACKAGE COVERS

Removal, Cleaning and Inspection, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Detergent (Item 18, WP 0312 00)

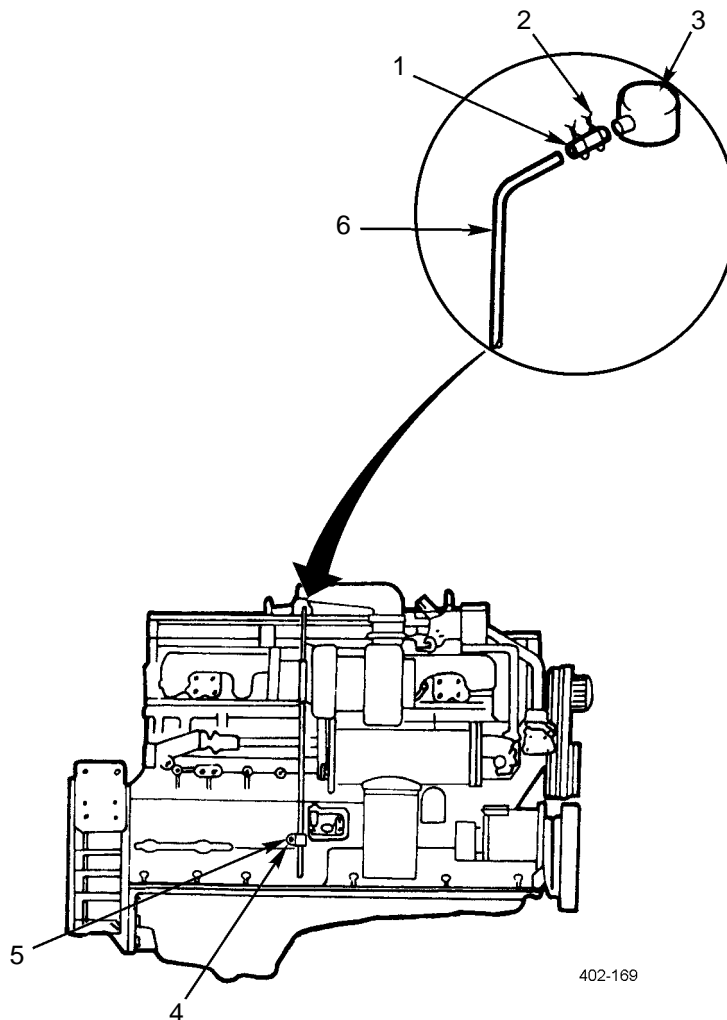
Equipment Condition

Parking brake set (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove two clamps (2) and line (1) from breather cap (3).
2. Remove tube (6) by loosening capscrews (5) and pulling tube (6) out of loop clamp (4).



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BREATHER TUBE MAINTENANCE - CONTINUED

0025 00

CLEANING

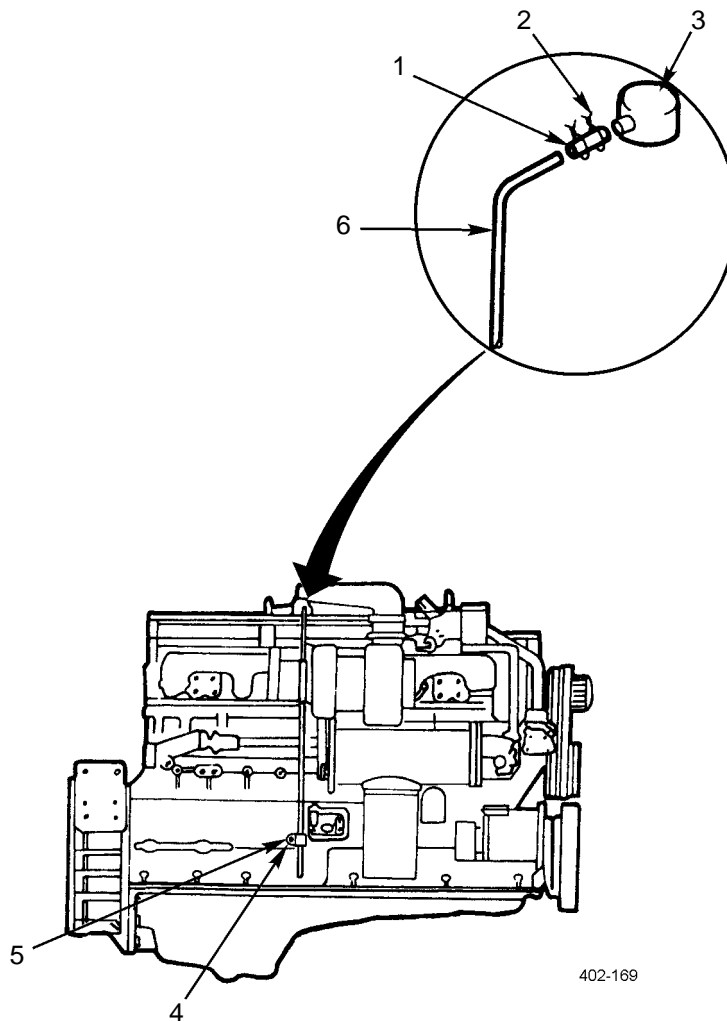
1. Immerse tube (6) and flush in detergent.
2. Rinse with clean water.

INSPECTION

1. Check tube (6) for cracks, nicks or dents. If tube is defective, replace.
2. Check line (1) for cracks. If line is defective, replace.

INSTALLATION

1. Attach line (1) to breather tube cap (3).
2. Put clamps (2) on line (1).
3. Push tube (6) into line (1) and loop clamp (4).
4. Tighten capscrew (5). Put clamps (2) into place.



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END OF WORK PACKAGE

ROCKER ARM HOUSING COVERS MAINTENANCE

0026 00

THIS WORK PACKAGE COVERS

Removal of Crossover Tube, Removal of Cover, Cleaning, Installation of Cover, Installation of Crossover Tube

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15 - 75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Detergent (Item 18, WP 0312 00)

Materials/Parts - Continued

Rocker arm housing gasket (P/N 3054841)

Equipment Condition

Breather tube removed (for center cover only) (WP 0025 00)

Turbo air inlet removed (WP 0034 00)

Parking brake set (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

CAUTION

Work area must be clean. Dirt in the turbocharger and engine can cause damage.

REMOVAL OF CROSSOVER TUBE (FOR CENTER COVER ONLY)

1. Unscrew and remove ether atomizer line (3).
2. Unscrew and remove four capscrews (4), washers (5) and gasket (6). Discard gasket.
3. Loosen upper clamp (7). If rubber connector is damaged, replace.
4. Remove crossover tube (8).

REMOVAL OF COVER

1. Unscrew and remove five capscrews (9) and washers (10).
2. Lift off rocker arm housing cover (11).
3. Take off gasket (1) and discard.

CLEANING

1. Clean rocker arm housing cover (11) with detergent.
2. Rinse with clean water.
3. Wipe grease from rim of engine retarder housing (2) where gasket rests.

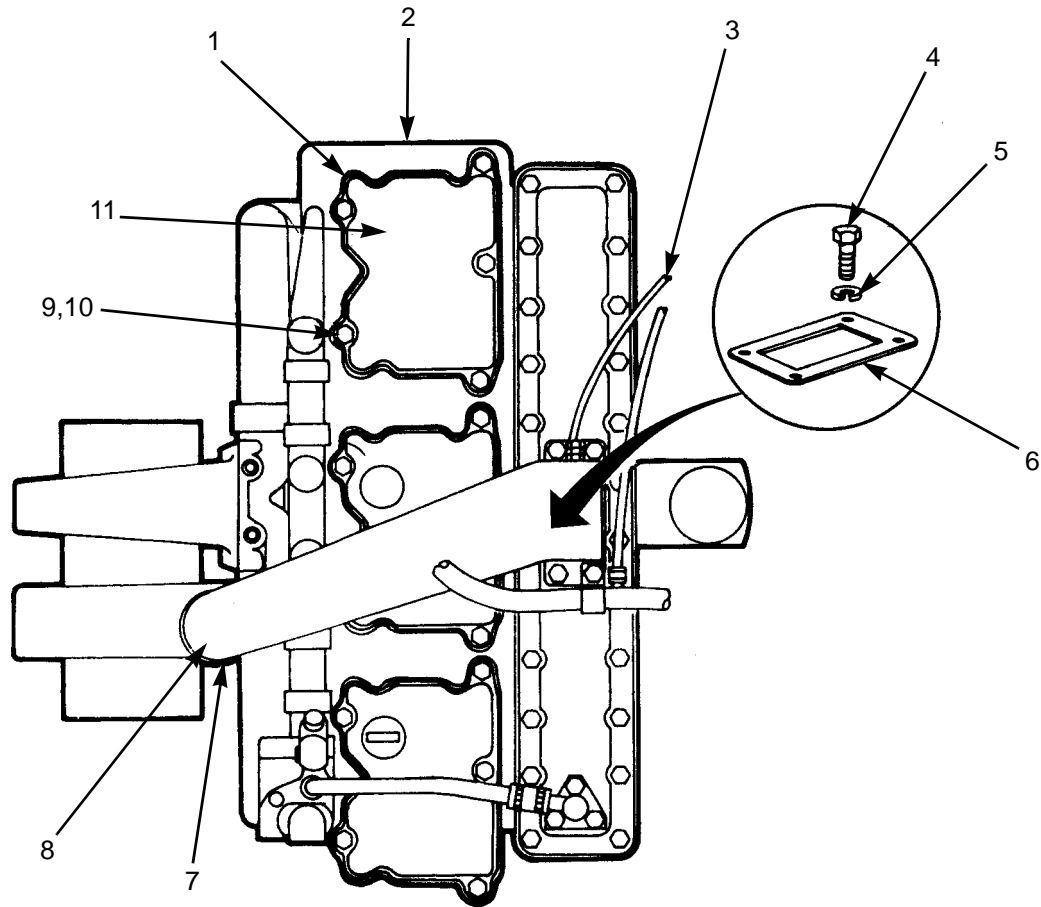
INSTALLATION OF COVER

1. Set new gasket (1) into place on engine retarder housing (2).
2. Set rocker arm housing cover (11) onto gasket (1).
3. Tighten capscrews (9) and washers (10) to 15 lb-ft (20 Nm).

INSTALLATION OF CROSSOVER TUBE (CENTER COVER ONLY)

1. Hold crossover tube (8) and new crossover tube gasket (6) in place and attach with capscrews (4) and washers (5).
2. Tighten upper clamp (7).
3. Tighten crossover tube capscrews (4).
4. Connect and tighten ether atomizer line (3).

INSTALLATION OF CROSSOVER TUBE (CENTER COVER ONLY) - CONTINUED



TOP VIEW

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5. Install breather tube (WP 0025 00) if removed.
6. Install turbo air inlet (WP 0034 00).

END OF WORK PACKAGE

FUEL PUMP SCREEN MAINTENANCE

0027 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Installation, Checking for Leaks

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Left fender removed (WP 0184 00)

Parking brake set (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

Materials/Parts

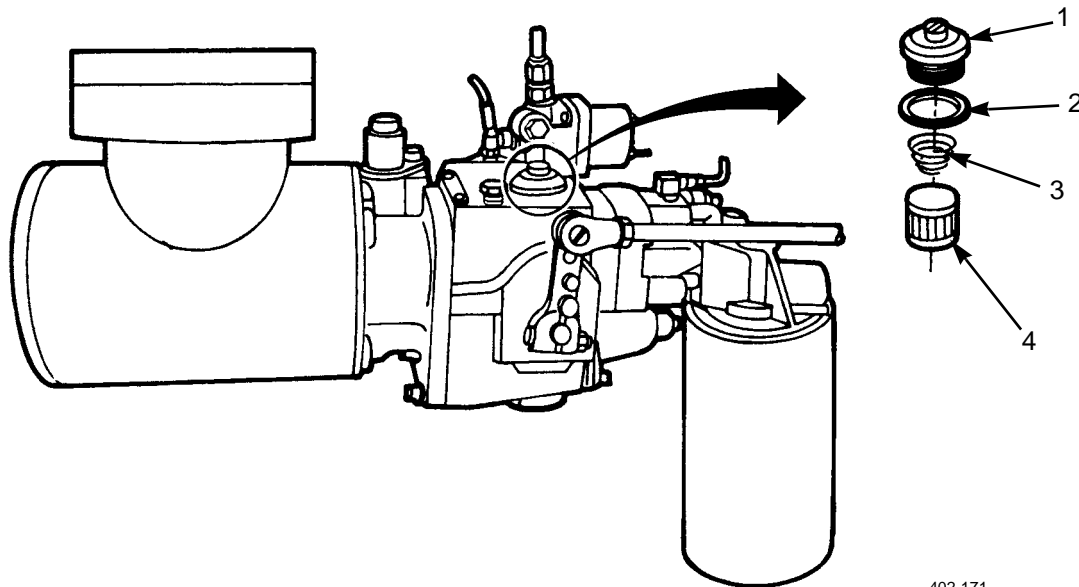
Detergent (Item 18, WP 0312 00)

Rags, wiping (Item 39, WP 0312 00)

Cap seal ring (P/N 154088)

REMOVAL

1. Unscrew and remove filter screen cap (1).
2. Take out cap seal ring (2), filter spring (3), and fuel filter screen assembly (4). Discard cap seal ring (2).



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CLEANING

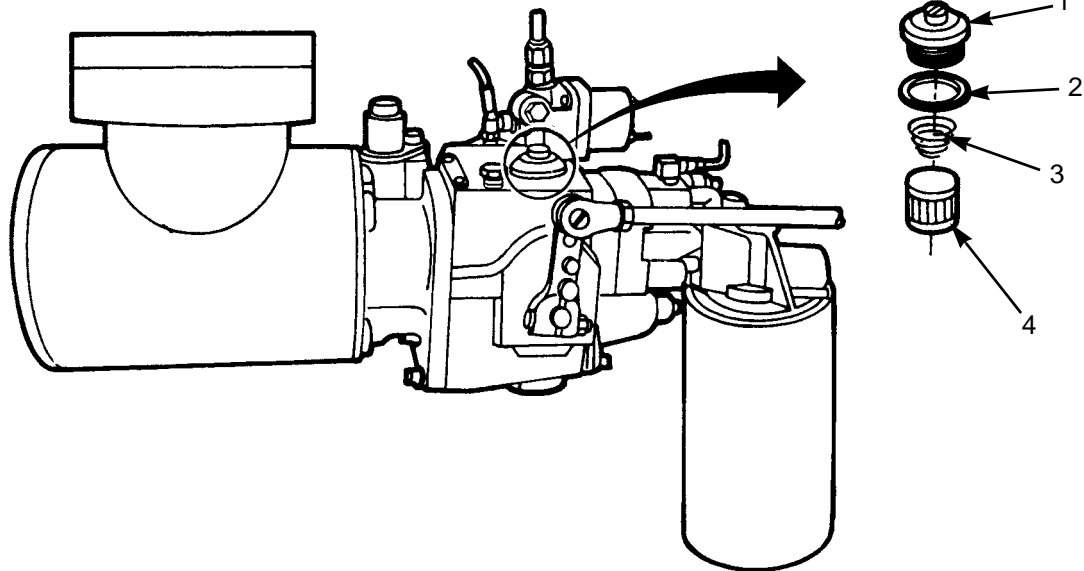
1. Clean fuel filter screen assembly (4) with detergent.
2. Rinse with clean water.

INSTALLATION

1. Drop fuel filter screen assembly (4) into place. Ensure opening is facing down.
2. Set filter spring (3) and new cap seal ring (2) into place.
3. Screw filter screen cap (1) in.

CHECKING FOR LEAKS

1. Start up engine.
2. Look for leaking around the edges of the filter screen cap (1).



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3. Install left fender (WP 0184 00).

END OF WORK PACKAGE

ENGINE OIL FILTERS AND LINES MAINTENANCE

0028 00**THIS WORK PACKAGE COVERS**

Draining/Replenishing Oil, Primary Filter Replacement, Bypass Filter Replacement, Oil Lines, Inspection/Replacement, Check for Leaks.

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Wrench, strap (Item 107, WP 0313 00)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)

Oil, lubricating (Item 27, WP 0312 00)

Rags, wiping (Item 39, WP 0312 00)

Wire, non-electrical (Item 50, WP 0312 00)

Materials/Parts - Continued

Cover gasket (P/N 4311)

Element, bypass filter (P/N C175AP)

Oil filter, primary (P/N 299670)

References

TM 9-2320-303-10

TM 9-2815-225-34&P

Equipment Condition

Engine warm (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

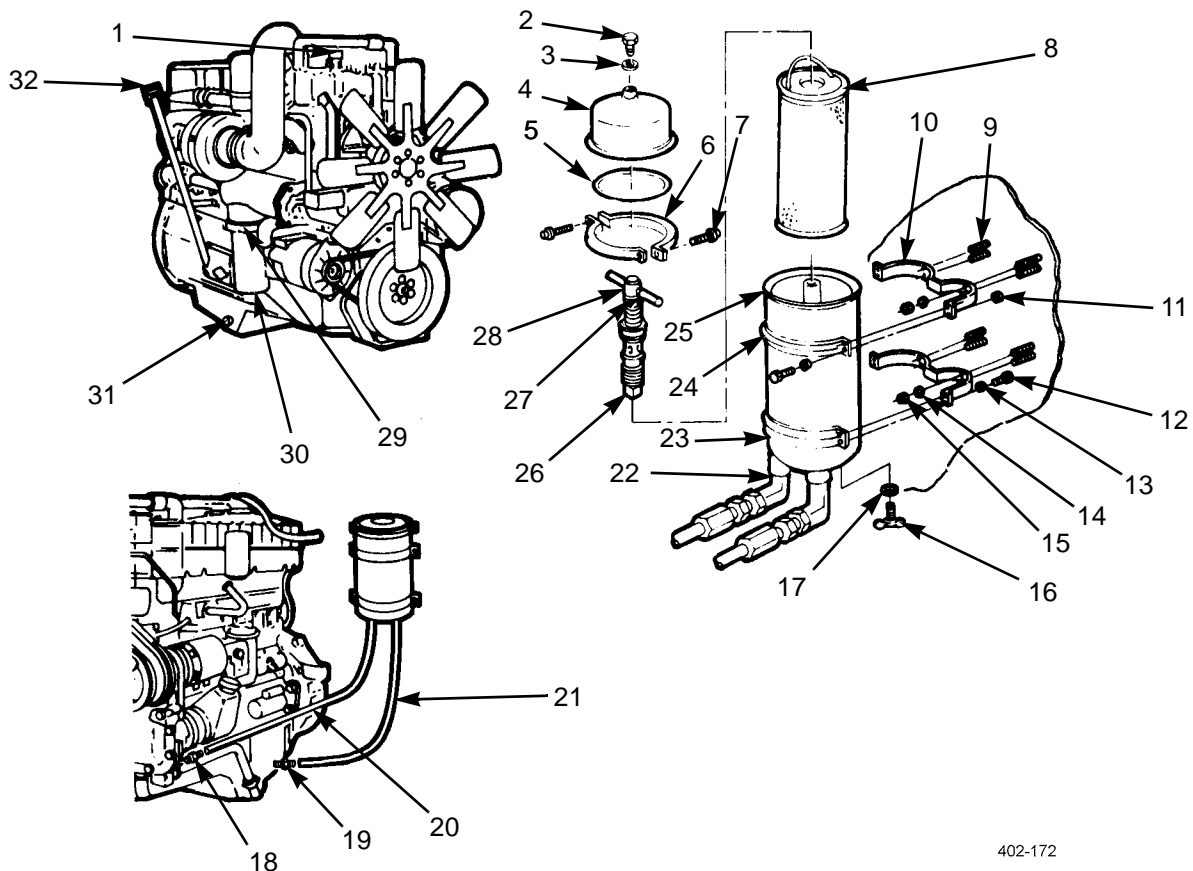
Parking brake set (TM 9-2320-303-10)

DRAINING/REPLENISHING OIL

1. Remove vent plug (2) and washer (3) from bypass filter (8). Allow sufficient time for oil to drain from bypass filter to crankcase.
2. Place drain pan under drain plug (31).
3. Remove drain plug (31). Allow all oil to drain.
4. Inspect magnet for foreign particles and wipe clean.
5. Install drain plug (31) and tighten.
6. Remove filler cap (1).
7. Pour oil thru filler cap (1) opening.
8. Install filler cap (1).

PRIMARY FILTER REPLACEMENT

1. Place drain pan under filter (30).
2. Remove filter (30) from adapter (29).
3. Pour oil from filter (30) into drain pan. Discard filter.
4. Inspect adapter (29) for cracks, nicks, and damaged threads. If adapter is defective, refer to TM 9-2815-225-34&P.
5. Lightly coat new filter seal with clean lubricating oil.



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PRIMARY FILTER REPLACEMENT - CONTINUED**CAUTION**

DO NOT use strap wrench to install filter. Tighten by hand.

6. Install filter (30) on filter adapter (29) by hand.

BYPASS FILTER REPLACEMENT

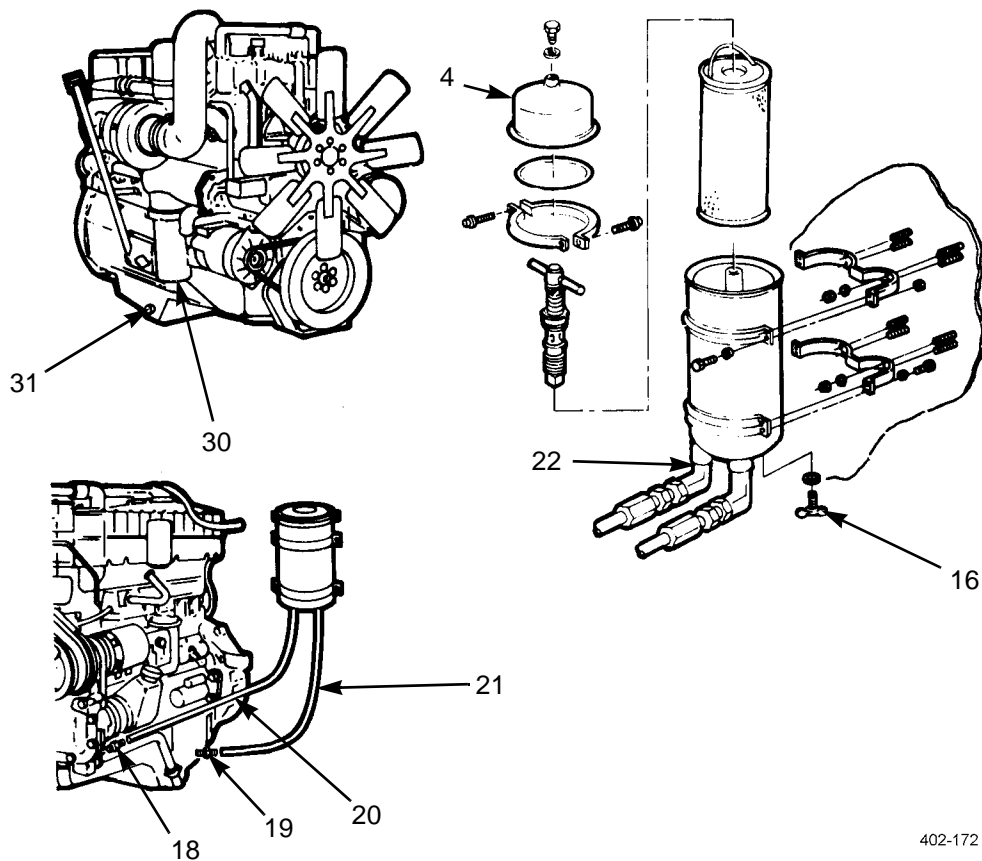
1. Place drain pan under bypass filter draincock (16).
2. Open bypass filter draincock (16) and allow all oil to drain. Close draincock.
3. If removed, install bypass filter draincock (16) and washer (17).
4. Install washer (17) and draincock (16). Ensure draincock is closed.
5. Remove two clamping bolts (7).
6. Remove clamping ring (6).
7. Remove cover (4) and gasket (5). Discard cover gasket.
8. Remove pack hold down assembly (28).
9. Remove bypass filter element (8). Discard filter element.
10. Remove filter-to-pump line (20) and filter -to -sump line (21) from two elbows (22).
11. Remove eight bolts (12), lockwashers (13), and nuts (11).
12. Remove two mounting bracket clamps (10) and canister (23).
13. Remove two elbows (22) from canister (23). Remove eight nuts (15) and lockwashers (14) from eight mounting studs (9) at firewall.
14. Inspect orifice (26) and bleeder hole (27). Holes should not be blocked. If necessary, use a piece of wire to clean blocked holes.
15. Inspect mounting brackets (10), clamps (24), canister (23), and elbows (22) for damage, looseness, stains from leaks, and crossed threads. Replace any damaged components as necessary.
16. Position two mounting brackets (10) over eight mounting studs (9) and secure with eight lockwashers (14) and nuts (15).
17. Coat threads of two elbows (22) and install onto canister (23).
18. Install canister (23) on two mounting brackets (10) with two clamps (24), eight bolts (12), lockwashers (13), and nuts (15).
19. Install filter-to-pump line (20) and filter-to-sump line (21) onto two elbows (22).
20. Install bypass filter element (8) into canister (23).
21. Install pack hold down assembly (28) thru center of bypass filter element (8) in canister (23) and screw all the way to the stop.
22. Set cover (4) and new cover gasket (5) on canister flange (25).
23. Position clamping ring (6) over cover (4) and canister flange (25) and secure with two clamping bolts (7). Tighten bolts until they stop against shoulder.
24. Install washer (3) and vent plug (2) on cover (4).

OIL LINES INSPECTION/REPLACEMENT

1. Remove filter-to-pump line (20) and filter-to-sump line (21) from two connectors (18 and 19). Inspect for cracks, stains from leaks, kinks, and end fittings damage.
2. Remove two connectors (18) and (19) from oil pump and oil sump. Replace if threads are damaged.
3. Coat threads and install two connectors (18) and (19) into oil pump and oil sump.
4. Install filter-to-pump line (20) and filter-to-sump line (21) onto connectors (18) and (19).

CHECK FOR LEAKS

1. Start engine (TM 9-2320-303-10) and run 3-5 minutes.
2. Shut down engine (TM 9-2320-303-10) and let set for 8-10 minutes.
3. Check primary filter (30), drain plug (31), connectors (18) and (19), two elbows (22), draincock (16), cover (4), filter-to-pump line (20) and filter-to-sump line (21) for leaks.
4. Remove dipstick (32) and check oil level. Oil level should be near "H" mark. Fill as necessary.



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END OF WORK PACKAGE

ENGINE RETARDER INSPECTION

0029 00

THIS WORK PACKAGE COVERS

Inspection

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2815-225-34&P

Materials/Parts

Wipes, lint-free (Item 49, WP 0312 00)

TM 9-2320-303-10

Personnel Required

Two

Equipment Condition

Crossover tube and rocker arm housing cover removed (WP 0026 00)

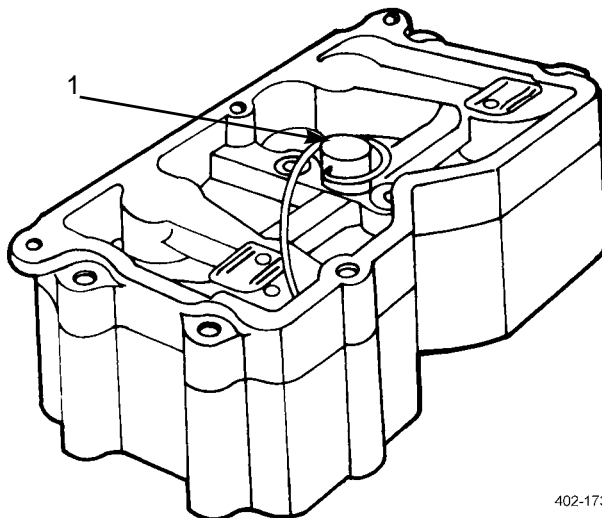
**WARNING**

During normal operation turbocharger and outlet pipe can become very hot. Be careful not to touch these components with bare hands as serious burns may result.

CAUTION

Engine will be running with rocker arm housing cover removed. Ensure work area is clean and dust-free. DO NOT allow dirt, tools, or engine parts to fall into engine.

1. Start engine (TM 9-2320-303-10).
2. Bleed brakes by pressing each engine retarder armature (1) five or six times in a row.



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ENGINE RETARDER INSPECTION - CONTINUED

0029 00

INSPECTION - CONTINUED

3. With engine brake switches on dash in down position, center armature remains down.
4. Move left engine brake switch up; center armature remains down.
5. Move both engine brake switches up; all armatures go down.
6. If brake does not work properly, refer to TM 9-2815-225-34&P.
7. Install rocker arm housing cover and crossover tube (WP 0026 00).

END OF WORK PACKAGE

FUEL SOLENOID SHUTOFF VALVE MAINTENANCE

0030 00

THIS WORK PACKAGE COVERS

Removal, Installation, Operational Check

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)
Shield (P/N 129839)

Materials/Parts - Continued

O-ring (P/N 129888)

Gasket (P/N 391-3994)

Equipment Condition

Left fender removed (WP 0184 00)

Parking brake set (TM 9-2320-303-10)

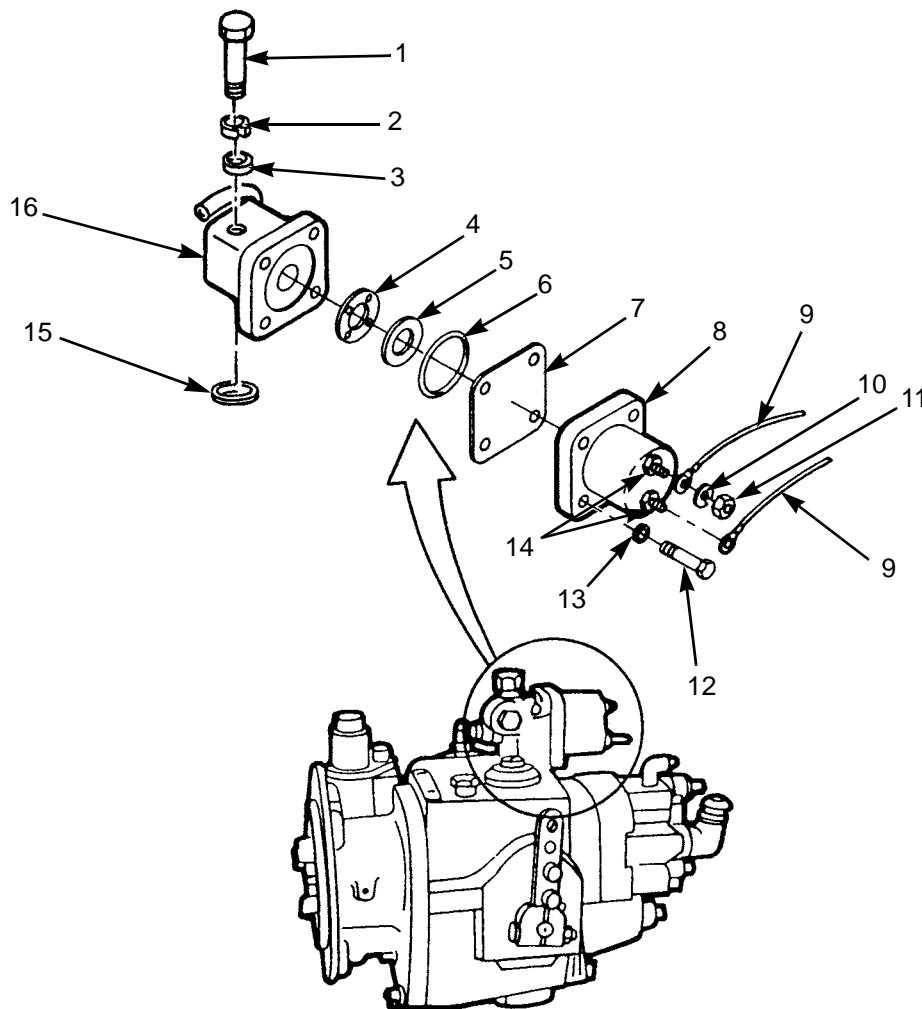
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Unscrew and remove two nuts (11) and washer (10).
2. Remove two wires (9) from terminals (14). Tag wires for installation references.
3. Unscrew and remove four screws (12) and washers (13).
4. Remove coil assembly (8), shield (7), o-ring (6), spring washer (5), and valve (4). Discard shield and o-ring.
5. Unscrew and remove two screws (1) and two washers (2 and 3).
6. Remove valve (16) and gasket (15). Discard gasket.

INSTALLATION

1. While holding gasket (15) and valve (16) in place, insert two screws (1) and washers (2 and 3). Tighten screws.
2. While holding coil assembly (8), shield (7), o-ring (6), spring washer (5) and valve (4) in place, insert four screws (12) and washers (13).
3. Tighten four mounting screws (12) and washers (13).
4. Attach two wires (9) to terminals (14).
5. Install nuts (11) and washers (10) on terminals and tighten.
6. Install left fender (WP 0184 00).



FUEL SOLENOID SHUTOFF VALVE MAINTENANCE - CONTINUED

0030 00

OPERATIONAL CHECK

1. Turn ignition switch on and off again.
2. Listen for a “click” from the coil assembly (8) when switch is turned on or off.
3. Start up engine. Engine will not start unless solenoid is working.

END OF WORK PACKAGE

AIR CLEANER ELEMENT REPLACEMENT

0031 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Filter (P/N P548796)

Equipment Conditions

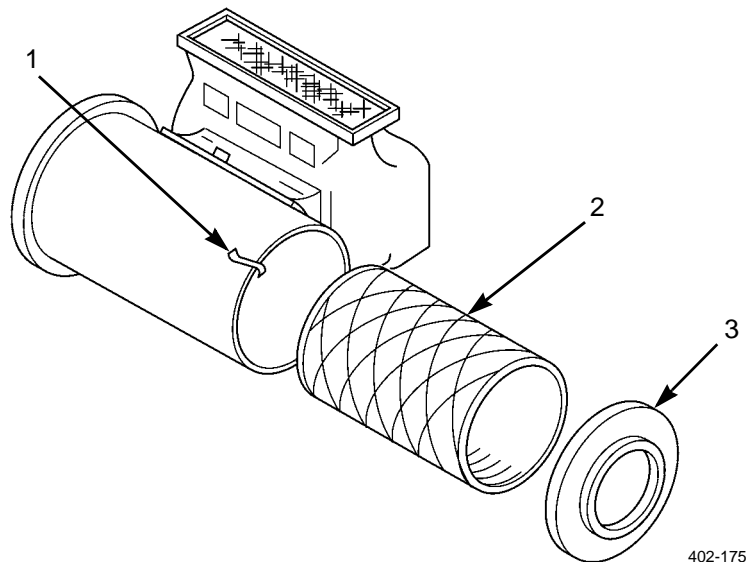
Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

REMOVAL**NOTE**

End cover is part of the air cleaner element.

1. Release three clamps (1) and remove air cleaner element (2).
2. Remove air cleaner intake (3) from air cleaner element (2). Discard element.

**INSTALLATION**

1. Install air cleaner intake (3) on new air cleaner element (2).
2. Install air cleaner element (2) and fasten three clamps (1).

END OF WORK PACKAGE

AIR CLEANER, PRE-CLEANER, AND DUCT ASSEMBLY MAINTENANCE

0032 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Air cleaner element removed (WP 0031 00)

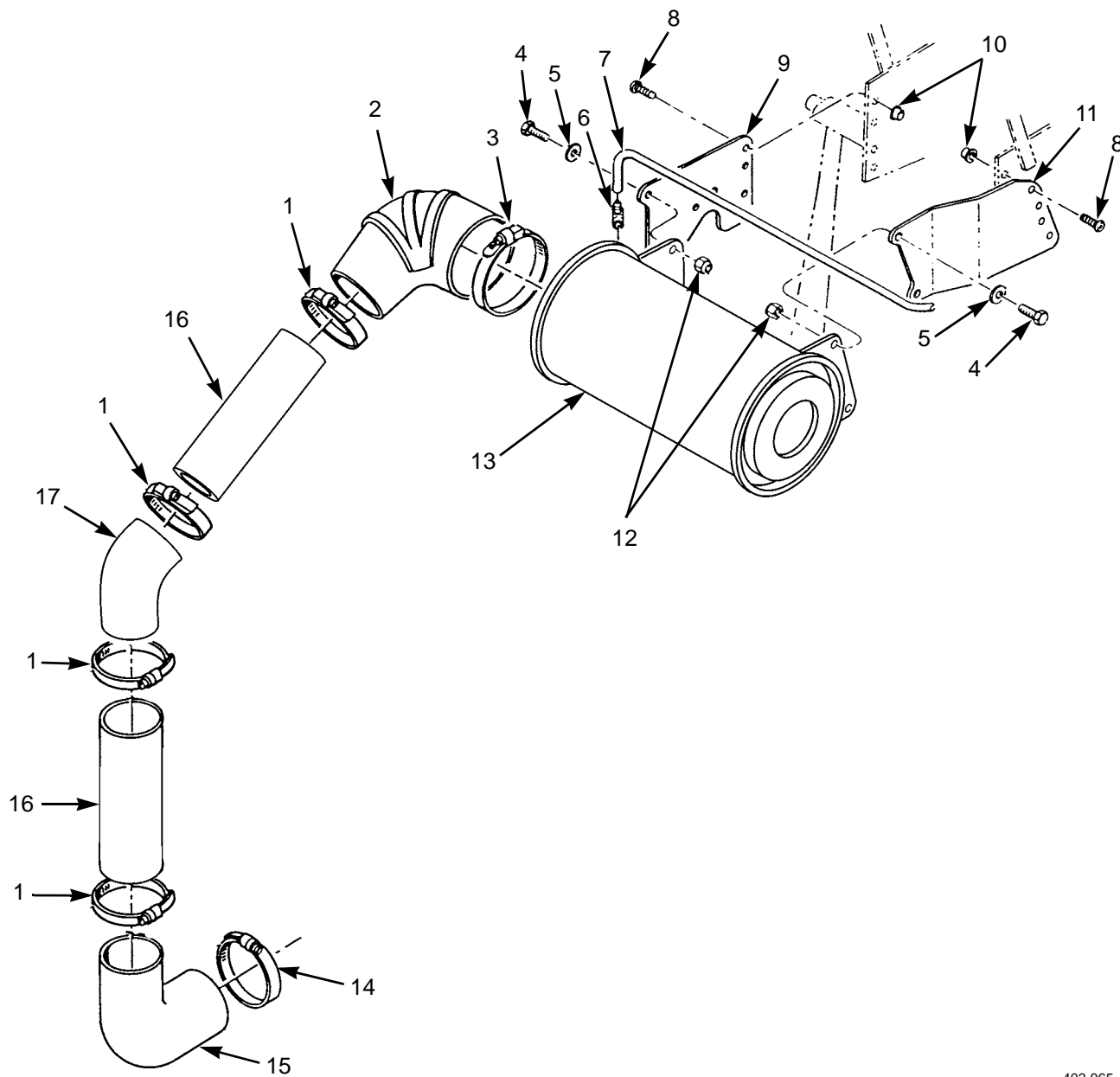
REMOVAL

1. Loosen clamp (14), four clamps (1), and clamp (3).
2. Remove tube (15), two tubes (16), tube (17), and tube (2).
3. Remove tube (7) and elbow (6).
4. Remove four nuts (12), four washers (5), and four screws (4).
5. Remove eight bushings (10), eight screws (8), and air cleaner assembly (13) from brackets (9 and 11).

INSTALLATION

1. Position air cleaner assembly (13) on brackets (9 and 11).
2. Install eight screws (8) and eight bushings (10).
3. Install four screws (4), four washers (5), and four nuts (12).
4. Apply pipe sealing compound on elbow (6) and install elbow and tube (7).
5. Connect tube (2) to air cleaner assembly (13) with clamp (3).
6. Connect tube (16) to tube (2) with clamp (1).
7. Connect tube (17) to tube (16) with clamp (1).
8. Connect tube (16) to tube (17) with clamp (1).
9. Connect tube (15) with clamp (1) and clamp (14).

INSTALLATION- CONTINUED



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END OF WORK PACKAGE

DUCT ASSEMBLY REPAIR

0033 00

THIS WORK PACKAGE COVERS

Disassembly, Assembly

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Gasket (P/N 03-21565-000)

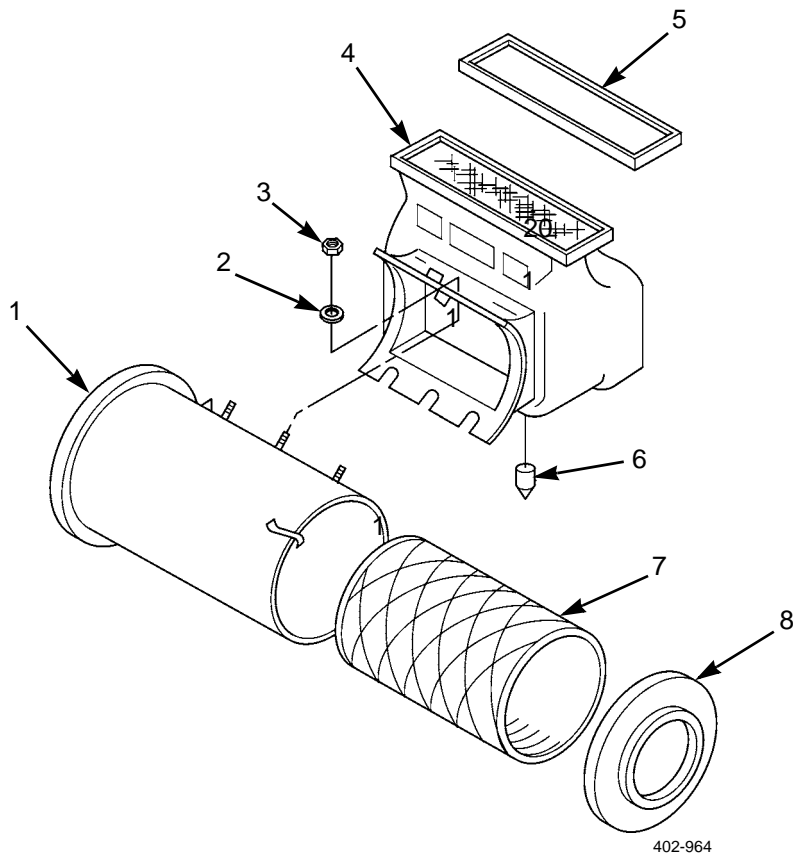
Nut, lock (P/N MS45913/1-4CG5C) (3)

Equipment Condition

Air cleaner, pre-cleaner, and duct assembly removed (WP 0032 00)

DISASSEMBLY

1. Remove cover (8) and filter (7) from housing (1).
2. Remove and discard gasket (5).
3. Remove three locknuts (3), three washers (2), and housing (1) from housing (4).
4. Remove breather (6) from housing (4).

**ASSEMBLY**

1. Install breather (6) on housing (4).
2. Position housing (1) on housing (4) and install three washers (2) and three new locknuts (3).
3. Install new gasket (5) on housing (4).
4. Install filter (7) in housing (1).
5. Install cover (8) on housing (1).
6. Install air cleaner, pre-cleaner, and duct assembly (WP 0032 00).

END OF WORK PACKAGE

TURBO AIR INLET MAINTENANCE**0034 00****THIS WORK PACKAGE COVERS**

Removal, Inspection, Installation, Checking for Leaks

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Parking brake set (TM 9-2320-303-10)

Material/Parts

Rags, wiping (Item 39, WP 0312 00)

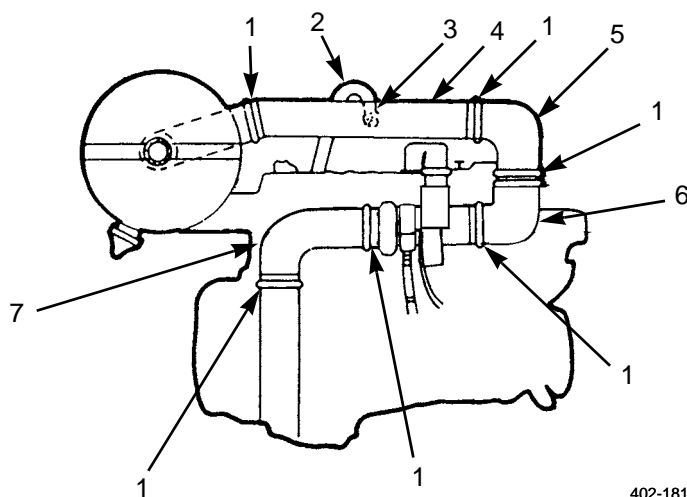
Master battery switch in OFF position (TM 9-2320-303-10)

CAUTION

Dirt in the air passages can severely damage the turbocharger and engine. Be sure your work area is clean. Clean parts before installation. Cover openings to keep out dust while you are working.

REMOVAL

1. Loosen six clamps (1).
2. Loosen and remove clamp (3) and hose (2).
3. Remove three elbow pipes (5, 6, and 7) and straight pipe (4).



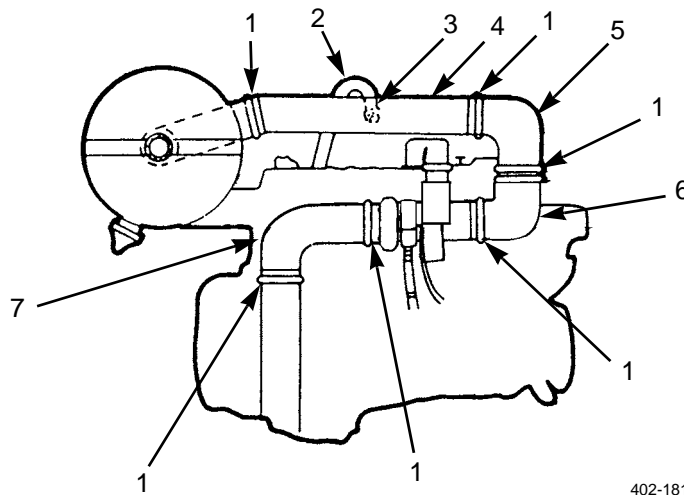
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INSPECTION

Inspect three elbow pipes (5, 6, and 7) and straight pipe (4).

INSTALLATION

1. Insert straight pipe (4) and elbow pipes (5, 6, and 7).
2. Tighten six clamps (1) to 32-36 lb-in. (3.6-4.1 Nm).
3. Install hose (2) and clamp (3).

**CHECKING FOR LEAKS****WARNING**

During normal operation, the turbocharger and outlet pipe can become very hot. Be careful not to touch these components with your bare hands. These components may be hot enough to cause severe burns.

Start engine (TM 9-2320-303-10) and check for leaks.

END OF WORK PACKAGE

FUEL FILTER (PRIMARY) MAINTENANCE

0035 00

THIS WORK PACKAGE COVERS

Removal, Installation, Checking for Leaks

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Materials/Parts

Fuel, diesel (Item 20 or 21, WP 0312 00)

Rags, wiping (Item 39, WP 0312 00)

Materials/Parts - Continued

Fuel Filter (P/N BM78793)

O-ring (P/N 213079)

References

TM 9-2320-303-10

Equipment Condition

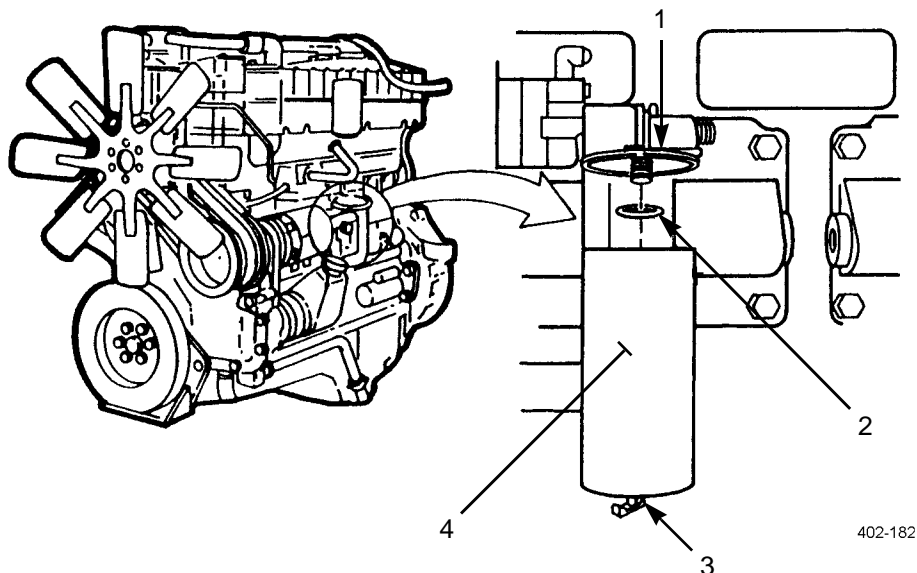
Left fender removed (WP 0184 00)

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

REMOVAL

1. Open draincock (3) and drain fuel into suitable container.
2. Unscrew and remove fuel filter (4).
3. Remove draincock (3) from filter (4). Discard filter.
4. Remove o-ring (2) from filter head (1). Discard o-ring.

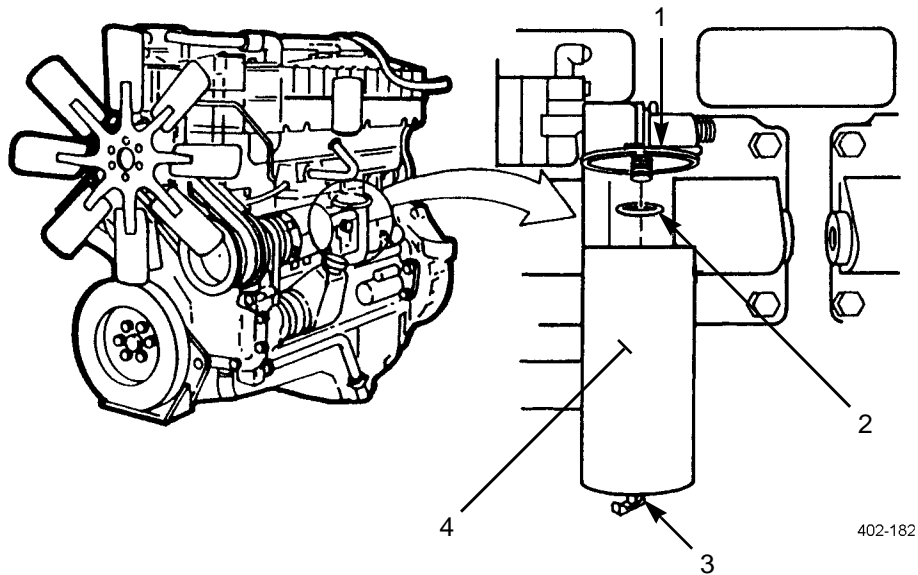


FUEL FILTER (PRIMARY) MAINTENANCE - CONTINUED

0035 00

INSTALLATION

1. Install draincock (3) in new fuel filter (4).
2. Fill with clean fuel.
3. Install new o-ring (2).
4. Hand tighten new fuel filter (4) just until seal touches filter head (1).
5. Tighten one-half turn to three-fourths turn more.

**CHECKING FOR LEAKS**

1. Start engine (TM 9-2320-303-10).
2. Check fuel filter (4) for leaks.
3. Install left fender (WP 0184 00).

END OF WORK PACKAGE

FUEL FILTER (SECONDARY) MAINTENANCE

0036 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2815-225-34&P

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Materials/Parts

Fuel, diesel (Item 20 or 21, WP 0312 00)

Oil, lubricating (Item 27, WP 0312 00)

REMOVAL**WARNING**

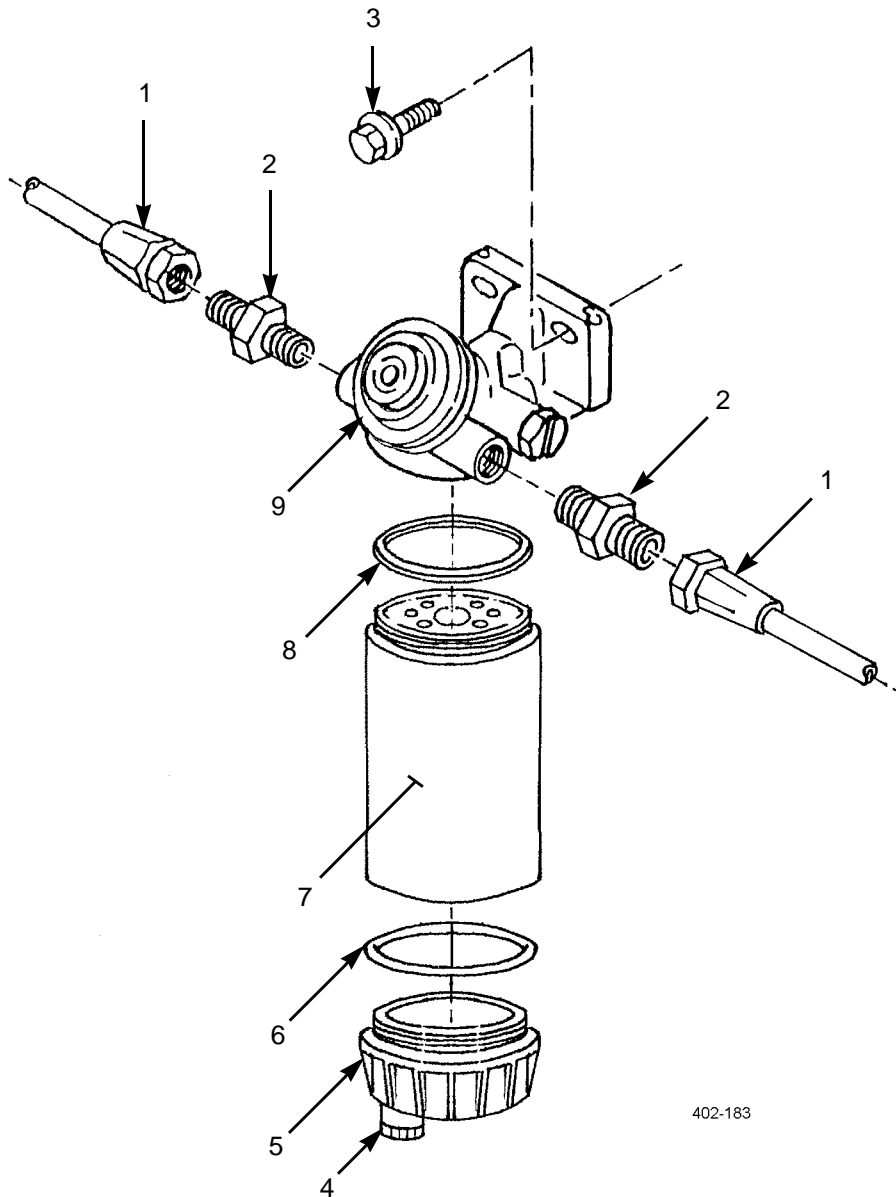
- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicle.
- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in a well-ventilated area. Failure to follow this warning could result in serious injury to personnel.
- Personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.

NOTE

Have suitable container ready to catch fuel.

REMOVAL - CONTINUED

1. Open drain valve (4) and allow fuel to drain. Close drain valve.
2. Remove sediment bowl (5) and preformed packing (6) from filter element (7). Discard preformed packing.
3. Remove filter element (7) and gasket (8) from housing (9). Discard filter element and gasket.
4. Remove two hoses (1) and fittings (2) from housing (9).
5. Remove two screws (3) and housing (9) from vehicle.



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INSTALLATION**WARNING**

- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicle.
 - Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in a well-ventilated area. Failure to follow this warning could result in serious injury to personnel.
 - Personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.
1. Install housing (9) to vehicle with two screws (3).
 2. Install two fittings (2) and hoses (1) to housing (9).
 3. Install new preformed packing (6) and sediment bowl (5) to new filter element (7).
 4. Apply thin film of lubricating oil to surface of new gasket (8).
 5. Fill filter element (7) 2/3-full with clean diesel fuel.
 6. Install new gasket (8) and filter element (7) to housing (9) until gasket contacts housing, then tighten filter element an additional 1/2 turn.

END OF WORK PACKAGE

FUEL TANK AND MOUNTING BRACKETS REPLACEMENT**0037 00****THIS WORK PACKAGE COVERS**

Fuel Tank Removal, Mounting Bracket Removal, Mounting Bracket Installation, Fuel Tank Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Trestle, hoist, portable (Item 105, WP 0313 00)

Materials/Parts

Rags, wiping (Item 39, WP 0312 00)

Materials/Parts - Continued

Tag, marker (Item 42, WP 0312 00)

Pin, cotter (P/N MS24665-359) (2)

Personnel Required

Two

References

TM 9-2320-303-10

Equipment Condition

Fuel level sending unit removed (WP 0090 00)

Right step removed (WP 0161 00)

FUEL TANK REMOVAL**WARNING**

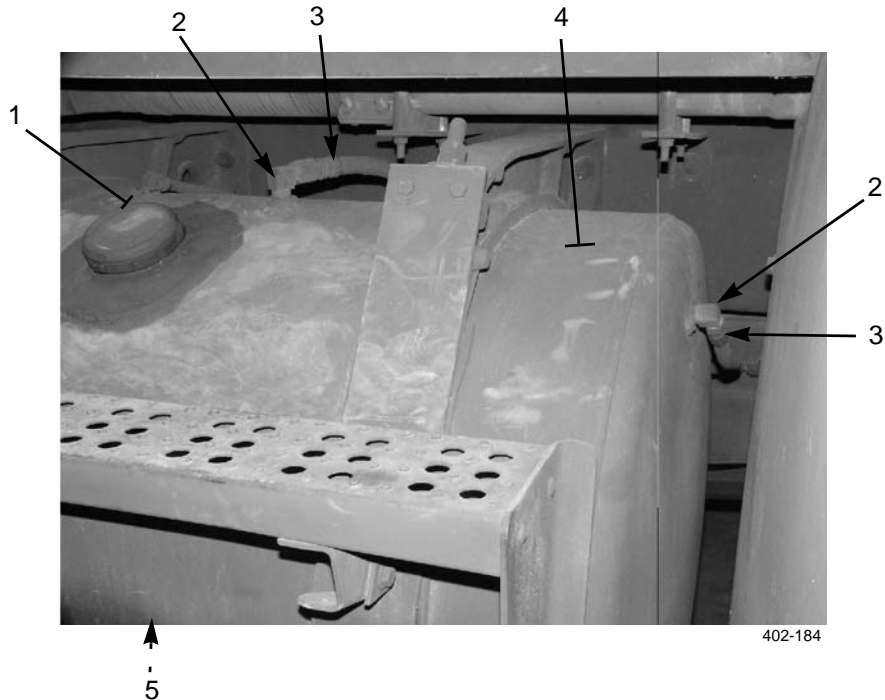
- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicle.
- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in a well-ventilated area. Failure to follow this warning could result in serious injury to personnel.
- Personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.

NOTE

Fuel tank capacity is 100 gal. Have suitable drain pans available.

FUEL TANK REMOVAL - CONTINUED

1. Position drain pan under drain plug (5) at bottom of fuel tank (4).
2. Remove fuel filler cap (1) and drain plug (5). Allow fuel to drain.
3. Install drain plug (5) and fuel filler cap (1).
4. Remove two fuel hoses (3) and elbows (2) from fuel tank (4).



5. Position trestle under fuel tank (4). Adjust trestle height to support weight of fuel tank.

NOTE

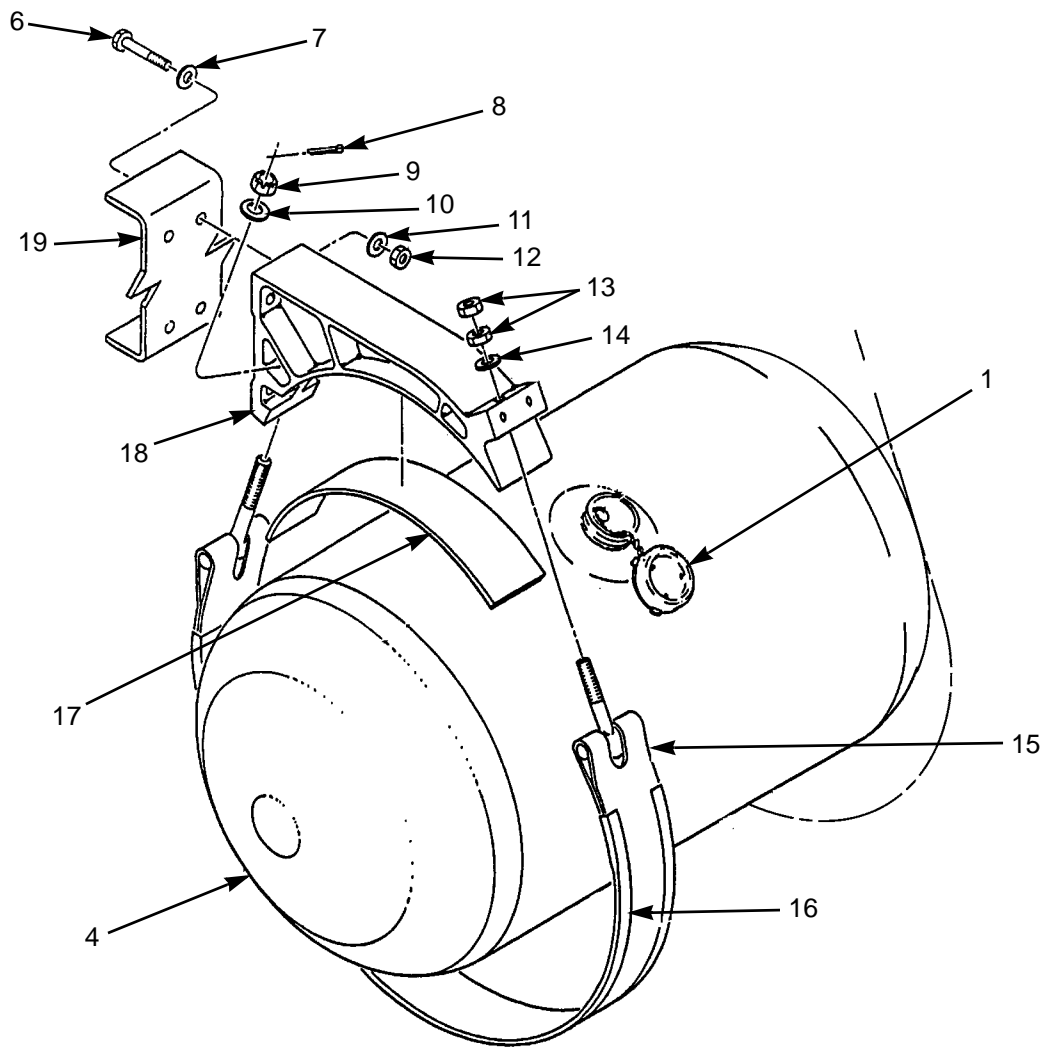
Perform step 6 for each of two straps.

6. Remove two nuts (13) and washer (14) from end of strap (15). Pull strap free of mounting bracket (18) and rotate strap aside.
7. Lower fuel tank (4) to clear mounting brackets (18) and remove fuel tank from vehicle.

MOUNTING BRACKET REMOVAL**NOTE**

- Perform steps 1 through 4 for each of two mounting brackets.
- Note position of strap in mounting bracket for installation.

1. Remove cotter pin (8), nut (9), washer (10), and strap (15) from mounting bracket (18). Discard cotter pin.
2. Remove insulator (16) from strap (15).
3. Remove four nuts (12), washers (11), screws (6), washers (7), and mounting bracket (18) from frame rail (19).
4. Remove bracket insulator (17) from mounting bracket (18).

MOUNTING BRACKET REMOVAL - CONTINUED

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MOUNTING BRACKET INSTALLATION**NOTE**

Perform steps 1 through 4 for each of two mounting brackets.

1. Install bracket insulator (17) to mounting bracket (18).
2. Install mounting bracket (18) to frame rail (19) with four washers (7), screws (6), washers (11) and nuts (12).
3. Install insulator (16) to strap (15).
4. Install strap (15) to mounting bracket (18) with washer (10), nut (9) and new cotter pin (8).

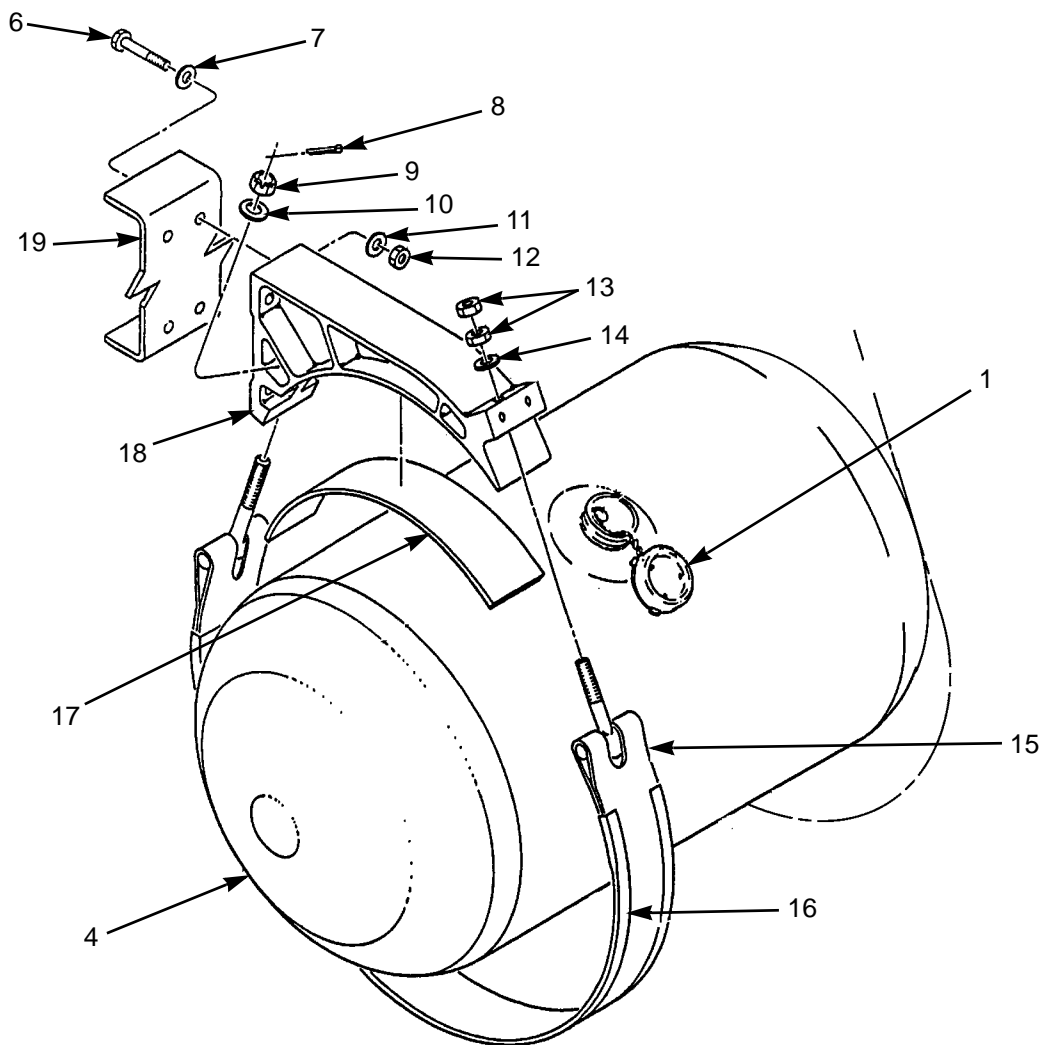
FUEL TANK INSTALLATION

1. Position fuel tank (4) to vehicle. Raise fuel tank to contact mounting brackets (18).

NOTE

Perform step 2 for each of two straps.

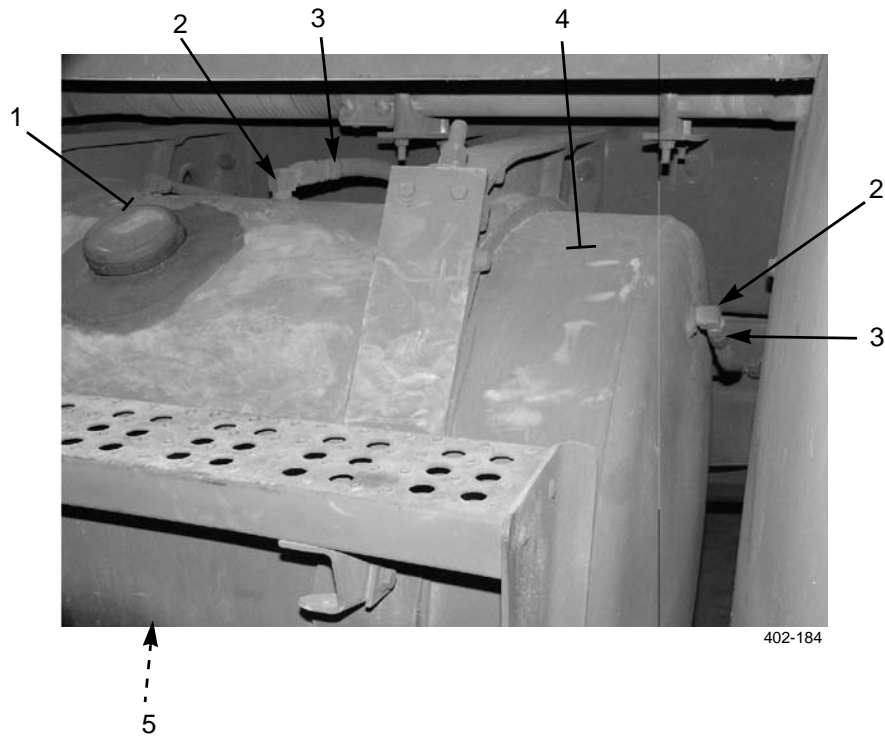
2. Push end of strap (15) into mounting bracket (18) and loosely install washer (14) and two nuts (13).
3. Remove trestle from under fuel tank (4).
4. Adjust position of fuel tank (4) so that drain plug is facing downward and filler cap (1) is easily accessible. Ensure that two drain plugs are installed.
5. Tighten two nuts (13) of each strap (15).



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FUEL TANK INSTALLATION - CONTINUED

6. Install two elbows (2) and two fuel hoses (3) to fuel tank (4).



7. Install fuel level sending unit (WP 0090 00).
8. Install right step (WP 0161 00).
9. Fill fuel tank (TM 9-2320-303-10).

END OF WORK PACKAGE

FUEL HOSES AND CLAMPS REPLACEMENT**0038 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)

Parking brake set (TM 9-2320-303-10)

REMOVAL**WARNING**

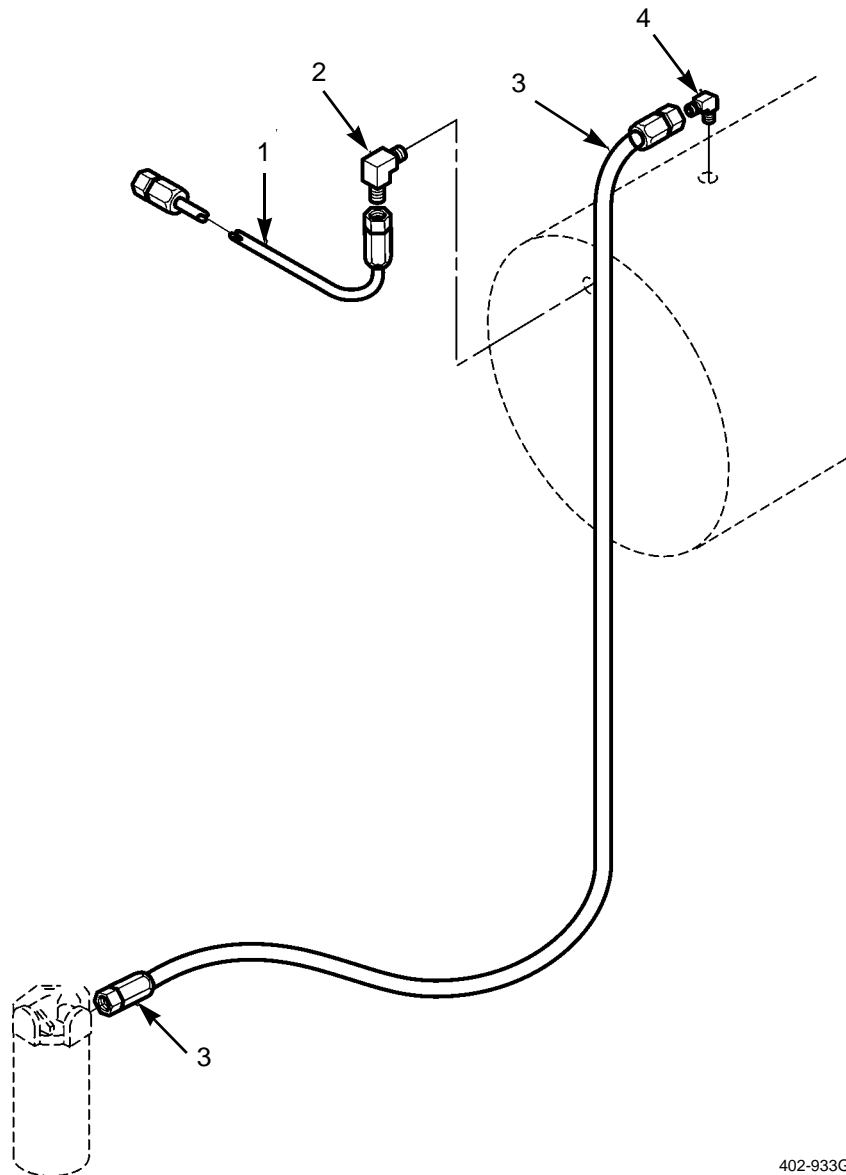
- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicle.
- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in a well-ventilated area. Failure to follow this warning could result in serious injury to personnel.
- Personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.

NOTE

- Have suitable container available to catch fuel draining from fuel hoses.
- Perform following steps to remove each fuel hose.

REMOVAL - CONTINUED

1. At fuel tank, disconnect hose (3) from elbow (4).
2. Trace hose (3) and disconnect at opposite end.
3. At fuel tank, disconnect hose (1) from elbow (2).
4. Trace hose (1) and disconnect at opposite end.
5. Remove elbows (2 and 4) from fuel tank.



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INSTALLATION

1. Apply pipe sealing compound to two elbows (2 and 4) and install on fuel tank.
2. Connect hose (1) to elbow (2) and at opposite end.
3. Connect hose (3) to elbow (4) and at opposite end.
4. Start engine and check for fuel leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

ETHER STARTING AID REPLACEMENT

0039 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Strap, tiedown (Item 41, WP 0312 00)

Washer, lock (P/N MS35338-45) (6)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-4CG5C) (2)

Nut, lock (P/N M45913/1-6CG5C) (2)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Ether starting aid fuel cylinder removed (WP 0040 00)

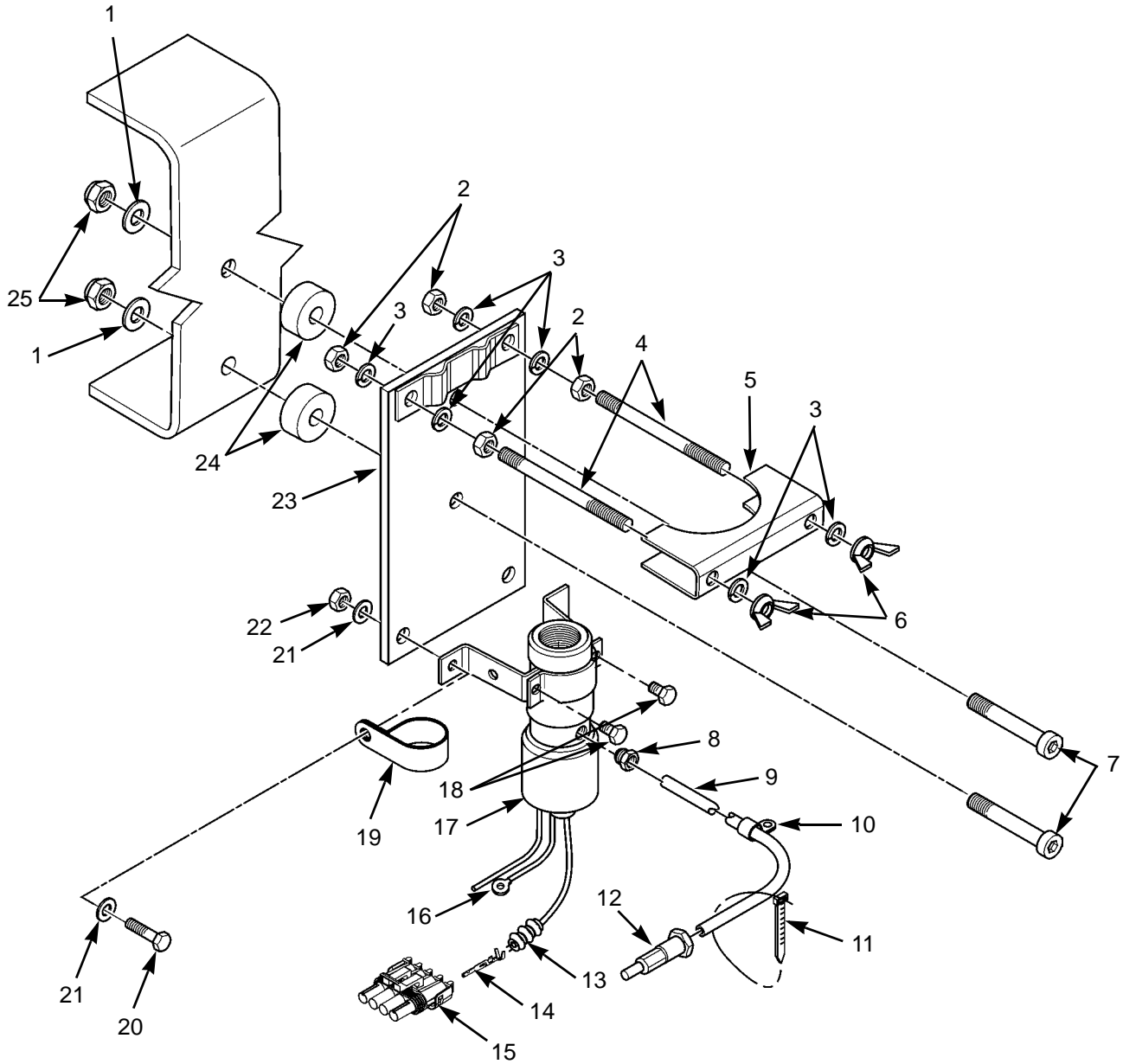
REMOVAL

1. Remove two wing nuts (6), six lockwashers (3), clamp (5), two studs (4), and four nuts (2). Discard lockwashers.
2. Disconnect lug (16), boot (13), electrical contact (14), and connector (15).
3. Remove tiedown straps (11).
4. Remove tube (9) from adapter (8) on valve and atomizer (12) on manifold. Remove clamp (10) from tube.
5. Remove atomizer (12) from manifold.
6. Remove adapter (8) from valve (17).
7. Loosen two screws (18) and remove valve (17) from bracket (part of valve).
8. Remove two screws (20), four lockwashers (21), two locknuts (22), and bracket (part of valve) from bracket (23). Discard lockwashers and locknuts.
9. Remove two screws (7), two spacers (24), two washers (1), two locknuts (25), and bracket (23). Discard locknuts.

INSTALLATION

1. Position bracket (23) and install two screws (7), two spacers (24), two washers (1), and two new locknuts (25).
2. Position bracket (part of valve) on bracket (23) and install two screws (20), four new lockwashers (21), and two new locknuts (22).
3. Install valve (17) on bracket (part of valve) and tighten two screws (18).
4. Install adapter (8) on valve (17).
5. Install atomizer (12) on manifold.
6. Install clamp (10) on tube (9) and install tube on adapter (8) and atomizer (12)
7. Install tiedown straps (11) in same position as removal.
8. Connect lug (16), boot (13), electrical contact (14), and connector (15).
9. Install two wing nuts (6), six new lockwashers (3), clamp (5), two studs (4), and four nuts (2).

INSTALLATION - CONTINUED



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END OF WORK PACKAGE

ETHER STARTING AID FUEL CYLINDER REPLACEMENT

0040 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Material/Parts

Cylinder, fuel (P/N MS39254)

Tools and Special Tools

Gloves, protective (Item 28, WP 0313 00)

Goggles (Item 30, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

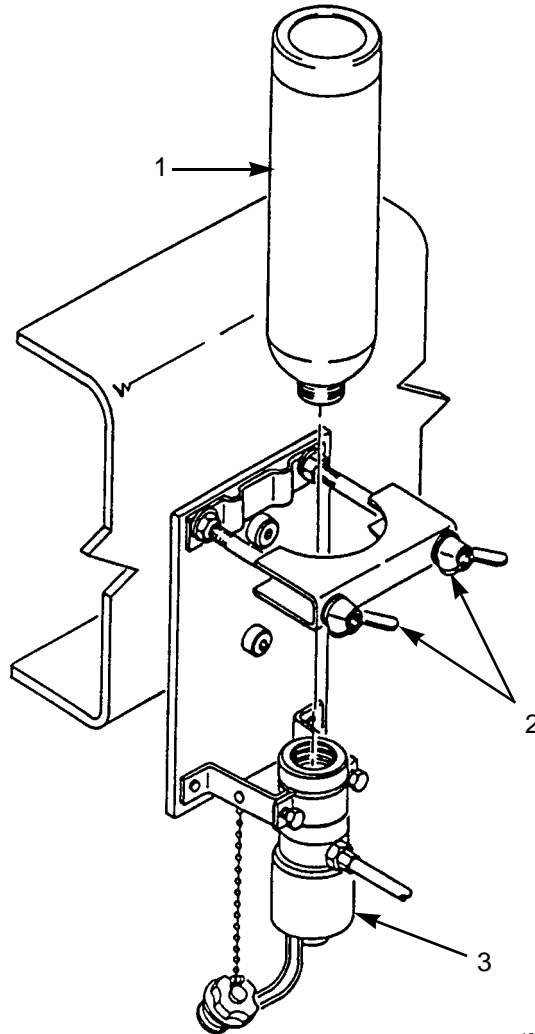
Parking brake set (TM 9-2320-303-10)

**WARNING**

Ether fuel is extremely flammable and toxic. DO NOT smoke and make sure you are in a well-ventilated area away from heat, open flames or sparks. Wear goggles and chemical resistant gloves. Avoid contact with skin and eyes and avoid breathing vapors. If fluid enters or fumes irritate the eyes, wash immediately with large quantities of clean water for 15 minutes. Seek medical attention immediately if ether is inhaled or causes eye irritation. Failure to follow this warning may cause death or serious injury to personnel.

REMOVAL

1. Loosen two wing nuts (2).
2. Unscrew fuel cylinder (1) and remove from valve (3). Discard fuel cylinder.



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INSTALLATION

1. Install new fuel cylinder (1) on valve (3).
2. Tighten two wing nuts (2).

END OF WORK PACKAGE

THROTTLE AND LINKAGE REPLACEMENT

0041 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Nut, lock (P/N 23-09900-104) (3)

Nut, lock (P/N 23-09336-005) (2)

Materials/Parts - Continued

Nut, lock (P/N 233774)

Nut, lock (P/N M45913/1-4CG5C) (8)

Nut, lock (P/N M45913/1-5CG5C)

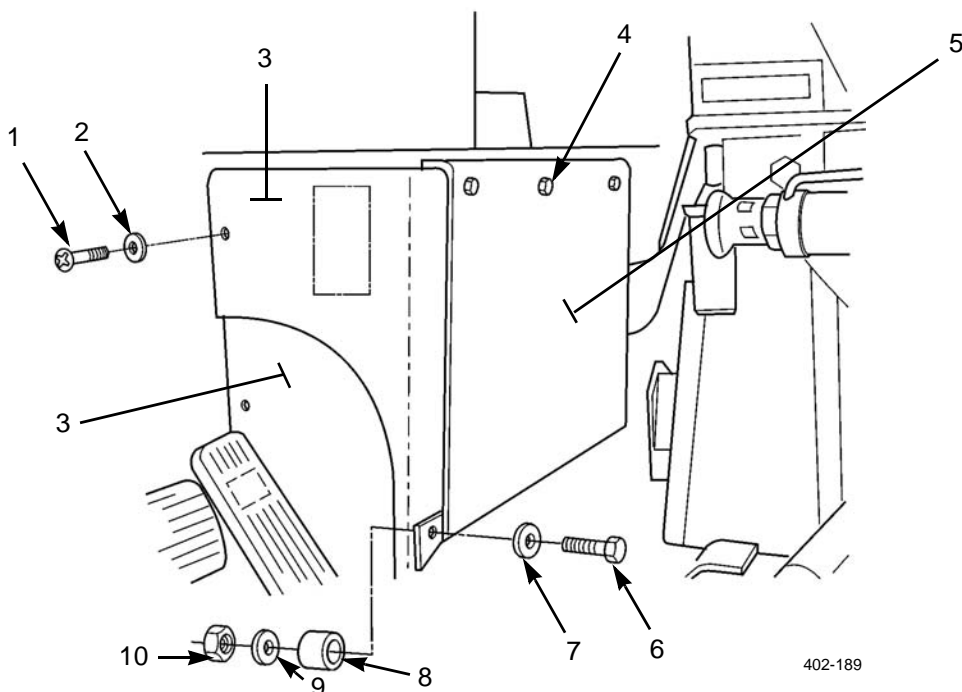
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

REMOVAL

1. Rotate three fasteners (4) counter-clockwise and remove front cover (5).
2. Remove three screws (1) and washers (2) from side covers (3).
3. Remove locknut (10), washer (9), spacer (8), screw (6), washer (7), and covers (3).



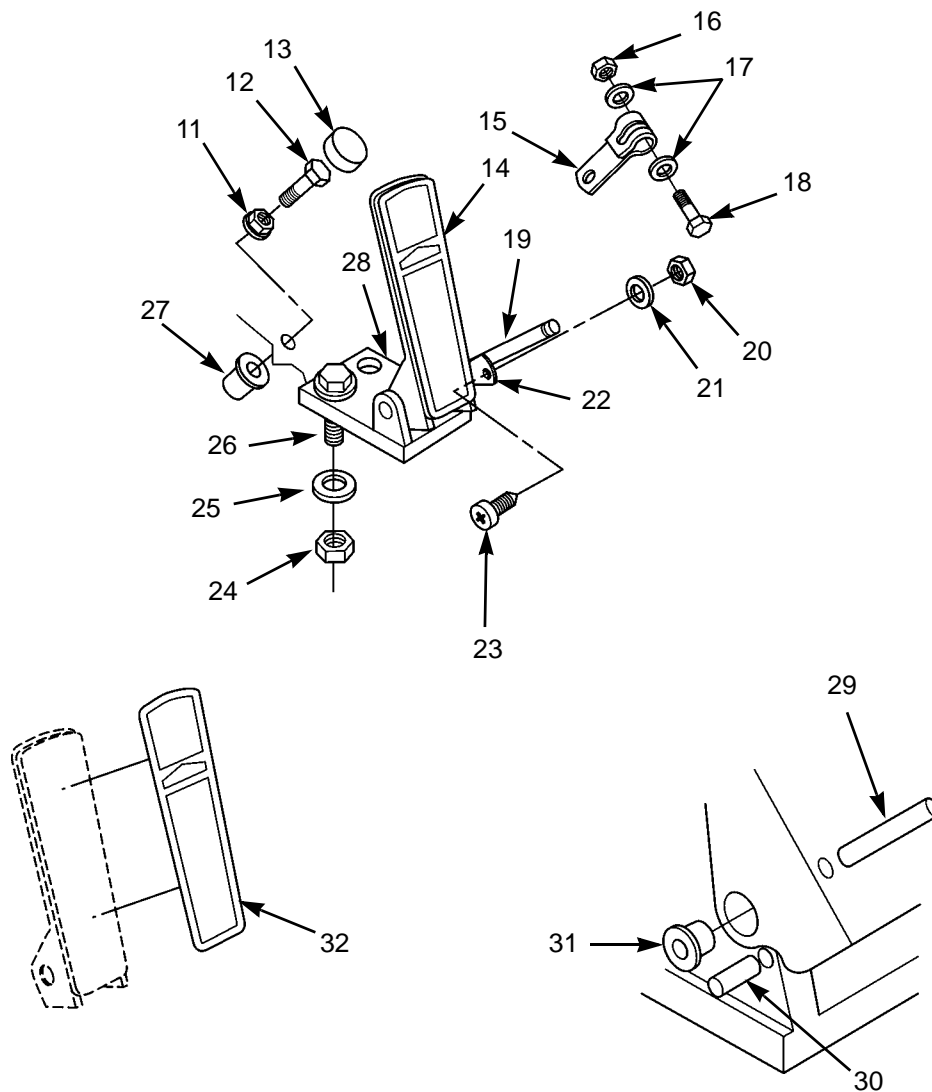
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THROTTLE AND LINKAGE REPLACEMENT - CONTINUED

0041 00

REMOVAL - CONTINUED

4. Remove bumper (13), screw (12), nut (11), and nut (27).
5. Remove screw (18), two washers (17), locknut (16) and bracket (15). Discard locknut.
6. Remove screw (23), washer (21), locknut (20), and housing (22). Discard locknut.
7. Remove pin (19) and pedal (14).
8. Remove two screws (26), washers (25), locknuts (24) and bracket (28). Discard locknuts.
9. Remove bushing (31), pin (29), and pin (30).
10. Remove pad (32) from pedal (14).



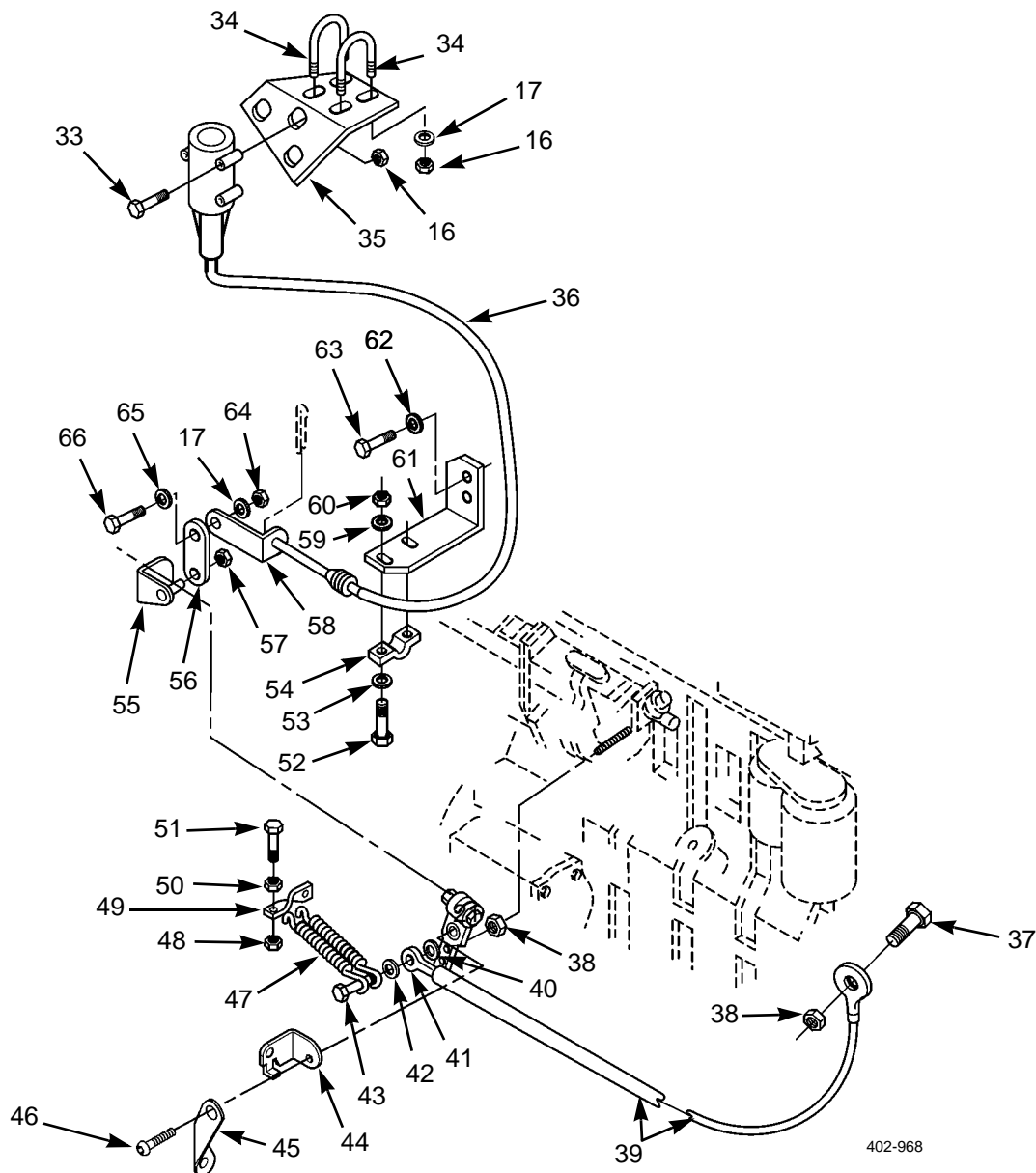
402-967

THROTTLE AND LINKAGE REPLACEMENT - CONTINUED

0041 00

REMOVAL - CONTINUED

11. Remove two locknuts (16), washers (17), and clamps (34) from bracket (35). Discard locknuts.
12. Remove locknut (64), washer (17), washer (65), and bolt (66) from bracket (58). Discard locknut.
13. Remove nut (57), link (56), and bracket (55).
14. Remove two screws (52), two washers (53), retainer (54), two washers (59), and two locknuts (60). Discard locknuts.
15. Remove three locknuts (16), screws (33), and throttle sensor (36) from vehicle. Discard locknuts.
16. Remove two screws (63), two washers (62), and bracket (61).
17. Remove screw (37) and locknut (38) from cable end (39). Discard locknut.
18. Remove screw (43), washer (42), washer (40), and locknut (38) from eye (41). Discard locknut.
19. Remove screw (46), bracket (45), and bracket (44).
20. Remove two screws (51), nuts (50), locknuts (48), bracket (49) and springs (47). Discard locknuts.

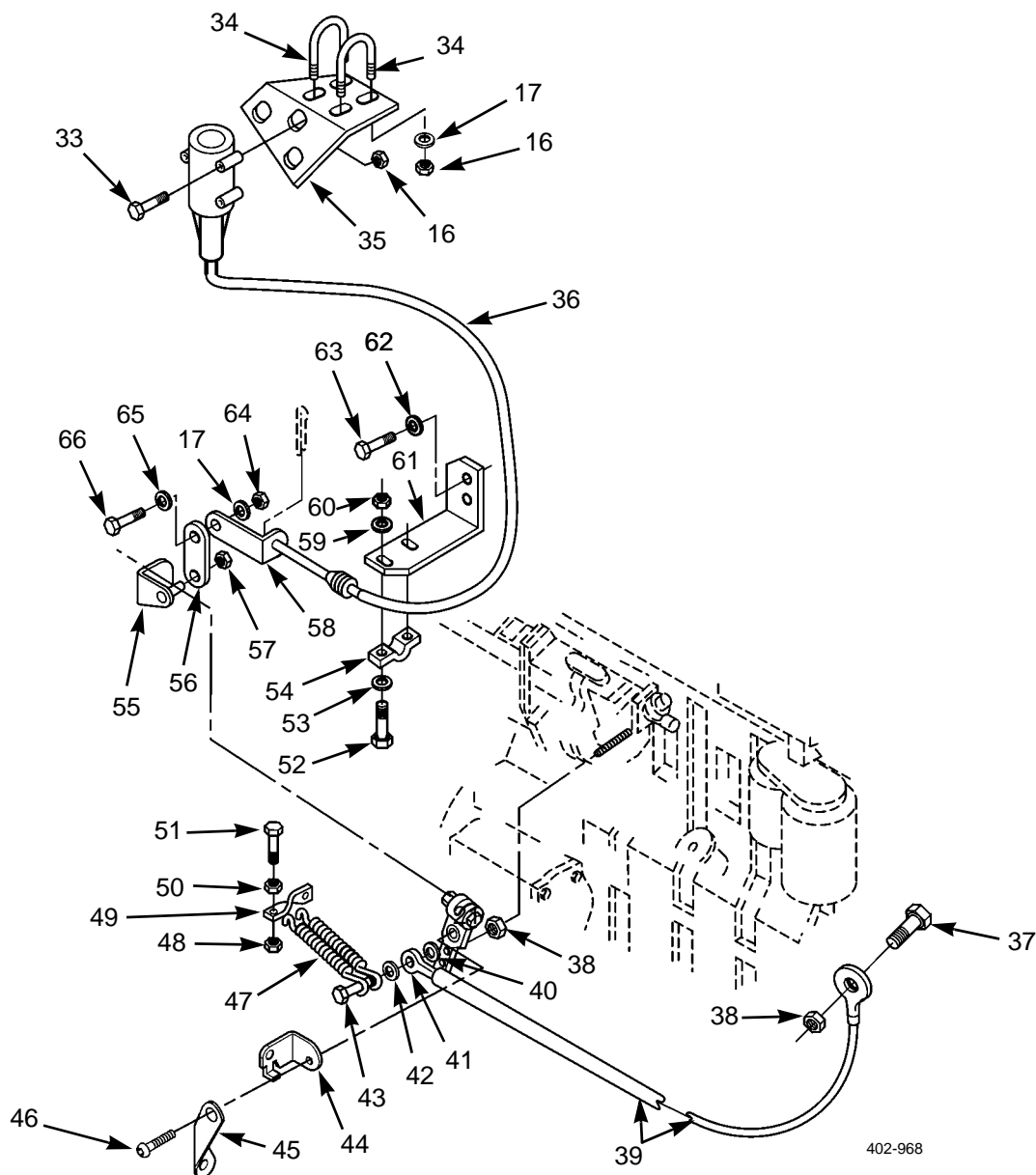


THROTTLE AND LINKAGE REPLACEMENT - CONTINUED

0041 00

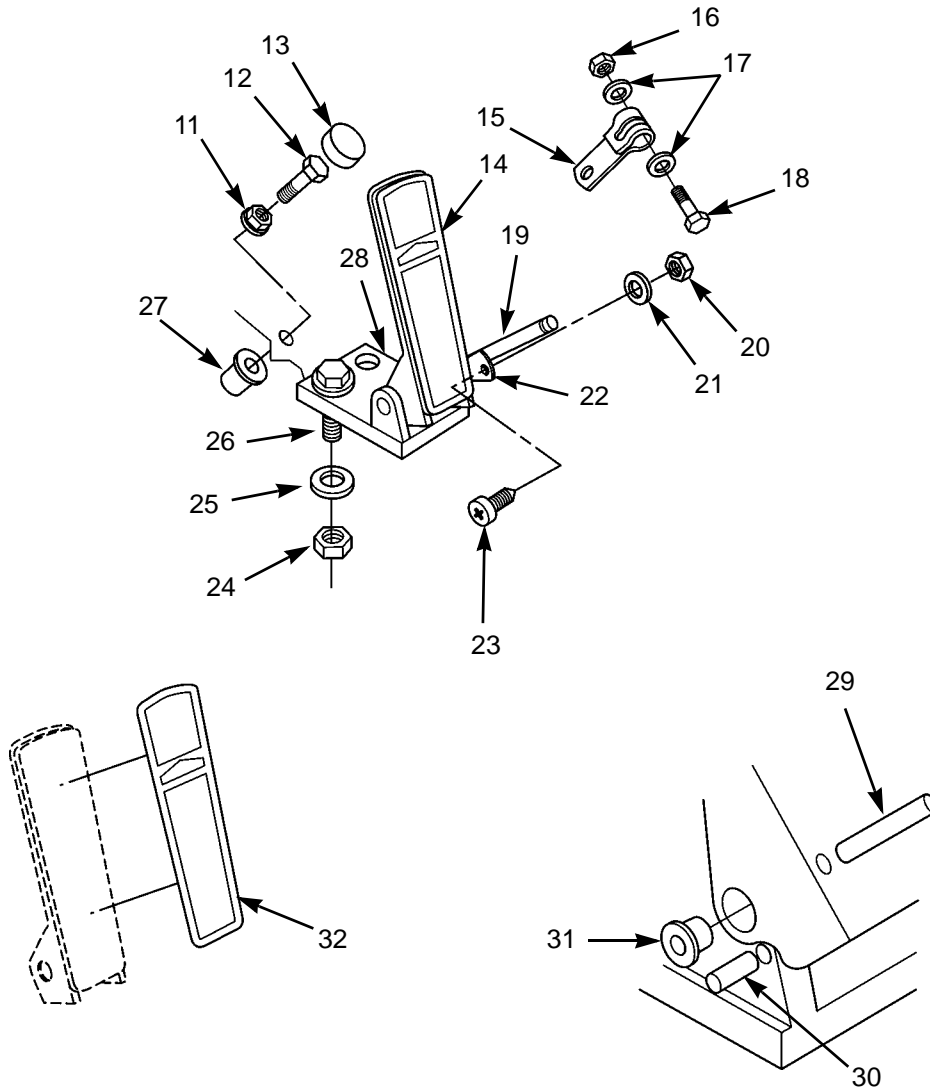
INSTALLATION

1. Install two springs (47), bracket (49), screws (51), nuts (50), and new locknuts (48).
2. Install bracket (44), bracket (45), and screw (46).
3. Install screw (43), washer (42), washer (40), and new locknut (38) to eye (41).
4. Install screw (37) and new locknut (38) to secure cable end (39).
5. Install bracket (61), two screws (63), and washers (62).
6. Install throttle sensor (36), three new locknuts (16), and screws (33).
7. Install retainer (54), two screws (52), washers (53), washers (59), and new locknuts (60).
8. Install bracket (55), link (56), and nut (57).
9. Install bracket (58), new locknut (64), washer (17), washer (65), and bolt (66).



INSTALLATION - CONTINUED

10. Install pad (32) on pedal (14).
11. Install bushing (31), pin (29), and pin (30).
12. Install clamps (34) to bracket (35) with washers (17) and two new locknuts (16).
13. Install bracket (28), two screws (26), washers (25), and new locknuts (24).
14. Install pedal (14) and pin (19).
15. Install housing (22), screw (23), washer (21), and new locknut (20).
16. Install bracket (15), screws (18), two washers (17), and new locknut (16).
17. Install bumper (13), screw (12), nut (11), and nut (27).

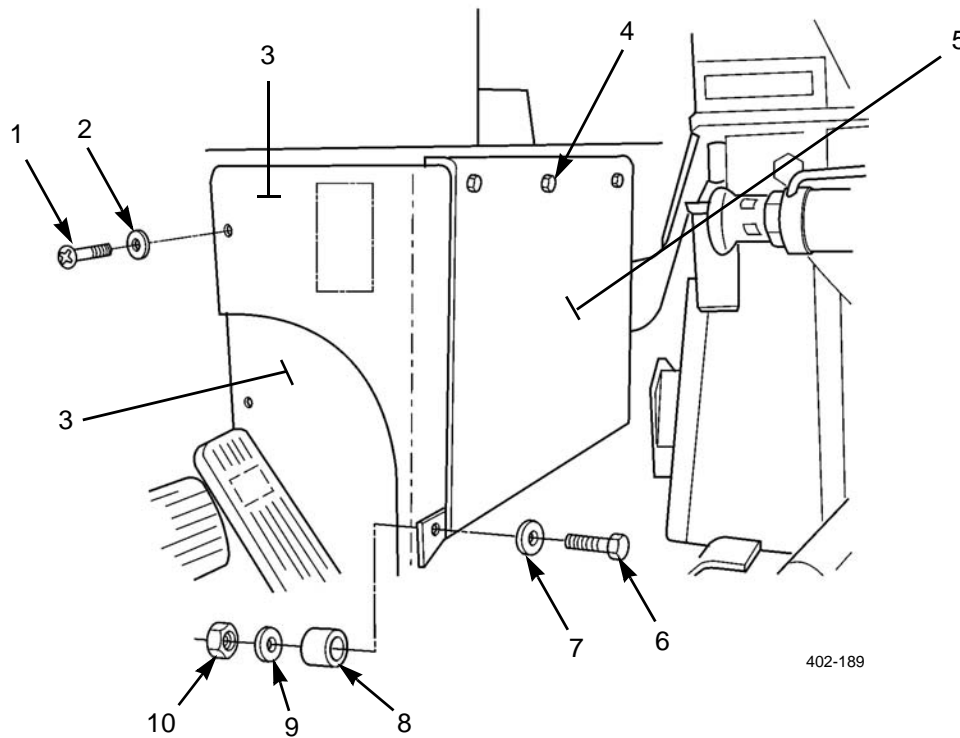


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INSTALLATION - CONTINUED**NOTE**

Position spacer between panel and bulkhead channel at bottom.

18. Install covers (3) with washer (7), screw (6), spacer (8), washer (9), and new locknut (10).
19. Install three washers (2) and screws (1) to covers (3).
20. Install front cover (5) and rotate three fasteners (4) clockwise to secure in place.

**END OF WORK PACKAGE**

MUFFLER AND EXHAUST STACK REPLACEMENT

0042 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Clamp, seal (P/N 04-19249-000)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313
00)

References

WP 0176 00



WARNING

Install seal clamps only hand-tight until all exhaust pipes are installed and tightened down. Failure to do so will cause exhaust leaks and can result in serious personnel injury.

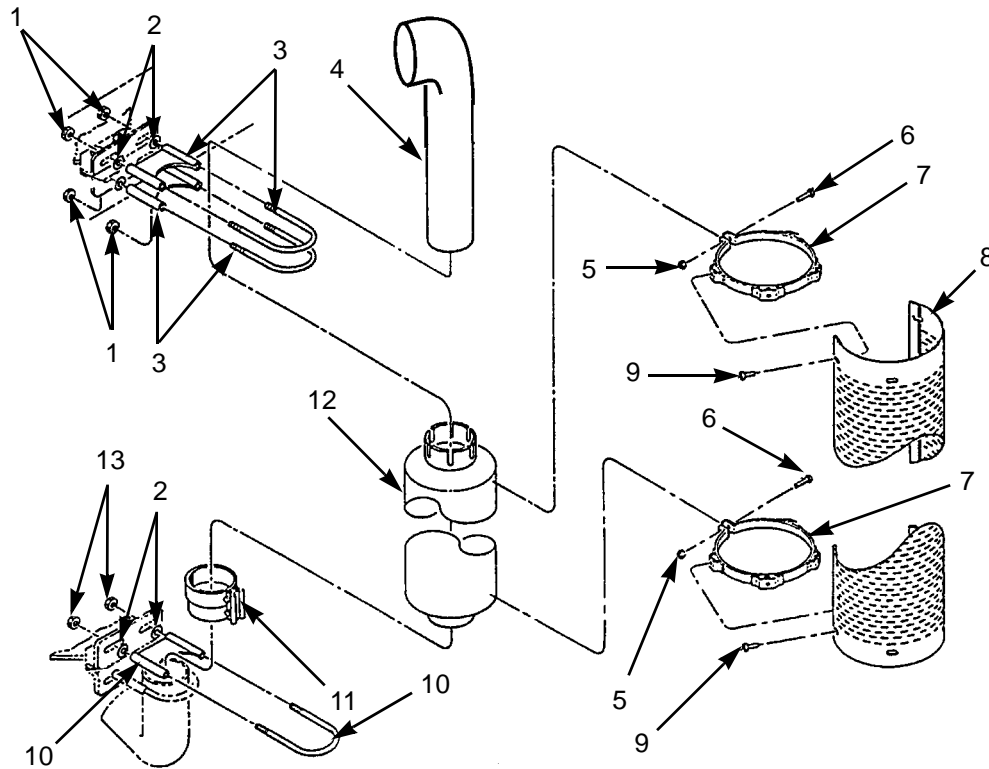
REMOVAL

1. Remove four nuts (1), two saddle clamps (3), and exhaust stack (4).
2. Using suitable lifting device, support muffler (12) and loosen seal clamp (11).

NOTE

Quantity of washers may vary. Washers are used for alignment.

3. Remove two nuts (13), saddle clamp (10), washers (2), muffler (12), and seal clamp (11). Discard seal clamp.
4. Remove eight screws (9) and slide heat shield (8) off muffler (12).
5. Remove two nuts (5), two screws (6), and two heat shield clamps (7).



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6. Remove two nuts (28), two washers (25), two screws (20), two brackets (24 and 26), two washers (22), and two isolators (23) from lower support bracket (29).
7. Repeat step 6 for removal of two brackets (19) from upper support bracket (18).

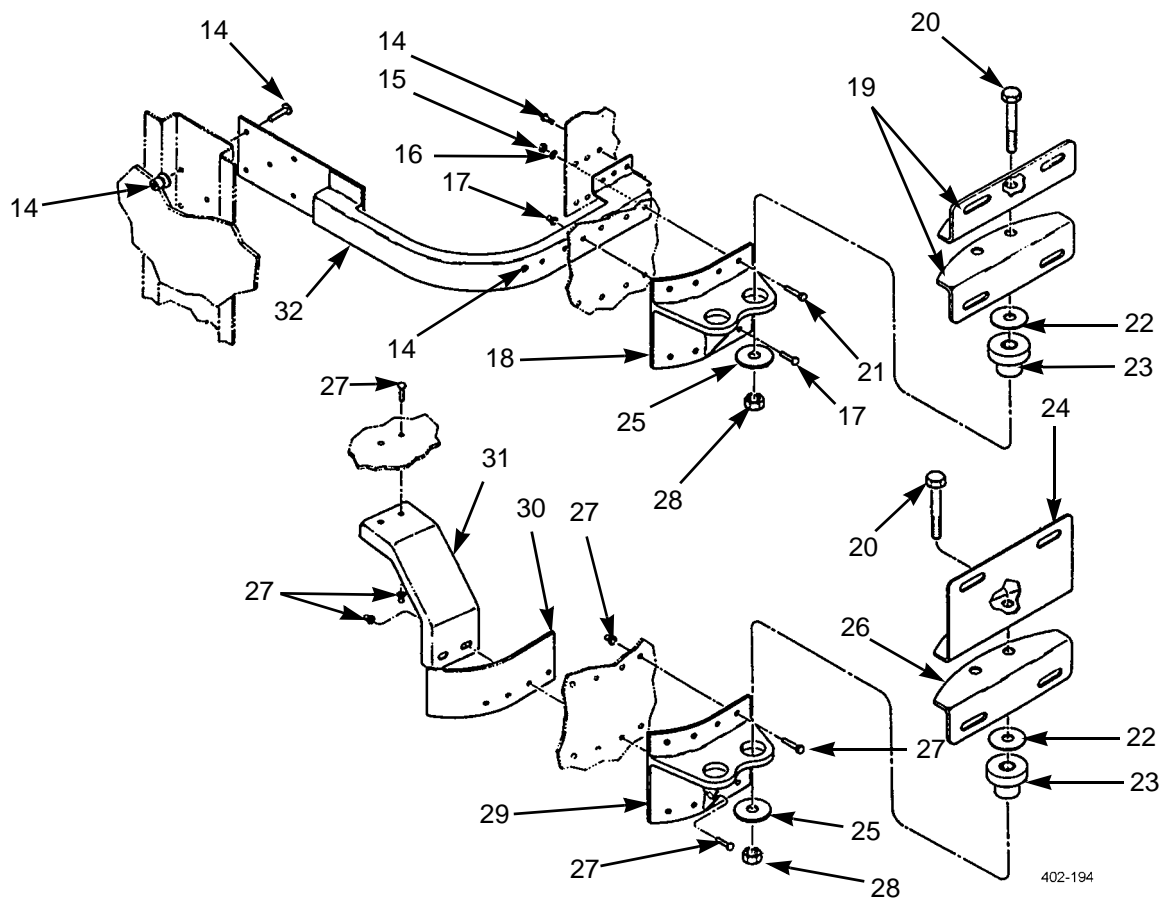
NOTE

Perform steps 8 through 10 only if brackets or backing plate have been damaged.

8. Remove right side cab liner (WP 0176 00).
9. Remove 10 lock bolts and collars (27), bracket (31), lower support bracket (29), and backing plate (30).

REMOVAL - CONTINUED

10. Remove two nuts (15), two washers (16), two screws (21), six lock bolts and collars (17), upper support bracket (18), 11 lock bolts and collars (14), and support bracket (32). Discard brackets and lock bolts and collars.



INSTALLATION**NOTE**

Perform steps 1 through 4 only if brackets or backing plate were removed.

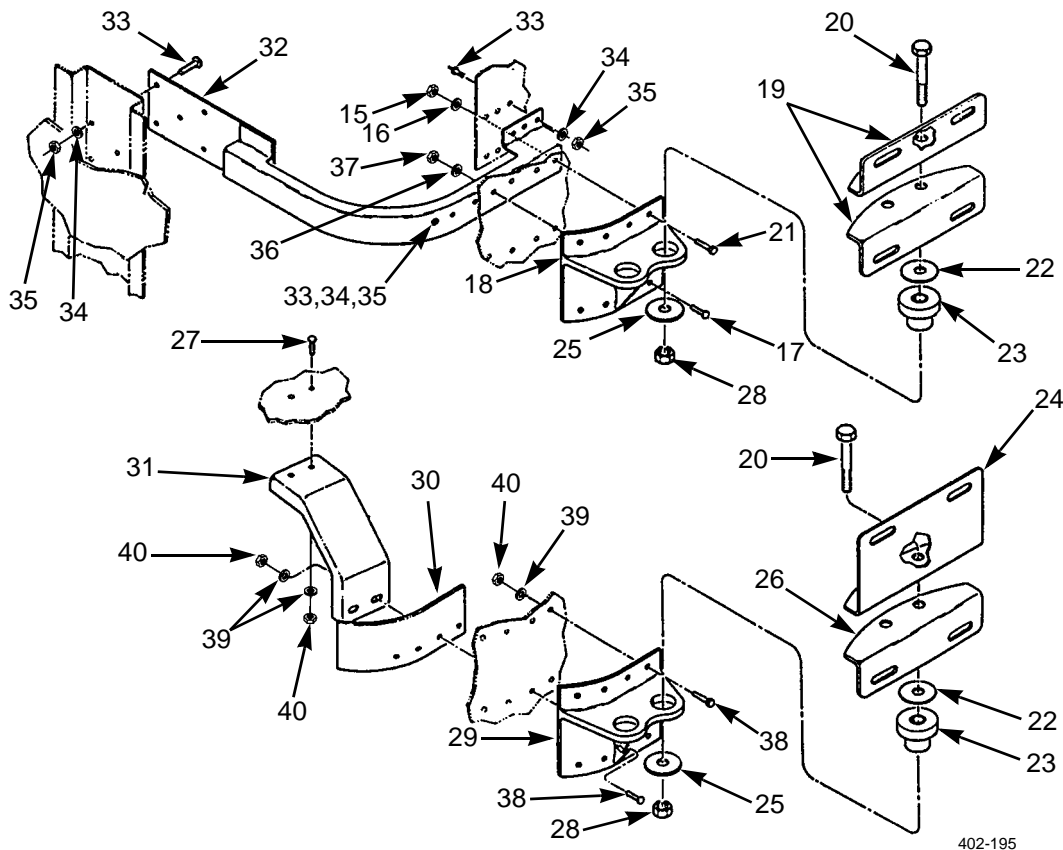
1. Install new support bracket (32), 11 new capscrews (33), 11 new washers (34), and 11 new locknuts (35).
2. Install new upper support bracket (18), six new capscrews (17), six new washers (36), six new locknuts (37), two screws (21), two washers (16), and two nuts (15).
3. Install backing plate (30), new lower support bracket (29), new bracket (31), 10 capscrews (38), 10 washers (39), and 10 locknuts (40).
4. Install right side cab liner (WP 0176 00).
5. Install two isolators (23), two washers (22), two brackets (19), two screws (20), two washers (25), and two nuts (28) in upper support bracket (18).
6. Repeat step 5 for installation of two brackets (24 and 26) in lower support bracket (13).
7. Install two heat shield clamps (7), two screws (6), and two nuts (5) on muffler (12).
8. Slide heat shield (8) on muffler (12) and install eight screws (9).

**WARNING**

Install seal clamps only hand-tight until all exhaust pipes are installed and tightened down. Failure to do so will cause exhaust leaks and can result in serious personnel injury.

INSTALLATION

- 9. Install new seal clamp (11) on muffler (12).

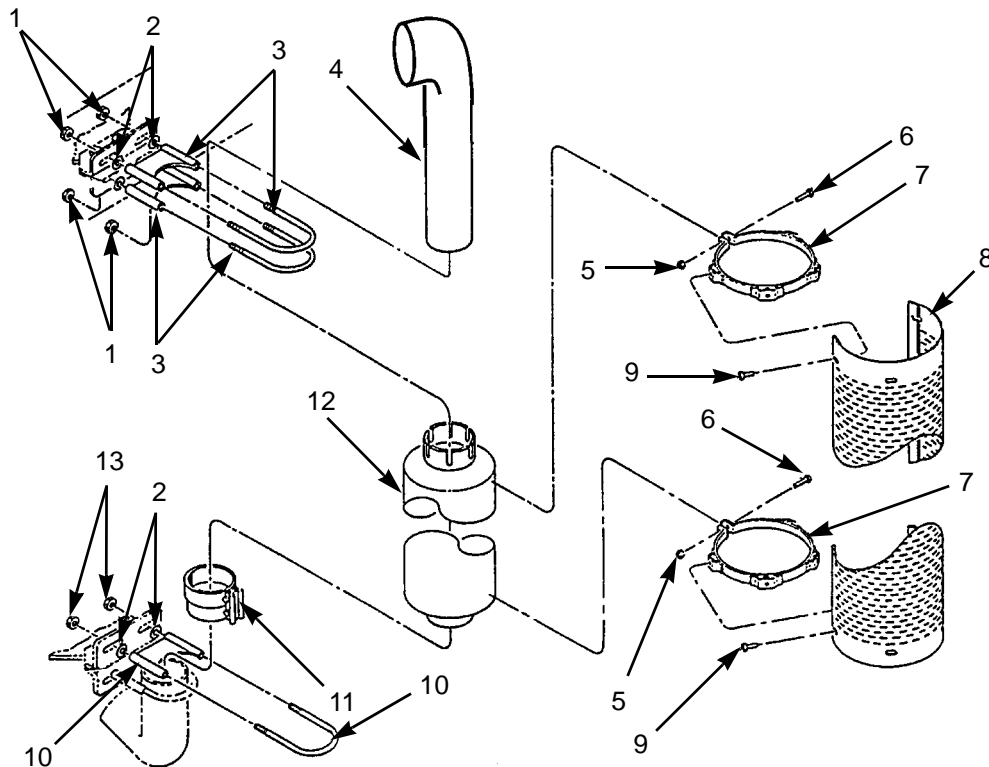


INSTALLATION - CONTINUED

NOTE

Washers are used for muffler alignment. Use only enough washers to keep muffler straight.

10. Using suitable lifting device, support muffler (12) and install muffler, washers (2), two saddle clamps (10), and four nuts (13).
11. Install exhaust stack (4), saddle clamp (3), and two nuts (1).



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12. Tighten seal clamp (11) to 33 lb-ft (45 Nm).

END OF WORK PACKAGE

EXHAUST PIPE AND CLAMP REPLACEMENT

0043 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Clamp, seal (P/N 04-19249-000) (6)

Equipment Conditions

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)



WARNING

Install seal clamps only hand-tight until all exhaust pipes are installed and tightened down. Failure to do so will cause exhaust leaks and can result in serious personnel injury.

REMOVAL

1. Loosen clamp (6) and seal clamp (8) and remove exhaust outlet pipe (5).
2. Remove clamp (6) and seal clamp (8). Discard seal clamp.
3. Remove seal clamp (10) and flex pipe (9). Discard seal clamp.

NOTE

Note location of heat shield for installation.

4. Remove clamp (21) and heat shield (17).
5. Loosen seal clamp (24) and remove four nuts (13), two saddle clamps (7), and pipe (11).
6. Remove and discard seal clamp (24).
7. Remove two nuts (14), two washers (15), two screws (22), two washers (23), and two brackets (12) from frame rail (16).
8. Remove seal clamp (18), flex pipe (20), seal clamp (26), and pipe elbow (19). Discard seal clamps.
9. Remove two nuts (1), washers (27), saddle clamp (4), seal clamp (3), and muffler inlet pipe (25) from muffler (2). Discard seal clamp.

INSTALLATION**WARNING**

Install seal clamps only hand-tight until all exhaust pipes are installed and tightened down. Failure to do so will cause exhaust leaks and can result in serious personnel injury.

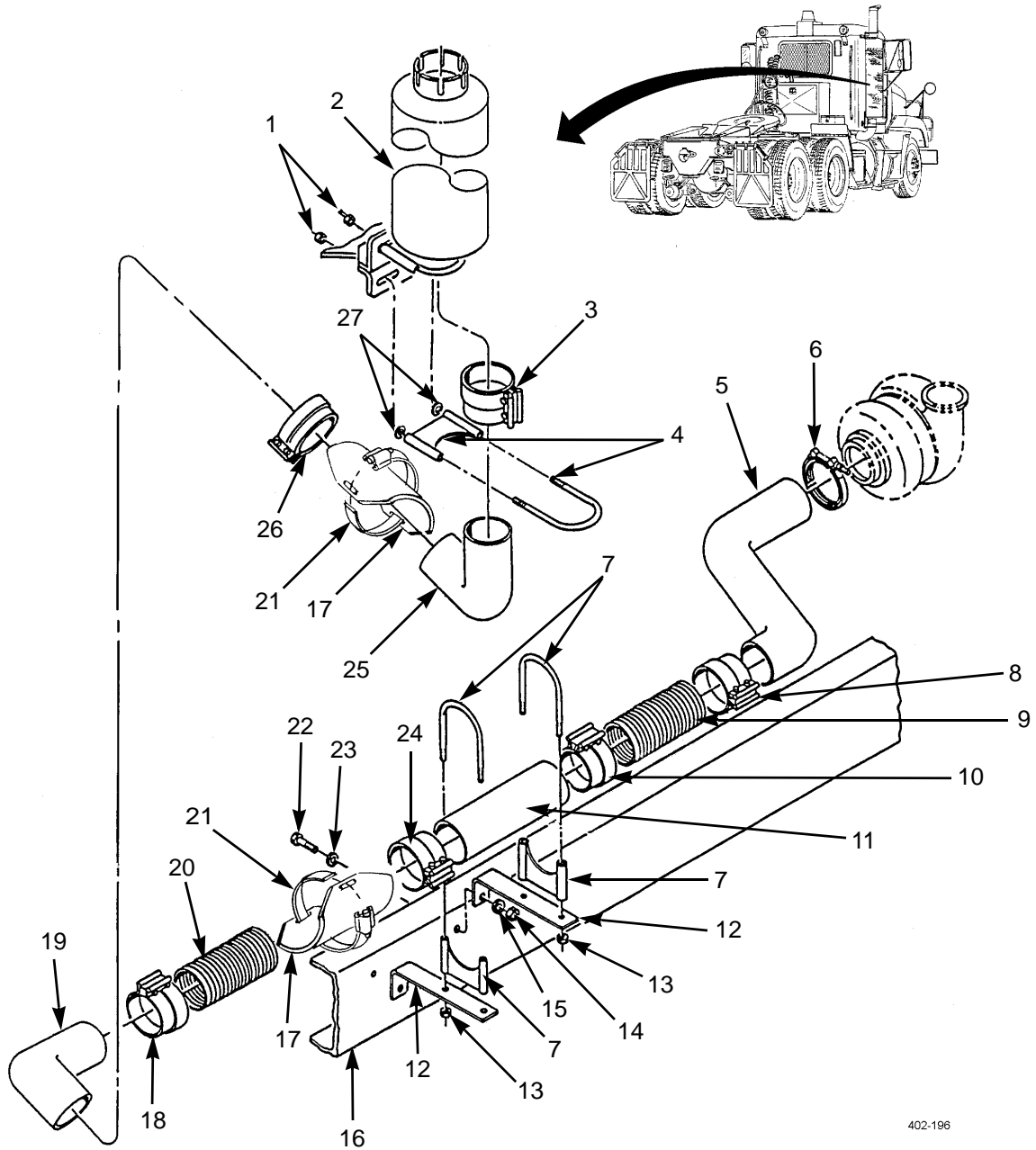
1. Install new seal clamp (3) and muffler inlet pipe (25) on muffler (2).

NOTE

Install quantity of washers noted during removal step 8.

2. Install saddle clamp (4), washers(s) (27), and two nuts (1).
3. Install two brackets (12), two washers (23), two screws (22), two washers (15), and two nuts (14) on frame rail (16).
4. Install two saddle clamps (7), pipe (11), and four nuts (13) loosely on two brackets (12).
5. Install new seal clamp (24), flex pipe (20), new seal clamp (18), pipe elbow (19), and new seal clamp (26).
6. Install heat shield (17) and clamp (21).
7. Install new seal clamp (10), flex pipe (9), new seal clamp (8), exhaust outlet pipe (5), and clamp (6).
8. Tighten four nuts (13).
9. Tighten all seal clamps (3, 8, 10, 17, 18, and 24) in three increments to 33 lb-ft (45 Nm).

INSTALLATION - CONTINUED



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END OF WORK PACKAGE

RADIATOR REPLACEMENT

0044 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Nut, lock (P/N M45913/1-8CG5C) (2)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-10CG5C) (2)

References

TM 9-2320-303-10

Equipment Condition

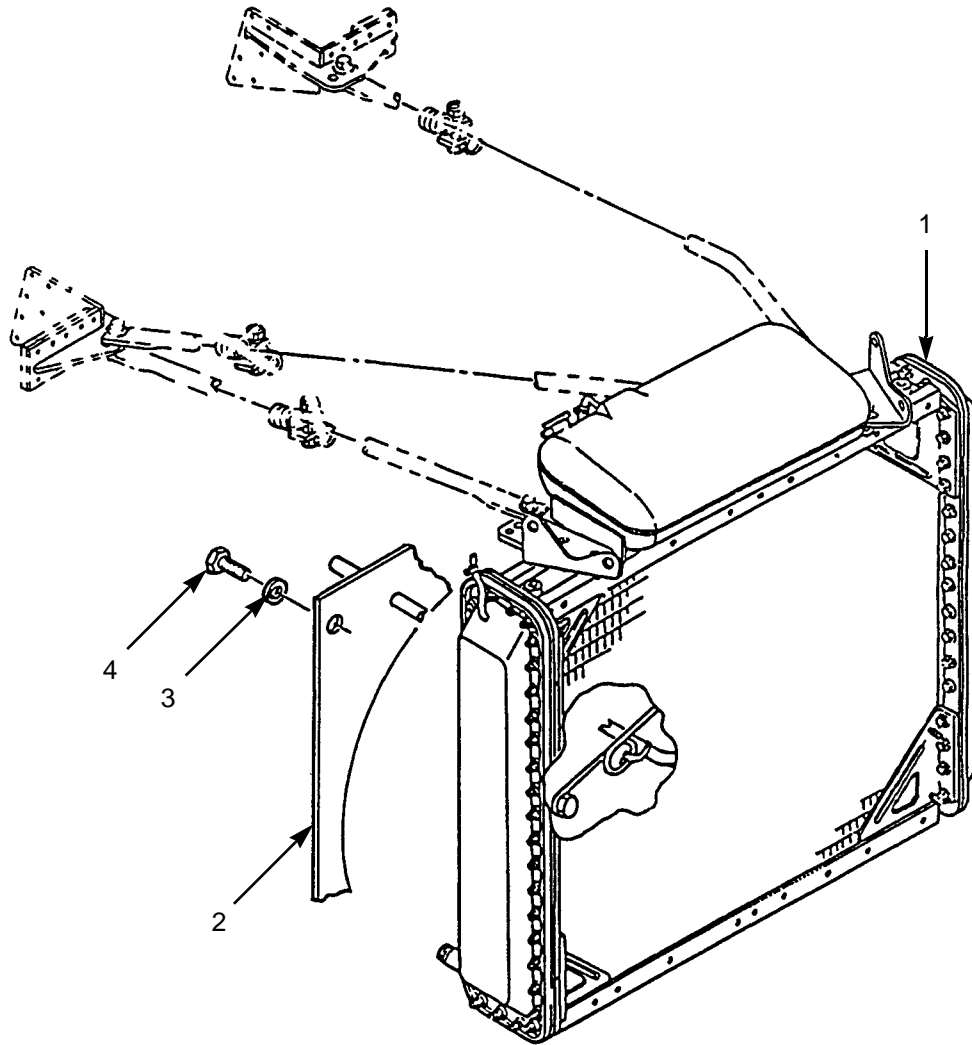
Cooling system drained (WP 0045 00)

Hood removed (WP 0178 00)

Electric horn removed (WP 0093 00)

REMOVAL

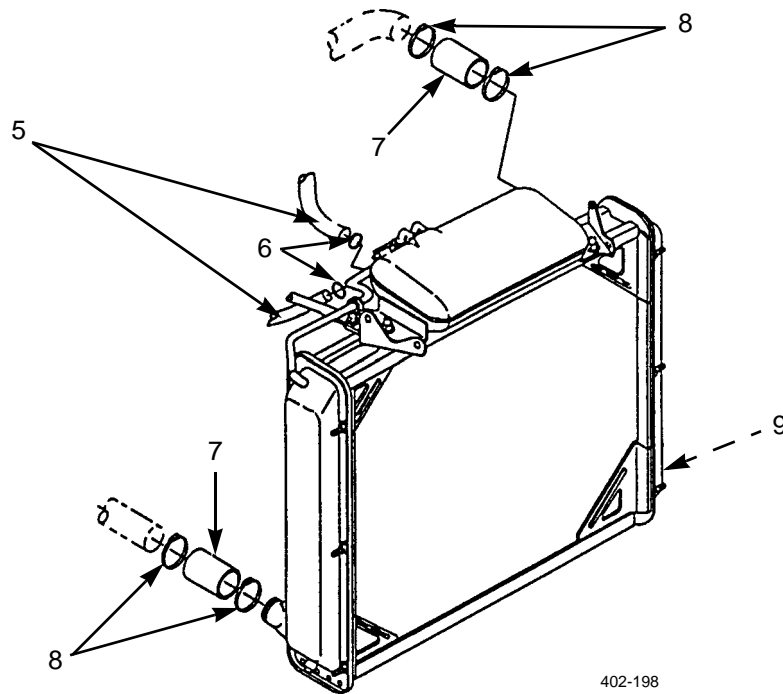
1. Remove four screws (4), and four washers (3) and push fan shroud (2) back from radiator (1).



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REMOVAL - CONTINUED

2. Disconnect ground strap (9) from left side of radiator (1).
3. Remove four clamps (8) and two hoses (7).
4. Remove two clamps (6) and disconnect two hoses (5).



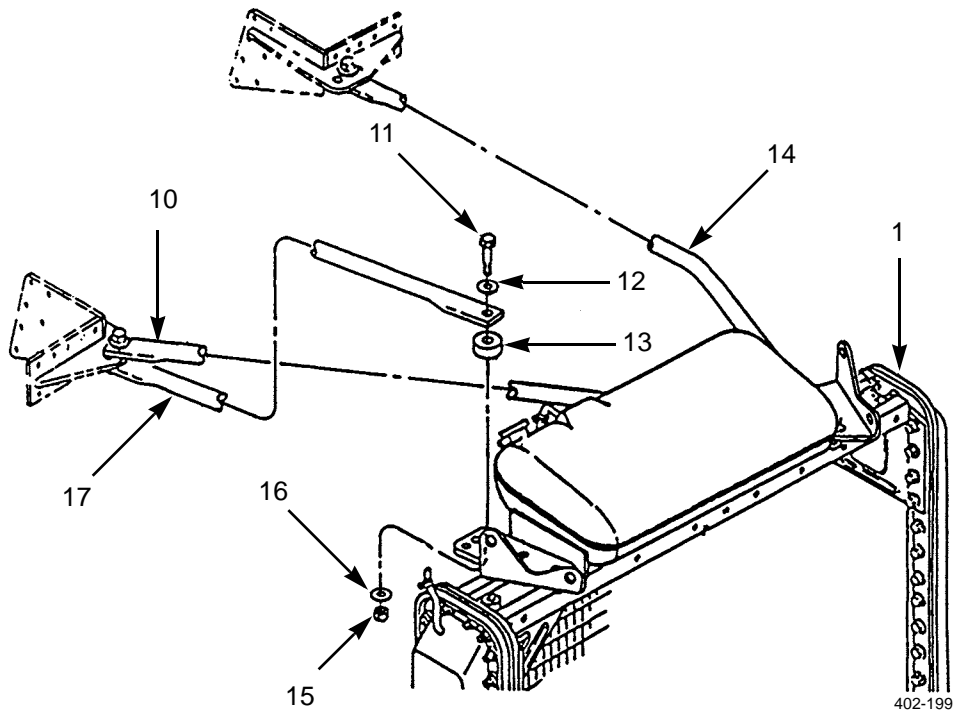
402-198

RADIATOR REPLACEMENT- CONTINUED

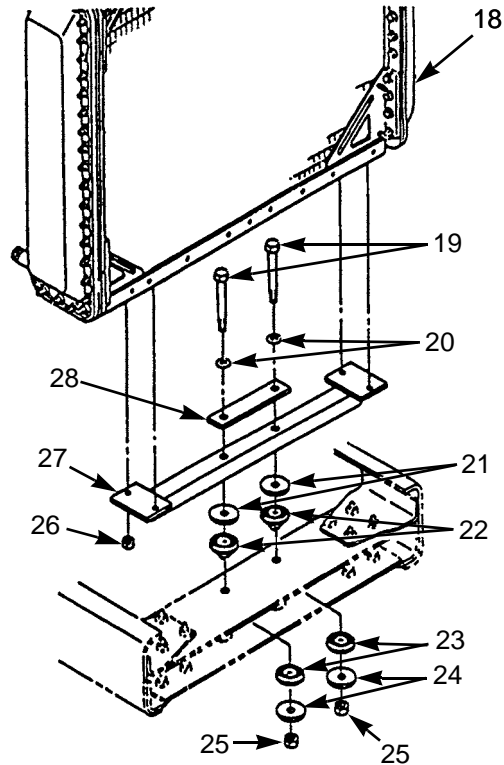
0044 00

REMOVAL - CONTINUED

5. Using suitable lifting device, support radiator (1).
6. Remove two locknuts (15), two washers (16), two screws (11), two washers (12), spacer (13), and three strut rods (10, 14, and 17) from radiator (1). Discard locknuts.



7. Remove two nuts (25), two washers (24), two isolators (23), radiator (1), two washers (21), and two isolators (22).
8. Remove four locknuts (26) and support (27) from radiator (1). Discard locknuts.
9. Remove two screws (19), two washers (20), and spacer (28) from support (27).

REMOVAL - CONTINUED

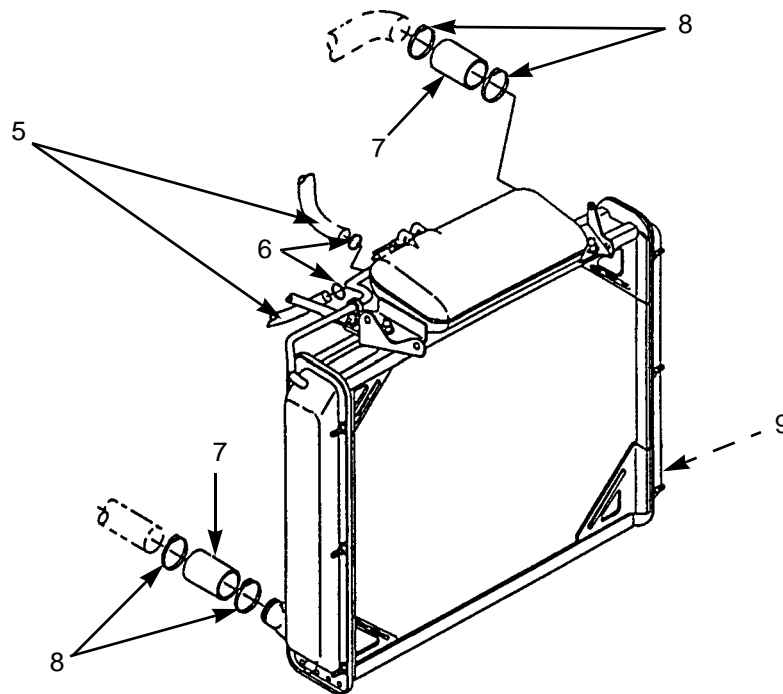
402-200

INSTALLATION

1. Install spacer (28), two washers (20), and two screws (19) on support (27).
2. Install support (27) and four new locknuts (26) on radiator (1).
3. Install two isolators (22) and two washers (21).
4. Using suitable lifting device, install radiator (1), two isolators (23), two washers (24), and two nuts (25).
5. Install spacer (13), three strut rods (10, 14, and 17), two washers (12), two screws (11), two washers (16), and two new locknuts (15) on radiator (1).

INSTALLATION - CONTINUED

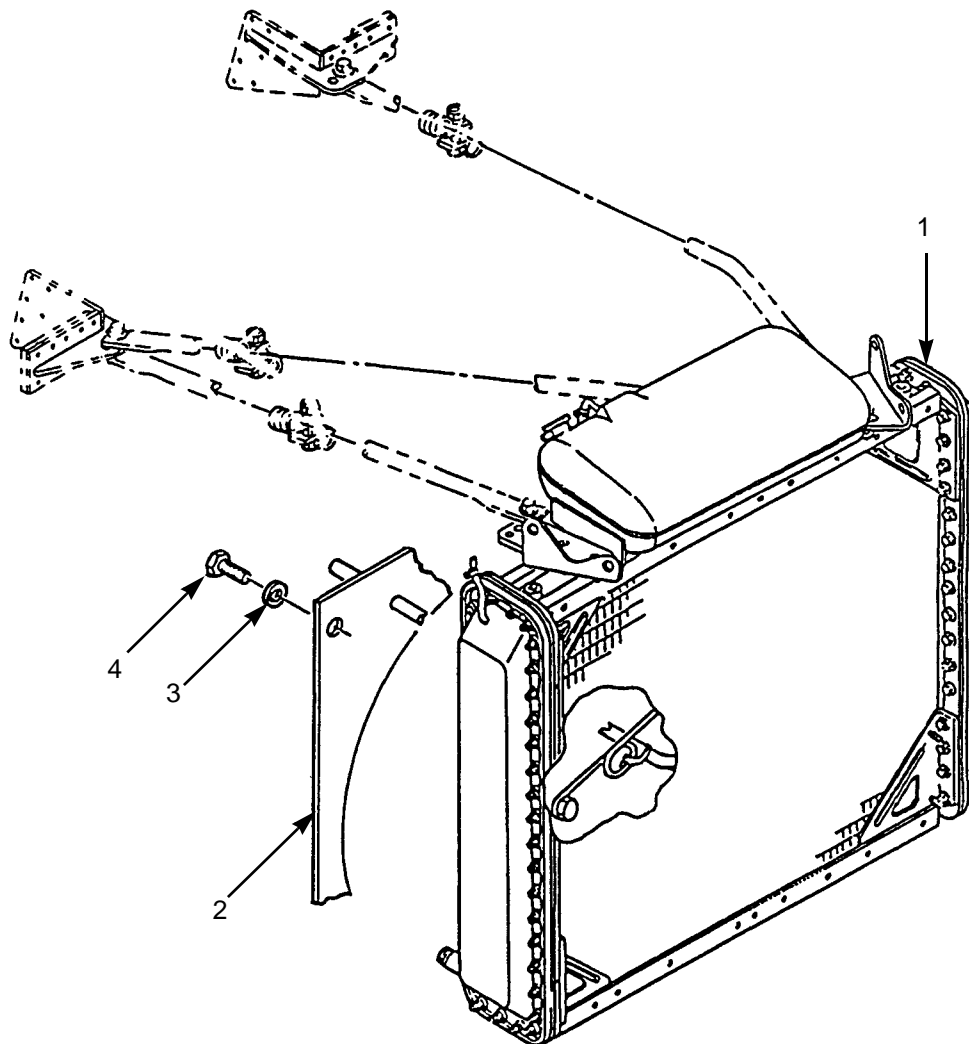
6. Connect two hoses (5) and install two clamps (6).
7. Install two hoses (7) and four clamps (8) on radiator (1).
8. Connect ground strap (9) to left side of radiator (1).



402-198

INSTALLATION - CONTINUED

9. Install fan shroud (2), four washers (3), and four screws (4).



402-197

10. Install electric horn (WP 0093 00).
11. Fill cooling system (WP 0045 00).
12. Install hood (WP 0178 00).

END OF WORK PACKAGE

DRAIN/REPLENISH COOLING SYSTEM

0045 00

THIS WORK PACKAGE COVERS

Drain/Replenish Coolant

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Materials/Parts

Antifreeze (Item 6 or 7, WP 0312 00)

Compound, pipe sealing (Item 17, WP 0312 00)

Materials/Parts - Continued

Rags, wiping (Item 39, WP 0312 00)

References

TM 9-2320-303-10

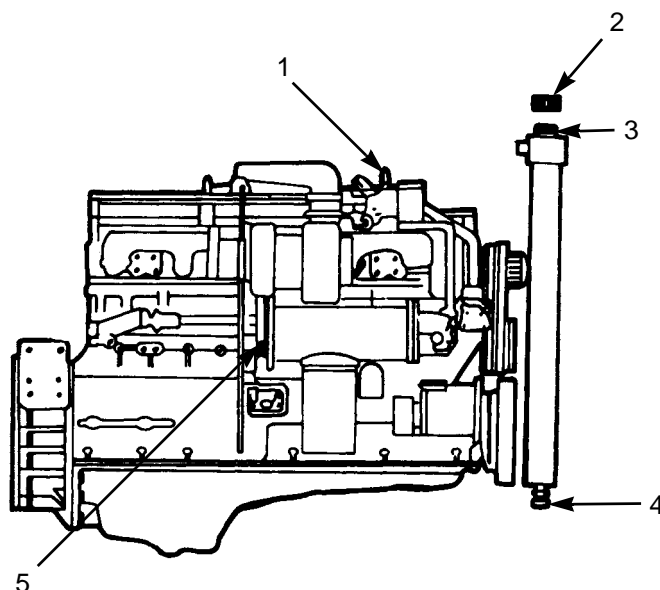
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake applied (TM 9-2320-303-10)

DRAIN COOLANT

1. Remove cap (2) on coolant expansion tank (3).
2. On bottom left side of radiator, remove drain plug (4) and allow coolant to drain.
3. Open thermostat petcock (1).
4. Open oil cooler draincock (5). Allow coolant to drain out. Close draincock.
5. Inspect petcock, draincock, and drain plug for evidence of leakage or damage.
6. If necessary, apply pipe sealing compound to threads of new petcock, draincock or drain plug and install.



402-201

REPLENISH COOLANT

1. Add coolant in expansion tank (3) until thermostat petcock (1) overflows.
2. Close thermostat petcock (1).
3. Continue adding coolant until level reaches bottom of opening on expansion tank (3).
4. Install cap (2) on expansion tank (3).
5. Start vehicle (TM 9-2320-303-10) and inspect for leaks.

END OF WORK PACKAGE

FAN IMPELLER AND SHROUD REPLACEMENT

0046 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313
00)

Materials/Parts

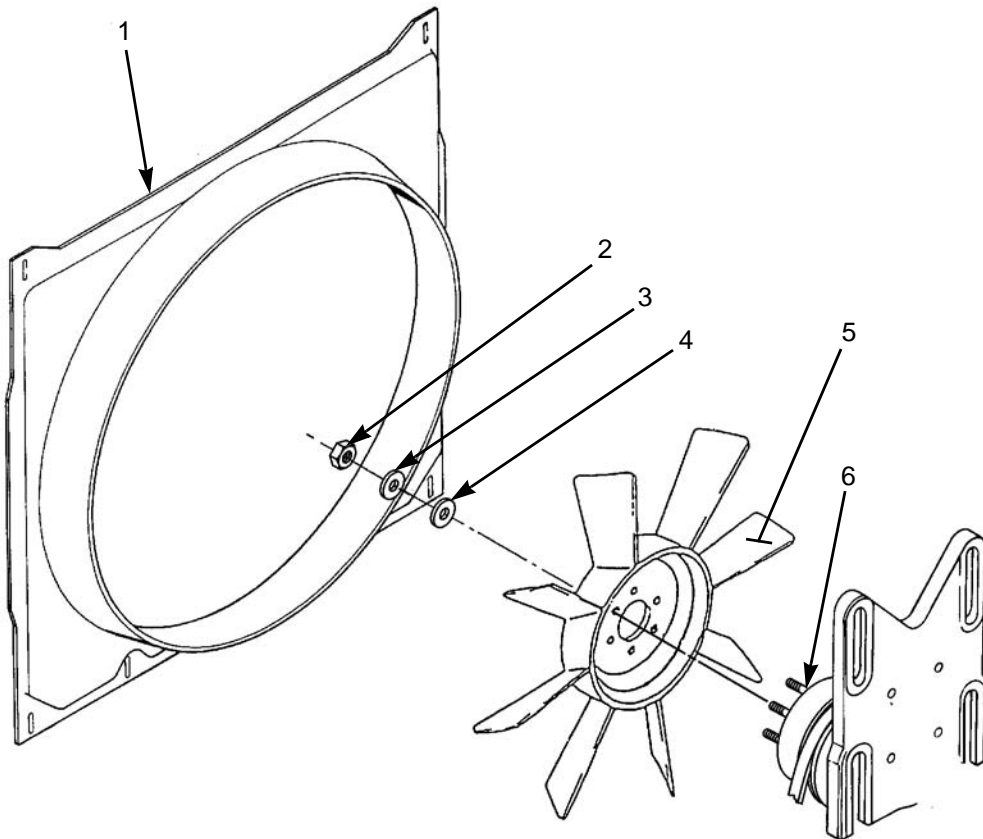
Washer, lock (P/N 5740254) (6)

Equipment Condition

Radiator removed (WP 0044 00)

REMOVAL**NOTE**

- Screws and washers holding shroud to radiator were removed when radiator was removed.
 - Note position of shroud for installation.
1. Lift shroud (1) out of engine compartment.
 2. Remove six nuts (2), lockwashers (3), washers (4), and fan impeller (5) from fan clutch (6). Discard lockwashers.



402-202

INSTALLATION

1. Install fan impeller (5) to fan clutch (6) with six washers (4), new lockwashers (3), and nuts (2).
2. Place shroud (1) into engine compartment.
3. Install radiator (WP 0044 00).

END OF WORK PACKAGE

THERMOSTAT AND HOUSING MAINTENANCE

0047 00**THIS WORK PACKAGE COVERS**Removal, Testing, Installation, Operational Check

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Handle, driver (Item 31, WP 0313 00)

Installer, seal (Item 50, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Wrench, torque (Item 110, WP 0313 00)

References

TM 9-2320-303-10

TM 9-2815-225-34&P

Materials/Parts

Gasket (P/N 3019158)

Gasket (P/N 208128)

Seal, rubber (P/N 18670)

Equipment Condition

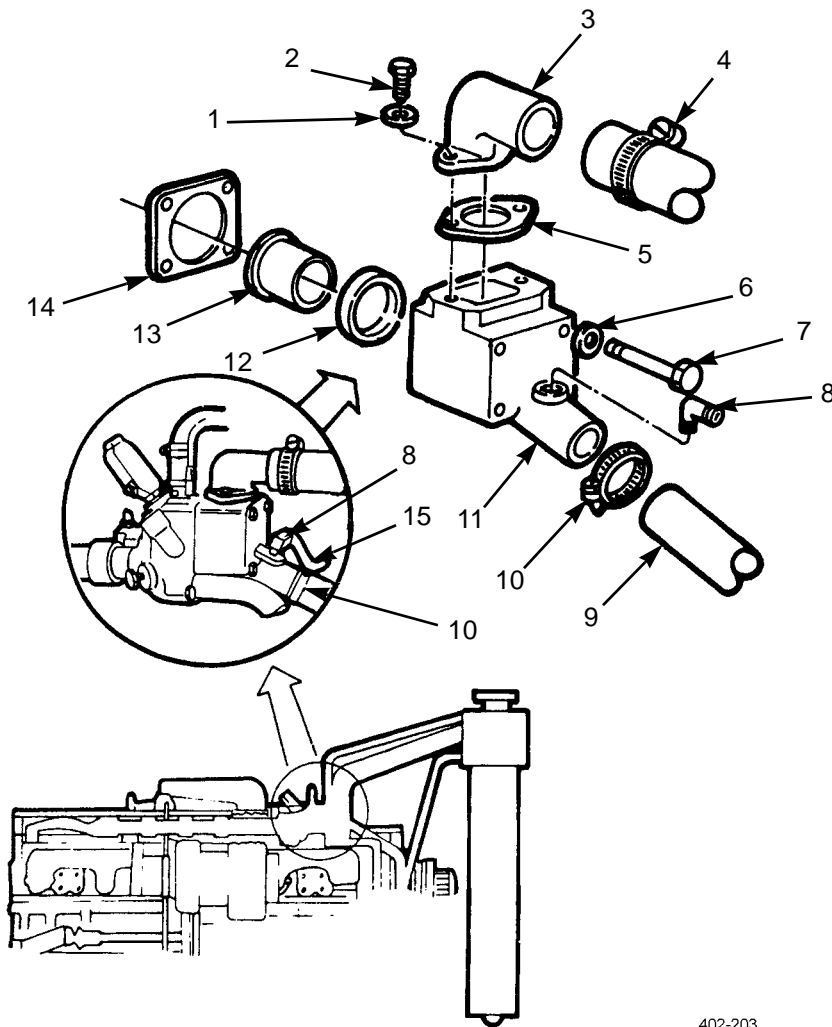
Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Cooling system drained below thermostat housing (WP 0045 00)

REMOVAL

1. Loosen and remove bypass hose clamp (4), radiator inlet hose clamp (10), and hose (9).
2. Unscrew compressor coolant line (15) from fitting (8).
3. Unscrew and remove two capscrews (2) and washers (1).
4. Remove elbow (3) and gasket (5). Check elbow for cracks. Discard gasket.
5. Unscrew and remove four capscrews (7) and washers (6).
6. Tap thermostat housing (11) with a soft head hammer and remove. Check housing for cracks, damaged fittings, or stains from leaks. Replace if necessary.
7. Remove gasket (14), thermostat (13), and rubber seal (12). Discard gasket and rubber seal.



402-203

TESTING

1. Check that at room temperature, thermostat (13) is closed. If thermostat does not work, replace it.
2. Put thermostat (13) in hot water. When temperature reaches 185°F (85°C), thermostat should open.

INSTALLATION**NOTE**

Rubber seal must be installed with part number or metal flange of seal toward mandrel to ensure proper sealing.

1. Install rubber seal (12) in thermostat housing (11) using thermostat seal mandrel.
2. Install new thermostat (13), new gasket (14), and thermostat housing (11) on engine.
3. Secure thermostat housing (11) with four capscrews (7) and washers (6).
4. Secure new gasket (5) and elbow (3) with two capscrews (2) and washers (1).
5. Screw compressor coolant line (15) to fitting (8).
6. Install hose (9) to thermostat housing (11) using bypass hose clamp (4) and radiator inlet hose clamp (10).
7. Fill cooling system.

OPERATIONAL CHECK

1. Start up engine (TM 9-2320-303-10).

NOTE

Make sure coolant is to the top of the radiator sight glass.

2. Check cooling system for leaks at thermostat housing.

END OF WORK PACKAGE

FAN CLUTCH SOLENOID REPLACEMENT

0048 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313
00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-
303-10)

Air tanks drained (TM 9-2320-303-10)

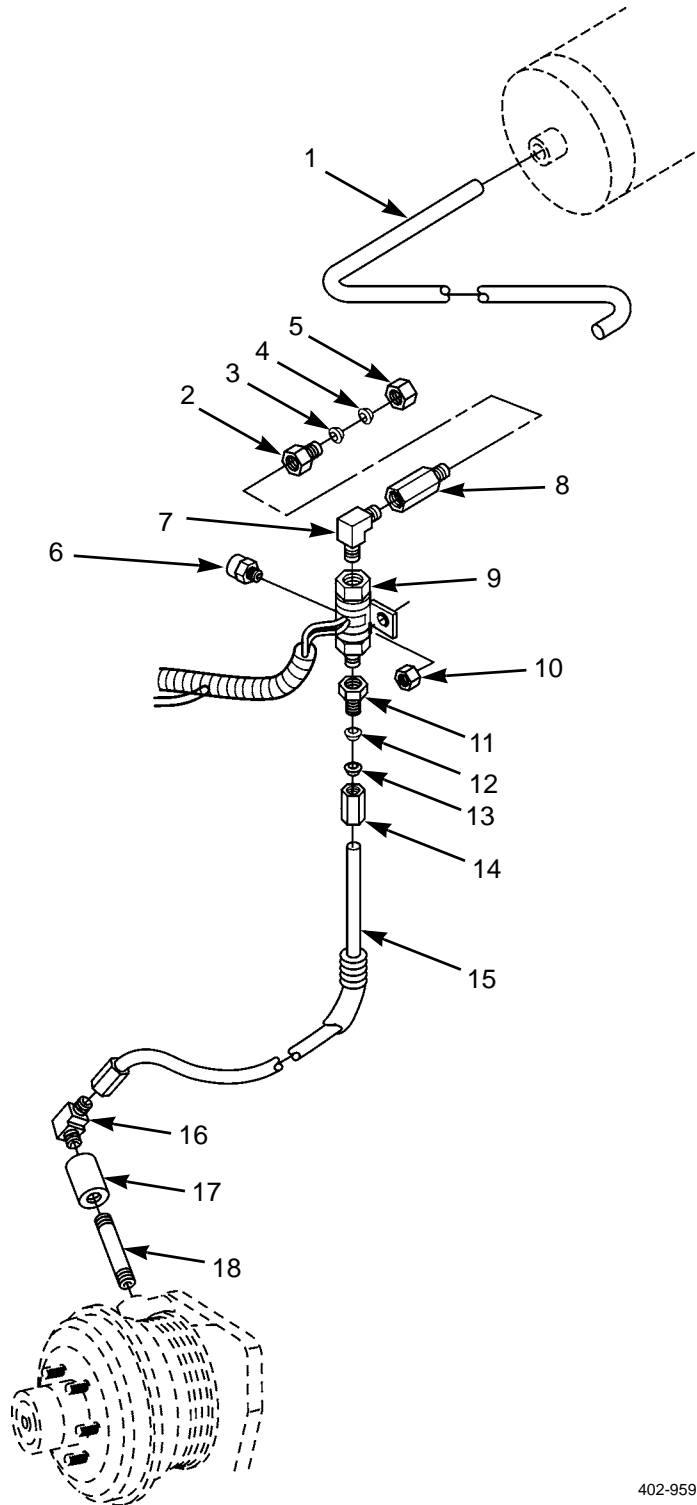
REMOVAL

1. Disconnect tube (15) from elbow (16).
2. Remove pipe nipple (18), pipe coupling (17), and elbow (16).
3. Remove adapter (14), insert (13), sleeve (12), and nut (11).
4. Remove lube fitting (6) from solenoid valve (9).
5. Disconnect tube (1) from adapter (2).
6. Remove adapter (2), insert (3), sleeve (4), and nut (5).
7. Remove filter (8) and elbow (7).
8. Remove nut (10) and solenoid valve (9).

INSTALLATION

1. Position solenoid valve (9) and install nut (10).
2. Install elbow (7) and filter (8).
3. Install adapter (2), insert (3), sleeve (4), and nut (5).
4. Connect tube (1) to adapter (2).
5. Install lube fitting (6).
6. Install adapter (14), insert (13), sleeve (12), and nut (11).
7. Install pipe nipple (18), pipe coupling (17), and elbow (16).
8. Connect tubing (15) to elbow (16).

INSTALLATION - CONTINUED



402-959

END OF WORK PACKAGE

FAN CLUTCH AND DRIVE PULLEY REPLACEMENT

0049 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Equipment Condition

Fan impeller and shroud removed (WP 0046 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Fan belts removed (WP 0056 00)

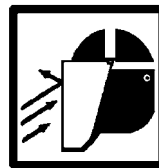
Air system drained (TM 9-2320-303-10)

REMOVAL

1. Disconnect air line (5) from fitting (6) of spindle (1).



WARNING

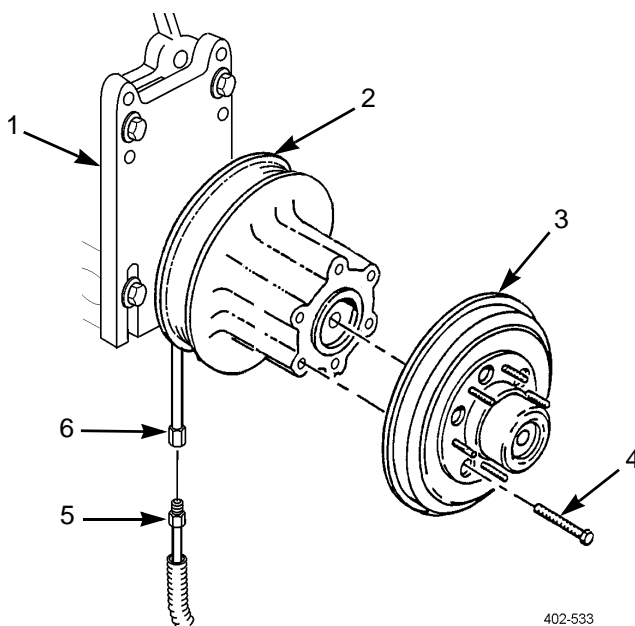


Compressed air used for cleaning or drying purposes, or for cleaning restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

NOTE

Perform step 2 if six screws of fan clutch are not accessible.

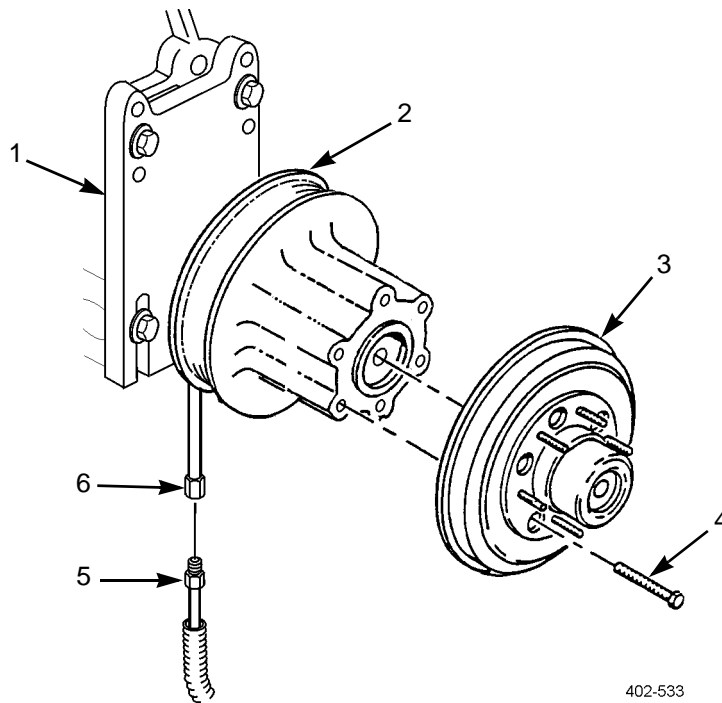
2. Apply air pressure to fitting (6) of spindle (1) and rotate fan clutch (3) to access heads of six screws (4).
3. Remove six screws (4), fan clutch (3), and drive pulley (2) from spindle (1).



402-533

FAN CLUTCH AND DRIVE PULLEY REPLACEMENT - CONTINUED**0049 00****INSTALLATION**

1. Install drive pulley (2), and fan clutch (3) with six screws (4).
2. Connect air line (5) to fitting (6) of spindle (1).



3. Install fan belts (WP 0056 00).
4. Install fan impeller and shroud (WP 0046 00).

END OF WORK PACKAGE

RADIATOR HOSES MAINTENANCE

0050 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pliers, hose clamp (Item 67, WP 0313 00)

Pliers, slip joint (Item 70, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Coolant drained (WP 0045 00)

Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Gasket (P/N 3019158)

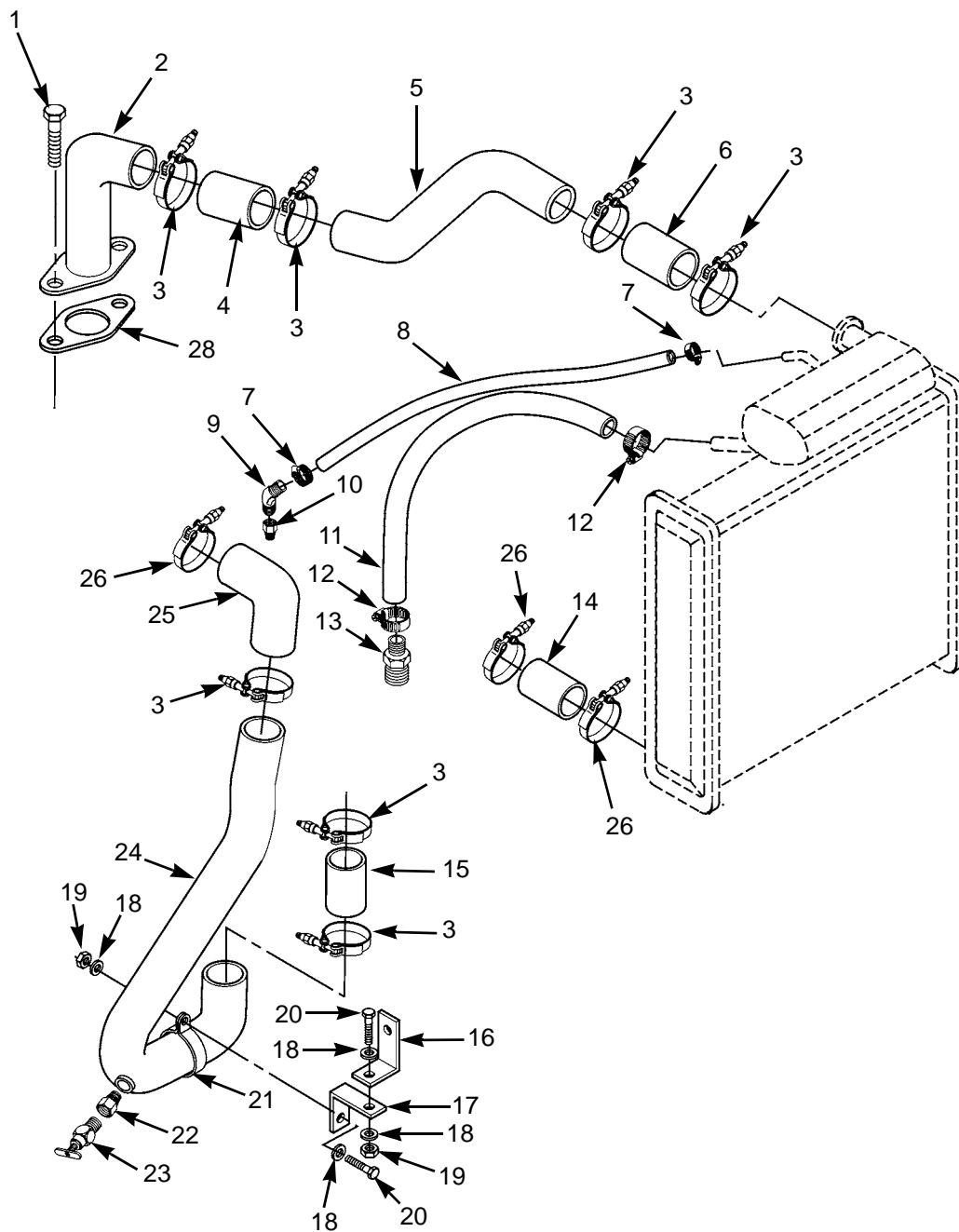
REMOVAL

1. Remove two hose clamps (3) from hose (6). Remove hose.
2. Remove two hose clamps (3) from hose (5), hose (4), and outlet (2). Remove hoses.
3. Remove two bolts (1), gasket (28), and outlet (2). Discard gasket.
4. Remove two clamps (7) from hose (8). Remove hose.
5. Remove elbow (9) and pipe bushing (10).
6. Remove two clamps (26) from hose (14). Remove hose.
7. Remove two clamps (12) from hose (11). Remove hose.
8. Remove straight adapter (13).
9. Remove two clamps (3 and 26) from hose (25). Remove hose.
10. Remove two screws (20), four washers (18), two nuts (19), bracket (16), bracket (17), and strap (21).
11. Remove drain cock (23) and bushing (22) from hose (24).
12. Remove two clamps (3) from hoses (15 and 24). Remove hoses.

INSTALLATION

1. Install hose (15) with two clamps (3).
2. Install strap (21) on hose (24).
3. Install bushing (22) and drain cock (23) on hose (24).
4. Install hose (24) with two clamps (3).
5. Install bracket (16) and bracket (17) with two screws (20), four washers (18), and two nuts (19).
6. Install hose (25) with two clamps (3 and 26).
7. Install hose (14) with two clamps (26).
8. Apply pipe sealing compound to adapter (13) and install adapter.
9. Install hose (11) with two clamps (12).
10. Apply pipe sealing compound to bushing (10) and install bushing.
11. Apply pipe sealing compound to elbow (9) and install elbow.
12. Install hose (8) with two clamps (7).
13. Install new gasket (28), outlet (2), and two bolts (1).
14. Install hoses (4, 5, and 6) with four clamps (3).
15. Fill cooling system to proper level (TM 9-2320-303-10).
16. Start engine and check for leaks (TM 9-2320-303-10).

INSTALLATION - CONTINUED



402-966

END OF WORK PACKAGE

WATER MANIFOLD MAINTENANCE

0051 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

O-rings (P/N 70624) (4)

Rings, sealing (P/N 3024709) (6)

Gasket (P/N 148203)

Gasket (P/N 3001960)

Equipment Condition

Vehicle parked on level ground

Engine off (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Coolant drained below manifold level (WP 0045 00)

Fan clutch actuator removed (TM 9-2815-225-34&P)

Water temperature switch wire removed (TM 9-2815-225-34&P)

Air cleaner assembly removed (WP 0032 00)

Turbo air inlet removed (WP 0034 00)

REMOVAL

1. Loosen clamps on return hose (3) and radiator hose (5). Disconnect hose.
2. Remove capscrew (1) from transfer tube (9) and remove tube.
3. Remove deaeration line (4) heater hose (2), air compressor line (7), and hose (8) from front manifold (26).
4. Unscrew and remove four capscrews (28) and washers (27).
5. Remove rear manifold (31) and coupling (30).
6. Remove and discard o-rings (25) and sealing rings (24).
7. Unscrew and remove four capscrews (28) and washers (27).
8. Remove center manifold (29) and coupling (30).
9. Remove and discard o-rings (25) and sealing rings (24).
10. Unscrew and remove four capscrews (23) and washers (22).
11. Remove front manifold (26) and coupling (30).
12. Unscrew and remove hose fitting (14) and connector (13).
13. Unscrew and remove two capscrews (11 and 12) and four washers (10).
14. Unscrew and remove two capscrews (17 and 19). Remove water transfer connection (15), gasket (16), bracket (18), water inlet connection (20) and gasket (21).
15. Discard gaskets (16 and 21).

INSPECTION

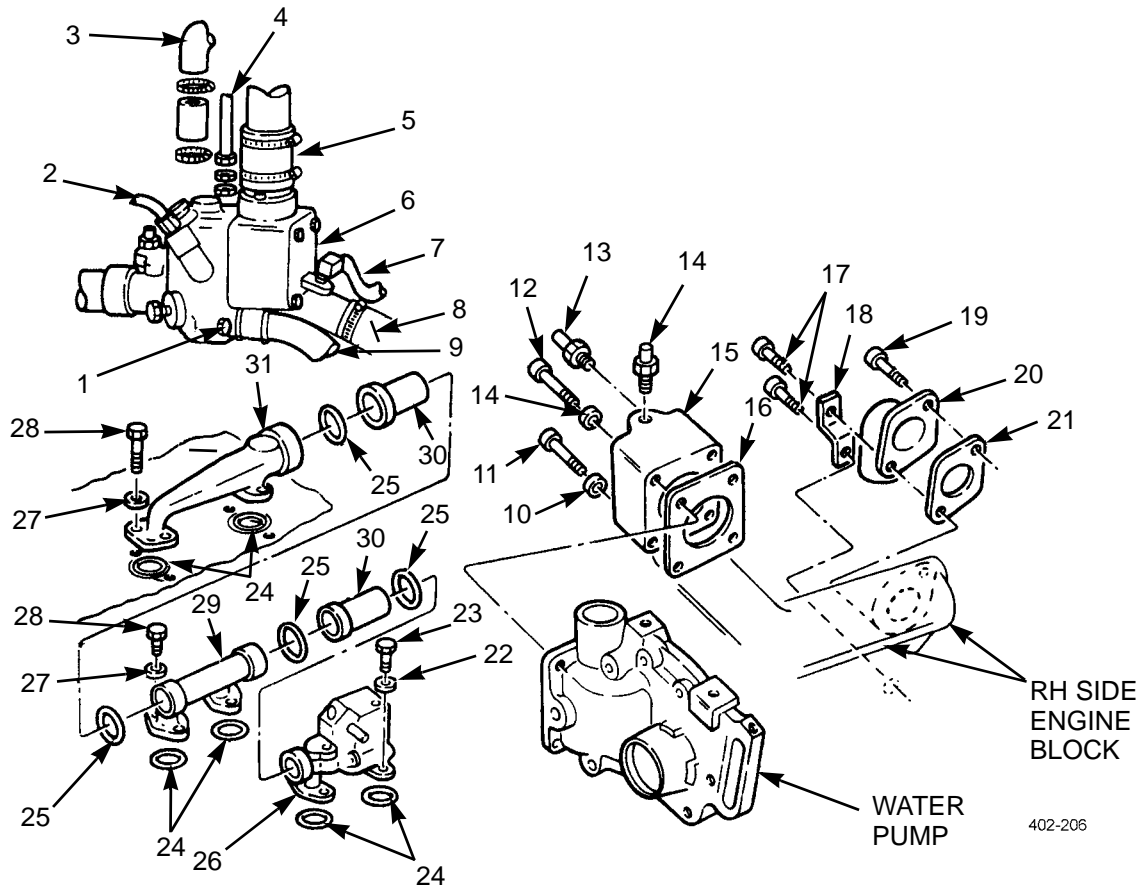
1. Inspect mating surfaces of front manifold (26), center manifold (29), rear manifold (31), two couplings (30), thermostat housing (6), water transfer connection (15), and water inlet connection (20) for burrs, cracks, or distortion. Replace if necessary.
2. Inspect front manifold (26), center manifold (29), rear manifold (31), and two couplings (30) for cracks, leaks, or discoloration.

INSTALLATION

1. Install hose fitting (14) and connector (13) into water transfer connection (15).
2. Install new gasket (16) and water transfer connection (15) to water pump with two capscrews (11 and 12) and four washers (10).
3. Mount new gasket (21), water inlet connection (20) and bracket (18) to water transfer connection (15) as shown and to side of engine with two capscrews (17) and one capscrew (19).
4. Place front manifold (26) and two new sealing rings (24) in position on engine block.
5. Finger tighten four capscrews (23) and washers (22).
6. Place coupling (30), two new o-rings (25), center manifold (29) and two new sealing rings (24) in position against front manifold (26) and engine block .
7. Finger tighten four capscrews (28) and washers (27).
8. Place rear manifold (31), two new o-rings (25), coupling (30), and two new sealing rings (24) in position on engine block against center manifold (29).
9. Finger tighten four capscrews (28) and washers (27).
10. Alternately, tighten twelve capscrews (28) to 35 lb-ft (47 Nm).

INSTALLATION - CONTINUED

11. Connect deaeration line (4) and heater hose (2) into front manifold (26).
12. Install and tighten air compressor line (7).
13. Attach return hose (3), radiator hose (5) and hose (8) to front manifold (26) and tighten clamps.
14. Install transfer tube (9) to front manifold (26) with capscrew (1).



15. Install water temperature switch wire (TM 9-2815-225-34&P).
16. Install fan clutch actuator (TM 9-2815-225-34&P).
17. Install air cleaner assembly (WP 0032 00).
18. Install turbo air inlet (WP 0034 00).
19. Refill cooling system and check for leaks (WP 0045 00).

END OF WORK PACKAGE

WATER PUMP MAINTENANCE

0052 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Gasket (P/N 3002385)

Washer, lock (P/N S604) (2)

References

TM 9-2815-225-34&P

Equipment Condition

Vehicle parked on level ground

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Fan removed (WP 0046 00)

Fan clutch and belts removed (TM 9-2815-225-34&P)

Water pump belts removed (WP 0053 00)

Coolant drained (WP 0045 00)

REMOVAL

1. Remove adjusting screw (7) from idler pulley (10).
2. Remove hex nut (8) and lockwasher (9) and remove idler pulley (10) from water pump (11). Discard lockwasher.
3. Loosen and remove two capscrews (4) and washers (5).
4. Loosen and remove four capscrews and washers (6).
5. Loosen and remove two capscrews and washers (12).
6. Unscrew and remove capscrew (2), lockwasher (1), and clamp (14). Discard lockwasher.
7. Unscrew and remove four capscrews and washers (13).
8. Remove water pump (11) and gasket from engine and bypass tube (3). Discard gasket.

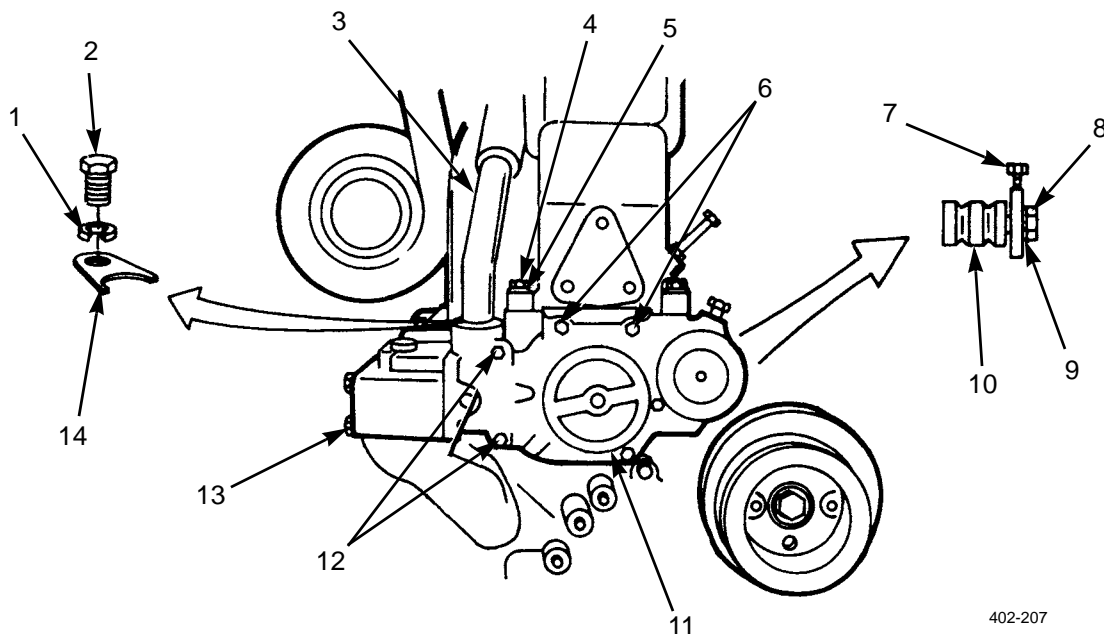
INSTALLATION

1. Put water pump (11) and new gasket in position on engine block and connect bypass tube (3).

NOTE

Install capscrews hand-tight first.

2. Install and tighten four capscrews and washers (13) to 35 lb-ft (47 Nm).
3. Install and tighten four capscrews (2), new lockwasher (1), and clamp (14).
4. Install and tighten two capscrews and washers (12), four capscrews and washers (6) to 35 lb-ft (47 Nm).
5. Install and tighten two capscrews (4) and washers (5).
6. Install idler pulley (10) on water pump (11) and secure with hex nut (8) and new lockwasher (9). Do not tighten.
7. Install adjusting screw (7).



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WATER PUMP MAINTENANCE - CONTINUED

0052 00

INSTALLATION - CONTINUED

8. Install water pump belt (WP 0053 00).
9. Adjust water pump belt (WP 0053 00).
10. Install fan clutch (TM 9-2815-225-34&P).
11. Install fan belt (WP 0056 00).
12. Install fan (WP 0046 00).
13. Replenish coolant and check for leaks (WP 0045 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation, Adjustment

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Equipment Condition

Vehicle parked on level ground

Engine off (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Fan removed (WP 0046 00)

Fan belts removed (WP 0056 00)

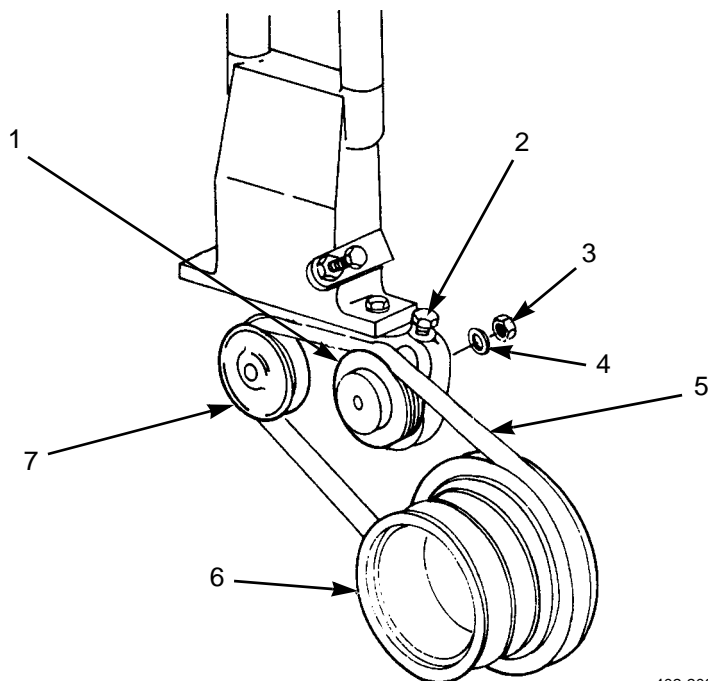
REMOVAL

1. Loosen idler pulley locknut (3) and washer (4).
2. Loosen idler belt adjusting screw (2).

NOTE

Fan belts and fan must be removed first.

3. Take idler belt (5) off.



402-208

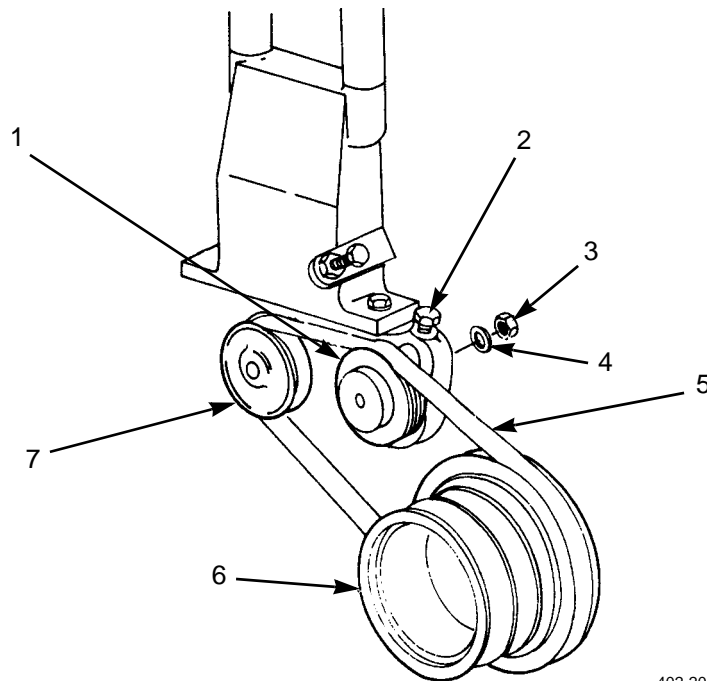
INSTALLATION**NOTE**

Do not force belt on with screwdriver.

Put idler belt (5) on over idler pulley (1), water pump pulley (7), and accessory drive (6).

ADJUSTMENT

1. Adjust idler belt adjusting screw (2) until belt free-play is less than 1/2 inch.



402-208

2. Tighten idler pulley locknut (2) to 50 lb-ft (68 Nm).
3. Install and adjust fan belts (WP 0056 00).
4. Install fan (WP 0046 00).

END OF WORK PACKAGE

WATER PUMP IDLER PULLEY MAINTENANCE**0054 00****THIS WORK PACKAGE COVERS**

Removal, Installation, Operational Check

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

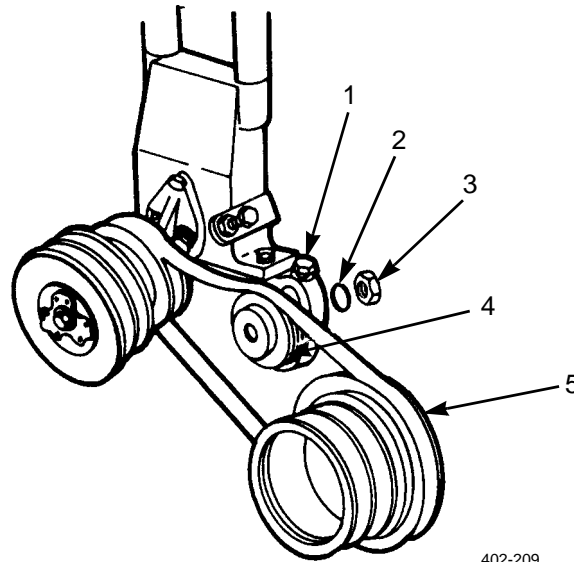
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

REMOVAL

1. Remove nut (3) and washer (2).
2. Remove idler belt adjusting screw (1).
3. Remove idler pulley (4).



402-209

INSTALLATION

1. Set idler pulley (4) into place.
2. Install idler belt adjusting screw (1).
3. Install and finger tighten washer (2) and nut (3).
4. Adjust belt (5) tension with adjusting screw (1) until belt free-play is less than 1/2 inch.
5. Tighten locknut (3) to 50 lb-ft (68 Nm) with a torque wrench.

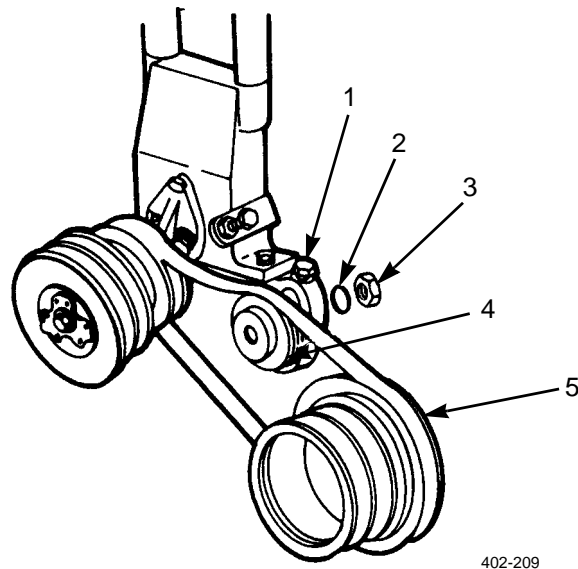
OPERATIONAL CHECK

1. Start engine (TM 9-2320-303-10).

WARNING

Be sure to stay completely clear of fan blades. Do not reach into fan area while engine is operating. Failure to follow this warning could result in injury.

2. Check that belt (5) rides smoothly on idler pulley (4) and that pulley is not slipping.



3. Shut down engine (TM 9-2320-303-10).

END OF WORK PACKAGE

HEATER SHUTOFF VALVE MAINTENANCE**0055 00****THIS WORK PACKAGE COVERS**

Removal, Installation, Bleeding Heater

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

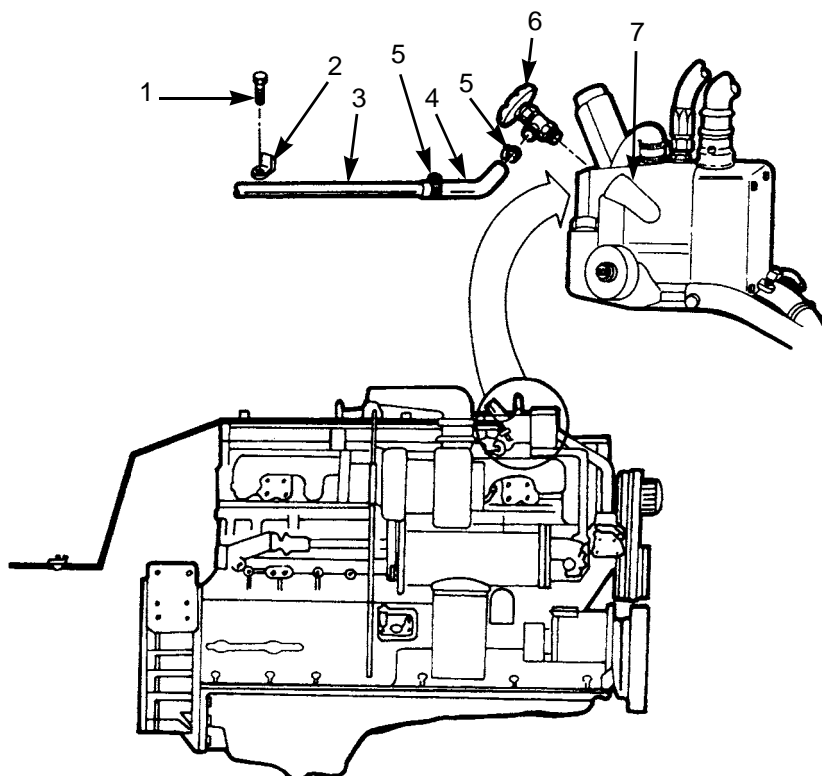
Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Coolant drained below level of valve (WP 0045 00)

REMOVAL

1. Loosen two clamps (5).
2. Remove capscrew (1) and clamp (2).
3. Remove heater tube (3) and rubber hose (4) from valve (6).
4. Unscrew and remove valve (6) from manifold (7).



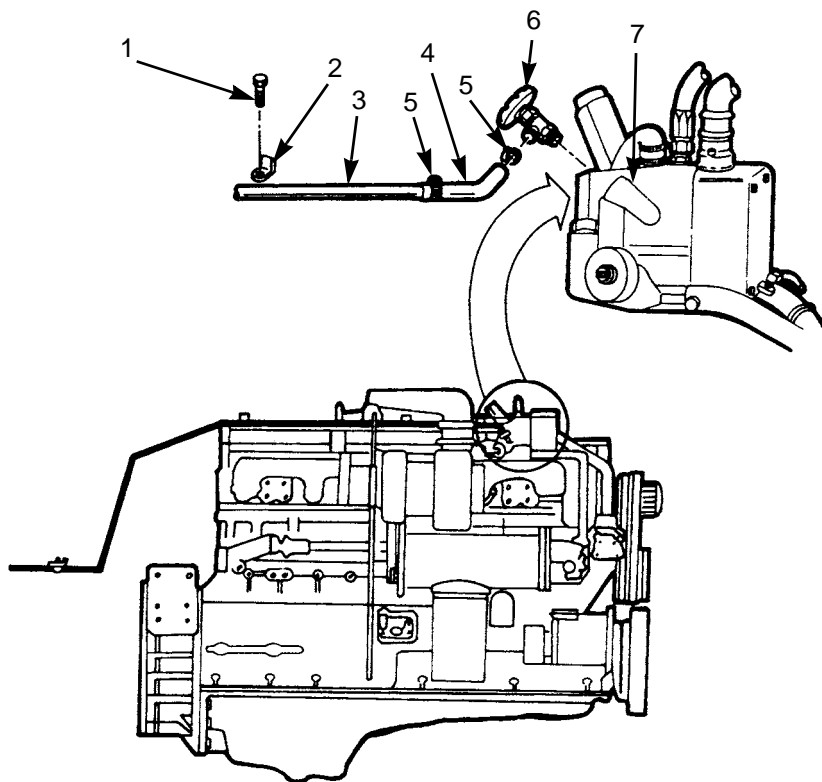
402-210

HEATER SHUTOFF VALVE MAINTENANCE - CONTINUED

0055 00

INSTALLATION

1. Coat threads of new valve (6) with sealing compound.
2. Install valve (6) into manifold (7).
3. Connect heater tube (3) and rubber hose (4) to valve (6).
4. Install clamp (2) and capscrew (1).
5. Tighten clamps (5).



402-210

BLEEDING HEATER**NOTE**

Before removing outlet hose, place clean container under heater openings to catch coolant.

1. At top front of engine, loosen clamp and disconnect cab/heater return hose.
2. Start engine (TM 9-2320-303-10).
3. Select cab heat.
4. When coolant flows from heater return hose, turn off cab heat.
5. Immediately connect heater return hose to engine. Tighten clamp.
6. Select cab heat.
7. With engine running, check valve (6) for leaks.

END OF WORK PACKAGE

FAN BELT MAINTENANCE

0056 00

THIS WORK PACKAGE COVERSRemoval, Installation, Adjustment

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

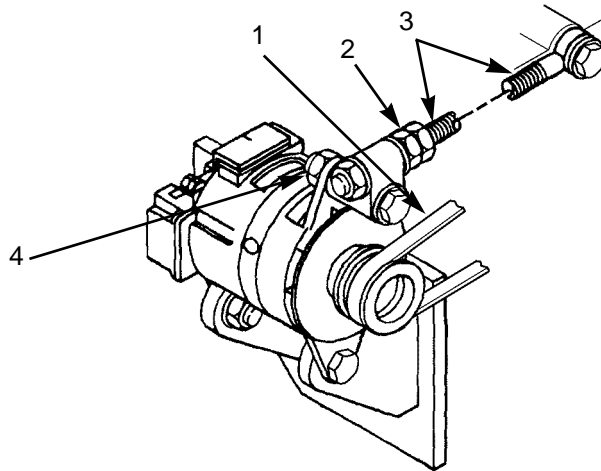
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

REMOVAL

1. Loosen two nuts (4).
2. Rotate two adjusting nuts (2) and retract adjustment rod (3).
3. Remove fan belt (1).



402-960

INSTALLATION

Put new fan belt (1) over fan blade and position on fan clutch pulley and accessory drive pulley.

ADJUSTMENT

1. Rotate two adjusting nuts (2) and extend adjustment rod (3) until belt free-play is less than 1/2 inch.
2. Tighten two nuts (4).
3. Road test vehicle and recheck belt tension after road test.

END OF WORK PACKAGE

WATER FILTER MAINTENANCE

0057 00

THIS WORK PACKAGE COVERS

Removal, Installation, Checking for Leaks

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Wrench, strap (Item 107, WP 0313 00)

Materials/Parts

Oil lubricating (Item 27, WP 0312 00)

Rag, wiping (Item 39, WP 0312 00)

Element, filter (P/N WF-2077)

Equipment Condition

Vehicle parked on level ground

Engine off (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)



WARNING

Wait until the coolant temperature is below 120°F (50°C) before removing water filter. Failure to do so can cause personal injury from heated coolant spray.

WATER FILTER MAINTENANCE - CONTINUED

0057 00

REMOVAL

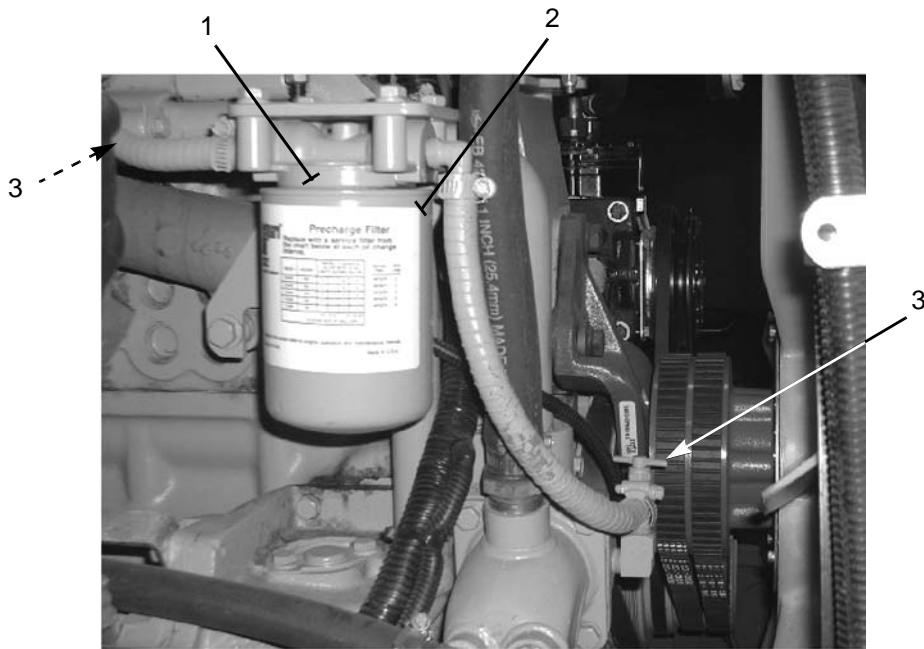
1. Close both valves (3).
2. Using a strap wrench, unscrew and remove water filter (2) from filter head (1).

INSTALLATION

1. Apply thin film of lubricating oil to water filter gasket sealing surface.
2. Install new filter element (2) and hand tighten until element touches filter head (1).
3. Tighten additional 1/2 to 3/4 turn.
4. Open both valves (3).

CHECKING FOR LEAKS

1. Start engine (TM 9-2320-303-10).
2. Visually check water filter (2) for leaks.



402-211

END OF WORK PACKAGE

ALTERNATOR AND VOLTAGE REGULATOR REPLACEMENT (M915A4)**0058 00****THIS WORK PACKAGE COVERS**

Alternator: Removal, Installation

Voltage Regulator: Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Washer, lock (P/N J50-09)

References

WP 0059 00

Equipment Condition

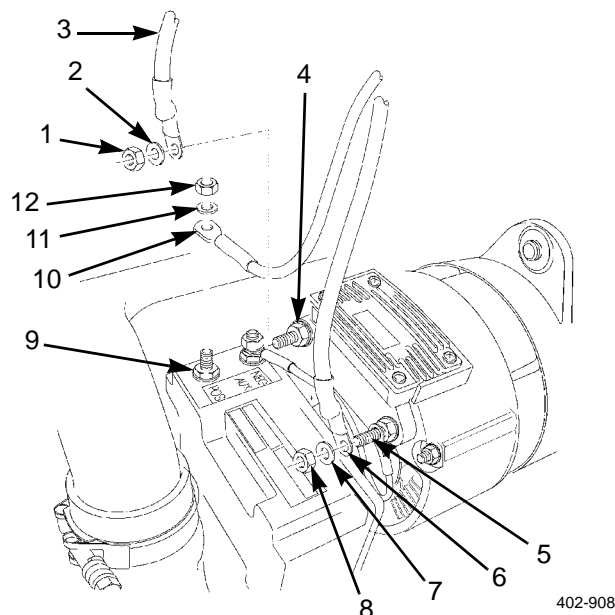
Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

ALTERNATOR REMOVAL**NOTE**

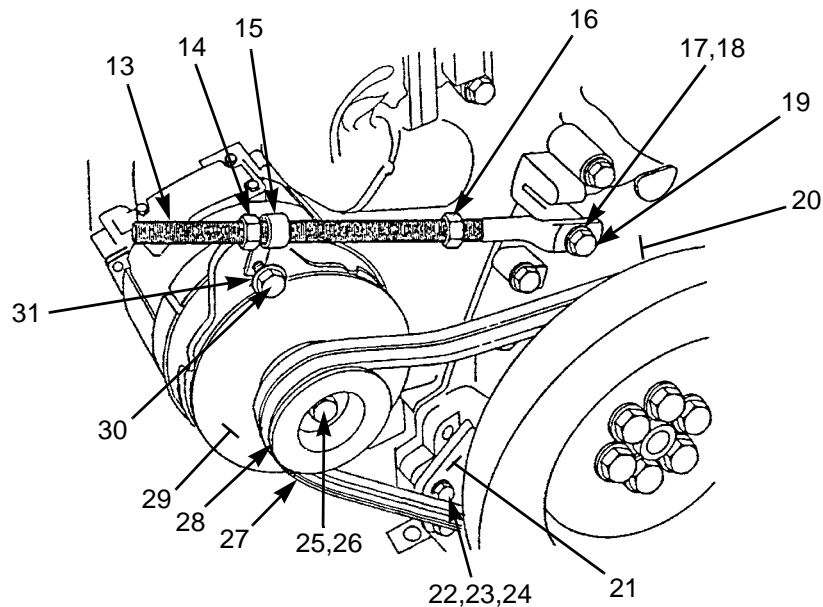
- Tag wires prior to removal.
- Nuts may vary in size; note size and location of nuts prior to removal to aid in installation.

1. Remove nut (8), washer (7), and 12V positive lead (6) from 12V positive terminal (5).
2. Remove nut (1), washer (2), and ground lead (3) from negative terminal (4).
3. Remove nut (12), washer (11), and 24V positive lead (10) from 24V positive terminal (9).



ALTERNATOR REMOVAL - CONTINUED

4. Loosen upper jamnut (14) and lower jamnut (16) on adjusting rod (13).
5. Loosen bolt (30) and washer (31) securing alternator (29) to adjusting rod endlink (15).
6. Remove bolt (19), lockwasher (17), washer (18), and adjusting rod (13) from cylinder block (20). Discard lockwasher.
7. Loosen bolt (22) securing alternator (29) from mounting bracket (21).
8. Rotate alternator (29) toward cylinder block (20) and remove two drivebelts (27) from alternator pulley (28).
9. Remove bolt (30) and washer (31) securing alternator (29) to adjusting rod endlink (15).
10. Remove bolt (22), two washers (23), nut (24), and alternator (29) from mounting bracket (21).
11. Remove nut (25), washer (26), and pulley (28) from alternator (29).



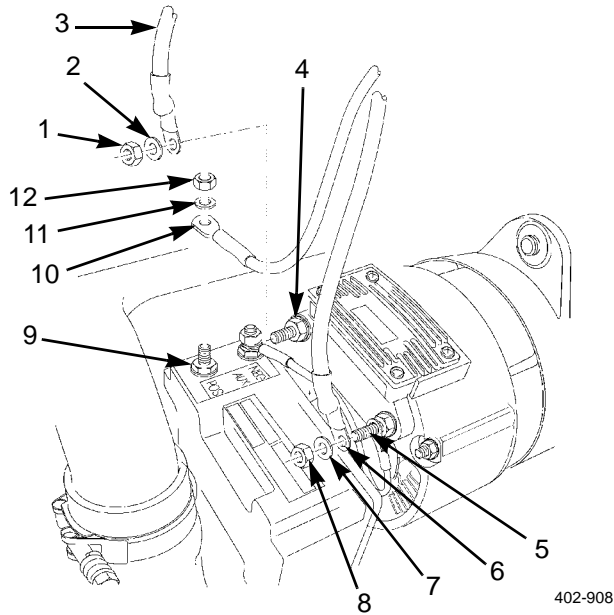
402-909

ALTERNATOR INSTALLATION

1. Position pulley (28) on alternator (29) and install washer (26) and nut (25).
2. Position alternator (29) on mounting bracket (21) and install bolt (22), two washers (23), and nut (24). Do not tighten bolt and nut.
3. Position alternator (29) to adjusting rod endlink (15) and install bolt (30) and washer (31). Do not tighten bolt.
4. Rotate alternator (29) toward cylinder block (20) and install two drivebelts (27) on alternator pulley (28).
5. Rotate alternator (29) away from cylinder block (20).
6. Tighten bolt (22) securing alternator (29) to mounting bracket (21).
7. Install adjusting rod (13) to cylinder block (20) with bolt (19), new lockwasher (17), and washer (18).
8. Tighten bolt (30) securing alternator (29) to adjusting rod endlink (15).

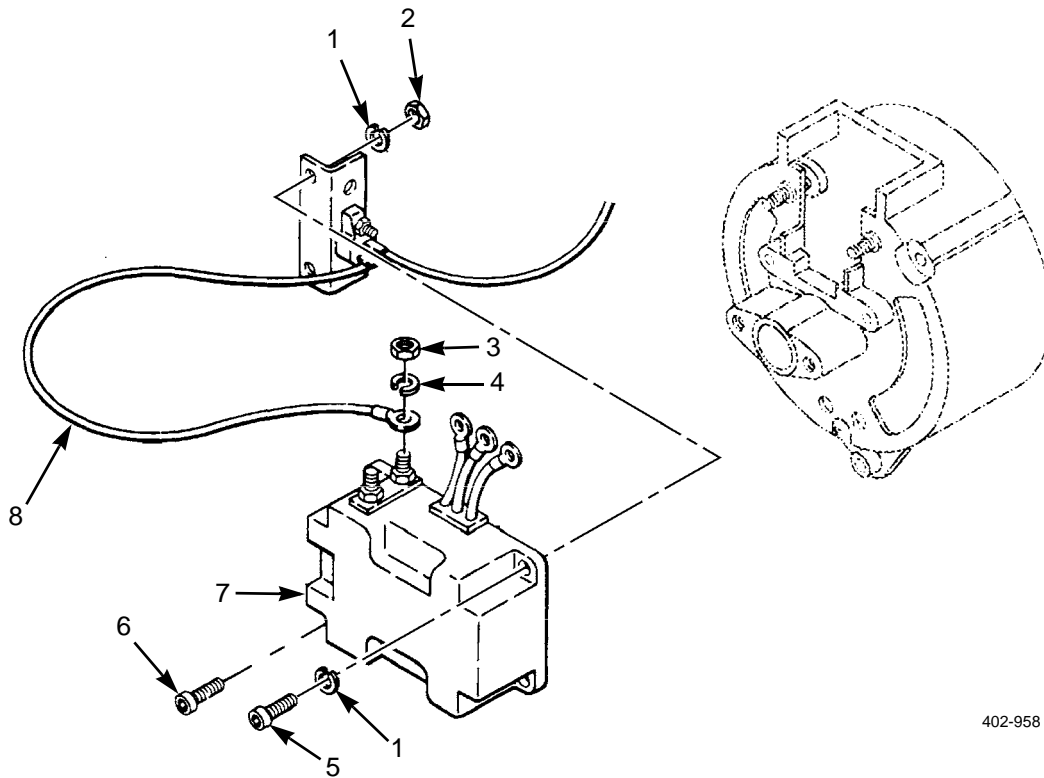
ALTERNATOR INSTALLATION - CONTINUED

9. Adjust alternator drive belt (WP 0059 00).
10. Install 24V positive lead (10) to 24V positive terminal (9) with washer (11) and nut (12).
11. Install ground lead (3) to negative terminal (4) with washer (2) and nut (1).
12. Install 12V positive lead (6) to 12V positive terminal (5) with washer (7) and nut (8)



VOLTAGE REGULATOR REMOVAL

1. Remove two nuts (3), two lockwashers (4), and two leads (8) from voltage regulator (7). Discard lockwashers.
2. Remove two nuts (2), two screws (5), four lockwashers (1). Discard lockwashers.
3. Remove two screws (6) and voltage regulator (7).



402-958

VOLTAGE REGULATOR INSTALLATION

1. Position voltage regulator (7) and install two screws (6).
2. Install two screws (5), four new lockwashers (1), and two nuts (2).
3. Install two leads (8), two new lockwashers (4), and two nuts (3).
4. Start vehicle and check operation of voltmeter on dash (TM 9-2320-302-10).

END OF WORK PACKAGE

ALTERNATOR REPLACEMENT (M915A4R2)**0058 01****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque (Item 108, WP 0313 00)

Wrench, torque (Item 110, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Lockwasher (P/N 453982)

References

TM 9-2320-303-10

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

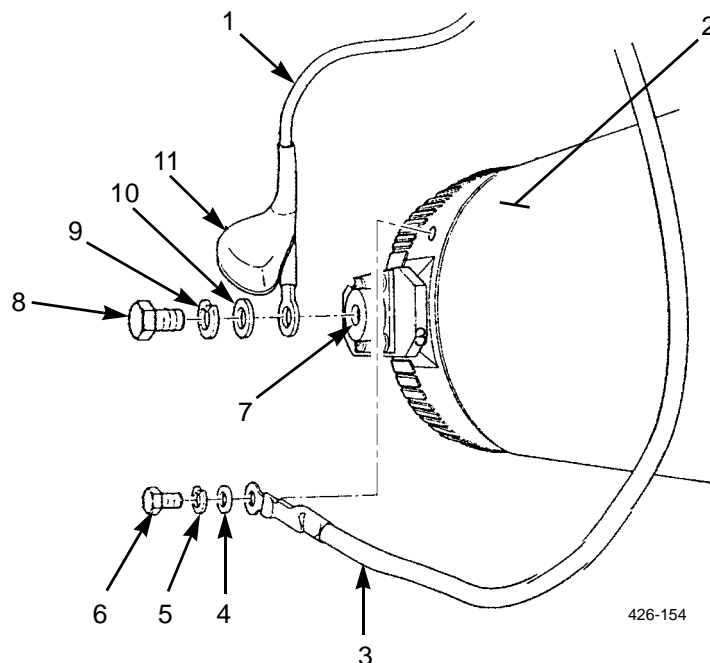
Parking brake set (TM 9-2320-303-10)

NOTE

If necessary, use assistance to remove and install alternator.

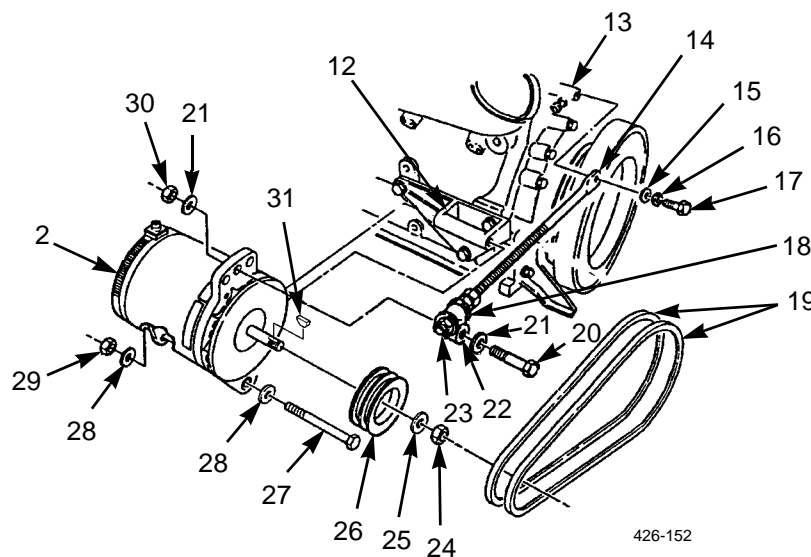
REMOVAL

1. Remove screw (6), lockwasher (5), washer (4), and ground electrical lead (3) from alternator (2).
2. Remove rubber boot (11) from positive terminal (7).
3. Remove screw (8), lockwasher (9), washer (10), and electrical lead (1) from positive terminal (7).



ALTERNATOR REPLACEMENT (M915A4R2)**0058 01****REMOVAL - CONTINUED**

4. Loosen upper jamnut (22) and lower jamnut (18) on adjusting rod (14).
5. Loosen locknut (29) and screw (20) securing alternator (2) to adjusting rod endlink (23).
6. Remove bolt (17), lockwasher (16), washer (15), and adjusting rod (14) from cylinder block (13). Discard lockwasher.
7. Loosen bolts (26) and nuts (28) on bracket (12).
8. Rotate alternator (2) toward cylinder block (13) and remove drivebelts (19) from pulley (25).
9. Remove screw (20), two washers (21), and locknut (30) securing alternator (2) to adjusting rod endlink (23).
10. Remove bolts (27), washers (28), nuts (29), and alternator (2) from bracket (12).
11. Remove nut (24), washer (25), pulley (26), and woodruff key (31) from alternator (2).

**INSTALLATION**

1. Install woodruff key (31), pulley (26), washer (25), and nut (24) on alternator (2). Tighten nut to 90-110 lb-ft (122-149 Nm).
2. Install alternator (2), bottom end first, on bracket (12) with two bolts (27), washers (28) and nuts (29). DO NOT tighten nuts.
3. Install adjusting rod (14) on cylinder block (13) with washer (15), new lockwasher (16) and bolt (17). DO NOT tighten bolt.
4. Install alternator (2) to adjusting rod endlink (23) with screw (20), two washers (21) and locknut (30). DO NOT tighten locknut.

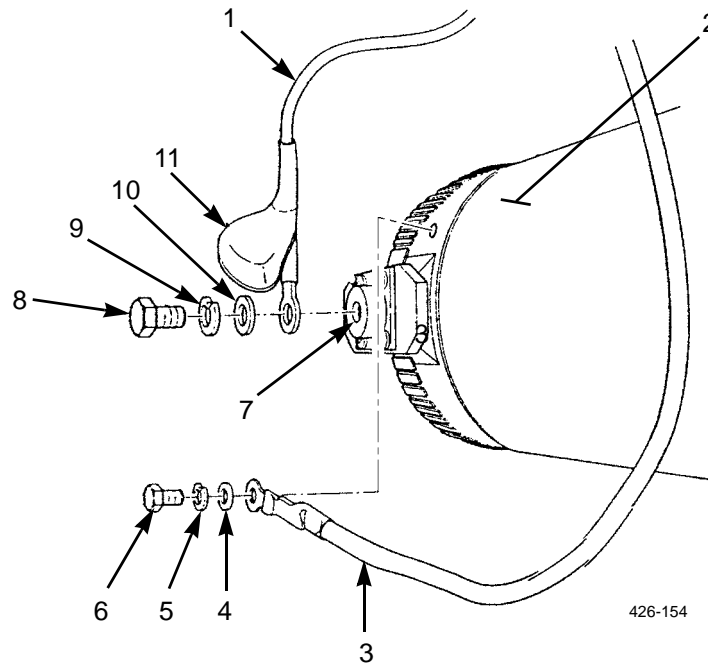
NOTE

Using a straightedge laid across alternator pulley and crankshaft pulley as a reference point. Check deflection of drivebelts midpoint between alternator pulley and crankshaft pulley.

5. Install drivebelts (19), rotate alternator (2) away from cylinder block (13) and tighten lower jamnut (18) on alternator adjusting rod (14) until drivebelts have 1/2 inch (13 mm) deflection. Tighten upper jamnut (22) and lower jamnut.
6. Tighten bolt (17) securing adjusting rod (14) on cylinder block (13) to 60-70 lb-ft (81-95 Nm)
7. Tighten locknut (29) securing alternator (2) to adjusting rod endlink (23) to 60-70 lb-ft (81-95 Nm).
8. Tighten nuts (29) securing alternator (2) to bracket (12) to 60-70 lb-ft (81-95 Nm).

ALTERNATOR REPLACEMENT (M915A4R2)**0058 01****INSTALLATION**

9. Install electrical lead (1) on alternator (2) positive terminal (7) with washer (10), lockwasher (9), and screw (8). Tighten screw to 11 lb-ft (15 Nm).
10. Slide rubber boot (11) over positive terminal (7).
11. Install ground electrical lead (3) on alternator (2) with washer (4), lockwasher (5), and screw (6). Tighten screw to 11 lb-ft (15 Nm).

**END OF WORK PACKAGE**

VOLTAGE REGULATOR REPLACEMENT (M915A4R2)

0058 02

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque (Item 108, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Parking brake set (TM 9-2320-303-10)

Hood open (TM 9-2320-303-10)

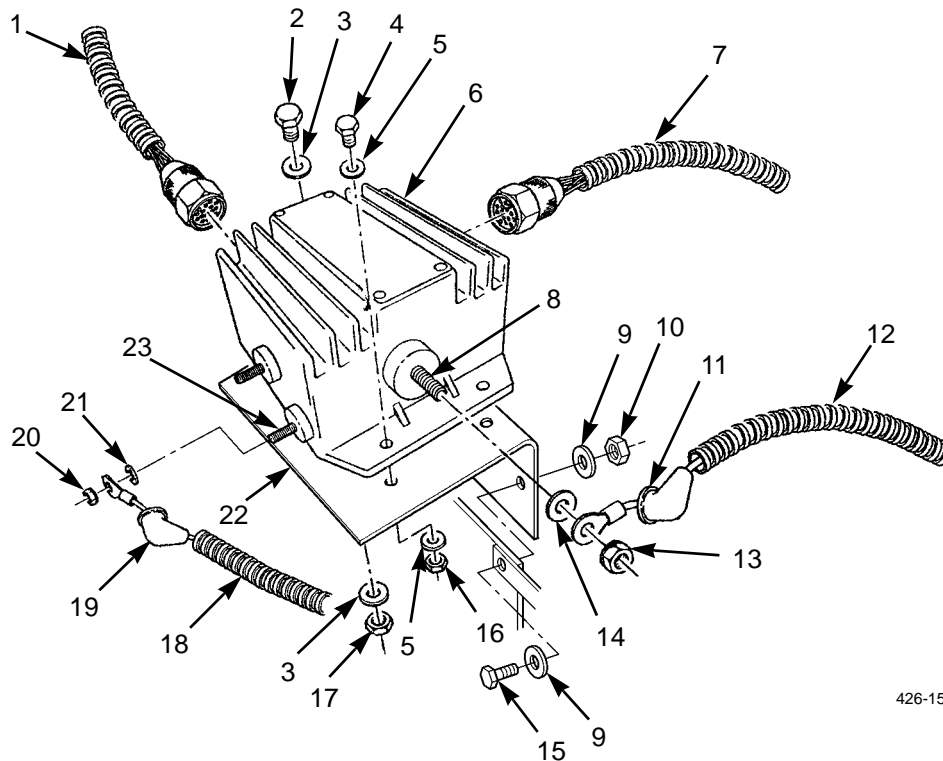
VOLTAGE REGULATOR REPLACEMENT (M915A4R2) - CONTINUED**0058 02****REMOVAL**

1. Remove rubber boot (11) from 14V terminal (8).
2. Remove nut (13), 12V positive lead (12), and washer (14) from 14V terminal (8).
3. Slide rubber boot (19) from ignition terminal (23).
4. Remove nut (20), ignition lead (18), and washer (21) from ignition terminal (23).
5. Disconnect connector (7) from voltage regulator (6).
6. Disconnect connector (1) from voltage regulator (6).
7. Remove locknut (17), two washers (3), and screw (2) from voltage regulator (6) and mounting plate (22).
8. Remove two locknuts (16), four washers (5), two screws (4) and voltage regulator (6) from mounting plate (22).

NOTE

If mounting plate is damaged, perform step 9.

9. Remove two bolts (15), four washers (9), two nuts (10), and mounting plate (22).



426-153

INSTALLATION**NOTE**

Perform step 1 if mounting plate was removed.

1. Position mounting plate (22) and install two bolts (15), four washers (9), and two nuts (10). Tighten nuts to 89 lb-in (10 Nm).
2. Position voltage regulator (6) on mounting plate (22) and install two screws (4), four washers (5), and two locknuts (16). Tighten locknuts to 89 lb-in (10 Nm).
3. Install screw (2), two washers (3), and locknut (17) to voltage regulator (6) and mounting plate (22). Tighten locknut to 89 lb-in (10 Nm).
4. Connect connector (1) to voltage regulator (6).
5. Connect connector (7) to voltage regulator (6).
6. Install washer (21), ignition lead (18), and nut (20) to ignition terminal (23) on voltage regulator (6). Tighten nut to 25 lb-in (2.8 Nm).
7. Slide rubber boot (19) over ignition terminal (23).
8. Install washer (14), 12V positive lead (12), and nut (13) onto 14V terminal (8). Tighten nut to 50 lb-in (5.6 Nm).
9. Slide rubber boot (11) over 14V terminal (8).
10. Close hood (TM 9-2320-303-10).

END OF WORK PACKAGE

ALTERNATOR BELTS MAINTENANCE

0059 00

THIS WORK PACKAGE COVERS

Removal, Installation, Adjustment

INITIAL SETUP**Maintenance Level**

Unit

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque (Item 110, WP 0313 00)

Parking brake set (TM 9-2320-303-10)

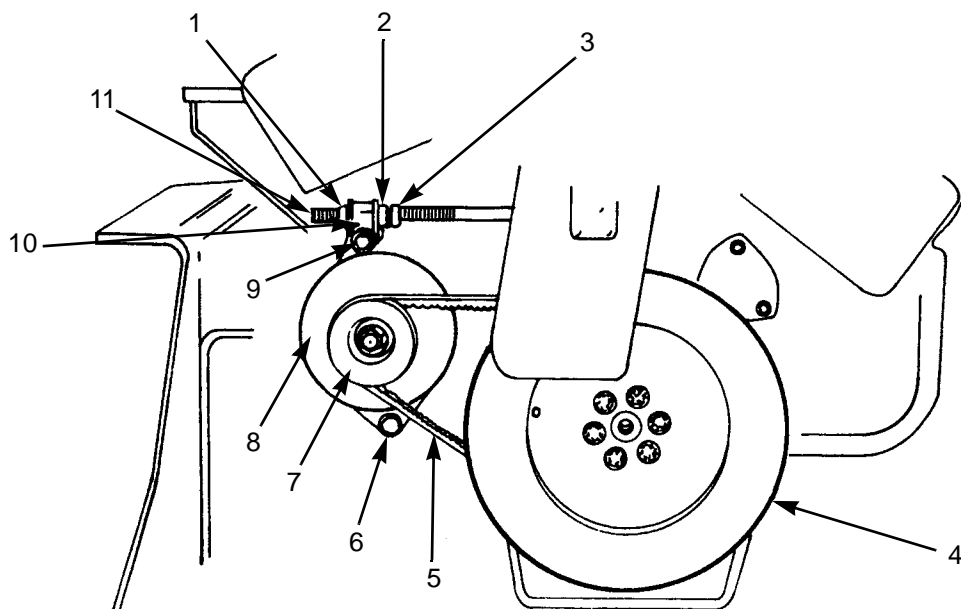
REMOVAL

1. Loosen alternator capscrews (6 and 9).
2. Loosen adjusting nut (3).
3. Loosen adjusting nut (2) to allow alternator (8) to slide towards engine along adjusting rod (11), enough to remove alternator belts (5).

NOTE

Alternator belts are a matched set.

4. Take off two alternator belts (5).

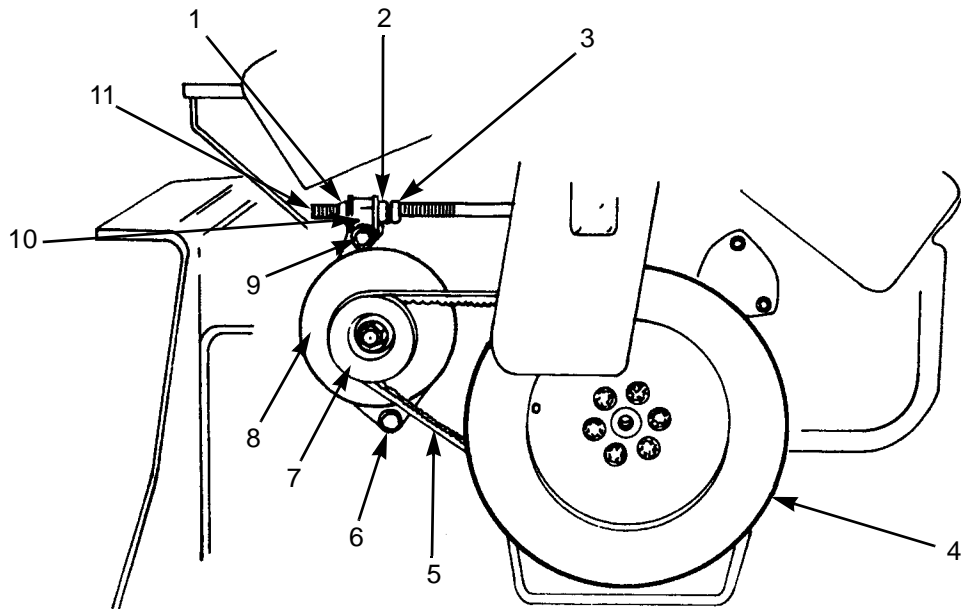


401-213

NOTE

- Do not pry belts on with a screwdriver.
- Always replace belts as a set.
- Never put on just one new belt.

1. Put alternator belts (5) onto alternator pulley (7) and vibration damper (4).



401-213

2. Push alternator away from engine until belts stop the travel of alternator.

ADJUSTMENT

NOTE

A used belt is one that has been on the truck for more than a thousand miles.

1. Tighten adjusting nut (2) against adjusting rod collar (10) until belt free play is less than 1/2 inch.
2. Tighten jam nut (1) against collar (10).
3. Tighten adjusting nut (3) against adjusting nut (2).
4. Torque alternator capscrews (6 and 9) to 30 lb-ft (41 Nm).

END OF WORK PACKAGE

STARTER MOTOR MAINTENANCE

0060 00

THIS WORK PACKAGE COVERS

Removal, Installation, Operational Check

INITIAL SETUP

Maintenance Level

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Sling, nylon (Item 86, WP 0313 00)

Personnel Required

Two

Materials/Parts

Gasket (P/N 03070)

Gasket (P/N 11664480)

Equipment Condition

Mastery battery switch in OFF position (TM 9-2320-303-10)

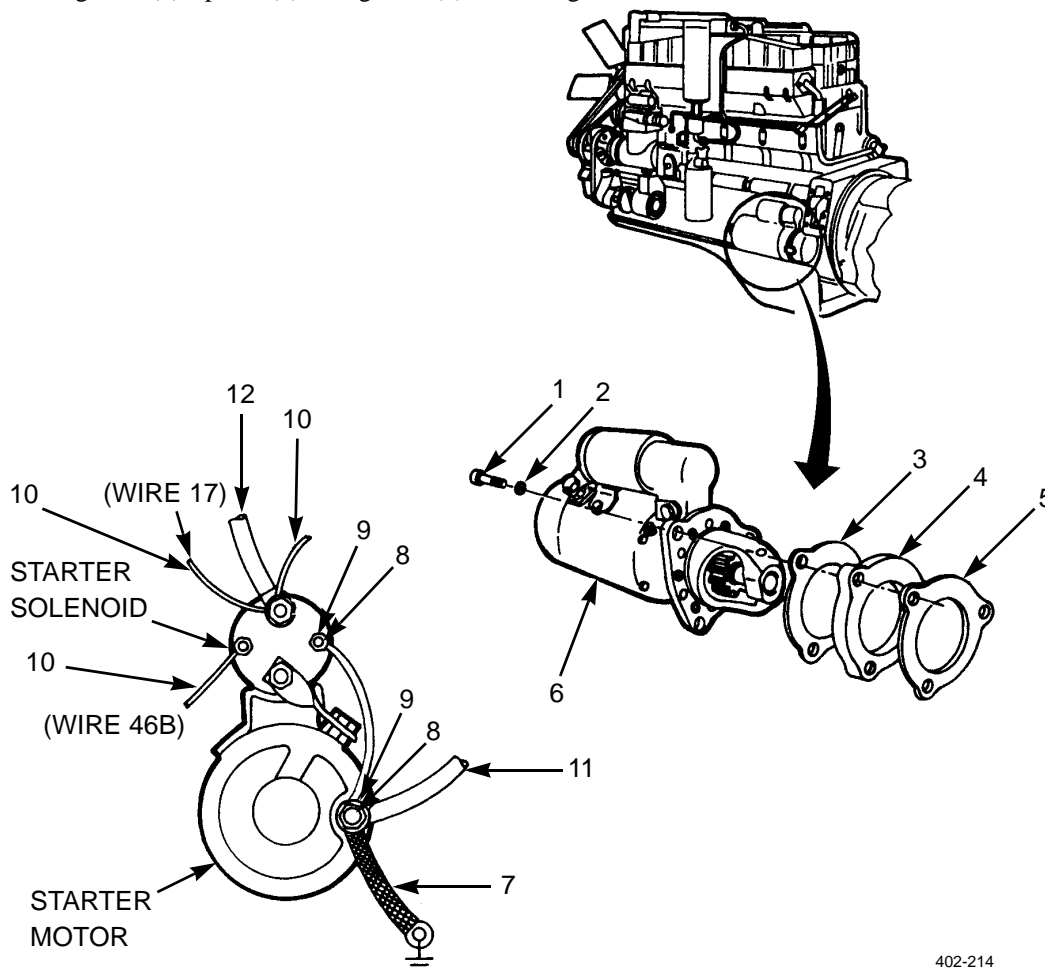
Parking brake set (TM 9-2320-303-10)

STARTER MOTOR MAINTENANCE - CONTINUED

0060 00

REMOVAL

1. Remove two hex nuts (9) and washers (8).
2. Remove three wires (10), two cables (11 and 12), and ground strap (7).
3. Remove three bolts (1) and washers (2).
4. Remove starter motor (6).
5. Remove gasket (3), spacer (4), and gasket (5). Discard gaskets.



402-214

INSTALLATION

1. Align and install new gasket (3), spacer (4), and new gasket (5) on starter motor (6).
2. Align and install starter motor (6).
3. Install and tighten three washers (2) and bolts (1).
4. Install three wires (10), two cables (11 and 12), and ground strap (7) on starter motor (6) according to figure.
5. Install and tighten two washers (8) and hex nuts (9).

OPERATIONAL CHECK

1. Start engine (TM 9-2320-303-10).
2. Verify that starter motor (6) engages.

END OF WORK PACKAGE

STARTER RELAY REPLACEMENT

0061 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Conditions

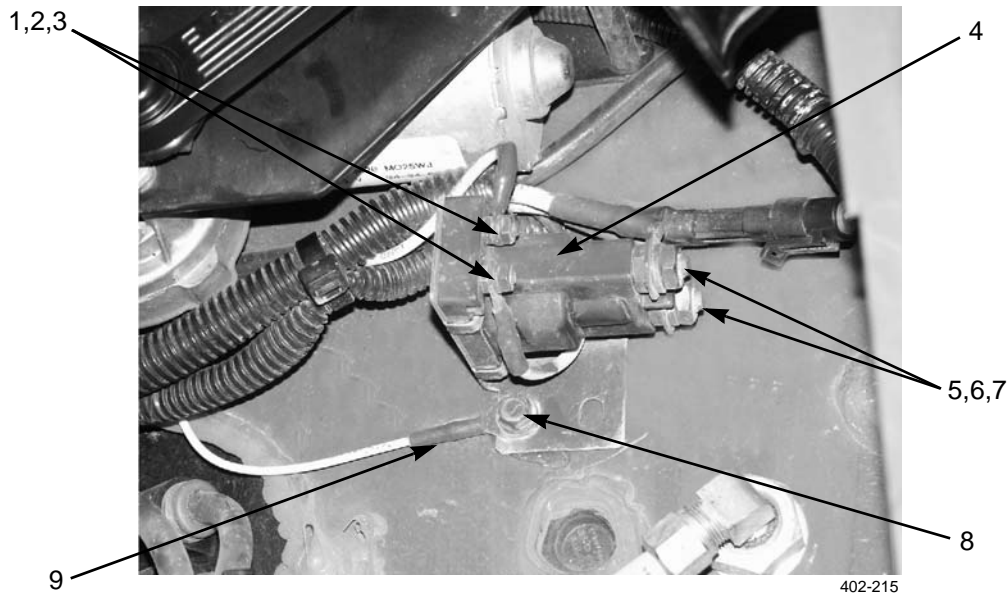
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

Tag all wires to aid in installation.

1. Remove two nuts (1), two washers (2), and two leads (3) from starter relay (4).
2. Remove two nuts (5), two washers (6), and two leads (7) from starter relay (4).
3. Remove two bolts (8), lead (9), and starter relay (4).



INSTALLATION

1. Position starter relay (4) on firewall and install lead (9) and two bolts (8).
2. Install two leads (7), two washers (6), and two nuts (5).
3. Install two leads (3), two washers (2), and two nuts (1).

END OF WORK PACKAGE

LEFT PANEL GAGES AND LAMPS REPLACEMENT

0062 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

Equipment Condition

Air system drained (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove four screws (8) and pull panel (7) away from dashboard.
2. Remove three lamp holders (2) from engine oil pressure gage (9), engine water temperature gage (10), and voltmeter (11).

NOTE

Tag all plugs and tubes to aid in installation.

3. Remove two plugs (1), connector (13), and two tubes (3) from engine oil pressure gage (9), engine water temperature gage (10), and voltmeter (11). Remove panel (7).

NOTE

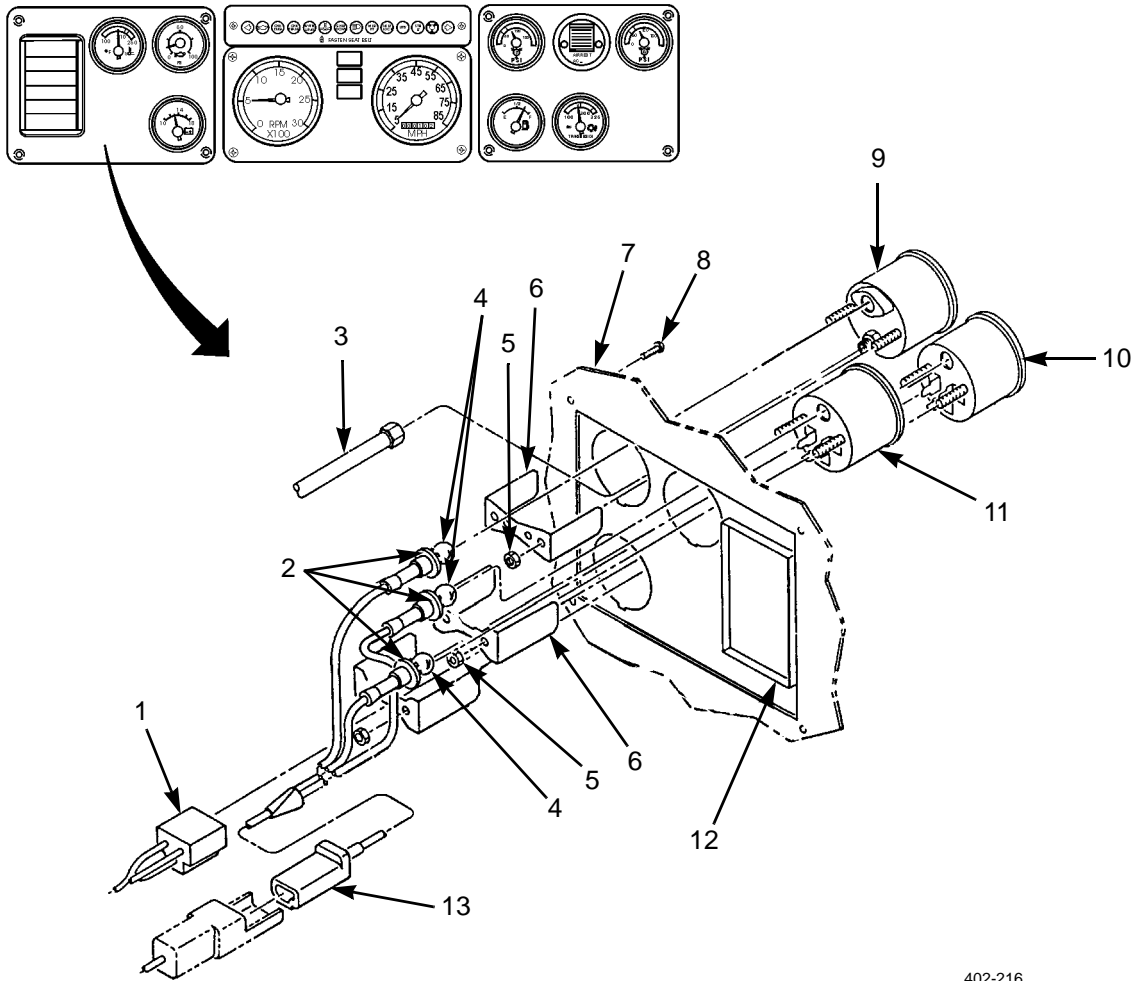
Note location of gages to aid in installation.

4. Remove two locknuts (5), bracket (6), and engine oil pressure gage (9) from panel (7).
5. Repeat step 4 for engine water temperature gage (10) and voltmeter (11).
6. Remove air vent (12) from panel (7).
7. Turn three lamps (4) to left and remove from lamp holders (2).

INSTALLATION

1. Install three lamps (4) in lamp holders (2). Turn lamps to right to lock in place.
2. Install air vent (12) on panel (7).
3. Install engine oil pressure gage (9) and bracket (6) on panel (7) with two locknuts (5).
4. Repeat step 3 for engine water temperature gage (10) and voltmeter (11).
5. Install three lamp holders (2) on engine oil pressure gage (9), engine water temperature gage (10), and voltmeter (11).
6. Install two tubes (3), connector (13), and two plugs (1) on engine oil pressure gage (9), engine water temperature gage (10), and voltmeter (11).
7. Install panel (7) on dashboard with four screws (8).
8. Run vehicle and build air pressure to proper level (TM 9-2320-303-10). Check operation of gages and check for air system leaks.

INSTALLATION - CONTINUED



402-216

END OF WORK PACKAGE

CENTER PANEL GAGES AND TACHOMETER DRIVE CABLE REPLACEMENT

0063 00

THIS WORK PACKAGE COVERS

Center Panel Gages: Removal, Installation
Tachometer Drive Cable: Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

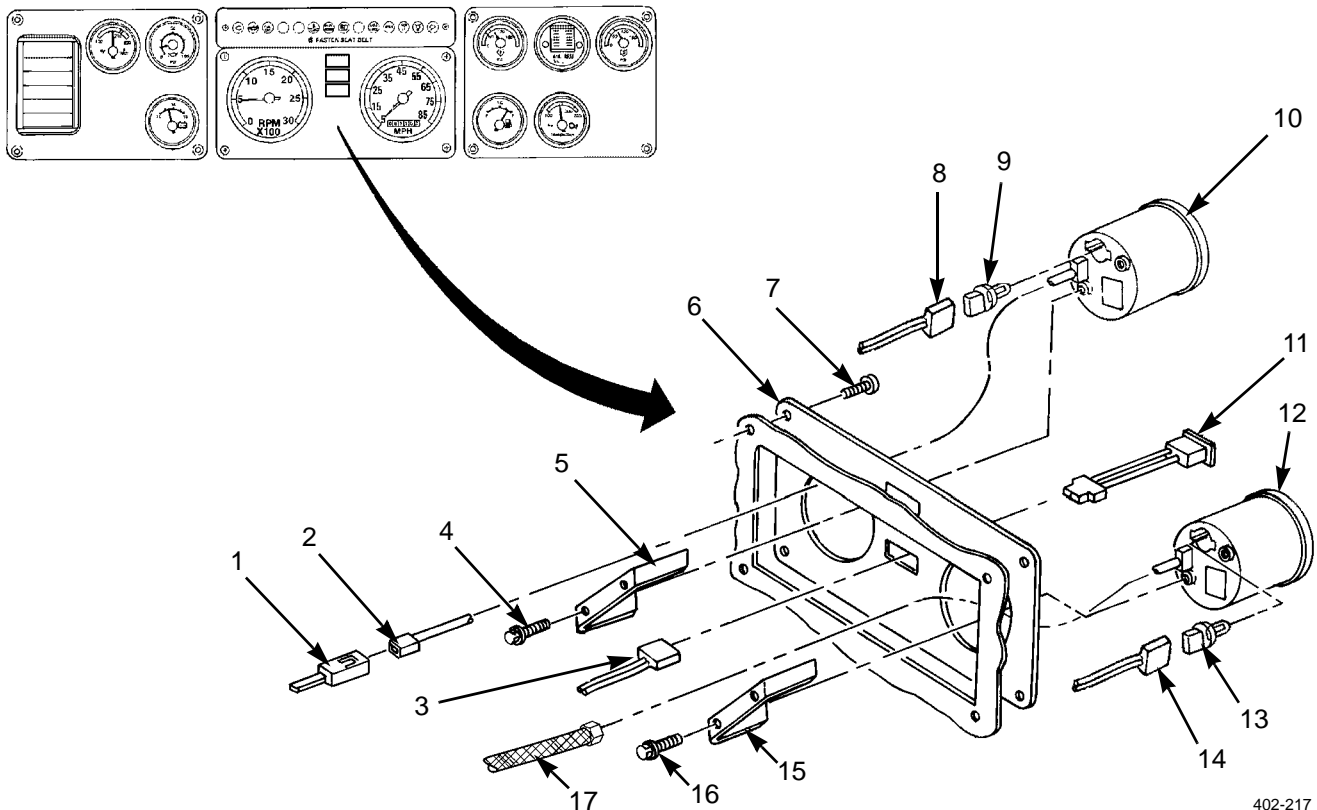
CENTER PANEL GAGES REMOVAL

1. Remove four screws (7) and pull panel (6) away from dashboard.

NOTE

Tag connectors to aid in installation.

2. Disconnect tachometer drive cable (17) from tachometer (12).
3. Remove cab wiring harness connectors (3) from indicator lights (11). Remove indicator lights.
4. Disconnect lead (14) from lamp (13) and remove lamp from tachometer (12).
5. Disconnect lead (8) from lamp (9) and remove lamp from speedometer (10).
6. Remove connector (2) from cab wiring harness connector (1). Remove panel (6).
7. Remove two screws (16), bracket (15), and tachometer (12) from panel (6).
8. Remove two screws (4), bracket (5), and speedometer (10) from panel (6).



402-217

CENTER PANEL GAGES INSTALLATION

1. Install indicator lights (11) on panel (6).
2. Install speedometer (10) on panel (6) with bracket (5) and two screws (4).
3. Install lamp (9) in speedometer (10) and connect lead (8) to lamp.
4. Install tachometer (12) to panel (6) with bracket (15) and two screws (16).
5. Install lamp (13) in tachometer (12) and connect lead (14) to lamp.
6. Install connector (2) on cab wiring harness connector (1).
7. Install cab wiring harness connectors (3) to indicator lights (11).

CENTER PANEL GAGES INSTALLATION - CONTINUED

8. Connect tachometer drive cable (17) to tachometer (12).
9. Install panel (6) on dashboard with four screws (7).
10. Start vehicle (TM 9-2320-303-10). Check gages and lights for proper operation.

TACHOMETER DRIVE CABLE REMOVAL

1. In cab, remove four screws (7) and pull dash panel (6) out far enough to disconnect tachometer drive cable (17) from tachometer (12).
2. Disconnect tachometer drive cable (17) from tachometer (12).
3. In engine compartment at fire wall, remove grommet and pull tachometer drive cable from cab into engine compartment.
4. Unscrew nut (18) and remove tachometer drive cable (17) from vehicle.



402-957

TACHOMETER DRIVE CABLE INSTALLATION

1. In engine compartment, position tachometer drive cable (17) and install nut (18).
2. Feed tachometer drive cable through hole in fire wall and install grommet.
3. In cab, connect tachometer drive cable (17) to tachometer (12).
4. Position dash panel (6) and install four screws (7).
5. Start vehicle and check operation of tachometer (TM 9-2320-303-10).

END OF WORK PACKAGE

RIGHT PANEL GAGES AND LAMPS REPLACEMENT

0064 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

Equipment Condition

Air system drained (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

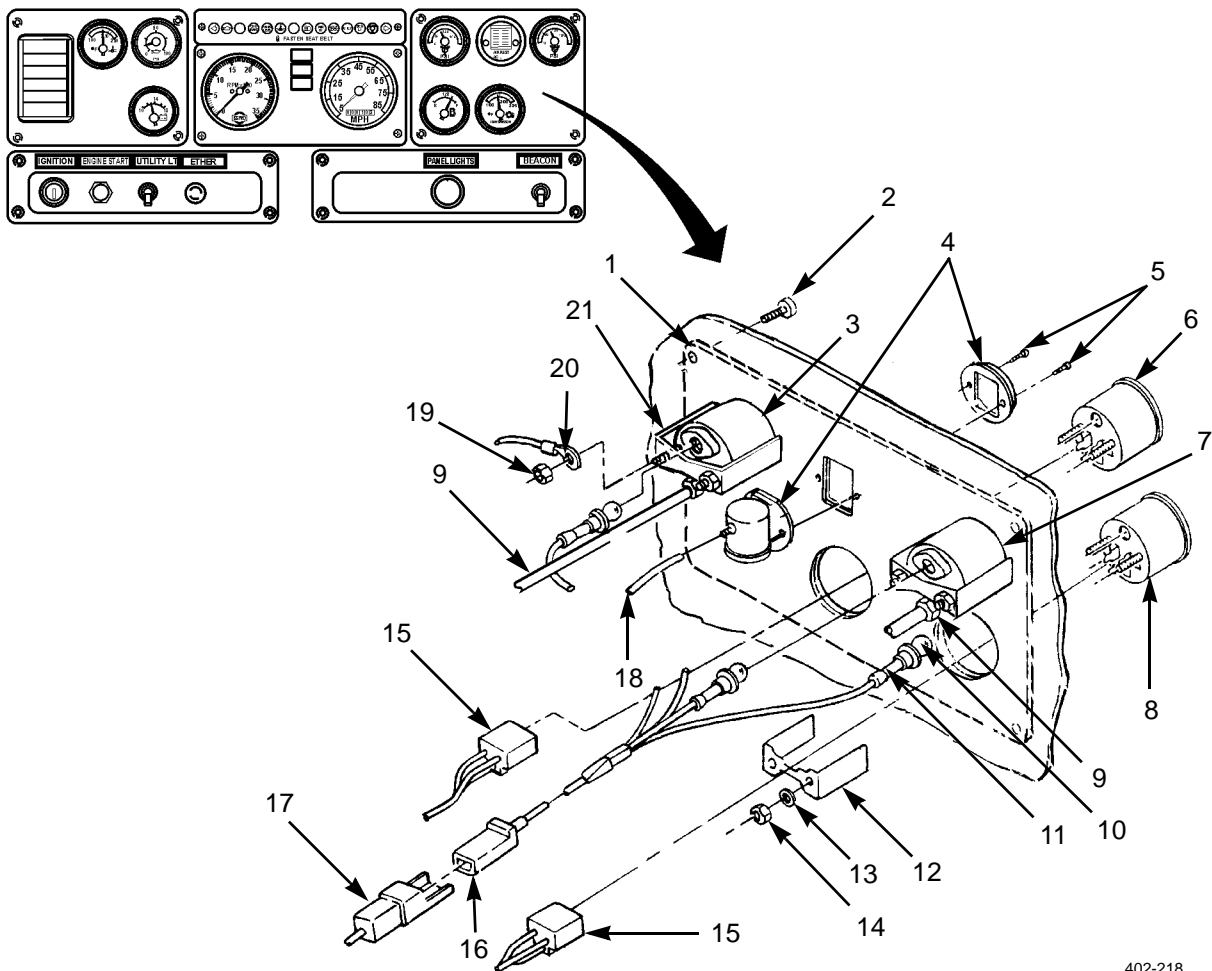
REMOVAL

1. Remove four screws (2) and pull panel (1) away from dashboard.

NOTE

Tag all air tubes, connectors, and gages prior to removal to aid in installation.

2. Remove connector (16) from cab wiring harness connector (17).
3. Remove two connectors (15) from fuel level gage (8) and transmission oil temperature gage (6).
4. Remove two tubes (9) from air pressure gages (3 and 7). Disconnect tube (18) from air cleaner restriction indicator gage (4).
5. Remove panel (1) from dashboard.



402-218

6. Remove four lamp holders (11) from fuel level gage (8), transmission oil temperature gage (6), and two air pressure gages (3 and 7).
7. Remove four locknuts (19), ground wire (20), two brackets (21), and two air pressure gages (3 and 7) from panel (1).
8. Remove four nuts (14), washers (13), two brackets (12), fuel level gage (8), and transmission oil temperature gage (6) from panel (1).
9. Remove two screws (5) and air cleaner restriction indicator gage (4) from panel (1).
10. Turn four lamps (10) to left and remove from lamp holders (11).

RIGHT PANEL GAGES AND LAMPS REPLACEMENT - CONTINUED

0064 00***INSTALLATION***

1. Install four lamps (10) in lamp holders (11). Turn lamps to right to lock in place.
2. Install air cleaner restriction indicator gage (4) on panel (1) with two screws (5).
3. Install fuel level gage (8) and transmission oil temperature gage (6) on panel (1) with two brackets (12), four washers (13), and nuts (14).
4. Install two air pressure gages (3 and 7) on panel (1) with two brackets (21), ground wire (20), and four new locknuts (19).
5. Install four lamp holders (11) on fuel level gage (8), transmission oil temperature gage (6), and two air pressure gages (3 and 7).
6. Install two tubes (9) to air pressure gages (3 and 7). Connect tube (18) to air cleaner restriction indicator gage (4).
7. Install two connectors (15) on fuel level gage (8) and transmission oil temperature gage (6).
8. Install connector (16) on cab wiring harness connector (17).
9. Install panel (1) on dashboard with four screws (2).
10. Start vehicle (TM 9-2320-303-10). Check gages and lights for proper operation and check for air system leaks.

END OF WORK PACKAGE

UPPER RIGHT DASH PANEL REPLACEMENT

0065 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 50, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

Equipment Condition

Parking brake and trailer air supply valve removed
(WP 0150 00)

Master battery switch in OFF position (TM 9-2320-
303-10)

NOTE

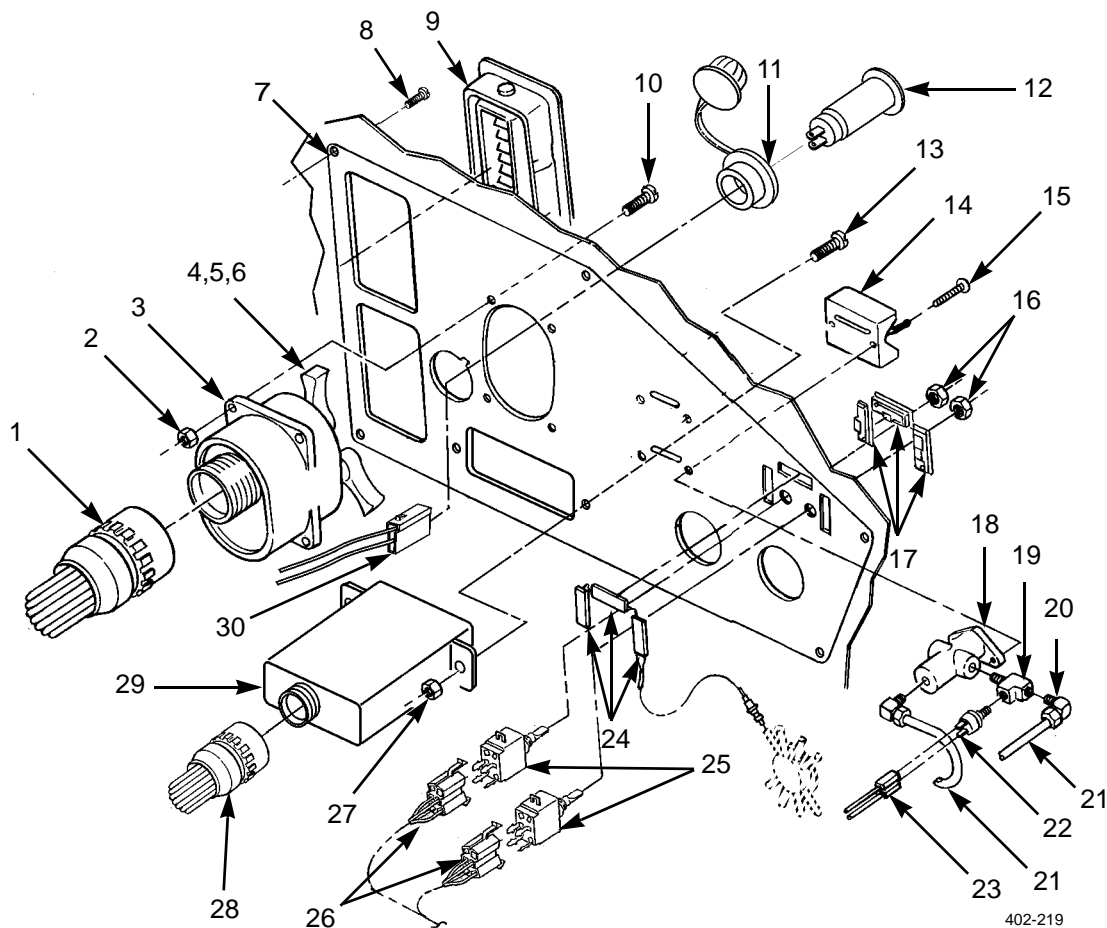
Tag air tubes and electrical connectors to aid in installation.

UPPER RIGHT DASH PANEL REPLACEMENT - CONTINUED

0065 00

REMOVAL

1. Remove five screws (8) and pull panel (7) away from dash enough to access rear of panel.
2. Remove connector (30) from 12V power receptacle (12).
3. Remove 12V power receptacle (12) from cap assembly (11).
4. Remove cap assembly (11) from panel (7).
5. Remove connector (1) from light switch (3).
6. Remove four nuts (2), screws (10), and light switch (3) from panel (7).
7. As required, remove three screws (4), knobs (5), and washers (6) from light switch (3).
8. Remove two connectors (26) from switches (25).
9. Remove three fiber optic labels (24) from panel (7).
10. Remove three label holders (17), two nuts (16), and two switches (25) from panel (7).
11. Remove two tubes (21) and connector (23).

**NOTE**

Two control valves are removed the same way. One control valve is illustrated. Perform steps 8 and 9 for all control valves.

REMOVAL - CONTINUED

12. Remove two screws (15), guard (14), and control valve (18) from panel (7).
13. Remove two elbows (20), sending unit (22), and tee (19) from control valve (18).
14. Remove connector (28) from driver display unit (29).
15. Remove two screws (13), two nuts (27), and driver display unit (29) from panel (7).
16. Remove two air vents (9) from panel (7).
17. Remove panel (7) from dashboard.

INSTALLATION

1. Install two air vents (9) on panel (7).
2. Position panel (7) to dashboard.
3. Install driver display unit (29) to panel (7) with two screws (13) and two nuts (27).
4. Install connector (28) to driver display unit (29).

**WARNING**

Adhesives 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 a well-ventilated area. If adhesive or sealing compound contacts skin or clothing, wash immediately with soap and water.

NOTE

- Two control valves are installed the same way. One control valve is illustrated. Perform steps 5 and 6 for all control valves.
 - Apply pipe sealing compound to threads of all fittings before installation.
5. Install tee (19), two elbows (20), and sending unit (22) on control valve (18).
 6. Install control valve (18) and guard (14) on panel (7) with two screws (15).
 7. Install two tubes (21). Install connector (23) on sending unit (22).
 8. Install three label holders (17) on panel (7).
 9. Install two switches (25) on panel (7) with two nuts (16).
 10. Install three fiber optic labels (24) on panel (7).
 11. Install two connectors (26) on switches (25).
 12. If removed, install three washers (6), knobs (5), and screws (4) on light switch (3).
 13. Install light switch (3) on panel (7) with four screws (10) and nuts (2).
 14. Install connector (1) on light switch (3).
 15. Install cap assembly (11) on panel (16).
 16. Install 12V power receptacle (12) in cap assembly (11).
 17. Connect connector (30) to 12V power receptacle (12).
 18. Position panel (7) on dash and install five screws (8).

UPPER RIGHT DASH PANEL REPLACEMENT - CONTINUED

0065 00

INSTALLATION - CONTINUED

19. Install parking brake and trailer air supply valve (WP 0150 00).
20. Start vehicle and check all dash panel functions (TM 9-2320-303-10).

END OF WORK PACKAGE

LEFT-HAND SWITCH PANEL REPLACEMENT

0066 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

Equipment Condition

Mastery battery switch in OFF position (TM 9-2320-303-10)

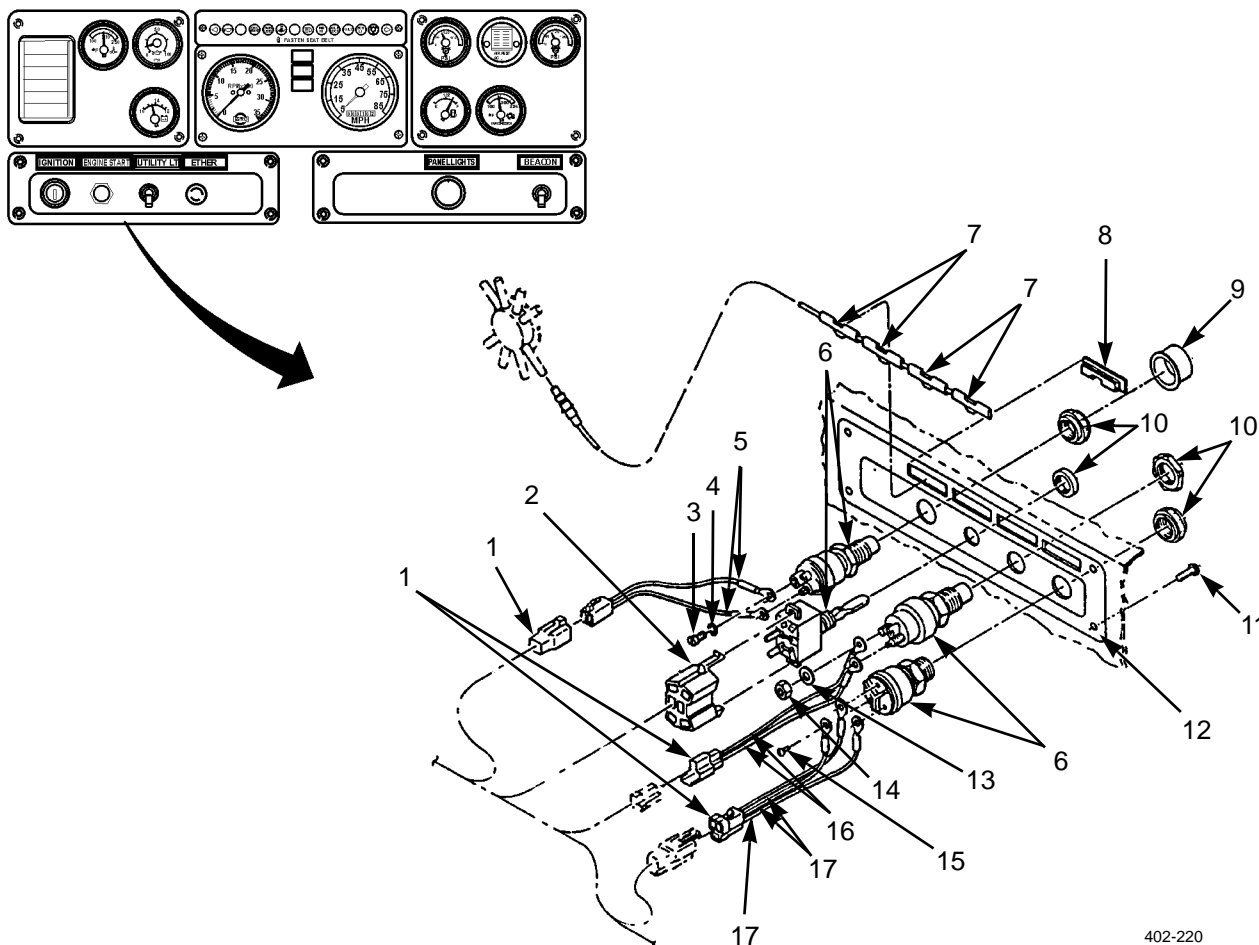
REMOVAL

1. Remove four screws (11) and pull panel (12) out of dashboard.

NOTE

Tag connectors prior to removal to aid in installation.

2. Disconnect plug (2) and three connectors (1) and remove four fiber optic labels (7), four label holders (8), and panel (12).
3. Remove three screws (15), pigtail (17), two nuts (14), two washers (13), and pigtail (16) from back of panel (12).
4. Remove two screws (3), two washers (4), and pigtail (5).
5. Remove boot (9), four nuts (10), and four switches (6) from panel (12).



402-220

INSTALLATION

1. Install four switches (6), four nuts (10), and boot (9).
2. Install pigtail (5), two new lockwashers (4), and two screws (3).
3. Install pigtail (16), two washers (13), two nuts (14), pigtail (17), and three screws (15) on back of panel (12).

INSTALLATION - CONTINUED

4. Install four label holders (8) and four fiber optic labels (7) and connect three connectors (1) and plug (2) on panel (12).
5. Install panel (12) and four screws (11) on dashboard.
6. Check function of switches (TM 9-2320-303-10).

END OF WORK PACKAGE

RIGHT-HAND SWITCH PANEL REPLACEMENT

0067 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

TM 9-2320-303-10

Equipment Condition

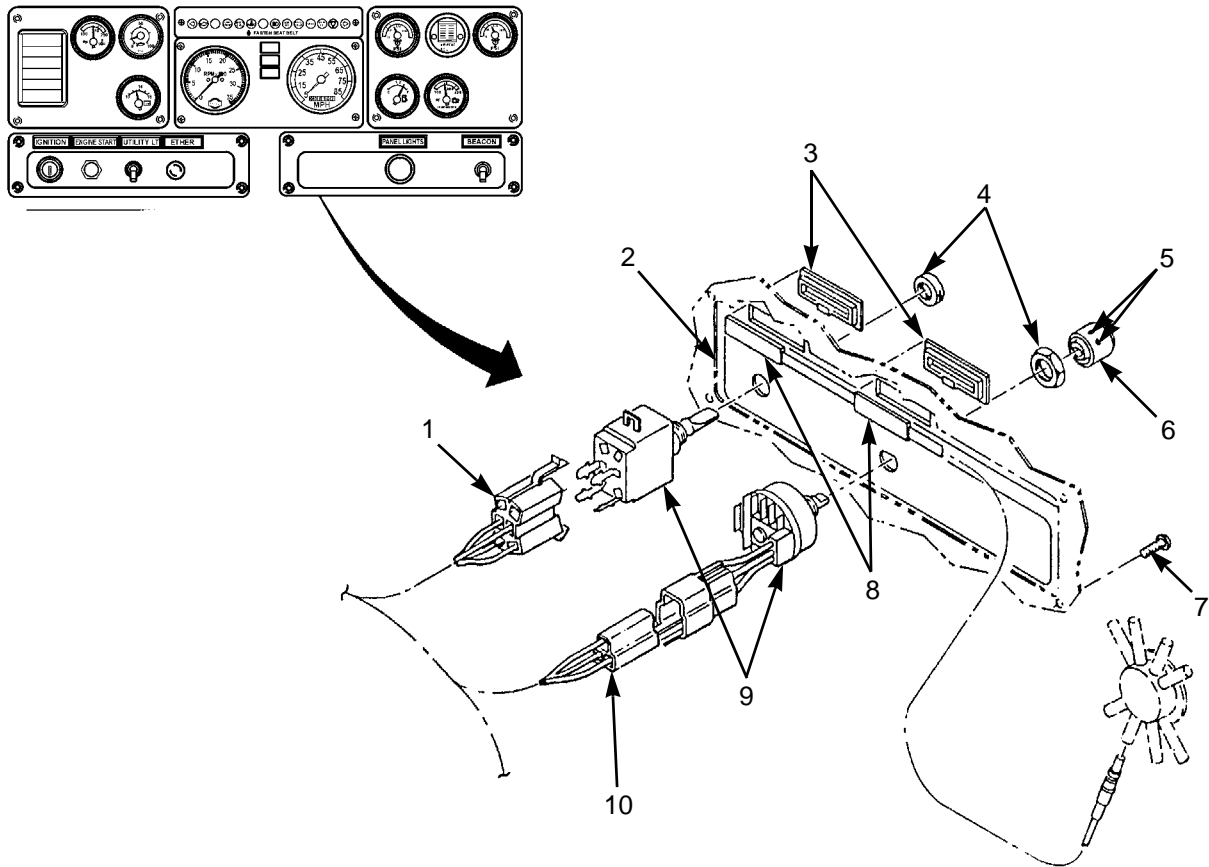
Master battery switch in OFF position (TM 9-2320-303-10)

RIGHT-HAND SWITCH PANEL REPLACEMENT - CONTINUED

0067 00

REMOVAL

1. Remove four screws (7) and pull panel (2) out of dashboard.
2. Disconnect plug (1) and connector (10) and remove two fiber optic labels (8) and panel (2).
3. Loosen two setscrews (5) and remove knob (6), two nuts (4), two switches (9), and two label holders (3) from panel (2).



402-221

INSTALLATION

1. Install two label holders (3), two switches (9), two nuts (4), and knob (6) on panel (2) and tighten two setscrews (5).
2. Install two fiber optic labels (8) and connect connector (10) and plug (1).
3. Install panel (2) and four screws (7).
4. Check function of switches and knobs (TM 9-2320-303-10).

END OF WORK PACKAGE

CONTROL MODULE REPLACEMENT

0068 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

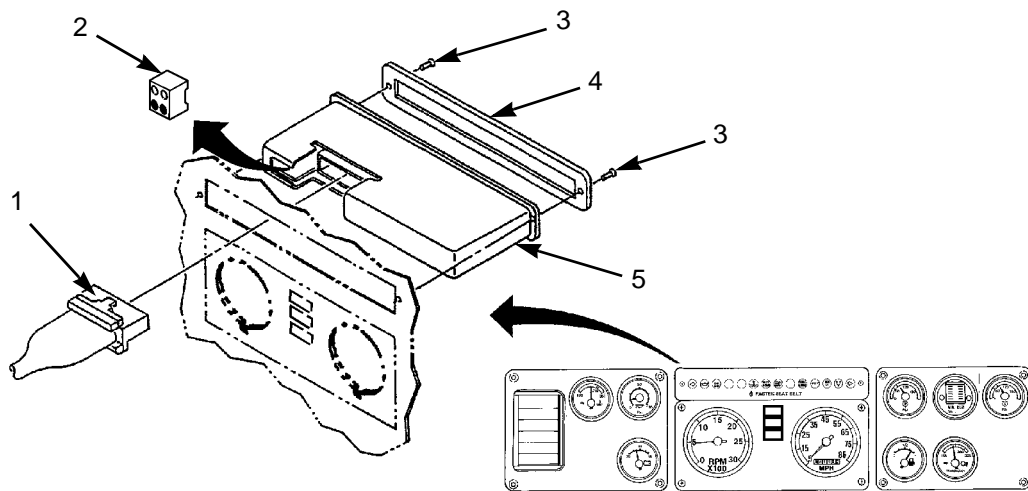
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove two screws (3), cover (4), and control module (5) from dashboard.
2. Remove plug (1) from control module (5).
3. Remove buzzer alarm (2) from control module (5).



402-222

INSTALLATION**NOTE**

Observe keyways and guide pins on plug when making connection. DO NOT force connection.

1. Install buzzer alarm (2) on control module (5).
2. Install plug (1) on control module (5).
3. Position control module (5) on dashboard and install cover (4) with two screws (3).
4. Start vehicle and check control module lights and buzzer (TM 9-2320-303-10).

END OF WORK PACKAGE

HEATER CONTROL PANEL REPLACEMENT

0069 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Air system drained (TM 9-2320-303-10)

Master battery switch is OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove two heater control knobs (3) and six screws (1). Pull control panel (2) out from dashboard.
2. Remove fiber optic label (13).

NOTE

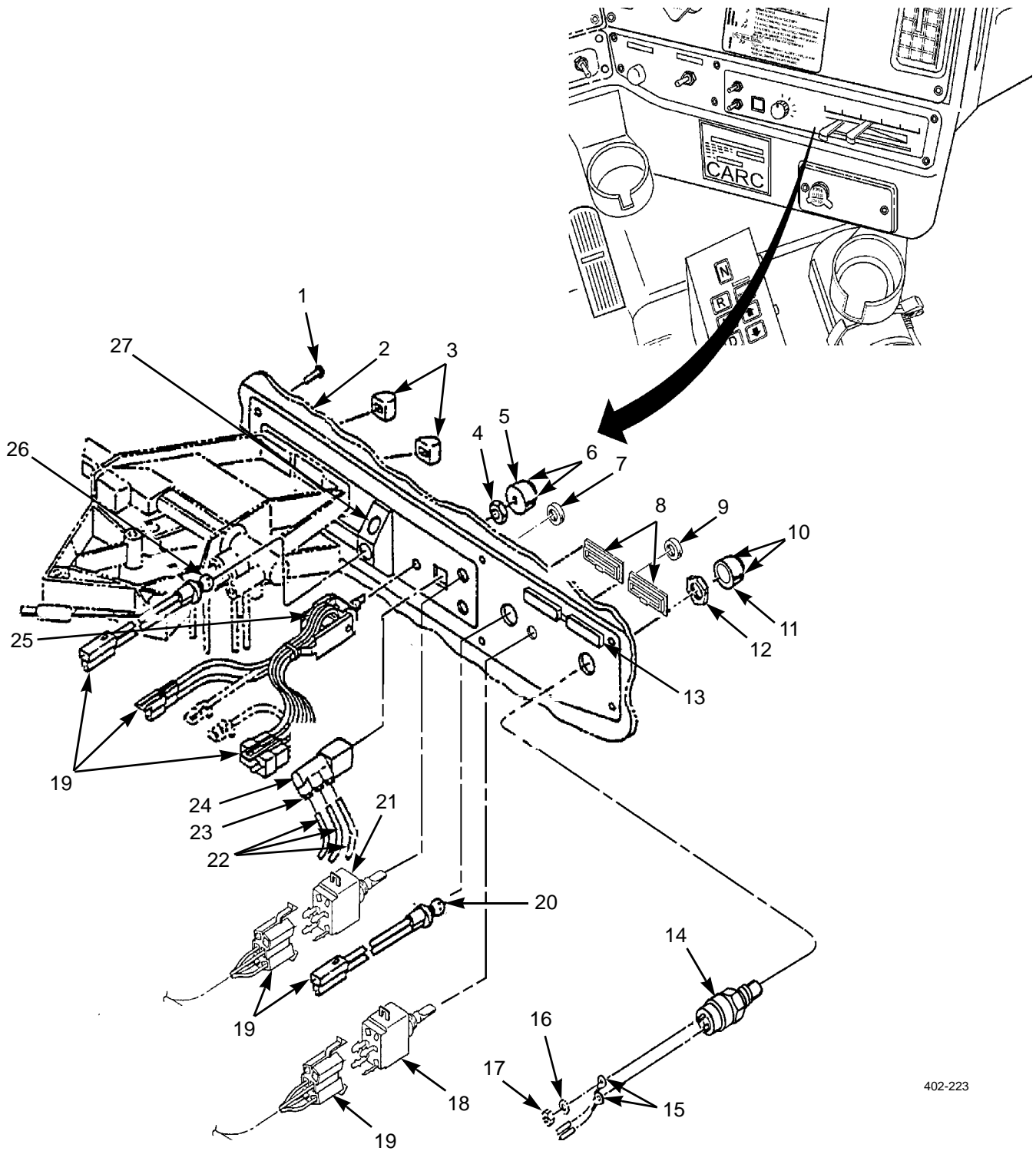
Tag all tubes and connectors prior to removal to aid in installation.

3. Remove two nuts (17), two washers (16), and two terminal lugs (15) from switch (14).
4. Loosen two setscrews (10) and remove knob (11), nut (12), and switch (14) from control panel (2).
5. Disconnect six connectors (19).
6. Remove nut (9) and mirror heat switch (18) from control panel (2).
7. Remove heater indicator light (20).
8. Remove two nuts (7) and auxiliary heater switches (21).
9. Press three plastic discs (23) and disconnect three tubes (22) from air switch (24).
10. Remove air switch (24).
11. Loosen two setscrews (6) and remove knob (5), nut (4), and fan speed switch (25).
12. Remove indicator light (26).
13. Remove ac/heater panel (27) and two label holders (8) from control panel (2).

INSTALLATION

1. Install two label holders (8) and ac/heater panel (27) to control panel (2).
2. Install indicator light (26).
3. Install fan speed switch (25), nut (4), and knob (5). Tighten two setscrews (6).
4. Install air switch (24).
5. Press three plastic discs (23) and connect three tubes (22) to air switch (24).
6. Install two auxiliary heater switches (21) and two nuts (7).
7. Install heater indicator light (20).
8. Install mirror heat switch (18) with nut (9).
9. Connect six connectors (19).
10. Install switch (14), nut (12), and knob (11). Tighten two setscrews (10).
11. Install two terminal lugs (15), two washers (16), and two nuts (17) on switch (14).
12. Install fiber optic labels (13).
13. Install control panel (2) to dashboard with six screws (1). Install two heater control knobs (3).
14. Start vehicle and check all control panel functions (TM 9-2320-302-10).

INSTALLATION - CONTINUED



402-223

END OF WORK PACKAGE

TURN SIGNAL SWITCH REPLACEMENT

0070 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Tape, electrical (Item 45, WP 0312 00)

Tools and Special Tools

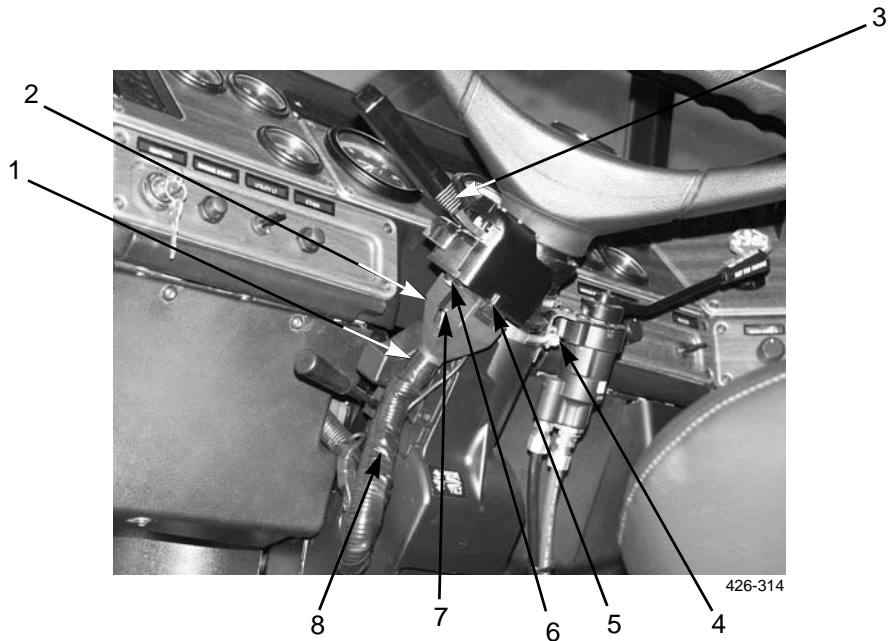
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove electrical tape (1) from cable (8) and cover (2).
2. On cover (2), remove screw (6) and clip (7).
3. Slide cover (2) onto cable (8) and unplug cable connector (5) from turn signal assembly (3).
4. Remove clamp (4) and turn signal assembly (3) from steering column.



INSTALLATION

1. Position clamp (4) and turn signal assembly (3) onto steering column. Tighten clamp.
2. Plug cable connector (5) into turn signal assembly (3).
3. Slide cover (2) over cable connector (5) and install clip (7) and screw (6).
4. Install electrical tape (1) onto cable (8) and cover (2).

END OF WORK PACKAGE

FIBER OPTIC LIGHT SOURCE REPLACEMENT

0071 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Strap, tiedown (Item 41, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Equipment Condition

Center gage panel removed (WP 0063 00)

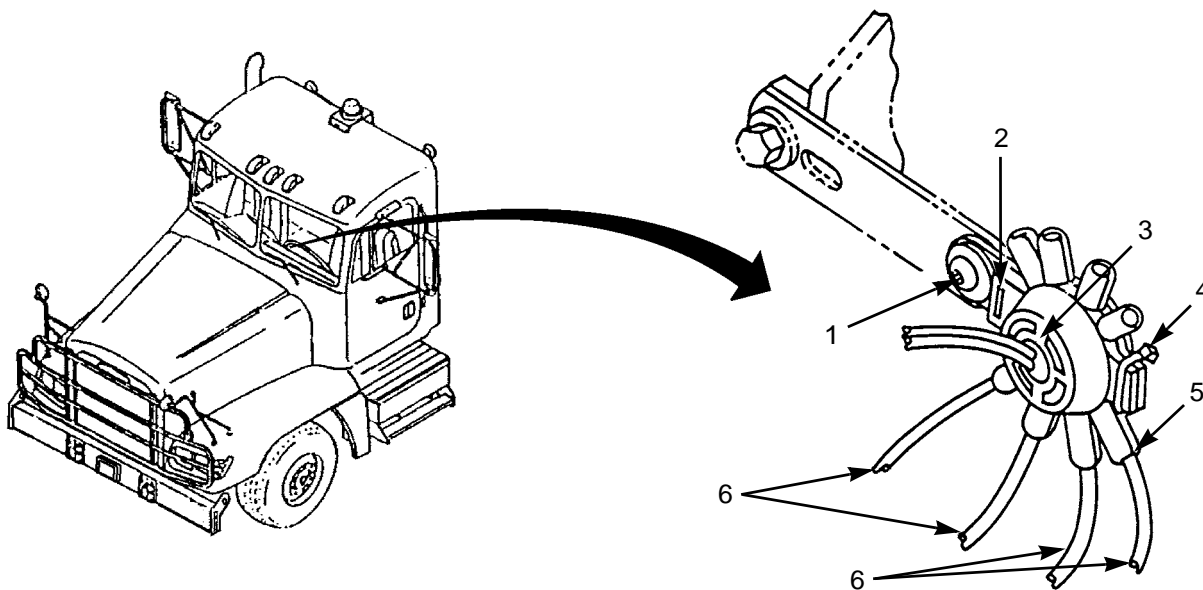
REMOVAL

1. Remove torx screw (1) and fiber optic light source (5).
2. Turn light socket (3) to left and remove from fiber optic light source (5).
3. Remove tie strap (4).

CAUTION

Do not crimp fiber optic lines. Crimping could cause lines to break internally resulting in instrument light failure.

4. Release two latches (2) on rear of fiber optic light source (3) and remove four fiber optic lines (6).

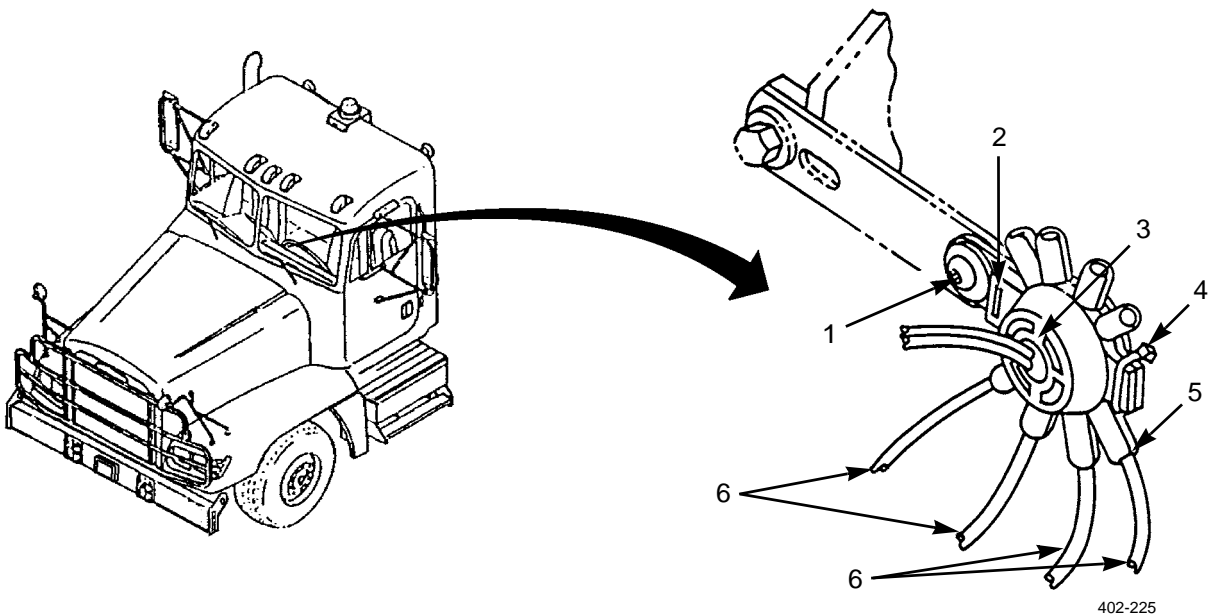


402-225

INSTALLATION**CAUTION**

Do not crimp fiber optic lines. Crimping could cause lines to break internally resulting in instrument light failure.

1. Install four fiber optic lines (6) and engage two latches (2) on rear of fiber optic light source (5).
2. Install tie strap (4).
3. Install light socket (3) in fiber optic light source (5) and turn to right.
4. Install fiber optic light source (5) and torx screw (1).



5. Install center gage panel (WP 0063 00).

END OF WORK PACKAGE

FUSE, RELAY, CIRCUIT BREAKER, AND HOLDER REPLACEMENT

0072 00

THIS WORK PACKAGE COVERS

Fuse Removal, Relay Removal, Circuit Breaker Removal, Holder Removal, Holder Installation, Circuit Breaker Installation, Relay Installation, Fuse Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

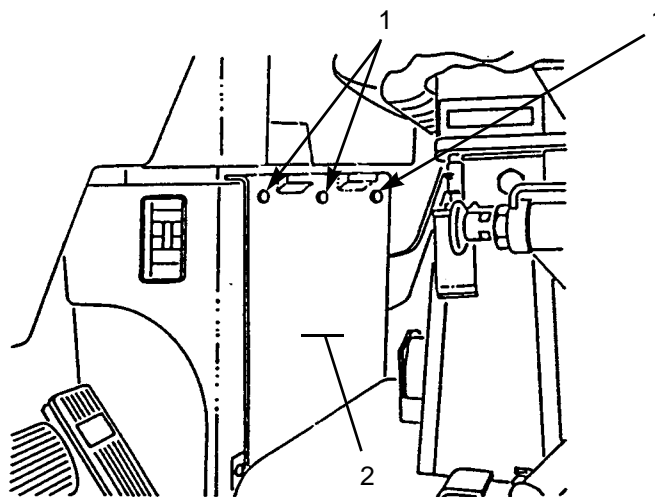
Master battery switch in OFF position (TM 9-2320-303-10)

NOTE

- Tag or note position of all fuses, relays, circuit breakers, and connectors to aid in installation.
- Refer to foldout 1 at end of manual for fuse, relay and circuit breaker location.

FUSE REMOVAL

1. Rotate three turnlock fasteners (1) and remove cover (2) from cab.



402-227

FUSE REMOVAL - CONTINUED

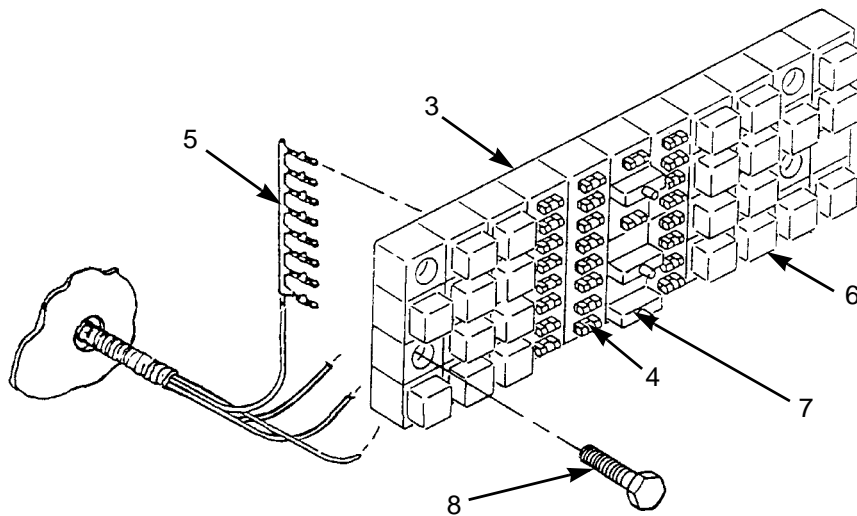
- Remove fuses (4) from holder (3).

RELAY REMOVAL

Remove relays (6) from holder (3).

CIRCUIT BREAKER REMOVAL

- Remove circuit breakers (7) from holder (3).
- Remove four screws (8) and holder (3) from cab.
- Remove connectors (5) from holder (3).



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HOLDER INSTALLATION

- Install connectors (5) on holder (3).
- Install holder (3) on cab with four screws (8).

CIRCUIT BREAKER INSTALLATION

Install circuit breakers (7) on holder (3).

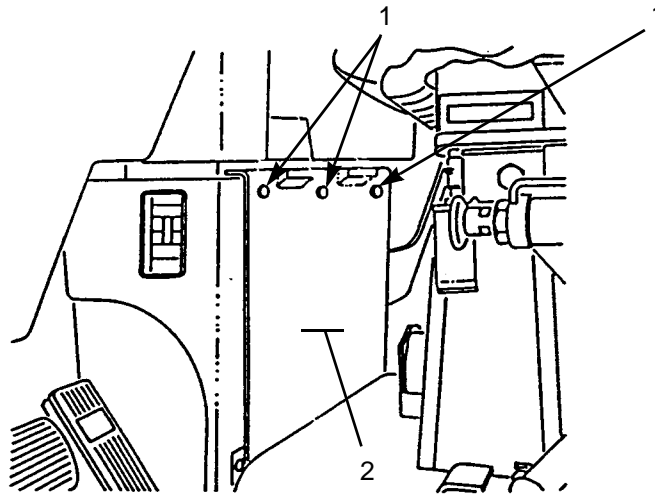
RELAY INSTALLATION

Install relays (6) on holder (3).

FUSE INSTALLATION**WARNING**

When replacing fuses, ensure that replacement fuses are correct amperage. Fuses with incorrect amperage could result in injury to personnel or damage to equipment.

1. Install fuses (4) on holder (3).
2. Position cover (2) in cab and rotate three turnlock fasteners (1).



402-227

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Fuse Replacement, ECU Fuse Wire: Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Material/Parts

Straps, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Material/Parts - Continued

Tape, insulation, electrical (Item 45, WP 0312 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

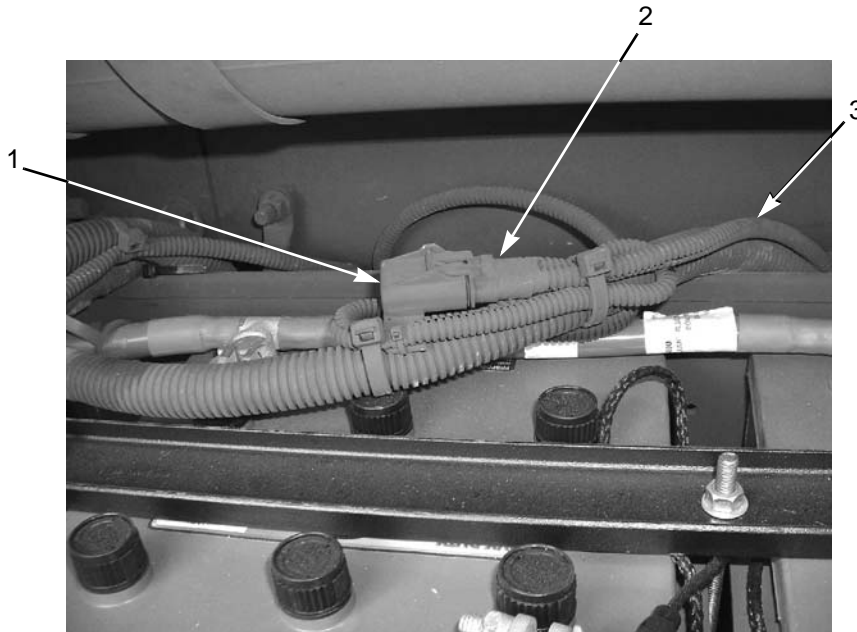
Battery box cover removed (TM 9-2320-303-10)

FUSE REPLACEMENT

NOTE

Note amperage of fuse to ensure correct replacement.

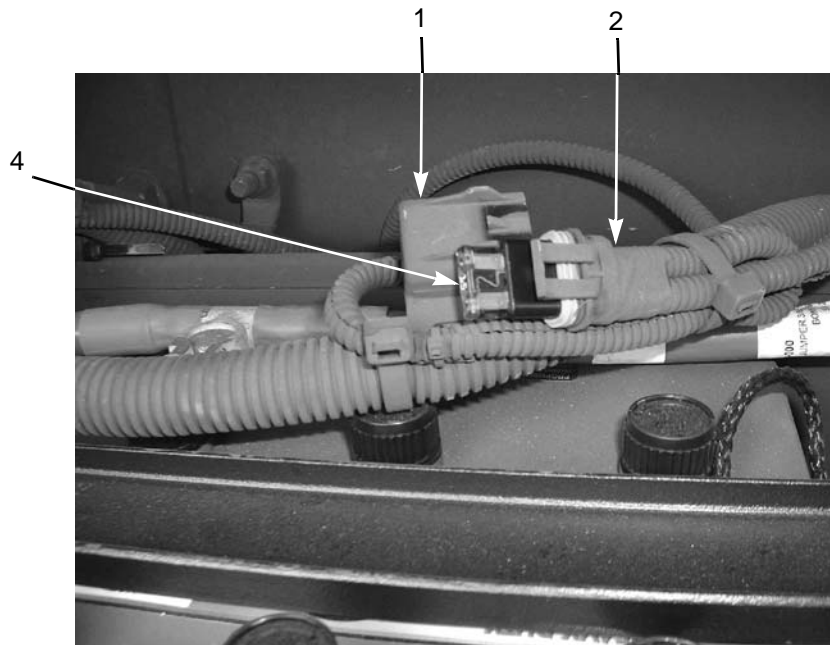
1. Remove fuse cover (1) from fuse connector (2) on ECU fuse wire (3).



402-934-1

FUSE REPLACEMENT - CONTINUED

- Remove fuse (4) from fuse connector (2).



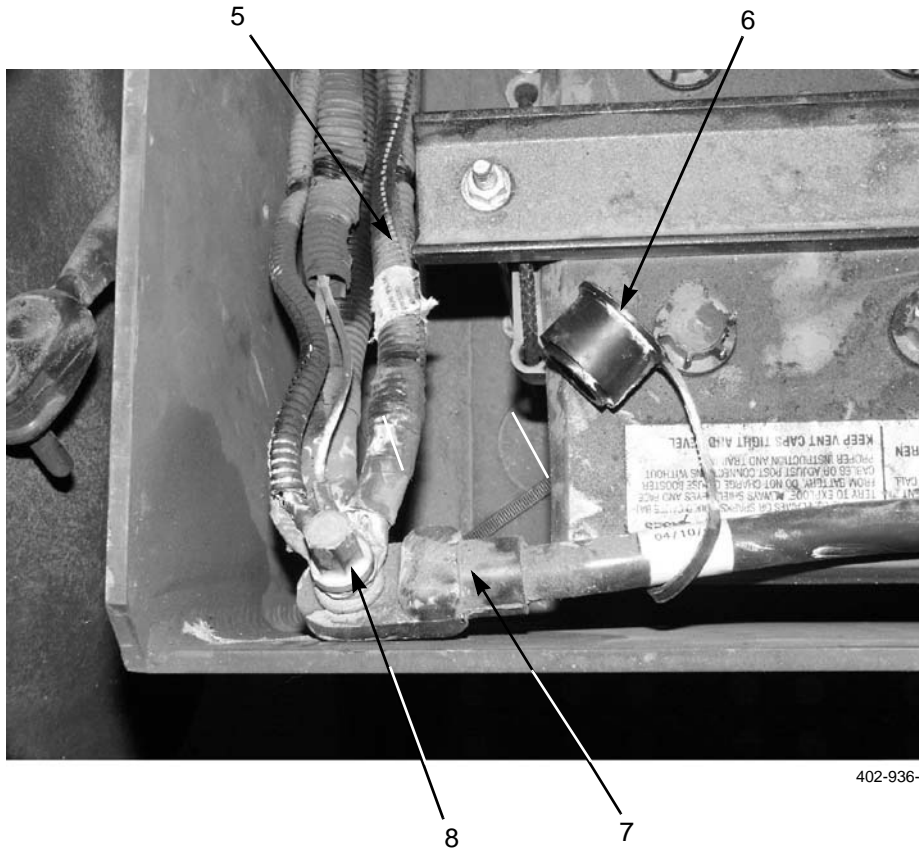
402-933-1

- Install fuse (4) in fuse connector (2).
- Install fuse cover (1) on fuse connector (2).

ECU FUSE WIRE REMOVAL**NOTE**

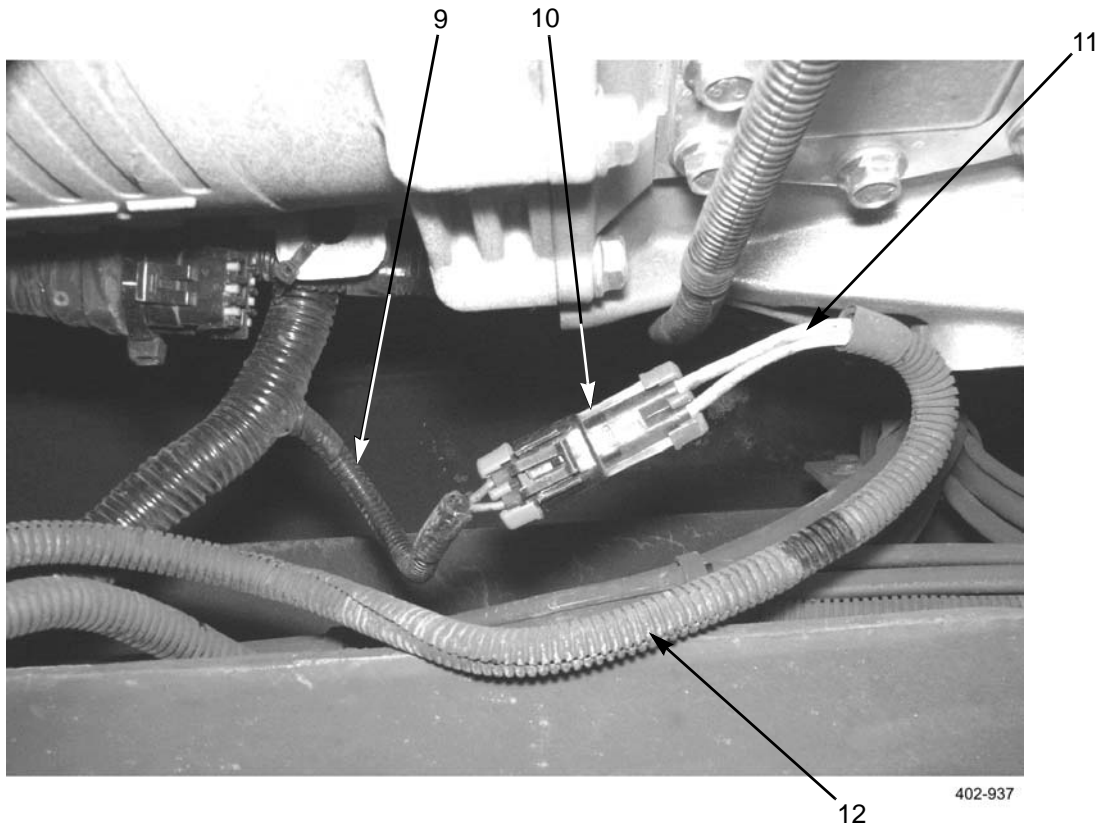
- Remove and discard tiedown straps and electrical tape as necessary.
- Tag wires to ensure correct installation.

1. Lift cap (6) and remove nut (8) and wire of ECU fuse wire (5) from negative battery cable (7).



ECU FUSE WIRE REMOVAL - CONTINUED

2. At transmission wiring harness (9), disconnect connector (10) of ECU fuse wire (11) from connector of transmission wiring harness.
3. Remove ECU fuse wire (11) from vehicle.
4. Remove conduit (12) from fuse wire (11).

**ECU FUSE WIRE INSTALLATION**

1. Install conduit (12) on ECU fuse wire (11).
2. Position ECU fuse wire (11) in vehicle.
3. At transmission wiring harness (9), connect connector (10) of ECU fuse wire (11) to connector on transmission wiring harness.
4. Install wire of ECU fuse wire (5) to negative battery cable (8) with nut (6). Install cap (7).
5. Install battery box cover (TM 9-2320-303-10).

END OF WORK PACKAGE

REAR BLACKOUT MARKER REPLACEMENT

0074 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-8CG5C) (2)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

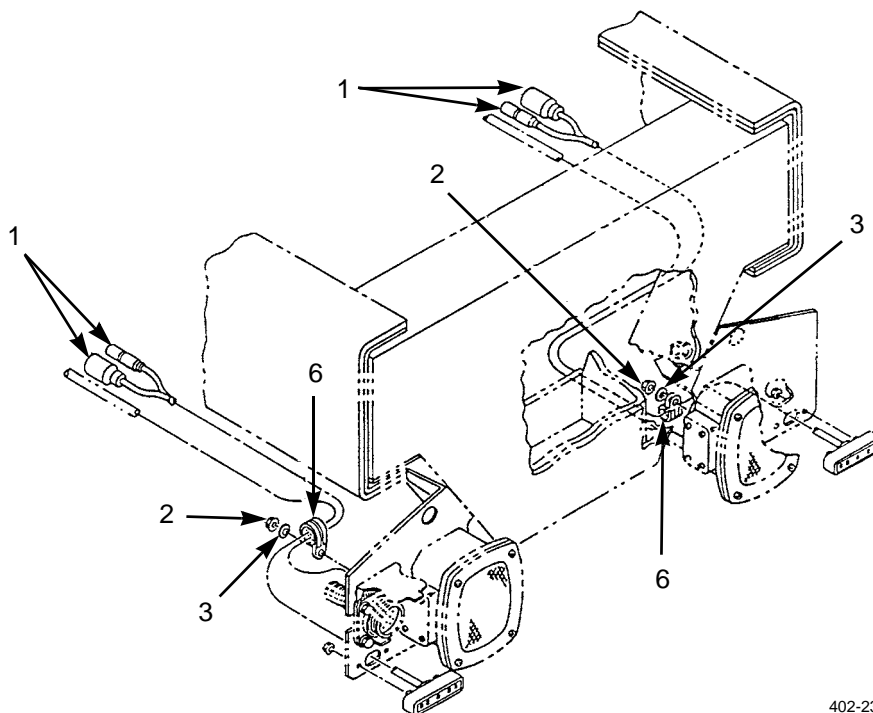
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL**NOTE**

- Procedure is the same for both blackout markers.
- Tag connectors prior to removal to aid in installation.

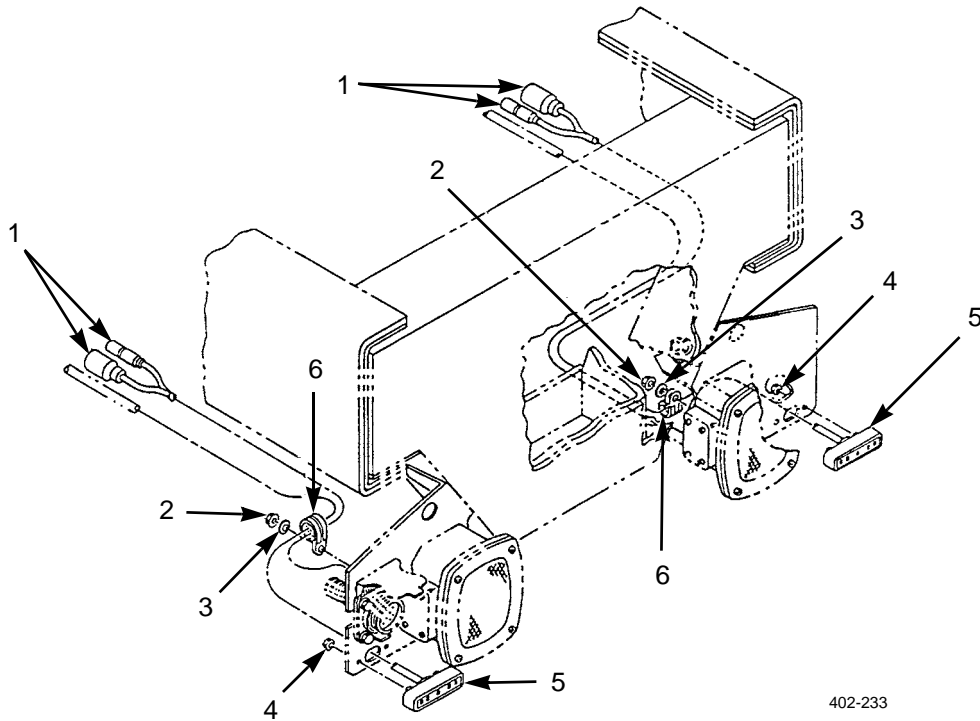
1. Disconnect two connectors (1).
2. Remove nut (2), washer (3), and clamp (6).



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REAR BLACKOUT MARKER REPLACEMENT - CONTINUED**0074 00****REMOVAL - CONTINUED**

3. Remove two locknuts (4) and blackout marker (5). Discard locknuts.
4. Repeat steps 1 through 3 for blackout marker on opposite side of vehicle.

**INSTALLATION****NOTE**

Procedure is the same for both blackout markers.

1. Install blackout marker (5) and two new locknuts (4).
2. Install clamp (6), washer (3), and nut (2).
3. Connect two connectors (1).
4. Repeat steps 1 through 3 for blackout marker on opposite side of vehicle.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

References

WP 0094 00

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

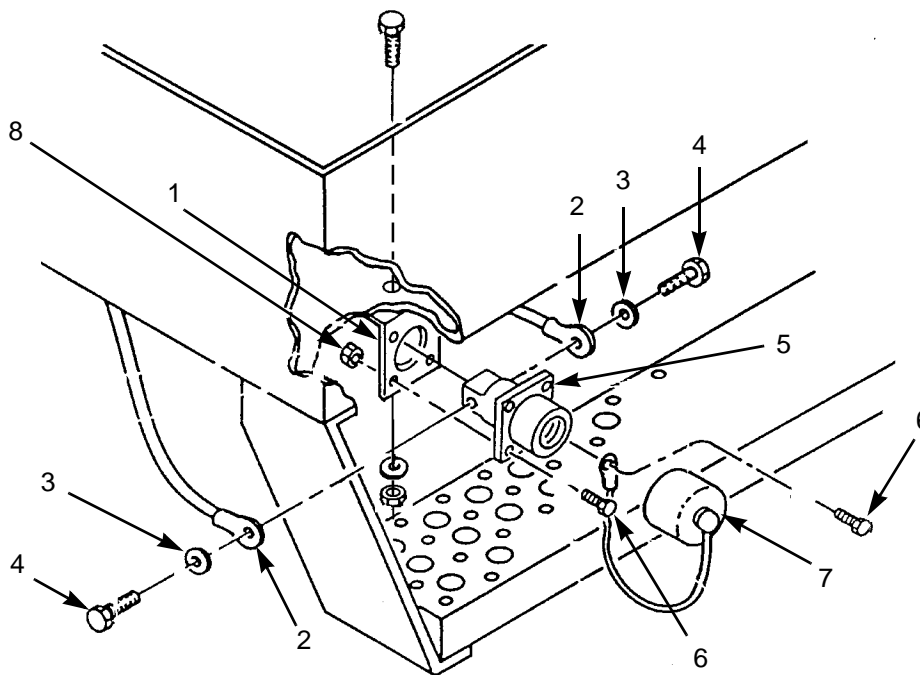
Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N 23-09336-005) (4)

REMOVAL

1. Remove two screws (4), lockwashers (3), and cables (2) from NATO slave receptacle (5).
2. Remove four locknuts (8), screws (6), cap (7) and NATO slave receptacle (5) from angle bracket (1). Discard locknuts.



402-234

REMOVAL - CONTINUED**NOTE**

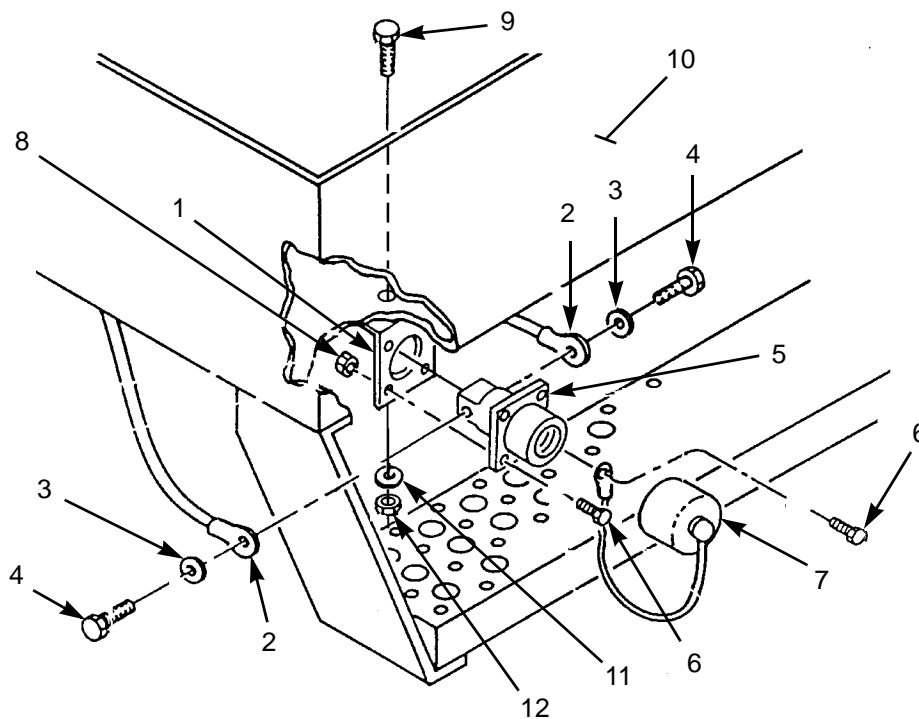
Perform steps 3 and 4 only if angle bracket is damaged.

3. Remove batteries (WP 0094 00).
4. Remove three nuts (12), washers (11), screws (9), and angle bracket (1) from battery box (10).

INSTALLATION**NOTE**

Perform steps 1 and 2 only if angle bracket was removed.

1. Install angle bracket (1) on battery box (10) with three screws (9), washers (11), and nuts (12).
2. Install batteries (WP 0094 00).
3. Install NATO slave receptacle (5) and cap (7) on angle bracket (1) with four screws (6), and new locknuts (8).
4. Install two cables (2) on NATO slave receptacle (5) with two lockwashers (3) and screws (4).



402-234

END OF WORK PACKAGE

UTILITY POWER RECEPTACLE REPLACEMENT

0076 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Drill, electric, portable (Item 20, WP 0313 00)

Drill set, twist (Item 21, WP 0313 00)

Riveter, blind, hand (Item 79, WP 0313 00)

Materials/Parts

Adhesive (Item 1, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Rivet, blind (P/N 101624-01) (2)

Washer, lock (P/N MS35338-135) (2)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Cab liners removed (WP 0176 00)

REMOVAL**NOTE**

- Cab has two utility power receptacles.
- Tag wires prior to removal to aid in installation.

UTILITY POWER RECEPTACLE REPLACEMENT - CONTINUED**0076 00****REMOVAL - CONTINUED**

1. Remove two screws (1), two wires (2), and two lockwashers (8) from rear of receptacle (4). Discard lockwashers.
2. Remove cover (6) from receptacle (4).

NOTE

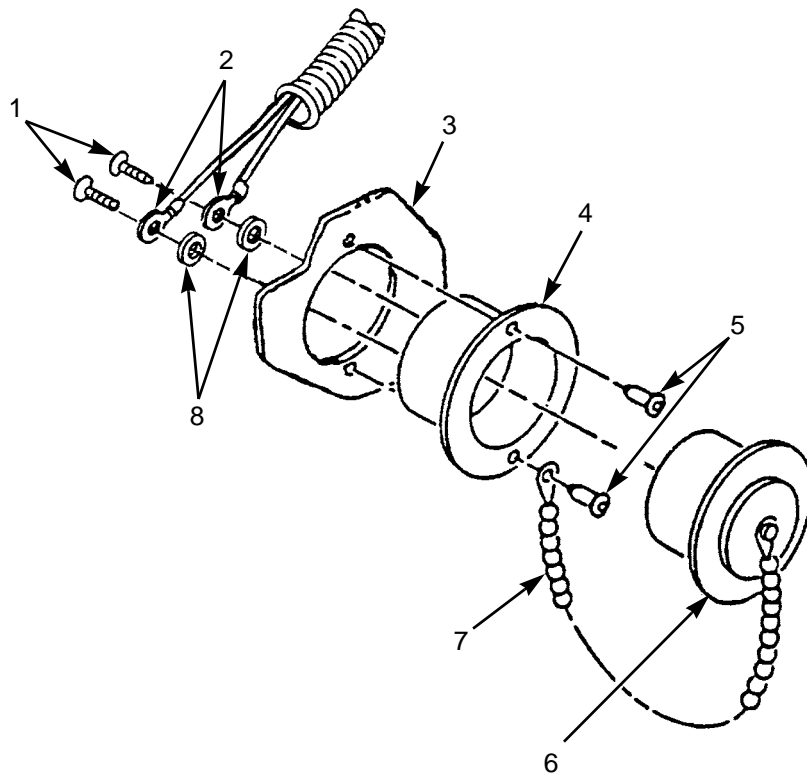
Note position of receptacle for installation.

3. Drill through and remove two rivets (5), receptacle (4), and chain (7) from cab (3). Discard rivets.

INSTALLATION**NOTE**

If receptacle has no gasket, use adhesive applied to mating surfaces of receptacle and cab.

1. Install chain (7) and receptacle (4) to cab (3) with two new rivets (5).
2. Install cover (6) on receptacle (4).
3. Install two new lockwashers (8) and two wires (2) with two screws (1).
4. Install cab liners (WP 0176 00).



402-235

END OF WORK PACKAGE

TRAILER ELECTRICAL RECEPTACLES REPLACEMENT

0077 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

WP 0098 00

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

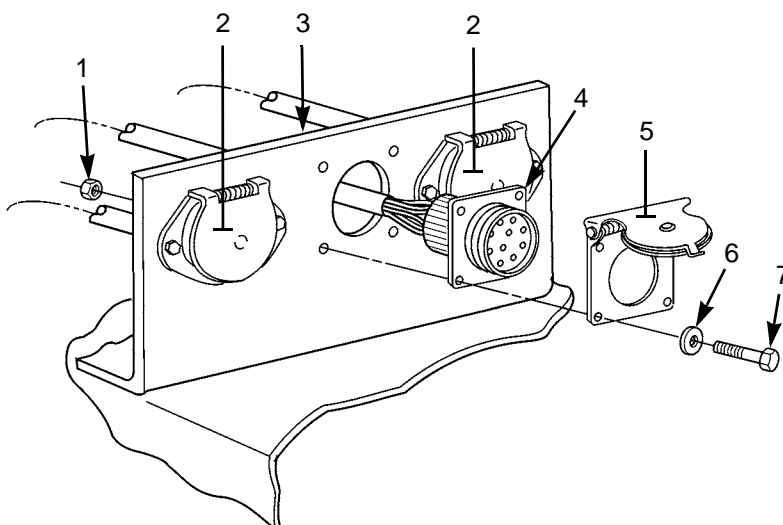
REMOVAL

1. Remove four nuts (1), washers (6), and bolts (7) from trailer electrical receptacle (4).
2. Remove trailer electrical receptacle (4) and cover (5) from bracket (3).

NOTE

Other two electrical receptacles use two nuts, washers, and bolts.

3. Repeat steps 1 and 2 for each of two other electrical receptacles (2).
4. Refer to WP 0098 00 to remove electrical receptacles (2 or 4) from electrical cable.



402-236

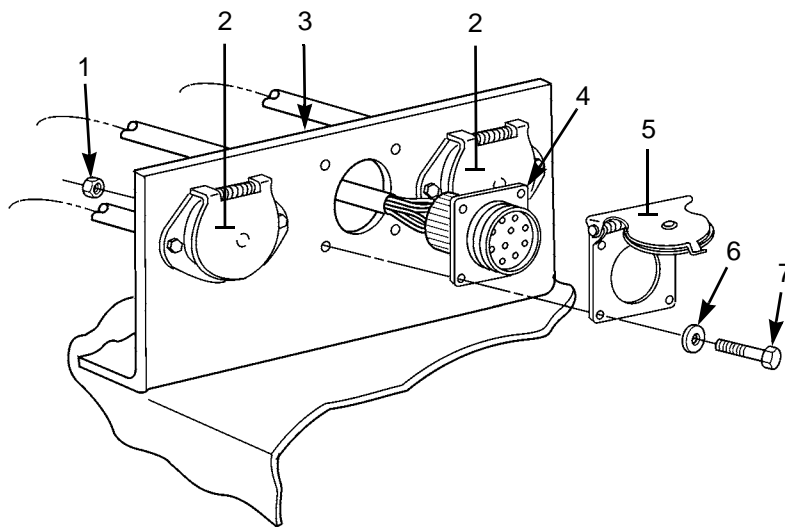
INSTALLATION

1. Refer to WP 0098 00 to install electrical receptacles (2 or 4) to electrical cable.
2. Position electrical receptacle (4) and cover (5) to bracket (3).
3. Install four bolts (7), washers (6), and nuts (1) to electrical receptacle (4).

NOTE

Other two electrical receptacles use two nuts, washers, and bolts.

4. Repeat steps 2 and 3 for each of two other electrical receptacles (2).



402-236

END OF WORK PACKAGE

HEADLAMP ADJUSTMENT

0078 00

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Tape, measuring, 50 feet (Item 96, WP 0313 00)

Equipment Conditions

Tires inflated to recommended pressure (TM 9-2320-303-10)

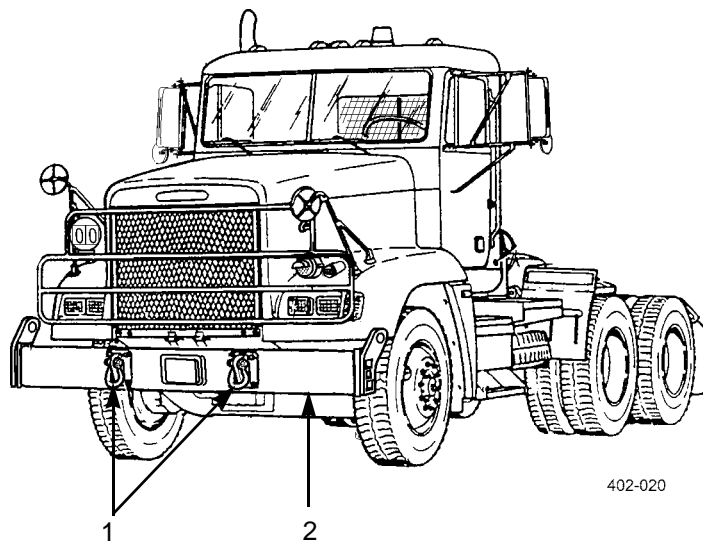
Headlights in ON position (TM 9-2320-303-10)

ADJUSTMENT

NOTE

Make sure all tires are properly inflated and there is no load on vehicle.

1. Determine centerline of vehicle by measuring distance between two tow brackets (1) and dividing by 2.
2. Measure distance determined in step 1 from either of two tow brackets (1) to center of bumper (2). Mark bumper.

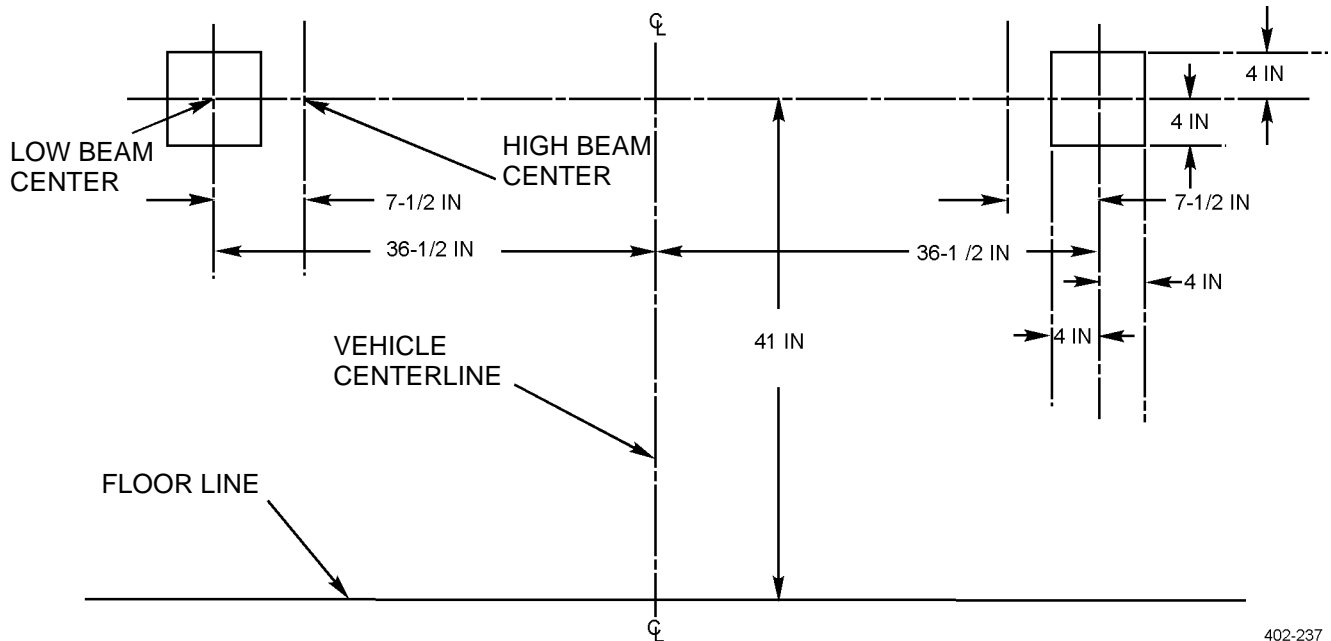


402-020

402-020

ADJUSTMENT - CONTINUED

3. Park vehicle 25 ft (7.63 m) from light colored wall and mark vehicle centerline on wall.
4. To determine low-beam headlamp centerline, measure 36.5 in. (92.7 cm) from centerline mark on both sides of centerline. Measure 41 in. (104.1 cm) from floor.
5. Measure 4 in. (10.2 cm) in all four directions from low-beam headlamp centerline to create 8-in (20.3 cm) square.
6. Repeat steps 4 and 5 for opposite low-beam headlamp.
7. To determine high-beam headlamp centerline, measure 7.5 in (19.1 cm) to right from centerline of left low-beam. Measure 7.5 in. (19.1 cm) to left from centerline of right low-beam.

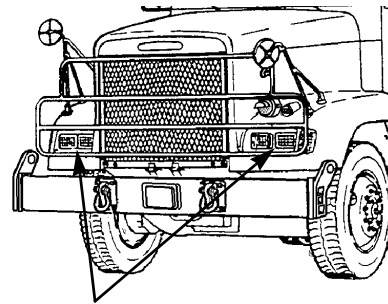
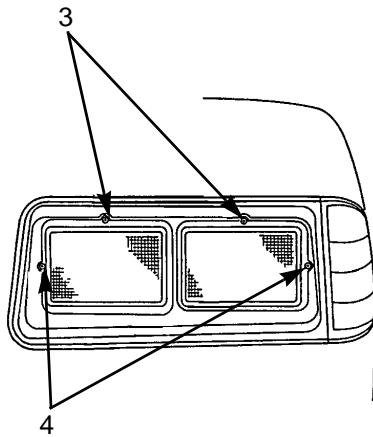


8. Repeat step 5 to create 8-in (20.3 cm) square for each high-beam headlamp.

402-237

ADJUSTMENT - CONTINUED

9. With headlamps on, adjust each headlamp until highest intensity point is just to right and just below headlamp centerline ± 4 in (± 10.2 cm). To adjust intensity point up or down, rotate center adjusting screw (3) left or right. To adjust intensity point left or right, rotate side adjusting screw (4) left or right.
10. With headlamps switched to high-beam, cover each low-beam headlamp with cardboard cut to 7.25 in x 5 in. (18.4 cm x 13 cm).
11. Adjust high-beam headlamp until highest intensity point is over centerline mark ± 4 in. (± 10.2 cm). To adjust intensity point up or down, rotate center adjusting screw (3) left or right. To adjust intensity point left or right, rotate side adjusting screw (4) left or right.



CARDBOARD
(7.25 IN. x 5 IN.)

402-238

END OF WORK PACKAGE

HEADLIGHT ASSEMBLY MAINTENANCE

0079 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Repair, Assembly, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Adhesive, silicone rubber (Item 5, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N 23-11488-110)

References

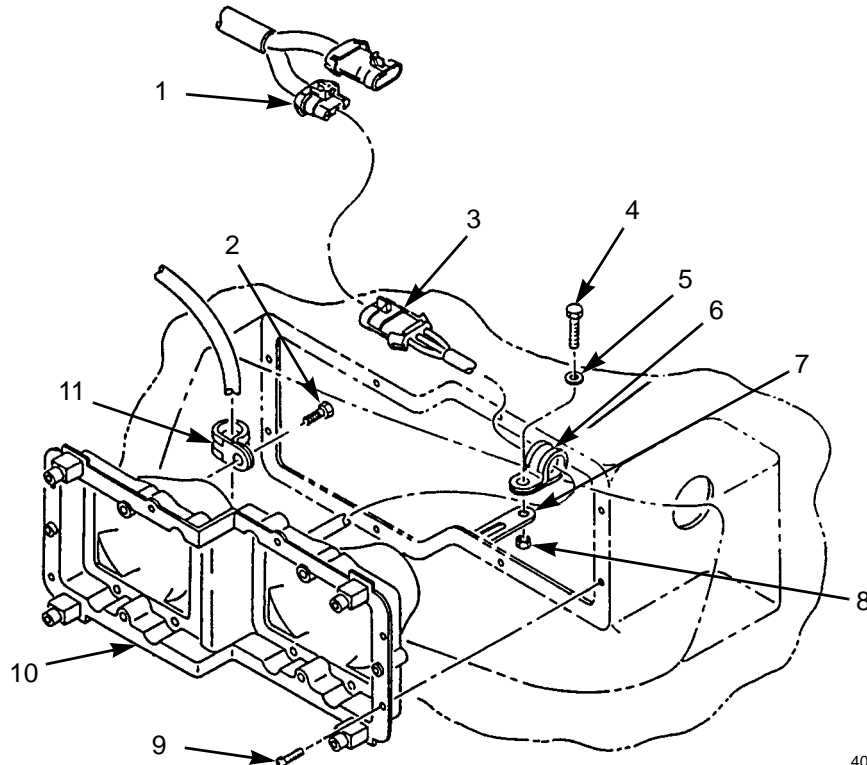
WP 0098 00

Equipment Condition

Headlamps removed (WP 0080 00)

REMOVAL

1. Disconnect 3-pin connector (3) from harness (1).
2. Remove locknut (8), screw (4), washer (5), and clamp (6) from bracket (7). Discard locknut.
3. Remove screw (2) and clamp (11) from headlight assembly (10).
4. Remove eight screws (9) and headlight assembly (10).



402-239

HEADLIGHT ASSEMBLY MAINTENANCE - CONTINUED**0079 00****DISASSEMBLY**

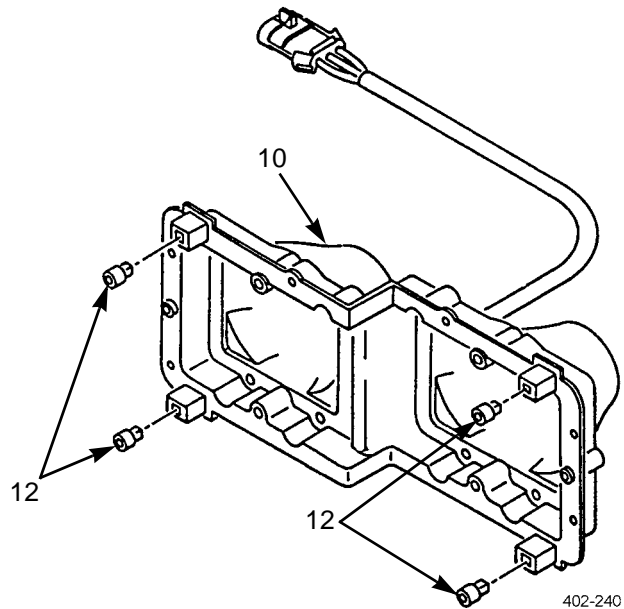
Remove four grommets (12) from headlight assembly (10).

REPAIR

Repair 3-pin connector in accordance with WP 0098 00.

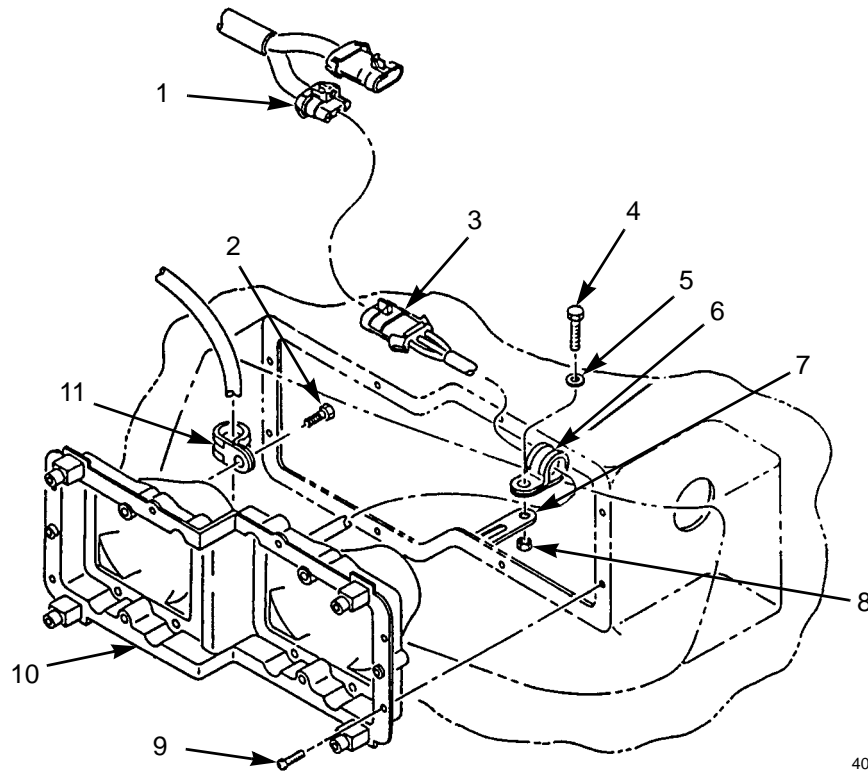
ASSEMBLY

Install four grommets (12) in headlight assembly (10).

**INSTALLATION**

1. Apply adhesive sealant to mating surface of headlight assembly (10) and install headlight assembly and eight screws (9).
2. Install clamp (11) and screw (2) in headlight assembly (10).
3. Install clamp (6), washer (5), screw (4), and new locknut (8) on bracket (7).
4. Connect 3-pin connector (3) to harness (1).

INSTALLATION - CONTINUED



402-239

5. Install headlamps (WP 0080 00).

END OF WORK PACKAGE

HEADLAMP REPLACEMENT

0080 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

WP 0078 00

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

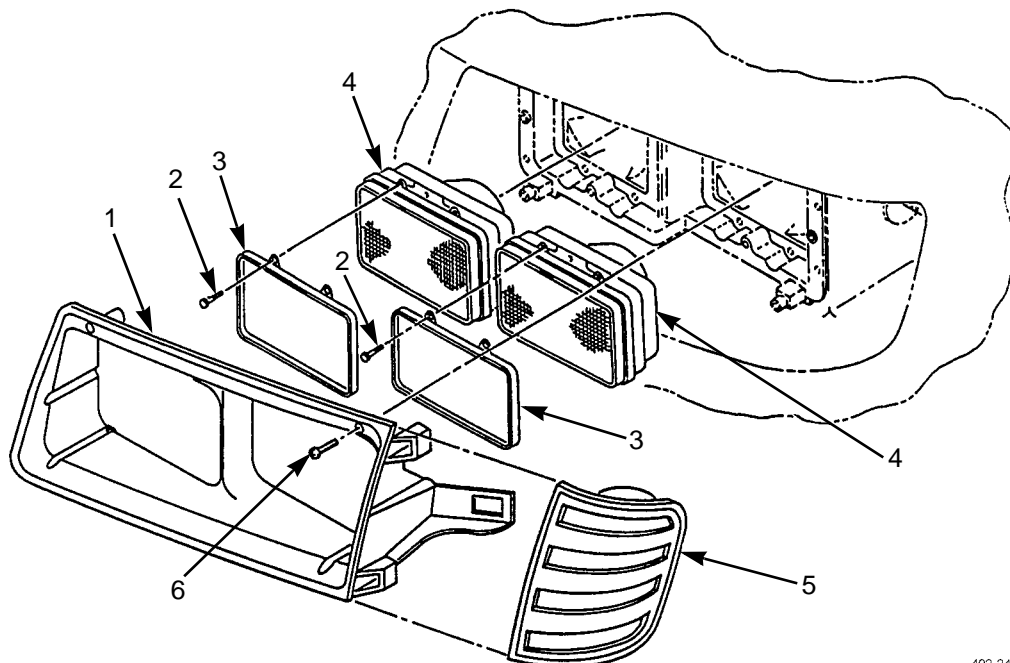
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL**NOTE**

Procedure is the same for all headlamps.

1. Remove four screws (6).
2. Disconnect turn signal light (5) and remove bezel (1).
3. Remove four screws (2) and headlamp retainer (3).
4. Remove headlamp (4).

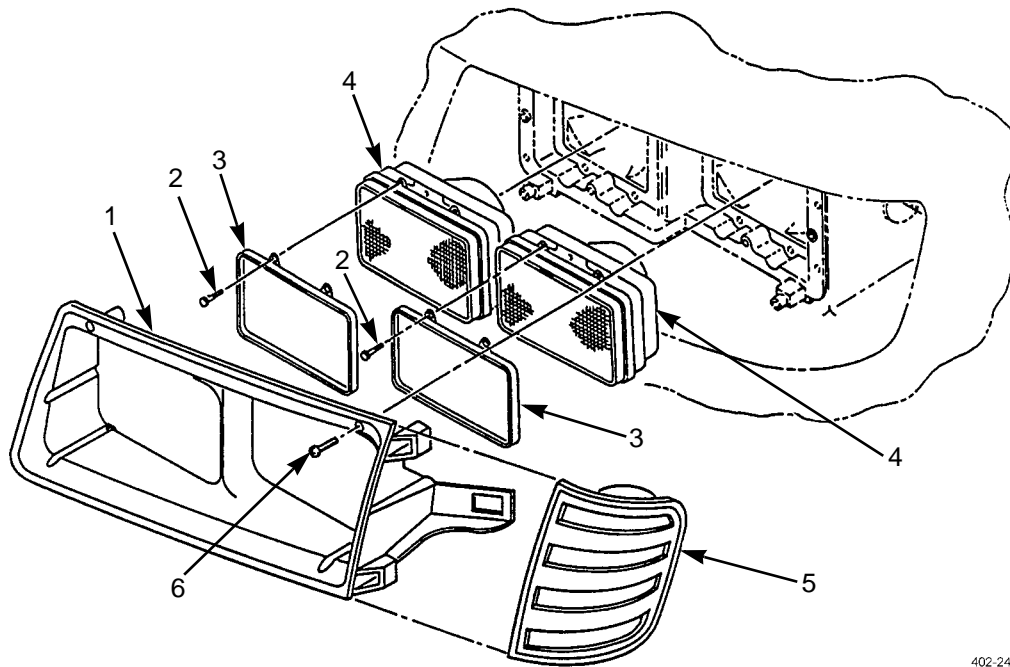


402-241

INSTALLATION**NOTE**

Procedure is the same for all headlamps.

1. Install headlamp (4).
2. Install headlamp retainer (3) and four screws (2).
3. Connect turn signal light (5) and install bezel (1) and four screws (6).



4. Adjust headlamps (WP 0078 00).

END OF WORK PACKAGE

LEFT/RIGHT TAILLIGHT MAINTENANCE (M915A4)

0081 00

THIS WORK PACKAGE COVERS

Lamp Replacement, Light Removal, Light Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Nut, lock (P/N 23-0106-06) (3)

Tools and Special Tools

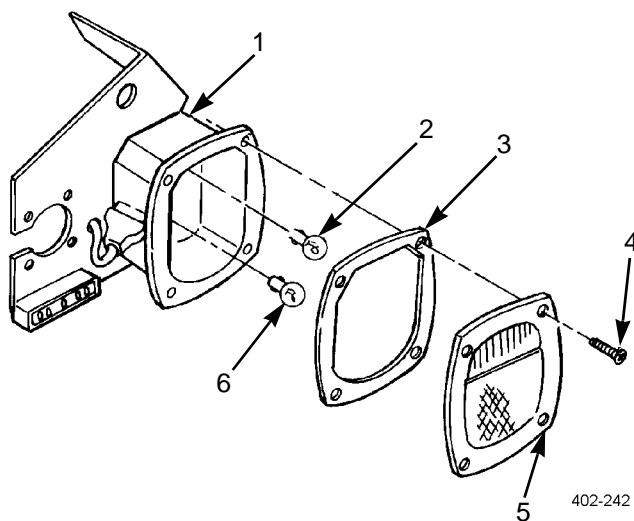
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

LAMP REPLACEMENT

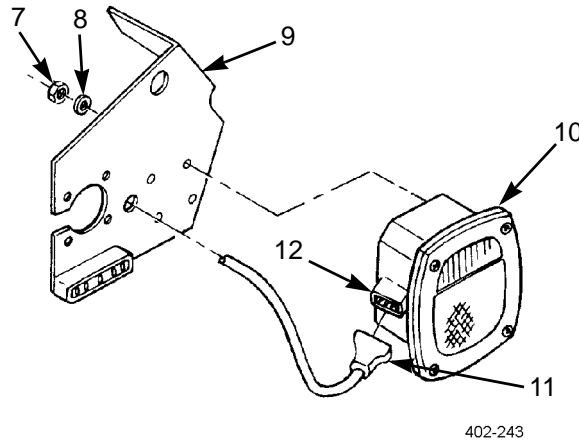
1. Remove four screws (4) and lens (5) from taillight housing (1).
2. Inspect gasket (3) for damage. Replace if damaged.
3. Press down and turn counterclockwise to remove lamp (2) and lamp (6).
4. Press down and turn clockwise to install lamp (2) and lamp (6).
5. Install lens (5) on taillight housing (1) with four screws (4).



LIGHT REMOVAL**NOTE**

Left and right taillights are removed the same. Left taillight is shown.

1. Disconnect taillight wiring harness connector (11) from taillight connector (12).
2. Remove three locknuts (7), washers (8), and taillight assembly (10) from bracket (9). Discard locknuts.

**LIGHT INSTALLATION****NOTE**

Left and right taillights are installed the same. Left taillight is shown.

1. Install taillight assembly (10) to bracket (9) with three washers (8) and new locknuts (7).
2. Connect taillight wiring harness connector (11) to taillight connector (12).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 102, WP 0313 00)
- Wrench set, socket attachment, screwdriver, torx (Item 114, WP 0313 00)

Materials/Parts

- Straps, tiedown (Item 41, WP 0312 00)
- Tags, marker (Item 42, WP 0312 00)
- Nut, lock (P/N 23-09336-005) (6)

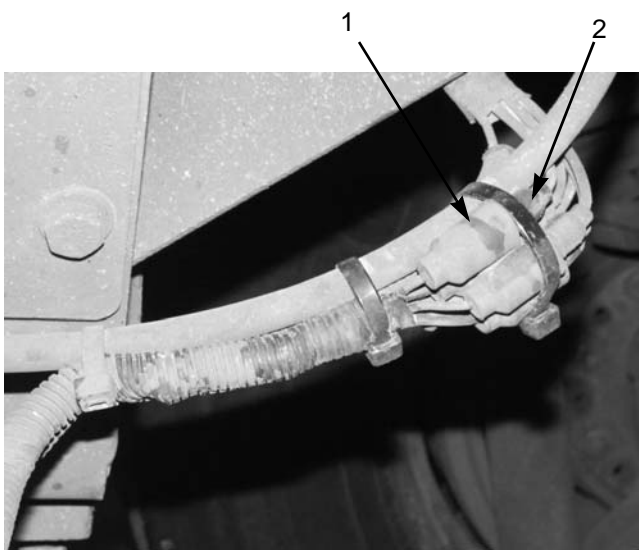
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

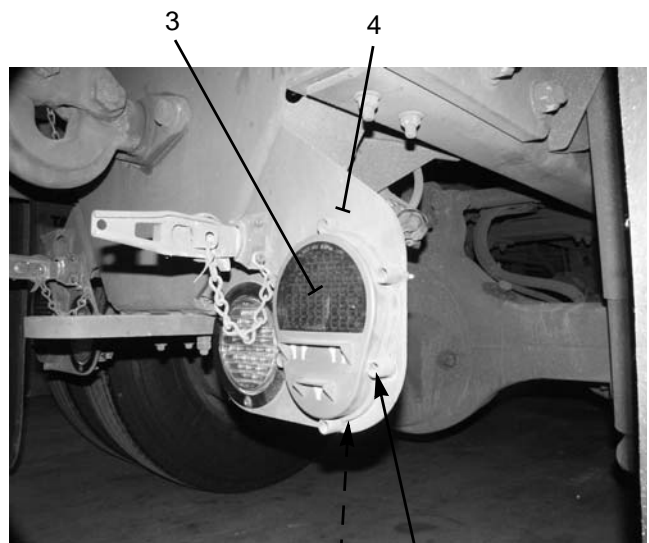
REMOVAL

NOTE

- Cut tiedown straps and discard. Use new tiedown straps on installation.
 - Tag connectors to ensure correct installation.
1. Disconnect five taillight connectors (1) from wiring harness connectors (2).
 2. Remove six locknuts (5), washers (6), torx screws (7), taillight (3), and gasket (8) from bracket (4). Discard locknuts.



426-041

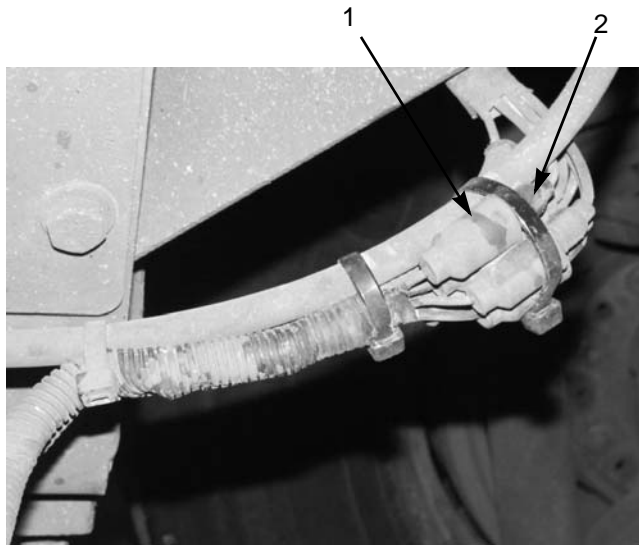


426-040

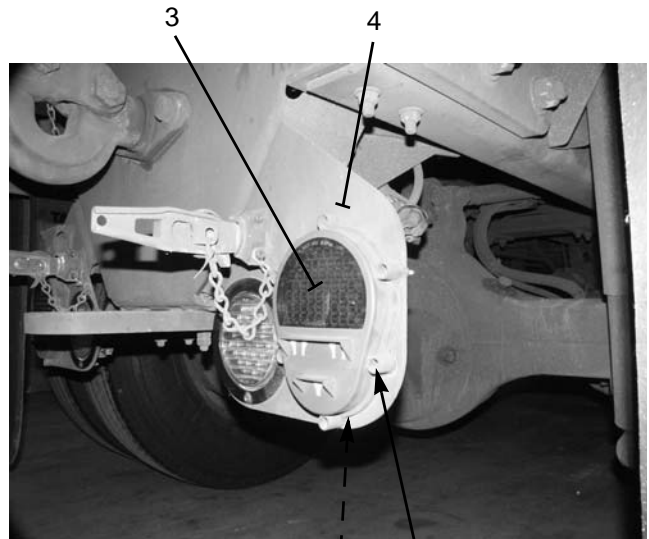
8 5,6,7

INSTALLATION**NOTE**

- Replacement taillight comes with a gasket.
 - Ensure that mounting surface for taillight is clean and free of old gasket material.
1. Install gasket (8) and taillight (3) to bracket (4) with six torx screws (7), washers (6), and new locknuts (5).
 2. Connect five taillight connectors (1) to wiring harness connectors (2). Install new tiedown straps.



426-041



426-040

8 5,6,7

END OF WORK PACKAGE

BLACKOUT LIGHT LAMP UNIT REPLACEMENT

0082 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Gasket (P/N 12468576)

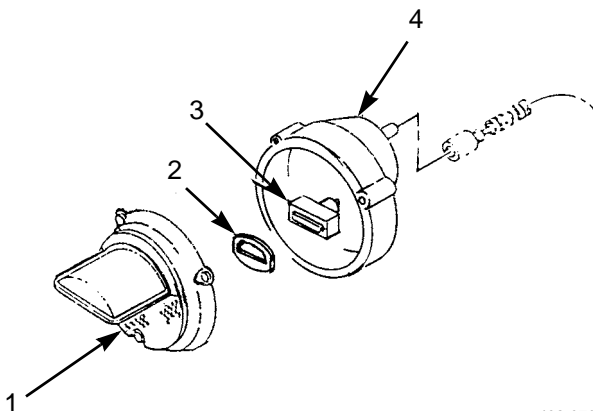
Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)**Equipment Condition**Master battery switch in OFF position (TM 9-2320-
303-10)

REMOVAL

1. Disconnect connector from rear of body (4).
2. Loosen three captive screws on cover (1) and remove cover.
3. Remove gasket (2) and lamp unit (3) from body (4). Discard gasket.

INSTALLATION

1. Install lamp unit (3) and new gasket (2) in body (4).
2. Position cover (1) on body (4) and tighten three captive screws.
3. Connect connector to rear of body (4).



402-973

END OF WORK PACKAGE

0082 00-1 (0082 00-2 Blank)

SIDE MARKER/TURN SIGNAL LIGHT REPLACEMENT (M915A4)

0083 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Gasket (P/N GNI/9700G1)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

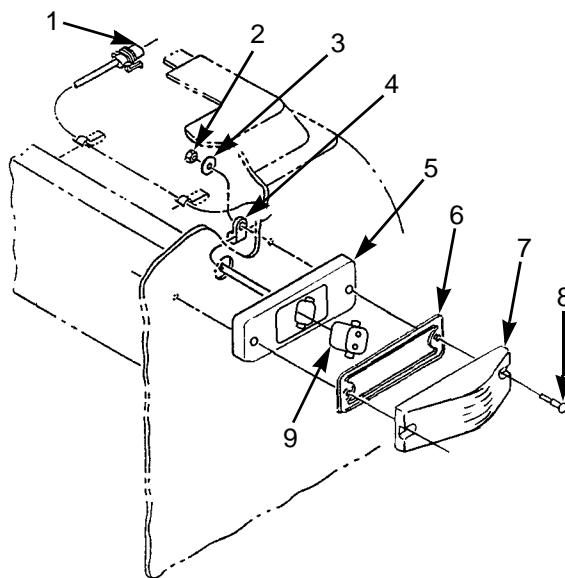
Master battery switch in OFF position (TM 9-2320-303-10)

NOTE

Left and right side marker/turn signal lights are replaced the same way. Left side marker/turn signal light is shown.

REMOVAL

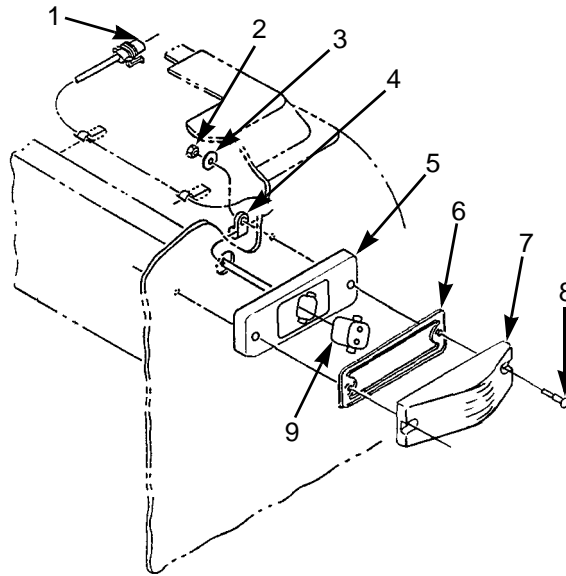
1. Remove two locknuts (2), washers (3), clamp (4), two screws (8), lens cover (7), and gasket (6) from side marker/turn signal light (5). Discard gasket.
2. Remove lamp (9) from side marker/turn signal light (5).
3. Disconnect connector (1) from side marker/turn signal light (5). Remove side marker/turn signal light from vehicle.



402-245

SIDE MARKER/TURN SIGNAL LIGHT REPLACEMENT (M915A4) - CONTINUED**0083 00****INSTALLATION**

1. Position side marker/turn signal light (5) on vehicle and connect connector (1).
2. Install lamp (9) on side marker/turn signal light (5).
3. Install new gasket (6), lens cover (7), and clamp (4) on side marker/turn signal light (5) with two screws (8), washers (3), and locknuts (2).



402-245

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

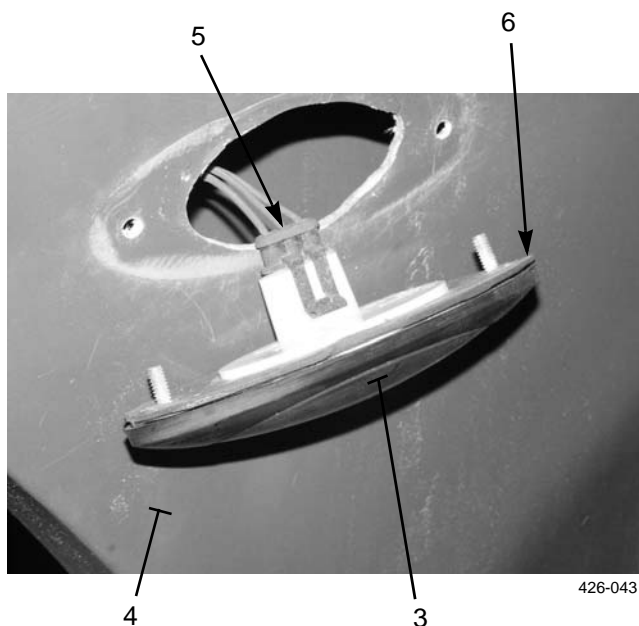
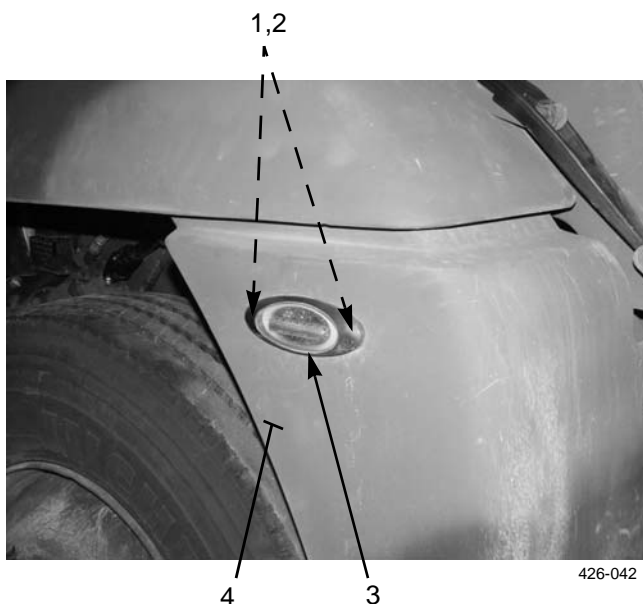
Hood opened (TM 9-2320-303-10)

REMOVAL

NOTE

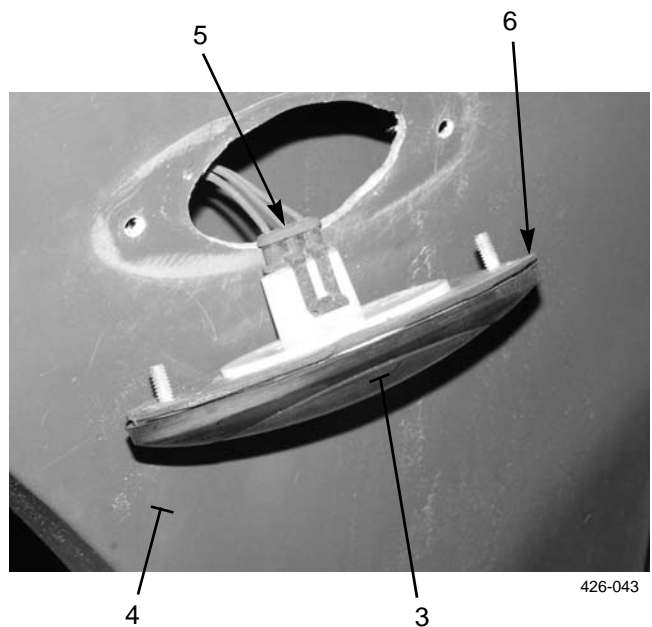
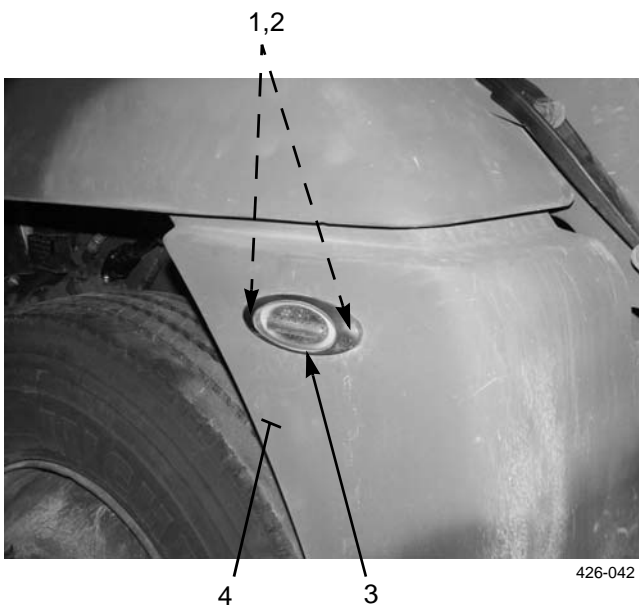
Note orientation of side marker/turn signal light to ensure correct installation.

1. Remove two nuts (1) and washers (2). Push outward on side marker/turn signal light (3) and remove from front fender extension (4).
2. Disconnect jumper harness connector (5) from back of side marker/turn signal light (3) and remove light and gasket (6) from front fender extension (4).



INSTALLATION**NOTE**

- Replacement side marker/turn signal light comes with a gasket.
 - Ensure that mounting surface for side marker/turn signal light is clean and free of old gasket material.
1. Position gasket (6) and side marker/turn signal light (3) at front fender extension (4). Connect jumper harness connector (5) to back of light.
 2. Install side marker/turn signal light (3) to front fender extension (4) with two washers (2) and nuts (1).
 3. Close hood (TM 9-2320-303-10).

**END OF WORK PACKAGE**

CLEARANCE LIGHT REPLACEMENT (M915A4)

0084 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

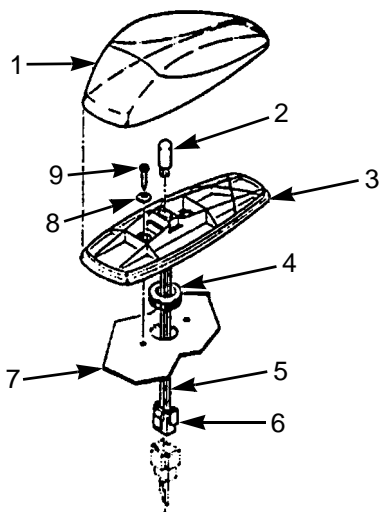
Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Head liners removed (WP 0177 00)

REMOVAL

1. Remove lens cover (1), lamp (2), two screws (9), and two washers (8) from clearance light (3).
2. Remove clearance light (3).
3. Disconnect connector (6) and pull harness (5) through hole.
4. Remove grommet (4) from cab (7).



402-246

INSTALLATION

1. Install grommet (4) in cab (7).
2. Feed harness (5) through hole.
3. Connect connector (6).
4. Install clearance light (3), two washers (8), two screws (9), lamp (2), and lens cover (1).
5. Install head liners (WP 0177 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Personnel Required

Two

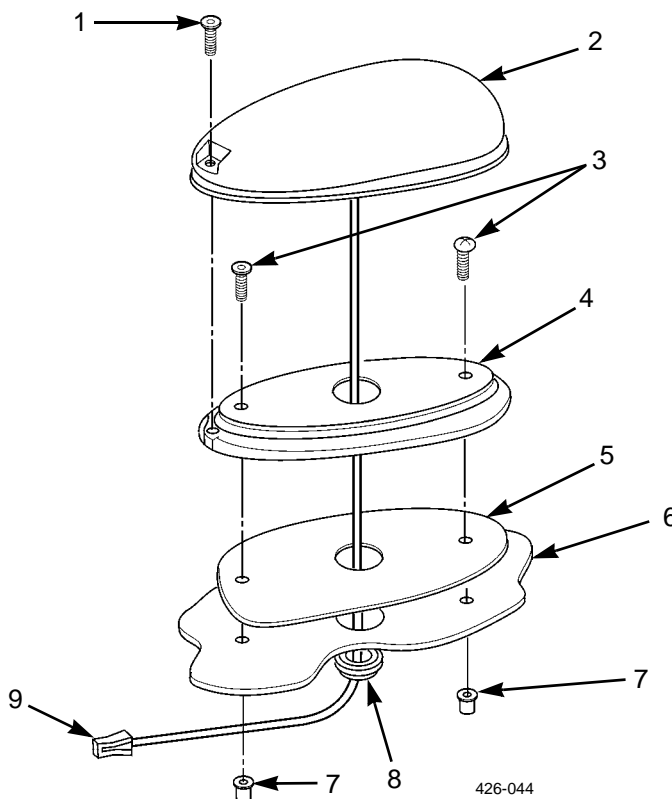
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Headliner(s) removed (WP 0177 00)

REMOVAL

1. From inside cab, disconnect wiring harness connector from clearance light connector (9).
2. Remove screw (1) from lens assembly (2).
3. Remove lens assembly (2) from lens base (4) feeding clearance light connector (9) through grommet (8).
4. With assistance, remove two threaded inserts (7), screws (3), lens base (4), and gasket (5) from cab roof (6).
5. Remove grommet (7) from cab roof (6).

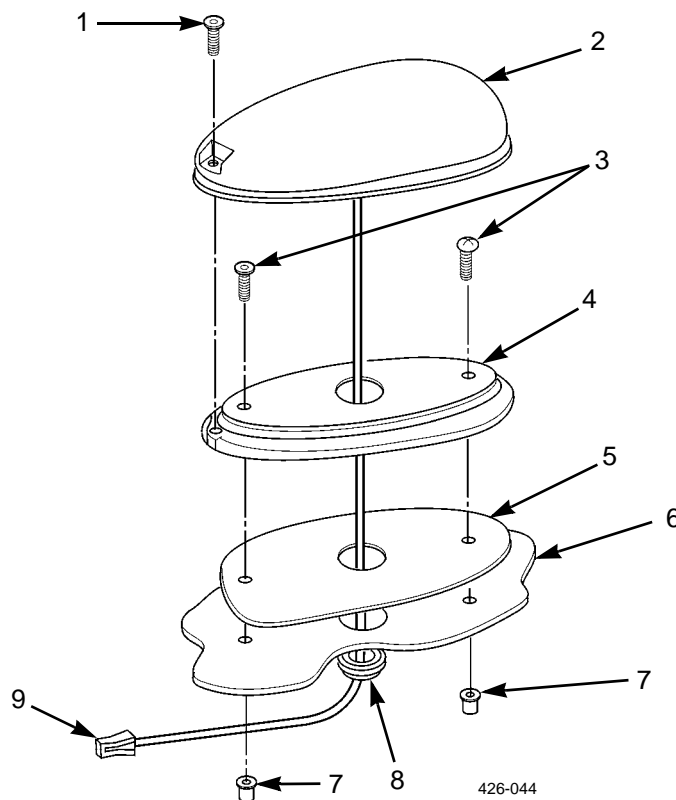


426-044

INSTALLATION**NOTE**

Clearance light must be positioned with "FRONT" printed on base facing front of vehicle.

1. Position grommet (8), gasket (5), and lens base (4) on cab roof (6) with clearance light connector (9) from lens assembly (2) through opening in roof. Seat grommet in opening in roof.
2. Install two screws (3) and threaded inserts (7).
3. Connect wiring harness connector to clearance light connector (9).
4. Position lens assembly (2) on lens base (4) and install screw (1).



5. Install headliner(s) (WP 0177 00).

END OF WORK PACKAGE

UTILITY LIGHT REPLACEMENT

0085 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Personnel Required

Two

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Materials/Parts

Nut, lock (P/N M45913/1-4CG5C) (6)

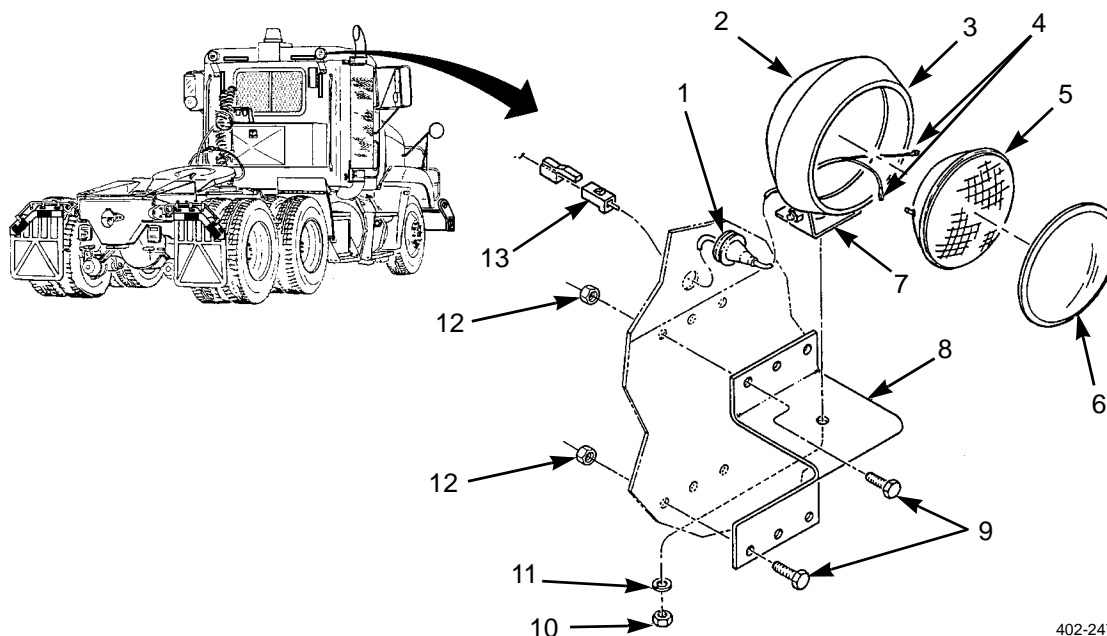
Cab liners removed (WP 0176 00)

Washer, lock (P/N MS35335-36)

Head liners removed (WP 0177 00)

REMOVAL

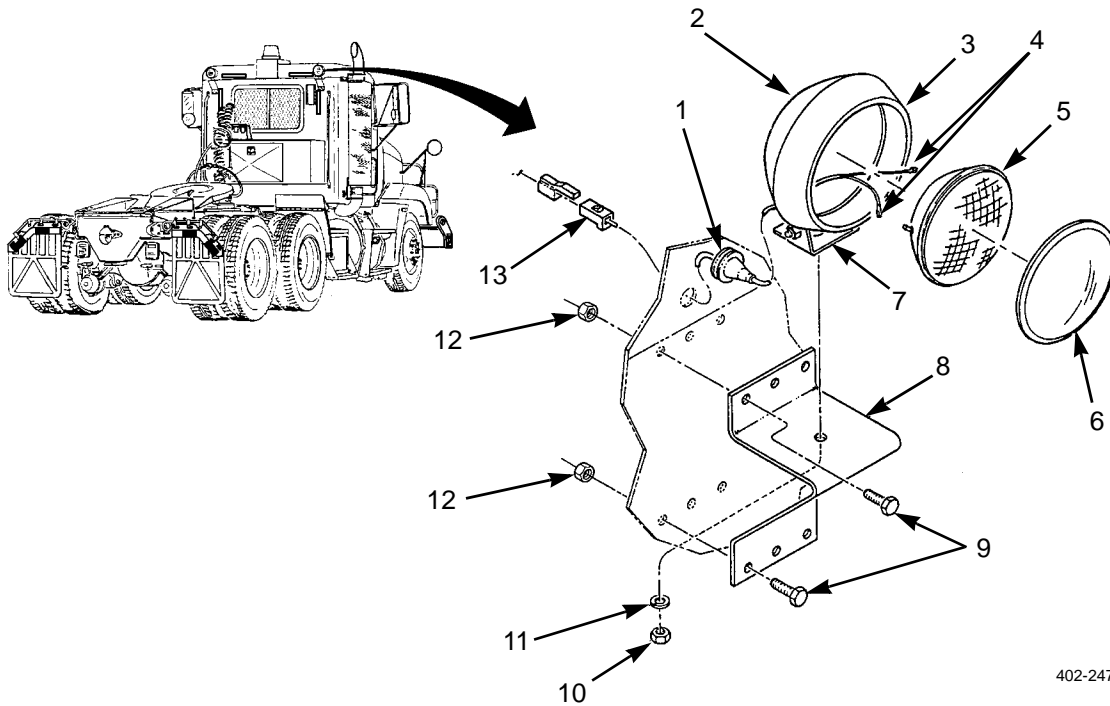
1. Remove lens retainer (6) from utility light (2).
2. Roll back rubber seal (3), remove lamp (5), and disconnect two wires (4).
3. Disconnect connector (13) and remove grommet (1).
4. Remove six locknuts (12), six screws (9), and mounting bracket (8). Discard locknuts.
5. Pull connector (13) out of cab.
6. Remove nut (10), lockwasher (11), and mounting bracket (7) from utility light (2). Discard lockwasher.



402-247

INSTALLATION

1. Install mounting bracket (7), new lockwasher (11), and nut (10) on utility light (2).
2. Feed connector (13) into cab.
3. Install mounting bracket (8), six screws (9), and six new locknuts (12).
4. Install grommet (1) and connect connector (13).
5. Connect two wires (4), install lamp (5), and roll rubber seal (3) over lamp (5).
6. Install lens retainer (6) on utility light (2).



7. Install cab liners (WP 0176 00).
8. Install head liners (WP 0177 00).

END OF WORK PACKAGE

INTERIOR LIGHT UNIT AND BULB REPLACEMENT

0086 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Lamp, incandescent (P/N 561)

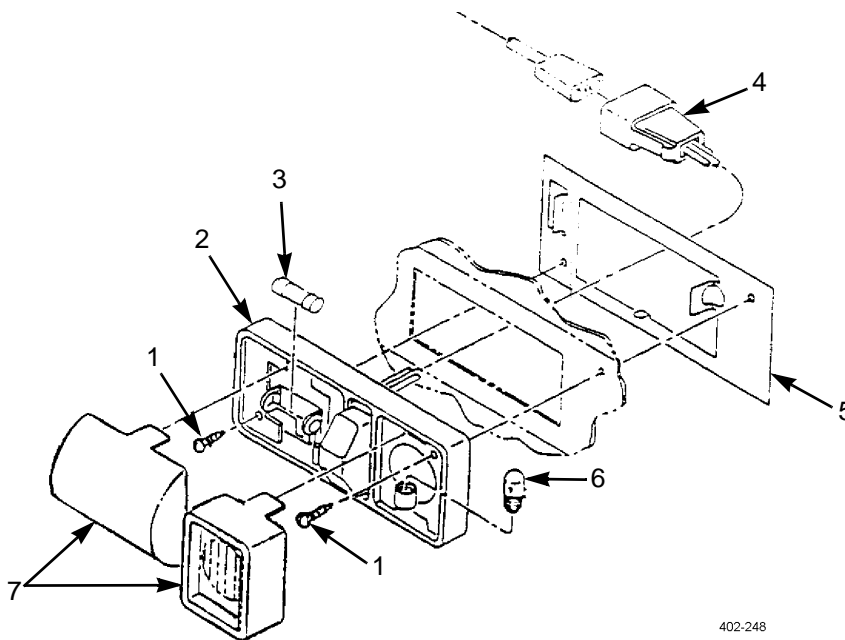
Lamp, incandescent (P/N AN3121-1816)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove two covers (7) and incandescent lamps (3 and 6) from light unit (2).
2. Remove two screws (1) and light unit (2) from mounting bracket (5).
3. Pull light unit (2) down and disconnect connector (4) from cab wiring harness.



402-248

INSTALLATION

1. Connect connector (4) to cab wiring harness.
2. Install light unit (2) on mounting bracket (5) with two screws (1).
3. Install two incandescent lamps (3 and 6) on light unit (2).
4. Install two covers (7) on light unit (2).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

TM 9-2320-303-10
WP 0141 00

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

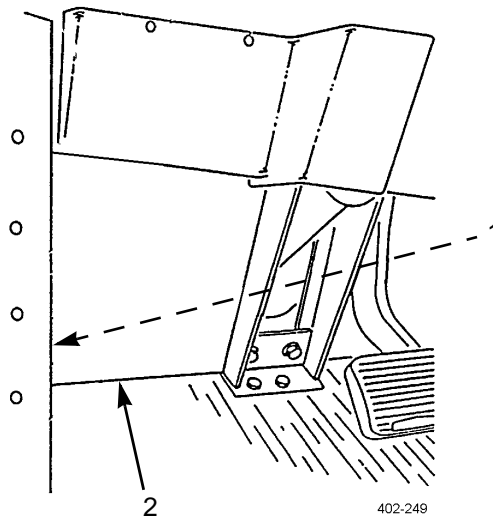
Equipment Condition

Air system drained (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove three screws (1) and cover (2).

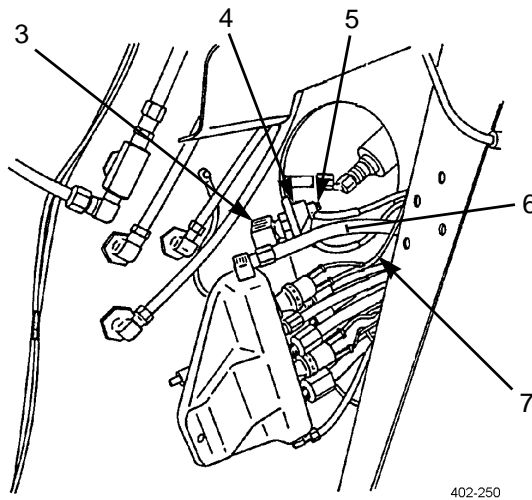


2. If necessary, remove cab air junction block (WP 0141 00) to access brake light/trailer brake light sending unit.

REMOVAL - CONTINUED**NOTE**

Tag electrical wires to aid in installation.

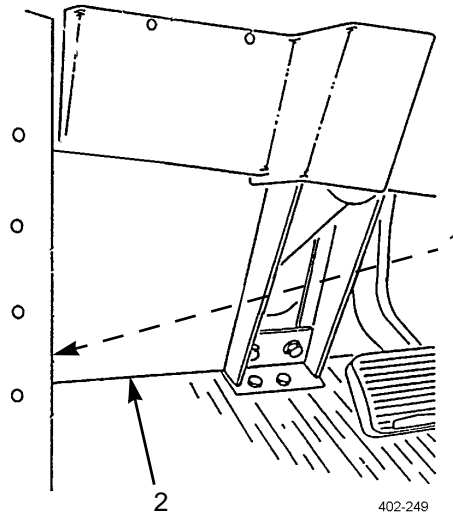
3. Remove two locknuts (5) and electrical wires (6 and 7) from brake light/trailer brake light sending unit (4). Discard locknuts.
4. Remove brake light/trailer brake light sending unit (4) from elbow (3).

**INSTALLATION****WARNING**

- Adhesives 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 a well-ventilated area. If adhesive or sealing compound contacts skin or clothing, wash immediately with soap and water.
 - Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.
1. Lightly coat threads of brake light/trailer brake light sending unit (4) with pipe sealing compound. Install sending unit on elbow (3).
 2. Install two electrical wires (6 and 7) on brake light/trailer brake light sending unit (4) with two new locknuts (5).

INSTALLATION - CONTINUED

3. If removed, install cab air junction block (WP 0141 00).
4. Install cover (2) with three screws (1).



5. Check air system for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment, screwdriver, torx (Item 114, WP 0313 00)

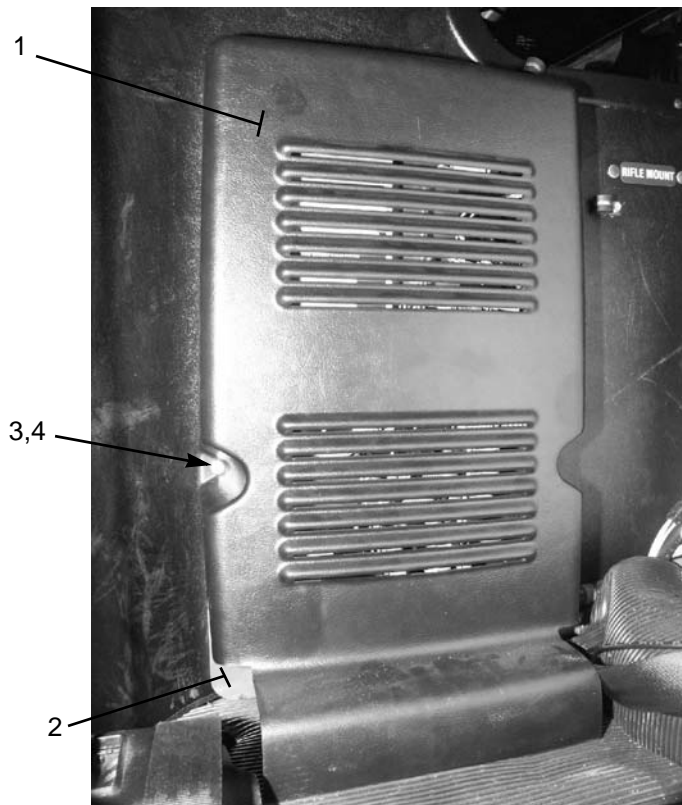
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Passenger seat as far forward as possible (TM 9-2320-303-10)

REMOVAL

1. Behind passenger seat, remove two screws (3), washers (4), and plastic cover (1) from plate (2).



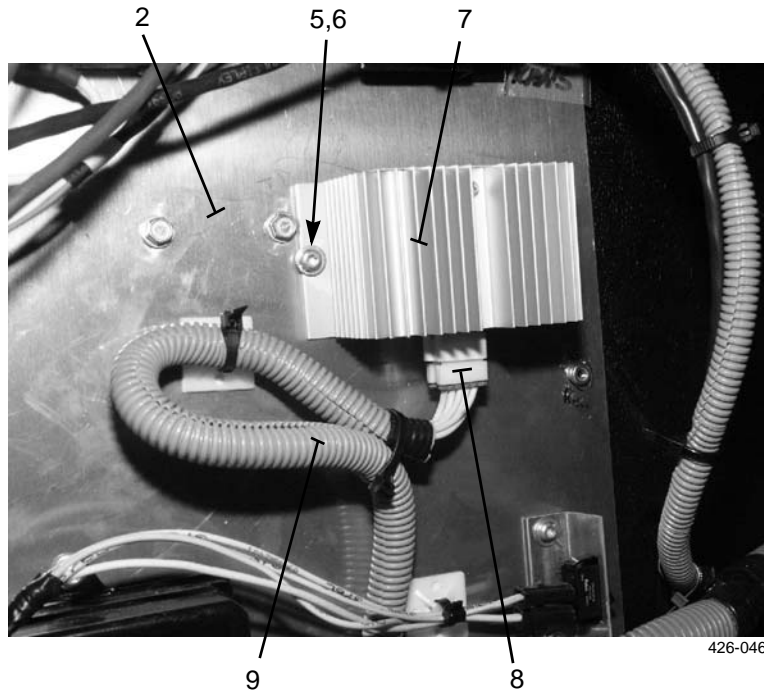
426-045

**DAYTIME RUNNING LIGHTS (DRL) CONTROL MODULE REPLACEMENT
(M915A4R2) - CONTINUED**

0087 01

REMOVAL - CONTINUED

2. At bottom of DRL control (7), disconnect connector (8) of wiring harness (9).
3. Remove two screws (5), washers (6), and DRL control (7) from plate (2).

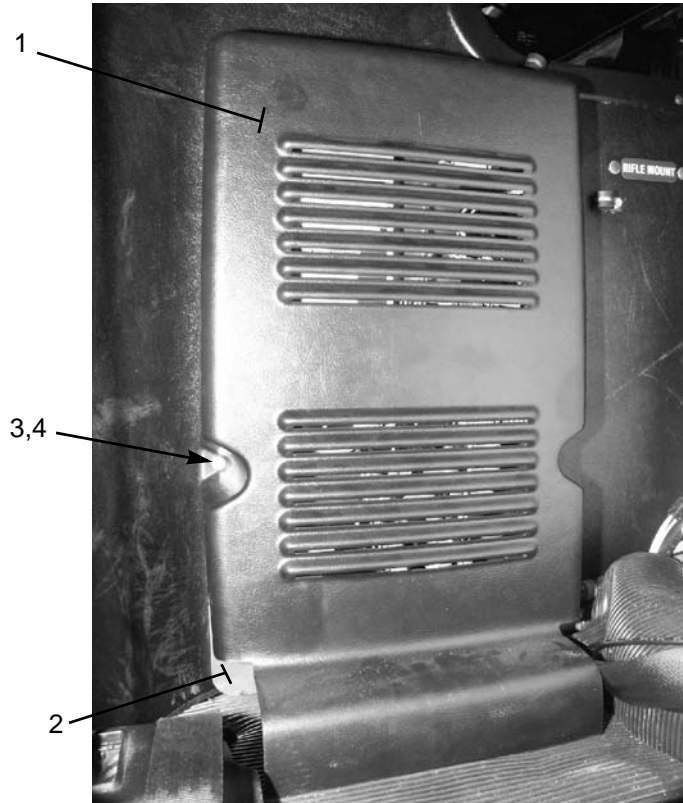
**INSTALLATION**

1. Install DRL control (7) to plate (2) with two washers (6) and screws (5).
2. Connect connector (8) of wiring harness (9) to bottom of DRL control (7).
3. Install plastic cover (1) to plate (2) with two washers (4) and screws (3).

**DAYTIME RUNNING LIGHTS (DRL) CONTROL MODULE REPLACEMENT
(M915A4R2) - CONTINUED**

0087 01

INSTALLATION - CONTINUED



END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment, screwdriver, torx (Item 114, WP 0313 00)

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Tape, insulation, electrical (Item 45, WP 0312 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

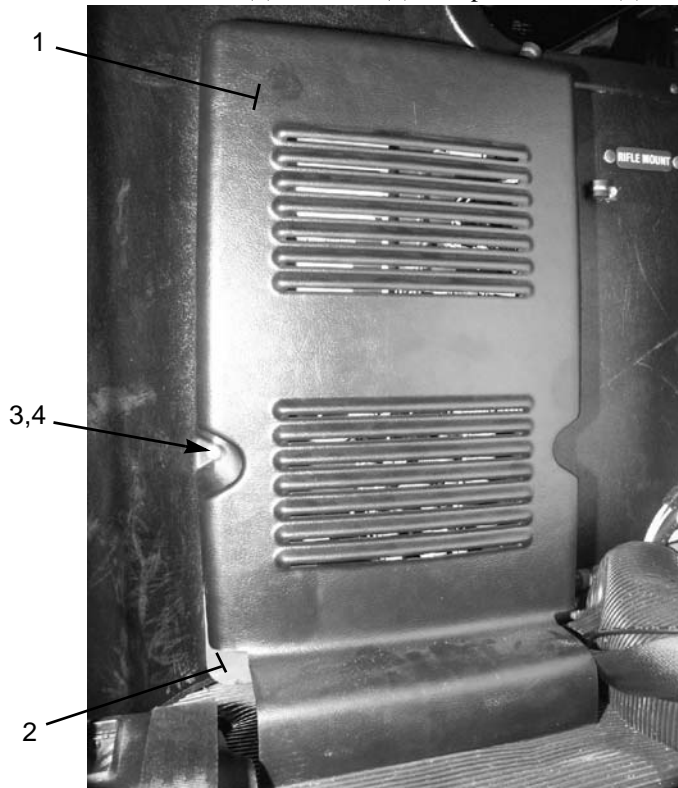
Passenger seat as far forward as possible (TM 9-2320-303-10)

REMOVAL

NOTE

Remove and discard tiedown straps and electrical tape as necessary.

1. Behind passenger seat, remove two screws (3), washers (4), and plastic cover (1) from plate (2).



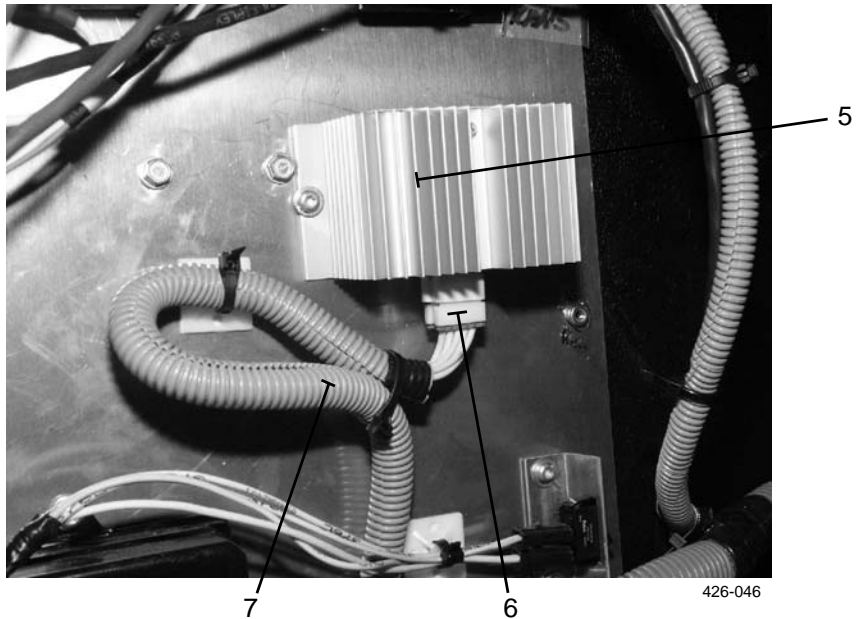
426-045

**DAYTIME RUNNING LIGHTS (DRL) WIRING HARNESS REPLACEMENT
(M915A4R2) - CONTINUED**

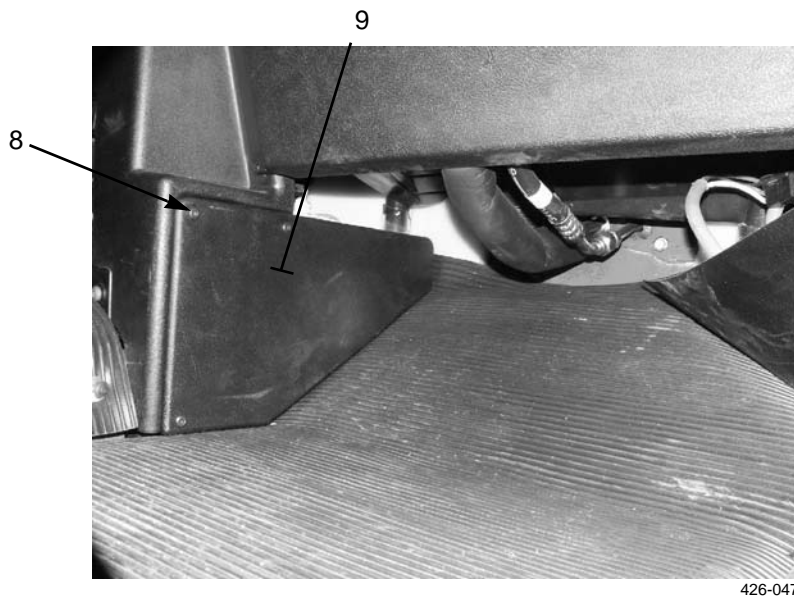
0087 02

REMOVAL - CONTINUED

2. At bottom of DRL control (5), disconnect connector (6) of DRL wiring harness (7).



3. Remove three screws (8) and access cover (9) at passenger side of cab floor.



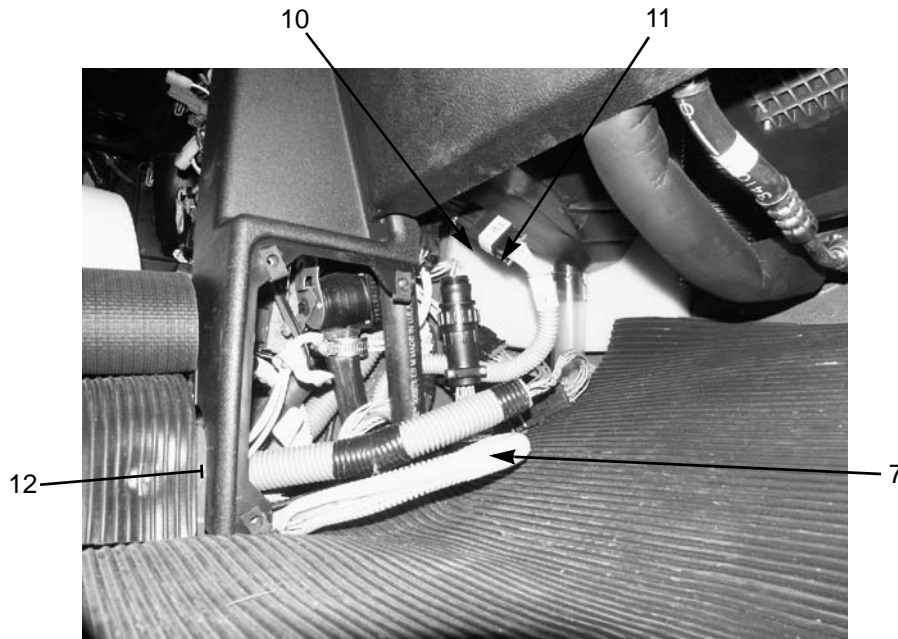
4. Trace DRL wiring harness (7) forward through transmission access tunnel (12).
5. Disconnect DRL wiring harness connector (11) from wiring harness (10).
6. Tie a suitable lacing wire or rope to DRL wiring harness (7) connector (11). Remove wiring harness from vehicle by pulling harness rearward through transmission access tunnel (12). DO NOT remove lacing wire or rope from tunnel.

**DAYTIME RUNNING LIGHTS (DRL) WIRING HARNESS REPLACEMENT
(M915A4R2) - CONTINUED**

0087 02

REMOVAL - CONTINUED

7. As required, remove conduit from DRL wiring harness (7).



426-048

INSTALLATION**NOTE**

Install new tiedown straps and electrical tape as required.

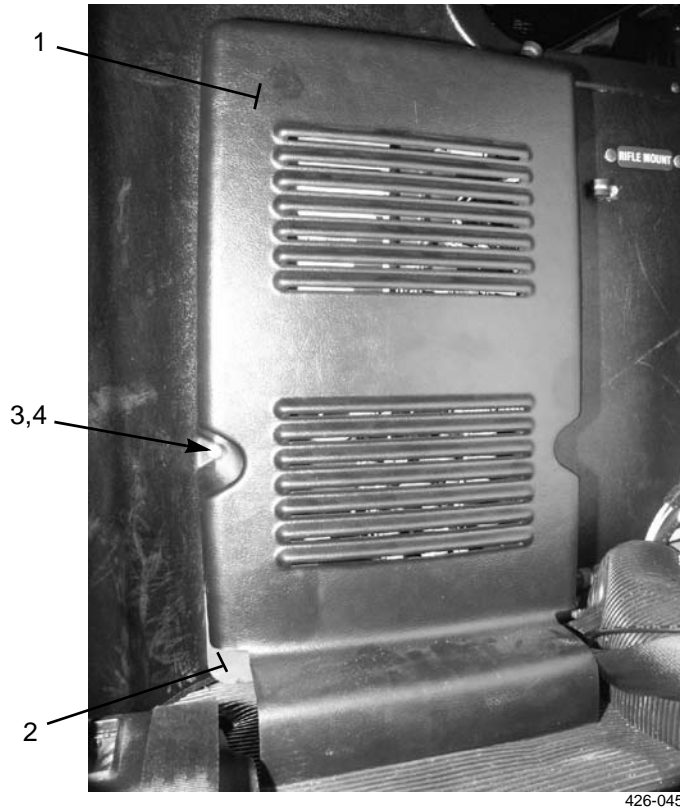
1. If removed, install conduit to DRL wiring harness (7).
2. Position DRL wiring harness (7) between points of connection.
3. Tie lacing wire or rope to DRL wiring harness (7) connector (11). Pull wiring harness forward through transmission access tunnel (12).
4. Connect DRL wiring harness connector (11) to wiring harness (10).
5. Install access cover (9) with three screws (8).
6. Connect connector (6) of DRL wiring harness (7) to bottom of DRL control (5).

**DAYTIME RUNNING LIGHTS (DRL) WIRING HARNESS REPLACEMENT
(M915A4R2) - CONTINUED**

0087 02

INSTALLATION - CONTINUED

7. Install plastic cover (1) to plate (2) with two washers (4) and screws (3).



END OF WORK PACKAGE

AIR PRESSURE SENDING UNITS (PRIMARY/SECONDARY) REPLACEMENT

0088 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

WP 0141 00

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Air system drained (TM 9-2320-303-10)

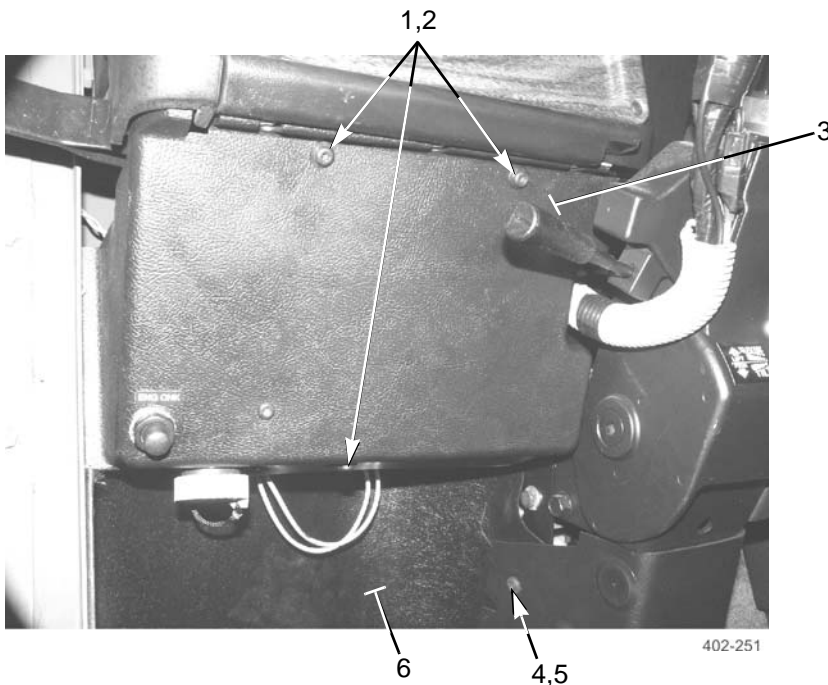
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

Tag air lines and wires to aid in installation.

1. Remove three screws (1) and washers (2) to separate lower dash cover (3) from dashboard.
2. Remove five screws (4) washers (5), and cover (6).



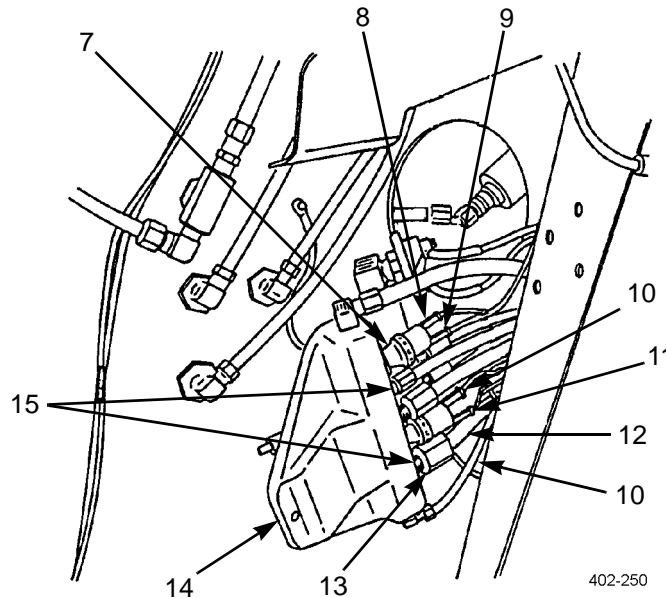
NOTE

If necessary, remove cab air junction block (WP 0141 00) for access to sensors.

REMOVAL - CONTINUED**NOTE**

Perform steps 3 through 5 to remove primary air pressure sending unit.

3. Remove two air lines (10) and fittings (15) from cab air junction block (14).
4. Disconnect two electrical connectors (11 and 12) from primary air pressure sending unit (13).
5. Remove primary air pressure sending unit (13) from cab air junction block (14).

**NOTE**

Perform steps 6 and 7 to remove secondary air pressure sending unit.

6. Disconnect two electrical connectors (8 and 9) from secondary air pressure sending unit (7).
7. Remove secondary air pressure sending unit (7) from cab air junction block (14).

INSTALLATION

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

INSTALLATION - CONTINUED**NOTE**

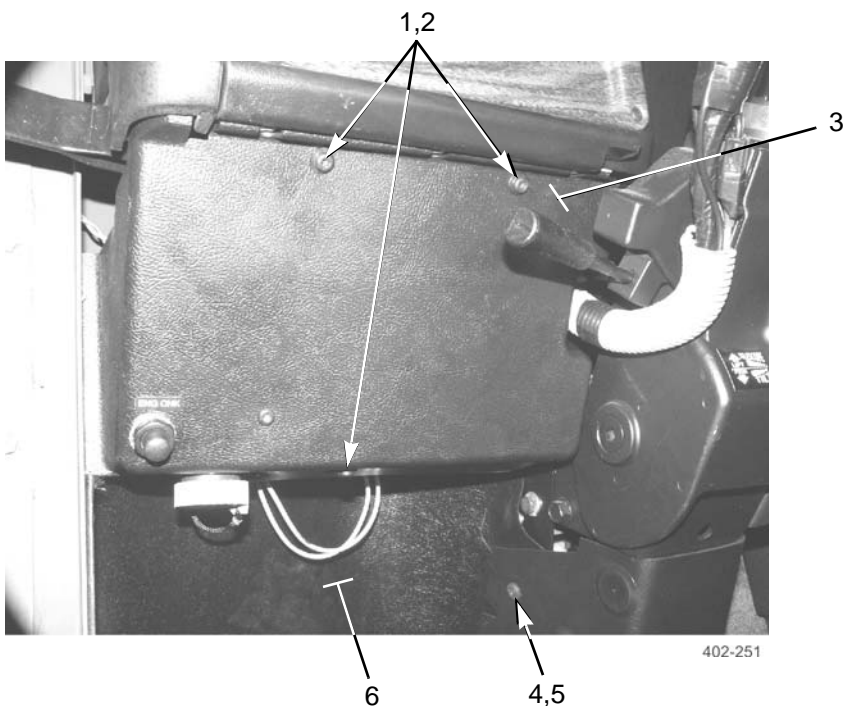
Perform steps 1 and 2 to install secondary air pressure sending unit.

1. Lightly coat threads of secondary air pressure sending unit (7) with pipe sealing compound. Install sending unit on cab air junction block (14).
2. Connect two electrical connectors (8 and 9) to secondary air pressure sending unit (7).

NOTE

Perform steps 3 through 6 to install primary air pressure sending unit.

3. Lightly coat threads of primary air pressure sending unit (13) with pipe sealing compound. Install sending unit on air junction block (14).
4. Connect two electrical connectors (11 and 12) to primary air pressure sending unit (13).
5. Lightly coat threads of two fittings (15) with pipe sealing compound. Install fittings on cab air junction block (14).
6. Install two air lines (10) on fittings (15).
7. If removed, install cab air junction block (WP 0195 00).
8. Install cover (6) with five washers (5) and screws (4).
9. Install cover (3) with three washers (2) and screws (1).
10. Check air system for leaks (TM 9-2320-303-10).

**END OF WORK PACKAGE**

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

WP 0141 00

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Air system drained (TM 9-2320-303-10)

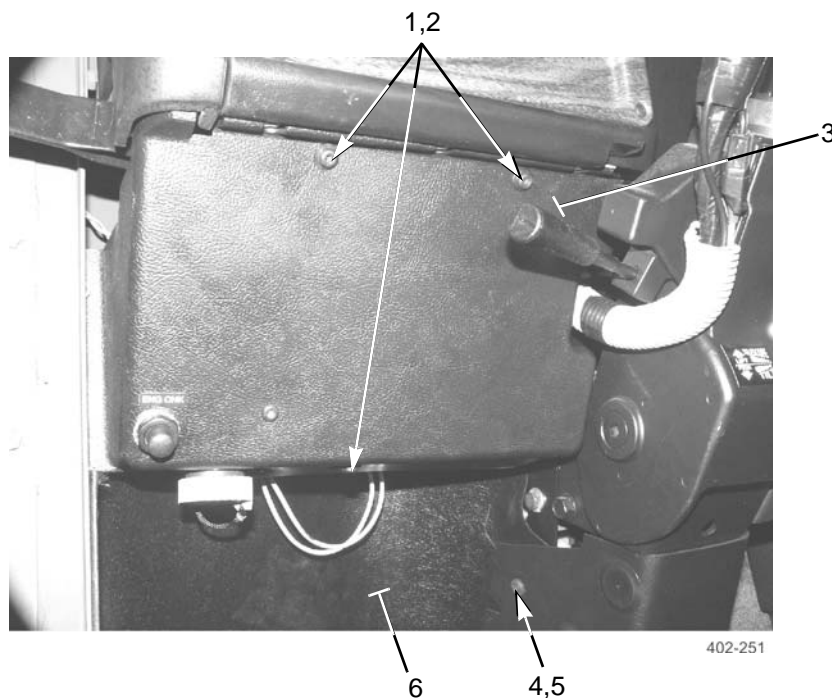
Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

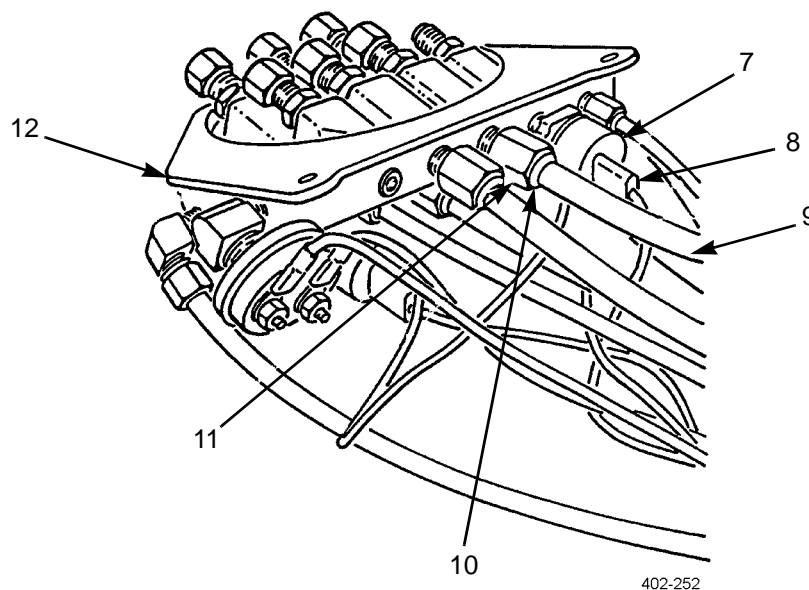
1. Remove three screws (1), washers (2), and cover (3).
2. Remove five screws (4), washers (5), and cover (6).



REMOVAL - CONTINUED**NOTE**

If it is necessary to remove cab air junction block, perform removal steps of Cab Air Junction Block Replacement (WP 0141 00).

3. Depress collar (10) and disconnect air line (9).
4. Remove fitting (11) from cab air junction block (12).
5. Disconnect electrical connector (8).
6. Remove oil pressure sending unit (7) from lower right side of cab air junction block (12).

**INSTALLATION****WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
- Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

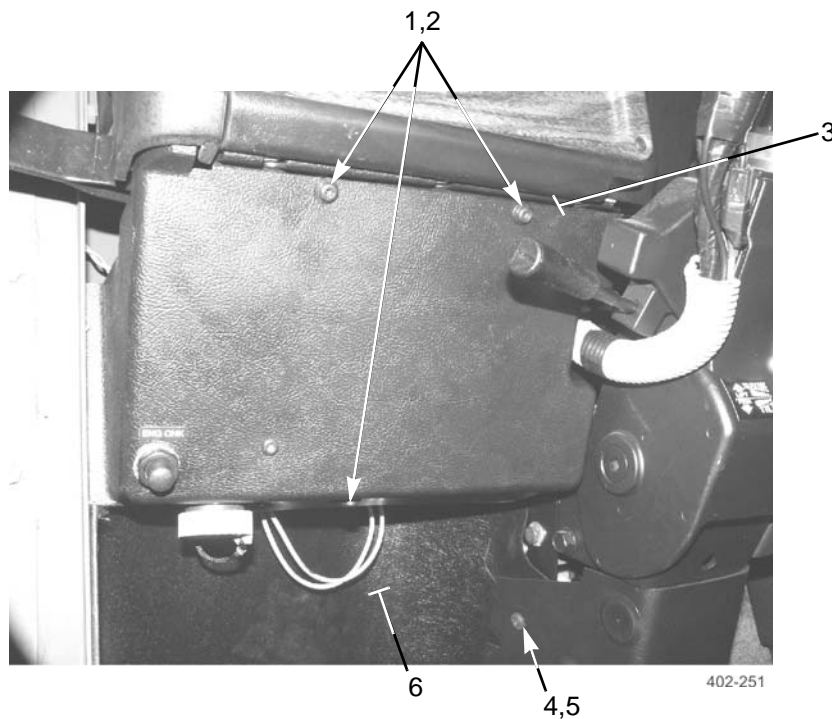
INSTALLATION - CONTINUED

1. Coat threads with sealing compound and install oil pressure sending unit (7) in lower right side of cab air junction block (12).
2. Connect electrical connector (8).
3. Coat threads with sealing compound and install fitting (11) in cab air junction block (12).
4. Install air line (9) completely in collar (10).

NOTE

If cab air junction block was removed, perform installation steps of Cab Air Junction Block Replacement (WP 0141 00).

5. Install cover (6), five washers (5), and five screws (4).
6. Install cover (3), three washers (2), and three screws (1).

**END OF WORK PACKAGE**

FUEL LEVEL SENDING UNIT REPLACEMENT

0090 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Seal (P/N 22-27156-000)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

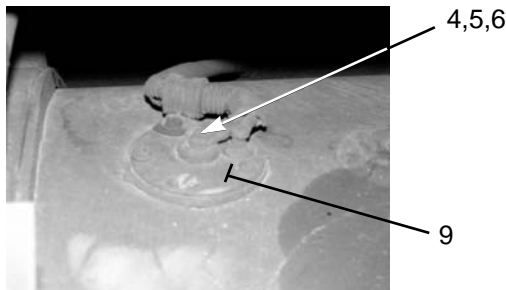
REMOVAL**WARNING**

- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel and damage to vehicles.
- Fuel vapors are toxic. Avoid prolonged exposure or breathing of fumes. Work in a well-ventilated area. Failure to follow this warning could result in serious injury to personnel.
- Personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.

NOTE

Tag wires to aid in installation.

1. Remove screw (4), washer (5), and wire lead (6) from fuel level sending unit (9).



402-253

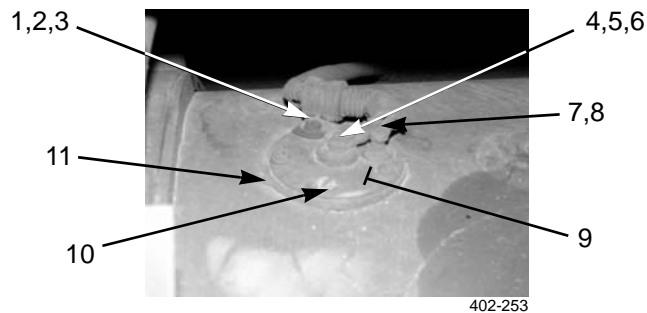
REMOVAL - CONTINUED**NOTE**

Note cable and clamp position and tag wire lead to aid in installation.

2. Remove screw (7) and ground lead (8) from fuel level sending unit (9).
3. Remove screw (1), clamp (2), and cable (3) from fuel level sending unit (9).
4. Remove four remaining screws (10), fuel level sending unit (9), and seal (11). Discard seal.

INSTALLATION

1. Install new seal (11) and fuel level sending unit (9) with float toward rear of vehicle.
2. Install four screws (10).
3. Install ground lead (8) with screw (7).
4. Install wire lead (6) with washer (5) and screw (4).
5. Install clamp (2) on cable (3) and secure clamp to fuel sending unit (9) with screw (1).

**END OF WORK PACKAGE**

FRONT ANTI-LOCK BRAKE SYSTEM (ABS) SENSOR REPLACEMENT

0091 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Grease, molybdenum disulfide (Item 25, WP 0312 00)

Materials/Parts - Continued

Straps, tiedown (Item 41, WP 0312 00)

Bushing (P/N S899-760-510-4)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Hood opened (TM 9-2320-303-10)

NOTE

- Right- and left-front ABS sensors are replaced the same way. Left-front ABS sensor is shown.
- Note location of tiedown straps to aid in installation.

REMOVAL

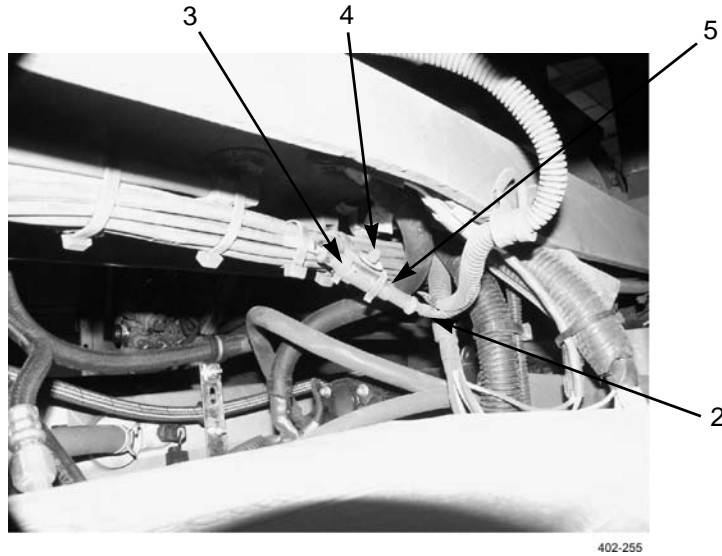
1. Trace ABS sensor cable (2) from wheel to other end of cable and remove all tiedown straps (1). Discard tiedown straps.



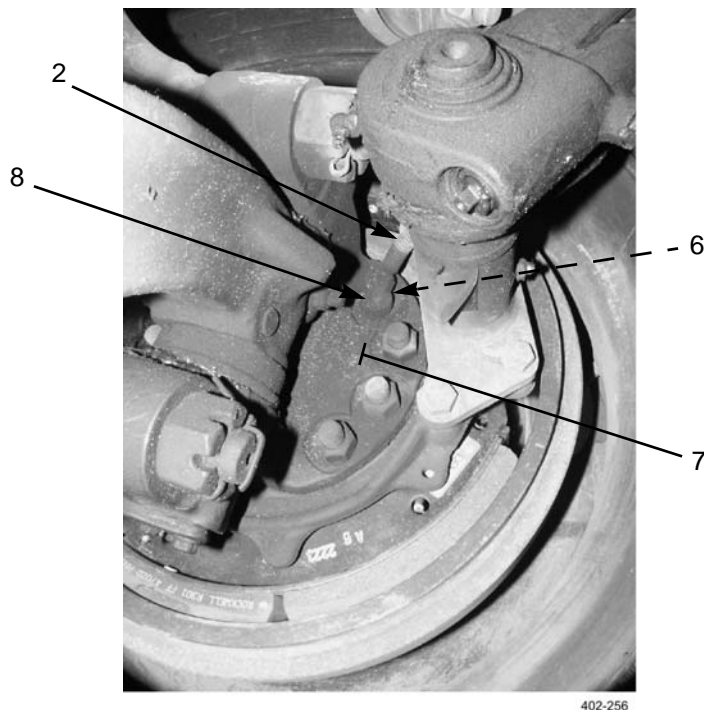
402-254

REMOVAL - CONTINUED

2. Remove clamp (4) from ABS sensor connector (5) and wiring harness connector (3).
3. Disconnect ABS sensor connector (5) from wiring harness connector (3).



4. At wheel, carefully pull body of ABS sensor (8) from steering knuckle (7) and remove sensor with ABS sensor cable (2) from vehicle.
5. Remove bushing (6) from steering knuckle (7). Discard bushing.



INSTALLATION**WARNING**

Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

1. Install new bushing (6) to steering knuckle (7).
2. Lightly coat outside of ABS sensor (8) with grease.
3. Carefully push body of ABS sensor (8) on steering knuckle (7) until sensor is stopped by ABS tone ring.

NOTE

Ensure that wire loom is installed around ABS sensor cable.

4. At other end of ABS sensor cable (2), connect ABS sensor connector (5) to wiring harness connector (3).
5. Install clamp (4) over ABS sensor connector (5) and wiring harness connector (3).
6. Along routing of ABS sensor cable (2), install new tiedown straps (1) to secure cable in position.
7. Close hood (TM 9-2320-303-10).



402-254

END OF WORK PACKAGE

REAR ANTI-LOCK BRAKE SYSTEM (ABS) SENSOR REPLACEMENT

0092 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Grease, molybdenum disulfide (Item 25, WP 0312 00)

Straps, tiedown (Item 41, WP 0312 00)

Personnel Required

Two

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

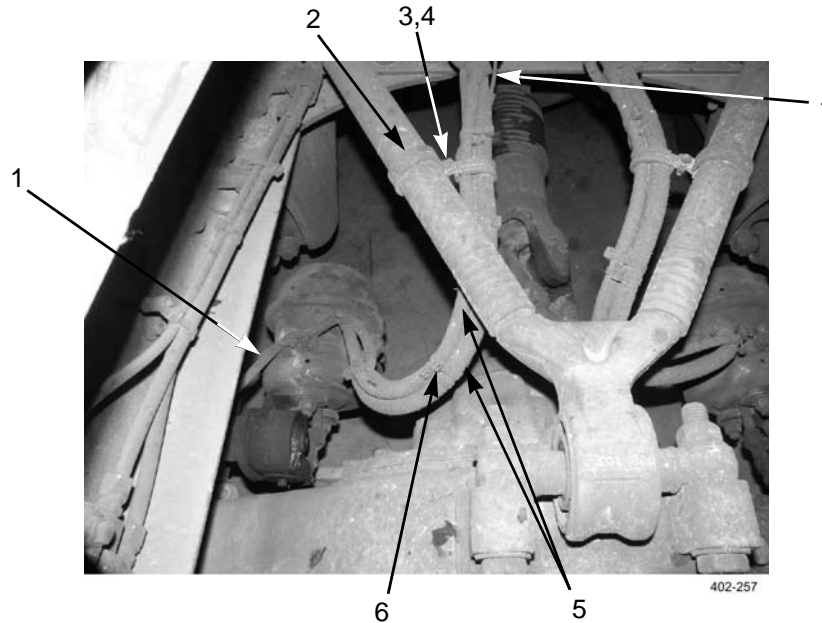
Hub and drum removed (WP 0155 00)

NOTE

- Rear ABS sensors are located on rear-rear axle only.
- Right- and left-rear ABS sensors are replaced the same way. Left-rear ABS sensor is shown.
- Note location of tiedown straps to aid in installation.

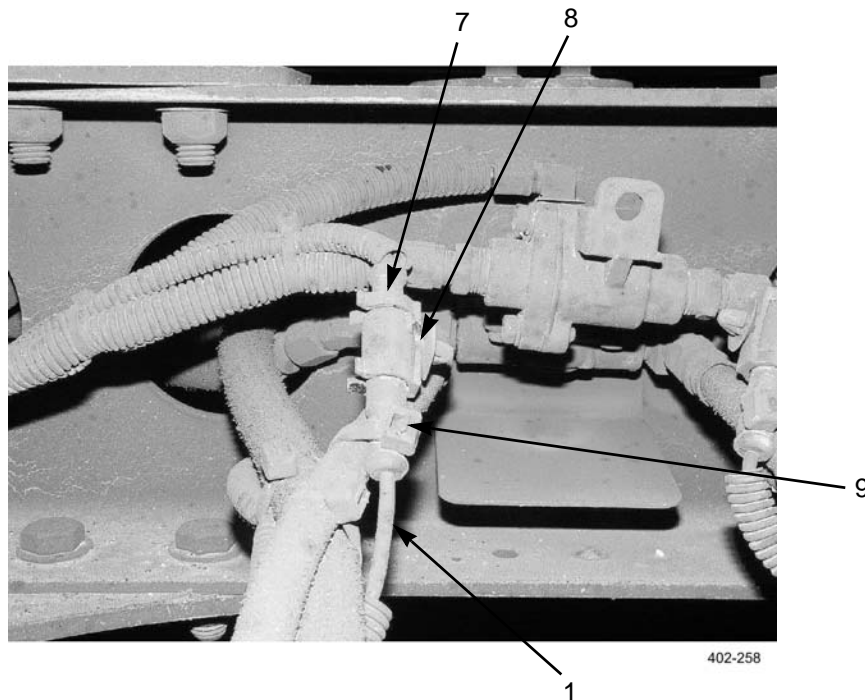
REMOVAL

1. Trace ABS sensor cable (1) from wheel to other end of cable and remove all tiedown straps (6). Discard tiedown straps.
2. Remove nut (3), screw (4), clamp (2), and release ABS sensor cable (1) from air lines (5).

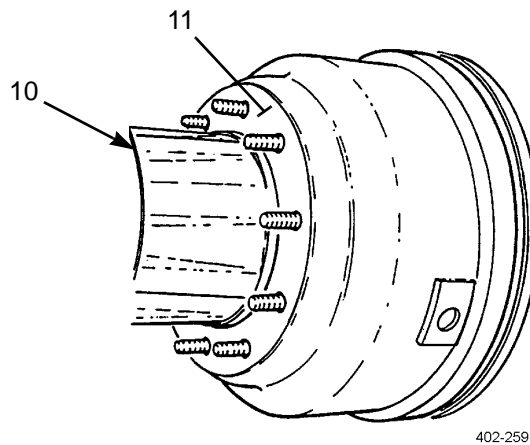


REMOVAL - CONTINUED

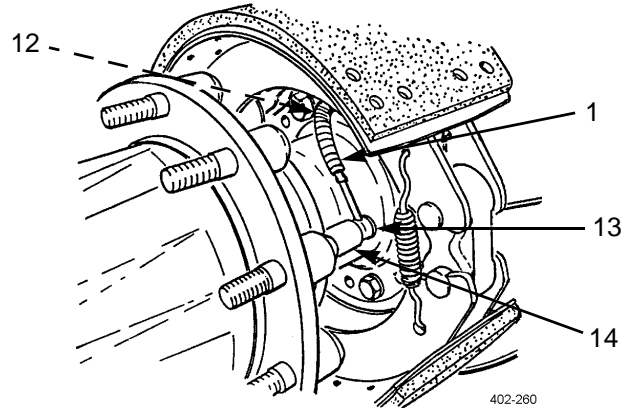
3. Remove clamp (8) from ABS sensor connector (9) and wiring harness connector (7).
4. Disconnect ABS sensor connector (9) from wiring harness connector (7).



5. With assistance, remove drum (11) from axle (10).



6. Remove ABS sensor (13) from mounting bracket (14).
7. Remove ABS sensor (13) with ABS sensor cable (1) through brake spider (12) and remove from vehicle.

REMOVAL - CONTINUED**INSTALLATION****WARNING**

Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

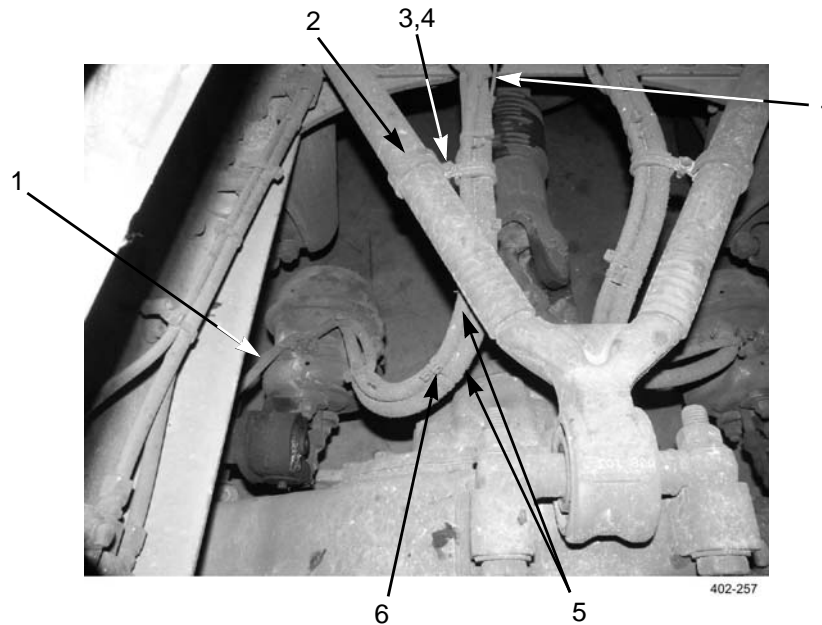
NOTE

Ensure that wire loom is installed around ABS sensor cable.

1. Position ABS sensor (13) and feed ABS sensor cable (1) through brake spider (12).
2. Lightly coat outside of ABS sensor (13) with grease.
3. Carefully install ABS sensor (13) on mounting bracket (14) until sensor is stopped by ABS tone ring.
4. Install drum (11) on axle (10).
5. At other end of ABS sensor cable (1), connect ABS sensor connector (9) to wiring harness connector (7).
6. Install clamp (8) over ABS sensor connector (9) and wiring harness connector (7).

INSTALLATION - CONTINUED

7. Secure ABS sensor cable (1) to air lines (5) with clamp (2), screw (4), and nut (3).
8. Along ABS sensor cable (1), install new tiedown straps (6) to secure cable in position.



9. Install hub and drum (WP 0155 00).

END OF WORK PACKAGE

ELECTRIC HORN REPLACEMENT

0093 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Strap, tiedown (Item 41, WP 0312 00)

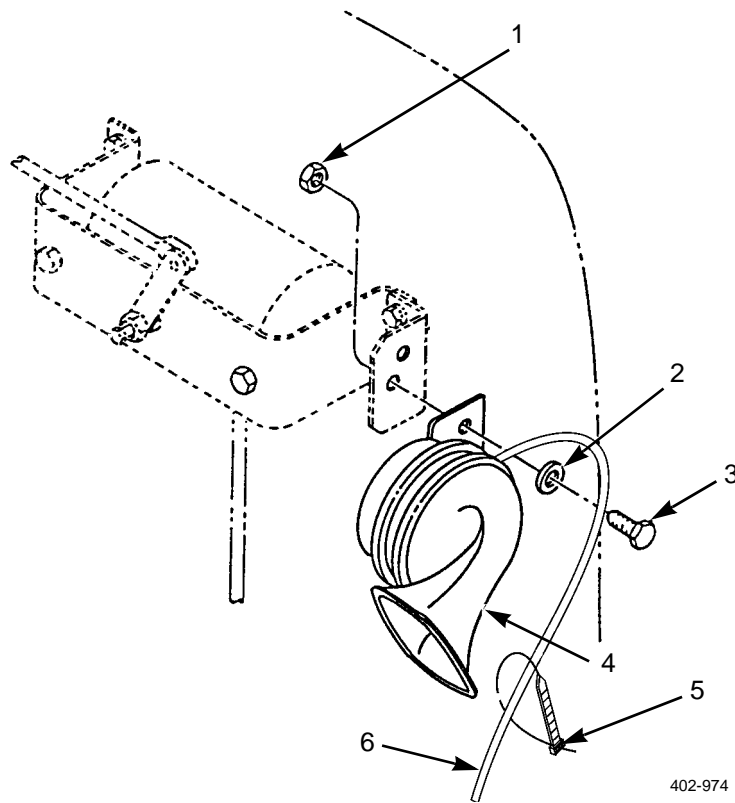
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Hood raised (TM 9-2320-303-10)

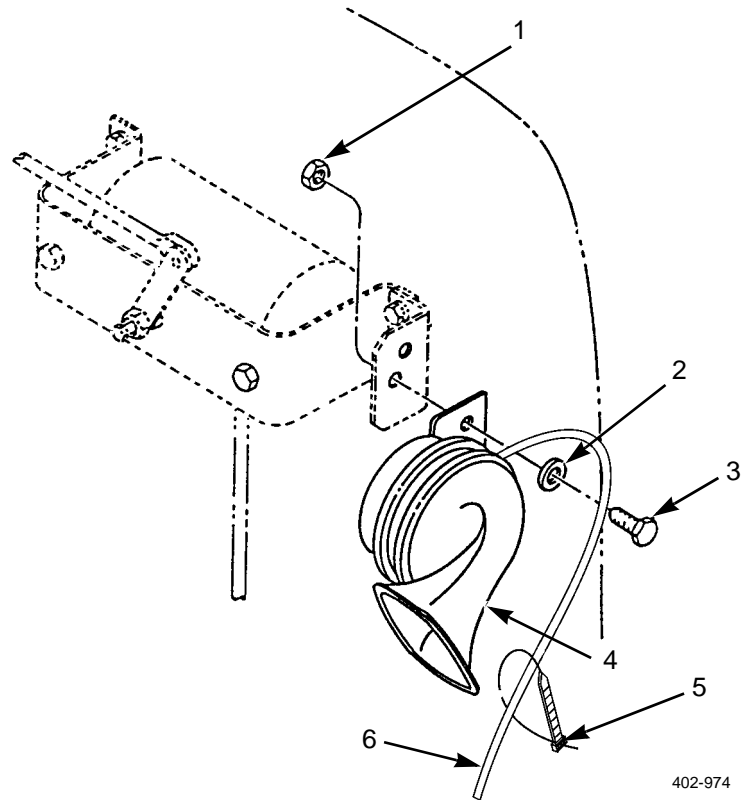
REMOVAL

1. Trace wiring harness (6) and remove tiedown straps (5). Disconnect harness at end.
2. Remove nut (1), washer (2), screw (3) and horn (4).



INSTALLATION

1. Position horn (4) and install screw (3), washer (2), and nut (1).
2. Connect wiring harness (6) and install tiedown straps (5) in same location as removal.
3. Lower hood (TM 9-2320-303-10).

**END OF WORK PACKAGE**

BATTERY REPLACEMENT

0094 00

THIS WORK PACKAGE COVERS

Removal, Installation, Service, Charging

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Nut, lock (P/N M45913/1-5CBB) (6)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

TB 9-6140-252-13

Gloves, chemical (Item 27, WP 0313 00)

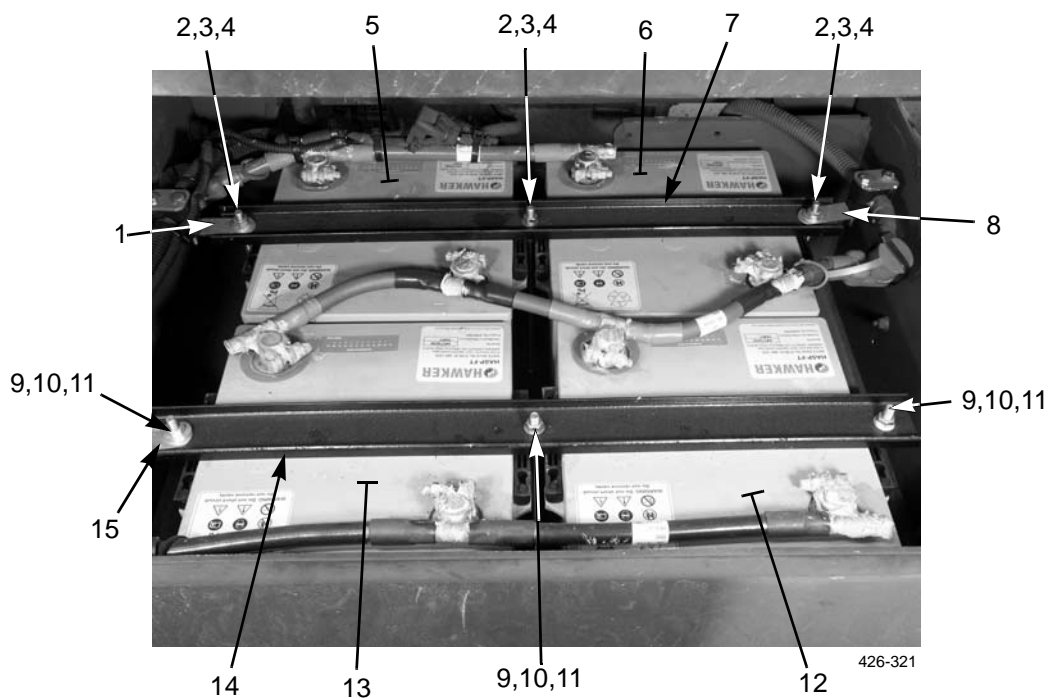
Equipment Condition

Goggles, industrial (Item 30, WP 0313 00)

Battery cables removed (WP 0095 00)

REMOVAL

1. Remove three locknuts (9), three washers (10), cable bracket (15) and hold down bracket (14) from threaded studs (11).
2. Lift batteries (12 and 13) from battery compartment.
3. Remove three locknuts (2), three washers (3), two cable brackets (1 and 8) and hold down bracket (7) from threaded studs (4).
4. Slide batteries (5 and 6) towards outer edge of battery compartment.
5. Lift batteries (5 and 6) from battery compartment.

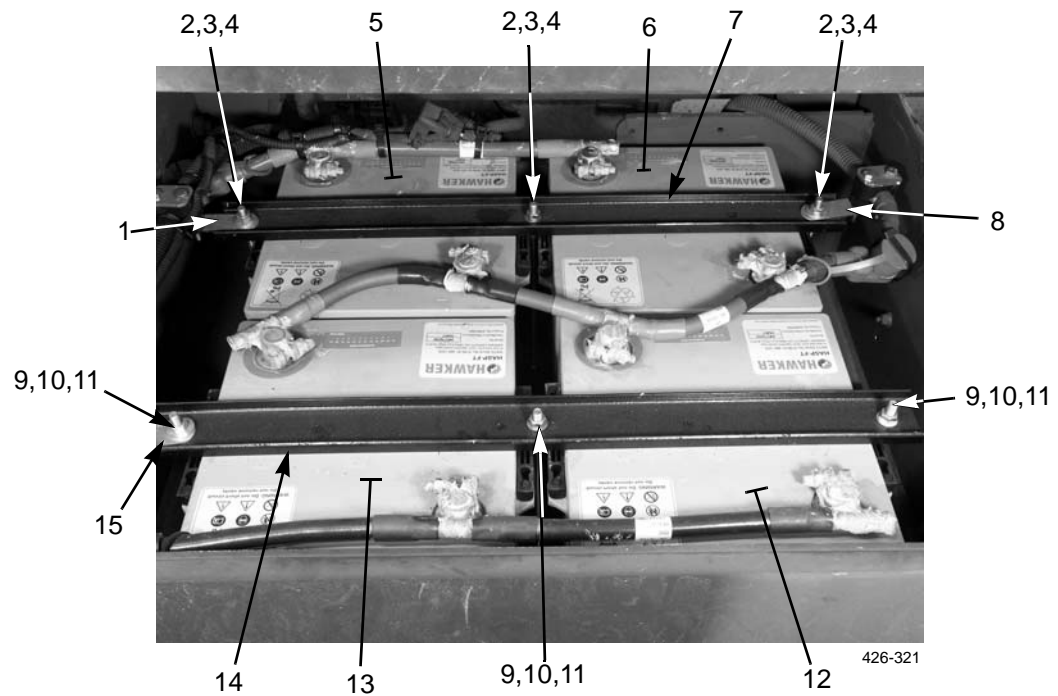


BATTERY REPLACEMENT - CONTINUED

0094 00

INSTALLATION

1. Place batteries (5 and 6) into battery compartment.
2. Slide batteries (5 and 6) to inner edge of battery compartment.
3. Position hold down bracket (7) over threaded studs (4).
4. Position cable brackets (1 and 8) over threaded studs (4).
5. Install three washers (3) and three locknuts (2).
6. Position remaining two batteries (12 and 13) into battery compartment.
7. Position hold down bracket (14) over threaded studs (11).
8. Position cable bracket (15) over threaded studs (11).
9. Install three washers (10) and three locknuts (9).



10. Install battery cables (WP 0095 00).

SERVICE

Refer to TB 9-6140-252-13 for servicing of batteries.

CHARGING

Battery's approximate state of charge (SOC) can be determined by measuring its open circuit voltage (OCV). For a rested battery (a battery that has not been charged or discharged for 8 hours) OCV and SOC are related as follows:

>12.9 Volts OCV: 95% - 100% state of charge (SOC)

12.7 Volts OCV: about 80% SOC

12.5 Volts OCV: about 60% SOC

12.3 Volts OCV: about 50% SOC

12.1 Volts OCV: about 35% SOC

11.9 Volts OCV: about 20% SOC

11.7 Volts OCV: about 10% SOC

11.5 Volts OCV: about 5% SOC

< 11.4 Volts OCV: 0% SOC

END OF WORK PACKAGE

BATTERY CABLE REPLACEMENT

0095 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Goggles, industrial (Item 30, WP 0313 00)

Materials/Parts

Grease (Item 25, WP 0312 00)

Materials/Parts - Continued

Strap, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Battery box cover removed (TM 9-2320-303-10)

REMOVAL



WARNING

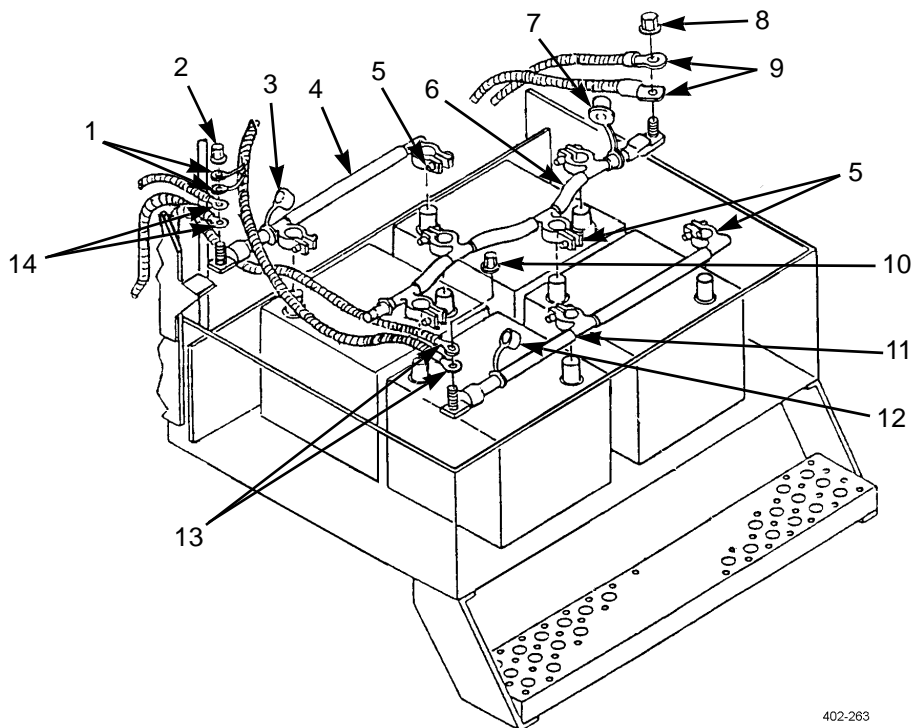
Disconnect negative battery terminal before connecting or disconnecting any electrical connectors. Failure to do so may result in electrical shock and injury to personnel.

NOTE

Tag all wires and cables prior to removal to aid in installation.

REMOVAL - CONTINUED

1. Remove tiedown straps from battery cable (4).
2. Remove cap (12), nut (10), and two cables (13) from negative battery cable (11).
3. Remove cap (7), nut (8), and two cables (9) from battery cable (6).
4. Remove cap (3), nut (2), two wires (1), and two cables (14) from battery cable (4).
5. Loosen eight nuts (5), and remove negative battery cable (11), and two battery cables (4 and 6).



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INSTALLATION

1. Install two battery cables (4 and 6) and negative battery cable (11), and tighten eight nuts (5).
2. Install two cables (14), two wires (1), nut (2), and cap (3) to battery cable (4).
3. Install two cables (9), nut (8), and cap (7) to battery cable (6).
4. Install two cables (13), nut (10), and cap (12) to negative battery cable (11).
5. Install battery box cover (TM 9-2320-303-10).
6. Route cables along battery cable (4) and install tiedown straps.
7. Apply a coat of grease to each battery terminal connection.

END OF WORK PACKAGE

BATTERY BOX REPLACEMENT**0096 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Nut, kep (P/N 23-10340-125) (2)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Jack, hydraulic, hand (Item 52, WP 0313 00)

Equipment Condition

Batteries and battery hold-down pins removed (WP 0094 00)

Left step removed (WP 0164 00)

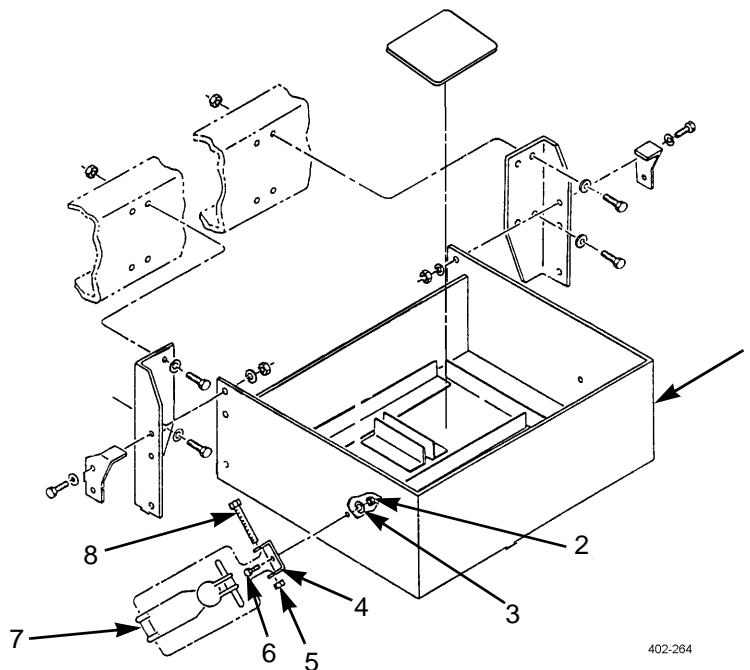
NATO slave receptacle removed (WP 0075 00)

Master battery switch removed (WP 0106 00)

REMOVAL**NOTE**

Perform step 1 at each side of battery box.

1. Remove nut (5), bolt (8), and rubber latch (7) from battery box (1).
2. Remove kep nut (2), washer (3), bolt (6), and bracket (4) from battery box (1).
3. Using suitable jack, support battery box (1).



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REMOVAL - CONTINUED**NOTE**

Perform step 3 at each side of battery box.

4. Remove three nuts (17), six washers (15), three bolts (14), and bracket (13) holding battery box (1) on bracket (11).
5. Remove battery box (1) from vehicle and remove four plywood liners (10).

NOTE

Perform step 6 to remove each of two brackets from vehicle.

6. Remove four nuts (9), washers (12), bolts (16), and bracket (11) from vehicle.

INSTALLATION**NOTE**

Perform step 1 to install each of two brackets to vehicle.

1. Install bracket (11) on vehicle with four bolts (16), washers (12), and nuts (9).
2. Install four plywood liners (10) in battery box (1).
3. Using suitable jack, position battery box on two brackets (11).

NOTE

Perform step 4 at each side of battery box.

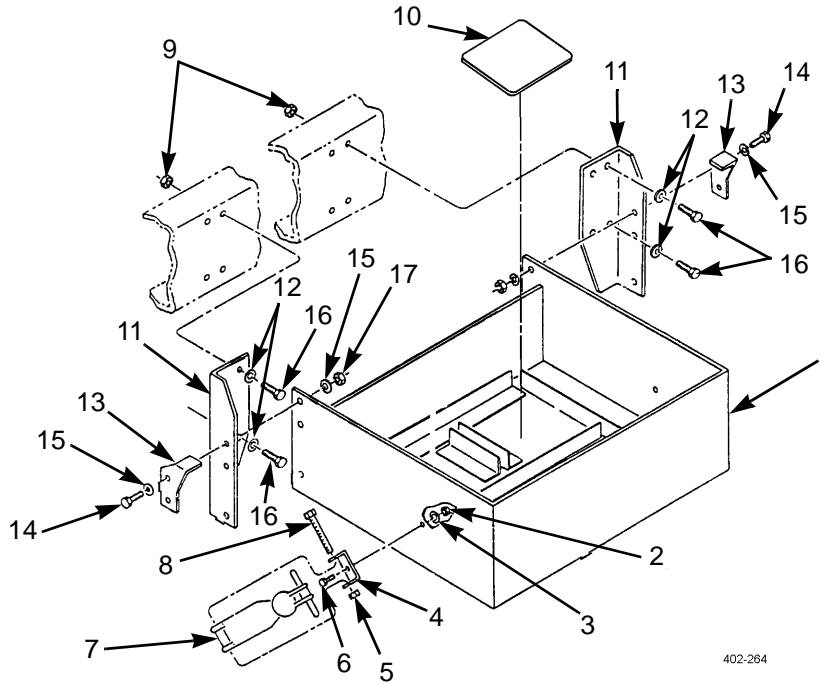
4. Install battery box (1) and bracket (13) on bracket (11) with three bolts (14), six washers (15), and three nuts (17).
5. Remove jack from battery box (1).

NOTE

Perform step 6 and 7 at each side of battery box.

6. Install bracket (4) with bolt (6), washer (3), and new kep nut (2).
7. Install rubber latch (7) on battery box (1) with bolt (8), and nut (5).
8. Install NATO slave receptacle (WP 0075 00).
9. Install left step (WP 0164 00).
10. Install battery hold-down pins and batteries (WP 0094 00).
11. Install master battery switch (WP 0106 00).

INSTALLATION - CONTINUED



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END OF WORK PACKAGE

CAB-TO-FRAME GROUND WIRE REPLACEMENT

0097 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Equipment Condition

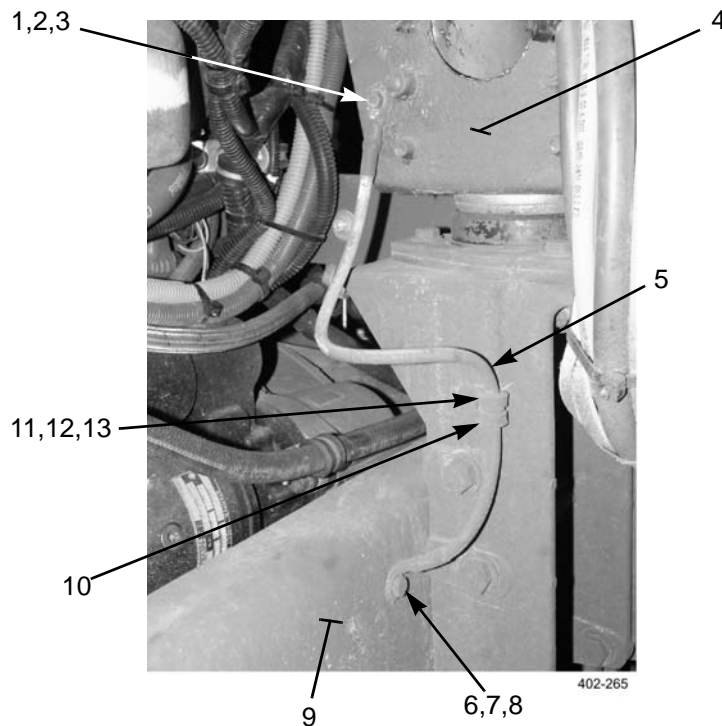
Master battery switch in OFF position (TM 9-2320-303-10)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

1. At left-front of cab (4), remove nut (11), two washers (12), screw (13), and loop clamp (10) from cab-to-frame ground wire (5).
2. Remove nut (1), washer (2), and screw (3) holding cab-to frame ground wire (5) to cab (4).
3. Remove nut (6), two washers (7), screw (8), and cab-to-frame ground wire (5) from frame (9).

**INSTALLATION**

1. Install cab-to-frame ground wire (5) to frame (9) with screw (8), two washers (7) and nut (6).
2. Install cab-to-frame ground wire (5) to cab (4) with screw (3), washer (2) and nut (1).
3. Install loop clamp (10) to cab-to-frame ground wire (5) with screw (13), two washers (12), and nut (11).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Standard Military Connector Repair, Commercial Connector Repair, Splicing

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 102, WP 0313 00)
- Tool kit, electrical connector repair (Item 101, WP 0313 00)
- Harness, wiring (Item 32, WP 0313 00)
- Heat gun (Item 33, WP 0313 00)
- Soldering gun (Item 90, WP 0313 00)
- Stripper, wire, hand (Item 94, WP 0313 00)

Materials/Parts

- Flux, soldering (Item 19, WP 0312 00)
- Solder (Item 40, WP 0312 00)
- Tags, marker (Item 42, WP 0312 00)

Equipment Condition

- Master battery switch in OFF position (TM 9-2320-303-10)

References

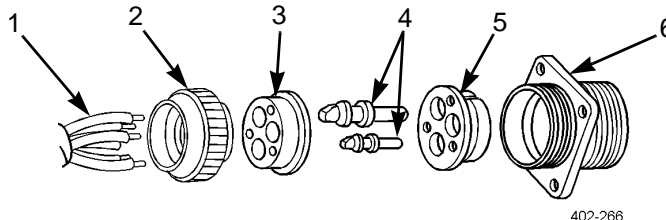
- TB SIG 222

NOTE

Tag cables and wires to aid in installation.

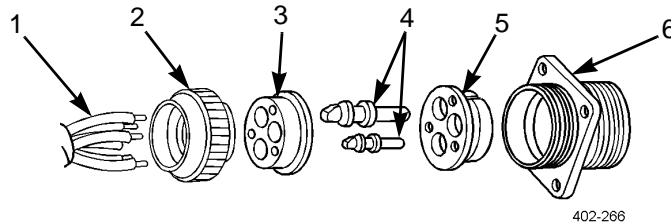
STANDARD MILITARY CONNECTOR REPAIR**1. Panel Mounting Receptacle Disassembly.**

- a. Unscrew nut (2) from shell (6) assembly and slide back on cable leads (1).
- b. Push grommet (3) back on cable leads (1).
- c. Drive contacts (4) out through rear of insert (5) with pin extractor.
- d. Push insert (5) out through rear of shell (6).
- e. Unsolder cable leads (1) from contacts (4).

**2. Panel Mounting Receptacle Assembly.**

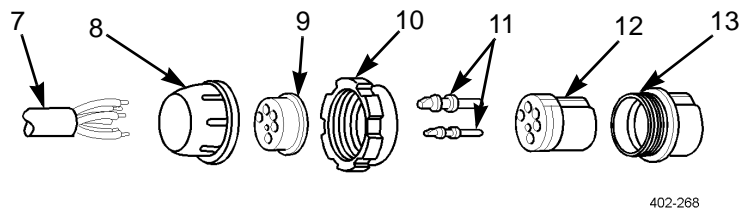
- a. Strip cable insulation equal to depth of solder wells of contacts (4).
- b. Slide nut (2) over cable leads (1).
- c. Slide grommet (3) over cable leads (1).
- d. Insert cable leads (1) into solder wells of contacts (4) and solder.
- e. Push insert (5) into shell (6) from rear until seated. Groove in insert must be aligned with guide in shell to ensure proper fit.

- f. Push contacts (4) into insert (5) from rear until seated.
- g. Push grommet (3) down cable leads (1) and over solder wells of contacts (4).
- h. Screw nut (2) onto shell (6) assembly.



3. **Plug Disassembly.**

- a. Unscrew nut (8) from shell (13) assembly and slide back on cable leads (7).
- b. Push grommet (9) back on cable leads (7).
- c. Slide coupling nut (10) off shell (13) assembly.
- d. Drive contacts (11) out through rear of insert (12) with pin extractor.
- e. Push insert (12) out through rear of shell (13).
- f. Unsolder cable leads (7) from contacts (11).



4. **Plug Assembly.**

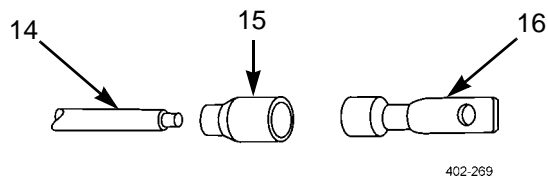
- a. Strip cable insulation equal to depth of solder wells of contacts (11).
- b. Slide nut (8) over cable leads (7).
- c. Slide grommet (9) over cable leads (7).
- d. Insert cable leads (7) into solder wells of contacts (11) and solder.
- e. Push insert (12) into shell (13) from rear until seated. Groove in insert must be aligned with guide in shell to ensure proper fit.
- f. Push contacts (11) into insert (12) from rear until seated.
- g. Slide coupling nut (10) onto shell (13) assembly.
- h. Push grommet (9) down cable leads (7) and over solder wells of contacts (11).
- i. Screw nut (8) onto shell (13) assembly.

NOTE

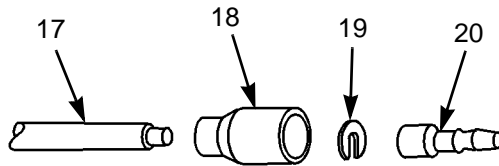
The following procedures cover assembly of new terminals and connectors. Prepare cable by cutting off damaged or defective terminal or connector.

5. **Terminal-type Cable Connector.**

- a. Strip cable (14) insulation equal to depth of terminal (16) well.
- b. Slide insulation (15) over cable (14).
- c. Insert cable (14) into terminal (16) well and crimp.
- d. Slide insulation (15) over crimped end of terminal (16).

6. **Male Cable Connector With C-washer.**

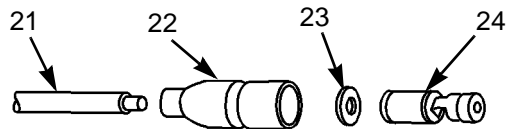
- a. Strip cable (17) insulation equal to depth of terminal (20) well.
- b. Slide shell (18) over cable (17).
- c. Insert cable (17) into terminal (20) well and crimp.
- d. Place C-washer (19) over cable (17) at crimped junction and slide shell (18) over C-washer and terminal (20).



STANDARD MILITARY CONNECTOR REPAIR - CONTINUED

7. **Female Cable Connector With Washer.**

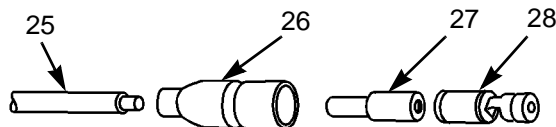
- a. Strip cable (21) insulation approximately 1/8 in (3.2 mm).
- b. Slide shell (22) and washer (23) over cable (21).
- c. Place cable (21) in cylindrical end of terminal (24) and crimp.
- d. Slide shell (22) and washer (23) over terminal (24).



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8. **Female Cable Connector With Sleeve.**

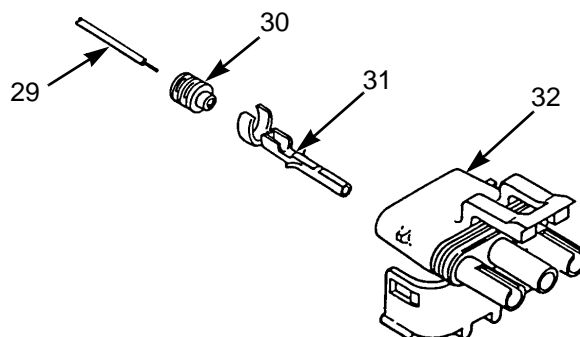
- a. Strip cable (25) insulation approximately 1/8 in (3.2 mm).
- b. Slide shell (26) and sleeve (27) over cable (25).
- c. Place cable (25) in cylindrical end of terminal (28) and crimp.
- d. Slide shell (26) and sleeve (27) over terminal (28).



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9. **Sealed Connector.**

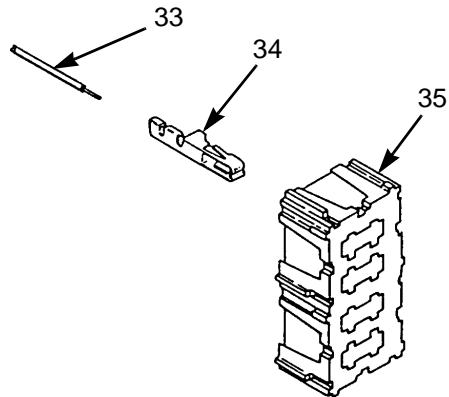
- a. Strip cable (29) insulation approximately 1/8 in (3.2 mm).
- b. Slide seal (30) onto cable (29).
- c. Crimp terminal (31) onto cable (29).
- d. Insert terminal (31) into connector (32) and close lock.



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ELECTRICAL CONNECTORS MAINTENANCE - CONTINUED**0098 00****10. Panel Connector.**

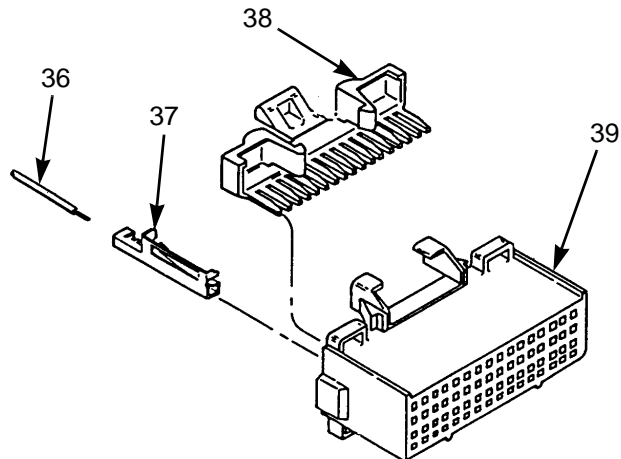
- a. Strip cable (33) insulation.
- b. Crimp terminal (34) onto cable (33).
- c. Insert terminal (34) into connector (35).



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11. Harness Connector.

- a. Strip cable (36) insulation.
- b. Crimp terminal (37) onto cable (36).
- c. Insert terminal (37) into connector (39).
- d. Install lock (38) in connector (39).



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ELECTRICAL CONNECTORS MAINTENANCE - CONTINUED**0098 00**

1. **Crimp and Removal Tools.** Crimp tools and connector removal tools can be purchased from Kent-Moore. Tools and associated part numbers are listed in Table 1.

Table 1. Crimp and Removal Tools.

CONNECTOR	TOOL	PART NUMBER
Metri-Pack 150	Removing	J35689
	Crimp	J35123
Weather Pack	Removing	J36400-5
	Crimp	J35606
Metri-Pack 280	Removing (18 AWG)	J33095
	Crimp (18 AWG)	J38125-6
	Removing (12 AWG - Used for power harness)	J33095
	Crimp (12 AWG - Used for power harness)	J39848
Deutsch	Removing (12 AWG)	J37451
	Removing (16-18 AWG)	J34513
	Crimp	J34182

2. **Metri-Pack 150 Connectors.**

a. Connector Part Numbers.

- (1) Metri-Pack 150 series connectors are "pull-to-seat" connectors. Each wire must be pushed through the connector prior to crimping the terminal. Cable seals are inserted into the shell of the connector and hold many wires.
- (2) Metri-Pack 150 connectors are listed in Table 2.

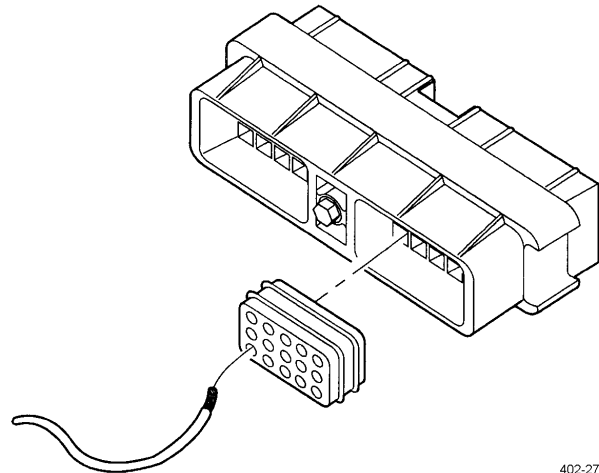
Table 2. Metri-Pack 150 Connector Part Numbers.

ECM ENGINE HARNESS		ECM VEHICLE INTERFACE HARNESS	
Connector	P/N: 12034400	Connector	P/N: 12034398
Terminal	P/N: 12103881	Terminal	P/N: 12103881
Seal	In Connector	Seal	In Connector
Plug	P/N: 12034413	Plug	P/N: 12034413
ECM COMMUNICATION HARNESS CONNECTOR		TEMPERATURE SENSOR HARNESS	
Connector	P/N: 12066317	Connector	P/N: 12162193
Terminal	P/N: 12103881	Terminal	P/N: 12103881
Seal	In Connector	Seal	In Connector
Plug	P/N: 12034413	Plug	P/N: Not Applicable
PRESSURE SENSOR HARNESS		FIRE TRUCK PRESSURE SENSOR (PGS)	
Connector	P/N: 12047909	Connector	P/N: 12065287
Terminal	P/N: 12103881	Terminal	P/N: 12103881
Seal	In Connector	Seal	In Connector
Plug	P/N: Not Applicable	Plug	P/N: Not Applicable
SRS HARNESS		TRS HARNESS	
Connector	P/N: 12162193	Connector	P/N: 12162197
Terminal	P/N: 12103881	Terminal	P/N: 12103881
Seal	In Connector	Seal	In Connector
Plug	P/N: Not Applicable	Plug	P/N: Not Applicable
INJECTOR (GRAY)		INJECTOR (BLACK)	
Connector	P/N: 12162830	Connector	P/N: 12040947
Terminal	P/N: 12103881	Terminal	P/N: 12103881
Seal	P/N: Not Applicable	Seal	P/N: Not Applicable
Plug	P/N: 12034413	Plug	P/N: 12034413

COMMERCIAL CONNECTOR REPAIR - CONTINUED

- b. **Installation.** Metri-Pack 150 connectors are “pull-to-seat” design. The cable is pushed through seal and correct cavity of connector before crimping terminal to cable. It should be stripped of insulation **AFTER** it is placed through seal and connector body. Use the following instructions for terminal installation:

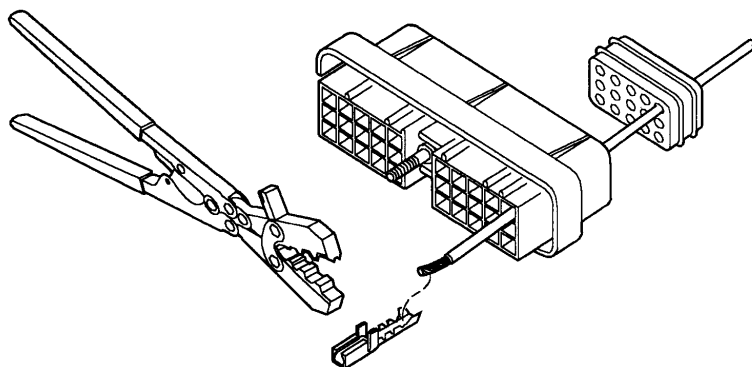
- (1) Position cable through seal and correct cavity of connector (Figure 1).



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Figure 1. Inserting Wire in Connector.

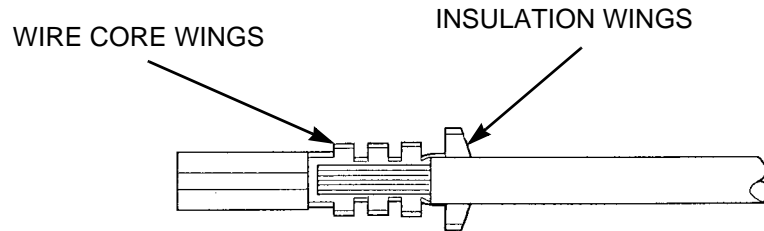
- (2) Strip end of cable using wire strippers to leave 0.2 +/- 0.02 in (5.0 +/- 0.5 mm) of bare conductor.
- (3) Squeeze handles of crimping tool together firmly to cause jaws to automatically open.
- (4) Hold “wire side” facing you.
- (5) Push terminal holder to open position and insert terminal until wire attaching portion of terminal rests on 20-22 anvil. Be sure wire core wings and insulation wings of terminal are pointing toward upper jaw of crimping tool (Figure 2).



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Figure 2. Terminal and Crimping Tool Position.

- (6) Insert cable into terminal until stripped portion is positioned in wire core wings and insulation portion ends just forward of insulation wings (Figure 3).



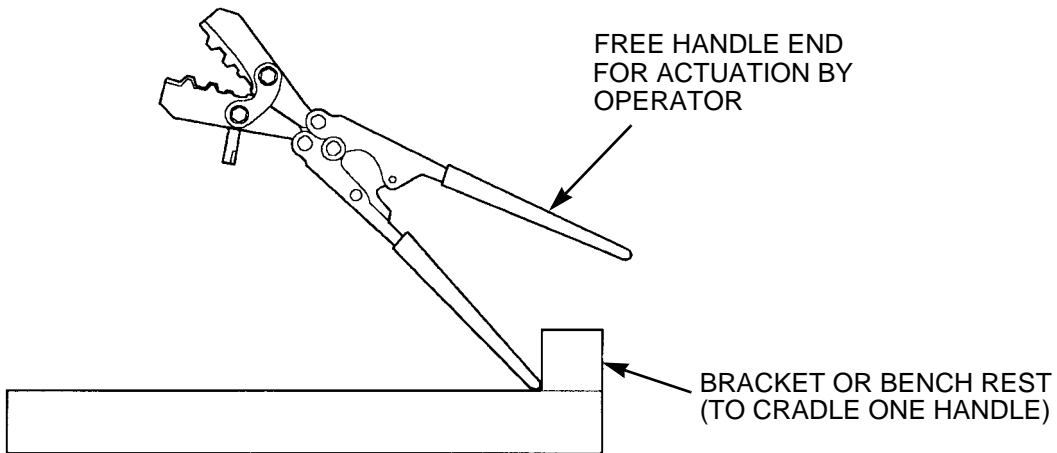
402-278

Figure 3. Cable to Terminal Alignment.

- (7) Compress handles of crimping tool until ratchet automatically releases and crimp is complete.

NOTE

For faster, more efficient crimping operation, a bracket or bench rest may be used to cradle one handle of tool. Operator can apply terminals by grasping and actuating only one handle of tool (Figure 4).



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Figure 4. Crimping Operation.

- (8) Release crimping tool with lock lever located between handles, in case of jamming.

NOTE

For ECM 30-pin connectors, put locking tang opposite lettered side.

- (9) Align locking tang of terminal with lettered side of connector.
(10) Pull cable back through connector until a click is heard (Figure 5). Position seal into connector.

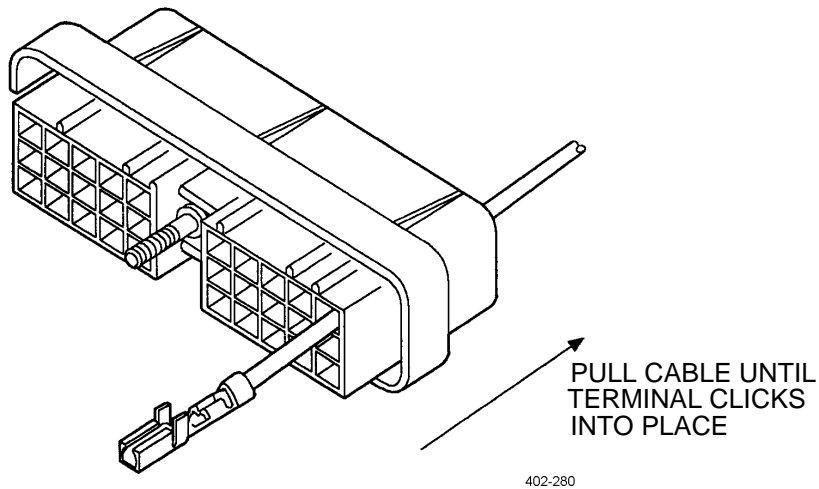


Figure 5. Pulling Terminal to Seat.

- c. **Removal and Repair.** A tang on terminal locks into a tab molded into plastic connector to retain cable assembly. Remove Metri-Pack 150 terminals using the following instructions:
- (1) Insert removal tool into cavity of connector, placing tip of tool between locking tang of terminal and wall of cavity (Figure 6).

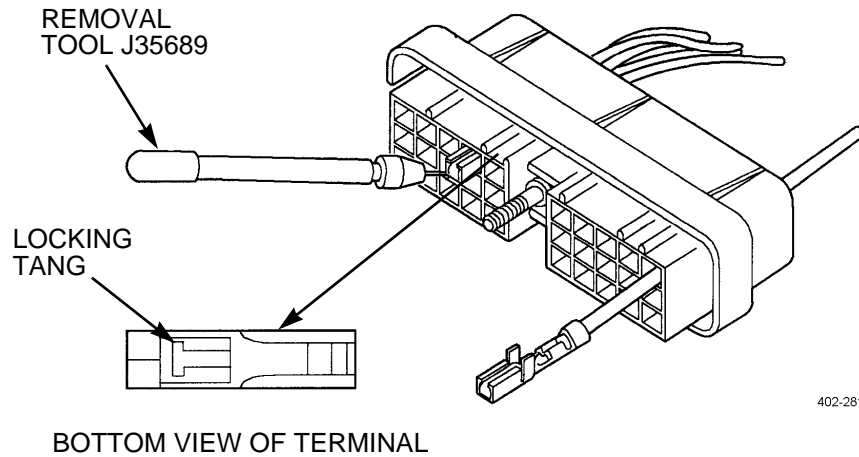


Figure 6. Terminal Removal.

- (2) Depress locking tang of terminal to release from connector.
 - (3) Push cable forward through terminal until complete crimp is exposed.
 - (4) Cut cable immediately behind damaged terminal to repair.
 - (5) Follow installation instructions for crimping terminal and inserting into connector.
3. **Weather Pack and Metri-Pack 280 Connectors.**
- a. **Connector Part Numbers.**
 - (1) Weather Pack and Metri-Pack 280 series connectors are “push-to-seat design”. The terminal is crimped onto each wire before it is inserted into the connector. A cable seal is crimped on each wire at the same time the terminal is crimped onto the wire. Weather Pack connectors use a secondary lock on both male and female connector bodies and the lock snaps into place over the cable seals after installation. Some Metri-Pack connectors have secondary locks as well.
 - (2) Weather Pack connectors and their associated part numbers are listed in Table 3.
 - (3) Metri-Pack 280 connectors and their associated part numbers are listed in Table 4.

Table 3. Weather Pack Connectors and Part Numbers.

TURBO BOOST PRESSURE SENSOR HARNESS		ENGINE BRAKE CONNECTOR, SERIES 60	
Connector	P/N: 12015384	Connector	P/N: 12010973/12162000
Terminal	P/N: 12089040	Terminal	P/N: 12048074/12045773
Seal	P/N: 12015323		
THROTTLE POSITION SENSOR - HARNESS SIDE		THROTTLE POSITION SENSOR - SENSOR SIDE	
Connector	P/N: 12015793	Connector	P/N: 12010717
Terminal	P/N: 12089188	Terminal	P/N: 12089040
Seal	P/N: 12015323	Seal	P/N: 12015323
Plug	P/N: Not Applicable	Plug	P/N: Not Applicable
IGNITION CONNECTOR POWER HARNESS SIDE		IGNITION CONNECTOR VEHICLE INTERFACE HARNESS SIDE	
Connector	P/N: 12034074	Connector	P/N: 12015378
Terminal	P/N: 12089040	Terminal	P/N: 12089188
ALLISON INTERFACE MODULE		ALLISON INTERFACE MODULE MAXIMUM FEATURE	
Connector	P/N: 12015791	Connector	P/N: 12015799
Terminal	P/N: 12089188	Terminal	P/N: 12089188
Seal	P/N: 12015323	Seal	P/N: 12015323
		Plug	P/N: 12010300

Table 4. Metri-Pack 280 Connectors and Part Numbers.

COOLANT LEVEL SENSOR CONNECTOR		POWER HARNESS	
Connector	P/N: 15300027	Connector	P/N: 12124634
Terminal	P/N: 12077411	Terminal	P/N: 12077413
Seal	P/N: 12015323	Seal	P/N: 12015193
Secondary Lock	P/N: 15300014	Secondary Lock	P/N: 12052816
Plug	P/N: Not Applicable	Plug	P/N: Not Applicable

b. **Installation.** Use the following instructions for terminal installation:

- (1) Insert terminal into locating hole of crimping tool using proper hole according to gage of cable to be used (Figure 7).

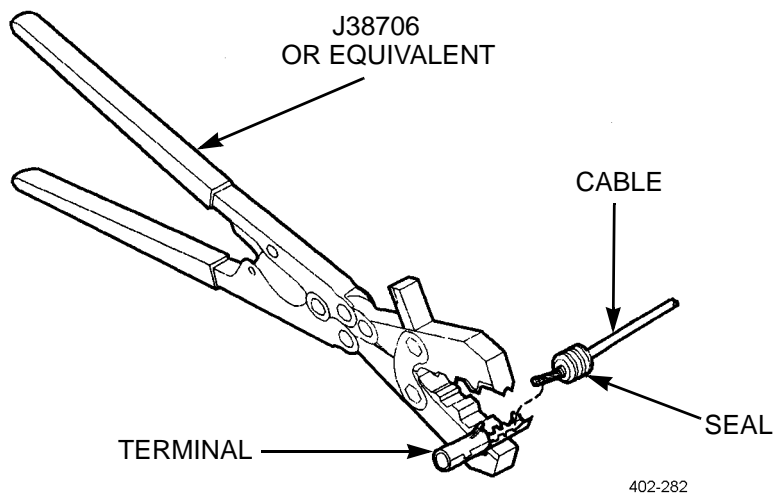


Figure 7. Terminal Position.

- (2) Insert cable into terminal until stripped position is positioned in cable core wings, and seal and insulated portion of cable are in insulation wings (Figure 8).

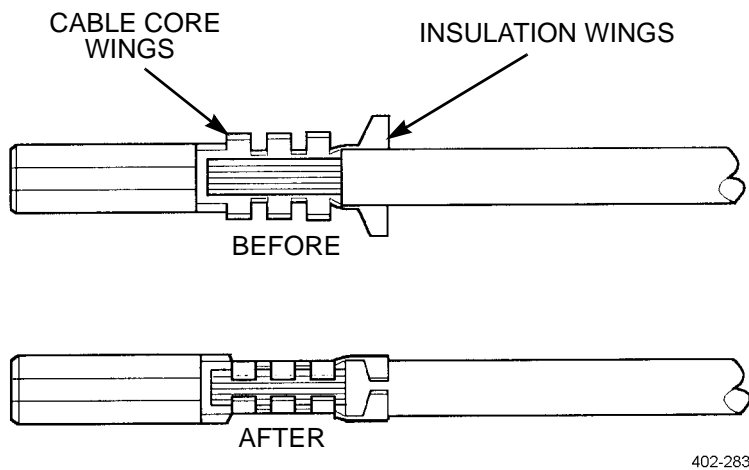


Figure 8. Cable and Terminal Position Before and After Crimping.

- (3) Compress handles of crimping tool until ratchet automatically releases and crimp is complete. A properly crimped terminal is shown (Figure 8).
- (4) Release crimping tool with lock lever located between handles, in case of jamming.
- (5) Push crimped terminal into connector until it clicks into place. Gently tug on cable to make sure it is secure (Figure 9).

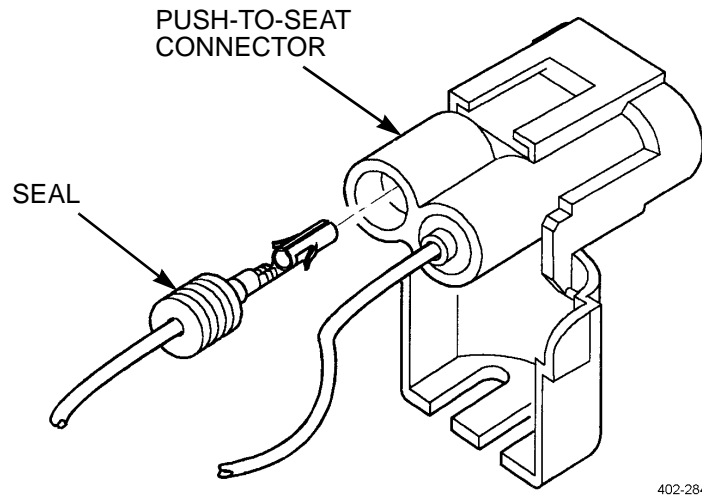


Figure 9. Inserting Terminal in Connector.

- c. **Removal and Repair.** Two locking tangs are used on terminals to secure them to the connector body. Use the following instructions for removing terminals from connector body:
- (1) Disengage locking tang securing connector bodies to each other. Grasp one half of connector in each hand and gently pull apart.
 - (2) Unlatch and open secondary lock on connector (Figure 10).

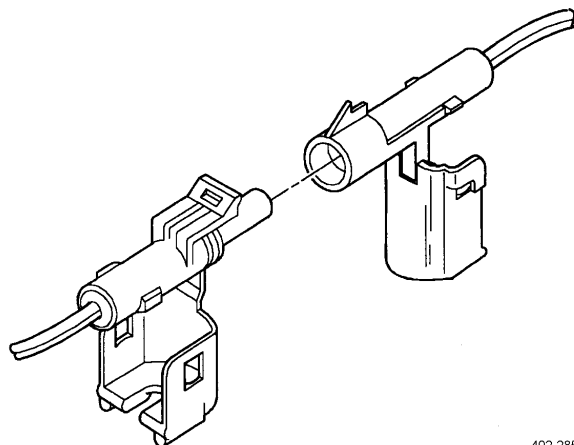
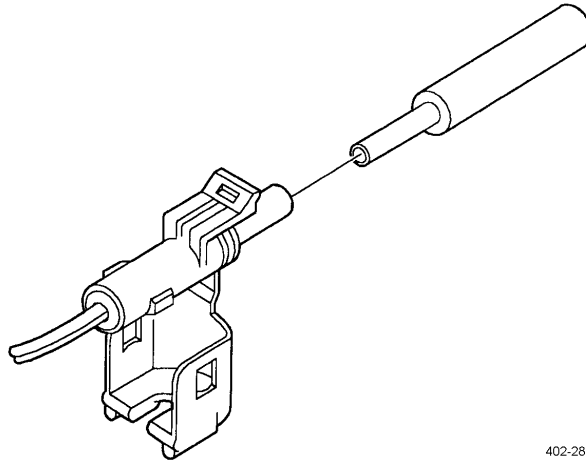


Figure 10. Unlatched Secondary Lock.

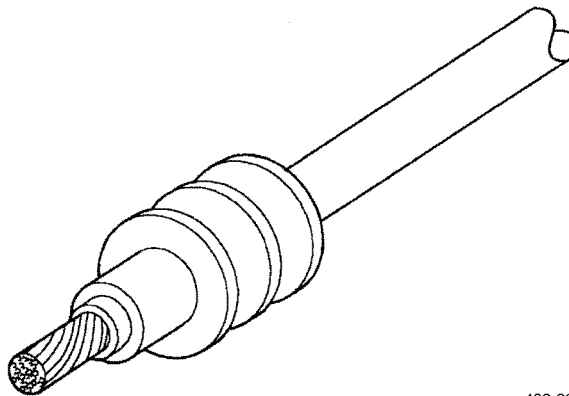
- (3) Grasp cable to be removed and push terminal to forward position.
- (4) Insert removal tool straight into front of connector cavity until it rests on cavity shoulder.
- (5) Grasp cable and push forward through connector cavity into tool while holding tool securely in place (Figure 11).



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Figure 11. Removal Tool Procedure.

- (6) Tool will press locking tangs of terminal. Pull cable rearward (back through connector). Remove tool from connector cavity.
- (7) Cut wire immediately behind cable seat and slip new cable seal onto wire.
- (8) Strip end of cable using strippers to leave 0.2 +/- 0.02 in (5.0 +/- 0.5 mm) of bare conductor. Position cable seal as shown (Figure 12).



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Figure 12. Proper Cable Seal Position.

- (9) Crimp new terminal onto wire using crimp tool (Figure 13).

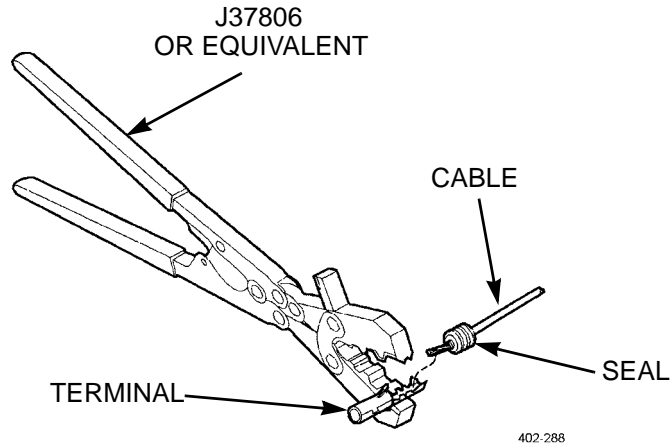


Figure 13. Crimping Procedure.

4. **Deutsch Connectors.**

a. **Connector Part Numbers.**

- (1) Deutsch connectors have cable seals molded into the connector. These connectors are “push-to-seat” connectors with cylindrical terminals. The diagnostic connector terminals are gold plated for clarity.
- (2) Deutsch connectors and their associated part numbers are listed in Table 5.

COMMERCIAL CONNECTOR REPAIR - CONTINUED**Table 5. Deutsch Connectors and Part Numbers.**

DIAGNOSTIC CONNECTOR	
Connector	P/N: 23513052
Terminal	P/N: 23513053
Protective Cap	P/N: 23413054
Plug	P/N: 23507136
ENGINEMINDER	
Connector	P/N: 23512222
Terminal	P/N: 23507132
Plug	P/N: 23507136
MASTERMIND - POWER AND COMMUNICATION LINK	
Connector	P/N: 23512221
Terminal	P/N: 23507132
Plug	P/N: 23507136
MASTERMIND - INPUTS AND OUTPUTS	
Connector	P/N: 23512223
Terminal	P/N: 23507066
Plug	P/N: 23507136

b. Installation.

- (1) Strip approximately 1/4 in (6.4 mm) of insulation from cable.
- (2) Remove lock clip, raise wire gage selector, and rotate knob to number matching gage wire being used.
- (3) Lower selection and insert lock clip.
- (4) Position contact so that the crimp barrel is 1/32 in (0.8 mm) above four indenters (Figure 14). Crimp cable.

COMMERCIAL CONNECTOR REPAIR - CONTINUED

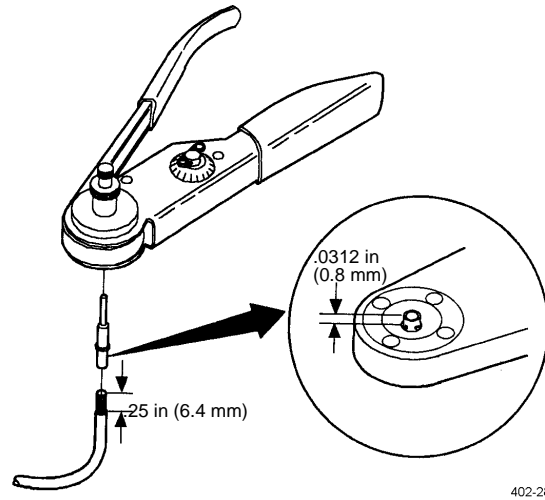


Figure 14. Setting Wire Gage Selector and Positioning Contact.

- (5) Grasp contact approximately 1 in (25.4 mm) behind contact crimp barrel.
- (6) Hold connector with rear grommet facing you (Figure 15).

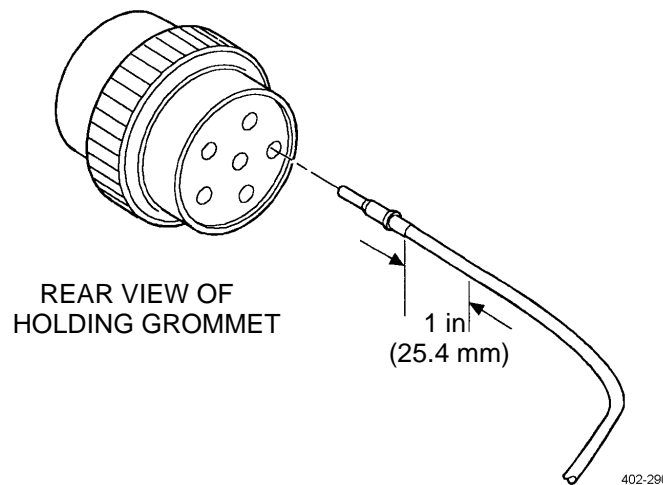


Figure 15. Pushing Contact into Grommet.

COMMERCIAL CONNECTOR REPAIR - CONTINUED

- (7) Push contact into grommet until a positive stop is felt (Figure 15). A slight tug will confirm that it is properly locked into place (Figure 16).

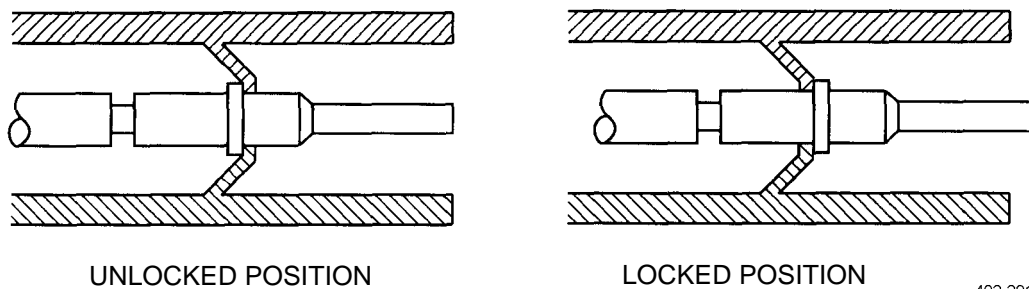


Figure 16. Locking Terminal into Connector.

- c. **Removal.** The appropriate size removal tool should be used when removing cables from connectors. The proper removal tool size is listed in Table 1.
- (1) With rear insert toward you, snap appropriate size removal tool over cable of contact to be removed (Figure 17).

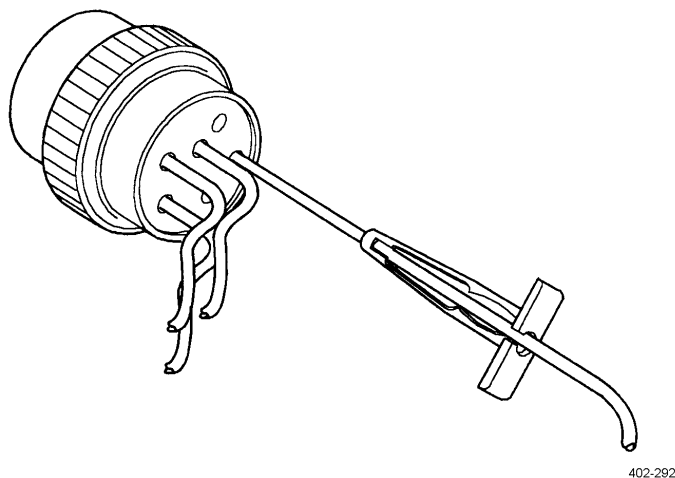


Figure 17. Removal Tool Position.

COMMERCIAL CONNECTOR REPAIR - CONTINUED

- (2) Slide tool along cable into insert cavity until it engages and resistance is felt. DO NOT twist or insert tool at an angle (Figure 18).

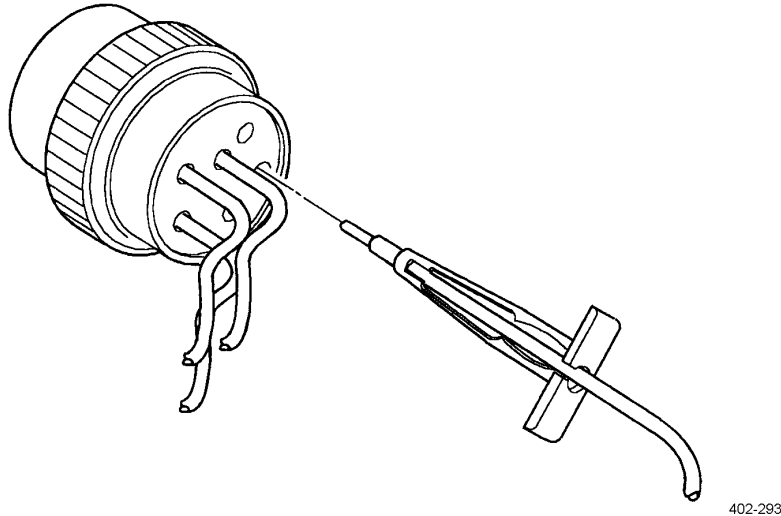


Figure 18. Removal Tool Insertion.

- (3) Pull contact cable assembly out of connector. Keep reverse tension on cable and forward tension on tool.

SPLICING1. **Splicing Guidelines.**

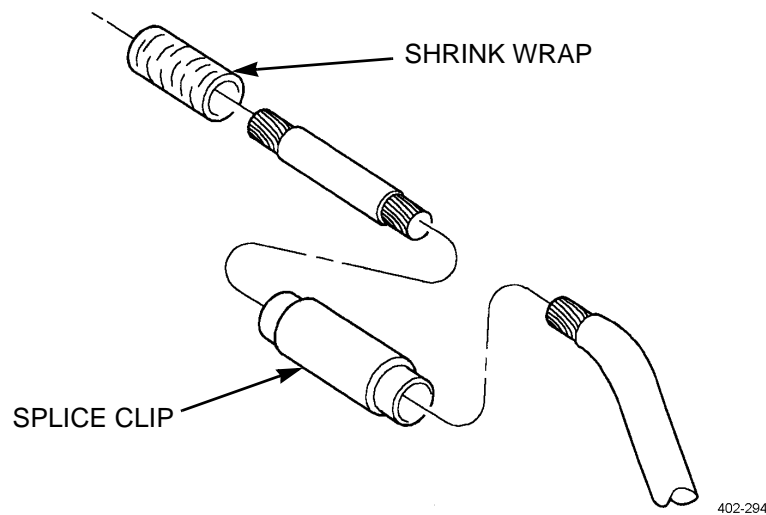
- a. The following are guidelines which may be used for splices. The methods described are not the only acceptable methods. Any method should produce a high quality, tight splice with durable insulation which can be expected to last the life of the vehicle.
- b. The selection of crimpers and splice connectors is optional. Select a high quality crimper equivalent to Kent-Moore tool J38706 and commercially available splice clips.
- c. The following is a list of tools required for splicing wires:
 - Soldering iron
 - Rosin core solder
 - Wire strippers
 - Heat shrink tubing
 - Splice clips
 - Crimp pliers

2. **Splicing Straight Leads.**

- a. Locate broken wire.
- b. Remove insulation as required. Ensure exposed wire is clean and not corroded.
- c. Slide a sleeve of shrink wrap on wire long enough to cover splice and overlap wire insulation, about 1/4 in (6.4 mm) on both sides.

SPLICING - CONTINUED

- d. Insert one wire into splice clip (P/N: 0597428 or equivalent) and crimp.
- e. Insert other wire into splice and crimp (Figure 19).

**Figure 19. Spliced Wire.**

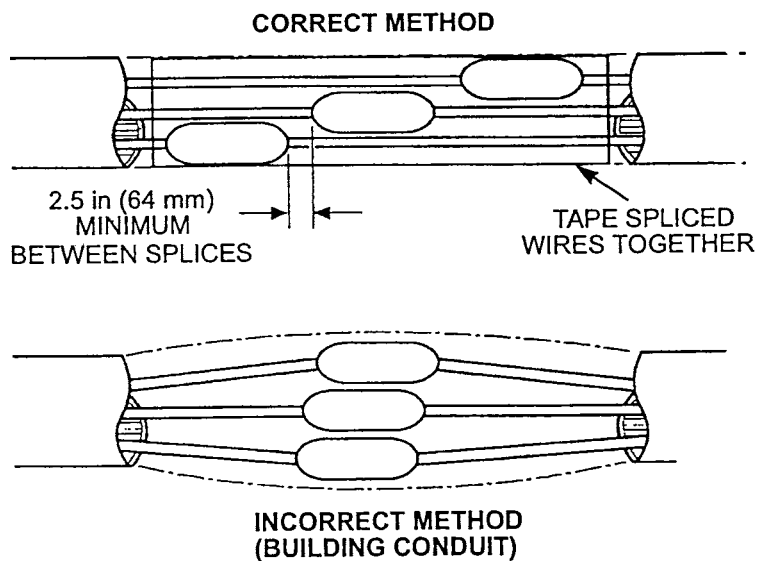
3. **Soldering Splice Connectors.** See TB SIG 222 for more information about solder and soldering. Soldering splice connectors is optional. To solder splice connectors:
 - a. You **MUST** use rosin core solder.
 - b. Check exposed wire before splice is crimped in connector. Exposed wire **MUST** be clean before splice is crimped.
 - c. Use a suitable electronic soldering iron to heat wires. Apply solder to heated wire (not to soldering iron) allowing sufficient solder flow into splice joint.
 - d. Pull on connection to ensure crimping and soldering integrity.
4. **Heat Shrinkable Tubing.**
 - a. Shrink wrap is required. Alpha FIT-300, Raychem TAT-125 or any equivalent heat shrink dual wall epoxy encapsulating adhesive polyolefin is required. The following are sources of supply:

Alpha Wire Corp
 711 Lidgerwood Ave
 P.O. Box 711
 Elizabeth, New Jersey 07207-0711
 1-800-5 2ALPHA

Raychem Corporation, Thermofit Div
 300 Constitution Drive, Bldg. B
 Menlo Park, CA 94025
 415-361-3860

SPLICING - CONTINUED

- b. To heat shrink wrap a splice:
- (1) Select correct diameter to allow a tight wrap when heated. Heat shrink wrap **MUST** be long enough to overlap wire insulation about 1/4 in (6.4 mm) on both sides of splice.
 - (2) Heat shrink wrap with a heat gun; do not concentrate heat in one location, but play heat over entire length of shrink wrap until joint is complete.
5. **Splicing Multiple Broken Wires.**
- a. Stagger position of each splice as illustrated (Figure 20).
 - b. You **MUST** stagger positions to prevent a large bulge in harness and to prevent wires from chafing against each other.

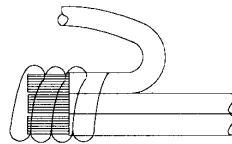


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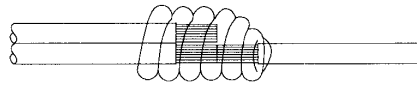
Figure 20. Multiple Splices.

SPLICING - CONTINUED6. **Three-Wire Splices.**

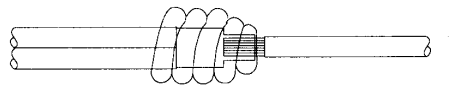
- a. Three-way splice connectors are commercially available to accommodate three-wire splices.
- b. The technique is the same as a single butt splice connector (Figure 21).



EXAMPLE 1



EXAMPLE 2



EXAMPLE 3

Figure 21. Three-way Splices.**END OF WORK PACKAGE**

AIR CONDITIONER BINARY SWITCH WIRING HARNESS REPLACEMENT

0099 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

References

TM 9-2320-303-10

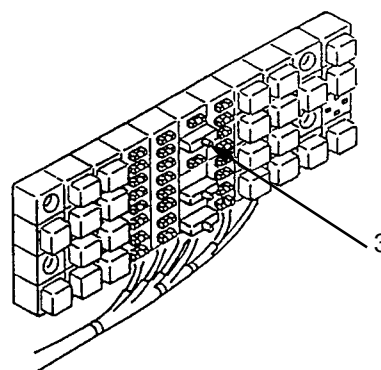
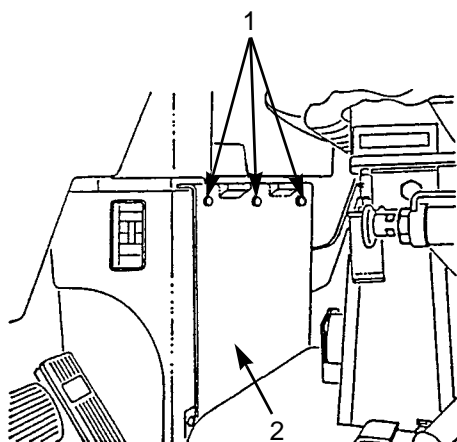
WP 0072 00

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

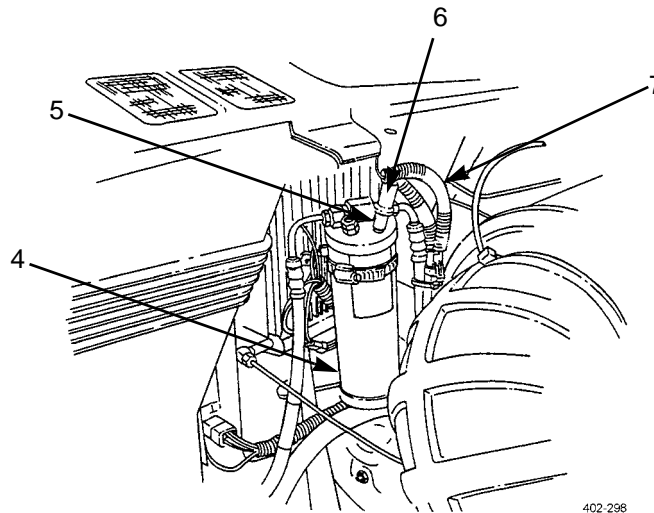
1. Unlock three fasteners (1) by turning counterclockwise and remove access panel (2).
2. Remove fuse, relay, and circuit breaker holder (WP 0072 00).
3. Locate circuit 98A on circuit breaker panel (3) and disconnect wiring harness connector from panel.



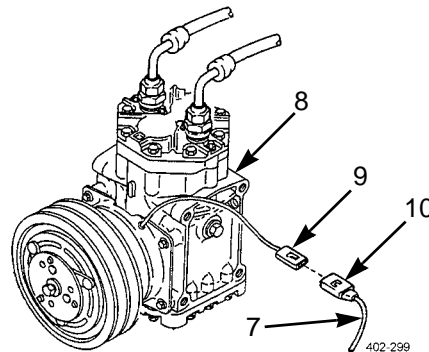
402-297

REMOVAL - CONTINUED

4. Trace wiring harness from circuit breaker panel to firewall, removing tiedown straps. Note location of tiedown straps.
5. Remove grommet from firewall and feed wiring harness into engine compartment.
6. Trace wiring harness (7) to receiver-drier (4), removing tiedown straps. Note location of tiedown straps.
7. Disconnect wiring harness connector (6) from binary switch (5) on receiver-drier (4).



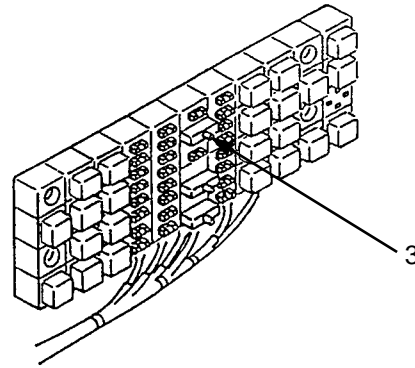
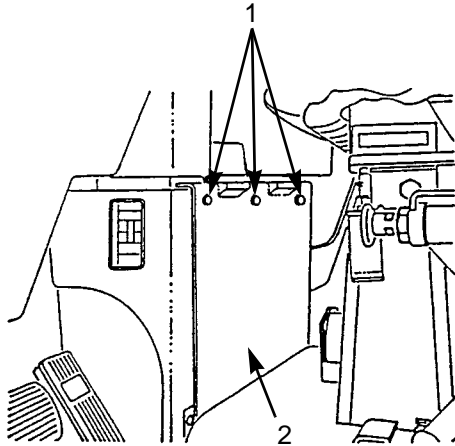
8. Trace wiring harness (7) to compressor (8), removing tiedown straps. Note location of tiedown straps.
9. Disconnect wiring harness connector (10) from compressor wiring harness connector (9).

**INSTALLATION**

1. Connect wiring harness connector (6) to binary switch (5) on receiver-drier (4).
2. Route one branch of wiring harness (7) to compressor (8), securing wiring harness with tiedown straps.
3. Connect wiring harness connector (10) to compressor wiring harness connector (9).
4. Install grommet on branch of wiring harness (7) leading to circuit breaker panel (3) inside cab. Route harness through firewall to circuit 98A on circuit breaker panel.
5. Install grommet into firewall and secure harness with tiedown straps.
6. Connect wiring harness connector (7) to circuit 98A on circuit breaker panel (3).
7. Install fuse, relay, and circuit breaker holder (WP 0072 00).

INSTALLATION - CONTINUED

8. Install access panel (2) and lock three fasteners (1) by turning clockwise.



402-297

9. Operate heater/air conditioner (TM 9-2320-303-10).

END OF WORK PACKAGE

FRONT BLACKOUT DRIVE LIGHT REPLACEMENT

0100 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Tape, insulation, electrical (Item 45, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (3)

Materials/Parts - Continued

Washer, lock (P/N 004-003005-055)

References

WP 0098 00

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

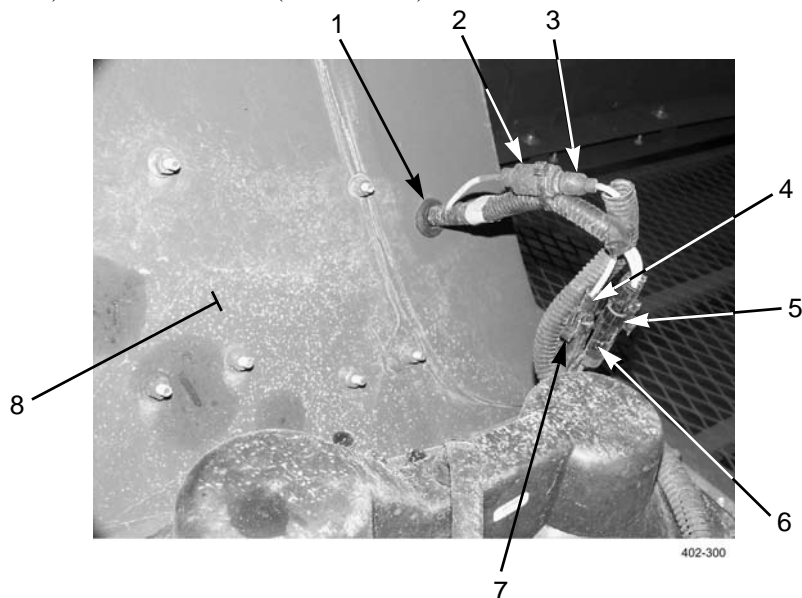
Hood opened (TM 9-2320-303-10)

REMOVAL

NOTE

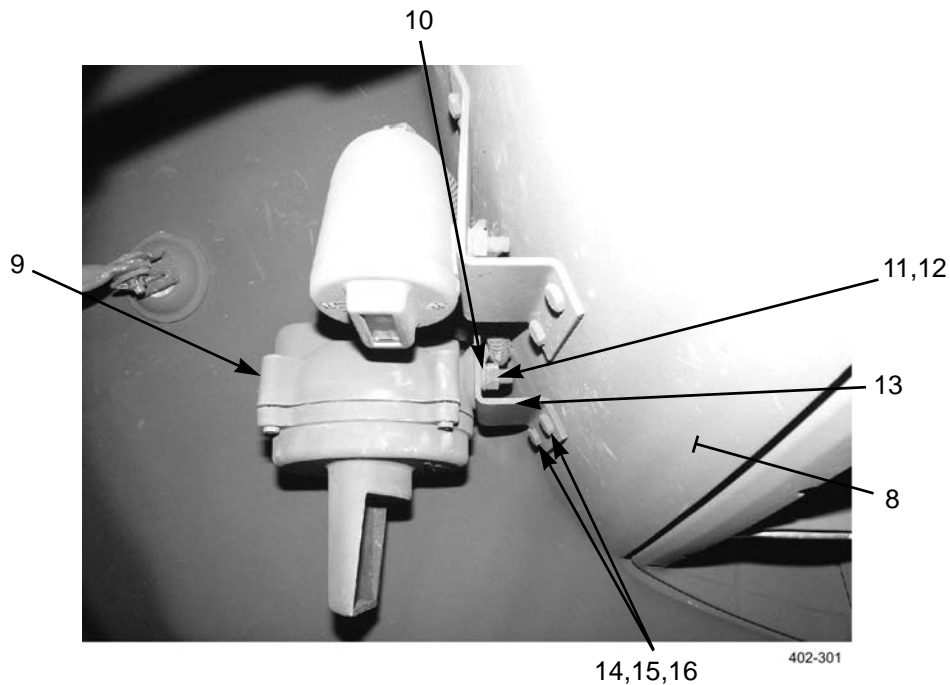
- Remove tiedown straps as required and discard. Use new tiedown straps on installation.
- Tag connectors to ensure correct installation.

1. Disconnect blackout marker light connector (2) from wiring harness connector (3).
2. Disconnect blackout marker light (single-wire) connector (4) from wiring harness connector (7).
3. Disconnect blackout drive light (2-wire) connector (5) from wiring harness connector (6).
4. Remove electrical tape and wire looms. Separate blackout marker light wires from blackout drive light wires. Remove connectors (2, 4, and 5) from ends of wires (WP 0098 00).



FRONT BLACKOUT DRIVE LIGHT REPLACEMENT - CONTINUED**0100 00****REMOVAL - CONTINUED**

5. Remove nut (11), lockwasher (12), ground wire (10), and blackout drive light (9) from mounting bracket (13). Discard lockwasher.
6. Remove grommet (1) and pull blackout drive and marker light wires through fender (8) while removing blackout drive light (9).
7. If damaged, remove three locknuts (14) washers (15), screws (16), and mounting bracket (13) from fender (8). Discard locknuts.

**INSTALLATION**

1. If removed, install mounting bracket (13) to fender (8) with three screws (16), washers (15), and new locknuts (14).

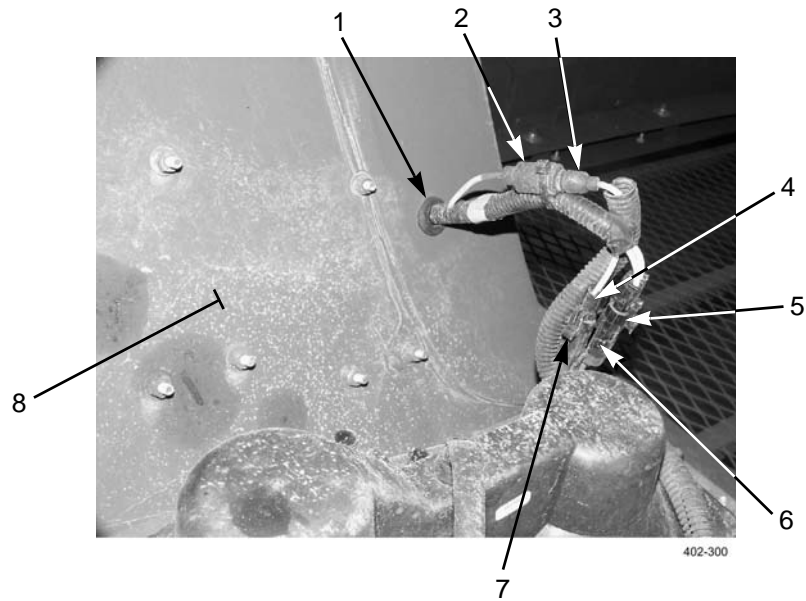
NOTE

Ensure that wire loom is installed over wires before wires are fed through fender.

2. Feed blackout drive and marker light wires through grommet (1) and fender (8). Seat grommet in fender.
3. Install blackout drive light (9) and ground wire (10) to mounting bracket (13) with new lockwasher (12) and nut (11).

(0100 00-4 Blank)FRONT BLACKOUT DRIVE LIGHT REPLACEMENT - CONTINUED

0100

INSTALLATION - CONTINUED

4. Install connectors (2, 4, and 5) on wires (WP 0098 00).
5. Connect blackout drive light (2-wire) connector (5) to wiring harness connector (6).
6. Connect blackout marker light (single-wire) connector (4) to wiring harness connector (7).
7. Connect blackout marker light connector (2) to wiring harness connector (3).
8. Install wire looms around wires and secure wire looms with electrical tape.
9. Close hood (TM 9-2320-303-10).

END OF WORK PACKAGE

FRONT BLACKOUT MARKER LIGHT REPLACEMENT

0101 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Tape, insulation, electrical (Item 45, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (3)

Materials/Parts - Continued

Washer, lock (P/N 004-003005-055)

References

WP 0098 00

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

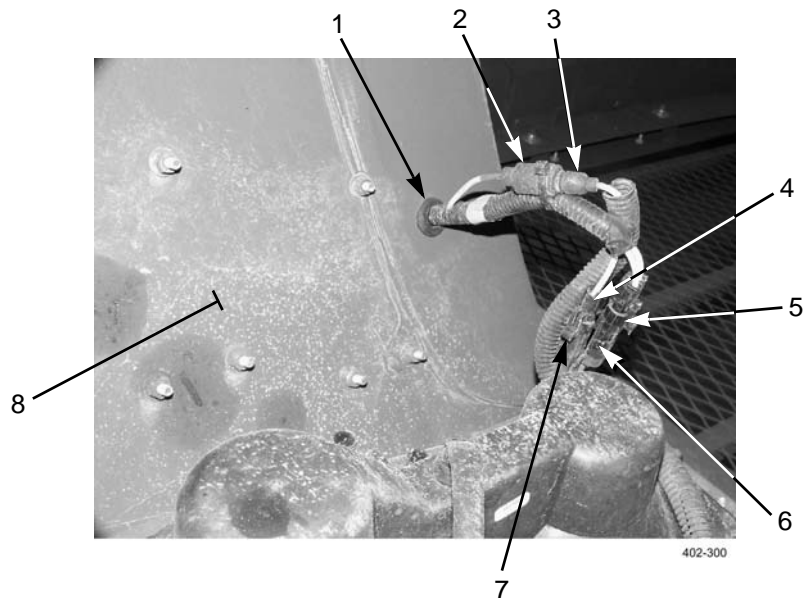
Hood opened (TM 9-2320-303-10)

NOTE

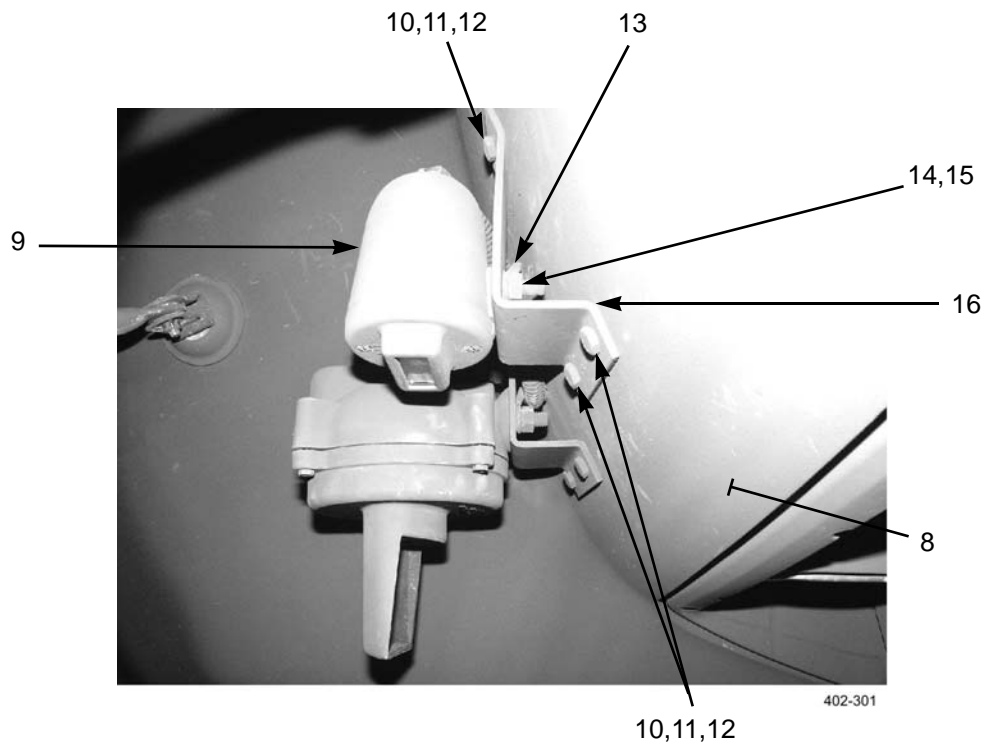
- Replacement of right- and left-front blackout marker lights is the same except that left-front blackout marker light wires must be separated from blackout drive light wires during replacement procedure, by removing electrical tape and wire looms. Blackout drive light wires must also be removed from fender as blackout marker light wires are removed.
- Left-front blackout marker light is illustrated.

REMOVAL**NOTE**

- Remove tiedown straps as required and discard.
 - Tag connectors to ensure correct installation.
1. Disconnect blackout marker light connector (2) from wiring harness connector (3).
 2. Disconnect blackout marker light (single-wire) connector (4) from wiring harness connector (7).
 3. Disconnect blackout drive light (2-wire) connector (5) from wiring harness connector (6).
 4. If removing left-front blackout marker light, remove electrical tape and wire looms. Separate blackout marker light wires from blackout drive light wires. Remove connectors (2, 4, and 5) from ends of wires (WP 0098 00).



5. Remove nut (14), lockwasher (15), ground wire (13), and blackout marker light (9) from mounting bracket (16). Discard lockwasher.
6. Remove grommet (1) and pull blackout marker and drive light wires through fender (8) while removing blackout marker light (9).
7. If damaged, remove three locknuts (10) washers (11), screws (12), and mounting bracket (16) from fender (8). Discard locknuts.

REMOVAL - CONTINUED**INSTALLATION**

1. If removed, install mounting bracket (16) to fender (8) with three screws (12), washers (11), and new locknuts (10).

NOTE

Ensure that wire loom is installed over wires before wires are fed through fender.

2. Feed blackout marker and drive light wires through grommet (1) and fender (8). Seat grommet in fender.
3. Install blackout marker light (9) and ground wire (13) to mounting bracket (16) with new lockwasher (15) and nut (14).
4. Install connectors (2, 4, and 5) on wires (WP 0098 00).
5. Connect blackout drive light (2-wire) connector (5) to wiring harness connector (6).
6. Connect blackout marker light (single-wire) connector (4) to wiring harness connector (7).
7. Connect blackout marker light connector (2) to wiring harness connector (3).
8. If installing left-front blackout marker light, install wire looms around wires and secure wire looms with electrical tape.

END OF WORK PACKAGE

PARKING BRAKE PRESSURE SWITCH REPLACEMENT

0102 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Goggles, industrial (Item 30, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

References

TM 9-2320-303-10

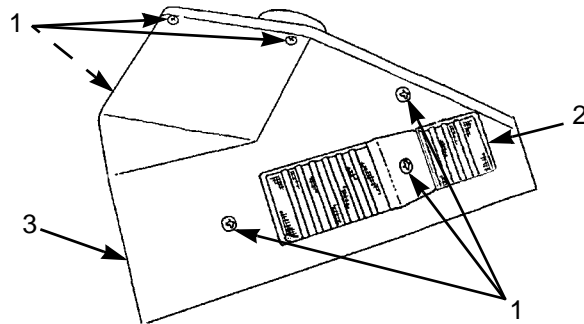
Equipment Condition

Air system drained (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

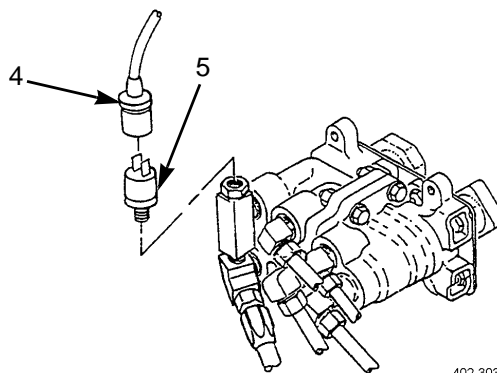
REMOVAL

1. Remove six torx screws (1), defroster vent (2), and dashboard cover (3) from dashboard.



402-302

2. Remove wiring harness connector (4) from parking brake pressure switch (5).



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REMOVAL - CONTINUED**WARNING**

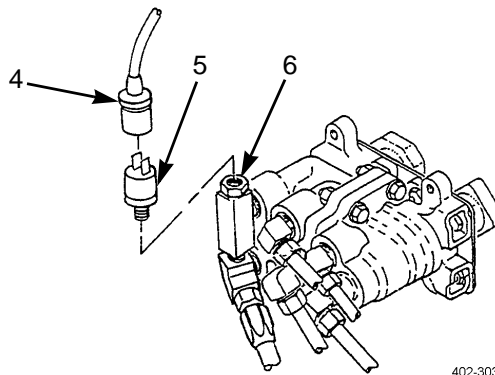
- DO NOT disconnect any air system lines or fittings unless vehicle engine is shut down and air system pressure is relieved. Failure to follow this warning could result in serious injury to personnel.
- Always wear eye protection when disconnecting air lines. Residual air will be expelled. Failure to follow this warning may result in serious eye injury.

3. Remove parking brake pressure switch (5) from adapter fitting (6).

INSTALLATION**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel and damage to equipment.

1. Lightly coat threads on parking brake pressure switch (5) with pipe sealing compound.
2. Install parking brake pressure switch (5) on adapter fitting (6).
3. Install wiring harness connector (4) on parking brake pressure switch (5).



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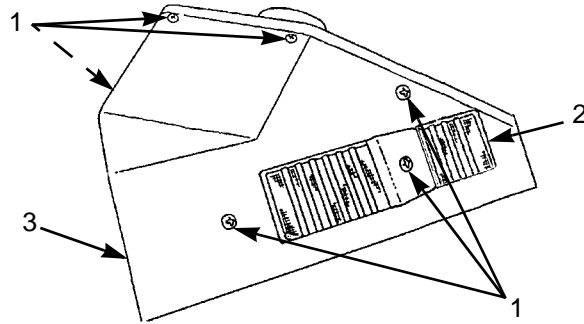
NOTE

Ensure that parking brake light illuminates when parking brake is applied.

4. Start vehicle, pressurize air system, apply parking brake and check for air leaks (TM 9-2320-303-10).

INSTALLATION - CONTINUED

5. Shut vehicle off (TM 9-2320-303-10).
6. Install dash panel cover (3) and defroster vent (2) with six torx screws (1).



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END OF WORK PACKAGE

WATER LEVEL PROBE REPLACEMENT

0103 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Materials/Parts - Continued

Tag, marker (Item 42, WP 0312 00)

Equipment Condition

Cooling system drained (WP 0045 00)

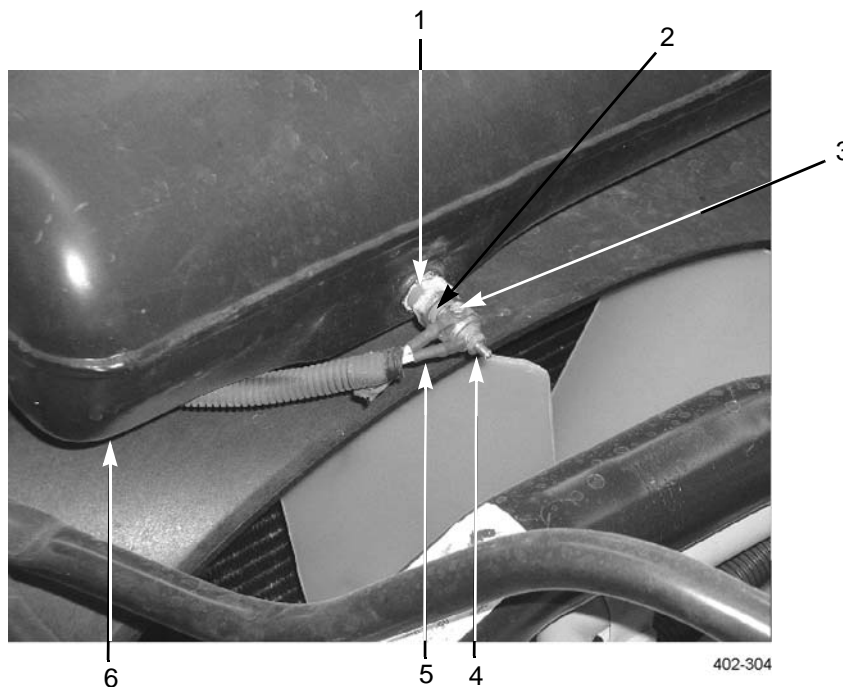
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

Tag wires to aid in installation.

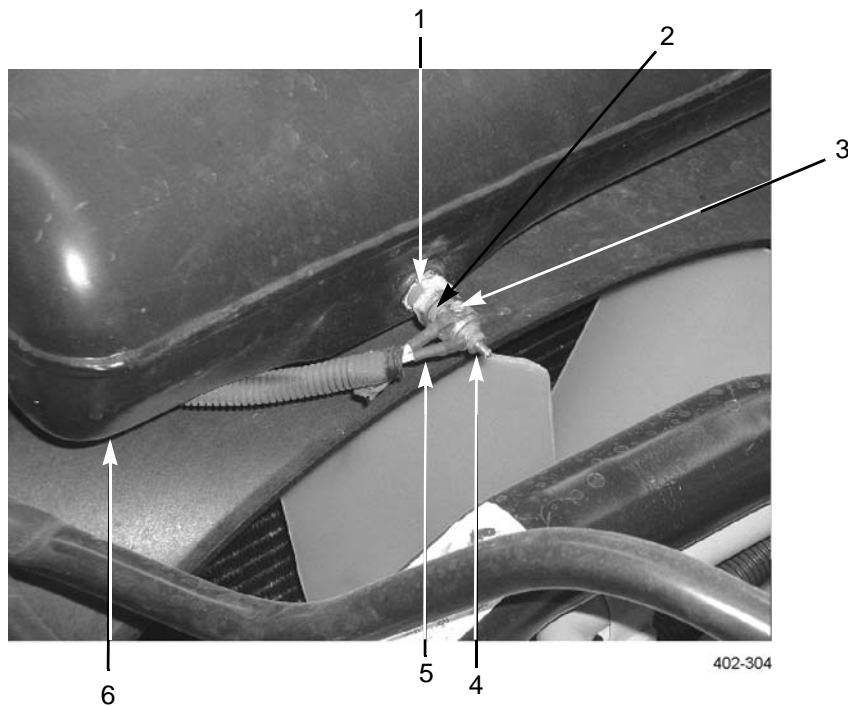
1. Remove nut (4) and wire lead (5) from probe (1).
2. Remove screw (3) and wire lead (2) from probe (1).
3. Remove probe (1) from coolant tank (6).



INSTALLATION**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

1. Apply pipe sealing compound to threads of probe (1).
2. Install probe (1) in coolant tank (6).
3. Install wire lead (2) and screw (3) on probe (1).
4. Install wire lead (5) and nut (4) on probe (1).

**END OF WORK PACKAGE**

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Tools and Special Tools

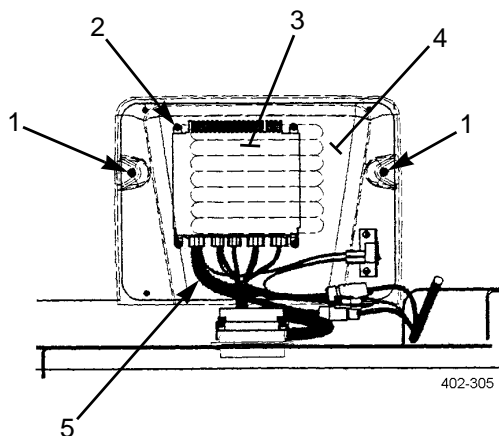
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove two screws (1) and cover (4).
2. Tag and disconnect cable connectors (5) from electronic control unit (3).
3. Remove four screws (2) and electronic control unit (3).

**INSTALLATION**

1. Position electronic control unit (3) and install four screws (2).
2. Connect cable connectors (5) to electronic control unit (3) and remove tags.
3. Position cover (4) and install two screws (1).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

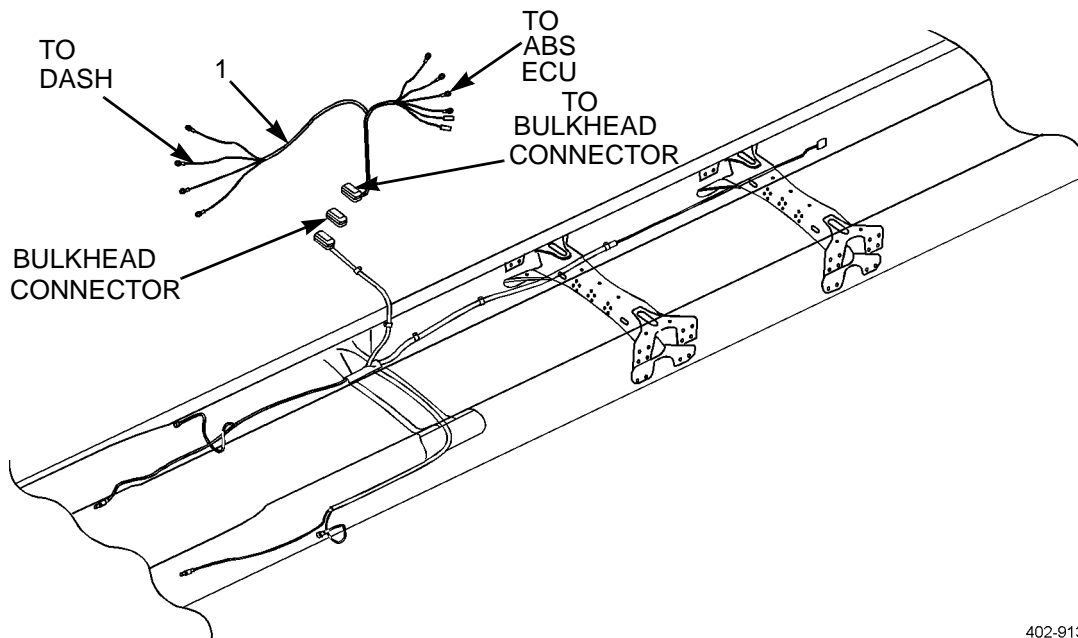
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

- Note number and location of tiedown straps to aid in installation.
- Tag wiring harness and leads prior to removal to aid in installation.

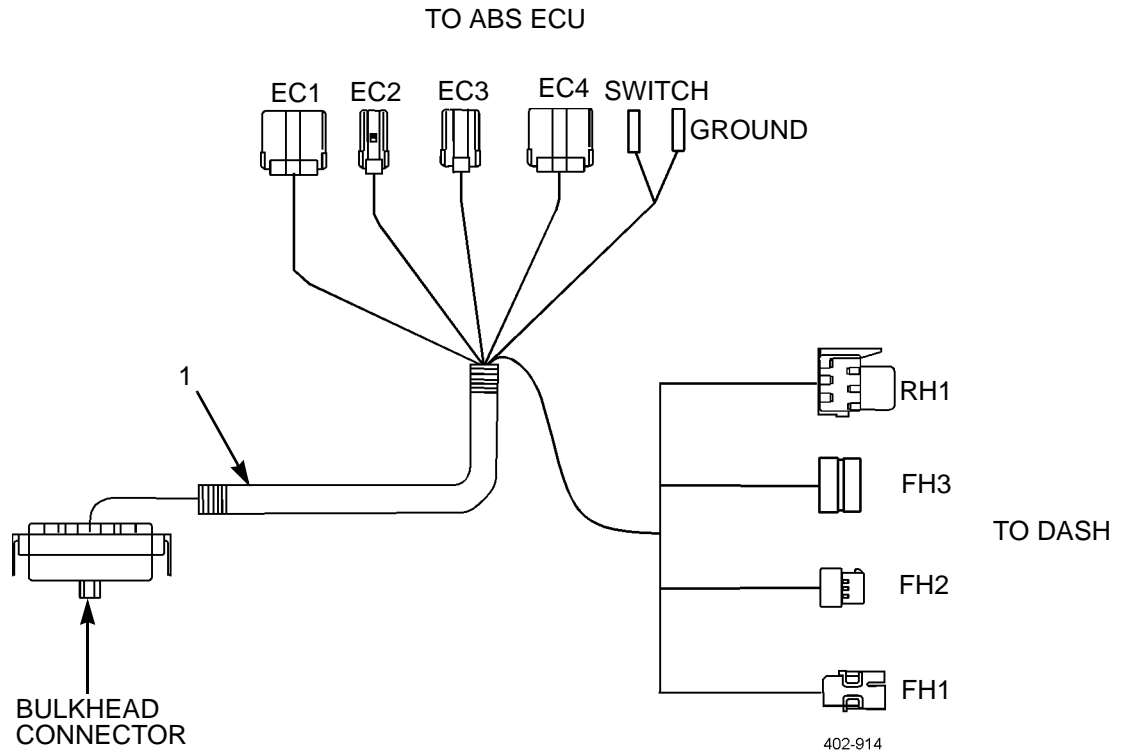
1. Remove tiedown straps securing cab ABS wiring harness (1). Discard tiedown straps.
2. Disconnect ABS wiring harness (1) connections, using illustration as a guide.



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INSTALLATION

1. Connect ABS wiring harness (1) connections, using illustration as a guide.
2. Install same number of new tiedown straps as were removed, to secure cab ABS wiring harness (1).



END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (6)

Materials/Parts - Continued

Washer, lock (P/N MS35338-48) (4)

Washer, lock (P/N 23-00702-025) (2)

References

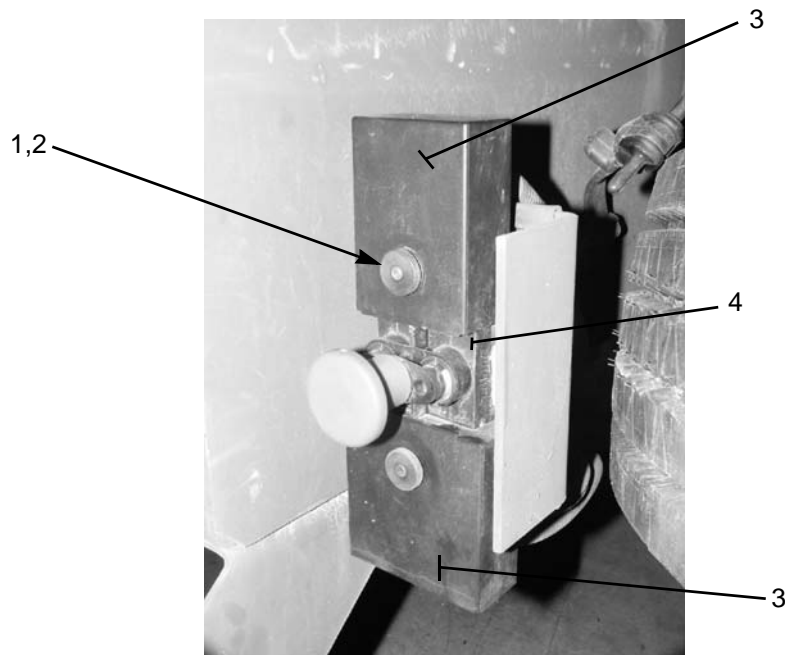
TM 9-2320-303 -10

Equipment Condition

Battery cables disconnected (WP 0095 00)

REMOVAL

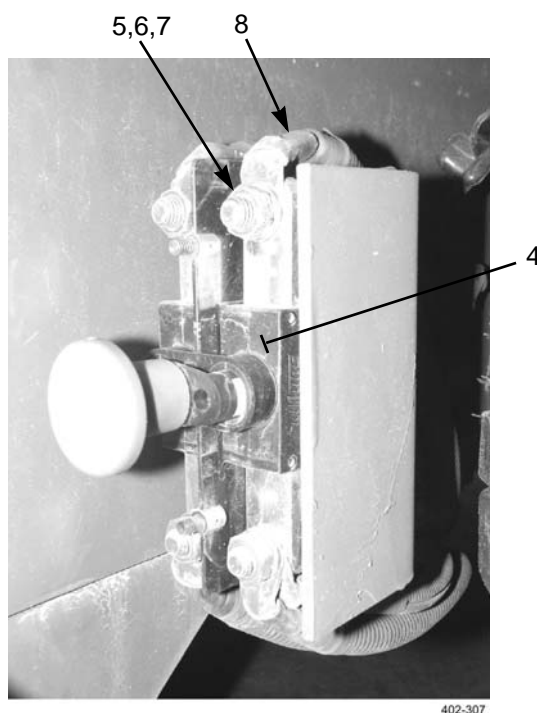
1. Rotate knob (1) at upper and lower covers (3) of master battery switch (4) and remove two knobs, lockwashers (2), and covers. Discard lockwashers.



402-306

REMOVAL - CONTINUED**NOTE**

- Tag cables to ensure correct installation.
 - Each terminal at bottom of master battery switch has TWO cables attached.
2. Remove four nuts (5), lockwashers (6), and six cables (8) from four screws (7) at terminals of master battery switch (4). Discard lockwashers.

**NOTE**

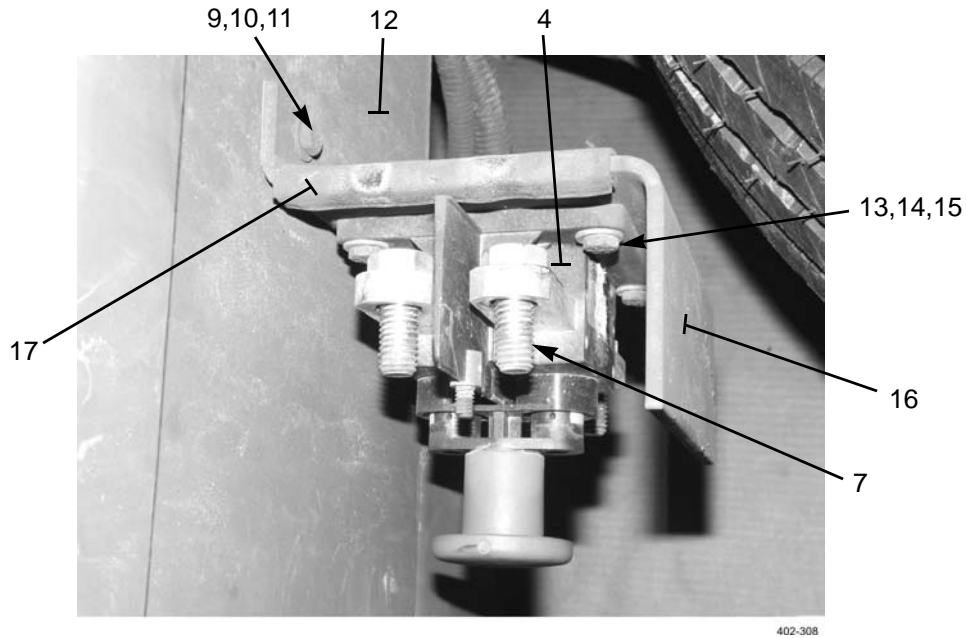
Note position of master battery switch for installation.

3. Remove four locknuts (13), eight washers (14), four screws (15), master battery switch (4), and four screws (7) from bracket (16). Discard locknuts.

NOTE

Perform steps 4 through 6 to remove bracket.

4. Remove two insulators (17) from bracket (16).
5. Remove cover from battery box (TM 9-2320-303-10).
6. Remove two locknuts (9), four washers (10), two screws (11), and bracket (16) from side of battery box (12). Discard locknuts.

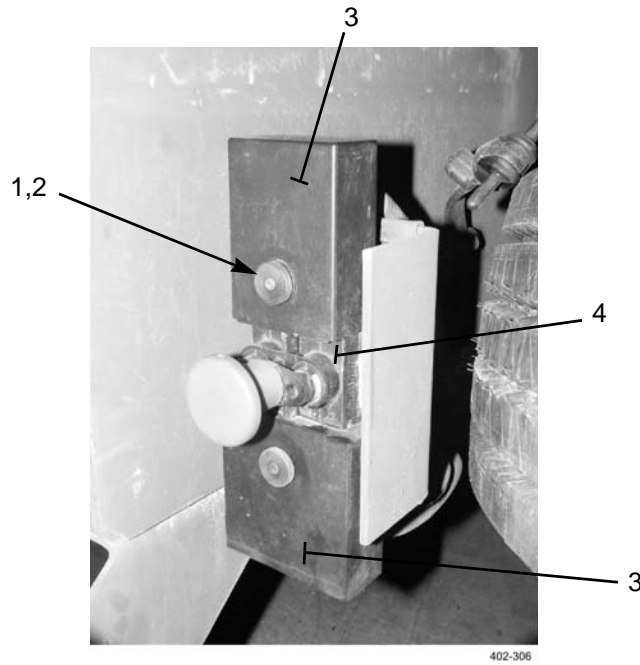
REMOVAL - CONTINUED**INSTALLATION****NOTE**

Perform steps 1 through 3 to install bracket.

1. Install bracket (16) to side of battery box (12) with two screws (11), four washers (10), and two new locknuts (9).
2. Install cover to battery box (TM 9-2320-303-10).
3. Install two insulators (17) to bracket (16).
4. Position four screws (7) through rear of master battery switch (4). Install master battery switch to bracket (16) with four screws (15), eight washers (14), and four new locknuts (13).
5. Install six cables (8) to terminals of master battery switch (4) with four new lockwashers (6) and nuts (5) on screws (7).

INSTALLATION - CONTINUED

6. Install two covers (3) to master battery switch (4) with two new lockwashers (2) and knobs (1).



7. Install battery cables (WP 0095 00).

END OF WORK PACKAGE

SHIFT TOWER MAINTENANCE (M915A4)

0107 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Equipment Condition

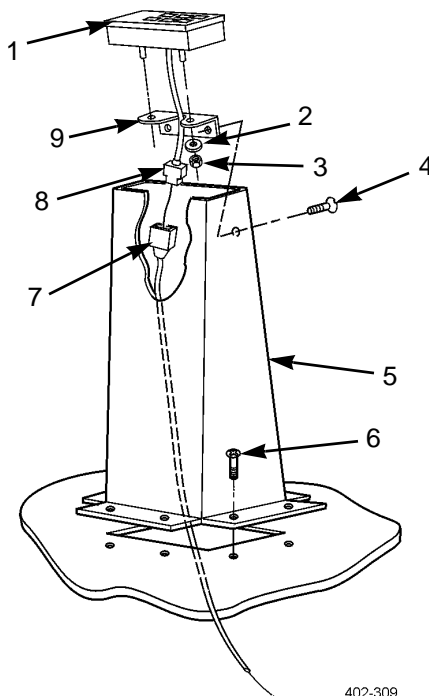
Master battery switch in OFF position (TM 9-2320-303-10)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

1. Remove two screws (4) from side of shift tower (5).
2. Lift shift selector (1) from shift tower (5) and disconnect transmission harness connector (7) from shift selector connector (8).
3. Remove two nuts (3), washers (2), and bracket (9) from shift selector (1).
4. Remove eight screws (6), and shift tower (5) from cab floor.



402-309

INSTALLATION

1. Position shift tower (5) on cab floor and install eight screws (6).
2. Position bracket (9) on shift selector (1) and install two washers (2) and nuts (3).
3. Connect shift selector connector (8) to transmission harness connector (9).
4. Position shift selector (1) on shift tower (5) and install two screws (4).

END OF WORK PACKAGE

SHIFT SELECTOR AND BRACKET REPLACEMENT (M915A4R2)

0107 01

THIS WORK PACKAGE COVERS

Shift Selector and Bracket Removal, Shift Selector and Bracket Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

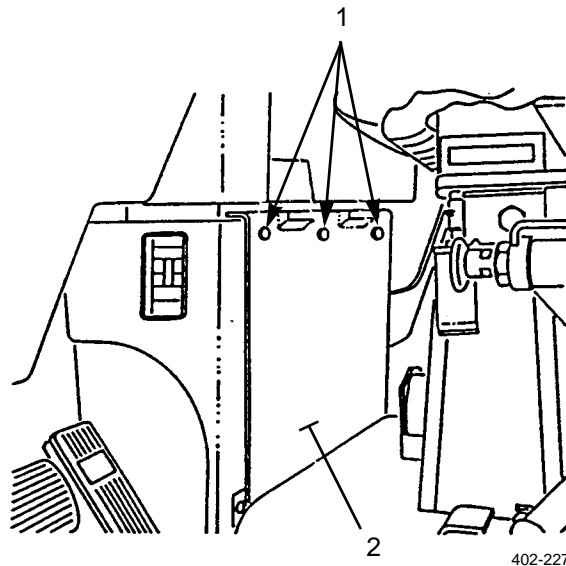
Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)

NOTE

Shift selector and bracket can be removed from dash as an assembly or shift selector can be removed from bracket.

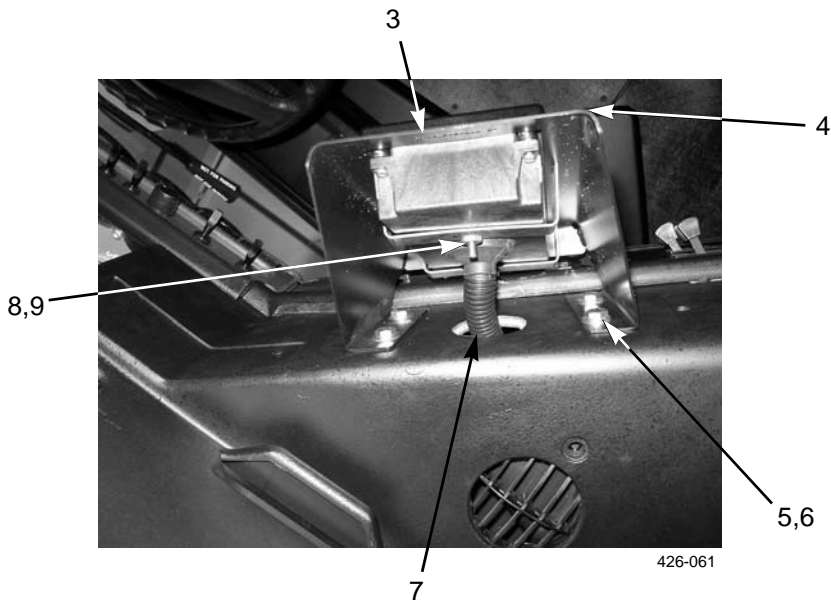
SHIFT SELECTOR AND BRACKET REMOVAL

1. Rotate three turnlock fasteners (1) and remove cover (2).



SHIFT SELECTOR AND BRACKET REMOVAL - CONTINUED

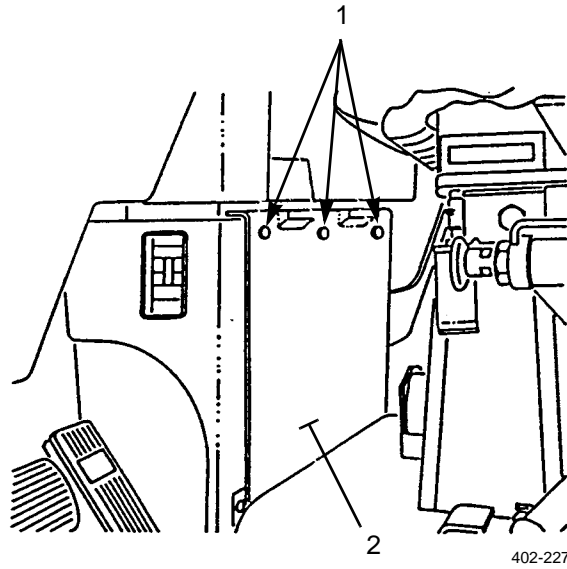
2. Under dash, locate and disconnect shift selector harness (7) connector from vehicle harness connector.
3. Remove two nuts (8), two washers (9), and shift selector (3) from bracket (4).
4. If necessary, remove four bolts (5), four washers (6), and bracket (4) from dash.

***SHIFT SELECTOR AND BRACKET INSTALLATION***

1. If removed, position bracket (4) on dash and install four bolts (5) and four washers (6).
2. Feed shift selector harness (7) connector through hole in dash and position shift selector (3) on bracket (4).
3. Install two nuts (8) and two washers (9) securing shift selector (3) to bracket (4).
4. Under dash, connect shift selector harness (7) connector to vehicle harness connector.

SHIFT SELECTOR AND BRACKET INSTALLATION - CONTINUED

5. Position cover (2) and rotate three turnlock fasteners (1).



END OF WORK PACKAGE

TRANSMISSION OIL FILL/LEVEL CHECK TUBE REPLACEMENT

0108 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Strap, tiedown (Item 41, WP 312 00)

Seal (P/N 29507823)

Washer, lock (P/N MS35338-44) (2)

Equipment Condition

Transmission dipstick removed (TM 9-2320-303-10)

REMOVAL

1. Remove screw (11) and clamp (10) from right side of transmission (9).

NOTE

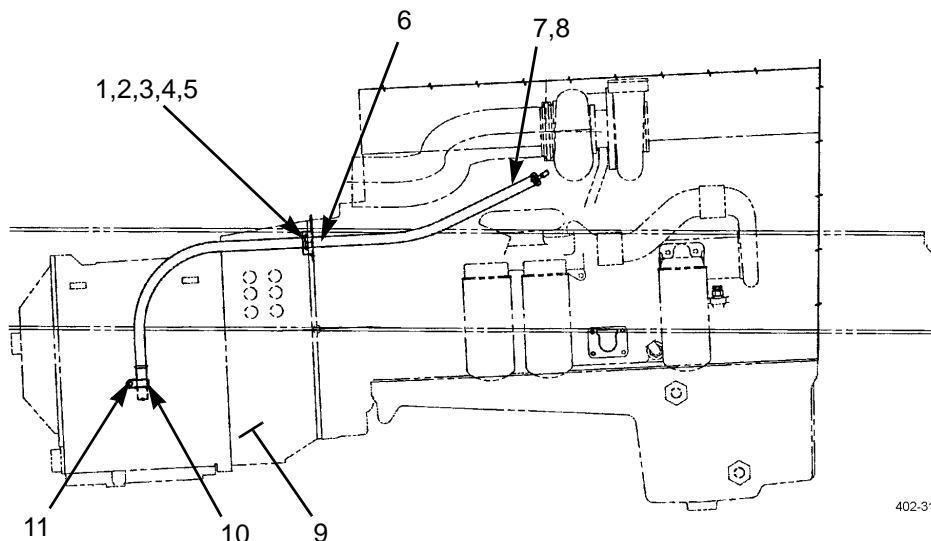
Note amount and location of tiedown straps to aid in installation.

2. Remove and discard tiedown straps.
3. Remove two nuts (1), lockwashers (2), U-bolt (3), transmission oil fill/level check tube (7) and seal (8) from transmission bracket (6) and transmission (8). Discard lockwashers and seal.

NOTE

Perform step 4 only if transmission bracket is damaged.

4. Remove two screws (4), washers (5), and transmission bracket (6) from transmission (8).

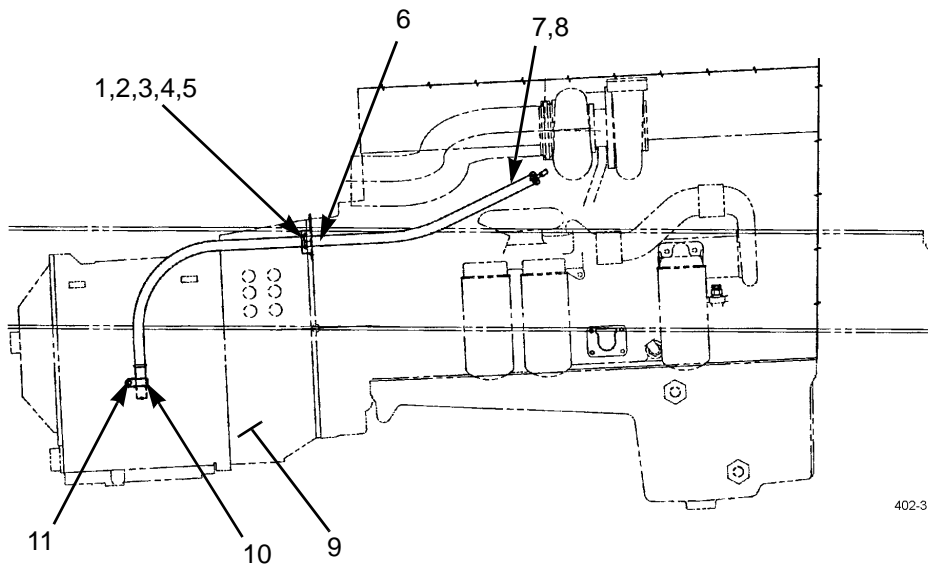


402-310

INSTALLATION**NOTE**

Perform step 1 if transmission bracket was removed.

1. Install transmission bracket (6) on transmission (8) with two washers (5) and screws (4). Tighten screws to 54-65 lb-ft (73-88 Nm).
2. Position clamp (10) on transmission oil fill/level check tube (7), new seal (8) and install transmission oil fill/level check tube on transmission (9) and transmission bracket (6) with U-bolt (3), two new lockwashers (2), and nuts (1).
3. Install clamp (10) on right side of transmission (9) with screw (11).
4. Install tiedown straps.



5. Install transmission dipstick (TM 9-2320-303-10).

END OF WORK PACKAGE

TRANSMISSION OIL FILTER ELEMENTS REPLACEMENT

0109 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

- Tool kit, general mechanic's (Item 102, WP 0313 00)
- Pan, drain (Item 62, WP 0313 00)
- Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

- Oil, lubricating (Item 27, WP 0312 00)
- Element, filter (P/N 29538232) (2)
- O-ring (P/N 29524448)
- O-ring (P/N 29507437)

References

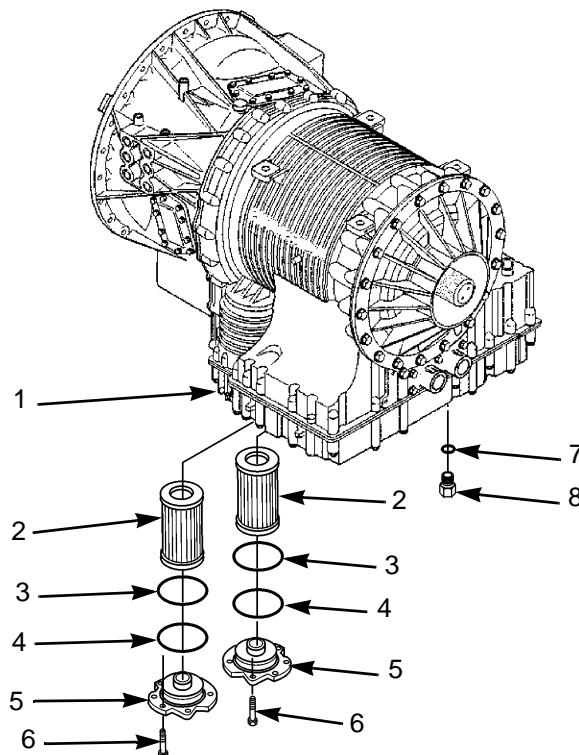
TM 9-2320-303-10

NOTE

Perform this procedure for two transmission oil filter elements.

REMOVAL

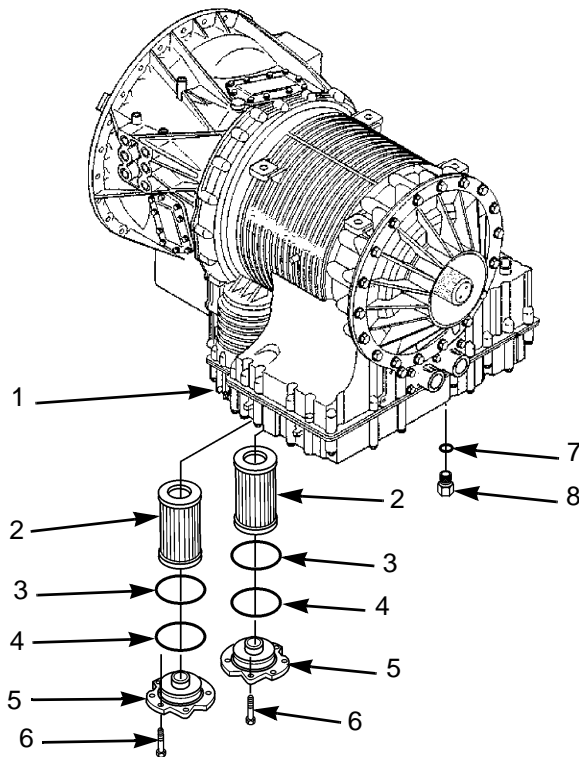
1. Place suitable container under transmission.
2. Remove drain plug (8) and o-ring (7).
3. Remove six screws (6), cover (5), preformed packing (4), seal (3), and transmission oil filter element (2) from bottom of transmission (1). Discard preformed packing, seal, and transmission oil filter element.



402-311

INSTALLATION

1. Apply a light coat of lubricating oil to new performed packing (4) and sealing surface of new transmission oil filter element (2).
2. Position preformed packing (4), new seal (3), and transmission oil filter element (2) on cover (5).
3. Install cover (5) on transmission (1) with six screws (6). Tighten screws to 38-45 lb-ft (52-61 Nm).
4. Apply a light coat of lubricating oil to o-ring (7).
5. Install o-ring (7) and drain plug (8).



402-311

6. Refill transmission with oil (TM 9-2320-303-10).
7. Start vehicle and check for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

TRANSMISSION ELECTRONIC CONTROL UNIT (ECU)/TRANSMISSION CONTROL MODULE (TCM) REPLACEMENT

0110 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, screwdriver, torx (Item 114, WP 0313 00)

Materials/Parts

Strap, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Equipment Conditions

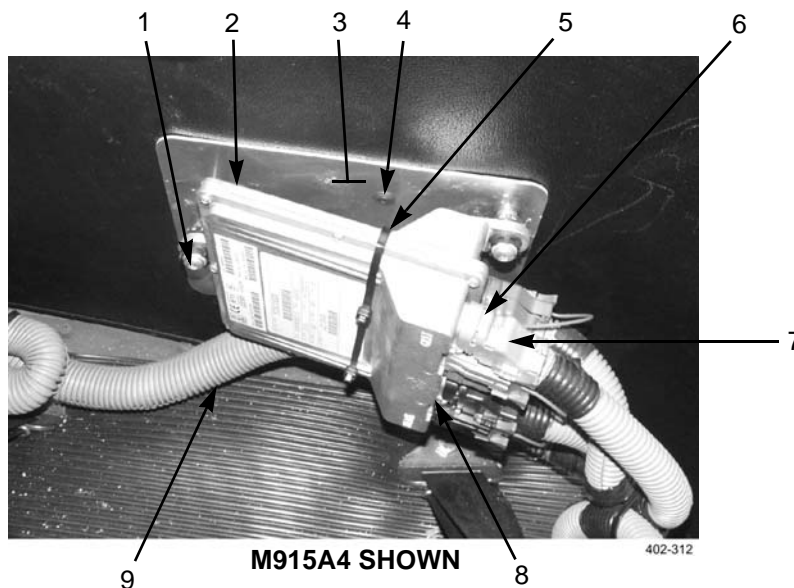
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

Tag connectors to aid in installation.

1. Cut and discard tiedown strap (5).
2. Disconnect three transmission ECU harnesses (6, 7, and 8) from ECU (2) (M915A4).
3. Disconnect one TCM harness (6) from TCM (2) (M915A4R2).
4. Remove three screws (1) and ECU/TCM (2) from mounting plate (3) on cab rear wall.
5. If damaged, remove three screws (4) and mounting plate (3) from cab rear wall.

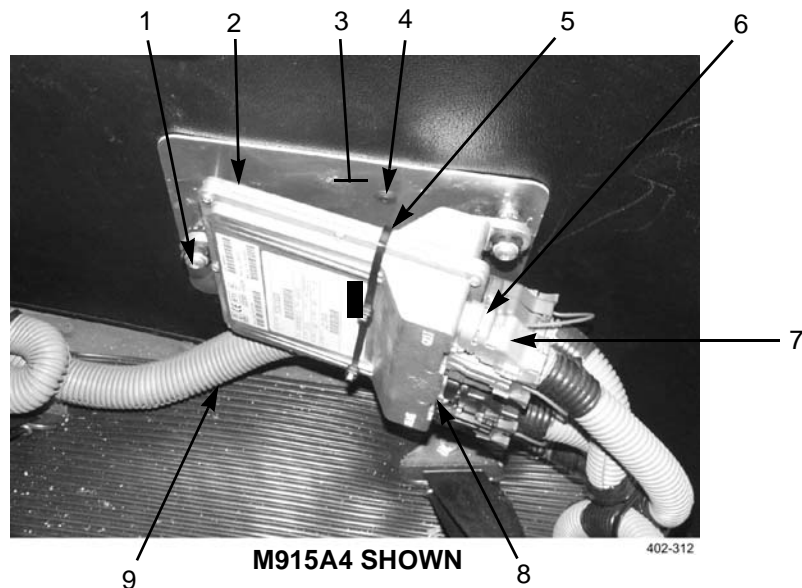


TRANSMISSION ELECTRONIC CONTROL UNIT (ECU)/TRANSMISSION CONTROL MODULE (TCM) REPLACEMENT - CONTINUED

0110 00

INSTALLATION

1. If removed, position mounting plate (3) on cab rear wall and install three screws (4).
2. Position ECU/TCM (2) on mounting plate (3) and install three screws (1).
3. Connect three transmission ECU harnesses (6, 7, and 8) (M915A4).
4. Connect one TCM harness (6) to TCM (2) (M915A4R2).
5. Install tiedown strap (5) around ECU/TCM (2) and wiring harness conduit (9).

**END OF WORK PACKAGE**

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Tools and Special Tools

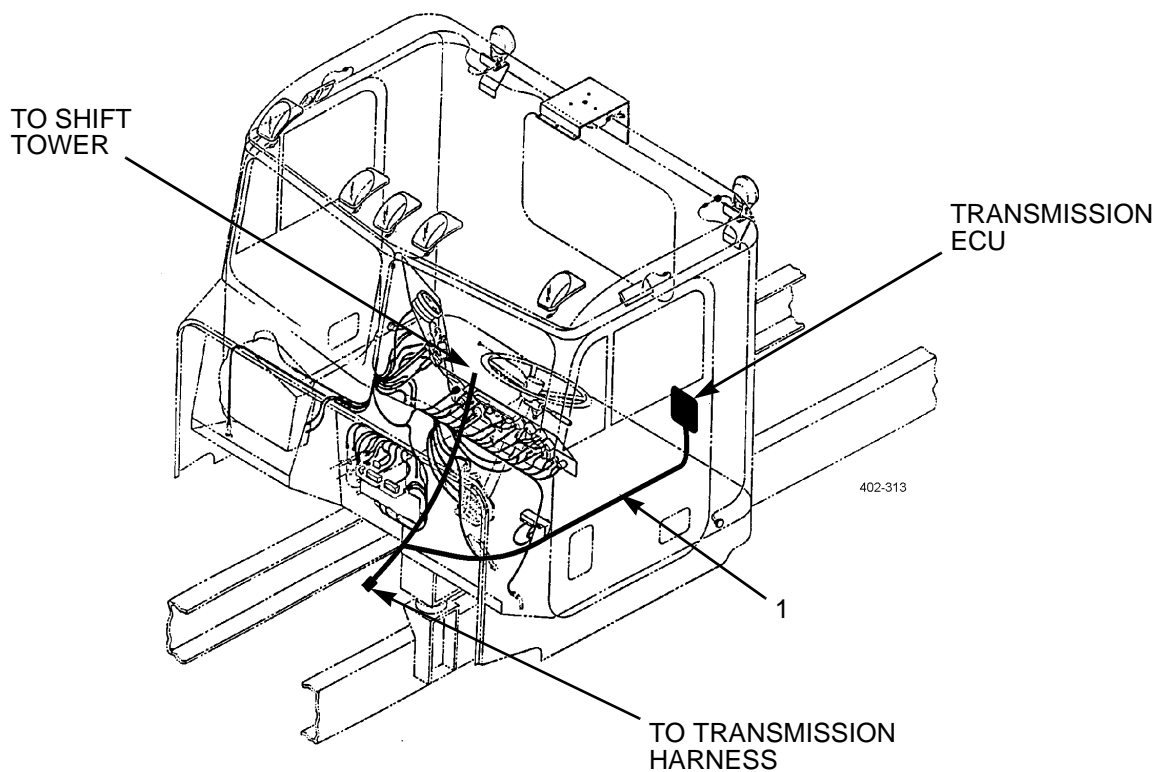
Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

NOTE

Wiring harness and leads are secured in place by cushion clamps and screw terminals. Only remove hardware securing harness or lead to be removed.

Disconnect and remove transmission ECU wiring harness (1) using illustration as a guide.



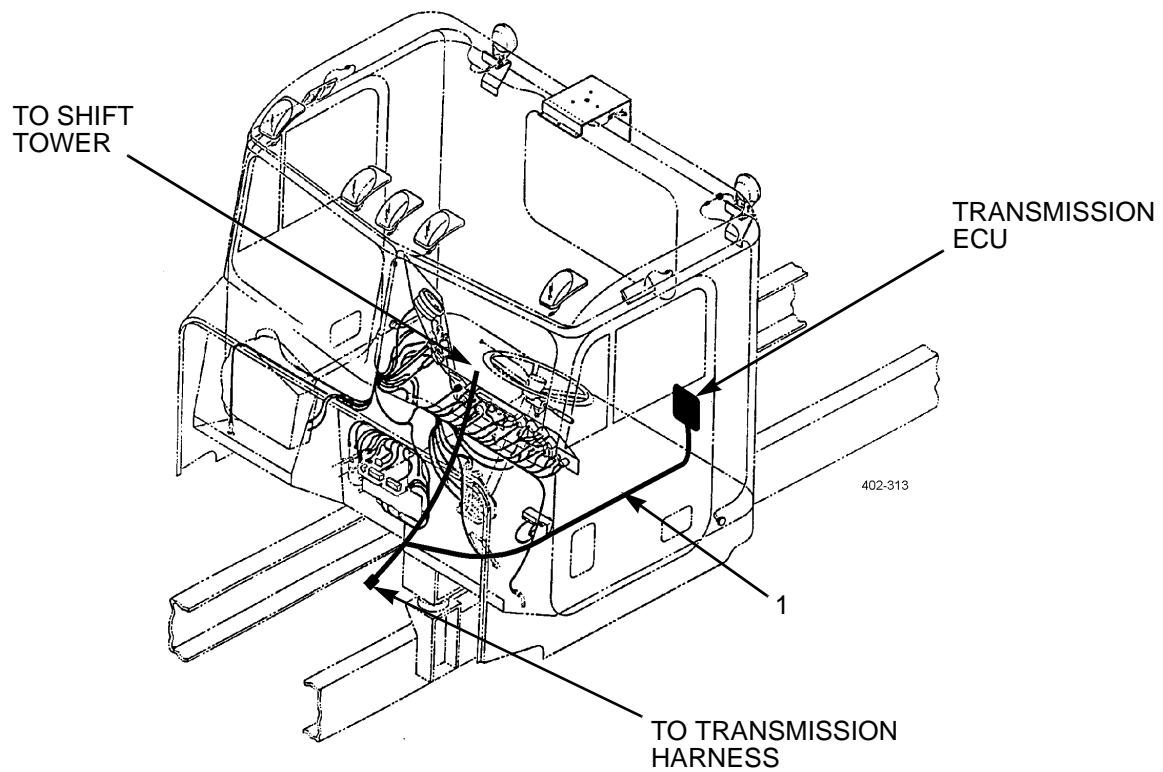
**TRANSMISSION ELECTRONIC CONTROL UNIT (ECU) WIRING
HARNESS REPLACEMENT - CONTINUED**

0111 00

INSTALLATION**NOTE**

Wiring harness and leads are secured in place by cushion clamps and screw terminals. Ensure that harness is secure and all hardware is tight.

Install, connect, and secure transmission ECU wiring harness (1) using illustration as a guide.

**END OF WORK PACKAGE**

TRANSMISSION SPEED SENSOR REPLACEMENT

0112 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Oil, lubricating (Item 27, WP 0312 00)

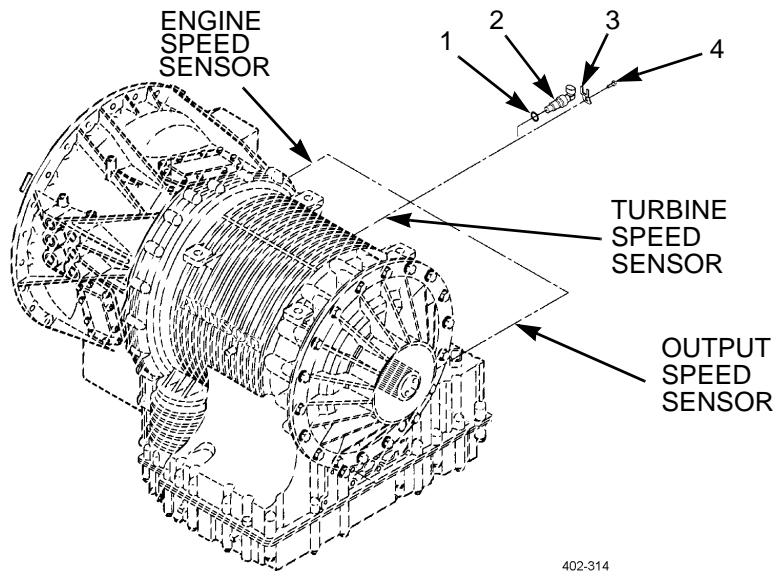
Packing, preformed (P/N 29503383)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

1. Locate speed sensor to be replaced.
2. Remove bolt (4), retainer (3), sensor (2), and preformed packing (1) from transmission. Discard preformed packing.



402-314

INSTALLATION

1. Lightly coat new preformed packing (1) with lubricating oil.
2. Install preformed packing (1) and speed sensor (2) on transmission with retainer (3) and bolt (4).

END OF WORK PACKAGE

TRANSMISSION BREATHER REPLACEMENT

0113 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Equipment Condition

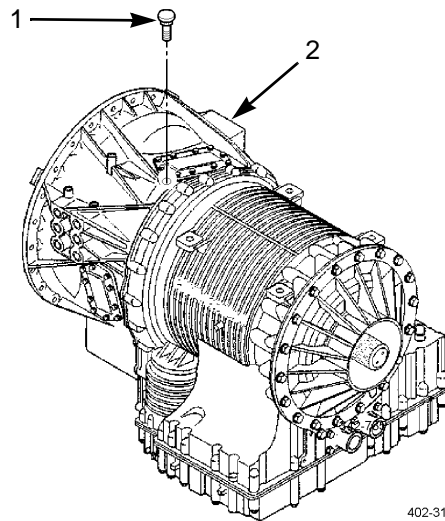
Transmission tunnel access cover removed (WP 0196 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

Remove transmission breather (1) from transmission (2).

**INSTALLATION**

1. Install transmission breather (1) on transmission (2).
2. Install transmission tunnel access cover (WP 0196 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Rags, wiping (Item 39, WP 0312 00)

Nut, lock (P/N 23-09901-108) (4)

Equipment Condition

Transmission oil cooler lines and fittings removed (WP 0115 00)

Cooling system drained (WP 0045 00)

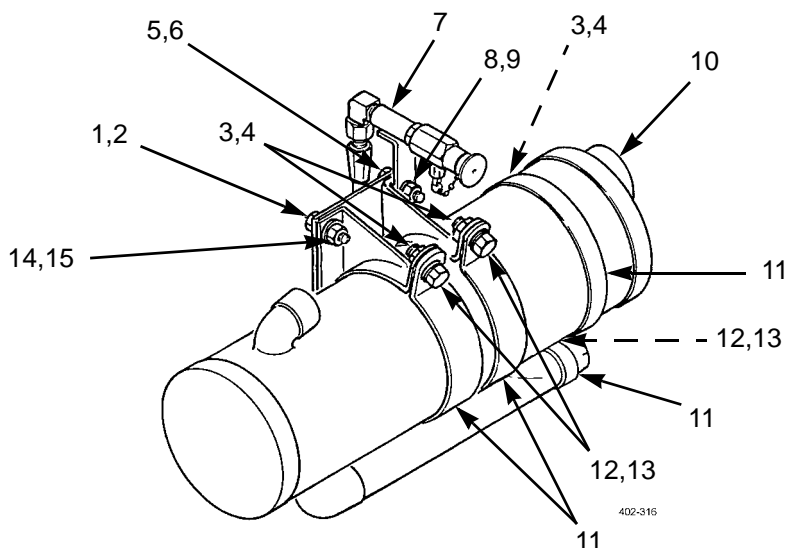
REMOVAL



WARNING

Spilled transmission fluid is very slippery. Wipe up any spilled fluid immediately. Failure to do so could result in serious injury to personnel.

1. Remove locknut (8), washer (9), screw (5), and washer (6) and set oil sample valve (7) aside. Discard locknut.
2. Remove three locknuts (14), three washers (15), three screws (1), three washers (2), and transmission oil cooler (10). Discard locknuts.



DISASSEMBLY

Remove three nuts (3), three washers (4), three capscrews (12), three washers (13), and four brackets (11).

ASSEMBLY

Install four brackets (11), three washers (13), three capscrews (12), three washers (4), and three nuts (3).

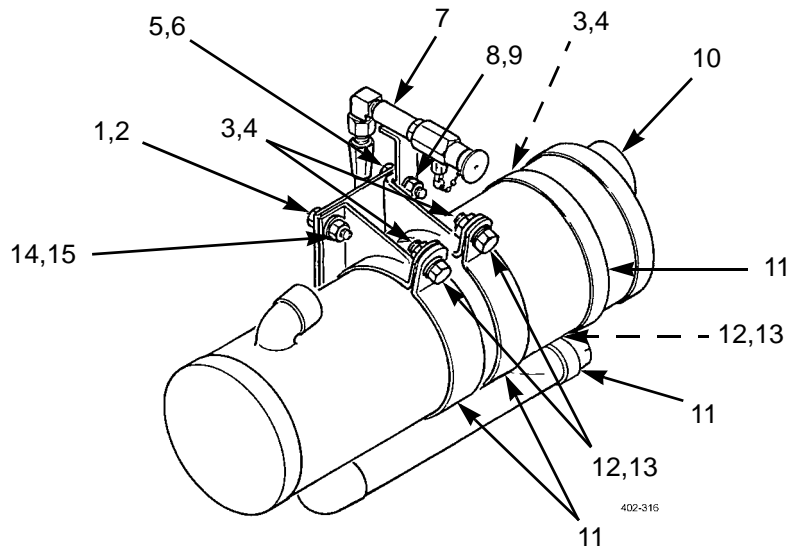
INSTALLATION



WARNING

Spilled transmission fluid is very slippery. Wipe up any spilled fluid immediately. Failure to do so could result in serious injury to personnel.

1. Install transmission oil cooler (10), three washers (2), three screws (1), three washers (15), and three new locknuts (14).
2. Install oil sample valve (7), washer (6), screw (5), washer (9), and new locknut (8).



3. Install transmission oil cooler lines and fittings (WP 0115 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing pipe, (Item 17, WP 0312 00)
 Oil, lubricating (Item 27, WP 0312 00)

Materials/Parts - Continued

Straps, tiedown (Item 41, WP 0312 00)
 Packing, preformed (P/N 316N552-9) (4)

Equipment Condition

Transmission oil drained (WP 0109 00)

REMOVAL

NOTE

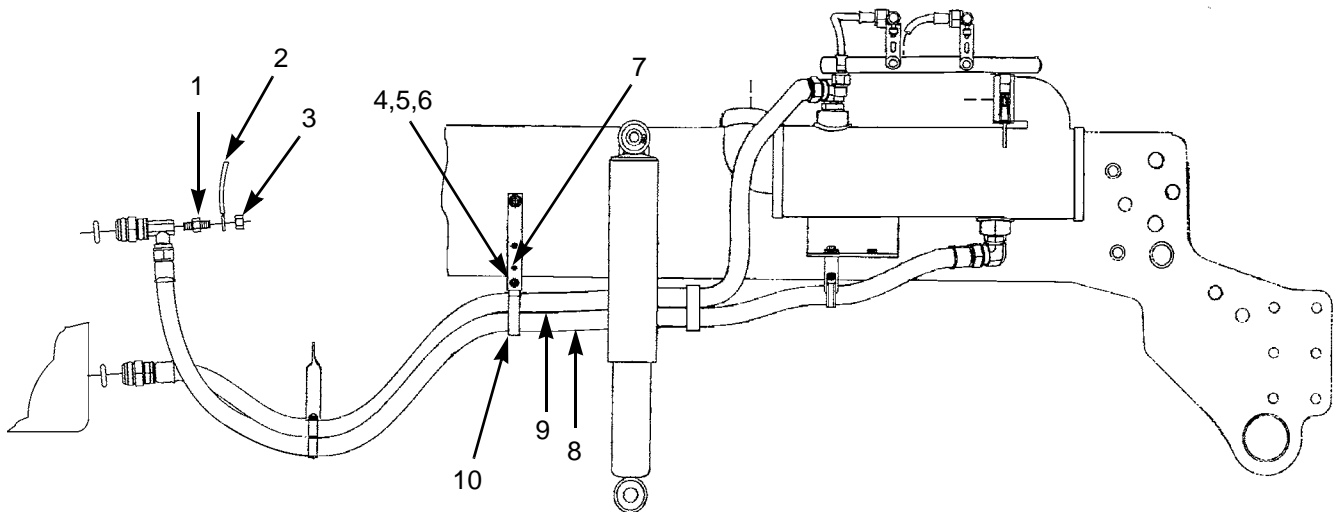
Performed steps 1 and 2 to free two transmission oil cooler lines from each of four support brackets.

1. Remove nut (4), washer (5), screw (6), and clamp (10) from support bracket (7).
2. Remove clamp (10) from two transmission oil cooler lines (8 and 9).

NOTE

Perform steps 3 thru 7 at front of transmission.

3. Remove nut (3) and wire terminal (2) from temperature sensor (1).



342-503

REMOVAL - CONTINUED

4. Remove temperature sensor (1) from elbow fitting (13).
5. Disconnect transmission oil cooler lines (8 and 9) from elbow fitting (13) and fitting (23).
6. Loosen jamnuts (12 and 22) of elbow fitting (13) and fitting (23) and remove from transmission (24).
7. Remove two preformed packings (11). Discard preformed packings.

NOTE

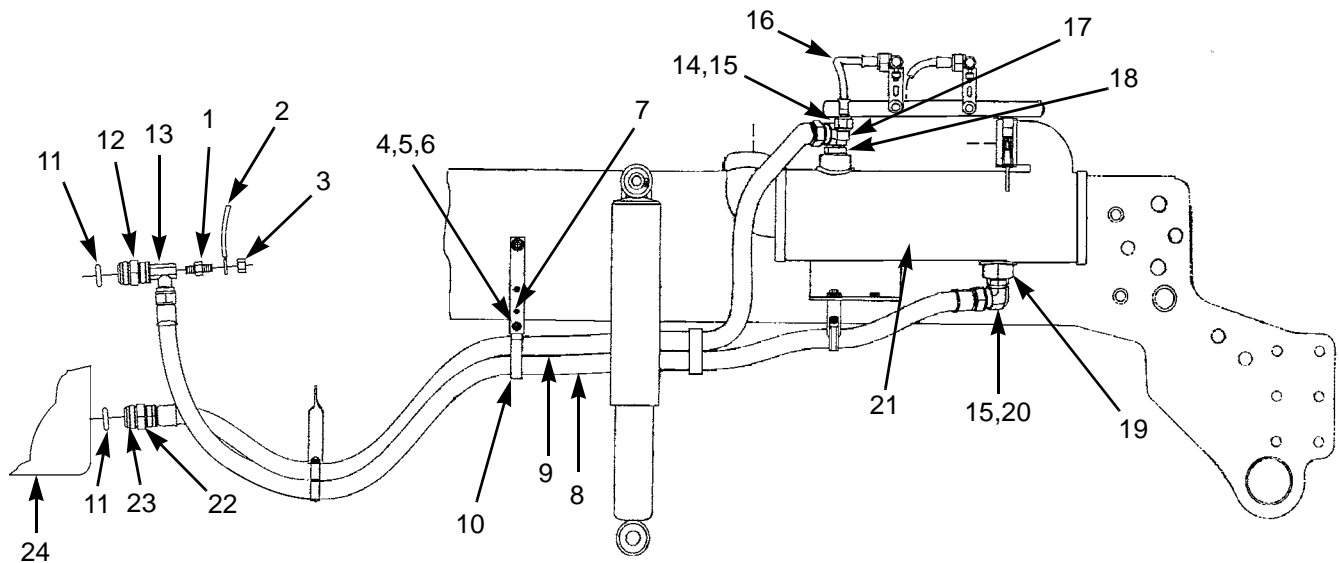
Perform steps 8 thru 12 at transmission oil cooler.

8. Disconnect transmission oil sample line (16) from elbow (17).
9. Remove elbow (17) from elbow (14).
10. Disconnect transmission oil cooler lines (8 and 9) from elbows (14 and 15).

NOTE

Remove tiedown straps as necessary and discard.

11. Remove transmission oil cooler lines (8 and 9) from vehicle.
12. Loosen jamnuts (18 and 19) of elbow fittings (15 and 17) and remove from transmission oil cooler (21).
13. Remove two preformed packings (20). Discard preformed packings.



342-503

INSTALLATION

NOTE

- Lightly lubricate new preformed packings with lubricating oil before installing packings.
 - Perform steps 1 through 6 at transmission oil cooler.
1. Install two preformed packings (20) to elbow fittings (14 and 15).

INSTALLATION - CONTINUED

2. Install two elbow fittings (14 and 15) to transmission oil cooler (21) and tighten jamnuts (18 and 19).
3. Position transmission oil cooler lines (8 and 9) to vehicle.
4. Connect transmission oil cooler lines (8 and 9) to two elbow fittings (14 and 15).

**WARNING**

Adhesive 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.

5. Apply pipe sealing compound to threads of elbow (17) and install elbow to elbow (14).
6. Connect transmission oil sample line (16) to elbow (17).

NOTE

Perform steps 7 through 11 at front of transmission.

7. Install two new preformed packings (11) to elbow fitting (13) and fitting (23).
8. Install elbow fitting (13) and fitting (23) to transmission (24) and tighten jamnuts (12 and 22).
9. Connect transmission oil cooler lines (8 and 9) to fitting (23) and elbow fitting (13).
10. Apply pipe sealing compound to threads of temperature sensor (1) and install temperature sensor to elbow fitting (13).
11. Install wire terminal (2) to temperature sensor (1) with nut (3).

NOTE

Perform steps 12 and 13 to attach two transmission oil cooler lines to each of four support brackets.

12. Position clamps (10) around transmission oil cooler lines (8 and 9).
13. Install clamp (10) to support brackets (7) with screws (6), washer (5), and nut (4). Install new tiedown straps as necessary.
14. Fill transmission oil (WP 0109 00).

END OF WORK PACKAGE

DRIVELINE REPLACEMENT (M915A4)

0116 00

THIS WORK PACKAGE COVERS

Main Driveline Removal, Inter-axle Driveline Removal, Main Driveline Installation, Inter-axle Driveline Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Grease, GAA (Item 23, WP 0312 00)

Personnel Required

Two

References

WP 0024 00

Equipment Condition

Wheels blocked (TM 9-2320-303-10)

Parking brakes released (TM 9-2320-303-10)

MAIN DRIVELINE REMOVAL



WARNING



Driveline is heavy. Support end of driveline as bearing straps are removed to prevent driveline from falling. Failure to follow this warning may cause serious injury to personnel.

MAIN DRIVELINE REMOVAL - CONTINUED**NOTE**

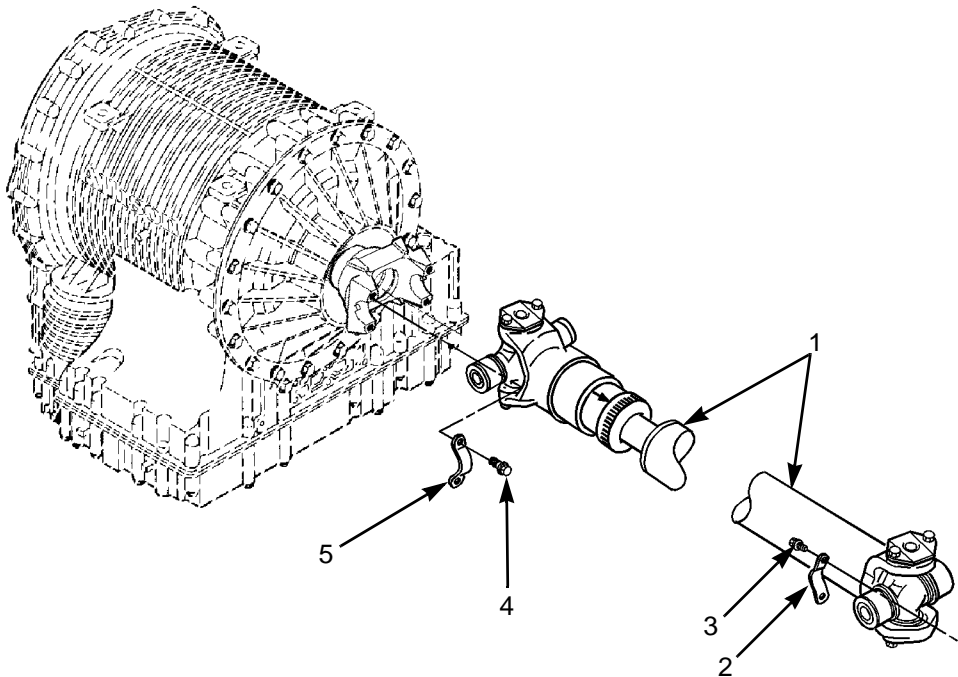
Perform following step at front end of main driveline.

1. Remove four screws (3) and two bearing straps (2) from universal joint of main driveline (1).

NOTE

Perform following step at rear end of main driveline.

2. Remove four screws (4) and two bearing straps (5) from universal joint of main driveline (1).
3. Remove main driveline (1) from vehicle.



402-323

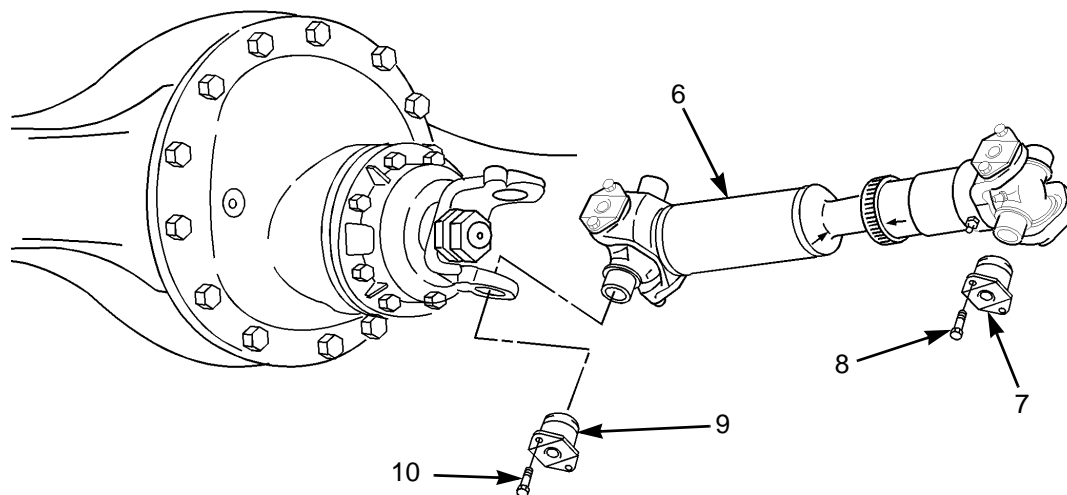
INTER-AXLE DRIVELINE REMOVAL**WARNING**

Driveline is heavy. Support end of driveline as bearing straps are removed to prevent driveline from falling. Failure to follow this warning may cause serious injury to personnel.

INTER-AXLE DRIVELINE REMOVAL - CONTINUED**NOTE**

Perform following steps at front end of inter-axle driveline.

1. Remove two screws (8) from each of two bearing caps (7). Discard screws.
2. Remove two bearing caps (7) from universal joint of inter-axle driveline (6).



402-324

NOTE

Perform following steps at rear end of inter-axle driveline.

3. Remove two screws (10) from each of two bearing caps (9). Discard screws.
4. Remove two bearing caps (9) from universal joint of inter-axle driveline (6).
5. Remove inter-axle driveline (6) from vehicle.

MAIN DRIVELINE INSTALLATION**NOTE**

Perform following steps at rear end of main driveline.

1. Position main driveline (1) to vehicle.
2. Install two bearing straps (5) and four screws (4) to universal joint of main driveline (1). Tighten screws to 125 lb-ft (170 Nm).

NOTE

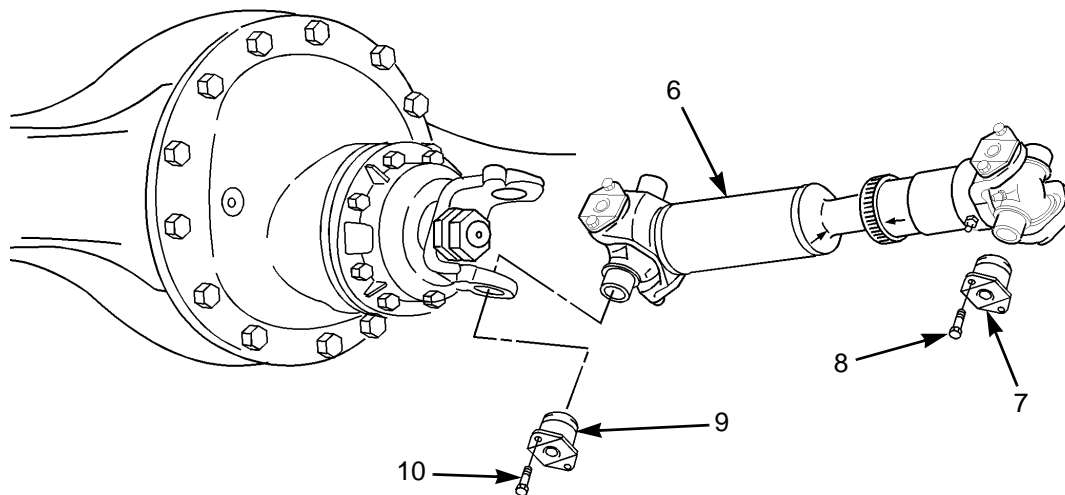
Perform following step at front end of main driveline.

3. Install two bearing straps (2) and four screws (3) to universal joint of main driveline (1). Tighten screws to 125 lb-ft (170 Nm).
4. Lubricate driveline (WP 0024 00).

INTER-AXLE DRIVELINE INSTALLATION**NOTE**

Perform following steps at rear end of inter-axle driveline.

1. Position inter-axle driveline (6) to vehicle and install two bearing caps (9).
2. Install two new screws (10) to each of two bearing caps (9). Tighten screws to 36 lb-ft (49 Nm).



402-324

NOTE

Perform following steps at front end of inter-axle driveline.

3. Position inter-axle driveline (6) to vehicle and install two bearing caps (7).
4. Install two new screws (8) to each of two bearing caps (7). Tighten screws to 36 lb-ft (49 Nm).
5. Lubricate driveline (WP 0024 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Driveline Removal, Driveline Installation, Driveline Repair

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 102, WP 0313 00)
- Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

- Screw, lock (P/N 185290) (8)
- Retainer, bearing (P/N 6-5-70-89) (4)

Personnel Required

Two

References

WP 0023 00

Equipment Condition

- Vehicle wheels blocked
- Parking brakes released (TM 9-2320-303-10)



WARNING



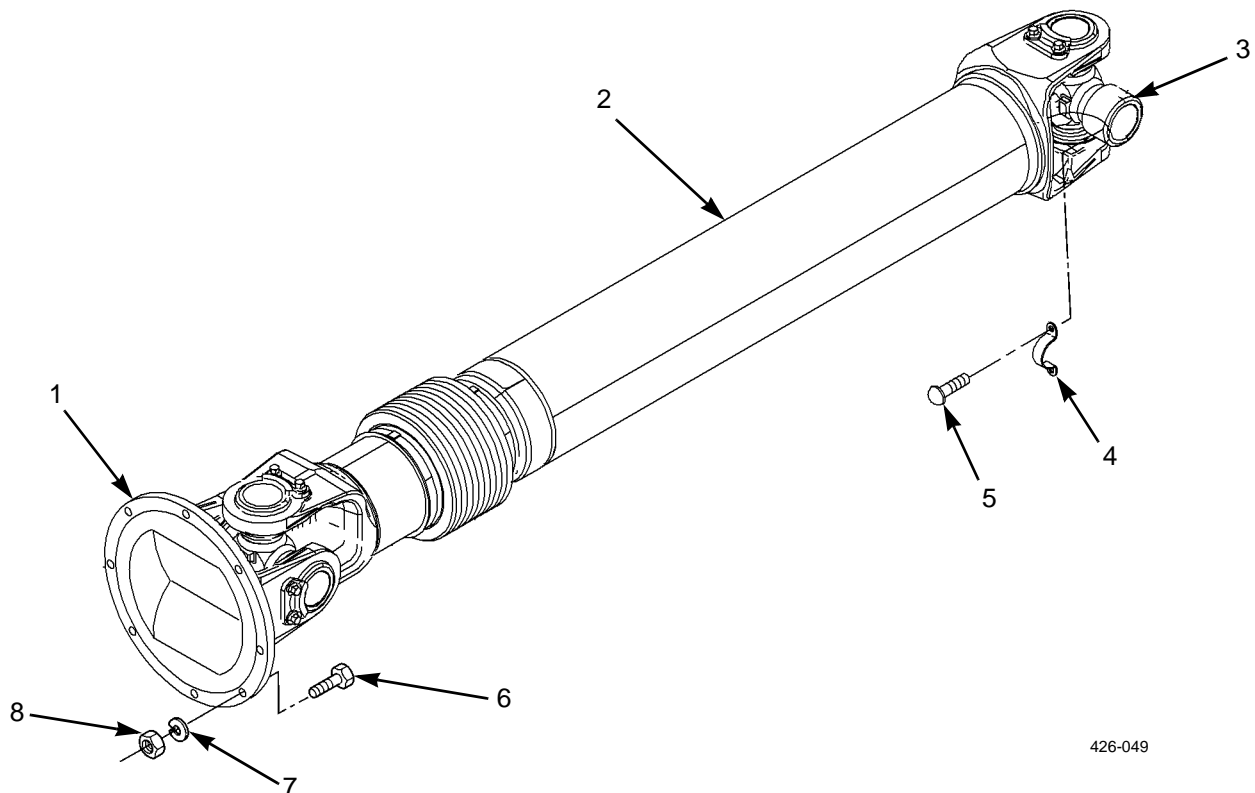
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

All driveline yoke connections are the same. Front axle-to-intermediate driveline is illustrated.

DRIVELINE REMOVAL

1. Make matchmarks at each end of driveline and adjoining components to aid in installation.
2. Support driveline (2).
3. For front axle disconnection of driveline (2), remove eight bolts (6), washers (7), and nuts (8) from flange yoke (1).
4. For each yoke disconnection of driveline (2), remove four screws (5) and two bearing retainers (4). Discard screws and bearing retainers.
5. Pry bearing (3) from yoke.
6. Remove driveline (2) from vehicle.



426-049

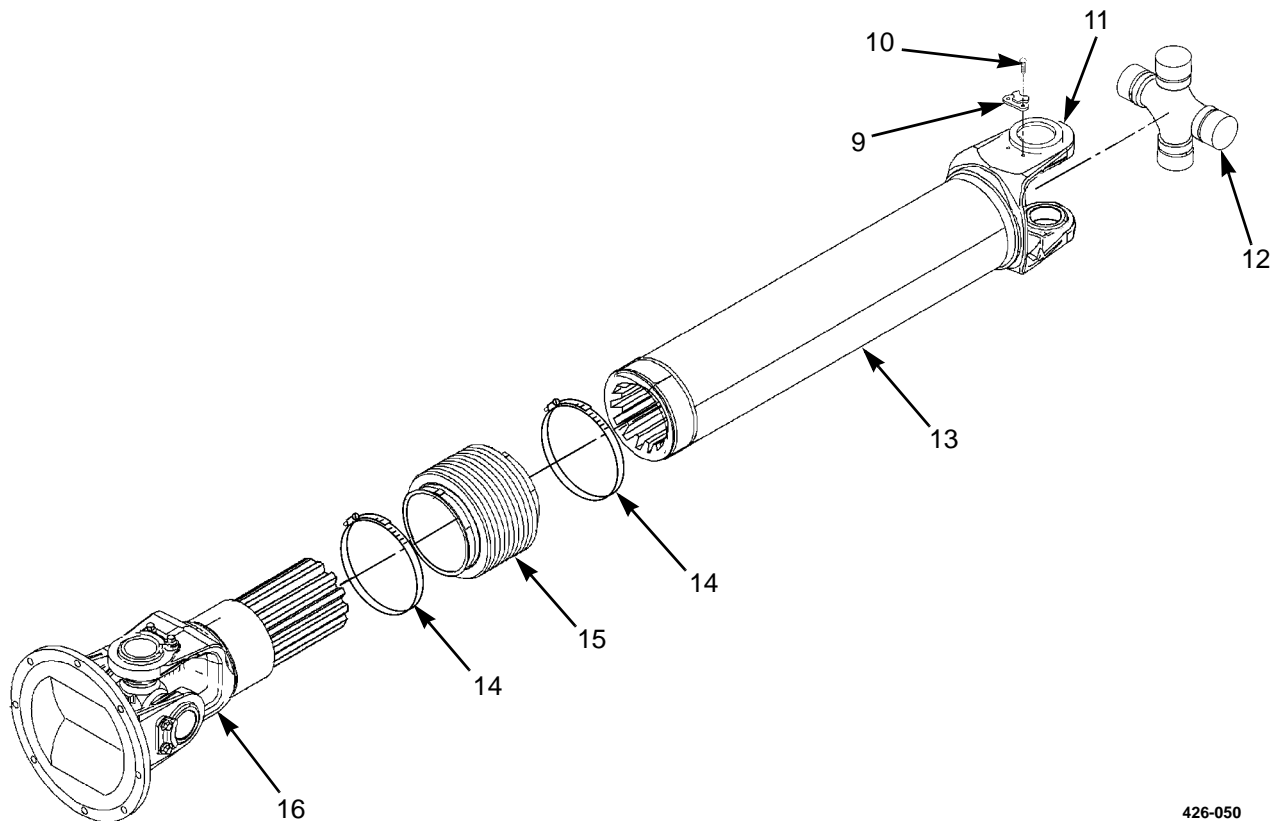
DRIVELINE INSTALLATION

1. Position driveline (2) in accordance with matchmarks made during removal.
2. For each yoke connection, install two bearing retainers (4) and four new screws (5) securing bearing (3) to yoke. Tighten screws to 28 lb-ft (38 Nm).
3. For front axle connection of driveline (2), install eight bolts (6), washers (7), and nuts (8). Tighten bolts to 11-14 lb-ft (15-19 Nm).
4. Lubricate driveline (WP 0024 00).

DRIVELINE REPAIR**NOTE**

Perform steps 1 through 4 to replace bearing and steps 5 through 11 to replace bellows.

1. Remove four screws (10) and two retainers (9) from yoke (11).
2. Remove bearing (12) from yoke (11).
3. Install bearing (12) into yoke (11).
4. Install two retainers (9) and four screws (10) on yoke (11). Tighten screws to 100-120 lb-ft (135-160 Nm).
5. Make matchmarks at each end of driveline and adjoining components to aid in installation.
6. Loosen clamp (14) at each end of bellows (15).
7. Remove yoke (16) from tube (13).
8. Remove bellows (15) from tube (13).
9. Place clamp (14) on each end of bellows (15) and slide bellows onto tube (13).
10. Position yoke (16) through bellows (15) and into tube (13) in accordance with matchmarks made during removal.
11. Tighten clamp (14) at each end of bellows (15).



426-050

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Main Driveline U-joints Removal, Inter-Axle Driveline U-joints Removal, Main Driveline U-joints Installation, Inter-Axle Driveline U-joints Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Grease, GAA (Item 23, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

WP 0024 00

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Equipment Condition

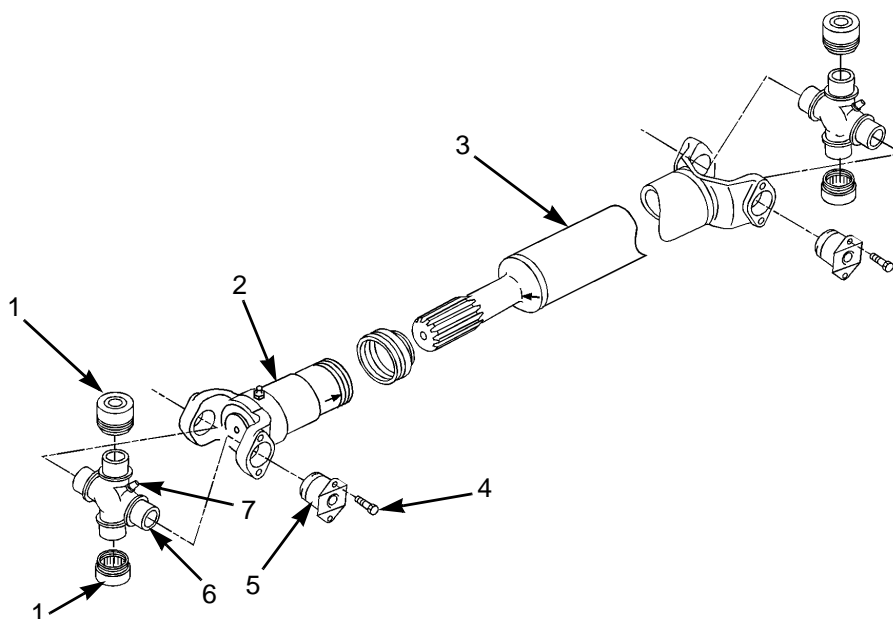
Drivelines removed from vehicle (WP 0116 00)

MAIN DRIVELINE U-JOINTS REMOVAL

NOTE

Perform following steps at front end of main driveline.

1. Remove two bearings (1) from universal joint (6).
2. Remove two screws (4) from each of two bearing caps (5).
3. Remove two bearing caps (5) and universal joint (6) from yoke (2) of main driveline (3).
4. Remove two grease fittings (7) from universal joint (6).



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MAIN DRIVELINE U-JOINTS REMOVAL - CONTINUED**NOTE**

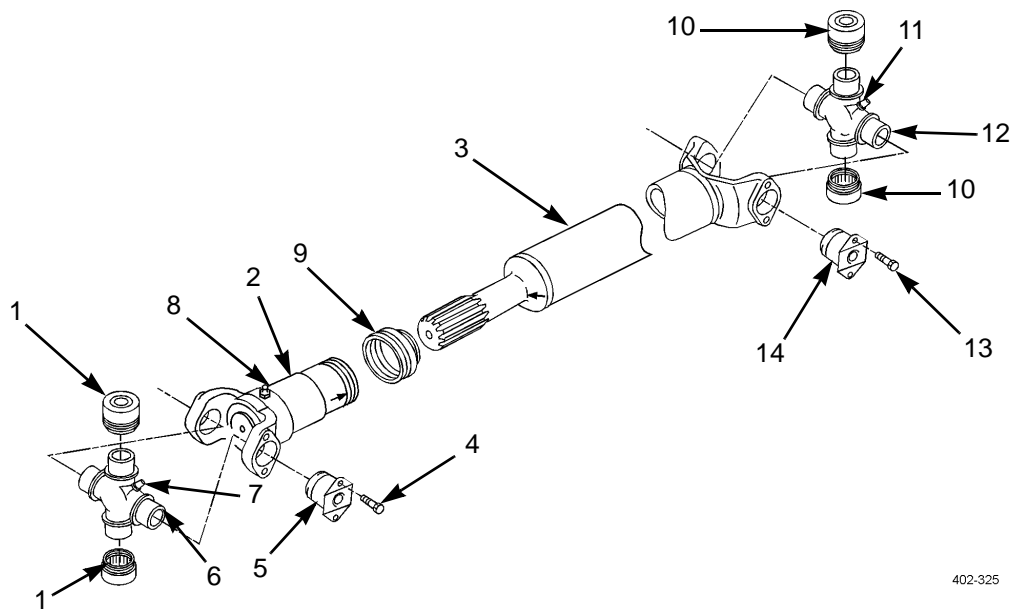
Note matchmarks on each half of main driveline for installation. Scribe or paint matchmarks on driveline if matchmarks are missing.

5. Remove dust seal (9) and yoke (2) from main driveline (3).
6. Remove grease fitting (8) from yoke (2).

NOTE

Perform following steps at rear end of main driveline.

7. Remove two bearings (10) from universal joint (12).
8. Remove two screws (13) from each of two bearing caps (14).
9. Remove two bearing caps (14) and universal joint (12) from main driveline (3).
10. Remove two grease fittings (11) from universal joint (12).



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INTER-AXLE DRIVELINE U-JOINTS REMOVAL**NOTE**

Perform the following steps at front end of inter-axle driveline.

1. Remove two screws (4) from each of two bearing caps (5).
2. Remove two bearing caps (5) and universal joint (6) from yoke (2) of inter-axle driveline (3).

INTER-AXLE DRIVELINE U-JOINTS REMOVAL - CONTINUED

3. Remove two grease fittings (7) from universal joint (6).

NOTE

Note matchmarks on each half of inter-axle driveline for installation. Scribe or paint matchmarks on driveline if matchmarks are missing.

4. Remove dust seal (9) and yoke (2) from inter-axle driveline (3).
5. Remove grease fitting (8) from yoke (2).

NOTE

Perform the following steps at rear end of inter-axle driveline.

6. Remove two screws (13) from each of two bearing caps (14).
7. Remove two bearing caps (14) and universal joint (12) from inter-axle driveline (3).
8. Remove two grease fittings (11) from universal joint (12).

MAIN DRIVELINE U-JOINTS INSTALLATION**NOTE**

Perform the following steps at rear end of main driveline.

1. Install two grease fittings (11) on universal joint (12).
2. Position universal joint (12) and two bearing caps (14) to main driveline (3).
3. Install two new screws (13) on each of two bearing caps (14). Tighten screws to 36 lb-ft (49 Nm).
4. Install two bearings (10) on universal joint (12).
5. Lubricate universal joint (14) (WP 0024 00).

NOTE

Perform the following steps at front end of main driveline.

6. Install grease fitting (8) on yoke (2).

NOTE

Align matchmarks on each half of main driveline.

7. Install dust seal (9) and yoke (2) on main driveline (3). Tighten dust seal.
8. Install two grease fittings (7) on universal joint (6).
9. Position universal joint (6) and two bearing caps (5) on main driveline (3).
10. Install two screws (4) on each of two bearing caps (5). Tighten screws to 36 lb-ft (49 Nm).
11. Install two bearings (1) on universal joint (6).
12. Lubricate yoke (2) and universal joint (6) (WP 0024 00).
13. Install main driveline (WP 0116 00).

INTER-AXLE DRIVELINE U-JOINTS INSTALLATION**NOTE**

Perform the following steps at rear end of inter-axle driveline.

1. Install two grease fittings (11) on universal joint (12).
2. Position universal joint (12) and two bearing caps (14) on inter-axle driveline (3).
3. Install two new screws (13) on each of two bearing caps (14). Tighten screws to 36 lb-ft (49 Nm).
4. Lubricate universal joint (12) (WP 0024 00).
5. Install grease fitting (8) on yoke (2).

NOTE

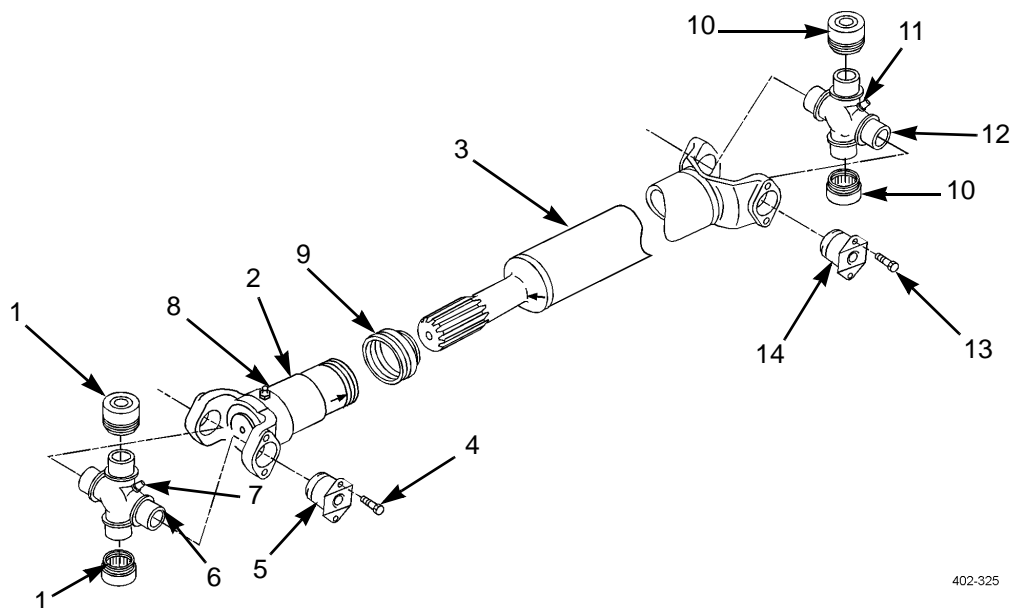
Align matchmarks on each half of inter-axle driveline.

6. Install dust seal (9) and yoke (2) on inter-axle driveline (3). Tighten dust seal.

NOTE

Perform the following steps at front end of inter-axle driveline.

7. Install two grease fittings (7) to universal joint (6).
8. Position universal joint (6) and two bearing caps (5) on yoke (2) of inter-axle driveline (3).
9. Install two screws (4) on each of two bearing caps (5). Tighten screws to 36 lb-ft (19 Nm).
10. Lubricate yoke (2) and universal joint (6) (WP 0024 00).
11. Install inter-axle driveline (WP 0116 00).



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END OF WORK PACKAGE

FRONT AXLE TOE-IN ALIGNMENT**0118 00****THIS WORK PACKAGE COVERS**

Alignment Check, Adjustment

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Jack, hydraulic, hand (Item 52, WP 0313 00)

Tape, measuring (Item 96, WP 0313 00)

Trestle, hoist (Item 105, WP 0313 00)

Tools and Special Tools - continued

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

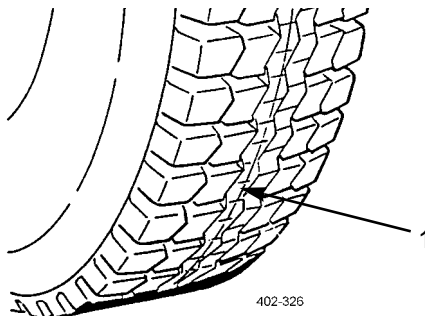
Paint, white (Item 35, WP 0312 00)

Personnel Required

Two

ALIGNMENT CHECK

1. Block rear wheels and raise front end of vehicle so front tires can be rotated. Support vehicle on jack stands.
2. Slowly rotate tire and whiten center of tire around complete circumference using spray paint or chalk. Repeat for opposite front tire.



3. Rotate tire and scribe a line (1) around complete circumference near center so that line is visible in whitened area. Repeat for opposite front tire.
4. Lower vehicle from jack stands.
5. Remove chocks. Back up vehicle a few feet, then drive forward approximately 10 feet.
6. Place transmission in neutral and set parking brake.
7. At front of tires, use tape measure held at axle height to measure distance between scribe lines (1) on front of each tire. Record measurement to nearest 1/32 inch.
8. At rear of tires, use tape measure held at axle height to measure distance between scribe lines (1) on rear of each tire. Record measurement to nearest 1/32 inch.
9. Measurement at front of tires must be 1/16 inch or less than rear measurement for proper toe-in alignment. If not, perform adjustment procedure.

ADJUSTMENT**NOTE**

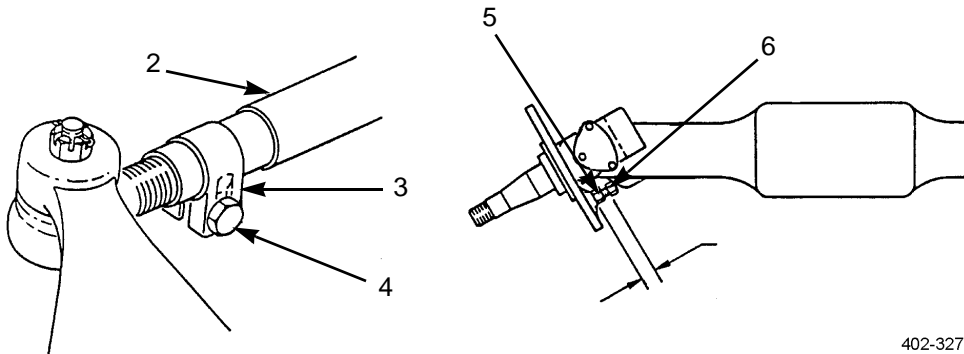
Perform steps 1 through 4 to adjust toe-in and perform steps 5 through 7 to adjust turn stop bolts.

1. Loosen capscrews (4) at clamps (3) on each end of tie rod (2).
2. Rotate tie rod (2) toward front of vehicle to increase toe-in; toward rear of vehicle to decrease toe-in.
3. Tighten capscrews (4) to 40-55 lb-ft (54-75 Nm).
4. Repeat alignment check steps 1 through 9.

NOTE

Steps 5 through 7 are the same for both sides.

5. Measure length of stop bolt (6). Length must be $9/16$ in. $\pm 1/16$ in.
6. If measurement from step 5 is not within tolerance, loosen locknut (5) and adjust stop bolt (6) to required length.
7. Tighten locknut (5) to 28 lb-ft (38 Nm).

**END OF WORK PACKAGE**

FRONT AXLE STOP CUSHION REPLACEMENT

0119 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

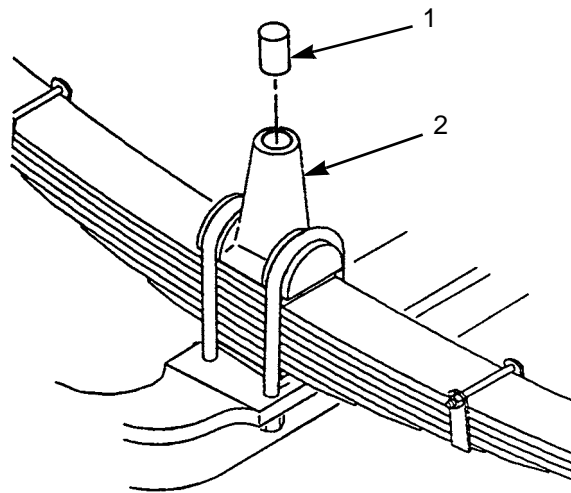
Materials/Parts

Adhesive (Item 2, WP 0312 00)

Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)

REMOVAL

Remove stop cushion (1) from front axle stop (2).



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INSTALLATION

1. Apply adhesive to inside diameter of front axle stop (2).
2. Install stop cushion (1) in front axle stop (2).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Draining Oil, Replacing Oil Filter, Replenishing Oil, Checking for Leaks

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Materials/Parts

Gear oil (Item 31, 32, or 33, WP 0312 00)

Materials/Parts - Continued

Oil filter element (P/N PER49)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Axle oil warm

Vehicle parked on level ground

Parking brake set (TM 9-2320-303-10)

Wheels blocked (TM 9-2320-303-10)

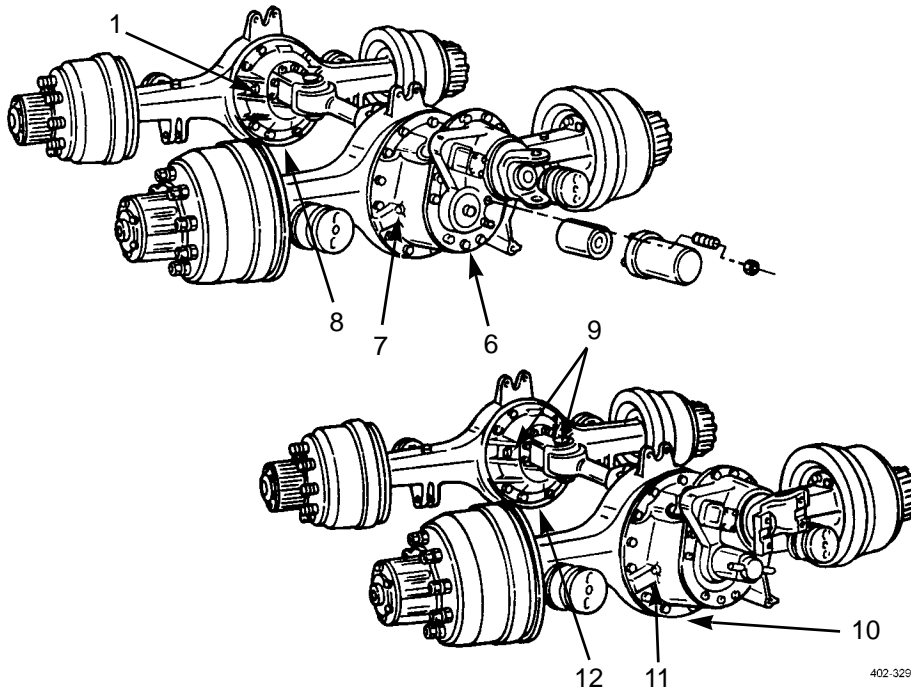
DRAINING OIL

1. Unscrew and remove filler plugs (1) and (7) or (9) and (11).

NOTE

Before removing a drain plug, place container to catch oil. Drain plugs are magnetic and any metal particles should be completely removed. If excessive, refer to Direct Support.

2. Remove magnetic drain plugs (6) and (8) or (10) and (12).



REAR AXLE MAINTENANCE - CONTINUED

0120 00

DRAINING OIL - CONTINUED

3. Allow oil to drain.
4. Wipe magnetic plugs and axle housing.
5. Screw in plugs.

REPLACING OIL FILTER

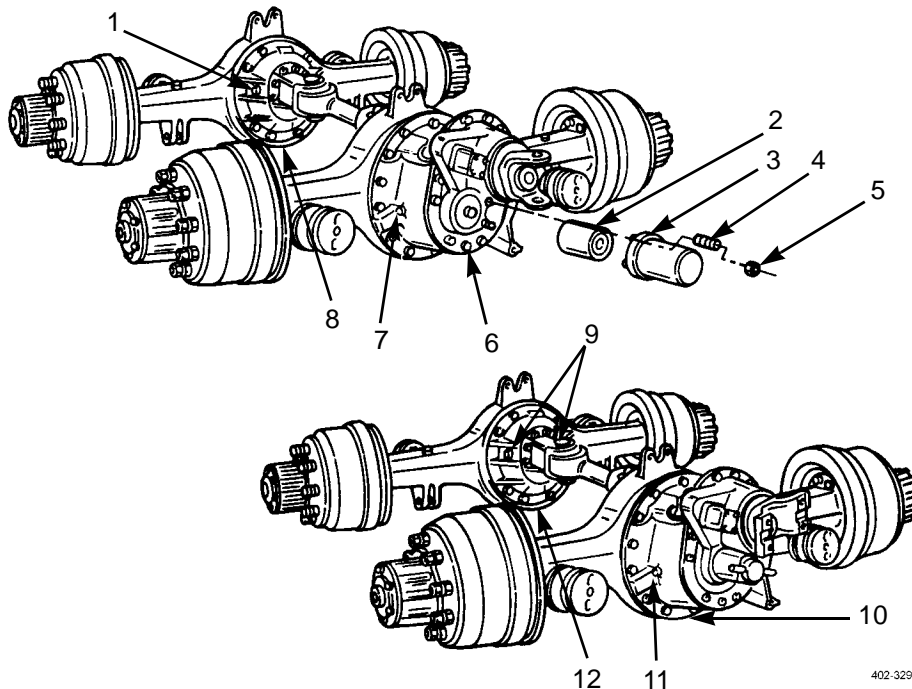
1. Remove two filter cover nuts (5). Replace studs (4) if damaged.
2. Slide off filter cover (3).
3. Using a strap wrench, remove and discard filter (2).
4. Moisten gasket with oil.
5. Install new filter (2) by tightening until gasket contacts adapter, then tighten one more full turn.
6. Slide filter cover (3) over new filter (2) and studs (4).
7. Secure with two nuts (5).

REPLENISHING OIL

1. Fill front-rear axle with 40 pints (19 liters) of gear oil and install filler plug (7) or (11).
2. Fill rear-rear axle with 36 pints (17 liters) of gear oil and install filler plug(s) (1 or 9).

CHECKING FOR LEAKS

1. Road test vehicle.
2. Check filler plugs (1 and 7) or (9 and 11), drain plugs (6 and 8) or (10 and 12), filter (2) for leaks.



3. Check oil level. Add more oil if necessary.

END OF WORK PACKAGE

REAR AXLE BREATHER REPLACEMENT

0121 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Equipment Condition

Wheels blocked

Parking brake set (TM 9-2320-303-10)

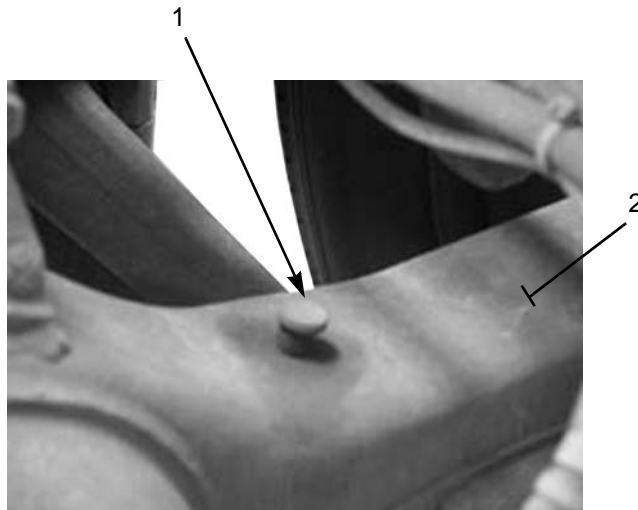
Master battery switch in OFF position (TM 9-2320-303-10)

NOTE

Although mounted on different sides of each axle, rear axle breathers are replaced the same way.

REMOVAL

Remove rear axle breather (1) from rear axle (2).



INSTALLATION**WARNING**

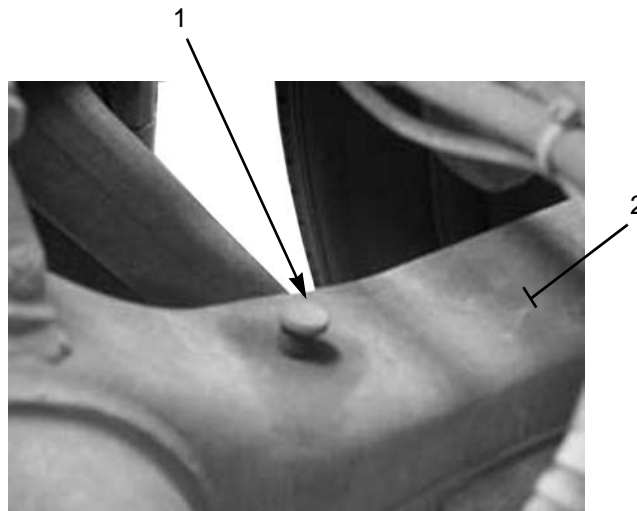
Adhesives and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.

1. Lightly coat threads of rear axle breather (1) with pipe sealing compound.

NOTE

Position of rear axle breather is important. Install rear axle breather so that mark and tube of breather face **AWAY** from differential.

2. Install rear axle breather (1) on rear axle (2).



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END OF WORK PACKAGE

FRONT BRAKESHOE AND LINING REPLACEMENT**0122 00****THIS WORK PACKAGE COVERS**

Removal, Inspection, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Compound, antiseize (Item 11, WP 0312 00)

Tools and Special Tools

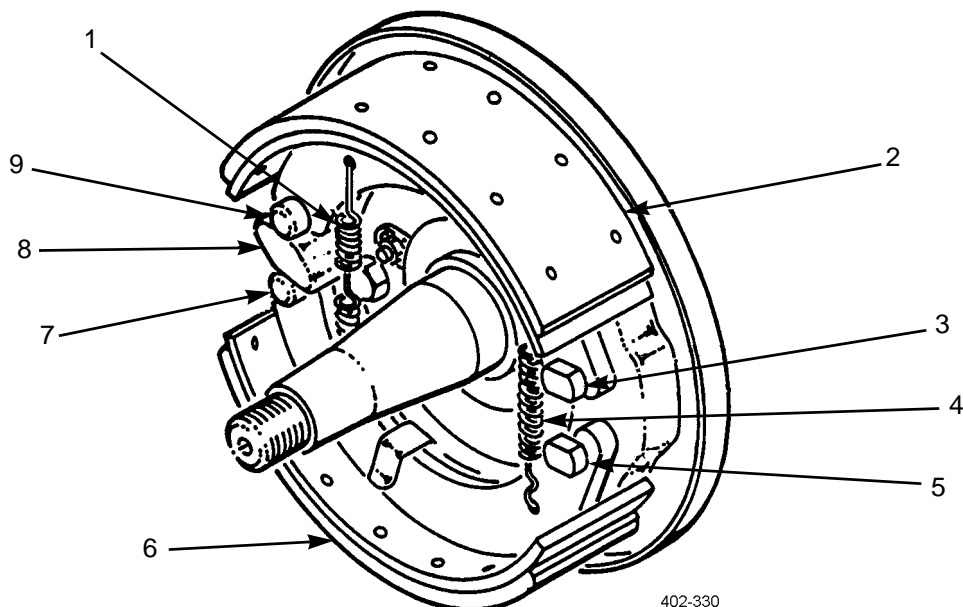
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Hub and drum removed (WP 0154 00)

REMOVAL

1. Lift upper brakeshoe (2) away from S-cam (8) and remove upper cam roller (9).
2. Push lower brakeshoe (6) away from S-cam (8) and remove lower cam roller (7).
3. Remove release spring (1) from upper and lower brakeshoes (2 and 6).
4. Grasp each brakeshoe (2 and 6) and pull to open position. Remove two brakeshoes and retaining spring (4) from two spider anchor pins (3 and 5).
5. Remove retaining spring (4) from two brakeshoes (2 and 6).

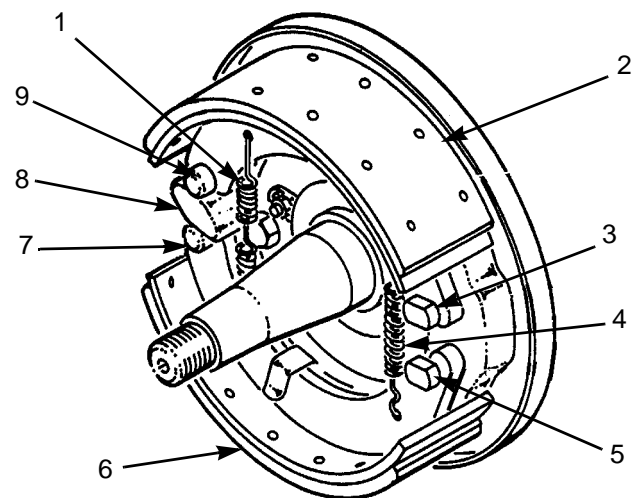
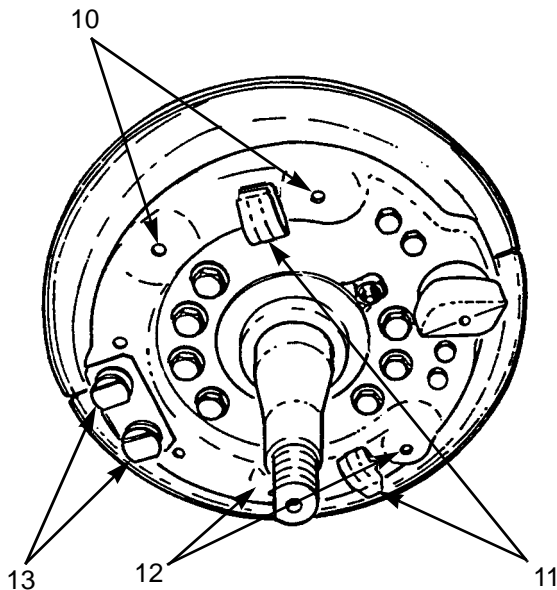
**INSPECTION**

1. Brake lining thickness must be no less than 1/4 in. If brake lining is less than 1/4 in., replace brake lining.
2. There must be no less than 1/32-in. clearance between top of brake lining and top of all rivet heads. If there is less than 1/32-in. clearance between top of brake lining and any rivet head, replace brake lining.

INSTALLATION**WARNING**

Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

1. Apply thin film of antiseize compound to contact points (10, 11, 12, and 13), two spider anchor pins (3 and 5), and small diameter of upper and lower cam rollers (7 and 9).
2. Install retaining spring (4) on each brakeshoe (2 and 6).
3. Install two brakeshoes (2 and 6) on two spider anchor pins (3 and 5).
4. Install release spring (1) on two brakeshoes (2 and 6).
5. Install upper cam roller (9) between upper brakeshoe (2) and S-cam (8).
6. Install lower cam roller (7) between brakeshoe (6) and S-cam (8).



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7. Install hub and drum (WP 0154 00).

END OF WORK PACKAGE

FRONT BRAKE SPIDER AND BRAKE CHAMBER BRACKET REPLACEMENT

0123 00

THIS WORK PACKAGE COVERS

Removal, Cleaning/Inspection, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Grease, GAA (Item 23, WP 0312 00)

Oil, lubricating (Item 27, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-10CG5C) (7)

Seal (P/N A-1205-V-1556) (2)

Equipment Condition

Front air brake chamber removed (WP 0139 00)

Front slack adjuster and S-cam removed (WP 0127 00)

Front brakeshoes removed (WP 0122 00)

Front ABS sensor removed (WP 0091 00)

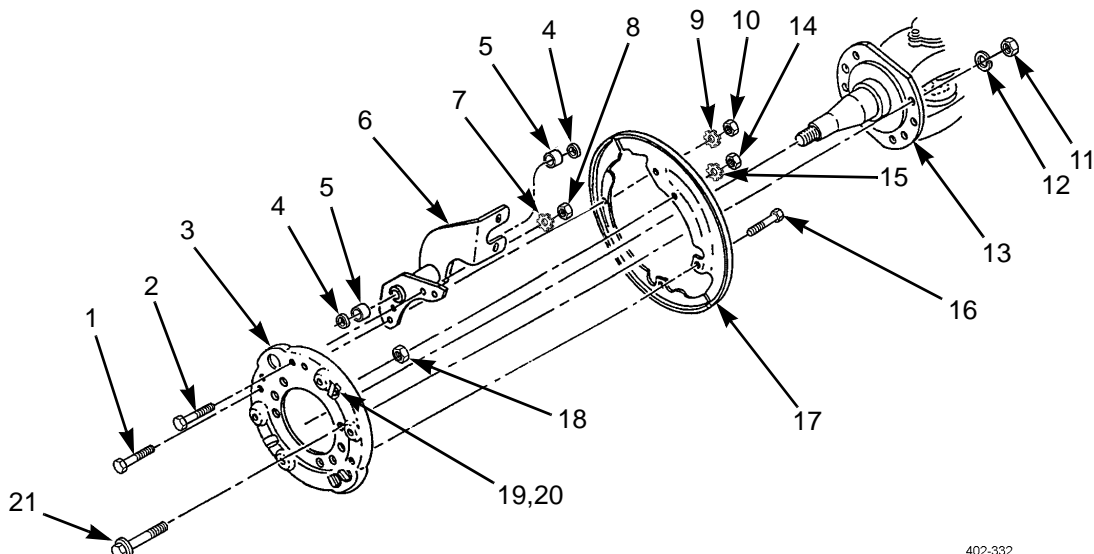
REMOVAL

1. Remove two nuts (10), two washers (9), and two capscrews (1).
2. Remove two nuts (14) and two washers (15) from brake spider (3).
3. Remove two capscrews (16) and 2-piece dust shield (17) from brake spider (3).
4. Remove two nuts (18), two capscrews (19), and two clamps (20) from brake spider (3).

NOTE

Note position of brake chamber bracket prior to removal to aid in installation.

5. Remove two nuts (8), two washers (7), two capscrews (2), and brake chamber bracket (6) from brake spider (3).
6. Remove two seals (4) and two bushings (5) from brake chamber bracket (6). Discard seals.
7. Remove seven locknuts (11), seven washers (12), seven capscrews (21), and brake spider (3) from axle flange (13). Discard locknuts.



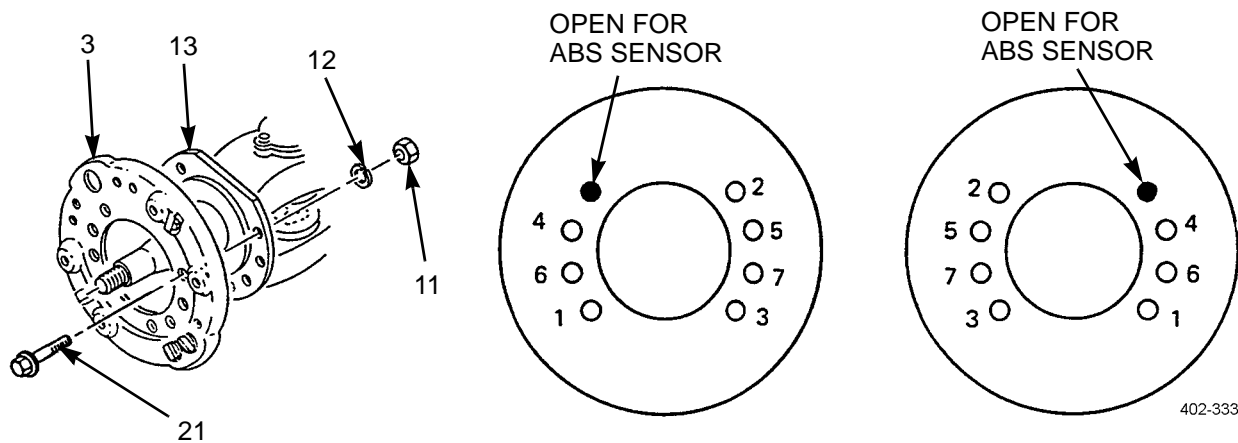
402-332

INSTALLATION

WARNING

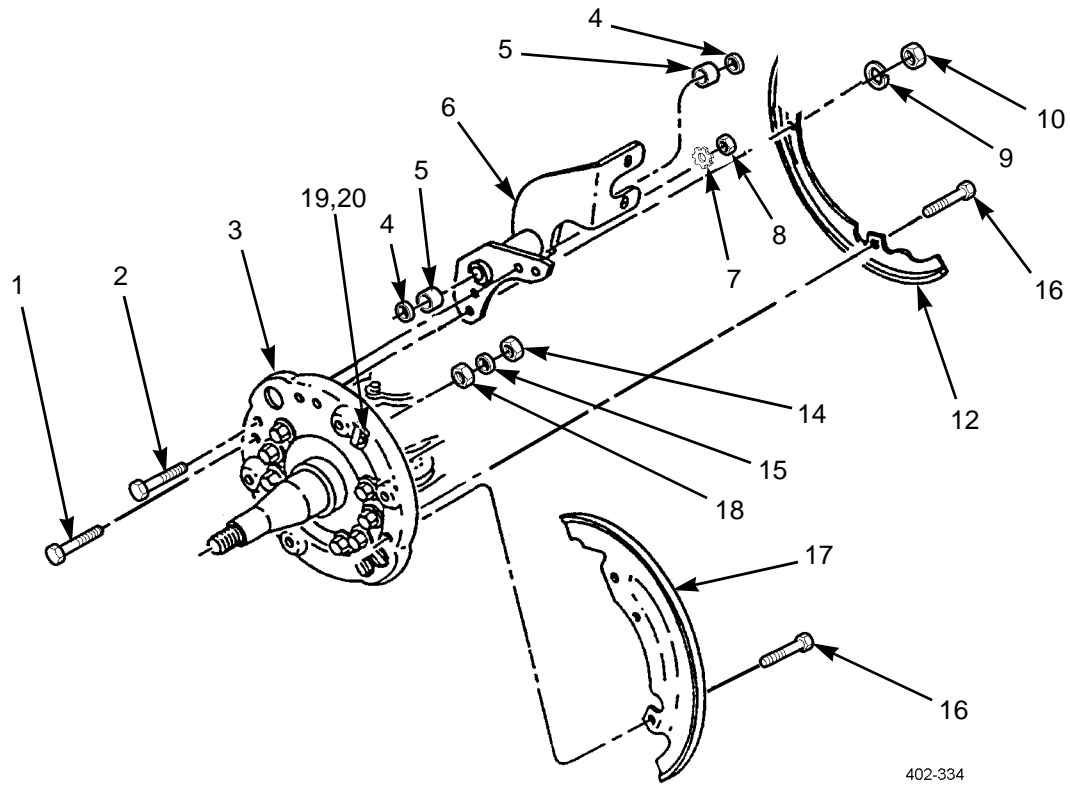
Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

1. Install brake spider (3) on axle flange (13).
2. Install seven capscrews (21), seven washers (12), and seven new locknuts (11) in brake spider (3). Tighten locknuts to 75 lb-ft (102 Nm) in sequence shown. Tighten locknuts again to 150-175 lb-ft (203-237 Nm) in sequence shown.



3. Apply light coating of oil to two bushings (5) and two new seals (4).
4. Install two bushings (5), with label ends facing each other, in brake chamber bracket (6) to depth of 0.375 in. (9.5 mm) from each end of brake chamber bracket.
5. Install two new seals (4) in brake chamber bracket (6) with lip of both seals facing toward vehicle.
6. Install brake chamber bracket (6) on brake spider (3) as noted during removal, step 5.
7. Install two capscrews (2), two washers (7), and two nuts (8).
8. Apply light coating of GAA to two bushings (5) in brake chamber bracket (6).
9. Install 2-piece dust shield (17) and two capscrews (16) on (18) on brake spider (3).
10. Install two clamps (19), two capscrews (20), and two nuts (18) on brake spider (3).
11. Install two washers (15) and two nuts (14) on brake spider (3).
12. Install two capscrews (1), two washers (9), and two nuts (10).

INSTALLATION - CONTINUED



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13. Install front slack adjuster and S-cam (WP 0139 00).
14. Install front air brake chamber (WP 0123 00).
15. Install front ABS sensor (WP 0091 00).
16. Install front brakeshoes (WP 0122 00).

END OF WORK PACKAGE

REAR BRAKESHOE AND LINING REPLACEMENT

0124 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Compound, antiseize (Item 11, WP 0312 00)

Tools and Special Tools

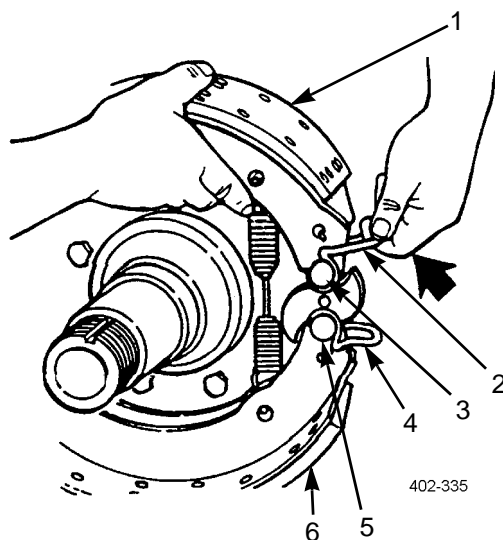
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Rear hub, drum, wheel bearings, and seal removed (WP 0154 00)

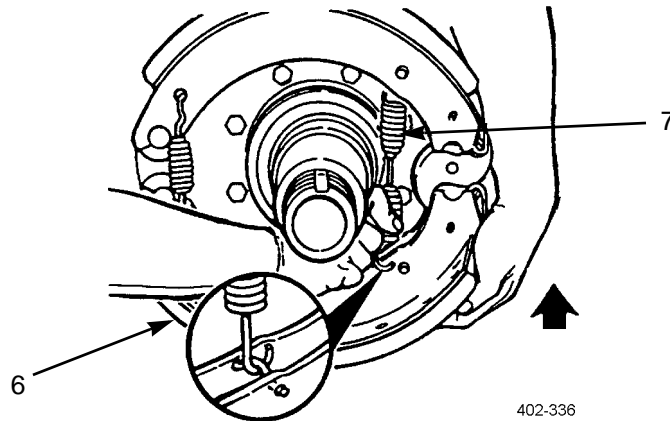
REMOVAL

1. Lift upper brakeshoe (1) and pull roller retaining clip (2).
2. Remove cam roller (3) and roller retaining clip (2).
3. Push on bottom brakeshoe (6) and pull roller retaining clip (4).
4. Remove cam roller (5) and roller retaining clip (4).

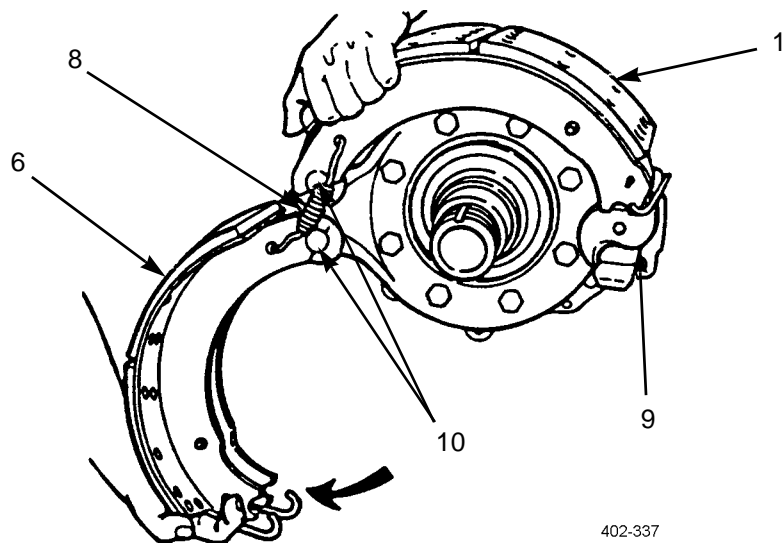


REMOVAL - CONTINUED

5. Lift lower brakeshoe (6) and remove return spring (7).



6. Rotate lower brakeshoe (6) away from S-cam (9).
7. Remove retaining spring (8), brakeshoes (1 and 6), and two anchor pins (10).

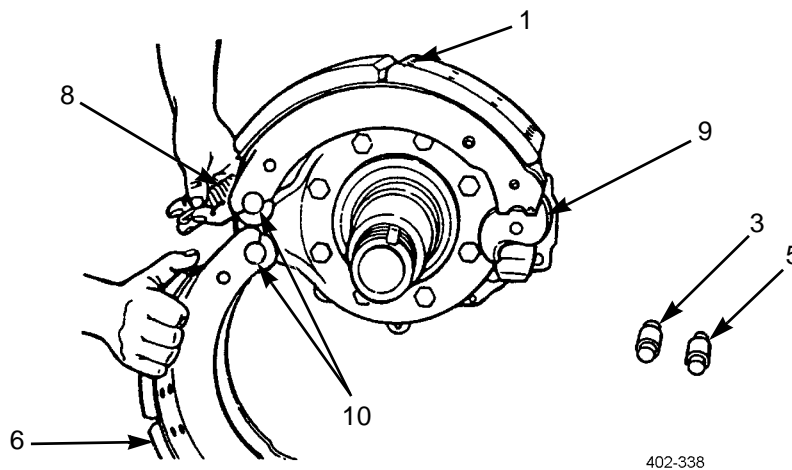
**INSPECTION**

1. Brake lining thickness must be no less than 1/4 in.
2. There must be no less than 1/32 in. clearance between top of brake lining and top of all rivet heads.

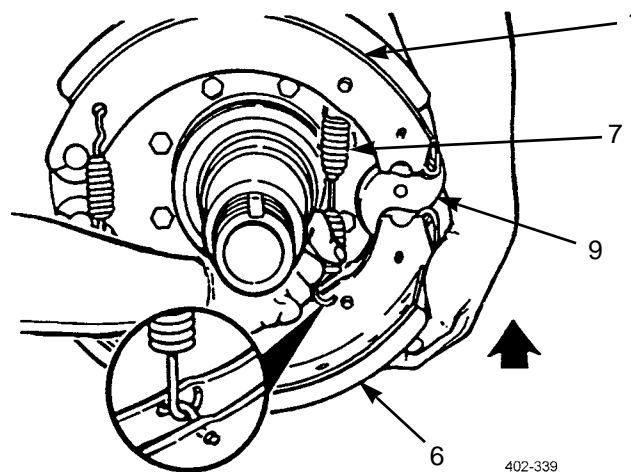
INSTALLATION**WARNING**

Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

1. Apply thin film of antiseize compound to each anchor pins (10) and small diameter of two cam rollers (3 and 5).
2. Install two anchor pins (10).
3. Install upper brakeshoe (1) on upper anchor pin (10).
4. Install lower brakeshoe (6) on lower anchor pin (10).
5. Install retaining spring (8) on anchor pin side.



6. Rotate lower brakeshoe (6) toward S-cam (9).
7. Install return spring (7) between upper and lower brakeshoes (1 and 6) on S-cam side.



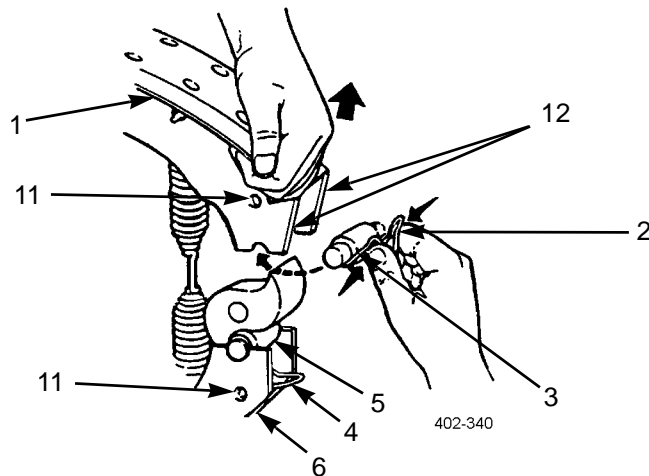
INSTALLATION - CONTINUED

8. Pull each brakeshoe (1 and 6) away from S-cam (9).
9. Install two cam rollers (2 and 5) and two roller retaining clips (3 and 4).

NOTE

Press ears of roller retaining clips together so that retainer will fit between brakeshoe webs.

10. Press each roller retaining clip (3 and 4) into brakeshoe webs (12) until ears of roller retaining clips lock in holes (11) of brakeshoe webs (12).



11. Install rear hub, drum, wheel bearings, and seal (WP 0154 00).

END OF WORK PACKAGE

REAR BRAKE SPIDER AND BRAKE CHAMBER BRACKET REPLACEMENT**0125 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Grease (Item 23, WP 0312 00)

Equipment Condition

Rear brakeshoe and lining removed (WP 0122 00)

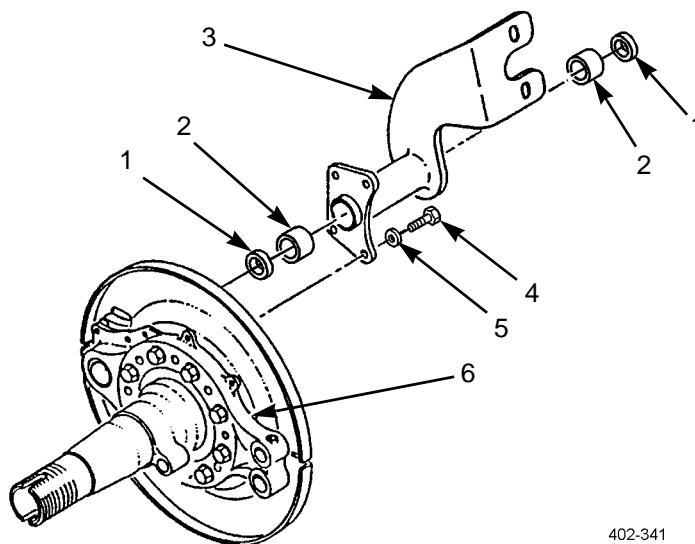
Rear air brake chamber removed (WP 0140 00)

Rear anti-lock brake system (ABS) sensor removed (WP 0092 00)

Slack adjuster and S-cam removed (WP 0127 00)

REMOVAL

1. Remove four capscrews (4), four washers (5), and brake chamber bracket (3) from spider (6).
2. Remove two grease seals (1) and two bushings (2) from spider (6).



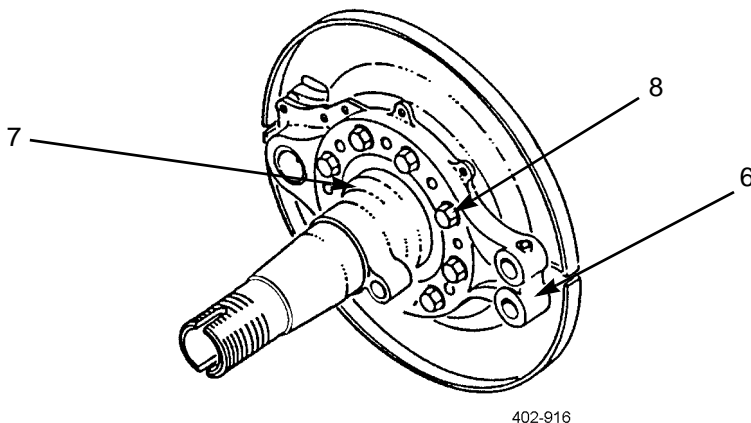
402-341

REMOVAL - CONTINUED

NOTE

Matchmark spider position prior to removal to aid in installation.

3. Remove eight flange bolts (8), and spider (6) from axle flange (7).

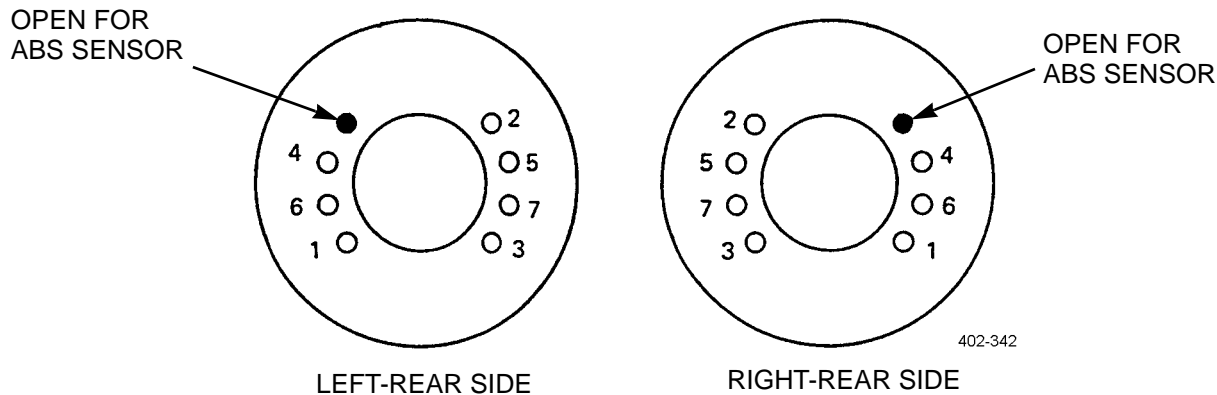


INSTALLATION

NOTE

Position spider as matchmarked during removal.

1. Install spider (6) and eight flange bolts (8) on axle flange (7). Tighten bolts to 150-175 lb-ft (203.4-237.3 Nm) in sequence shown.



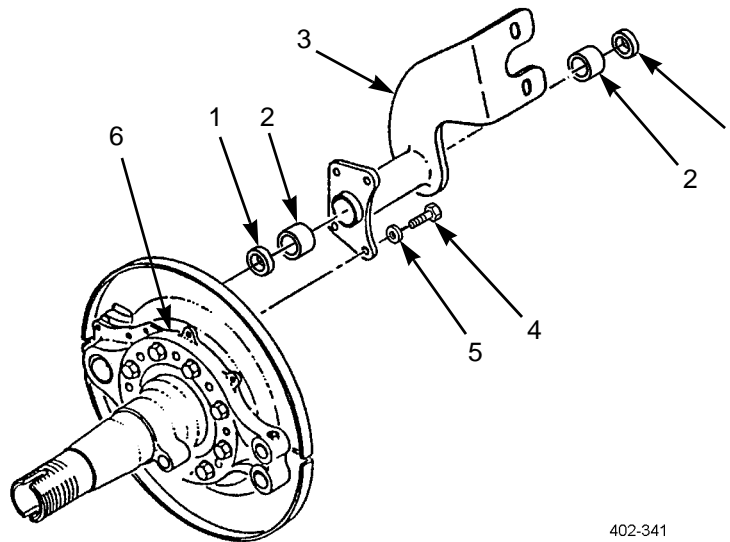
INSTALLATION - CONTINUED

2. Apply light coat of GAA to two bushings (2) and two grease seals (1).

NOTE

- Install bushings with label ends facing each other. Install to depth of 3/8 in. from each end.
- Install each grease seal with lip facing slack adjuster.

3. Install two bushings (2) and two grease seals (1) on spider (6).
4. Install brake chamber bracket (3), four capscrews (4), and four washers (5) on spider (6).



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5. Install rear brakeshoe and lining (WP 0122 00).
6. Install rear air brake chamber (WP 0140 00).
7. Install rear anti-lock brake system (ABS) sensor (WP 0092 00).
8. Install rear slack adjuster and S-cam (WP 0127 00).
9. Lubricate brake chamber bracket.

END OF WORK PACKAGE

BRAKE PEDAL REPLACEMENT

0126 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Strap, tiedown (Item 41, WP 0312 00)

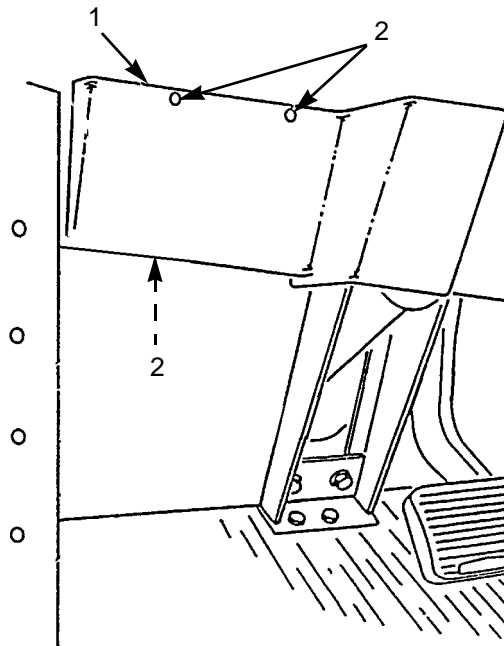
Pin, cotter (P/N K-500-PC-0001)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove three screws (2), and cover (1).



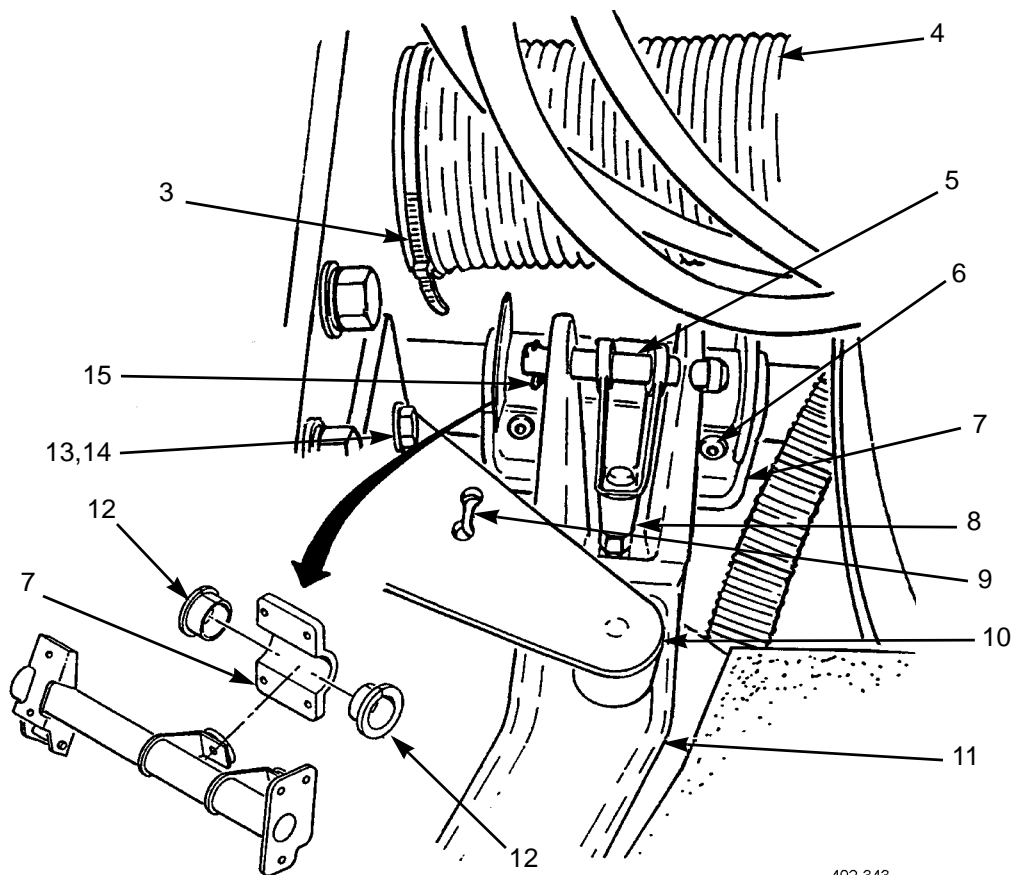
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BRAKE PEDAL REPLACEMENT - CONTINUED

0126 00

REMOVAL - CONTINUED

2. Remove tiedown strap (3) and disconnect defroster hose (4).
3. Remove two capscrews (13), two washers (14), bracket (10), and spring (9).
4. Remove four socket head screws (6), cap (7), and brake pedal (11).
5. Remove cotter pin (15), pin (5), and rod (8) from brake pedal (11). Discard cotter pin.
6. If damaged, remove two bearings (12).

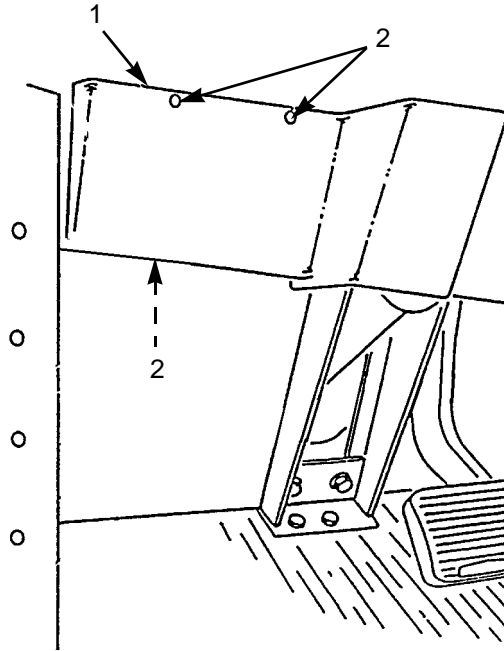


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INSTALLATION

1. If removed, install two bearings (12).
2. Install rod (8), pin (5), and new cotter pin (15) on brake pedal (11).
3. Install brake pedal (11), cap (7), and four socket head screws (6).
4. Install spring (9), bracket (10), two washers (13), and two capscrews (14).
5. Connect defroster hose (4) and install tiedown strap (3).
6. Install cover (1) and three screws (2).

INSTALLATION - CONTINUED



402-249

END OF WORK PACKAGE

SLACK ADJUSTER AND S-CAM REPLACEMENT

0127 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Indicator, dial (Item 36, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Compound, antiseize (Item 11, WP 0312 00)

Pin, cotter (P/N 2257C1173)

Pin, cotter (P/N 2257D1174)

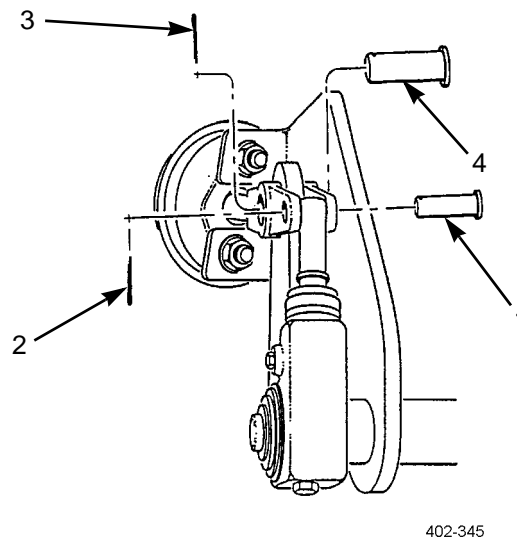
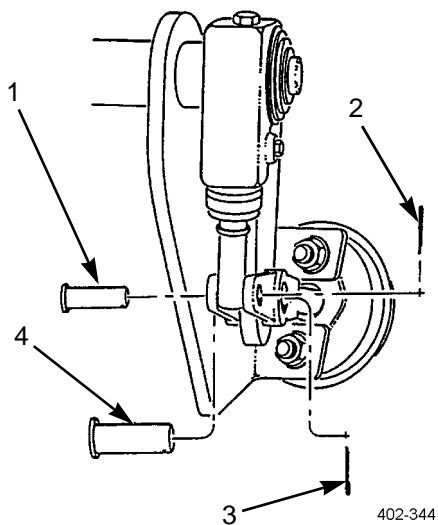
Equipment Condition

Front brakeshoe and lining removed (WP 0122 00)

Rear brakeshoe and lining removed (WP 0124 00)

REMOVAL

1. Remove small cotter pin (2) and small clevis pin (1). Discard cotter pin.
2. Remove large cotter pin (3) and large clevis pin (4). Discard cotter pin.



REMOVAL - CONTINUED**NOTE**

Note position of washers during steps 3 and 4 to aid in installation.

3. Remove retaining ring (9) and washers (8).
4. Remove slack adjuster (10) and washer (11) from splined shaft of S-cam (5).

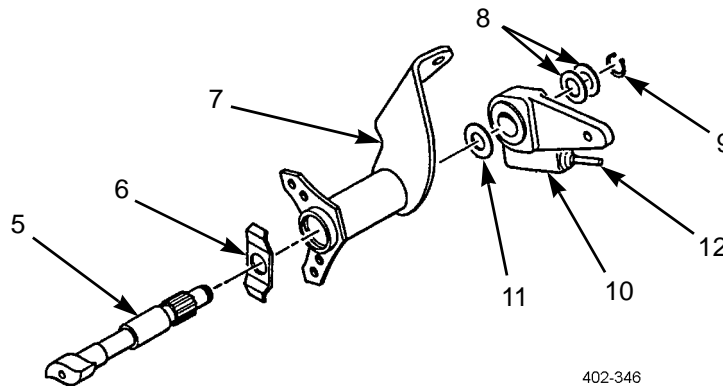
NOTE

Prior to performing step 5, mark position of S-cam.

5. Remove S-cam (5) and washer (6) from mounting bracket (7).

INSTALLATION

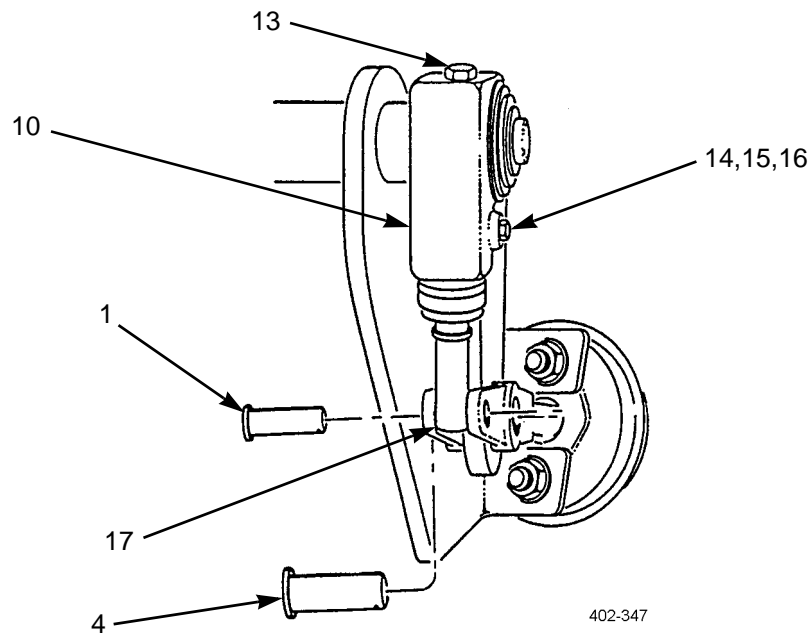
1. Apply thin film of antiseize compound on splines of S-cam (5).
2. Install washer (6) on S-cam (5).
3. Install S-cam (5) through tube of mounting bracket (7).
4. Install washer (11), as tagged during removal, on shaft of S-cam (5).
5. Install slack adjuster (10) over splines of S-cam (5) with capscrew (14) toward vehicle.
6. Install washers (8), as tagged during removal, and retaining ring (9) to secure slack adjuster (10) to S-cam (5).



INSTALLATION - CONTINUED**NOTE**

If repeating installation because measurement in step 16 exceeded 0.06 in. (1.5 mm) add one more washer than noted in step 3 of Removal.

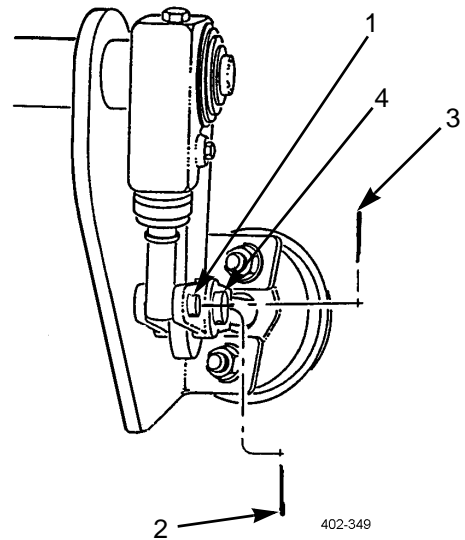
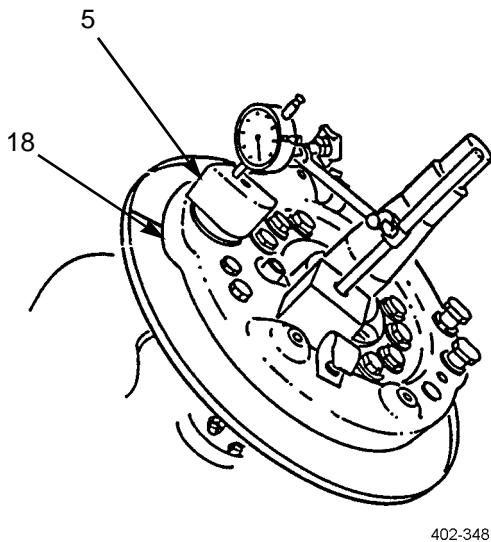
7. Remove capscrew (14), spring (15), and pawl (16).
8. Turn adjusting screw (13) to align slack adjuster (10) with brake chamber clevis (17).



INSTALLATION - CONTINUED**NOTE**

Step 9 is for front of vehicle.

9. Hold S-cam (5) in position noted during removal and turn adjusting screw (13) to align slack adjuster (10) with brake chamber clevis (17).
10. Install large clevis pin (4) in brake chamber clevis (17).
11. Pull out actuator rod (12) until hole in top of actuator rod is aligned with small hole in brake chamber clevis (17).
12. Install small clevis pin (2) in brake chamber clevis (17).
13. Install pawl (16), spring (15), and capscrew (14). Tighten capscrew to 15-20 lb-ft (20-27 Nm).
14. Make sure S-cam (5) is against brake spider (18).



INSTALLATION - CONTINUED

15. Attach magnetic base of dial indicator to brake spider (18) and reset dial indicator to zero.

NOTE

If reading is more than 0.06 in. (1.5 mm), perform steps 3 through 5 of Removal and steps 1 through 16 of Installation.

16. Push S-cam (5) outward to end of its travel and check reading on dial indicator.
17. Install new large cotter pin (3) in large clevis pin (4).
18. Install new small cotter pin (2) in small clevis pin (1).
19. Install front brakeshoe and lining (WP 0122 00).
20. Install rear brakeshoe and lining (WP 0124 00).

END OF WORK PACKAGE

SLACK ADJUSTER ADJUSTMENT

0128 00

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Jack, hydraulic (Item 52, WP 0313 00)

Trestle, hoist, portable (Item 105, WP 0313 00)

Wrench, torque, 0-300 lb-in (Item 109, WP 0313 00)

Tools and Special Tools - Continued

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

References

TM 9-2320-303-10

WP 0310 00

Equipment Condition

Wheel jacked up and axle supported by trestle

ADJUSTMENT

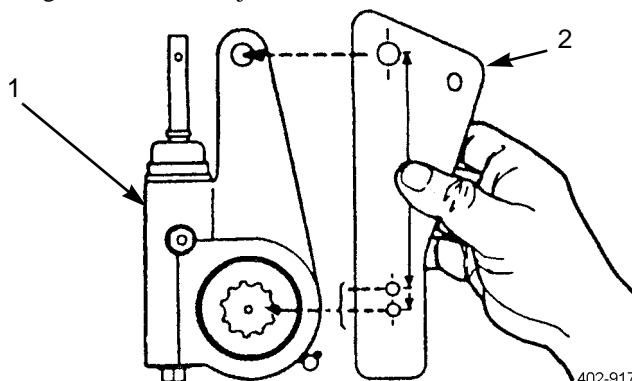
WARNING

- When the brake pushrod stroke exceeds the legal brake adjustment limit on a vehicle, there is likely a mechanical problem with the foundation brake components or the adjuster is improperly installed.
- Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. In fact, continual adjustment of automatic slack adjusters may result in premature wear of the adjuster itself. Further, the improper adjustment of some automatic slack adjusters may cause internal damage to the adjuster thereby preventing it from functioning properly. Failure to follow this warning could cause injury to personnel and damage to equipment.

NOTE

If a new slack adjuster or air brake chamber has been installed, perform steps 1 through 7 using manufactured automatic slack adjuster template (WP 0310 00).

1. Measure the length of the slack adjuster (1) with the template (2). The marks by the holes in the small end of the template indicate the length of the slack adjuster.

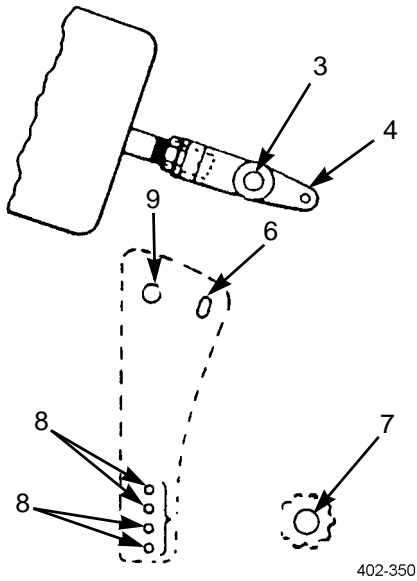


ADJUSTMENT - CONTINUED

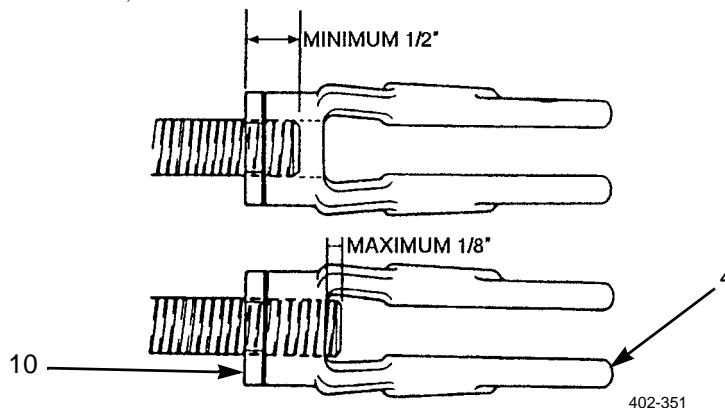
CAUTION

The clevis MUST be installed in the correct position on the push rod or the slack adjuster will not adjust the brake correctly resulting in premature wear of brakes.

2. Put the large clevis pin (3) through the large holes (9) in the template and the clevis (4).
3. Select the hole (8) in the template that matches the length of the slack adjuster. Hold that hole on the center of the camshaft or powershaft (7).



4. Look through slot (6) in the template. The small hole (8) in the clevis MUST be completely visible.
5. If necessary, adjust the position of the clevis (4) on the push rod until the small hole (5) in the clevis is completely visible through the slot (6) in the template.
6. Tighten the jam nut (10) against the clevis (4) to hold the clevis in the correct position. For the 1/2-20 threads, tighten the jam nut to a torque of 20-30 lb-ft (27-41 Nm). For 5/8-18 threads, tighten the jam nut to a torque of 25-50 lb-ft (34-68 Nm).
7. There must be at least 1/2 inch (12.7 mm) of thread engagement between the clevis and the push rod. The push rod must not extend through the clevis more than 1/8 inch (3.18 mm).
8. If adjustment cannot be obtained, install new air brake chamber.



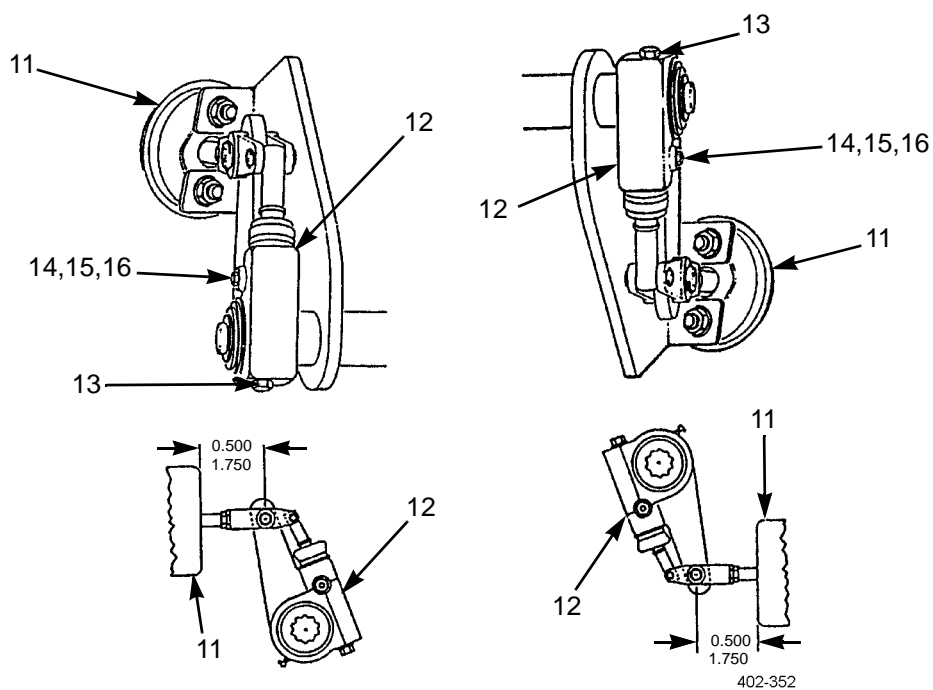
ADJUSTMENT - CONTINUED

9. Remove capscrew (14), spring (15), and pawl (16).
10. Rotate wheel and tighten screw (13) until wheel will not rotate.

NOTE

A slight amount of drag will be felt during wheel rotation.

11. Loosen screw (13) 1/4 turn and rotate wheel.
12. Install pawl (16), spring (15), and capscrew (14). Tighten capscrew to 15-20 lb-ft (20-27 Nm).
13. Using flat tip screwdriver, manually pull slack adjuster (12) in direction away from brake canister (11) while measuring total distance of travel between slack adjuster and brake canister.
14. If total distance of travel exceeds 1-3/4 in. (44.45 mm), or if total distance is not minimum of 1/2 in. (12.7 mm), repeat steps 9 through 13.



15. Remove jack stands and lower vehicle (TM 9-2320-303-10).

END OF WORK PACKAGE

PRIMARY I AIR TANK AND FITTINGS REPLACEMENT

0129 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Air system drained (TM 9-2320-303-10)

Rear platform removed (WP 0172 00)

References

TM 9-2320-303-10

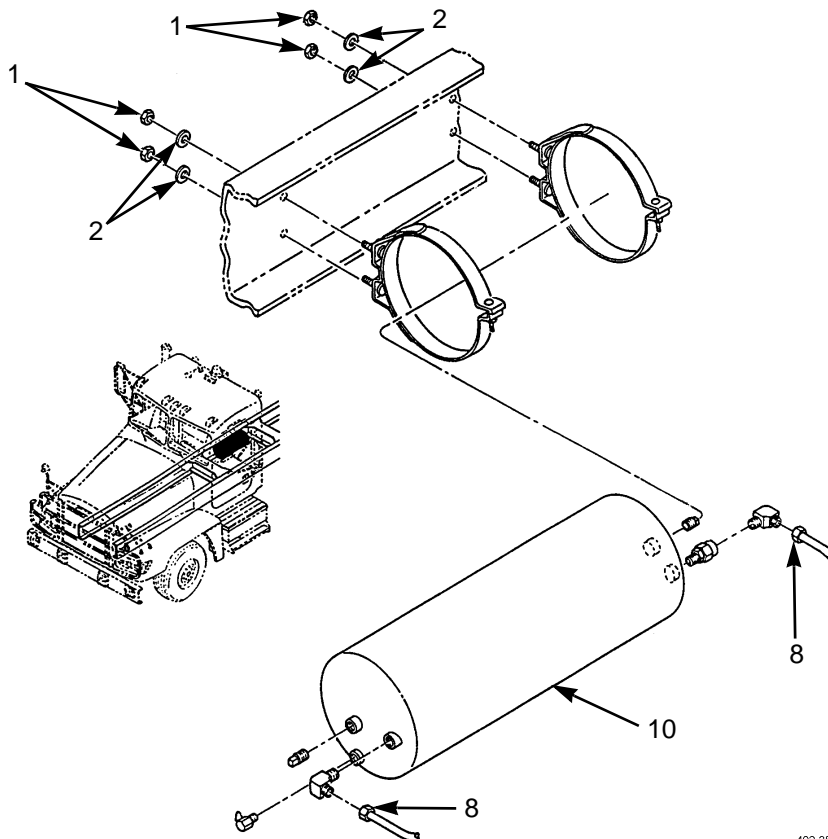
WP 0133 00

REMOVAL

NOTE

Tag all tubes prior to disconnecting to aid in connecting.

1. Disconnect two tubes (8) from air tank (10).
2. Remove four nuts (1), four washers (2), and air tank (10).

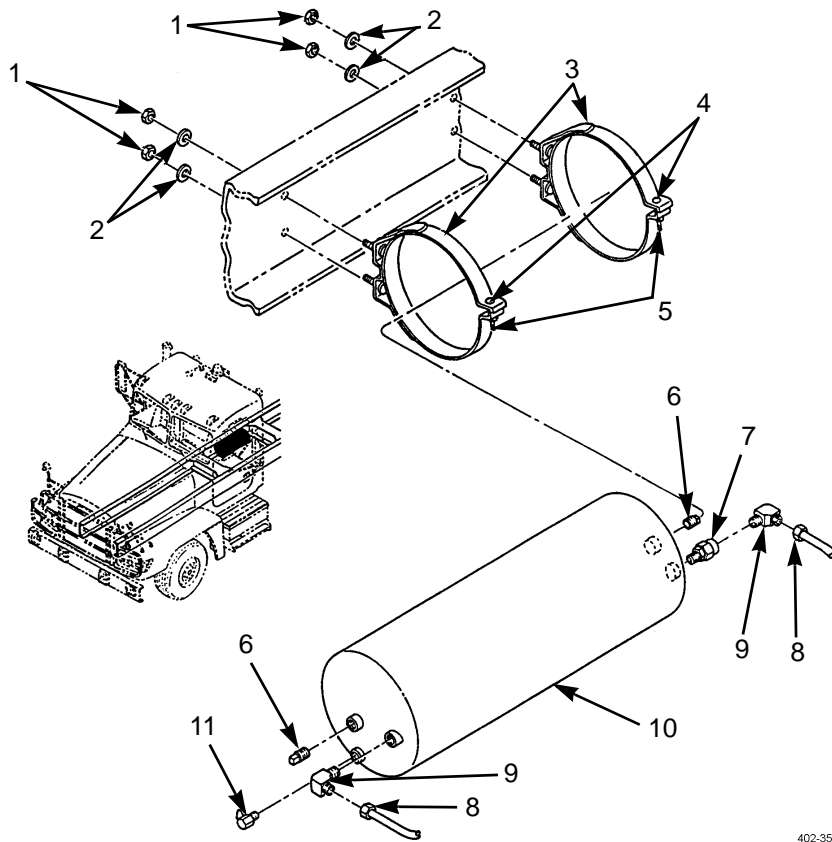


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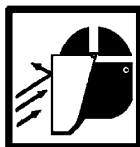
REMOVAL - CONTINUED

NOTE

- Perform steps 3 and 4 only if fittings or air tank are to be replaced.
 - Remove automatic drain valve (WP 0133 00) if equipped.
3. Remove two nuts (5), two screws (4), and two mounting brackets (3) from air tank (10).
 4. Remove two elbows (9), check valve (7), drain valve (11), and two plugs (6).



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INSTALLATION**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

NOTE

- Perform steps 1 through 3 only if fittings have been removed from air tank.
 - Install automatic drain valve (WP 0133 00) if equipped.
1. Coat pipe threads of two new plugs (6), new drain valve (11), new check valve (7), and two new elbows (9) with pipe sealant compound.
 2. Install two plugs (6), drain valve (11), check valve (7), and two elbows (9) in new air tank (2).
 3. Install two mounting brackets (3), two screws (4), and two nuts (5).
 4. Install air tank (10), four washers (7), and four nuts (1).
 5. Connect two tubes (8) to air tank (10).
 6. Install rear platform (WP 0172 00).
 7. Start vehicle and check for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

PRIMARY II AIR TANK AND FITTINGS REPLACEMENT**0130 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Compound, pipe, sealing (Item 17, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-6CG5C) (4)

References

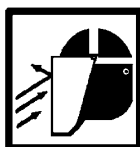
TM 9-2320-303-10

WP 0133 00

Equipment Condition

Air system drained (TM 9-2320-303-10)

Spare tire removed (TM 9-2320-303-10)

**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

REMOVAL

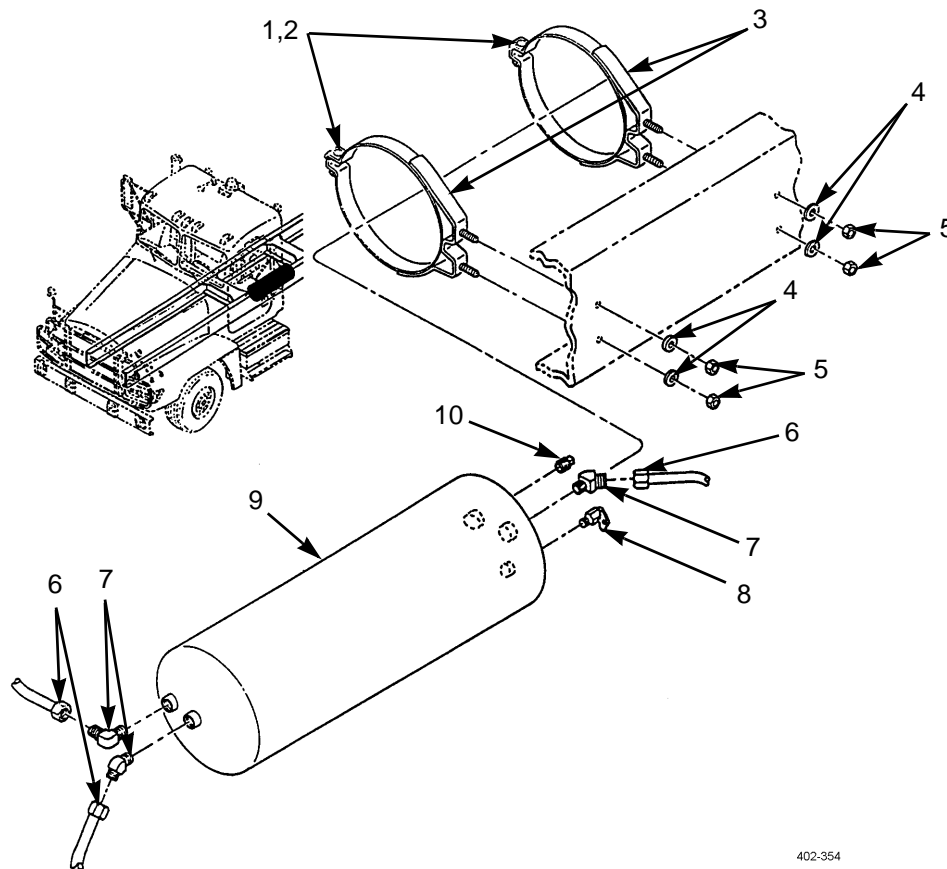
NOTE

Tag all tubes prior to disconnecting to aid in connecting.

1. Disconnect three tubes (6) from air tank (9).
2. Remove four locknuts (5), four washers (4), and air tank (9). Discard locknuts.

NOTE

- Perform steps 3 and 4 only if fittings or air tank are to be replaced.
 - Remove automatic drain valve (WP 0133 00) if equipped.
3. Remove two nuts (1), two screws (2), and two mounting brackets (3) from air tank (9).
 4. Remove three elbows (7), plug (10), and drain valve (8).

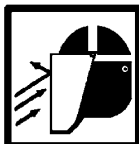


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INSTALLATION**NOTE**

- Perform steps 1 through 3 only if fittings have been removed from air tank.
- Install automatic drain valve (WP 0133 00) if equipped.

1. Install two mounting brackets (3), two screws (1), and two nuts (2).

**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

2. Coat pipe threads of new drain valve (8), new plug (10), and three new elbows (7) with pipe sealant compound.
3. Install drain valve (8), plug (10), and three elbows (7) in new air tank (9).
4. Install air tank (9), four washers (4), and four new locknuts (5).
5. Connect three tubes (6) to air tank (9).
6. Start vehicle and check for leaks (TM 9-2320-303-10).
7. Install spare tire (TM 9-2320-303-10).

END OF WORK PACKAGE

SECONDARY AIR TANK AND FITTINGS REPLACEMENT

0131 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)
 Tags, marker (Item 17 WP 0312 00)

Materials/Parts - Continued

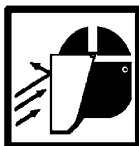
Nut, lock (P/N M45913/1-6CG5C) (8)

Reference

TM 9-2320-303-10
 WP 0133 00

Equipment Condition

Air system drained (TM 9-2320-303-10)



WARNING



- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

REMOVAL

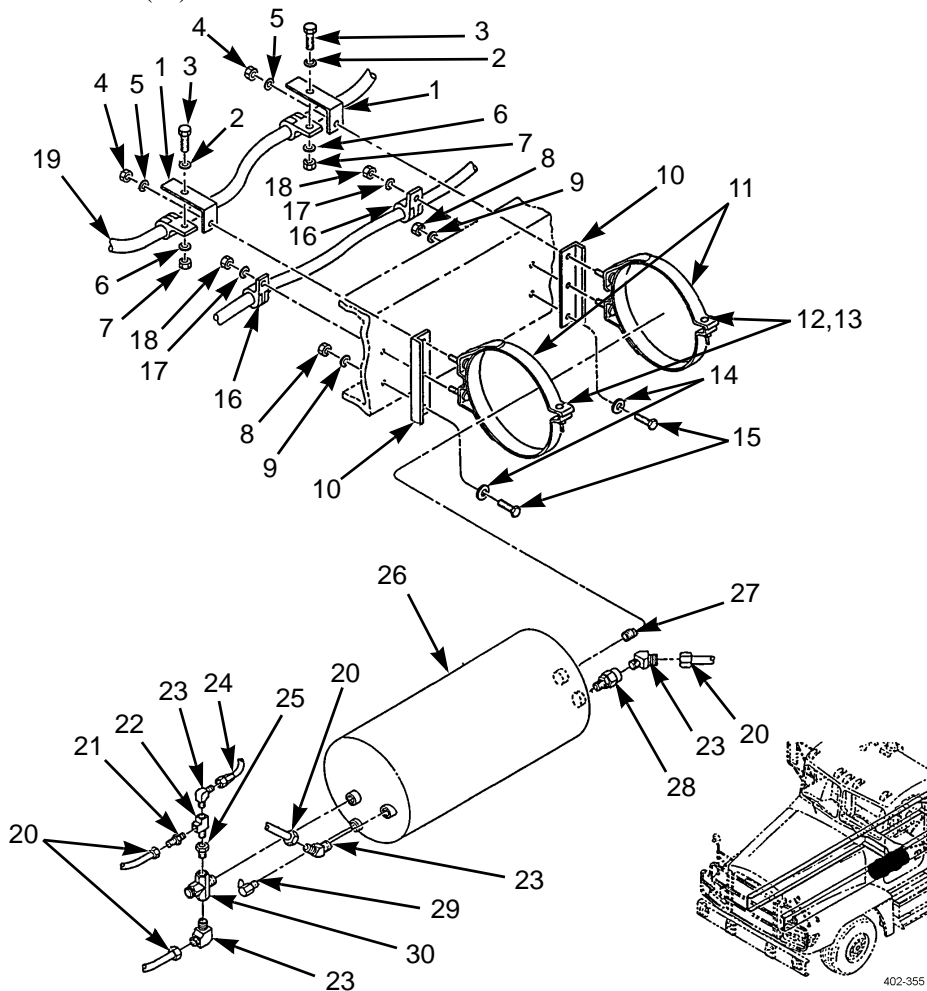
NOTE

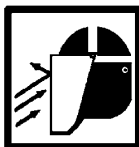
Tag all tubes prior to disconnecting to aid in connecting.

1. Disconnect four tubes (20) and hose (24) from air tank (26).
2. Remove two locknuts (12), two screws (13), and air tank (26). Discard locknuts.
3. Remove two locknuts (7), two washers (6), two capscrews (3), and two washers (2) and set cable (19) aside. Discard locknuts.
4. Remove two locknuts (4), two washers (5), and two brackets (1). Discard locknuts.
5. Remove two locknuts (18), two washers (17), two clamps (16), and two mounting brackets (11). Discard locknuts.
6. Remove two locknuts (8), two washers (9), two capscrews (15), two washers (14), and two brackets (10). Discard locknuts.

NOTE

- Perform step 7 only if fittings or air tank are to be replaced.
 - Remove automatic drain valve (WP 0133 00) if equipped.
7. Remove four elbows (23), check valve (28), plug (27), connector (21), tee (22), bushing (25), pressure protect valve (30), and drain valve (29).



INSTALLATION**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

NOTE

- Perform steps 1 and 2 only if fittings have been removed from air tank.
 - Install automatic drain valve (WP 0133 00) if equipped.
1. Coat pipe threads of new drain valve (29), new pressure protect valve (30), new bushing (25), new tee (22), new connector (21), new plug (27), new check valve (28), and four new elbows (23) with pipe sealant compound.
 2. Install drain valve (29), pressure protect valve (30), bushing (25), tee (22), connector (21), plug (27), check valve (28), and four elbows (23) in new air tank (26).
 3. Install two brackets (10), two washers (14), two capscrews (15), two washers (9), and two new locknuts (8).
 4. Install two mounting brackets (11), two clamps (16), two washer (17), and two new locknuts (18).
 5. Install two brackets (1), two washers (5), and two new locknuts (4).
 6. Install cable (19), two washers (2), two capscrews (3), two washers (6), and two new locknuts (7).
 7. Install air tank (26), two screws (13), and two new locknuts (12).
 8. Connect hose (24) and four tubes (20) to air tank (26).
 9. Start vehicle and check for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

AIR SUPPLY TANK AND FITTINGS REPLACEMENT**0132 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Pin, cotter (P/N MS24665-326)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-6CG5C) (6)

Reference

TM 9-2320-303-10

WP 0133 00

Equipment Condition

Air system drained (TM 9-2320-303-10)

Rear platform removed (WP 0172 00)

Primary I air tank removed (WP 0129 00)

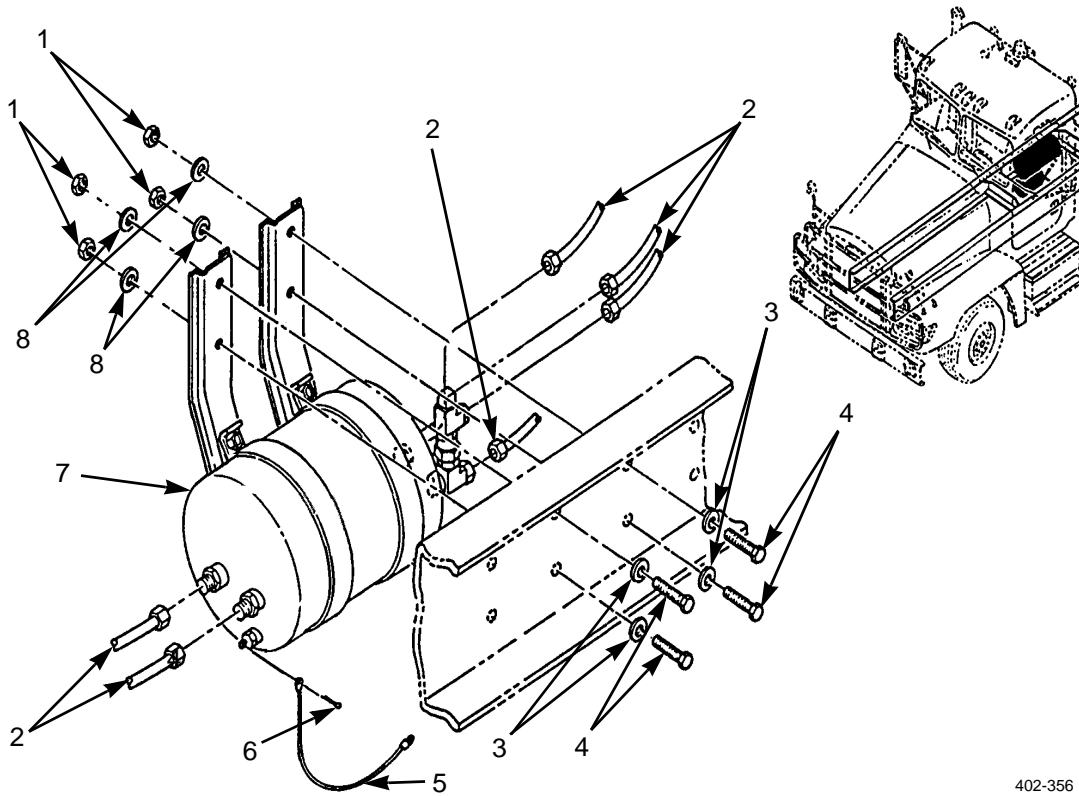
**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

REMOVAL - CONTINUED**NOTE**

Tag all tubes prior to disconnecting to aid in connecting.

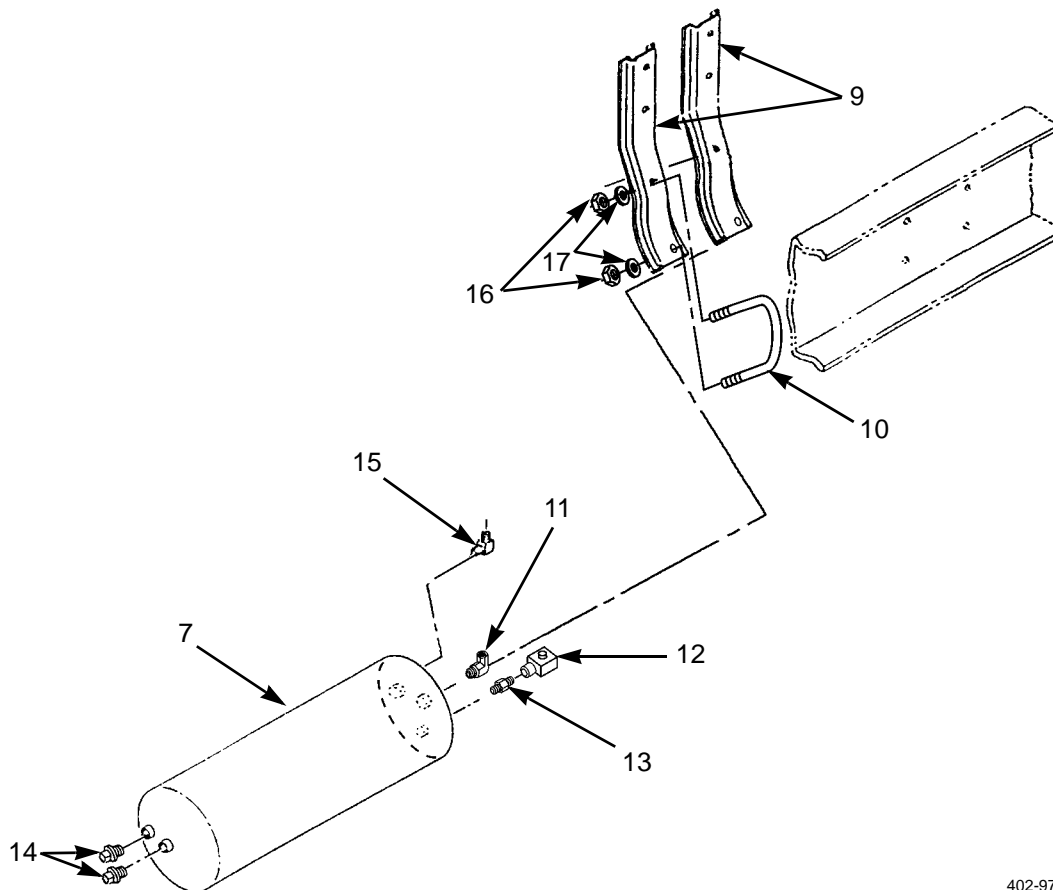
1. Disconnect six tubes (2) from air supply tank (7).
2. Remove cotter pin (6) and disconnect cable (5). Discard cotter pin.
3. Remove four locknuts (1), four washers (8), four screws (4), four washers (3), and air supply tank (7). Discard locknuts.



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REMOVAL - CONTINUED

4. Remove two locknuts (16), washers (17), u-bolts (10), and brackets (9) from tank (7). Discard locknuts.
5. Remove two pipe plugs (14), reducer (13), drain valve (12), elbow (11), and elbow (15).



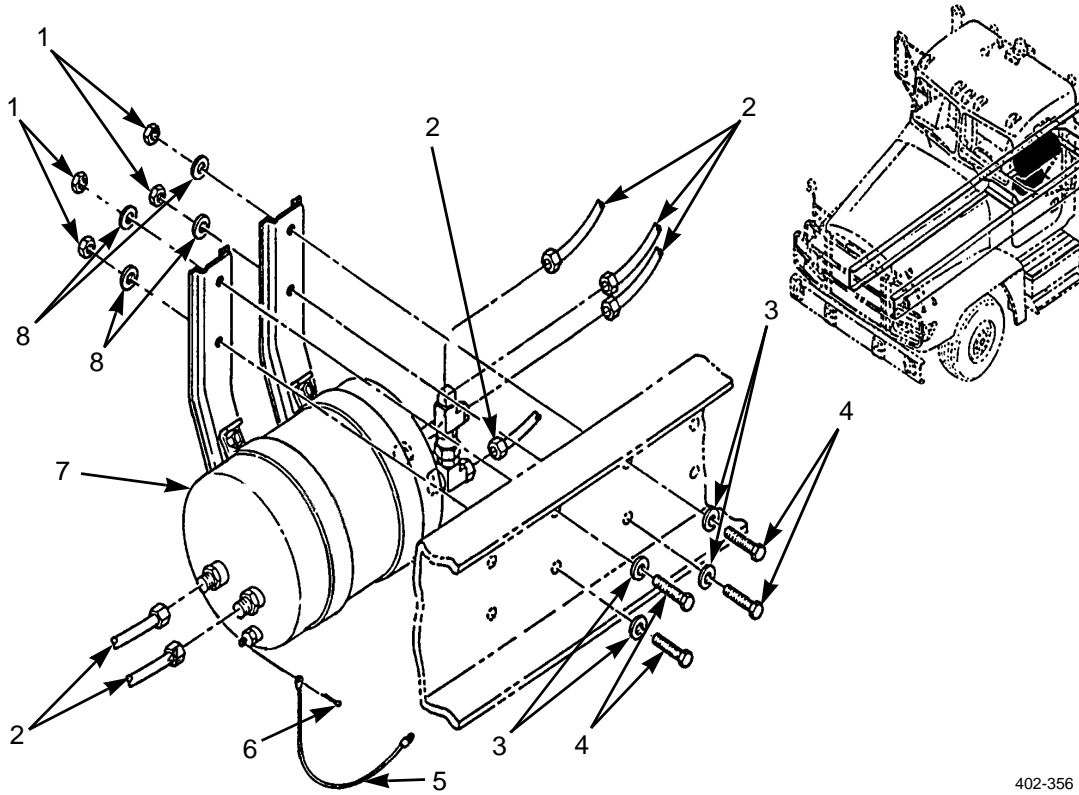
402-975

INSTALLATION

1. Install tank (7) on brackets (9) and install u-bolts (10), washers (17), and new locknuts (16).

**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
 - Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.
2. Coat pipe threads of two pipe plugs (14), reducer (13), drain valve (12), elbow (15), and elbow (11).
 3. Install two pipe plugs (14), reducer (13), drain valve (12), elbow (15), and elbow (11).

INSTALLATION - CONTINUED

402-356

4. Install air supply tank (7), four washers (3), four screws (4), four washers (8), and four new locknuts (1).
5. Connect cable (5) and install new cotter pin (6).
6. Connect six tubes (2) to air supply tank (7).
7. Install primary I air tank (WP 0129 00)
8. Start vehicle and check for leaks (TM 9-2320-303-10).
9. Install rear platform (WP 0172 00).

END OF WORK PACKAGE

AIR TANK AUTOMATIC DRAIN VALVE REPLACEMENT

0133 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

TM 9-2320-303-10

Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Equipment Conditions

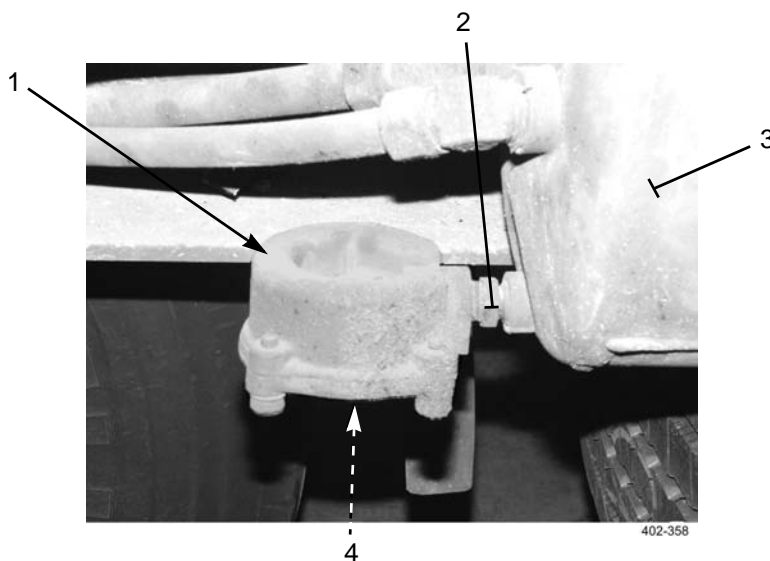
Air system drained (TM 9-2320-303-10)

NOTE

There are four automatic drain valves, one per air tank.

REMOVAL

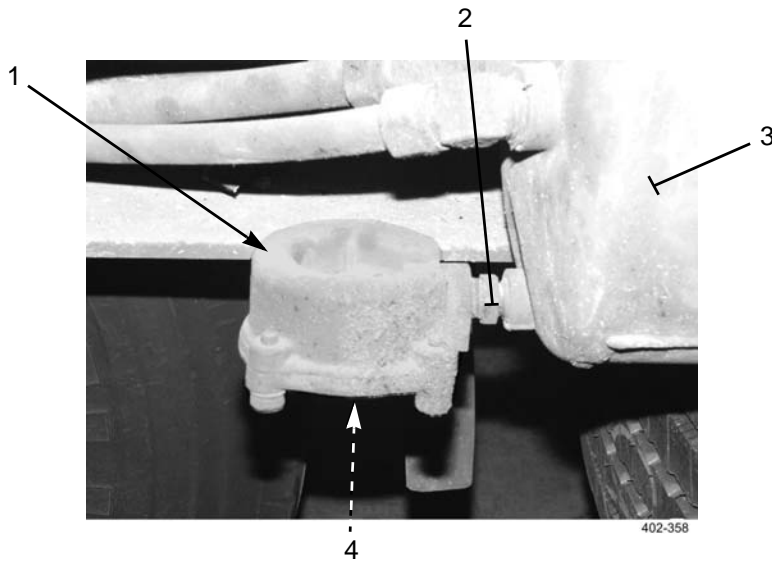
1. Press rubber pin (4) on drain valve (1) to release any residual air from tank.
2. Remove drain valve (1) from air tank (3).
3. Remove adapter (2) from drain valve (1).



INSTALLATION**WARNING**

Adhesives 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 a well-ventilated area. If adhesive or sealing compound contacts skin or clothing, wash immediately with soap and water.

4. Apply pipe sealing compound to threads of adapter (2).
5. Install adapter (2) on drain valve (1).
6. Install drain valve (1) on air tank (3).



7. Start vehicle and check for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

AIR DRYER REPLACEMENT

0134 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Straps, tiedown (Item 41, WP 0312 00)

Materials/Parts - Continued

Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Wheels blocked (TM 9-2320-303-10)

Air system drained (TM 9-2320-303-10)

Rear platform removed (WP 0172 00)

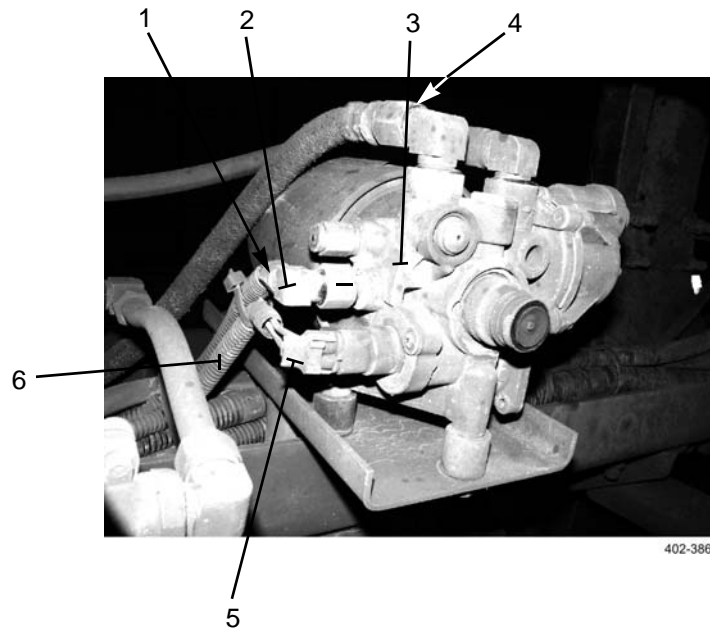
REMOVAL

NOTE

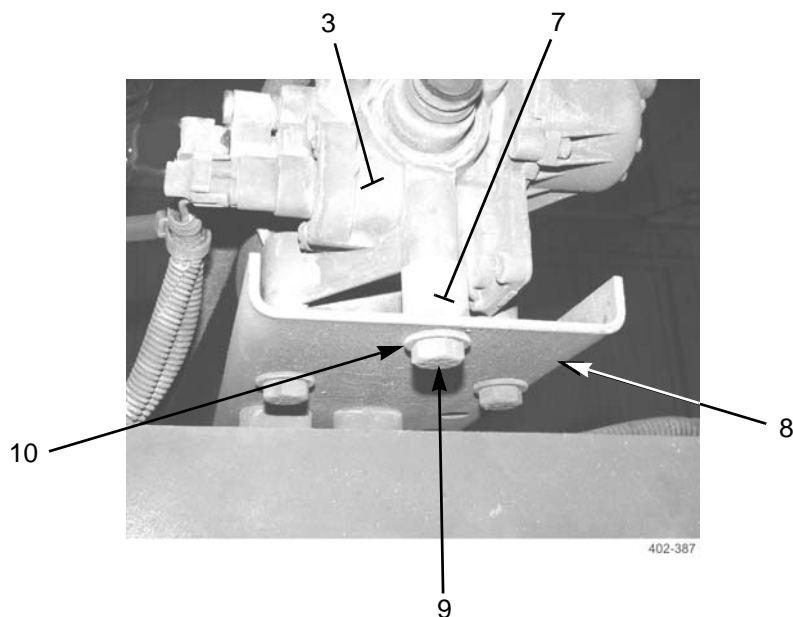
- Remove and discard tiedown straps as necessary. Use new tiedown straps on installation.
- Tag hoses and tubes to aid in installation.

REMOVAL - CONTINUED

1. Underneath front of air dryer (3), disconnect connector (5) of chassis wiring harness (6) from air dryer.
2. Disconnect air tube (1) from elbow (2).
3. Remove elbow (2) from air dryer (3).
4. At side of air dryer (3), disconnect two air hoses (4).



5. Remove three screws (9), washers (10), spacers (7), and air dryer (3) from air dryer bracket (8).



INSTALLATION

1. Install air dryer (4) to air dryer bracket (8) with three spacers (7), washers (10), and screws (9). Tighten screws to 22-30 lb-ft (30-40 Nm).
 - Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
 - Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.
2. Lightly coat threads of fittings with pipe sealing compound before they are installed.
3. Connect two air hoses (4).
4. At front of air dryer (3) install elbow (2).
5. Connect air tube (1) to elbow (2).
6. Connect connector (5) of chassis wiring harness (6) to air dryer (3).
7. Install rear platform (WP 0172 00).

END OF WORK PACKAGE

AIR DRYER CANISTER REPLACEMENT

0135 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, strap (Item 107, WP 0313 00)

Materials/Parts

Oil, lubricating (Item 27, WP 0312 00)

Materials/Parts - Continued

Canister, air dryer (P/N R 950011)

Equipment Condition

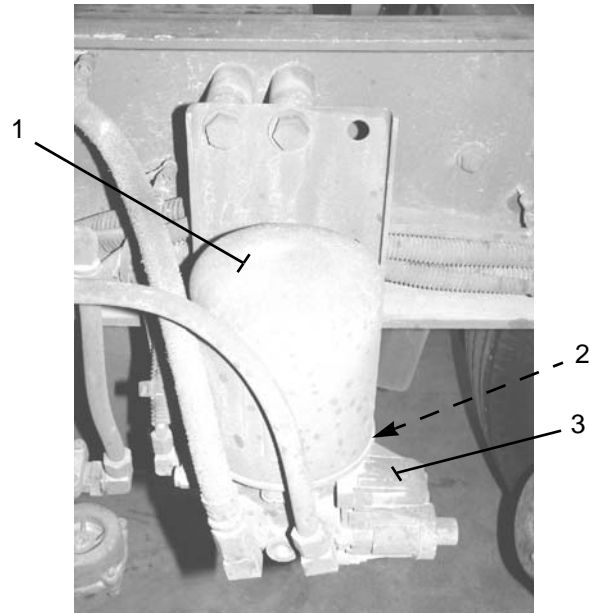
Wheels blocked (TM 9-2320-303-10)

Air system drained (TM 9-2320-303-10)

Rear platform removed (WP 0172 00)

REMOVAL

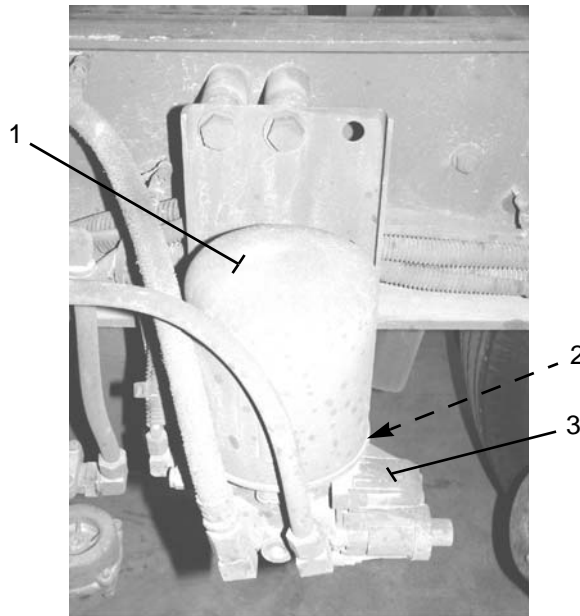
1. Use strap wrench to remove air dryer canister (1) from air dryer (3). Discard canister.
2. Remove o-ring (2) from air dryer (3). Discard o-ring.



INSTALLATION**NOTE**

New air dryer canister comes with a new o-ring.

1. Apply a thin coat of oil to new o-ring (2) and install o-ring to top of air dryer (3).
2. Apply a thin coat of oil to rubber seal of new air dryer canister (1).
3. Install air dryer canister (1) to air dryer (3) until rubber seal contacts surface of air dryer. Rotate canister an additional ONE full turn.



402-388

4. Install rear platform (WP 0172 00).

END OF WORK PACKAGE

FRONT GLADHANDS REPLACEMENT

0136 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Materials/Parts - Continued

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N NAS1021N17) (2)

Washer, lock (P/N MS35333-49) (2)

References

TM 9-2320-303-10

Equipment Condition

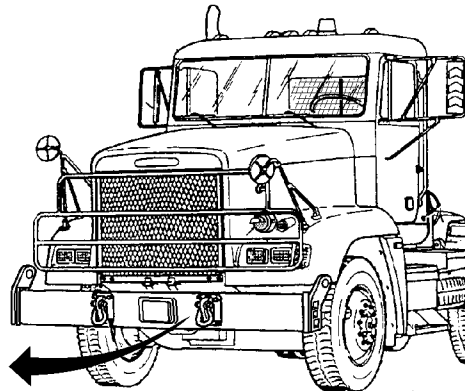
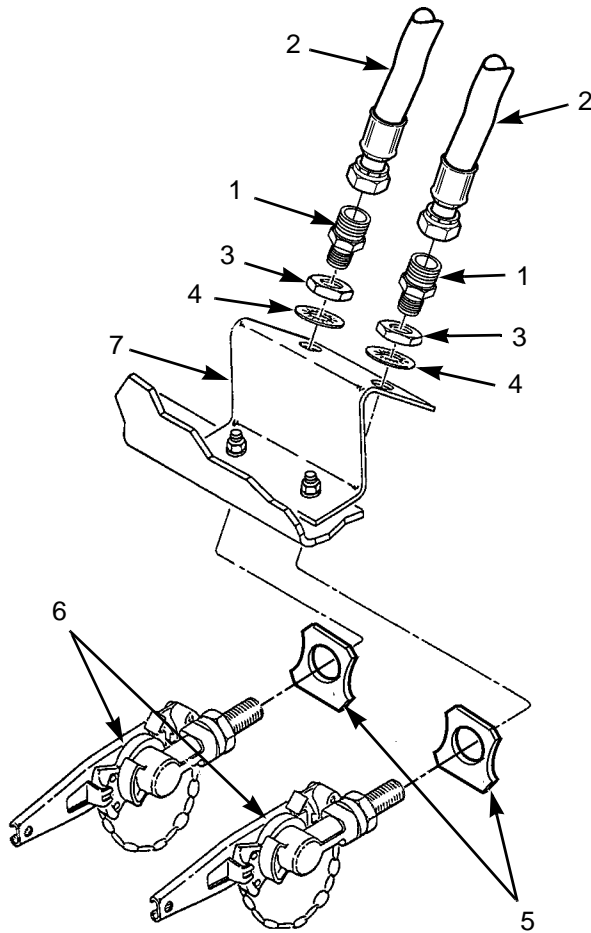
Air system drained (TM 9-2320-303-10)

NOTE

Tag hoses and adapters to aid in installation.

REMOVAL

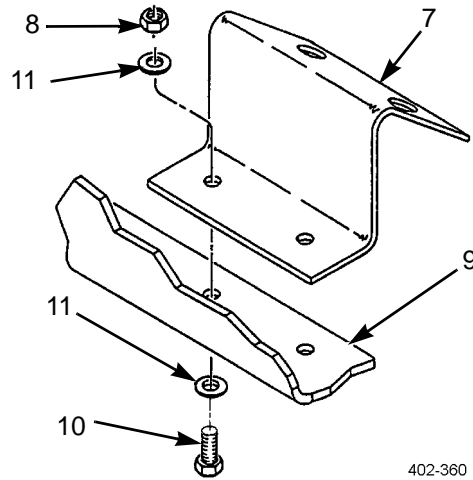
1. Disconnect two hoses (2) from two adapters (1).
2. Remove two adapters (1), nuts (3), lockwashers (4), data plates (5), and gladhands (6) from mounting bracket (7). Discard lockwashers.



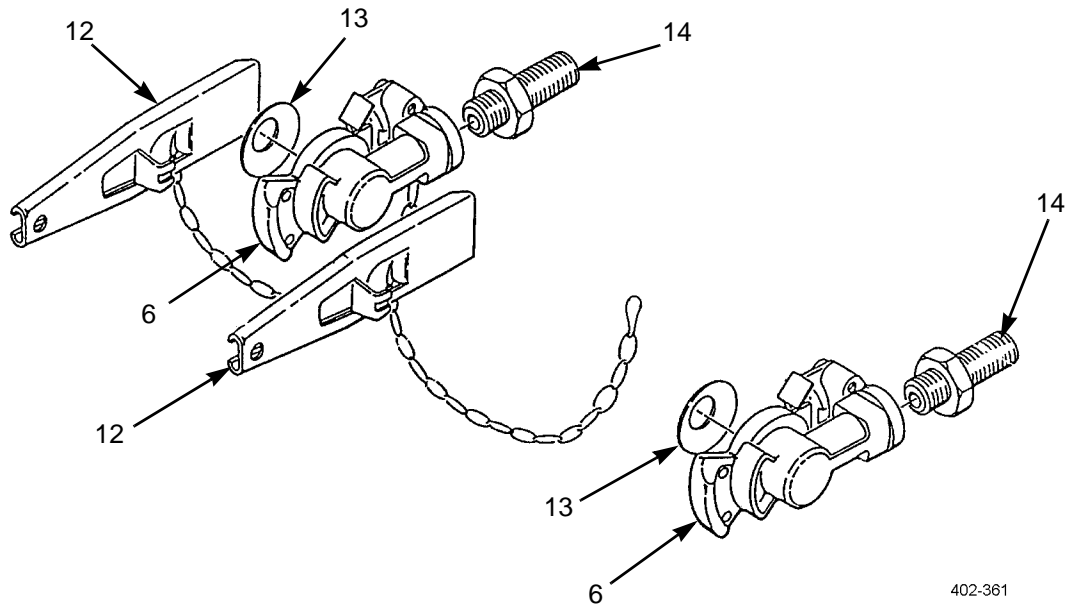
402-359

REMOVAL - CONTINUED

- Remove two locknuts (8), washers (11), screws (10), and mounting bracket (7) from bumper (9). Discard locknuts.



- Remove bulkhead fitting (14), dummy coupling (12), and seal (13) from each gladhand (6).



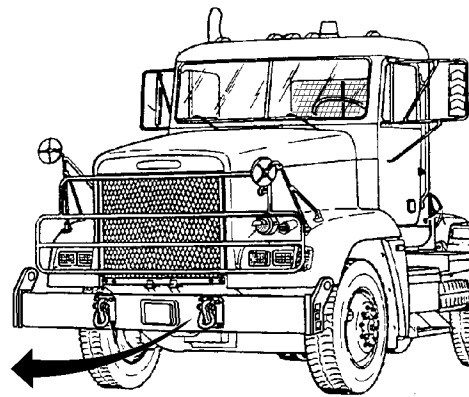
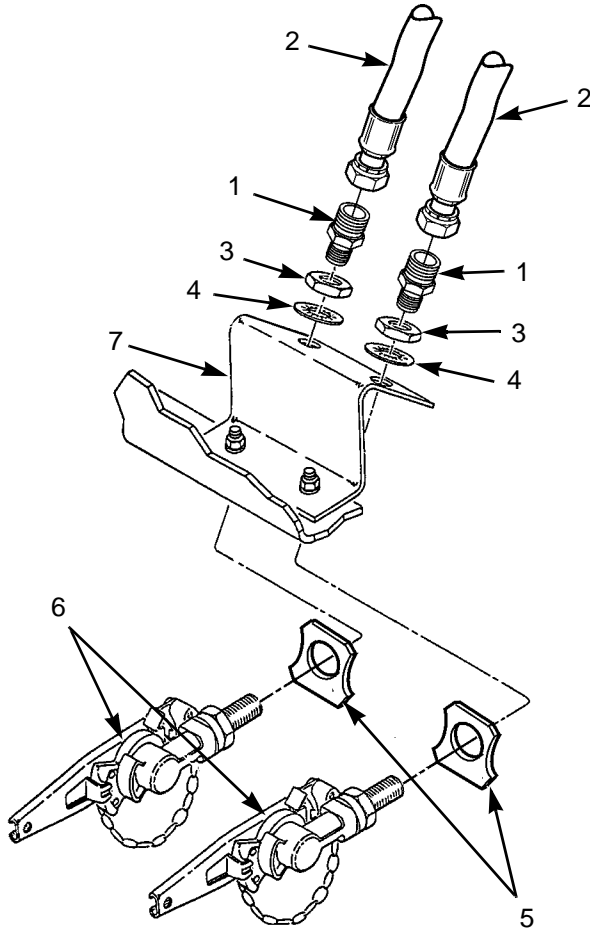
INSTALLATION

- Install seal (13), and dummy coupling (12) on each gladhand (6).

INSTALLATION - CONTINUED**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
 - Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.
2. Lightly coat threads of two bulkhead fittings (14) with pipe sealing compound. Install bulkhead fittings on gladhands (6).
 3. Install mounting bracket (7) on bumper (9) with two washers (11), screws (10), and new locknuts (8).
 4. Install data plates (5) on same gladhand (6) as during removal.
 5. Install two gladhands (6) on mounting bracket (7) with two new lockwashers (4) and nuts (3).
 6. Lightly coat threads of two elbows (1) with pipe sealing compound. Install elbows on two bulkhead fittings (14).
 7. Connect two tubes (2) to adapters (1).
 8. Start vehicle and build air pressure (TM 9-2320-303-10). Check for leaks.

INSTALLATION - CONTINUED



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END OF WORK PACKAGE

REAR GLADHANDS REPLACEMENT

0137 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

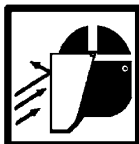
Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)
 Washer, lock (P/N MS35333-49) (2)

Equipment Condition

Air system drained (TM 9-2320-303-10)



WARNING



- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

REMOVAL**NOTE**

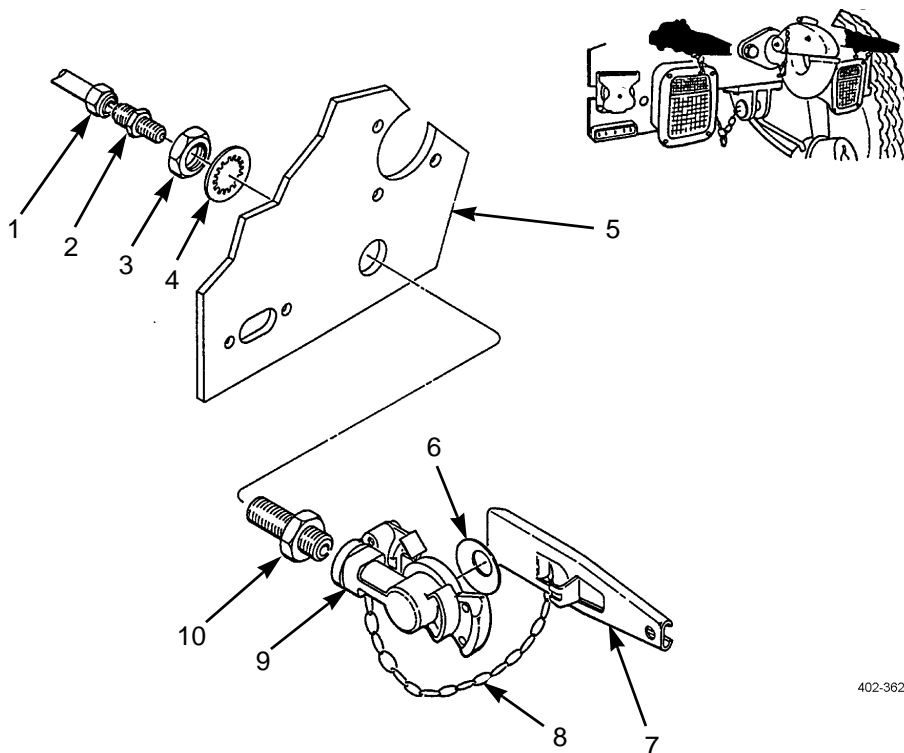
Procedure is for emergency gladhand and is the same for service gladhand.

1. Disconnect hose (1) from connector (2).

NOTE

It is not necessary to remove gladhand in order to replace gladhand seal.

2. Remove connector (2), nut (3), lockwasher (4), and gladhand (9) from bracket (5). Discard lockwasher.
3. Remove dummy coupling (7), chain (8), bulkhead fitting (10), and seal (6) from gladhand (9).



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INSPECTION

Inspect gladhand seals for cracks, tears, or any excessive wear. If present, replace gladhand seals.

INSTALLATION**NOTE**

Procedure is for emergency gladhand and is the same for service gladhand.

1. Install seal (6), chain (8), and dummy coupling (7) on gladhand (9).

INSTALLATION - CONTINUED**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
 - Sealant 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 sealant compound gets on skin or clothing, wash immediately with soap and water.
2. Coat threads with pipe sealant compound and install bulkhead fitting (10) in gladhand (9).
 3. Install gladhand (9), new lockwasher (4), and nut (3) in bracket (5).
 4. Coat threads with pipe sealant compound and install connector (2).
 5. Connect hose (1) to connector (2).

END OF WORK PACKAGE

AIR TUBE REPLACEMENT

0138 00

THIS WORK PACKAGE COVERSRemoval, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/PartsCompound, sealing, pipe (Item 17, WP 0312 00)
Straps, tiedown (Item 41, WP 0312 00)**Materials/Parts - Continued**

Tags, marker (Item 42, WP 0312 00)

ReferencesTM 9-2320-303-10
WP 0306 00**Equipment Condition**Air system drained (TM 9-2320-303-10)

REMOVAL**NOTES**

- Some air tubes use conventional compression fittings with tube nuts. Other air tubes use plastic push-in fittings. To replace push-in fittings, refer to instructions in *General Maintenance Instructions*, WP 0306 00.
- For location of air tubes, refer to Table 1, Air Tube Locator Table.
- Tag all air tubes and fittings to aid in installation.
- Remove and discard plastic tiedown straps. Install new tiedown straps.
- When replacing air tube, remove tube from vehicle and cut new tube 1/4-1/2 in (6.4-12.7 mm) longer than old air tube.

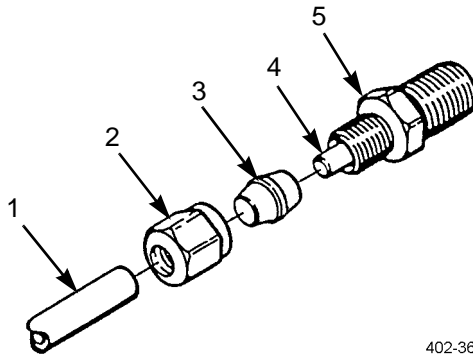
AIR TUBE REPLACEMENT - CONTINUED**0138 00****REMOVAL - CONTINUED**

1. Remove nut (2) from fitting (5).
2. Remove air tube (1) from fitting (5).

NOTE

If insert remains in fitting, do not remove. Cut air tube to remove ferrule.

3. Remove insert (4), ferrule (3), and nut (2) from air tube (1). Discard ferrule.



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INSTALLATION

1. Position nut (2), new ferrule (3), and insert (4) on air tube (1).

**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contact skin or clothing, wash immediately with soap and water.
 - Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel and damage to equipment.
2. Lightly coat threads of fitting (5) with pipe sealing compound. Install fitting on air tube (1).
 3. Install nut (2) on fitting (5).
 4. Start vehicle and build air pressure (TM 9-2320-303-10). Check for leaks.

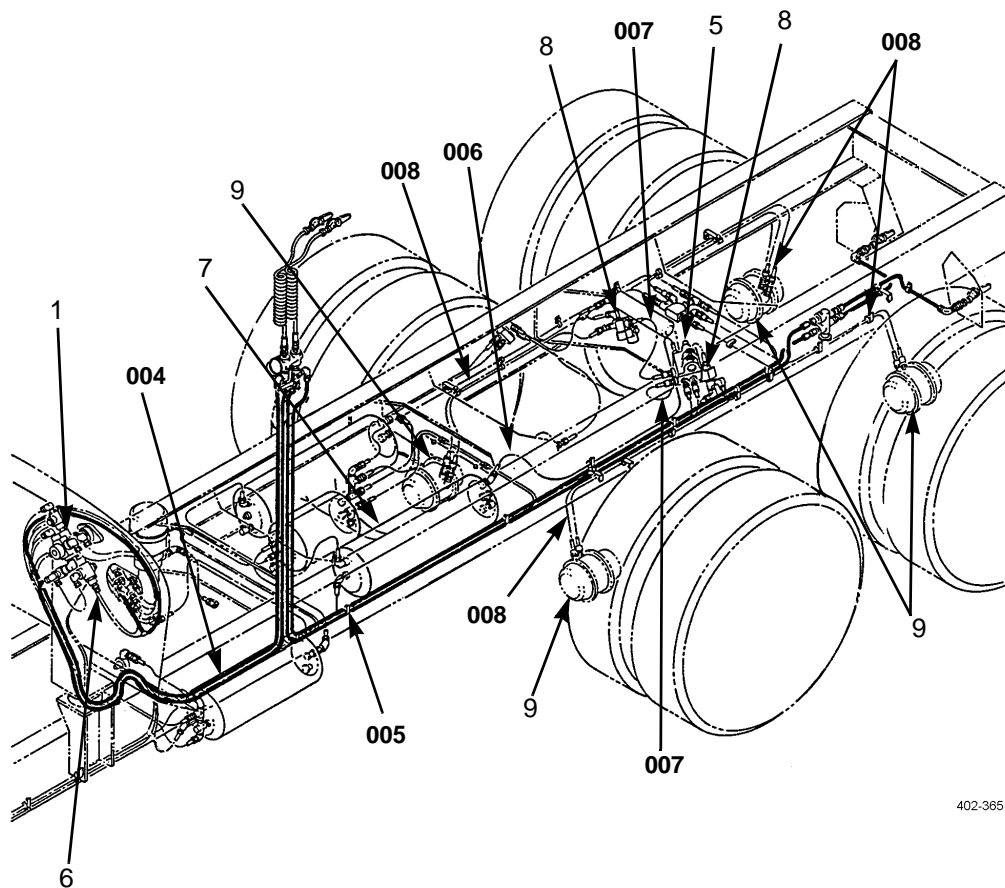
Table 1. Air Tube Locator Table.

TUBE NO.	FROM	FROM/TO	TO
001	Foot Brake Valve, D2 (1)		Quick Release Valve (2)
002	Quick Release Valve (2)		ABS Solenoid Valve (3)
003	ABS Solenoid Valve (3)		Front Brake Chamber (4)

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Table 1. Air Tube Locator Table - Continued.

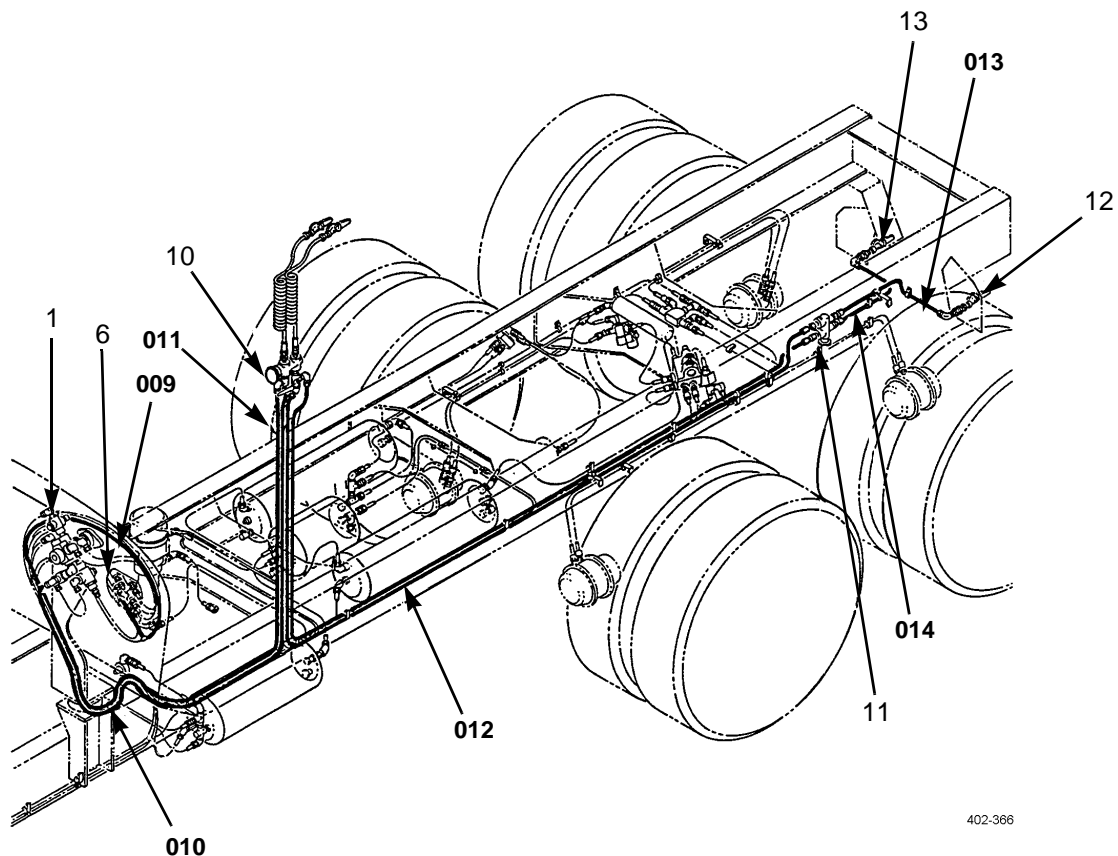
TUBE NO.	FROM	FROM/TO	TO
004	Foot Brake Valve, D2 (1)		Rear Relay Valve, SER (5)
005	Air Junction Block, No. 18 (6)		Rear Relay Valve, CONT (5)
006	Primary II Air Tank (7)		Rear Relay Valve, SUP (5)
007	Rear Relay Valve, DEL (5)		ABS Solenoid Valve (8)
008	ABS Solenoid Valve (8)		Rear Brake Chamber (9)



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Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
009	Air Junction Block, No. 18 (6)		Tractor Protection Valve, E (10)
010	Foot Brake Valve, D2 (1)		Tractor Protection Valve, S (10)
011	Tractor Protection Valve, E (10)		Rear Protection Valve, E (11)
012	Tractor Protection Valve, S (10)		Rear Protection Valve, S (11)
013	Rear Protection Valve, E (11)		Emergency Gladhand (12)
014	Rear Protection Valve, S (11)		Service Gladhand (13)



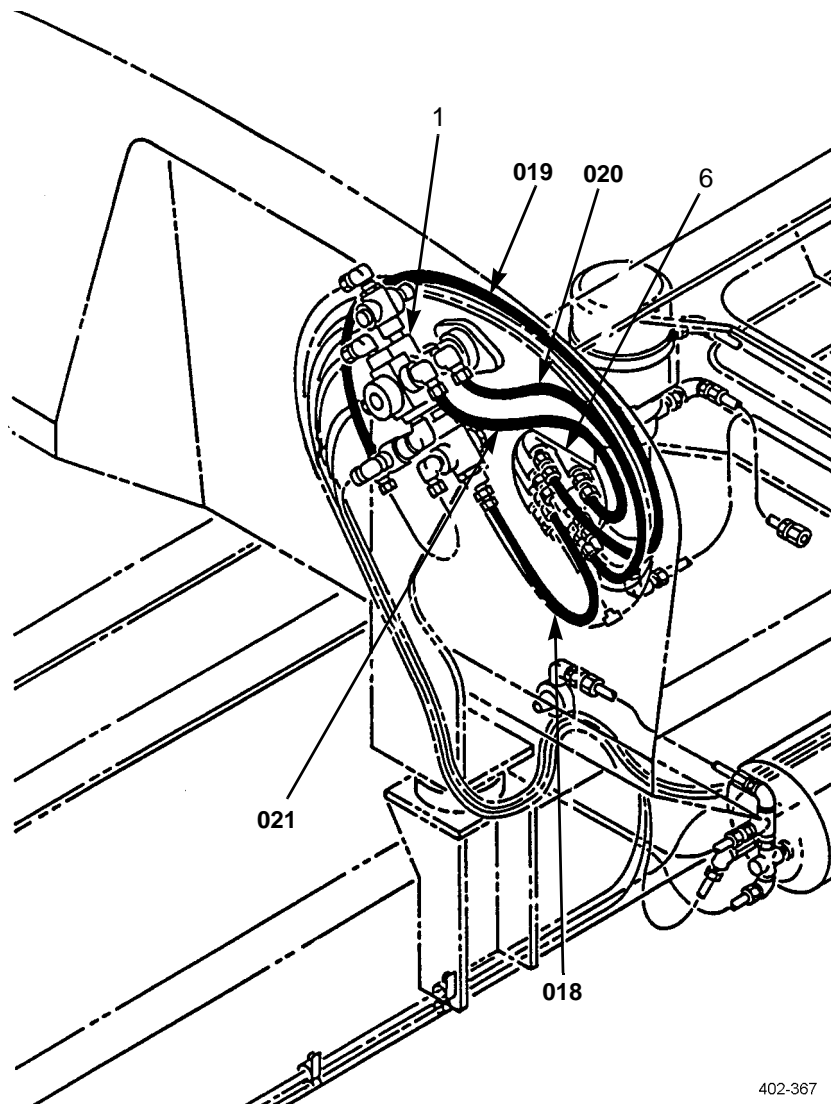
402-366

Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
015	Rear Quick Release Valve (14)		Rear Brake Chamber (9)
016	Rear Quick Release Valve (14)		Supply Air Tank (15)
017	Rear Quick Release Valve (14)		Air Junction Block, No. 21 (6)

Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
018	Air Junction Block, No. 17 (6)		Foot Brake Valve, D1 (1)
019	Air Junction Block, No. 19 (6)		Foot Brake Valve, D2 (1)
020	Air Junction Block, No. 13 (6)		Foot Brake Valve, S1 (1)
021	Air Junction Block, No. 22 (6)		Foot Brake Valve, S2 (1)



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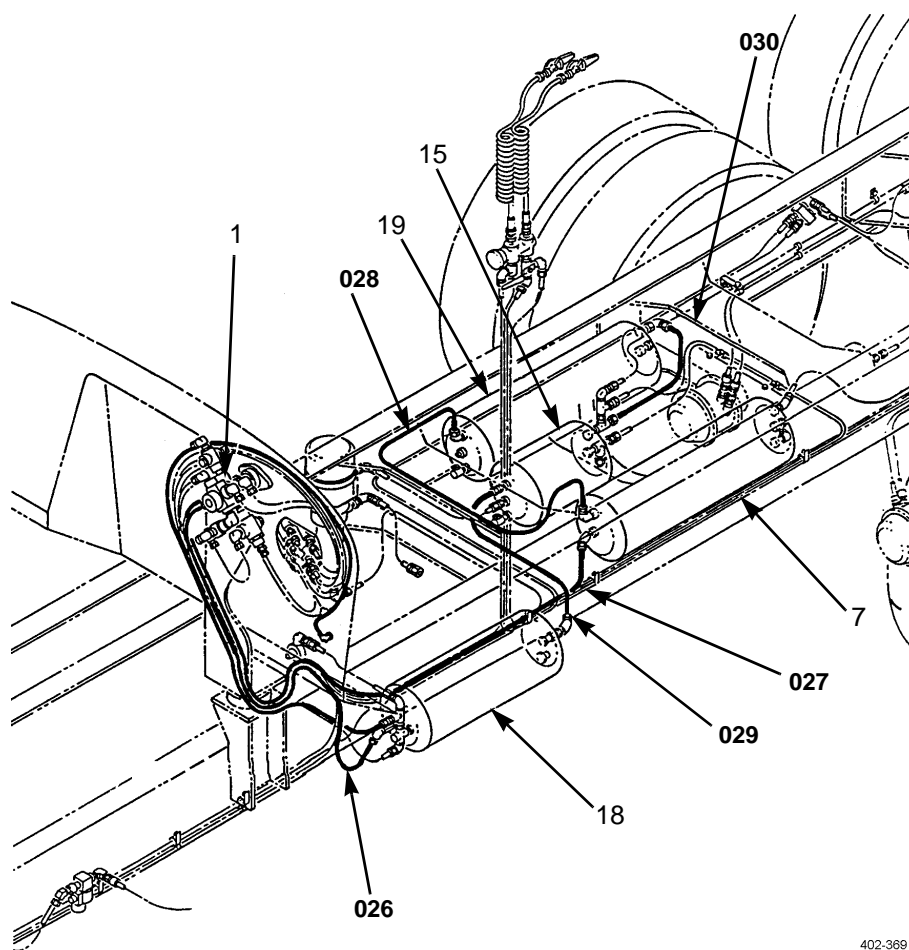
Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
022	Air Compressor (16)		Air Dryer (17)
023	Air Compressor (16)		Air Dryer (17)
024	Air Compressor (16)		Supply Air Tank (15)
025	Air Dryer (17)		Supply Air Tank (15)

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Table 1. Air Tube Locator Table - Continued.

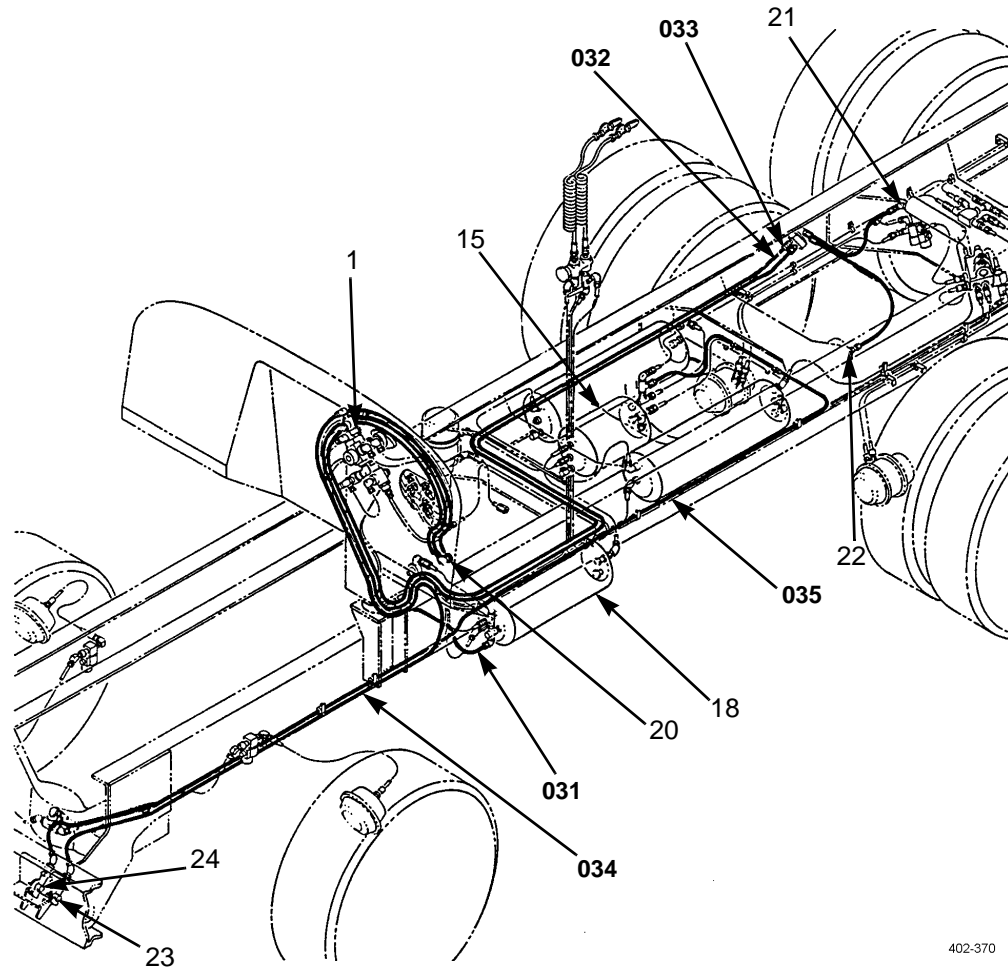
TUBE NO.	FROM	FROM/TO	TO
026	Secondary Air Tank (18)		Foot Brake Valve (1)
027	Primary II Air Tank (7)		Foot Brake Valve (1)
028	Primary II Air Tank (7)		Primary I Air Tank (19)
029	Supply Air Tank (15)		Secondary Air Tank (18)
030	Supply Air Tank (15)		Primary I Air Tank (19)



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Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
031	Secondary Air Tank (18)		Firewall (20)
032	Fifth Wheel (21) (M915A3)	Junction Block	Firewall (20)
033	Axle Interlock (22) (M915A3)	Junction Block	Firewall (20)
034	Front Service Gladhand (23)		Foot Brake Valve (1)
035	Front Emergency Gladhand (24)		Supply Air Tank (15)



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Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
036	Air Junction Block, No. 15 (6)		Primary Air Pressure Gage (25)
037	Air Junction Block, No. 11 (6)		Secondary Air Pressure Gage (26)
038	Firewall Tee (27)		Constant Air Junction Block (28)

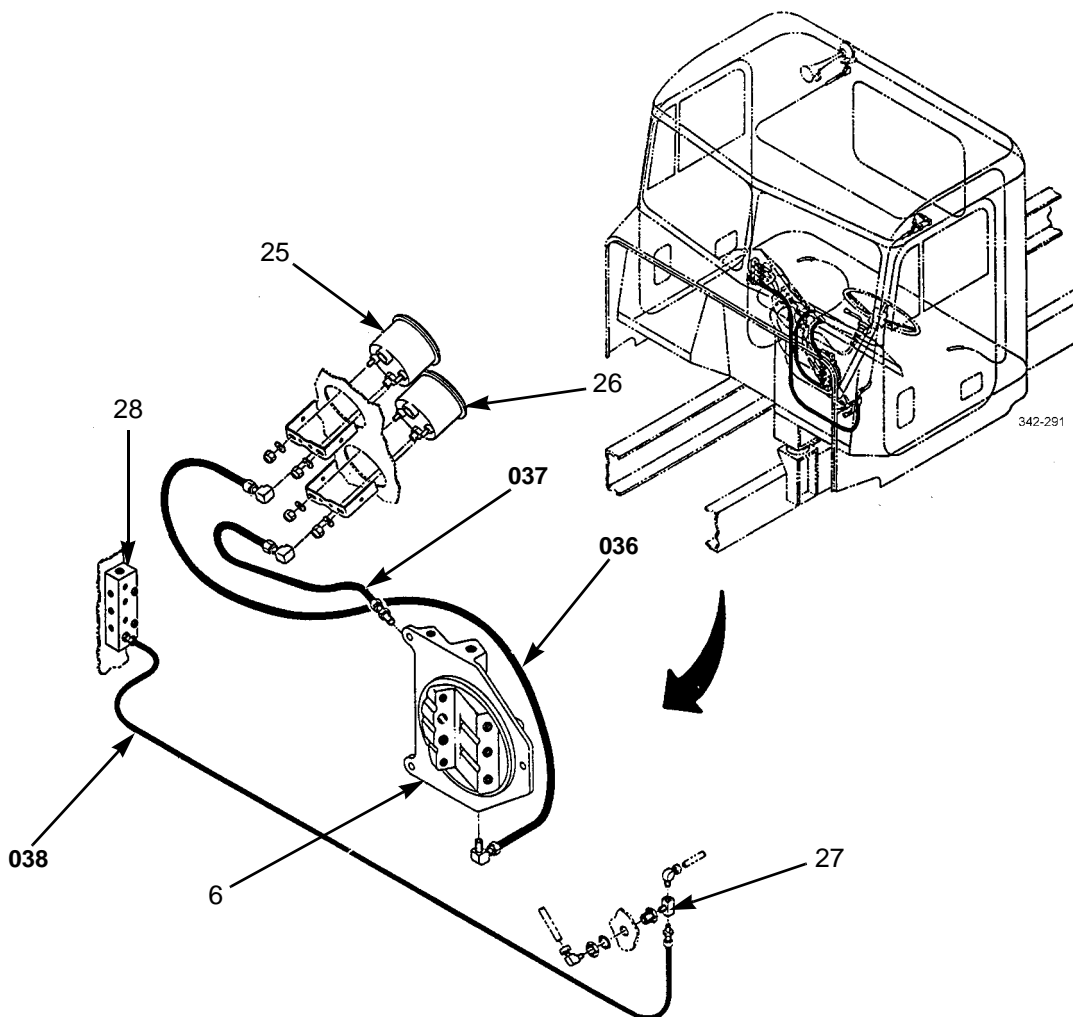
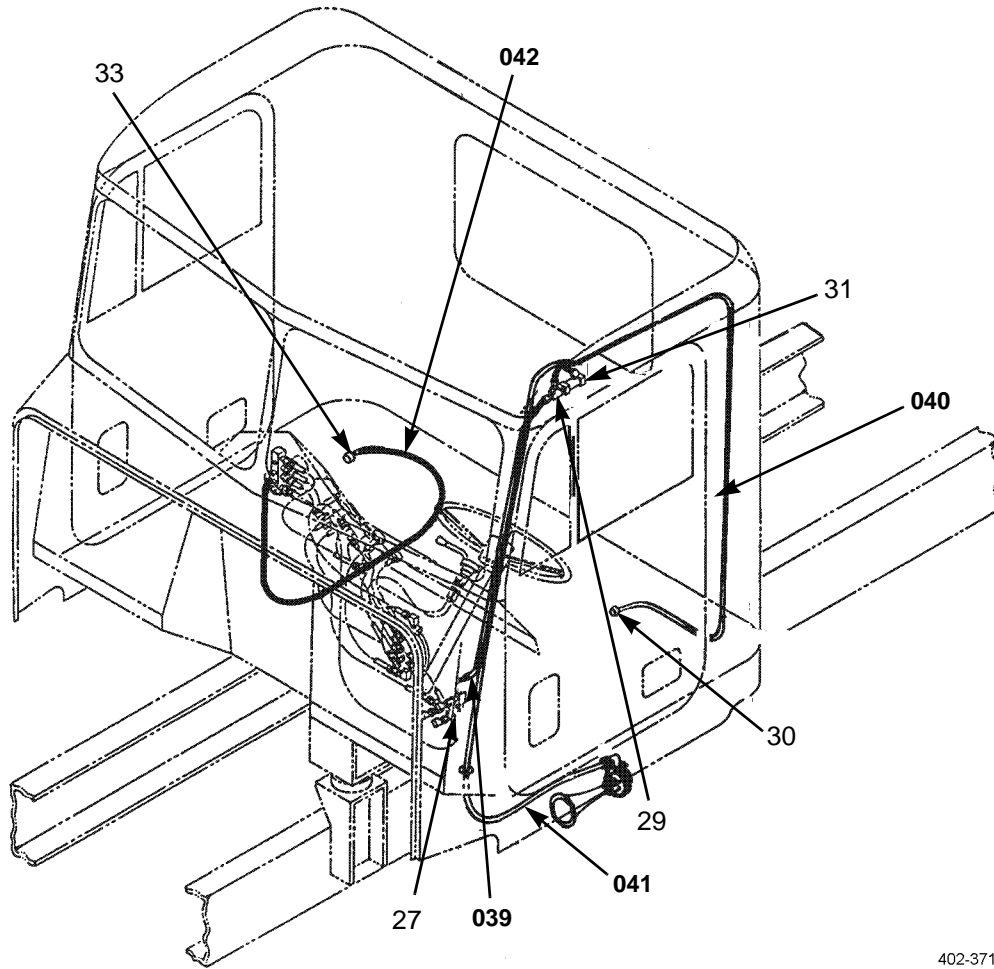


Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
039	Firewall Tee (27)		Air Horn Tee (29)
040	Air Horn Tee (29)		Driver Seat Air Cylinder (30)
041	Air Horn Tee (29)	Air Horn Valve (31)	Air Horn (32)
042	Constant Air Junction Block (28)		Passenger Seat Air Cylinder (33)



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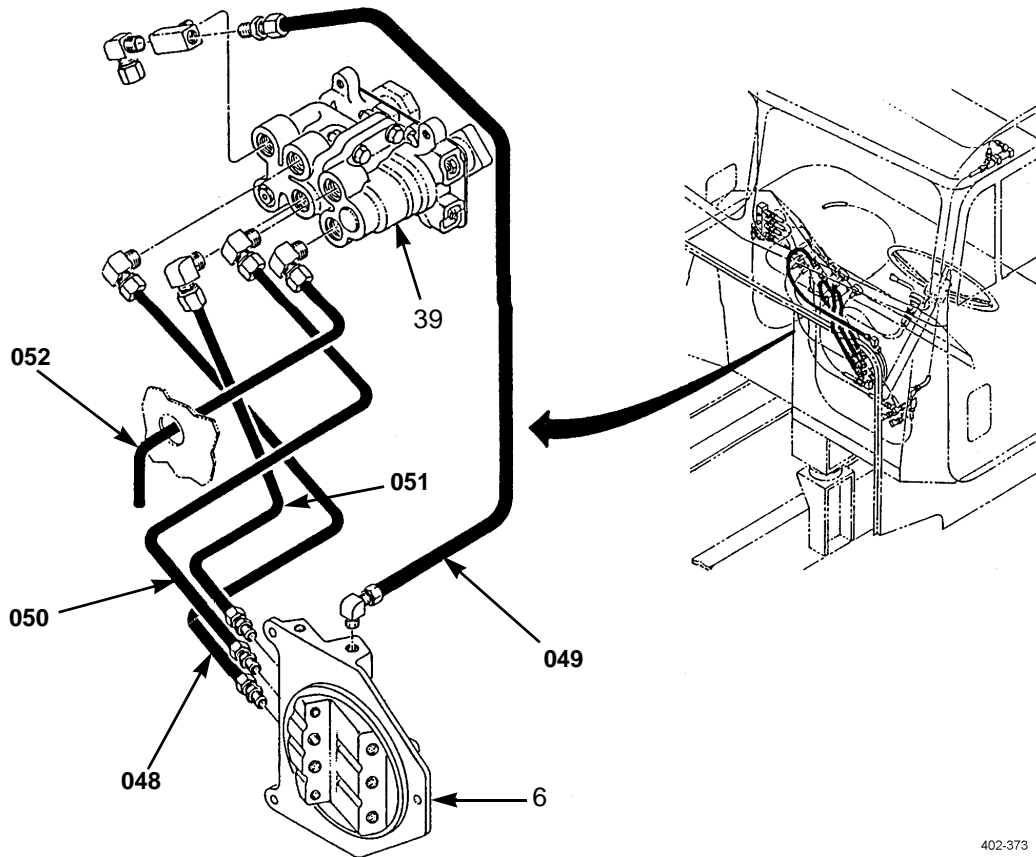
Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
043	Constant Air Junction Block (28)		Passenger Seat Air Cylinder (34)
044	Constant Air Junction Block (28)		Interaxle Lockup Valve (35)
045	Interaxle Lockup Valve (34)		Firewall Fitting, No. 1 (36)
046	Constant Air Junction Block (28)		Fifth Wheel Slide Valve (37)
047	Fifth Wheel Slide Valve (37)		Firewall Fitting, No. 2 (38)

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Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
048	Air Junction Block, No. 14 (6)		Parking Brake/Trailer Air Supply, S1 (39)
049	Air Junction Block, No. 9 (6)		Parking Brake/Trailer Air Supply, S2 (39)
050	Parking Brake/Trailer Air Supply, DEL TRC (39)		Air Junction Block, No. 12 (6)
051	Parking Brake/Trailer Air Supply, DEL TRL (39)		Air Junction Block, No. 4 (6)
052	Parking Brake/Trailer Air Supply, Firewall EXH (39)		Not Connected



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Table 1. Air Tube Locator Table - Continued.

TUBE NO.	FROM	FROM/TO	TO
053	Parking Brake/Trailer Air Supply, S2 (39)		Trailer Hand Brake, S (40)
054	Trailer Hand Brake, D (40)		Air Junction Block, No. 5 (6)
055	Trailer Hand Brake, E (40)	Firewall	Not Connected

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END OF WORK PACKAGE

FRONT AIR BRAKE CHAMBER REPLACEMENT

0139 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/PartsCompound, sealing, pipe (Item 17, WP 0312 00)
Strap, tiedown (Item 41, WP 0312 00)**Materials/Parts - Continued**

Pin, cotter (P/N 2257C1173)

Pin, cotter (P/N 2257D1174)

Equipment Condition

Air system drained (TM 9-2320-303-10)

Hood opened (TM 9-2320-303-10)

NOTE

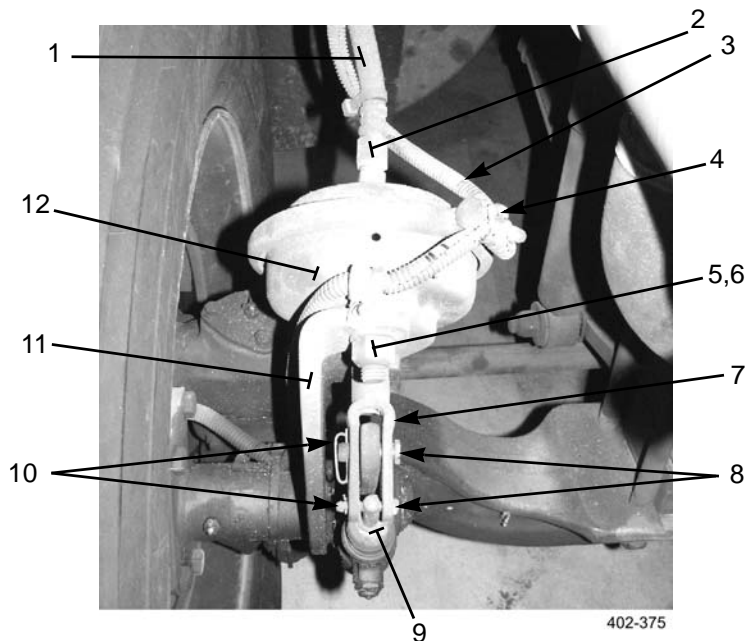
Each of two front air brake chambers is replaced the same way. Left-front air brake chamber is shown.

REMOVAL**WARNING**

DO NOT disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. Failure to follow this warning could result in serious injury to personnel.

REMOVAL - CONTINUED

1. Disconnect air hose (1) from adapter (2) of air brake chamber (12).
2. Remove adapter (2) from air brake chamber (12).
3. Remove tiedown strap (4) from ABS wiring harness (3). Discard tiedown strap.
4. Remove two cotter pins (10) and two clevis pins (8) connecting brake chamber clevis (7) to slack adjuster (9). Discard cotter pins.
5. Remove two nuts (5), washers (6), and air brake chamber (12) from mounting bracket (11).

**INSTALLATION**

1. Install air brake chamber (12) to mounting bracket (11) with two washers (6) and nuts (5).
2. Align brake chamber clevis (7) to slack adjuster (9) and install two clevis pins (8) and new cotter pins (10).

**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
 - Ensure that all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.
3. Lightly coat pipe threads of adapter (2) with pipe sealing compound and install adapter to air brake chamber (12).

INSTALLATION - CONTINUED

4. Connect air hose (1) to adapter (2).
5. Install ABS wiring harness (3) to air brake chamber (12) with new tiedown strap (4).
6. Start vehicle and build up air pressure (TM 9-2320-303-10). Check for leaks.
7. Close hood (TM 9-2320-303-10).
8. Adjust slack adjuster (WP 0128 00).

END OF WORK PACKAGE

REAR AIR BRAKE CHAMBER MAINTENANCE

0140 00**THIS WORK PACKAGE COVERS**Inspection, Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe, sealing (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N 9002001) (2)

Pin, cotter (P/N 2257C1173)

Materials/Parts - Continued

Pin, cotter (P/N 2257D1174)

References

TM 9-2320-303-10

Equipment Condition

Brakes caged (TM 9-2320-303-10)

Parking brake released (TM 9-2320-303-10)

Vehicle blocked (TM 9-2320-303-10)

Air system drained (TM 9-2320-303-10)

INSPECTION

1. Chock wheels.

NOTE

When inspection has been completed, ensure that weather seal cap is installed in release stud hole in spring brake chamber.

2. Remove weather seal cap from spring brake chamber and visually inspect through release stud hole. When fully released with 90-120 psi air pressure, top of piston on chamber should be no more than 1/4-3/8 in from top of head. Release stud access hole in center of piston should be somewhat centered.
3. Cage the brakes (TM 9-2320-303-10). If brakes will not cage, suspect a broken spring. Go to step 4.
4. Apply parking brake and measure pushrod stroke. A short or no stroke, compared to other wheels, indicates a broken spring.
5. With parking brake applied, tap head of spring brake chamber. A good spring will produce a ring/harmonic vibration.

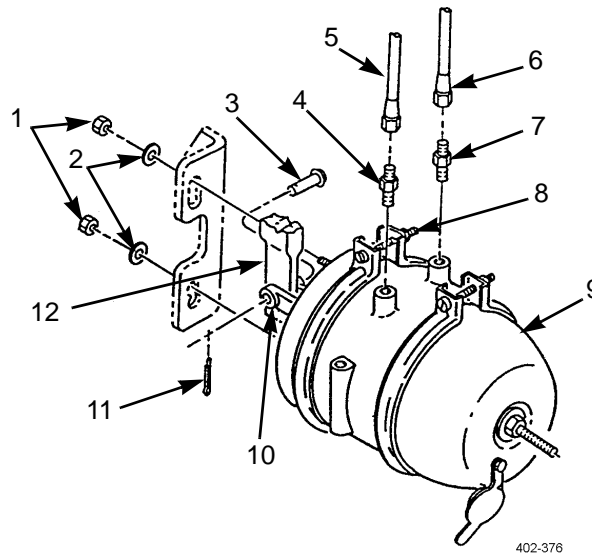
NOTE

In some cases brake chamber pushrod will return to zero position with a broken spring condition. Check in step 6 should not be considered as a definitive test.

6. Release parking brake and measure pushrod position. If it does not return all the way to zero stroke position, suspect a broken spring.

REMOVAL**NOTE**

- Tag air hoses to aid in installation.
 - Each of four rear brake chambers are replaced the same way. One is shown.
1. Disconnect service brake hose (5) and spring brake hose (6) from service brake fitting (4) and spring brake fitting (7).
 2. Remove two cotter pins (11) and clevis pins (3) from brake chamber clevis (10). Discard cotter pins.
 3. Remove two locknuts (1) and washers (2). Discard locknuts.
 4. Remove brake chamber (9).
 5. Remove service brake fitting (4) from brake chamber (9).
 6. Remove spring brake fitting (7) from brake chamber (9).

**INSTALLATION****WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
 - Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.
1. Lightly coat threads of service brake fitting (4) with pipe sealing compound. Install fitting on brake chamber (9).
 2. Lightly coat spring brake fitting (7) with pipe sealing compound. Install fitting on brake chamber (9).

INSTALLATION - CONTINUED**NOTE**

Brake chamber is mounted in upper part of figure 8 hole.

3. Install brake chamber (9) so that service brake fitting (4) and spring brake fitting (7) are accessible.
4. Install two washers (2) and new locknuts (1).
5. If service brake fitting (4) and spring brake fitting (7) are not properly aligned with hoses (5 and 6), loosen nut (8) and rotate brake chamber (9) until fittings and hoses are aligned. Tighten nut.
6. Connect brake chamber clevis (10) to slack adjuster (12) with two clevis pins (3) and new cotter pins (11).
7. Connect service brake hose (5) and spring brake hose (6) to service brake fitting (4) and spring brake fitting (7).
8. Uncage brakes (TM 9-2320-303-10).
9. Start vehicle and build air pressure (TM 9-2320-303-10). Check for leaks.

END OF WORK PACKAGE

CAB AIR JUNCTION BLOCK REPLACEMENT

0141 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, caulking (Item 12, WP 0312 00)
 Compound, sealing, pipe (Item 17, WP 0312 00)

Materials/Parts - continued

Tags, marker (Item 42, WP 0312 00)
 Nut, lock (P/N 23-10340-125) (3)

References

TM 9-2320-303-10
 WP 0306 00

Equipment Condition

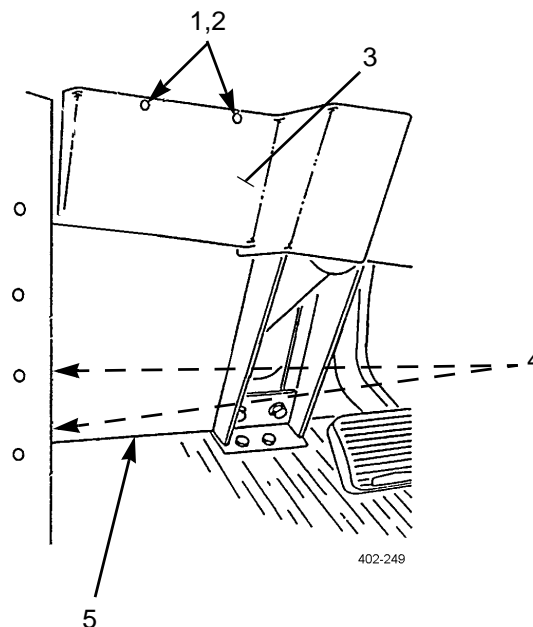
Air system drained (TM 9-2320-303-10)

NOTE

Refer to *General Maintenance Instructions* in WP 0306 00 for information on removing and installing air tubes with push-in fittings.

REMOVAL

1. Remove five screws (1), washers (2), and cover (3).
2. Remove two screws (4) and cover (5).

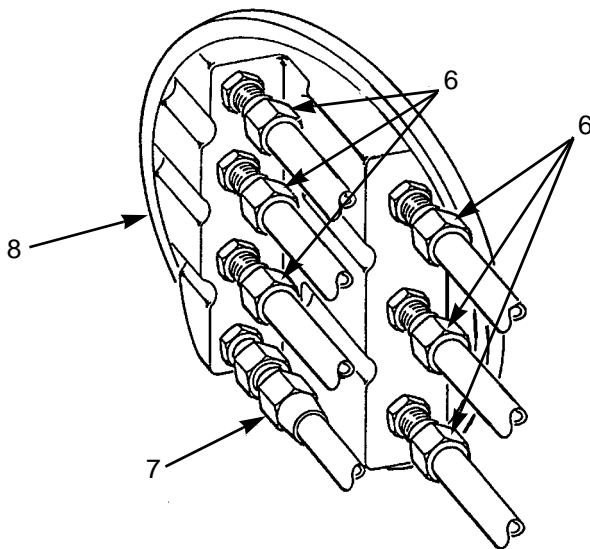


REMOVAL - CONTINUED

NOTE

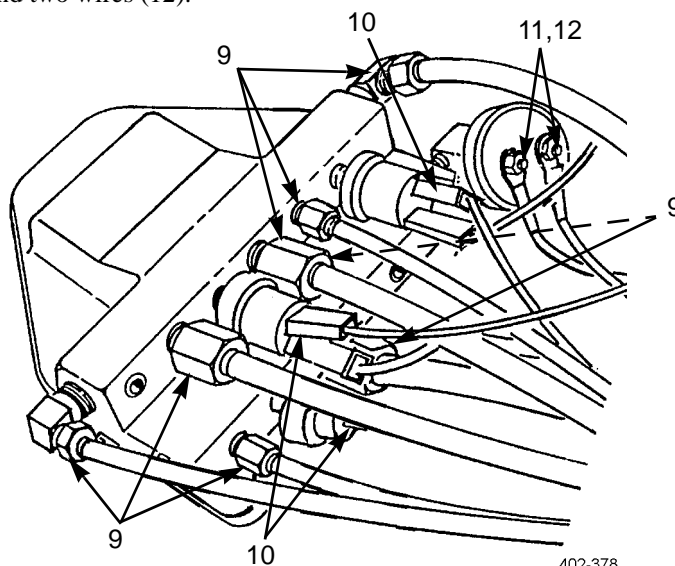
Tag all tubes, fittings, and wires to aid in installation.

3. Disconnect six tubes (6) and oil line (7) from cab air junction block (8).



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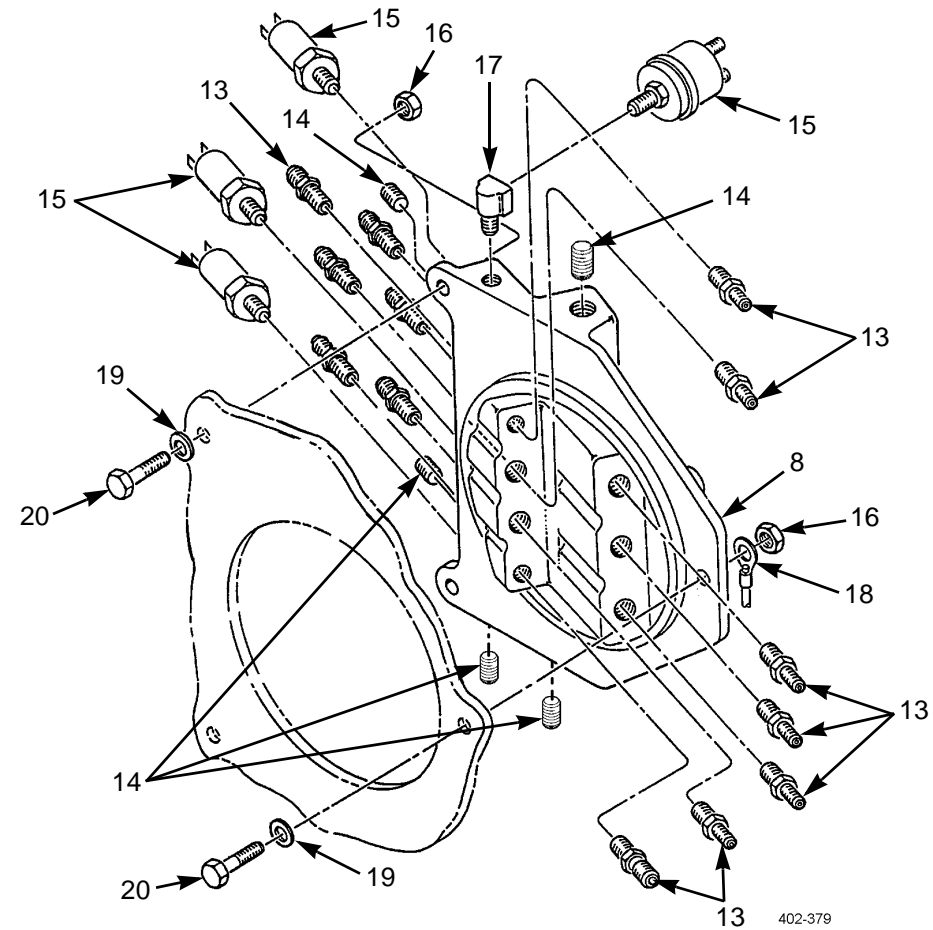
4. Disconnect eight tubes (9) and three plug connectors (10).
5. Remove two locknuts (11) and two wires (12).



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6. Remove three locknuts (16), screws (20), washers (19), ground wire (18), and cab air junction block (8). Discard locknuts.
7. Remove 13 connectors (13), four sending units (15), three elbows (17), and five pipe plugs (14) from cab air junction block (8).

REMOVAL - CONTINUED

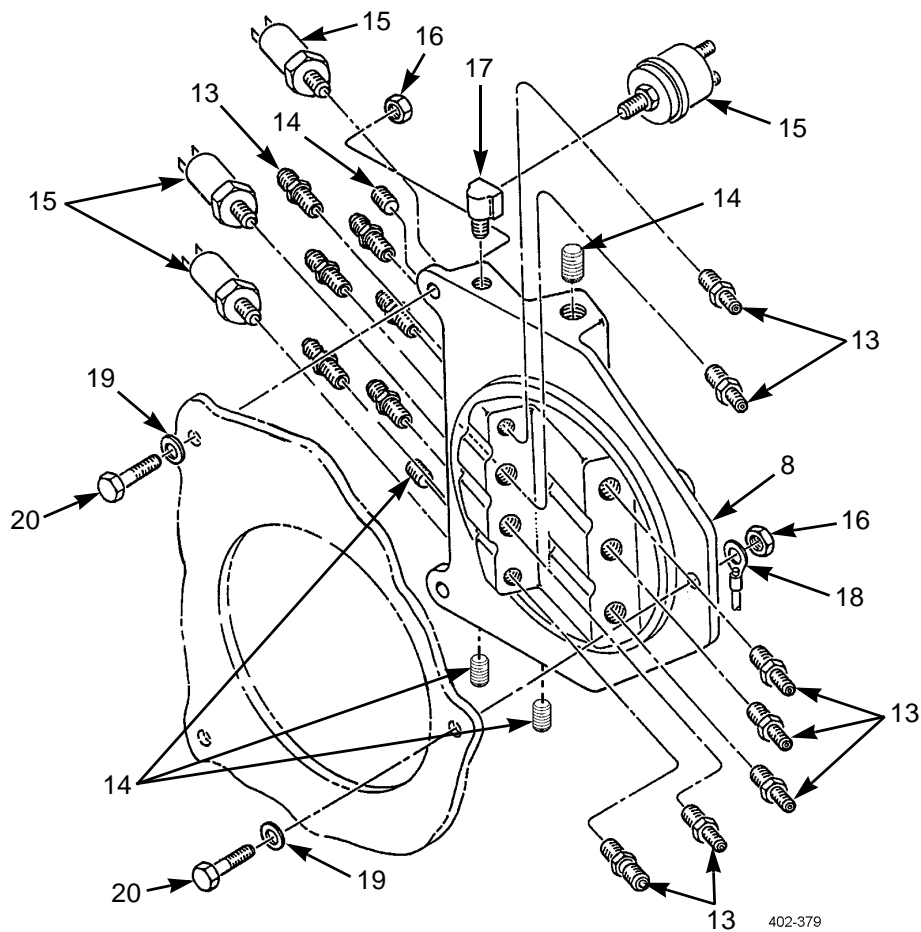


INSTALLATION



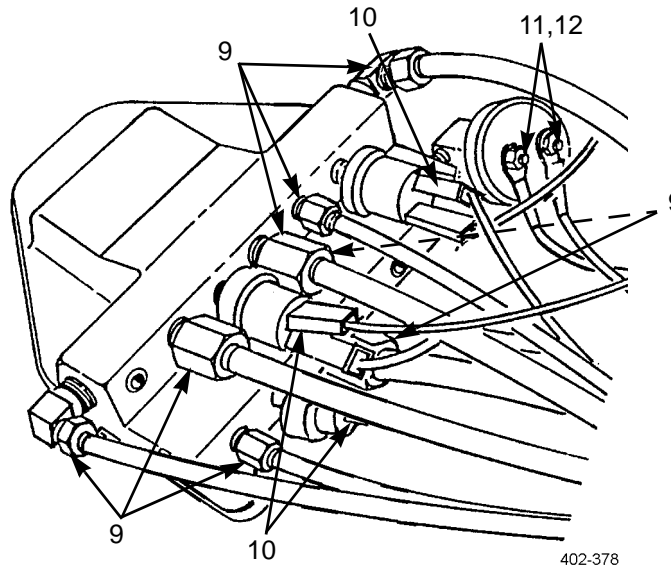
- Adhesives and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
- Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

1. Coat threads with pipe sealing compound and install 13 connectors (13), four sending units (15), three elbows (17), and five pipe plugs (14) in cab air junction block (8).
2. Apply caulking compound to mating surface of cab air junction block (8).
3. Install cab air junction block (8), ground wire (18), three washers (19), screws (20), and new locknuts (16).

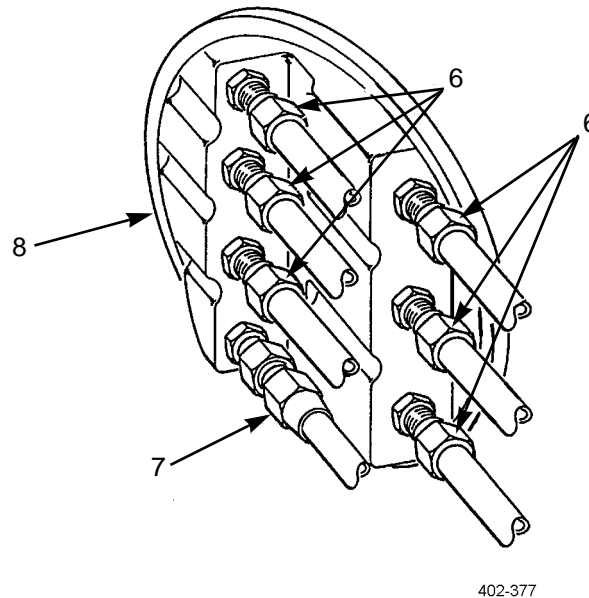


INSTALLATION - CONTINUED

4. Install two wires (12) with new locknuts (11).
5. Connect three plug connectors (10) and eight tubes (9).

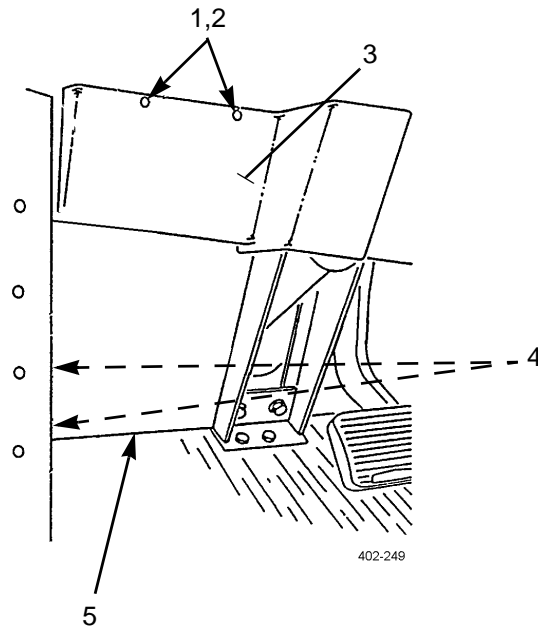


6. Connect six tubes (6) and oil line (7) to cab air junction block (8).



INSTALLATION - CONTINUED

7. Start vehicle and build air pressure (TM 9-2320-303-10). Check for leaks.
8. Install cover (5) and two screws (4).
9. Install cover (3) with five washers (2) and screws (1).

**END OF WORK PACKAGE**

CONSTANT AIR JUNCTION BLOCK REPLACEMENT

0142 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

WP 0306 00

Equipment Condition

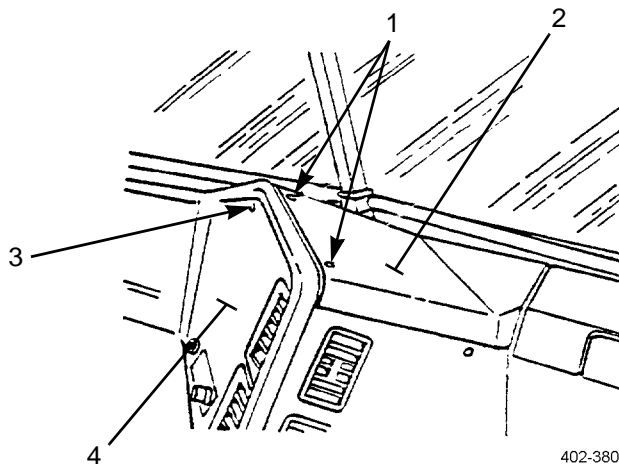
Air system drained (TM 9-2320-303-10)

NOTE

Refer to *General Maintenance Instructions* in WP 0306 00 for information on removing and installing air tubes with push-in fittings.

REMOVAL

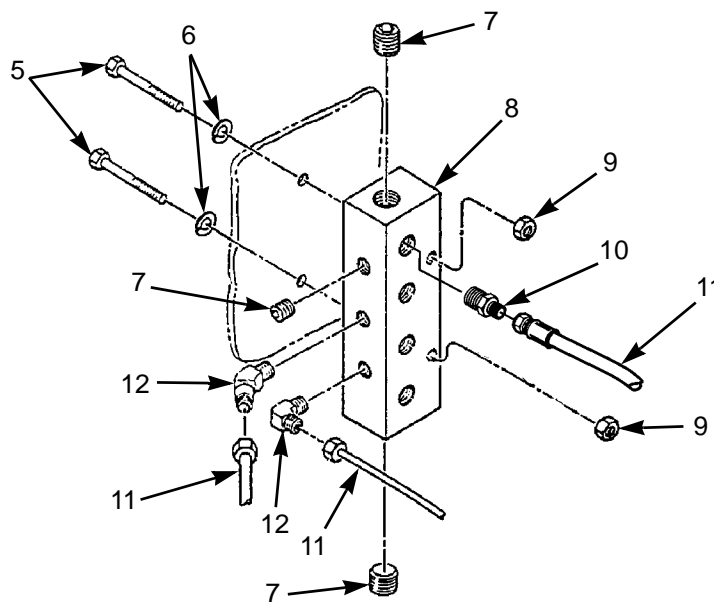
1. Remove six torx screws (1), dash top cover (2), and five torx screws (3). Set instrument panel (4) aside.



REMOVAL - CONTINUED**NOTE**

Tag all tubes, connectors and plugs prior to disconnecting/removal to aid in installation/connecting.

2. Disconnect three tubes (11).
3. Remove two nuts (9), washers (6), screws (5), and constant air junction block (8).
4. Remove connector (10), two elbows (12), and three plugs (7) from constant air junction block (8).



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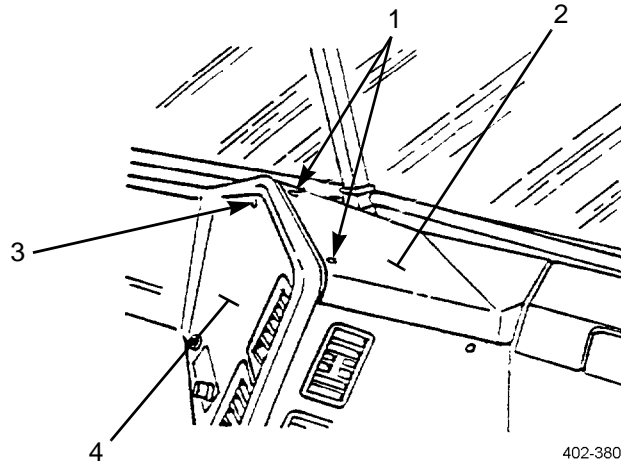
INSTALLATION**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

1. Coat threads with pipe sealing compound and install three plugs (7), two elbows (12), connector (10), in constant air junction block (8).

INSTALLATION - CONTINUED

2. Install constant air junction block (8) with two screws (5), washers (6), and nuts (9).
3. Connect three tubes (11) to constant air junction block (8).
4. Start vehicle and build air pressure (TM 9-2320-303-10). Check for leaks.
5. Position instrument panel (4) and install five torx screws (3), dash top cover (2), and six torx screws (1).

**END OF WORK PACKAGE**

TRACTOR PROTECTION VALVES REPLACEMENT

0143 00

THIS WORK PACKAGE COVERS

Front Tractor Protection Valve Removal, Rear Tractor Protection Valve Removal, Front Tractor Protection Valve Installation, Rear Tractor Protection Valve Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Materials/Parts - Continued

Strap, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-5CBB) (4)

References

TM 9-2320-303-10

Equipment Condition

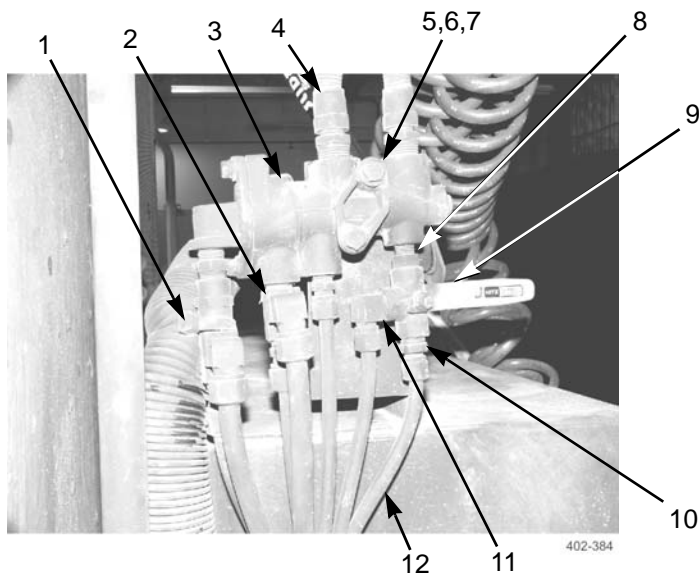
Air system drained (TM 9-2320-303-10)

FRONT TRACTOR PROTECTION VALVE REMOVAL

NOTE

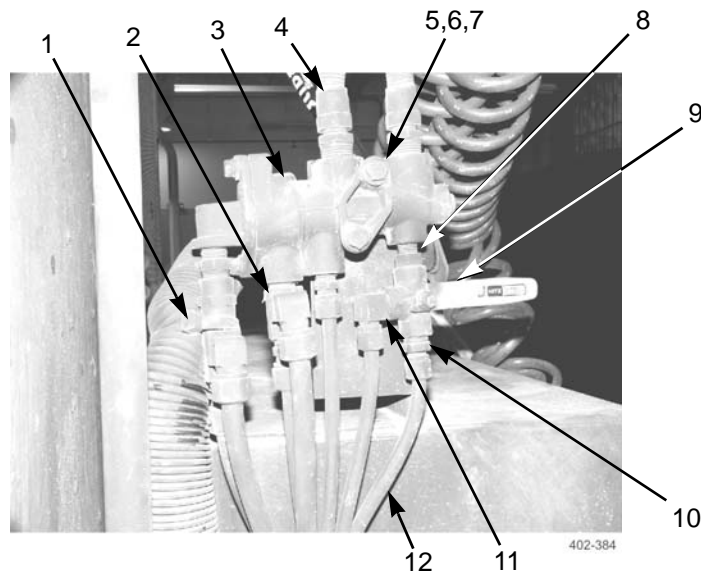
Tag tubes to aid in installation.

1. Remove tiedown strap (1).
2. Disconnect seven air lines (12) from tractor protection valve (3).
3. Remove two air hoses (4) from tractor protection valve (3).
4. Remove three elbows (11).



FRONT TRACTOR PROTECTION VALVE REMOVAL - CONTINUED

5. Remove four adapters (10).
6. Remove two tees (2).
7. Remove valve (9).
8. Remove two adapters (8).
9. Remove two locknuts (5), four washers (6), two bolts (7), and trailer protection valve (3). Discard locknuts.

**FRONT TRACTOR PROTECTION VALVE INSTALLATION****WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
- Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

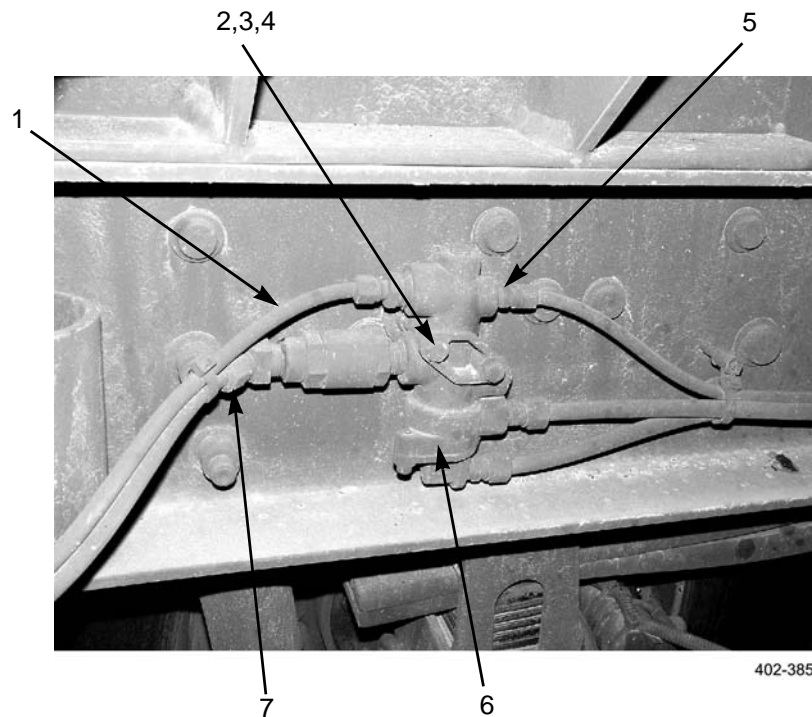
1. Install tractor protection valve (3) with two bolts (7), four washers (6), and two new locknuts (5).
2. Coat threads of six adapters (8), valve (9), two tees (2), and three elbows (11) with pipe sealing compound.
3. Install two adapters (8).
4. Install valve (9).

FRONT TRACTOR PROTECTION VALVE INSTALLATION - CONTINUED

5. Install two tees (2).
6. Install four adapters (10).
7. Install three elbows (11).
8. Install two air hoses (4) on tractor protection valve (3).
9. Connect seven air lines (12) to tractor protection valve (3).
10. Install tiedown strap (1).

REAR TRACTOR PROTECTION VALVE REMOVAL

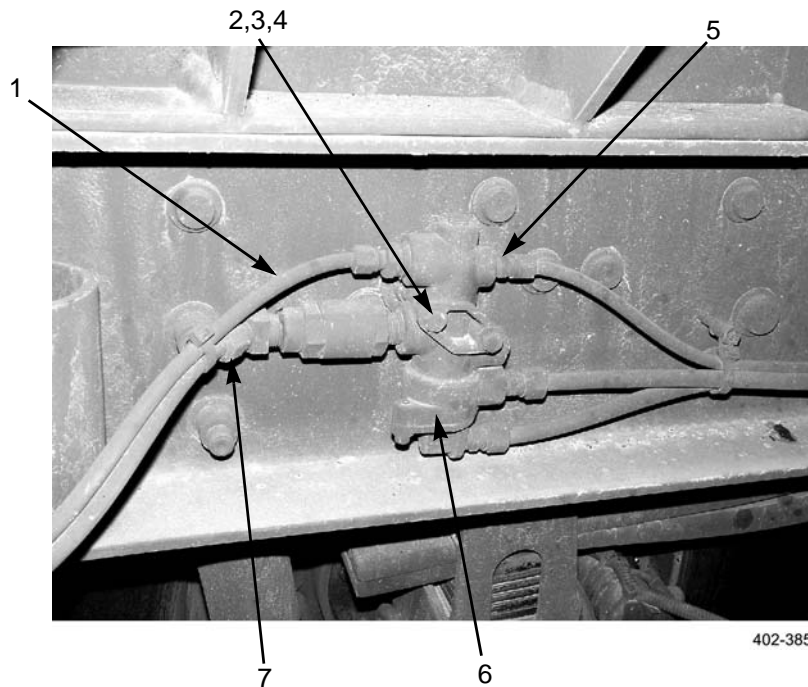
1. Disconnect five air lines (1).
2. Remove elbow (7).
3. Remove five adapters (5).
4. Remove two locknuts (2), four washers (3), two bolts (4), and trailer protection valve (6). Discard locknuts.



REAR TRACTOR PROTECTION VALVE INSTALLATION**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
- Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.

1. Install tractor protection valve (6) with two bolts (4), four washers (3), and two new locknuts (2).
2. Coat threads of one elbow (7) and five adapters (5) with pipe sealing compound.
3. Install five adapters (5).
4. Install one elbow (7).
5. Connect five air lines (1) to tractor protection valve (6).



6. Start vehicle and check air system for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

FRONT SERVICE BRAKE RELAY VALVE REPLACEMENT

0144 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)
 Tags, marker (Item 42, WP 0312 00)
 Nut, lock (P/N M45913/1-4CG5C) (2)

Equipment Condition

Air system drained (TM 9-2320-303-10)



WARNING

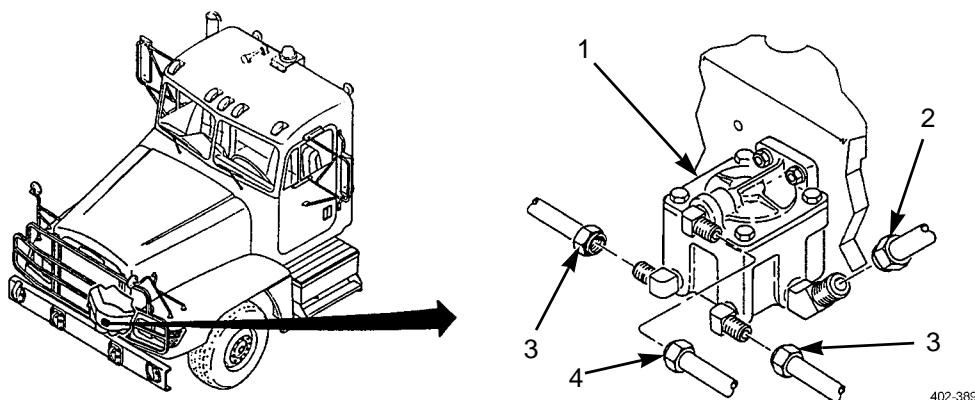
- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant compounds can burn easily, give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If sealant compound gets on skin or clothing, wash immediately with soap and water.

REMOVAL

NOTE

Tag tubes prior to removal to aid in installation.

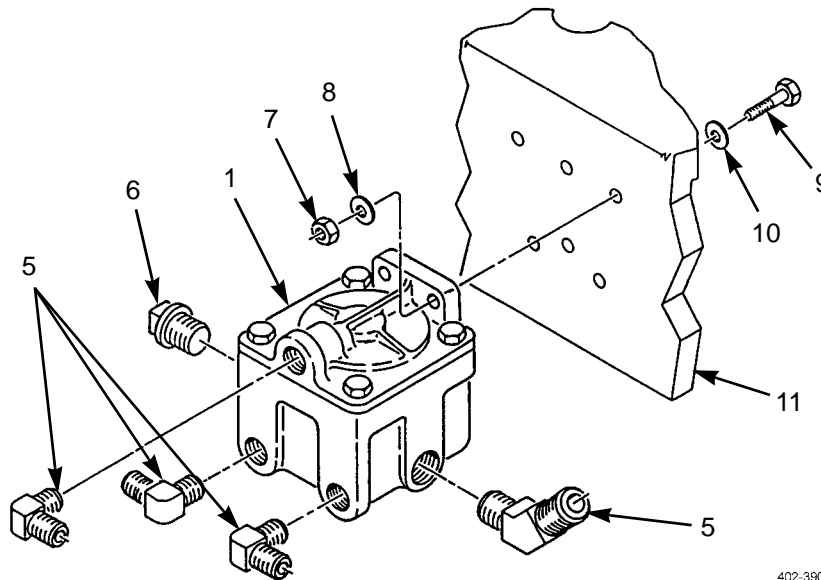
1. Disconnect control tube (4), supply tube (2), and two delivery tubes (3) from brake relay valve (1).

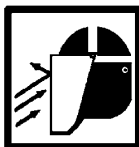


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REMOVAL - CONTINUED

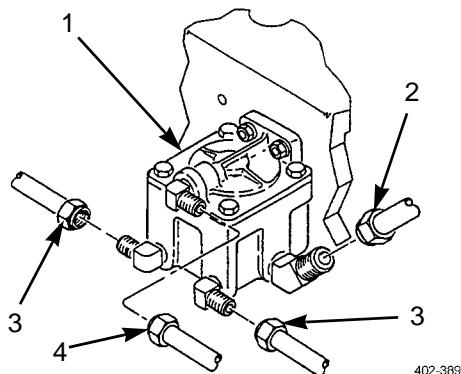
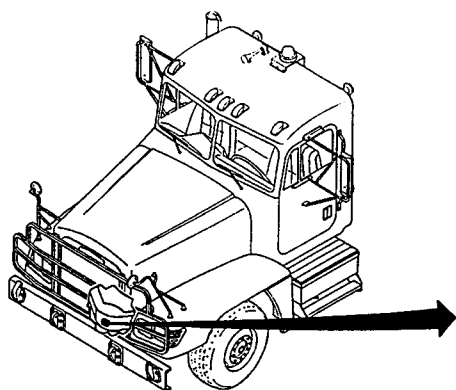
2. Remove two locknuts (7), two washers (8), two screws (9), two washers (10), and brake relay valve (1) from crossmember (11). Discard locknuts.
3. Remove four elbows (5) and plug (6) from brake relay valve (1).



INSTALLATION**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant compounds can burn easily, 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

1. Coat pipe threads of four elbows (5) and plug (6) with pipe sealant compound.
2. Install four elbows (5) and plug (6) in brake relay valve (1).
3. Install brake relay valve (1), two washers (10), two screws (9), two washers (8), and two new locknuts (7) on crossmember (11).
4. Connect two delivery tubes (3), supply tube (2), and control tube (4) to brake relay valve (1).



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END OF WORK PACKAGE

REAR SERVICE BRAKE RELAY VALVE REPLACEMENT

0145 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

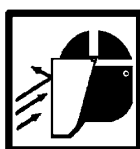
Compound, pipe sealing (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (2)

Equipment Condition

Air system drained (TM 9-2320-303-10)

**WARNING**

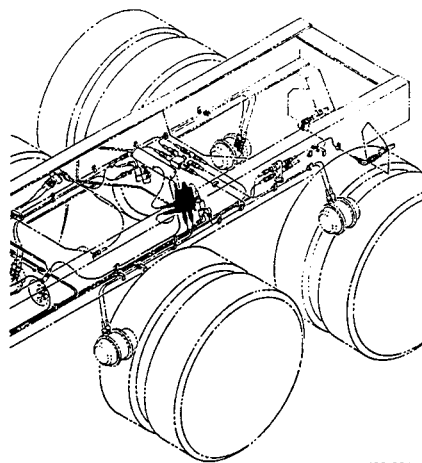
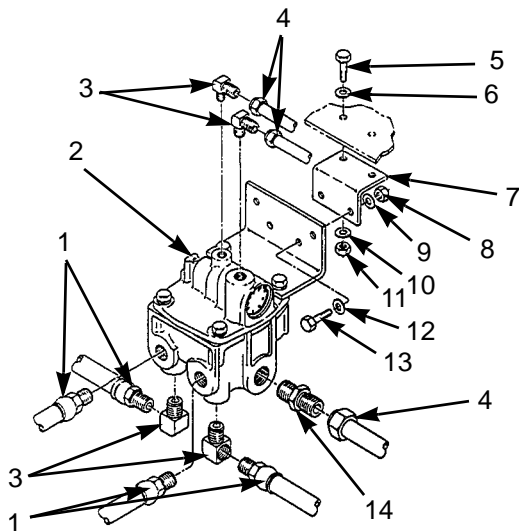
- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant compounds can burn easily, give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If sealant compound gets on skin or clothing, wash immediately with soap and water.

REMOVAL

NOTE

Tag all tubes prior to disconnecting to aid in installation.

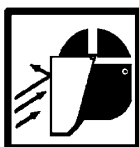
1. Disconnect three tubes (4) and four hoses (1) from relay valve (2).
2. Remove two locknuts (8), two washers (9), two screws (13), two washers (12), and relay valve (2). Discard locknuts.
3. Remove four elbows (3) and connector (14).
4. Remove two locknuts (11), two washers (10), two screws (5), two washers (6), and mounting bracket (7). Discard locknuts.



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INSTALLATION

1. Install mounting bracket (7), two washers (6), two screws (5), two washers (10), and two new locknuts (11).



WARNING



- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
 - Sealant compounds can burn easily, 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 sealant compound gets on skin or clothing, wash immediately with soap and water.
2. Coat pipe threads of four elbows (3) and connector (14) with pipe sealant compound.
 3. Install four elbows (3) and connector (14) on relay valve (2).
 4. Install relay valve (2), two washers (12), two screws (13), two washers (9), and two new locknuts (8).
 5. Connect three tubes (4) and four hoses (1) to relay valve (2).

END OF WORK PACKAGE

FOOT BRAKE VALVE REPLACEMENT

0146 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Grease, silicone (Item 24, WP 0312 00)

Materials/Parts - Continued

Tags, marker (Item 42, WP 0312 00)

Gasket (P/N 12-15695-000)

References

WP 0306 00

Equipment Condition

Air system drained (TM 9-2320-303-10)

Foot brake valve plunger rod disconnected from brake pedal (WP 0126 00)

NOTE

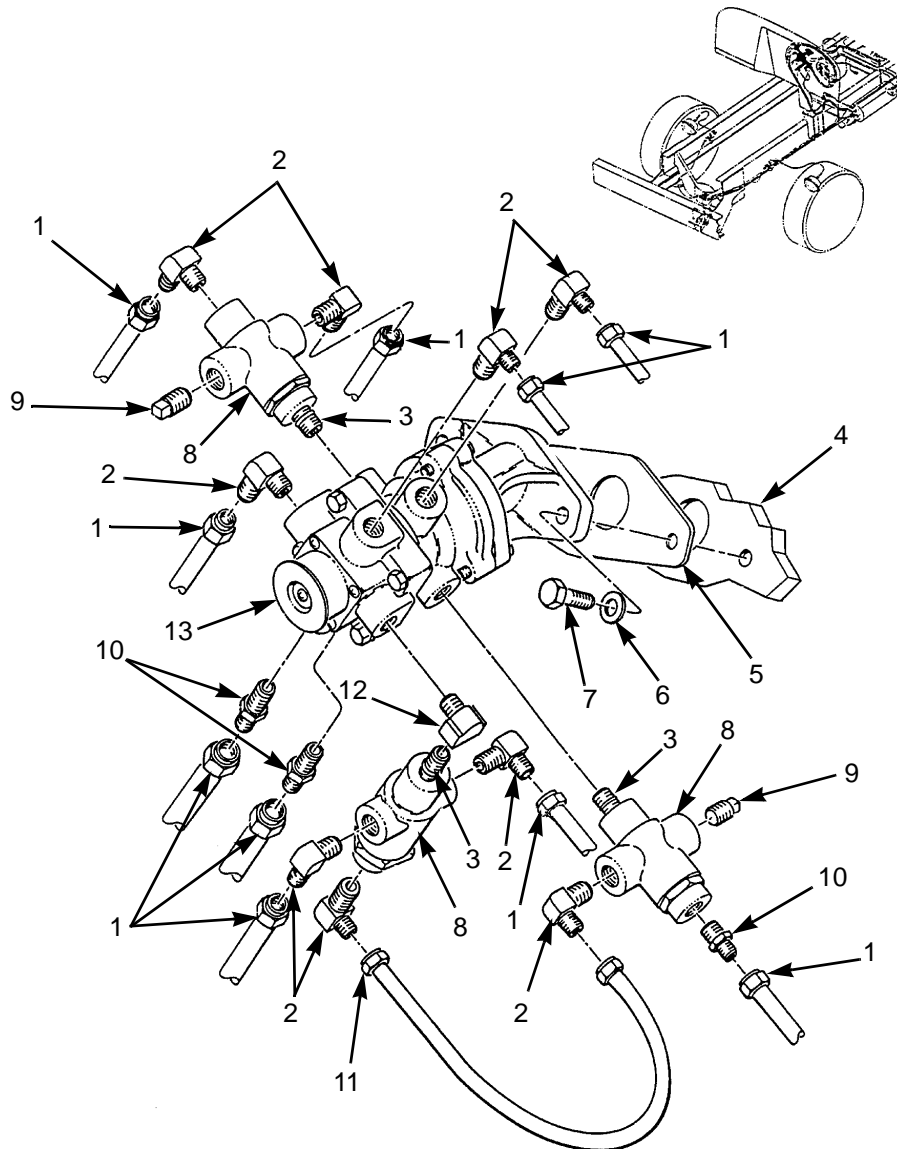
Refer to *General Maintenance Instructions* in WP 0306 00 for information on removing and installing air tubes with push-in fittings.

REMOVAL

NOTE

Tag tubes and connectors to aid in installation.

1. Disconnect 10 tubes (1) from elbows (2) and adapters (10). Remove tube (11).
2. Remove nine elbows (2), three adapters (10), two plugs (9), three check valves (8), three nipples (3), and elbow (12).
3. Remove two screws (7), washers (6), foot brake valve (13), and gasket (5) from firewall (4). Discard gasket.



402-392

INSTALLATION

1. Lightly coat sliding surface of foot brake valve (13) plunger and adapter bore with silicone grease.
2. Install foot brake valve (13) and new gasket (5) on firewall (4) with two washers (6) and screws (7).

**WARNING**

- Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.
 - Ensure all air lines and fittings are clear of debris and excess pipe sealing compound does not enter air lines or fittings. Failure to follow this warning could result in injury to personnel or damage to equipment.
3. Lightly coat threads with pipe sealing compound and install elbow (12), three nipples (3), three check valves (8), two plugs (9), three adapters (10), and nine elbows (2).
 4. Install tube (11). Connect 10 tubes (1) to elbows (2) and adapters (10).
 5. Connect foot brake valve plunger rod to brake pedal (WP 0126 00).
 6. Start vehicle and build air pressure (TM 9-2320-303-10). Check for leaks.

END OF WORK PACKAGE

FRONT QUICK-RELEASE VALVE REPLACEMENT

0147 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-5CBB) (2)

Equipment Condition

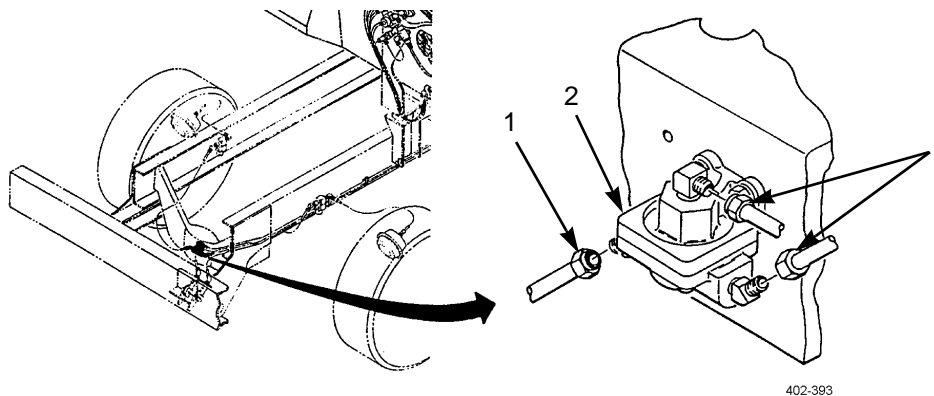
Air system drained (TM 9-2320-303-10)

REMOVAL

NOTE

Tag tubes prior to removal to aid in installation.

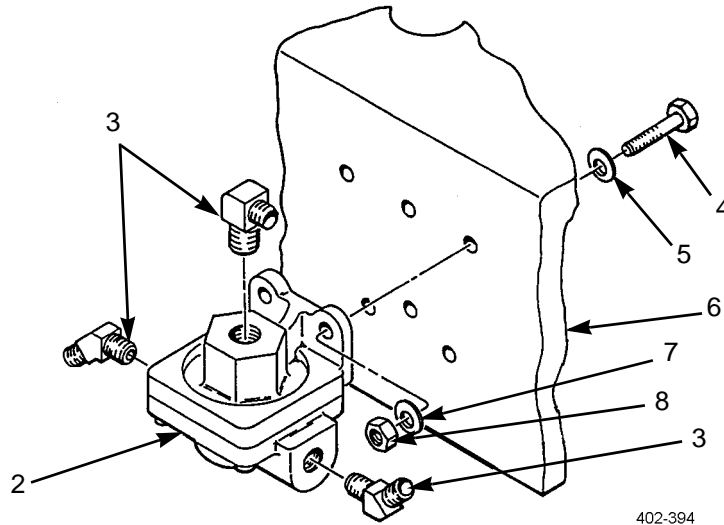
1. Disconnect three tubes (1) from quick-release valve (2).



402-393

REMOVAL - CONTINUED

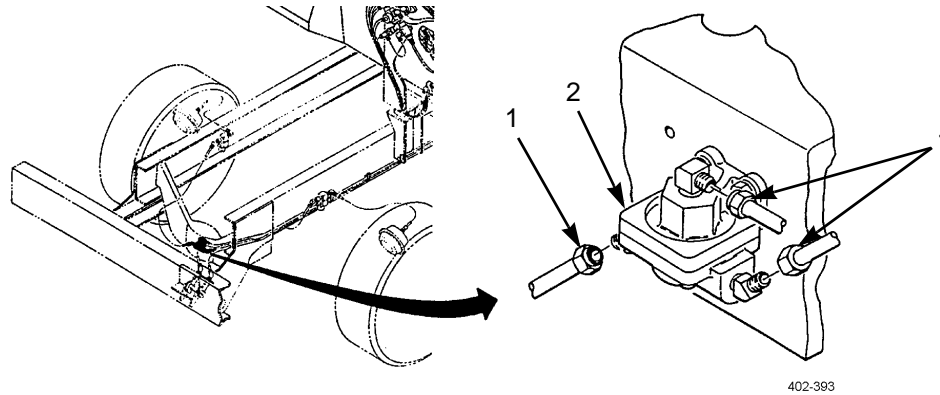
2. Remove two locknuts (8), two washers (7), two screws (4), two washers (5), and quick-release valve (2) from cross-member (6). Discard locknuts.
3. Remove three elbows (3) from quick-release valve (2).

**INSTALLATION****WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
 - Sealant compounds can burn easily, 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 sealant compound gets on skin or clothing, wash immediately with soap and water.
1. Coat threads with pipe sealant compound and install three elbows (3) in quick-release valve (2).
 2. Install quick-release valve (2), two washers (5), two screws (4), two washers (7), and two new locknuts (8) on cross-member (6).

INSTALLATION - CONTINUED

3. Connect three tubes (1) to quick-release valve (2).

**END OF WORK PACKAGE**

REAR QUICK-RELEASE VALVE REPLACEMENT

0148 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (2)

Equipment Condition

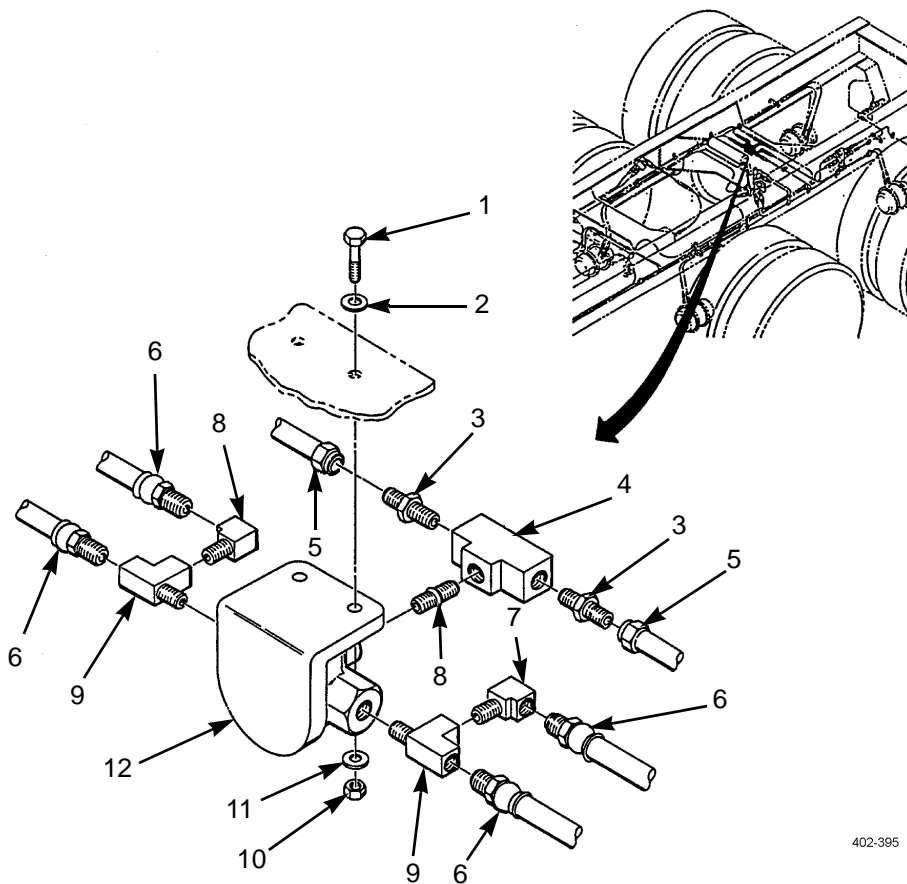
Air system drained (TM 9-2320-303-10)

REMOVAL

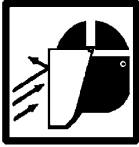
NOTE

Tag hoses and tubes prior to removal to aid in installation.

1. Disconnect four hoses (6) and two tubes (5) from quick-release valve (12).
2. Remove two locknuts (10), two washers (11), two screws (1), two washers (2), and quick-release valve (12). Discard locknuts.
3. Remove two elbows (7), two tees (9), two connectors (3), two-way check valve (4), and pipe nipple (8) from quick-release valve (12).



402-395

INSTALLATION**WARNING**

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant compounds can burn easily, 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

1. Coat threads with pipe sealant compound and install pipe nipple (8), two-way check valve (4), two connectors (3), two tees (9), and two elbows (7) in quick-release valve (12).
2. Install quick-release valve (12), two washers (2), two screws (1), two washers (11), and two new locknuts (10).
3. Connect four hoses (6) and two tubes (5) to quick-release valve (12).

END OF WORK PACKAGE

TRAILER HAND BRAKE REPLACEMENT

0149 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Materials/Parts - Continued

Tags, marker (Item 42, WP 0312 00)

References

TM 9-2320-303-10

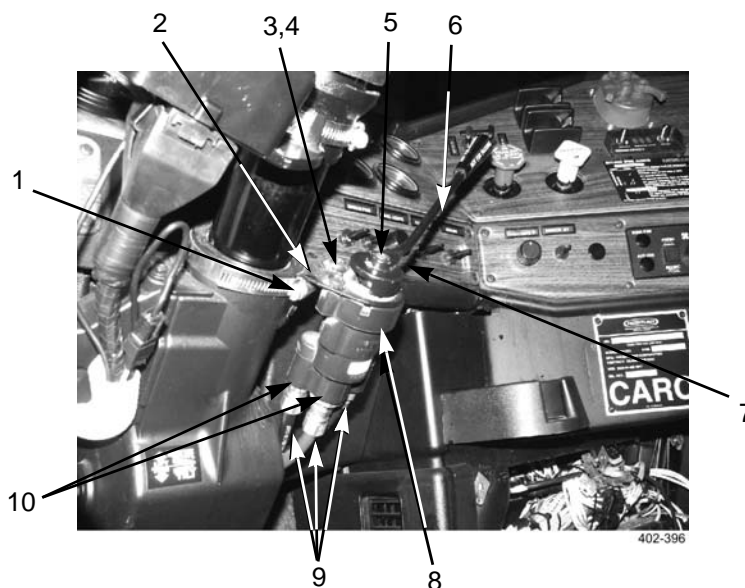
Equipment Condition

Air system drained (TM 9-2320-303-10)

REMOVAL**NOTE**

Tag tubes to aid in installation.

1. Disconnect three air lines (9) from trailer hand brake (8).
2. Remove two adapters (10) from trailer hand brake (8).
3. Remove clamp (1) and trailer hand brake (8) from steering column.
4. Remove screw (5) and handle (6) from trailer hand brake (8).
5. Remove three screws (3), washers (4), and bracket (2) from trailer hand brake (8).
6. Loosen jamnut (7), and unscrew handle (6) from handle base.
7. Unscrew jamnut (7) from handle (6).



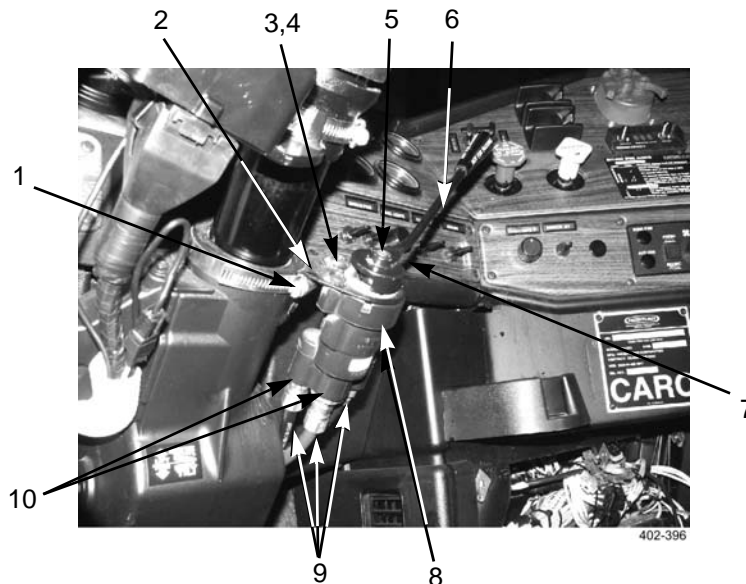
INSTALLATION

1. Screw jamnut (7) onto handle (6).
2. Screw handle (6) into handle base.
3. Tighten jamnut (7) against handle base.
4. Install bracket (2) with three screws (3) and washers (4).
5. Install handle (6) onto trailer hand brake (8) with screw (5).
6. Position trailer hand brake (8) on steering column and secure with clamp (1).

**WARNING**

Adhesives 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 a well-ventilated area. If adhesive or sealing compound contacts skin or clothing, wash immediately with soap and water.

7. Lightly coat threads of two adapters (10) and three air lines (9) with pipe sealing compound.
8. Install two adapters (10) to trailer hand brake (8).
9. Install three air lines (9) on trailer hand brake (8).



10. Start vehicle and check air system for leaks (TM 9-2320-303-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Materials/Parts

Compound, pipe sealing (Item 17, WP 0312 00)

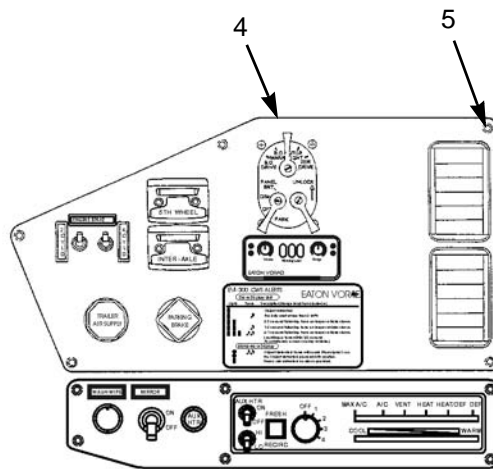
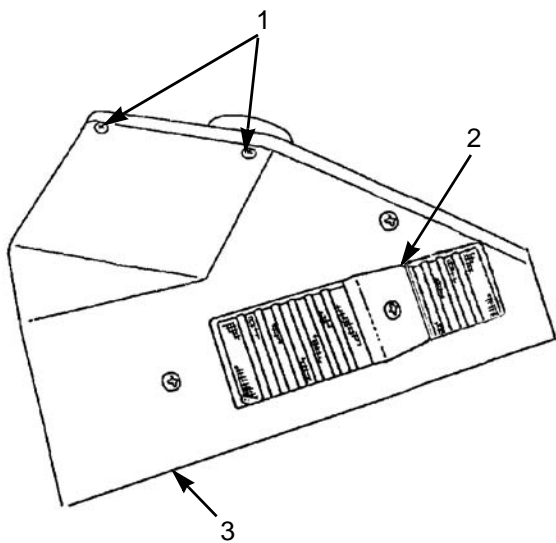
Tags, marker (Item 42, WP 0312 00)

Equipment Condition

Air system drained (TM 9-2320-303-10)

REMOVAL

1. Remove six torx screws (1), defroster vent (2), and cover (3).
2. Remove five torx screws (4) and panel (5).

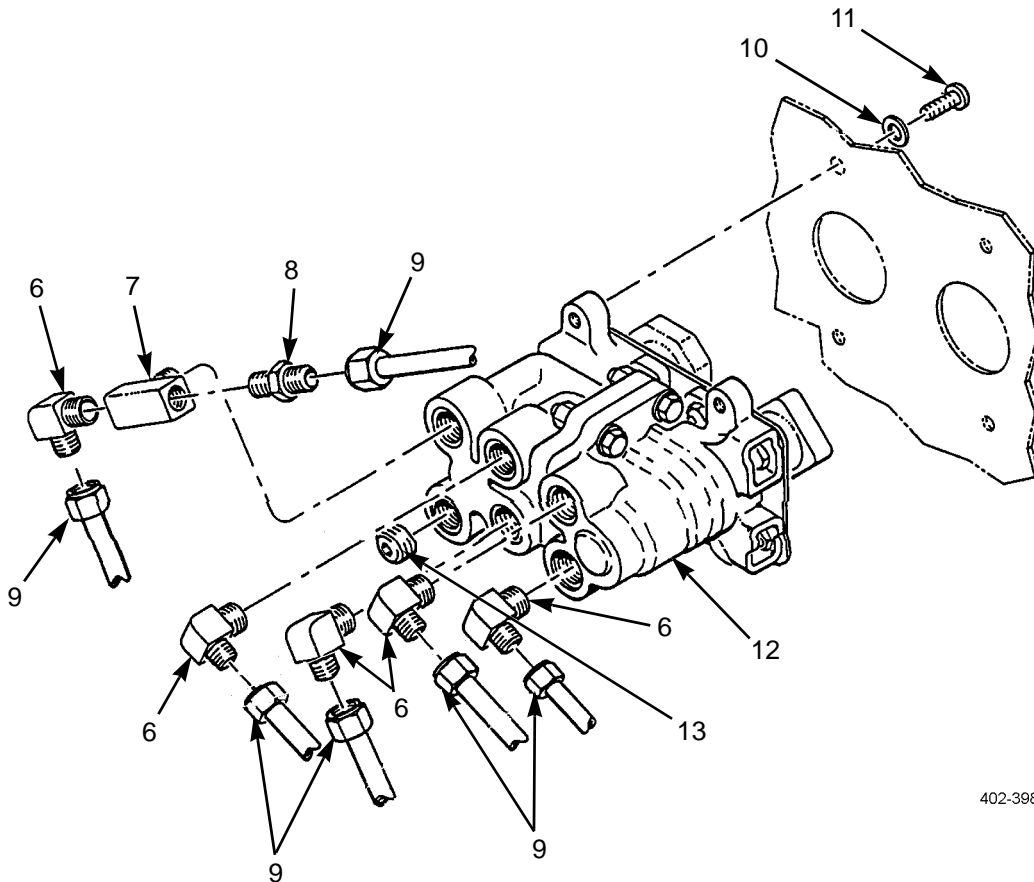


402-397

REMOVAL - CONTINUED**NOTE**

Tag all tubes prior to disconnecting to aid in connecting.

3. Disconnect six tubes (9) from valve (12).
4. Remove four screws (11), four washers (10), and valve (12).
5. Remove five elbows (6), adapter (8), tee (7), and plug (13) from valve (12).



402-398

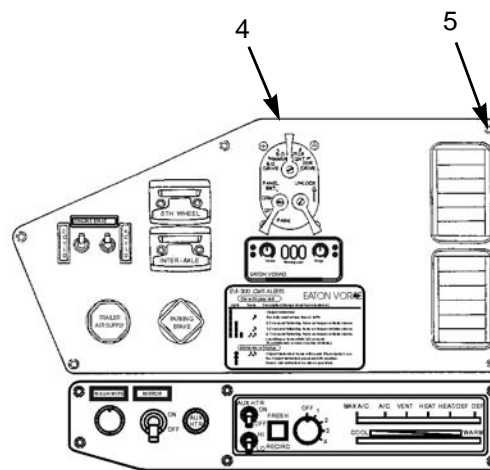
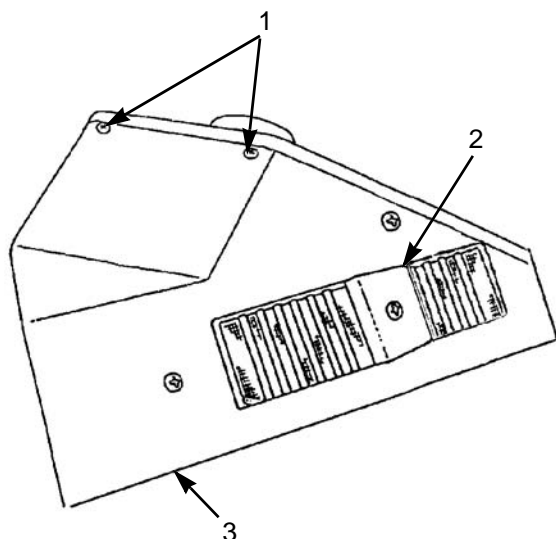
INSTALLATION



WARNING

- Make sure all air lines and fittings are clear of debris. Make sure excess pipe sealant compound does not enter air lines or fittings. Failure to do so could result in equipment failure and/or injury to personnel.
- Sealant compounds can burn easily, 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 sealant compound gets on skin or clothing, wash immediately with soap and water.

1. Coat threads with pipe sealant compound and install plug (13), tee (7), adapter (8) and five elbows (6) in valve (12).
2. Install valve (12), four washers (10), and four screws (11).
3. Connect six tubes (9) to valve (12).
4. Install panel (4) and five torx screws (5).
5. Install defroster vent (2), cover (3), and six torx screws (1).



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END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-5CBB) (2)

References

TM 9-2320-303-10

Equipment Condition

Air system drained (TM 9-2320-303-10)

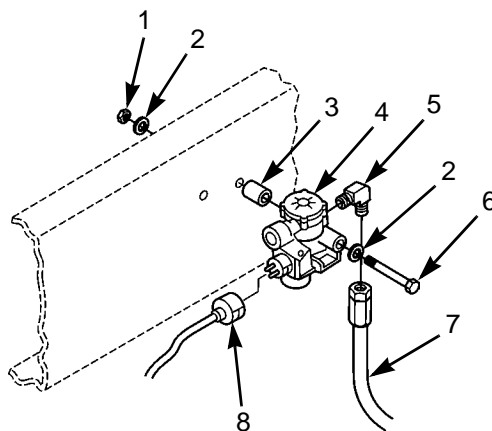
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

Tag air lines to aid in installation.

1. Disconnect electrical cable (8) from ABS valve (4).



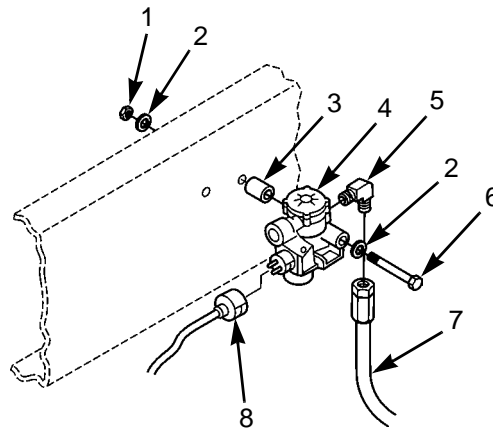
402-962

**FRONT ANTI-LOCK BRAKE SYSTEM (ABS) SOLENOID VALVE
REPLACEMENT (M915A4) - CONTINUED**

0151 00

REMOVAL - CONTINUED

2. Disconnect air line (7) from ABS valve (4).
3. Remove two screws (6), four washers (2), two locknuts (1), two spacers (3), and ABS valve (4). Discard locknuts.
4. Remove elbow (5) from ABS valve (4).



402-962

INSTALLATION

1. Apply pipe sealing compound to elbow (5) and install on ABS valve (4).
2. Position ABS valve (4) and install two screws (6), four washers (2), two spacers (3), and two new locknuts (1).
3. Connect air line (7) to ABS valve (4).
4. Connect electrical cable (8) to ABS valve (4).
5. Start vehicle (TM 9-2320-303-10) to build air pressure and check for leaks.

END OF WORK PACKAGE

FRONT ANTI-LOCK BRAKE SYSTEM (ABS) SOLENOID VALVE REPLACEMENT (M915A4R2)

0151 01

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N M45913/1-6CG5C) (2)

Nut, lock (P/N M45913/1-5CBB) (2)

Equipment Condition

Air system drained (TM 9-2320-303-10)

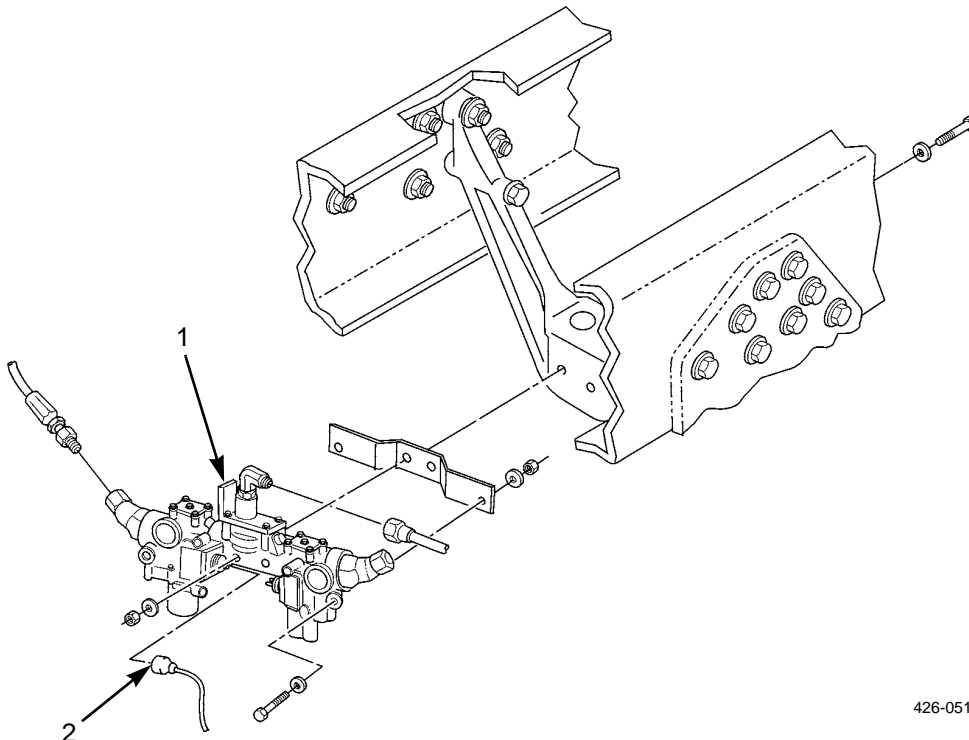
Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

NOTE

Tag air lines to aid in installation.

1. Disconnect two electrical cables (2) from ABS valve (1).



426-051

**FRONT ANTI-LOCK BRAKE SYSTEM (ABS) SOLENOID VALVE
REPLACEMENT (M915A4R2) - CONTINUED**

0151 01

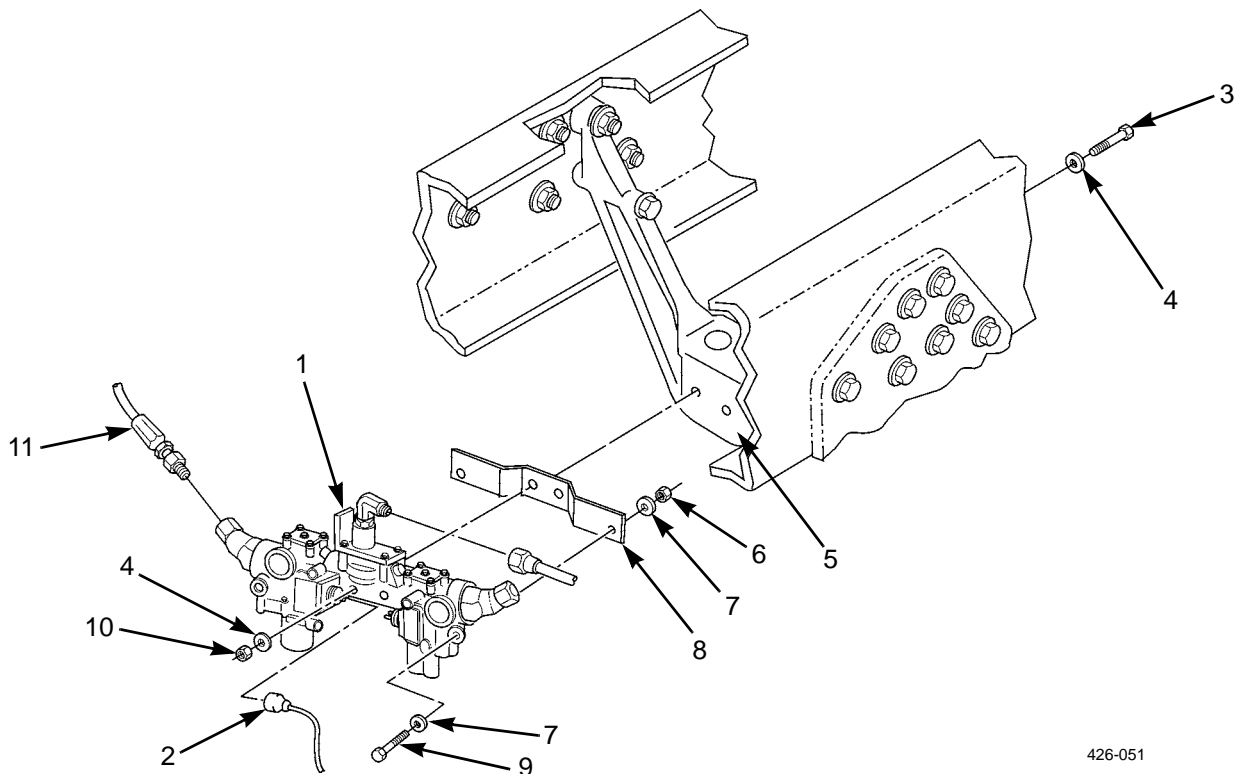
REMOVAL - CONTINUED

2. Disconnect three air lines (11) from ABS valve (1).
3. Remove two screws (9), four washers (7), two locknuts (6), and ABS valve (1) from bracket (8). Discard locknuts.

NOTE

Do not perform next step unless bracket is damaged.

4. Remove two bolts (3), four washers (4), two locknuts (10), and bracket (8) from frame (5). Discard locknuts.



INSTALLATION

NOTE

Do not perform next step unless bracket was removed.

1. Position bracket (8) on frame (5) and install two bolts (3), four washers (4), and two new locknuts (10).
2. Position ABS valve (1) on bracket (8) and install two screws (9), four washers (7), and two new locknuts (6).
3. Connect three air lines (11) to ABS valve (1).
4. Connect two electrical cables (2) to ABS valve (1).
5. Start vehicle (TM 9-2320-303-10) to build air pressure and check for leaks.

END OF WORK PACKAGE

REAR ANTI-LOCK BRAKE SYSTEM (ABS) SOLENOID VALVE REPLACEMENT**0152 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-5CBB) (2)

References

TM 9-2320-303-10

Equipment Condition

Air system drained (TM 9-2320-303-10)

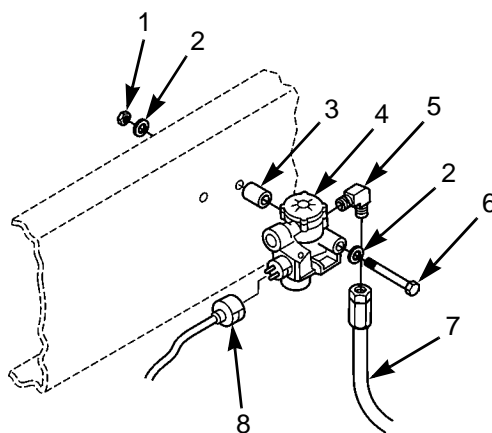
Rear platform removed (WP 0172 00)

NOTE

Forward-rear and rear-rear ABS solenoid valves are replaced the same way.

REMOVAL

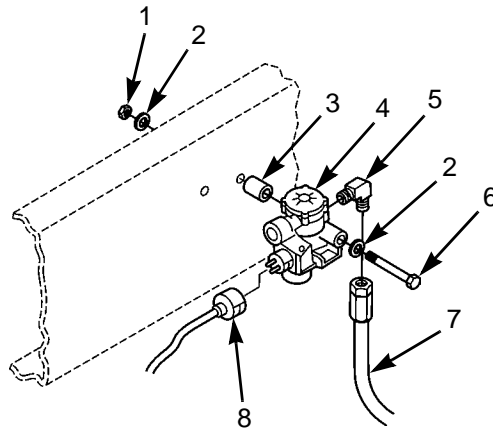
1. Disconnect electrical cable (8) from ABS valve (4).
2. Disconnect air line (7) from ABS valve (4).
3. Remove two screws (6), four washers (2), two locknuts (1), two spacers (3), and ABS valve (4). Discard locknuts.
4. Remove elbow (5) from ABS valve (4).



402-962

INSTALLATION

1. Apply pipe sealing compound to elbow (5) and install on ABS valve (4).
2. Position ABS valve (4) and install two screws (6), four washers (2), two spacers (3), and two new locknuts (1).
3. Connect air line (7) to ABS valve (4).
4. Connect electrical cable (8) to ABS valve (4).
5. Start vehicle (TM 9-2320-303-10) to build air pressure and check for leaks.



402-962

6. Install rear platform (WP 0172 00).

END OF WORK PACKAGE

FRONT AND DUAL REAR WHEEL LUG NUT TIGHTENING PROCEDURES

0153 00**THIS WORK PACKAGE COVERS**Front Wheel Lug Nut Tightening Procedure, Dual Rear Wheel Lug Nut Tightening Procedure

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools -Continued

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Tools and Special Tools

Wrench, torque, 100-600 lb-ft (Item 112, WP 0313 00)

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket, 3/4 in drive (Item 113, WP 0313 00)

FRONT WHEEL LUG NUT TIGHTENING PROCEDURE**WARNING**

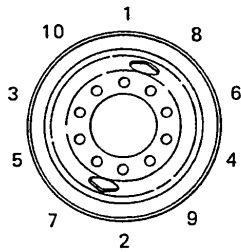
Whenever any wheel lug nuts require tightening or a wheel has been removed and replaced, all lug nuts must be torqued to the required torque. Failure to follow this warning may result in serious injury to personnel or damage to equipment.

NOTE

- Tightening pattern is the same for all wheel assemblies. Wheel nuts on left side of vehicle are left hand threads (turn right to loosen, turn left to tighten). Wheel nuts on right side of vehicle are right hand threads (turn left to loosen, turn right to tighten).
- After operating vehicle for 50-100 miles (80 to 160 km), retorque wheel nuts.

FRONT WHEEL LUG NUT TIGHTENING PROCEDURE - CONTINUED

1. Install a wheel lug nut on each wheel stud and hand tighten until each nut is flush with face or chamfer of wheel.
2. Rotate wheel half a turn to seat parts and hand tighten each wheel lug nut again.
3. Torque each wheel lug nut to 50 lb-ft (68 Nm) according to tightening pattern.
4. Using same tightening pattern, torque each wheel lug nut to 450-500 lb-ft (610-690 Nm).
5. Using same tightening pattern, retorque each wheel lug nut to 450-500 lb-ft (610-690 Nm).



402-401

OUTER AND INNER LUG NUT TIGHTENING SEQUENCE**DUAL REAR WHEEL LUG NUT TIGHTENING PROCEDURE****WARNING**

- Whenever any inner and/or outer wheel lug nuts require tightening or a wheel has been removed and replaced, all lug nuts must be torqued to the required torque. Failure to follow this warning may result in serious injury to personnel or damage to equipment.
- Whenever outer wheel lug nut(s) requires tightening, torque inner wheel lug nut(s) prior to torquing outer wheel lug nut(s). Failure to follow this warning may result in serious injury to personnel or damage to equipment

NOTE

- Tightening pattern is the same for all wheel assemblies. Wheel nuts on left side of vehicle are left hand threads (turn right to loosen, turn left to tighten). Wheel nuts on right side of vehicle are right hand threads (turn left to loosen, turn right to tighten).
 - After operating vehicle for 50-100 miles (80 to 160 km), retorque wheel nuts.
 - When retightening inner wheel lug nuts, loosen outer wheel lug nuts several turns, retighten inner wheel lug nuts, then retighten outer wheel lug nuts.
1. Install a wheel lug nut on each inner wheel stud and hand tighten until each nut is flush with face or chamfer of wheel.
 2. Rotate wheel half a turn to seat parts and hand tighten each inner wheel lug nut again.
 3. Torque each inner wheel lug nut to 50 lb-ft (68 Nm) according to tightening pattern.
 4. Using same tightening pattern, torque each inner wheel lug nut to 450-500 lb-ft (610-690 Nm).
 5. Using same tightening pattern, retorque each inner wheel lug nut to 450-500 lb-ft (610-690 Nm).
 6. Repeat steps 1 through 5 for outer wheel lug nuts.

END OF WORK PACKAGE

FRONT HUB, DRUM, WHEEL BEARINGS, AND SEAL REPLACEMENT**0154 00****THIS WORK PACKAGE COVERS**

Removal, Installation, Adjustment (End Play)

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Handle, driver (Item 31, WP 0313 00)

Indicator, dial (Item 36, WP 0313 00)

Inserter, ABS ring (Item 37, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Wrench, torque, 0-300 lb-in (Item 109, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0312 00)

Gasket (P/N 450755)

Seal, oil (P/N 35066)

Washer, lock (P/N 380GX108) (2)

Washer, lock (P/N MS35338-140) (6)

References

WP 0128 00

Equipment Condition

Front wheel removed (TM 9-2320-303-10)

Front anti-lock brake system (ABS) sensor removed (WP 0091 00)

NOTE

Front axle ABS tone ring replacement is covered in this work package.

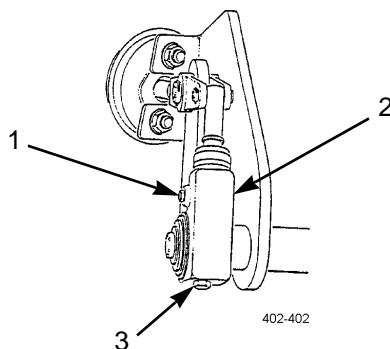
REMOVAL

1. Remove pressure relief screw, spring, and pawl assembly (1) from slack adjuster (2).

NOTE

Perform step 2 to obtain enough clearance between brake drum and brakeshoes to remove brake drum.

2. Turn adjusting nut (3) counterclockwise.



REMOVAL - CONTINUED

3. Remove brake drum (11) from hub (5).

NOTE

Place suitable container under hub opening to catch axle oil.

4. Remove six screws (17), lockwashers (16), hub cap (19), and gasket (15) from hub (5). Discard gasket and lockwashers.
5. Bend back tab on lockwasher (20).
6. Remove jamnut (14), lockwasher (20), lock ring (13), and adjusting nut (21) from axle spindle (10). Discard lockwasher.
7. Remove outer wheel bearing (12) from axle spindle (10). Outer bearing race (4) will remain in bore of hub (5).
8. Remove hub (5) from axle spindle (10).
9. Remove oil seal (9) and inner wheel bearing (8) from hub (5). Discard oil seal.

NOTE

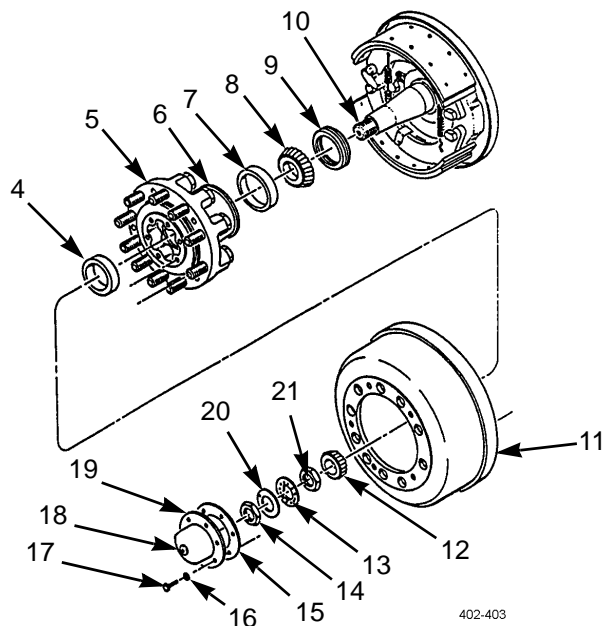
Perform step 10 if bearing races are damaged or if installing new bearings.

10. Remove inner bearing race (7) and outer bearing race (4) from bore of hub (5).

NOTE

ABS tone ring must be replaced if ring is damaged or if replacing hub.

11. To remove ABS tone ring (6) from hub (5), tap lightly beneath ring with a small hammer. Use a circular pattern with light tapping to prevent ring from cocking.



INSTALLATION**WARNING**

Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

NOTE

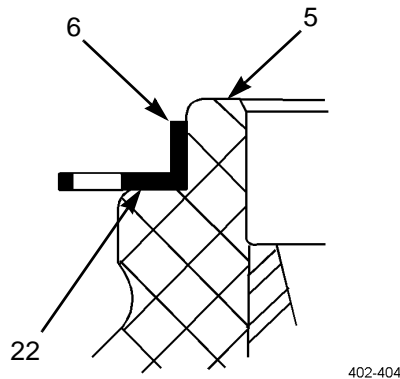
Perform step 1 if new bearing races or new bearings are being installed.

1. Install outer bearing race (4) and inner bearing race (7) in bore of hub (5).

NOTE

Ensure ABS tone ring seat on hub is clean and seat is not damaged. If seat is damaged, replace hub.

2. If removed, install ABS tone ring (6) on hub (5) as follows:
 - a. Place ABS tone ring (6) on hub ring seat (22) with inside diameter flange of ring up.
 - b. Center installation tool over ABS tone ring (6).
 - c. Using driver handle and hammer or mallet, drive ABS tone ring (6) onto hub ring seat (22). Inspect ring to ensure complete seating on hub (5).



3. Coat two wheel bearings (8 and 12) with clean gear lubricating oil.
4. Install inner wheel bearing (8) and new oil seal (9) in hub (5).
5. Apply coat of gear lubricating oil to axle spindle (10).

CAUTION

To prevent damage to equipment, do not unseat oil seal or wheel bearing when mounting hub.

6. Mount hub (5) fully over axle spindle (10).
7. Fill cavity in hub (5) with gear lubricating oil.
8. Install outer wheel bearing (12) in hub (5).

INSTALLATION - CONTINUED**NOTE**

Install adjusting nut with dimple facing out.

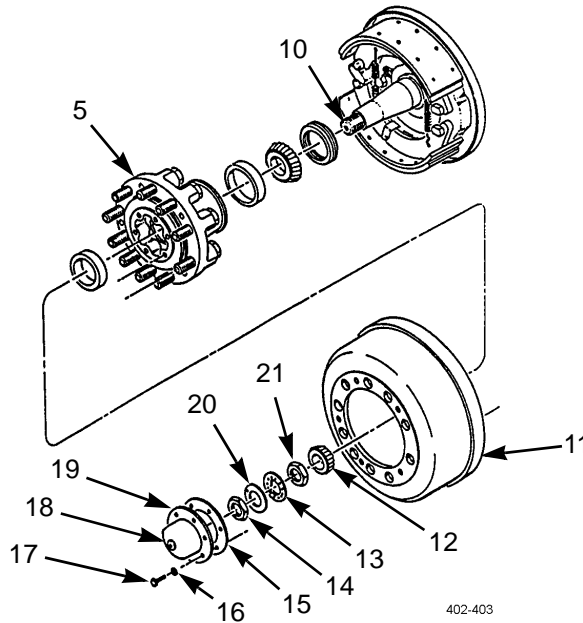
9. While turning hub (5), thread adjusting nut (21) on axle spindle (10) until against outer wheel bearing (12).
10. While turning hub (5) in both directions, tighten adjusting nut (21) to 100 lb-ft (136 Nm).
11. Loosen adjusting nut (21) completely to zero torque and spin wheel a few turns. Tighten adjusting nut to 50 lb-ft (68 Nm).
12. Back off adjusting nut (21) 1/6 to 1/4 turn.
13. Install lock ring (13) and new lockwasher (20) on axle spindle (10).
14. Install jamnut (14) on axle spindle (10). Tighten jamnut to 100-150 lb-ft (136-203 Nm).
15. Bend tab of lockwasher (20) over a flat on jamnut (14).

ADJUSTMENT (END PLAY)

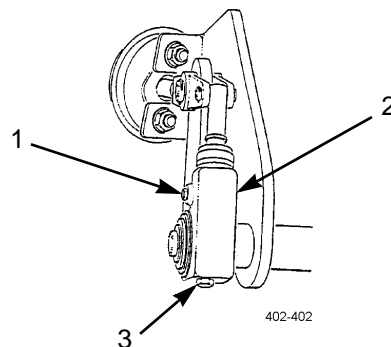
1. Attach dial indicator magnetic base to hub (5).
2. Adjust dial indicator so plunger is against spindle (10) end.
3. Position dial indicator parallel to axis of spindle (10).
4. Grasp hub (5) at 3 and 9 o'clock positions.
5. Push and pull hub (5) in and out while rotating hub approximately 45 degrees.
6. Note end play while rotating hub (5) until dial indicator tip is in same position before rotation began.
7. Acceptable end play is .001-.005 inches.
8. If end play is not within tolerance, loosen jamnut (14) and either back off or tighten adjusting nut (21) as required.
9. Repeat steps 1 through 7 until acceptable end play is achieved.
10. Install hub cap (19) and new gasket (15) on hub (5) and with six screws (17) and new lockwashers (16). Tighten screws to 180 lb-in (20 Nm).

ADJUSTMENT (END PLAY) - CONTINUED

11. Remove hub filler cap (18) and add gear lubricating oil to level of filler hole. Wait 5 minutes and add more oil, as needed.
12. Install hub filler cap (18).
13. Install brake drum (11) over hub (5).



14. Install pressure relief screw, spring, and pawl assembly (1) in slack adjuster (2). Tighten to 180-240 lb-in (20-27 Nm).



15. Install front wheel (TM 9-2320-303-10).
16. Adjust slack adjuster (WP 0128 00).
17. Install front anti-lock brake system (ABS) sensor (WP 0091 00).

END OF WORK PACKAGE

REAR HUB, DRUM, WHEEL BEARINGS, AND SEAL REPLACEMENT

0155 00

THIS WORK PACKAGE COVERS

Removal, Installation, Adjustment (End Play)

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Handle, driver (Item 31, WP 0313 00)

Indicator, dial (Item 36, WP 0313 00)

Insertor, ABS ring (Item 37, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Socket, socket wrench (Item 87, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Tools and Special Tools - Continued

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Wrench, torque, 100-600 lb-ft (Item 112, WP 0313 00)

Materials/Parts

Adhesive, RTV732 (Item 1, WP 0312 00)

Oil, lubricating (Item 33, WP 0312 00)

Seal, oil (P/N 1277701)

Equipment Condition

Rear brakes caged (TM 9-2320-303-10)

Rear wheels removed (TM 9-2320-303-10)

Rear anti-lock brake system (ABS) sensor removed (rear-rear axle only) (WP 0092 00)

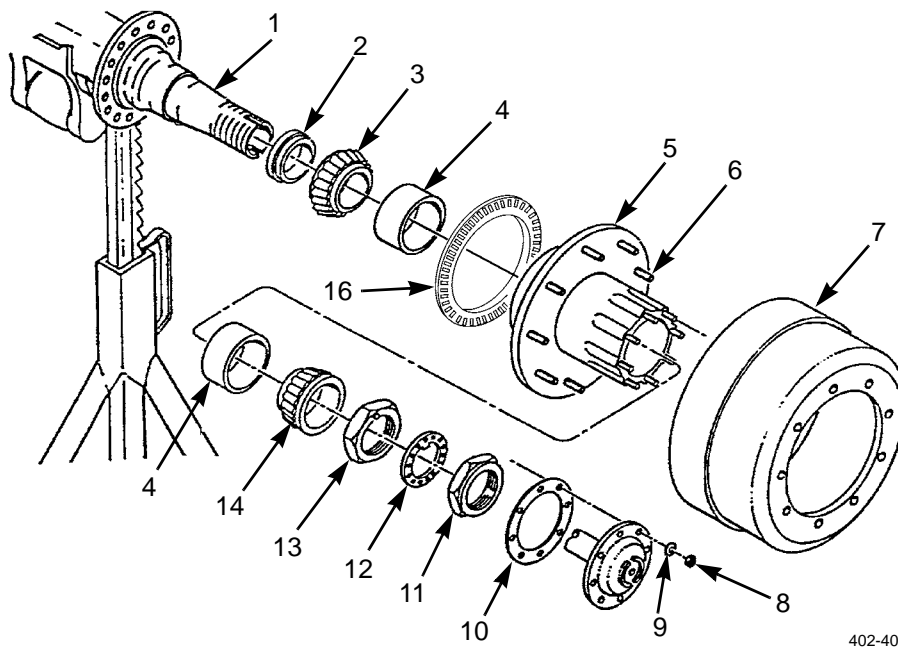
NOTE

ABS tone ring is located on rear-rear axle only and is covered in this work package.

REMOVAL**NOTE**

- Procedure is the same for both sides.
- Procedure is the same for both rear axles except as noted.

1. Remove brake drum (7) from hub (5).

**CAUTION**

Ensure axle hub studs are not damaged during axle shaft removal. If damage occurs, replace stud to allow proper installation of tapered dowels and nuts.

NOTE

Have suitable container available to catch oil that will spill when axle shaft is removed.

2. Remove eight nuts (8), washers (9), and axle shaft (10).
3. Remove jamnut (11), lock ring (12), and adjusting nut (13) from axle spindle (1).
4. Remove outer wheel bearing (14) from axle spindle (1).
5. Remove hub (5) from axle spindle (1).
6. Remove and discard seal (2) from hub (5).
7. Remove inner wheel bearing (3) from hub (5).
8. If damaged, remove eight studs (6) from hub (5).

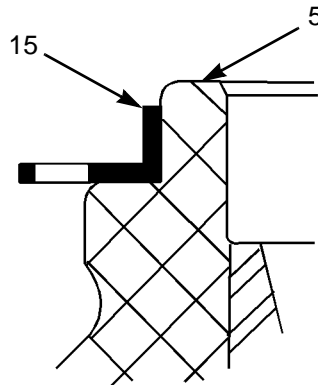
REMOVAL - CONTINUED**NOTE**

Perform step 9 if bearing cups are damaged or if installing new wheel bearings.

9. Using brass drift pin, carefully remove and discard two bearing cups (4) from hub (5).

NOTE

- The following step applies only to rear-rear axle hub.
 - ABS tone ring must be replaced if ring is damaged or if replacing hub.
10. To remove ABS tone ring (15) from hub (5), use a small pry bar or hammer to gently pry off ring. Use a circular pattern around ring to prevent cocking.



402-404

INSTALLATION**WARNING**

Brakeshoe linings and inside drum friction surface must be free of all oil/grease and other contaminants prior to assembly to ensure maximum braking capability. Oil/grease and other contaminants may compromise braking that could lead to a serious accident resulting in injury and/or death.

NOTE

- Procedure is the same for both sides.
- Procedure is the same for both rear axles except as noted.

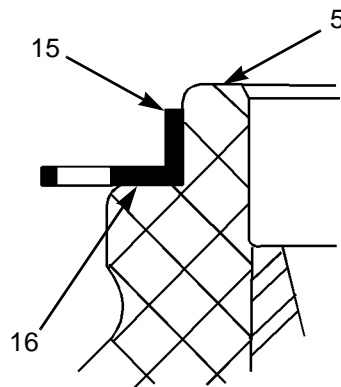
CAUTION

Bearings and bearing cups must be replaced as a set. Failure to do so could result in premature damage to either bearings or bearing cups.

1. If removed, use a brass draft pin to carefully install two bearing cups (4) in hub (5).
2. If removed, install eight studs (6) in hub (5).

INSTALLATION - CONTINUED**NOTE**

- The following step applies only to rear-rear axle hub.
 - Ensure ABS tone ring seat on hub is clean and seat is not damaged. If seat is damaged, replace hub.
3. If removed, install ABS tone ring (15) on hub (5) as follows:
 - a. Place ABS tone ring (15) on hub ring seat (16) with inside diameter flange of ring up.
 - b. Center installation tool over ABS tone ring (15).
 - c. Using installer handle and hammer or mallet, drive ABS tone ring (15) onto hub ring seat (16). Inspect ring to ensure complete seating on hub (5).



402-404

4. Coat inner wheel bearing (3) with gear lubricating oil.
5. Install inner wheel bearing (3) in hub (5).
6. Install new oil seal (2) in hub (5).
7. Install hub (5) on axle spindle (1) and fill cavity with gear lubricating oil.
8. Coat outer wheel bearing (14) with gear lubricating oil.
9. Install outer wheel bearing (14) in hub (5).

NOTE

Adjusting nut can be identified by protrusion on one side.

10. With protrusion facing out, install adjusting nut (13) until adjusting nut contacts outer wheel bearing (14).

CAUTION

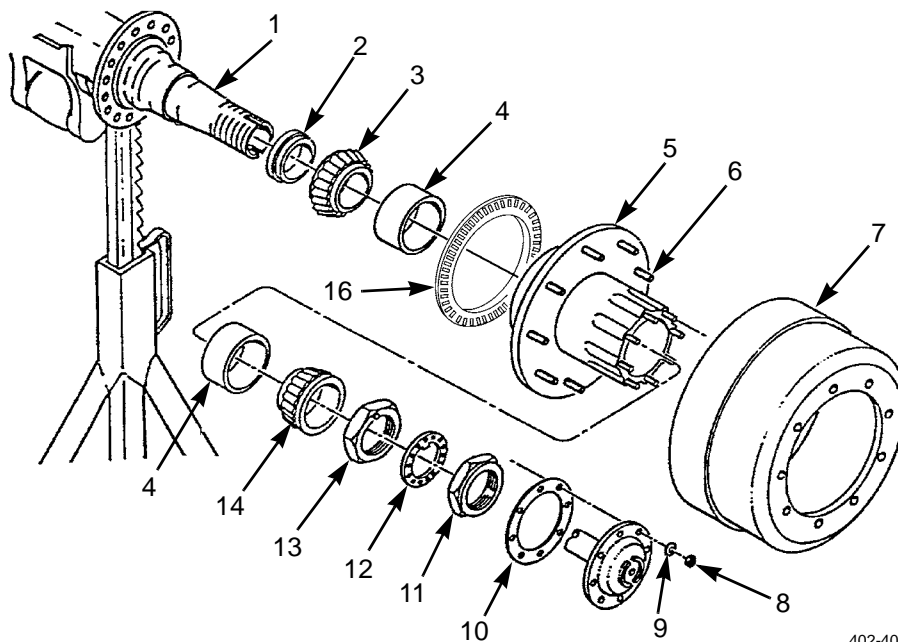
Hub must be rotated in both directions while tightening adjusting nut. Failure to do so will result in premature bearing failure.

11. Tighten adjusting nut (13) to 100 lb-ft (136 Nm).
12. Loosen adjusting nut (13) completely, then tighten to 50 lb-ft (68 Nm).
13. Loosen adjusting nut (13) 1/4 turn.

INSTALLATION - CONTINUED**NOTE**

During step 13, it may be necessary to tighten adjusting nut to align protrusion with alignment hole in lock ring.

14. Install lock ring (12) on axle spindle (1).
15. Install jamnut (11) on axle spindle (1). Tighten jamnut to 250-400 lb-ft (339-542 Nm).

**ADJUSTMENT (END PLAY)**

1. Attach dial indicator magnetic base to hub (5).
2. Adjust dial indicator so plunger is against spindle (1) end.
3. Position dial indicator parallel to axis of spindle (1).
4. Grasp hub (5) at 3 and 9 o'clock positions.
5. Push and pull hub (5) in and out while rotating hub approximately 45 degrees.
6. Note end play while rotating hub (5) until dial indicator tip is in same position before rotation began.
7. Acceptable end play is .001 - .005 inches.
8. If end play is not within tolerance, loosen jamnut (12) and either back off or tighten adjusting nut (14) as required.
9. Repeat steps 1 through 7 until acceptable end play is achieved.
10. Apply a bead of adhesive on inner circumference of axle shaft (10).

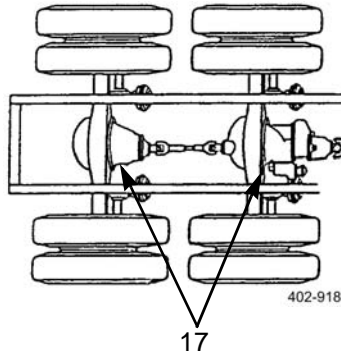
NOTE

Splines on axle shaft must engage in differential before axle flange will seat against hub.

11. Install axle shaft (10) with eight washers (9) and nuts (8). Tighten nuts to 155 lb-ft (210 Nm).
12. Install rear anti-lock brake system (ABS) sensor (rear-rear axle only) (WP 0092 00).

ADJUSTMENT (END PLAY) - CONTINUED

13. Install brake drum (7) on hub (5).
14. Remove plug (17) and check oil level in accordance with Unit PMCS. Add oil as needed (WP 0023 00).
15. Install plug (17) and tighten to 35 lb-ft (47 Nm).



16. Install rear wheels (TM 9-2320-303-10).
17. Uncage rear brakes (TM 9-2320-303-10).

END OF WORK PACKAGE

STEERING WHEEL REPLACEMENT

0156 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Puller kit, universal (Item 72, WP 0313 00)

Tools and Special Tools - Continued

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Equipment Condition

Front wheels straight

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL**NOTE**

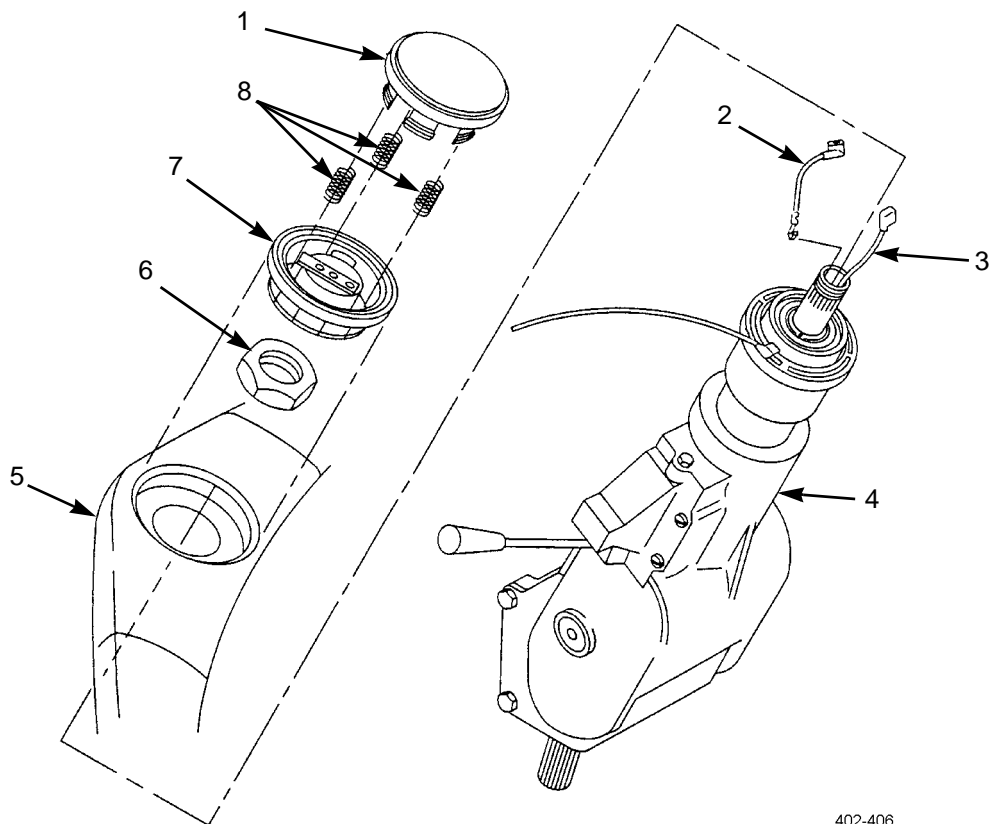
Avoid rotating steering wheel during any of the following steps.

1. Pry cover (1) from horn button (7) and remove three springs (8).
2. Lift horn button (7) from steering wheel (5) and disconnect two wires (2 and 3) from horn button.
3. Remove nut (6) from steering column (4).

CAUTION

Use care when removing steering wheel to prevent damage to wires.

4. Using universal puller kit, remove steering wheel (5).



402-406

INSTALLATION

1. Align steering wheel (5) with steering column (4).
2. Install steering wheel (5) with nut (6). Tighten nut to 60 lb-ft (80 Nm).
3. Connect two wires (2 and 3) to horn button (7) and press horn button into steering wheel (5).
4. Install three springs (8) and cover (1) to horn button (7).

END OF WORK PACKAGE

UNIVERSAL SHAFT MAINTENANCE**0157 00****THIS WORK PACKAGE COVERS**

Removal, Disassembly, Assembly, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Drill, electric, portable (Item 20, WP 0313 00)

Drill set, twist (Item 21, WP 0313 00)

Riveter, blind, hand (Item 79, WP 0313 00)

Materials/Parts

Nut, lock, (P/N 115307A)

Nut, lock (P/N 14-12087-000)

Kit (P/N 5-170X) (2)

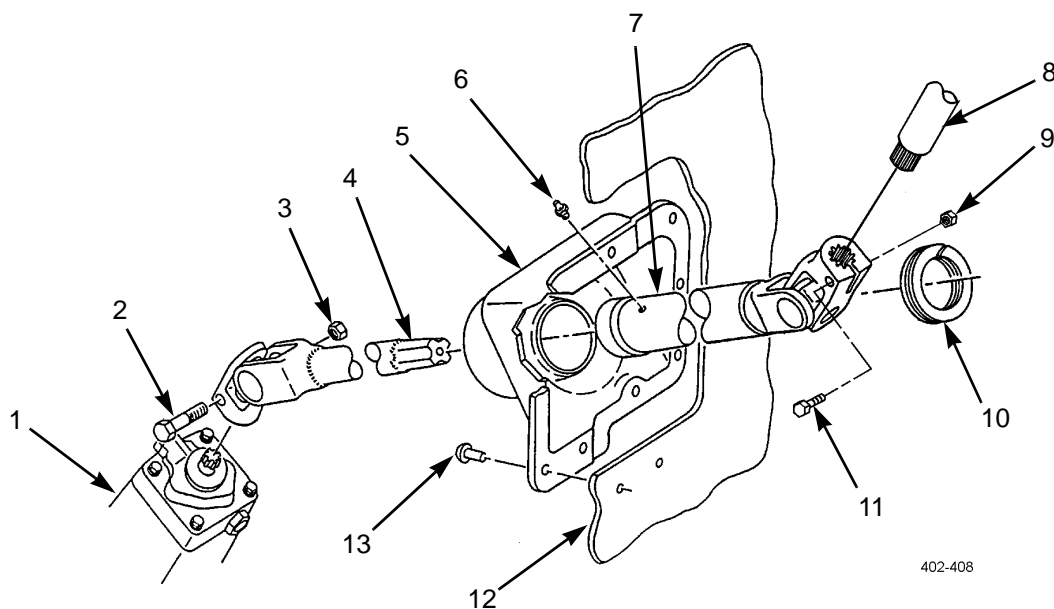
Rivet, blind (P/N 1641-0631) (10)

Equipment Condition

Steering column cover removed (WP 0195 00)

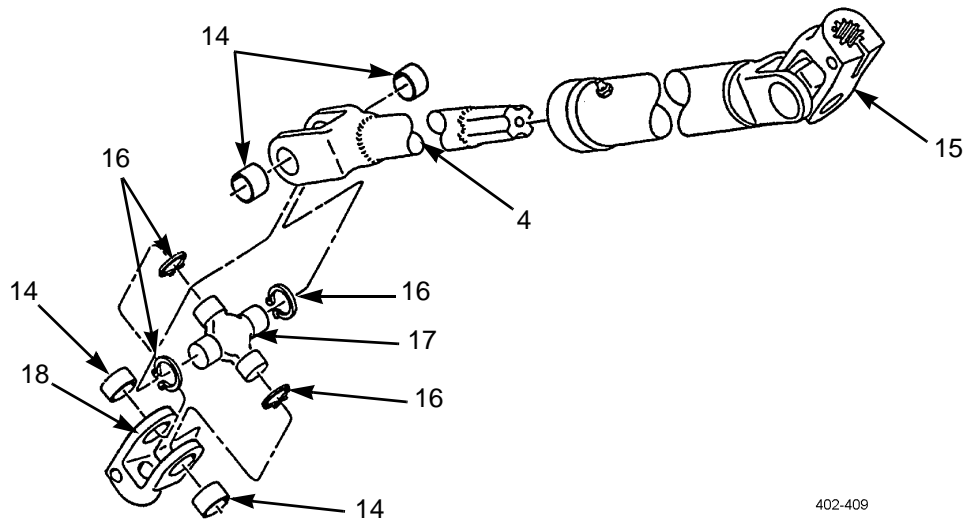
REMOVAL

1. Remove locknut (9) and screw (11) from upper shaft (7). Discard locknut.
2. Disconnect upper shaft (7) from steering column (8).
3. Support lower shaft (4) and remove grease fitting (6) from upper shaft (7).
4. Remove bushing (10) from boot (5).
5. Separate upper shaft (7) from lower shaft (4) and remove upper shaft from boot (5).
6. Remove locknut (3), screw (2), and lower shaft (4) from steering gear (1). Discard locknut.
7. If damaged, remove ten rivets (13) and boot (5) from firewall (12). Discard rivets.



DISASSEMBLY

1. Remove four snap rings (16), bearings (14), lower yoke (18), and cross (17) from lower shaft (4).
2. Repeat step 1 for upper yoke (15).



402-409

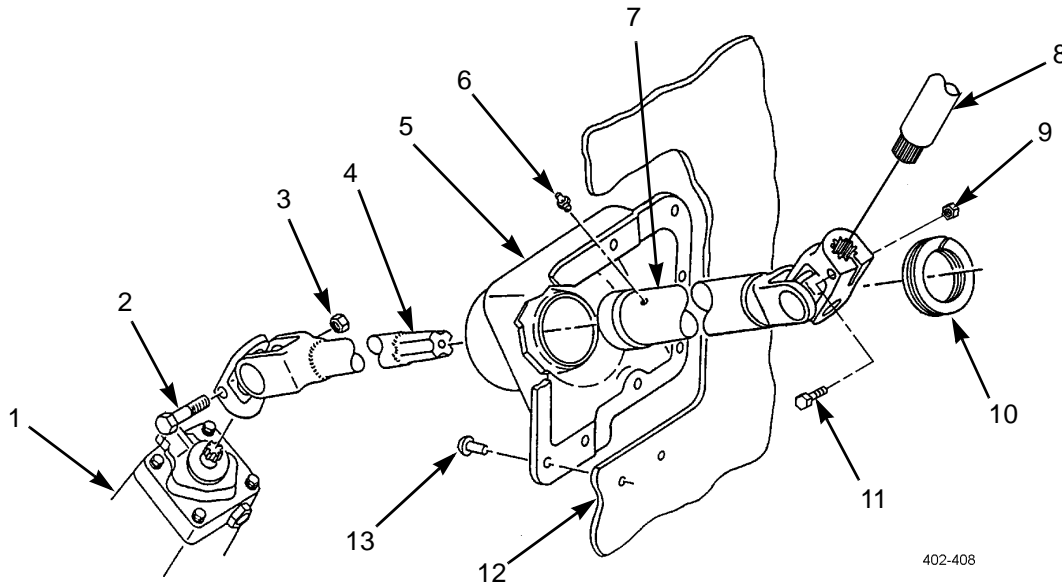
ASSEMBLY

1. Install cross (17), lower yoke (18), four bearings (14), and snap rings (16) on lower shaft (4).
2. Repeat step 1 for upper yoke (15).

INSTALLATION

1. If removed, install boot (5) on firewall (12) with ten new rivets (13).
2. Install splined end of lower shaft (4) through boot (5).
3. Install lower shaft (4) on steering gear (1).
4. Support lower shaft (4) on steering gear (1) and install screw (2) and new locknut (3).
5. Install upper shaft (7) through boot (5) and onto lower shaft (4).
6. Install bushing (10) on boot (5).
7. Install grease fitting (6) in upper shaft (7).
8. Connect upper shaft (7) to steering column (8) and install screw (11) and new locknut (9).
9. Install steering column cover (WP 0195 00).

INSTALLATION - CONTINUED



END OF WORK PACKAGE

PITMAN ARM AND DRAG LINK REPLACEMENT

0158 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Pin, cotter (P/N AN380-4-7) (2)

Nut, lock (P/N M45913/2-12FG5C)

References

WP 0024 00

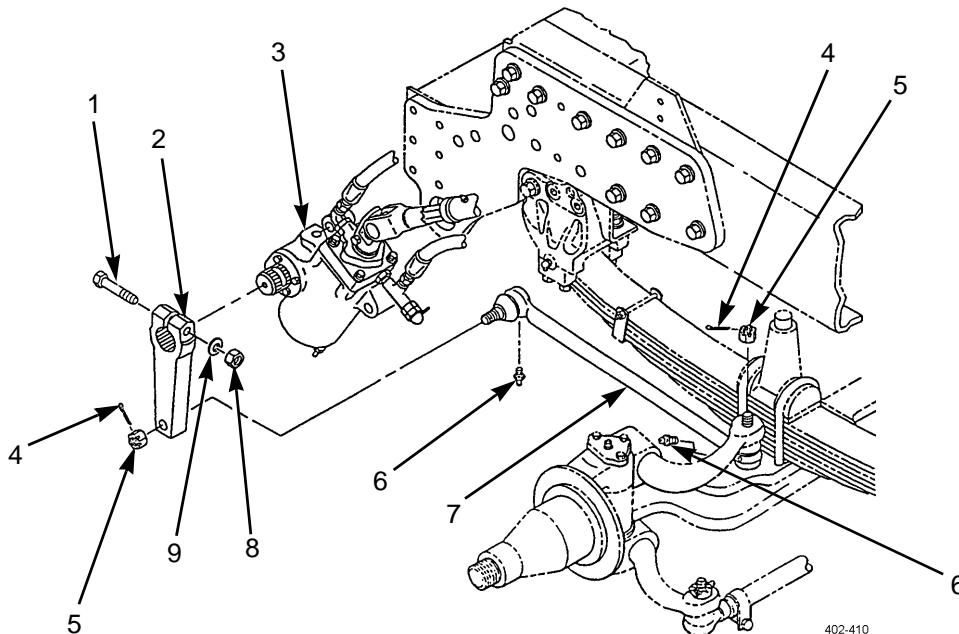
REMOVAL

1. Remove two cotter pins (4), two nuts (5), and drag link (7). Discard cotter pins.
2. If damaged, remove two grease fittings (6) from drag link (7).

NOTE

Mark pitman arm prior to removal.

3. Remove locknut (8), washer (9), screw (1), and pitman arm (2) from steering gear (3). Discard locknut.



402-410

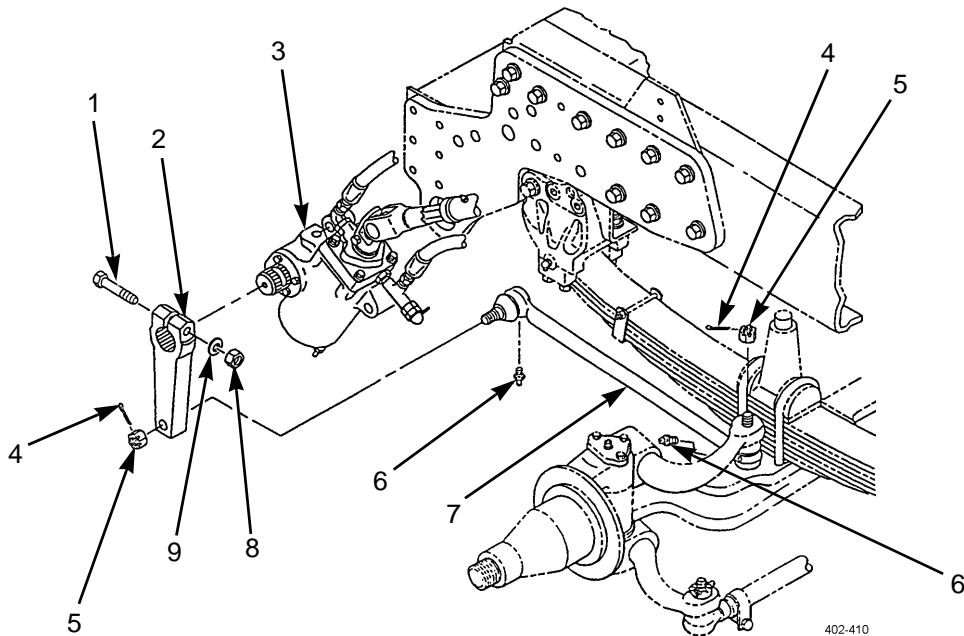
INSTALLATION

1. Install pitman arm (2), screw (1), washer (9), and new locknut (8) on steering gear (3). Tighten locknut to 150-220 lb-ft (203-312 Nm).
2. If removed, install two new grease fittings (6) in drag link (7).
3. Install drag link (7) and two nuts (5). Tighten nuts to 160-215 lb-ft (217-292 Nm).

NOTE

Nuts may be tightened further, but not to exceed 300 lb-ft (407 Nm), if necessary for installation of cotter pins.

4. Install two new cotter pins (4).



5. Lubricate pitman arm and drag link (WP 0024 00).

END OF WORK PACKAGE

POWER STEERING RESERVOIR AND HOSES REPLACEMENT

0159 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Materials/Parts

Oil, lubricating (Item 27, WP 0312 00)

Rags, wiping (Item 39, WP 0312 00)

Nut, lock (P/N M45913/1-8CG5C) (2)

References

TM 9-2320-303-10

REMOVAL



WARNING

Spilled hydraulic fluid is very slippery. Wipe up any spilled fluid immediately. Failure to do so could result in serious injury to personnel.

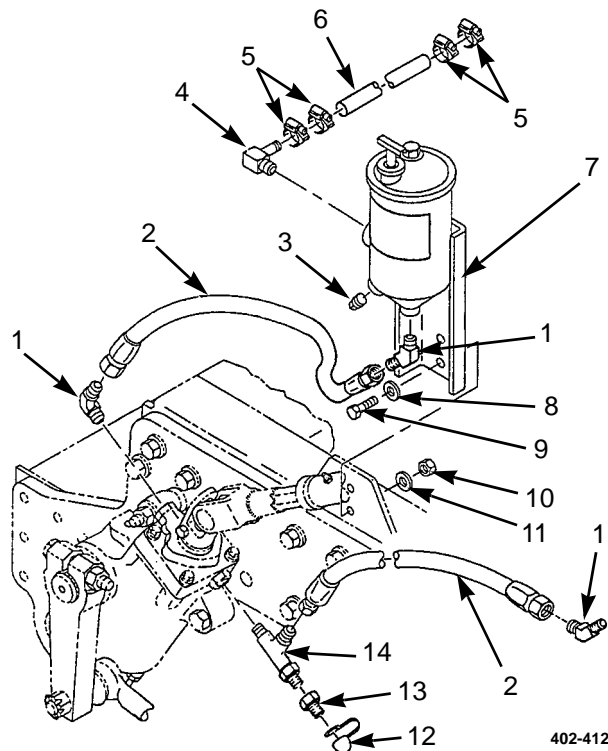
REMOVAL - CONTINUED

1. Remove plug (3) and drain power steering reservoir (7).

NOTE

Oil will be present when hoses are removed.

2. Remove four clamps (5), hose (6), and elbow (4) from power steering reservoir (7).
3. Remove two hoses (2), three elbows (1), cap (12), tap (13), and tee (14).
4. Remove two locknuts (10), two washers (11), two screws (9), two washers (8), and power steering reservoir (7). Discard locknuts.



402-412

INSTALLATION

1. Install power steering reservoir (7), two washers (8), two screws (9), two washers (11), and two new locknuts (10).

**WARNING**

Spilled hydraulic fluid is very slippery. Wipe up and spilled fluid immediately. Failure to do so could result in serious injury to personnel.

2. Install tee (14), tap (13), cap (12), three elbows (1), and two hoses (2).
3. Install plug (3), elbow (4), hose (6), and four clamps (5) in power steering reservoir (7).
4. Fill power steering reservoir (TM 9-2320-303-10).

END OF WORK PACKAGE

POWER STEERING RESERVOIR REPAIR

0160 00

THIS WORK PACKAGE COVERS

Disassembly, Assembly

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Rags, wiping (Item 39, WP 0313 00)

Element, filter (P/N 83213D)

Materials/Parts - Continued

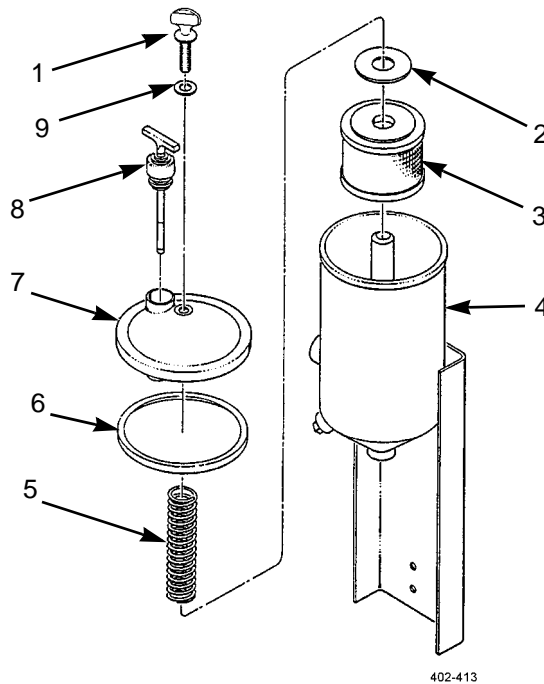
Gasket (P/N Q-59278)

Equipment Condition

Power steering reservoir drained (WP 0024 00)

DISASSEMBLY

1. Remove dipstick (8), wing screw (1), washer (9), gasket (6), and cover assembly (7).
2. Remove spring (5), washer (2), and filter element (3) from power steering reservoir (4). Discard filter element.



402-413

ASSEMBLY

1. Install new filter element (3), washer (2), and spring (5).
2. Install cover assembly (7), gasket (6), washer (9), wing screw (1), and dipstick (8) in power steering reservoir (4).
3. Fill power steering reservoir (WP 0024 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Drill, electric, portable (Item 20, WP 0313 00)

Drill set, twist (Item 21, WP 0313 00)

Tools and Special Tools - Continued

Riveter, blind, hand (Item 79, WP 0313 00)

Materials/Parts

Nut, lock (P/N M45913/1-6CG5C) (8)

Rivet, blind (P/N MA273-20000) (8)

Equipment Condition

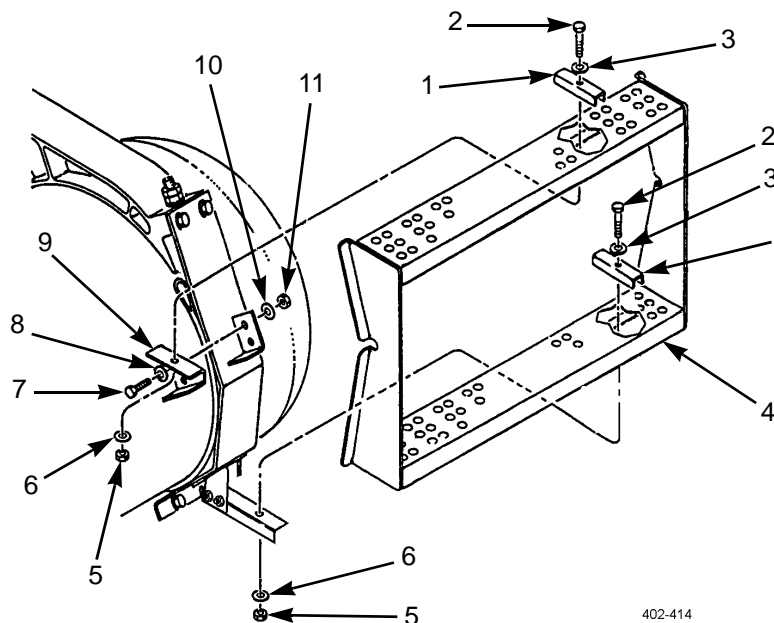
CWS side sensor removed (WP 0220 00)

REMOVAL

NOTE

Steps 1 through 5 are for front bracket assembly.

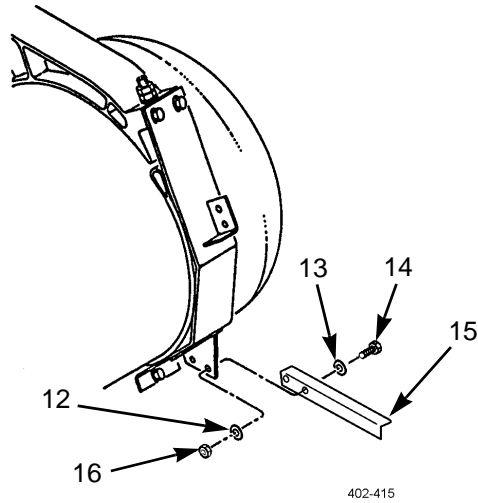
1. Remove four locknuts (5), four washers (6), four bolts (2), four washers (3), four clamps (1), and step assembly (4). Discard locknuts.
2. Remove two locknuts (11), two washers (10), two bolts (7), two washers (8), and bracket (9). Discard locknuts.



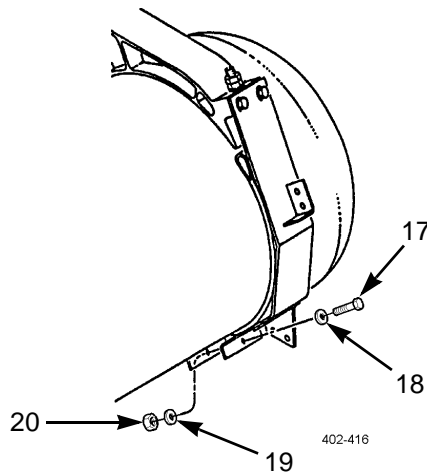
402-414

REMOVAL - CONTINUED

- Remove two nuts (14), two washers (13), two bolts (16), two washers (12), and bracket (15).

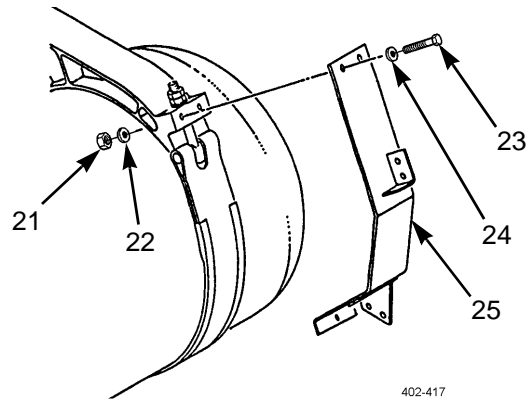


- Remove nut (20), washer (19), bolt (17), and washer (18).

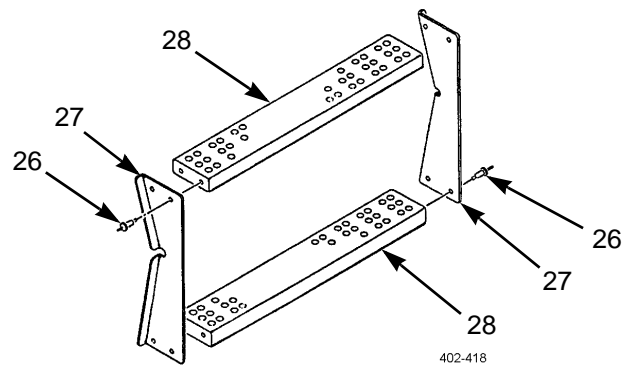


REMOVAL - CONTINUED

5. Remove two nuts (21), two washers (22), two bolts (23), two washers (24), and bracket (25).

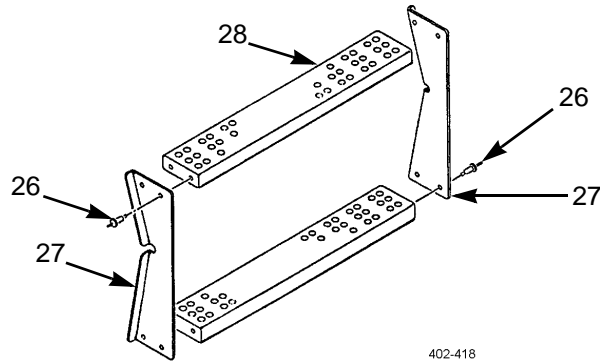


6. Repeat steps 2 through 5 for rear bracket assembly.
7. Remove eight rivets (26) and two support brackets (27) from two steps (28). Discard rivets.



INSTALLATION

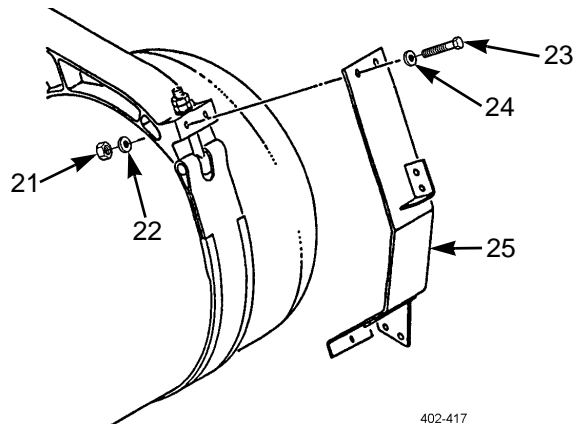
1. Install two support brackets (27), with eight new rivets (26), on two steps (28).



NOTE

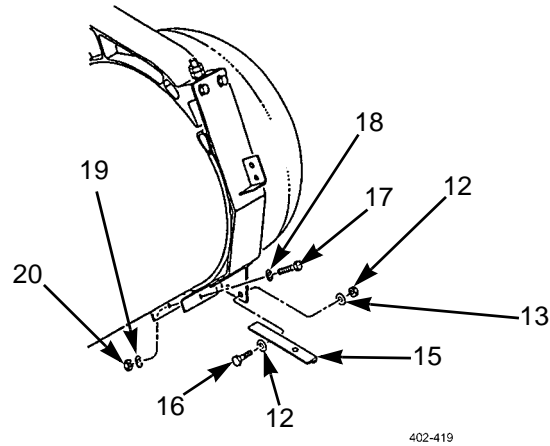
Steps 2 through 5 are for front bracket assembly.

2. Install bracket (25), two washers (24), two bolts (23), two washers (22), and two nuts (21).

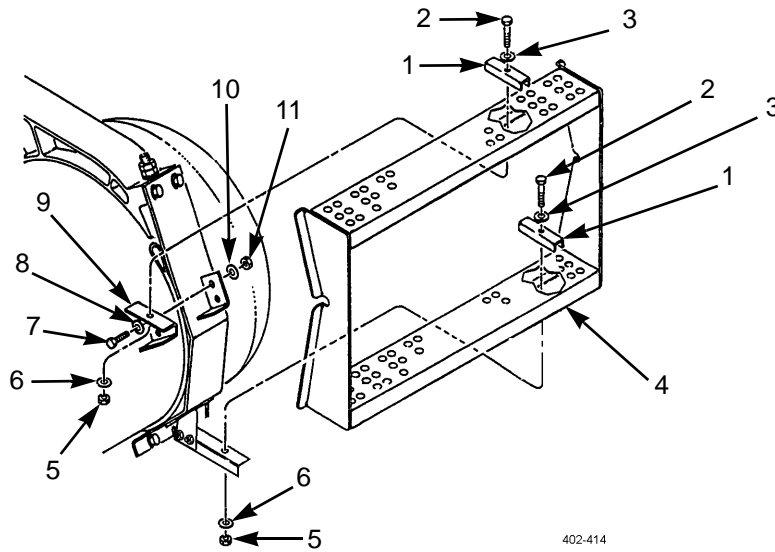


3. Install washer (18), bolt (17), washer (19), and nut (20).
4. Install bracket (15), two washers (12), two bolts (16), two washers (13), and two nuts (12).

INSTALLATION - CONTINUED



5. Install bracket (9), two washers (8), two bolts (7), two washers (10), and two new locknuts (11).
6. Repeat steps 2 through 5 for rear bracket assembly.
7. Install step assembly (4), four clamps (1), four washers (3), four bolts (2), four washers (6), and four new locknuts (5).



END OF WORK PACKAGE

REAR TIE DOWN REPLACEMENT**0162 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Nut, lock (P/N 23-09901-116) (8)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

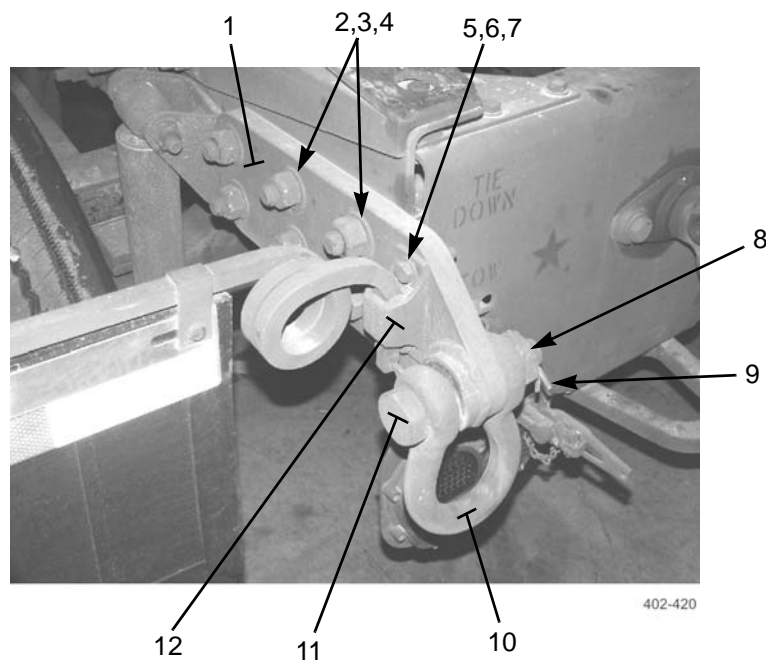
Mud flap assembly removed (WP 0167 00)

NOTE

Right- and left-rear tie downs are replaced the same way. Left-rear tie down is shown.

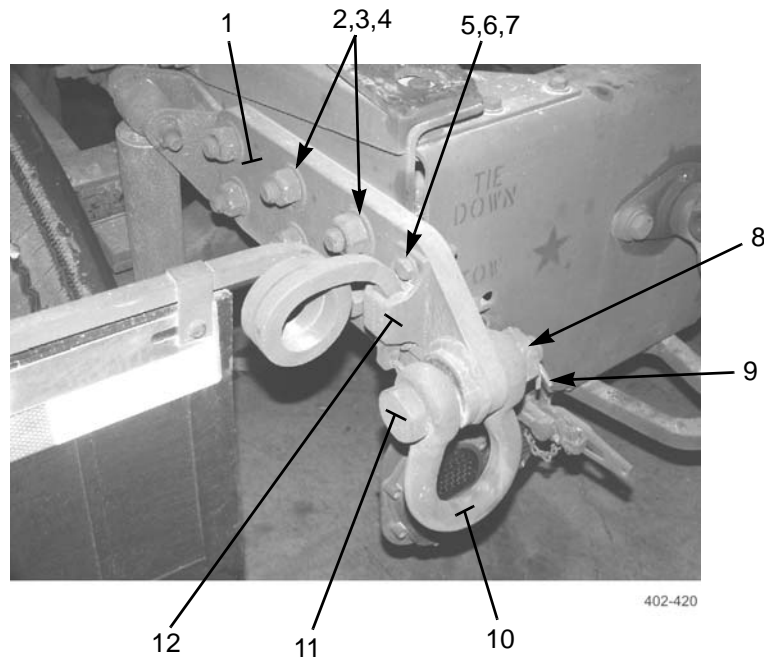
REMOVAL

1. Remove lock pin (9), nut (8), pin (11), and shackle (10), from tie down (1).
2. Remove two locknuts (5), four washers (6), two screws (7), and mud flap bracket (12) from tie down (1). Discard locknuts.
3. Remove six locknuts (2), 12 washers (3), six bolts (4) and tie down (1) from rear of vehicle. Discard locknuts.



REAR TIE DOWN REPLACEMENT - CONTINUED**0162 00****INSTALLATION**

1. Install tie down (1) to rear of vehicle with six bolts (4), 12 washers (3), and six new locknuts (2).
2. Install mud flap bracket (12) to tie down (1) with two screws (7), four washers (6), and two new locknuts (5).
3. Install shackle (10) to tie down (1) with pin (11), nut (8), and lock pin (9).



4. Install mud flap assembly (WP 0167 00).

END OF WORK PACKAGE

RIGHT REAR STEP REPLACEMENT

0163 00

THIS WORK PACKAGE COVERS

Disassembly, Assembly

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

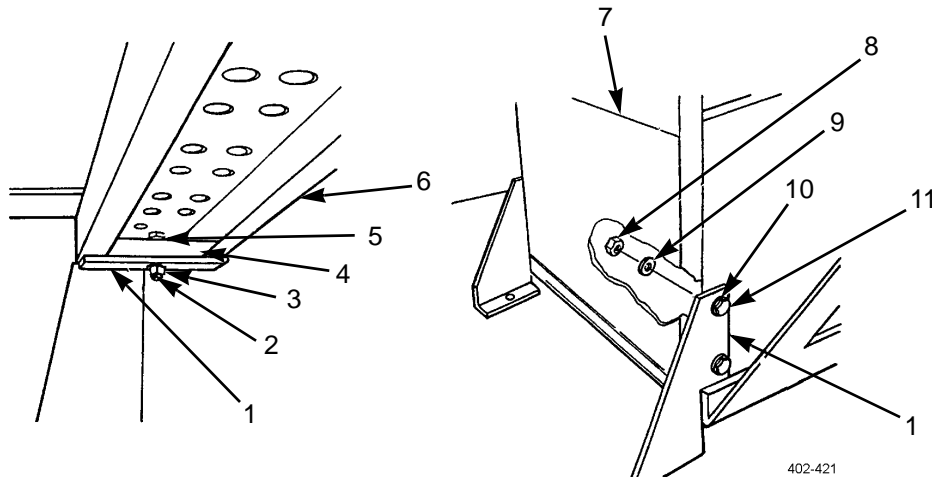
Materials/Parts

Nut, lock (P/N M45913/1-5CBB) (2)

Nut, lock (P/N M45913/1-8CG5C) (4)

REMOVAL

1. Remove two locknuts (2), two washers (3), two screws (5), two clamp bars (4), and step (6), from two mounting brackets (1). Discard locknuts.
2. Remove four locknuts (8), four washers (9), four screws (11), four washers (10), and two mounting brackets (1) from storage box (7). Discard locknuts.



INSTALLATION

1. Install two mounting brackets (1), four washers (10), four screws (11), four washers (9), and four new locknuts (8) on storage box (7).
2. Install step (6), two clamp bars (4), two screws (5), two washers (3), and two new locknuts (2) on two mounting brackets (1).

END OF WORK PACKAGE

LEFT STEP REPLACEMENT**0164 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Nut, lock (P/N M45913/1-5CBB) (2)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

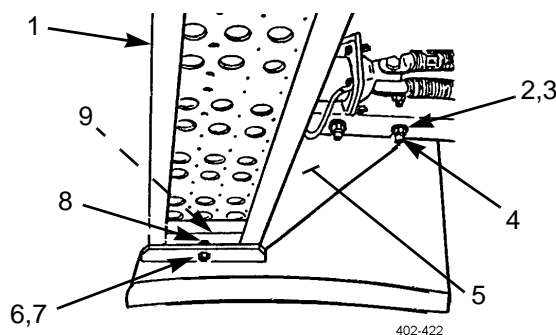
Battery box cover removed (TM 9-2320-303-10)

**WARNING**

DO NOT allow tools to come in contact with batteries. Electrical shock may occur.

REMOVAL

1. Remove two locknuts (6), four washers (7), two bolts (8), two clamps (9), and step (1) from brackets (5). Discard locknuts.
2. Remove four nuts (2), eight washers (3), four bolts (4), and brackets (5).

**INSTALLATION**

1. Install brackets (5) with eight washers (3), four bolts (4), and four nuts (2).
2. Install step (1) on brackets (5) with two clamps (9), two bolts (8), four washers (7), and two new locknuts (6).
3. Install battery box cover (TM 9-2320-303-10).

END OF WORK PACKAGE

LEFT SIDE PLATFORM REPLACEMENT**0165 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Nut, lock (P/N M45913/1-10CG5C) (4)

Tools and Special Tools

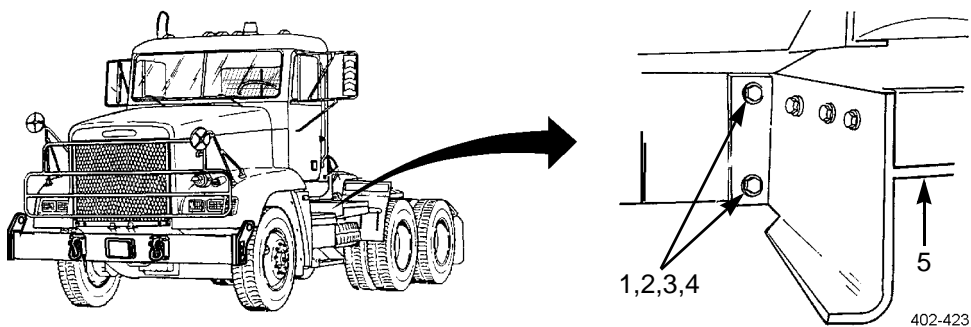
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Primary II air tank removed (WP 0130 00)

REMOVAL

Remove four locknuts (1), four washers (2), four screws (3), four washers (4), and left side platform (5). Discard locknuts.

**INSTALLATION**

1. Install left side platform (5), four washers (4), four screws (3), four washers (2), and four new locknuts (1).
2. Install primary II air tank (WP 0130 00).

END OF WORK PACKAGE

TAILLIGHT BRACKET REPLACEMENT**0166 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Nut, lock (P/N M45913/1-8CG5C) (2)

Equipment Condition

Rear blackout marker removed (WP 0074 00)

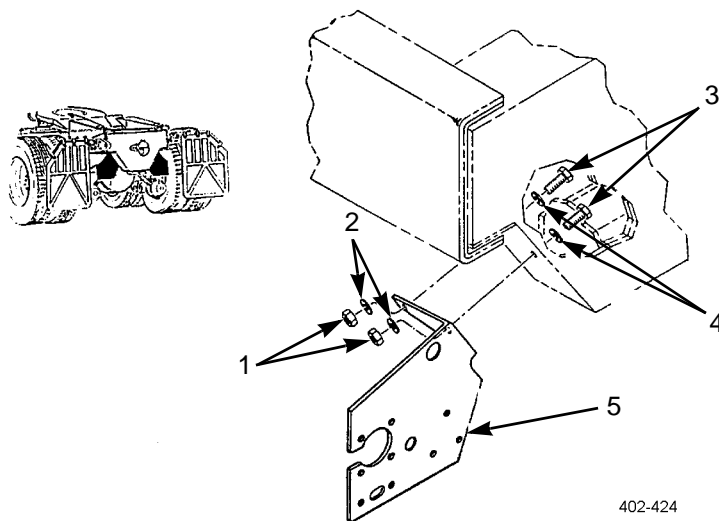
Taillight removed (WP 0081 00)

Rear gladhand removed (WP 0137 00)

REMOVAL**NOTE**

Procedure is the same for both sides of vehicle.

Remove two locknuts (1), two washers (2), bracket (5), two bolts (3), and two washers (4). Discard locknuts.

**INSTALLATION****NOTE**

Procedure is the same for both sides of vehicle.

1. Install two washers (4), two bolts (3), bracket (5), two washers (2), and two new locknuts (1).
2. Install rear blackout marker (WP 0074 00).

TAILLIGHT BRACKET REPLACEMENT - CONTINUED

0166 00

INSTALLATION - CONTINUED

3. Install rear gladhand (WP 0137 00).
4. Install taillight (WP 0081 00).

END OF WORK PACKAGE

MUD FLAP ASSEMBLY REPLACEMENT**0167 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)**Materials/Parts**

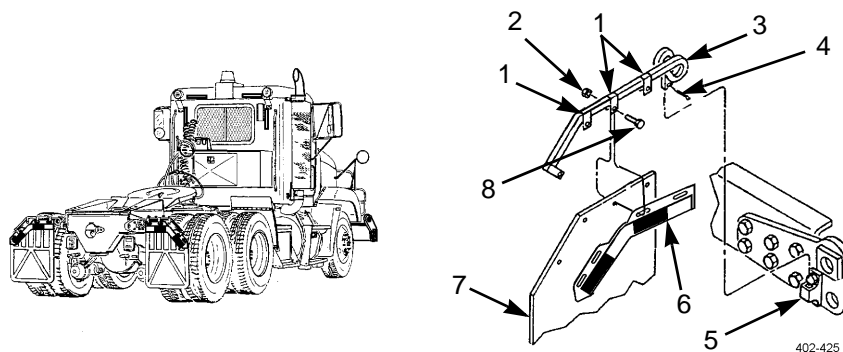
Nut, lock (P/N M45913/1-6CG5C) (4)

Pin, cotter (P/N MS24665-621)

REMOVAL**NOTE**

Procedure is the same for both sides.

1. Remove cotter pin (4) and mud flap hanger (3) from bracket (5). Discard cotter pin.
2. Remove four locknuts (2), four screws (8), mud flap (7), and reflective tape bracket (6). Discard locknuts.
3. Remove three clamps (1) from mud flap hanger (3).

**INSTALLATION****NOTE**

Procedure is the same for both sides.

1. Install three clamps (1) on mud flap hanger (3).
2. Position reflective tape bracket (6) on mud flap (7) and install four screws (8), and four new locknuts (2).
3. Install mud flap hanger (3) and new cotter pin (4) in bracket (5).

END OF WORK PACKAGE

PINTLE HOOK MAINTENANCE**0168 00****THIS WORK PACKAGE COVERS**

Removal, Disassembly, Assembly, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Grease, GAA (Item 23, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N XB-769) (2)

Pin, cotter (P/N XB-119-1)

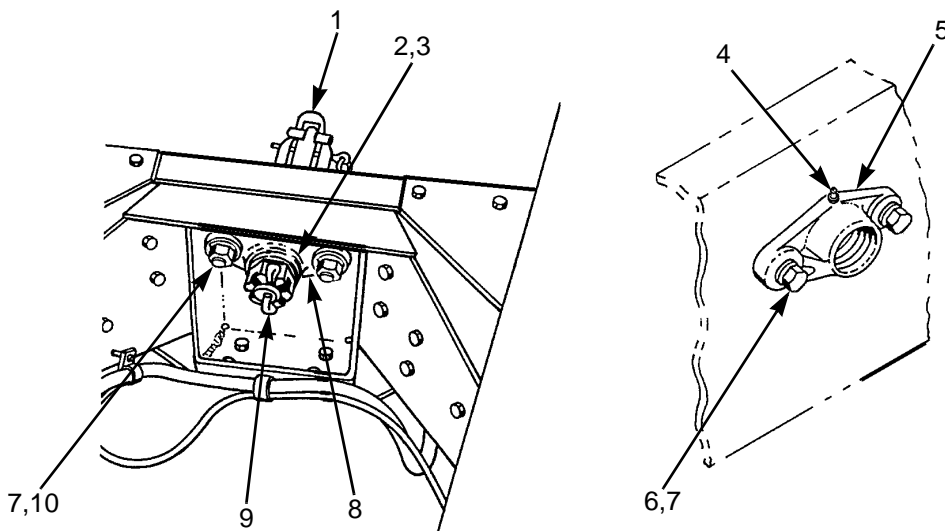
Pin, cotter (P/N XB-773)

References

WP 0024 00

REMOVAL

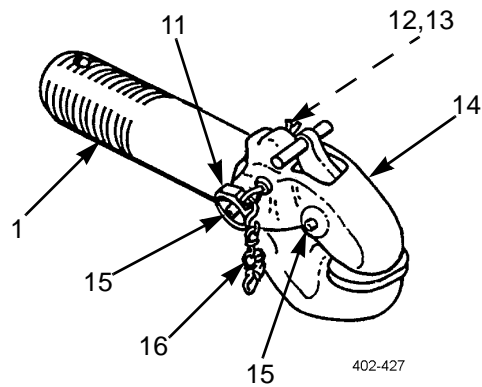
1. Remove cotter pin (9), castle nut (2), washer (3), and pintle hook (1) from vehicle. Discard cotter pin.
2. Remove two locknuts (10), washers (7), and inner bracket (8) from vehicle. Discard locknuts.
3. Remove two screws (6), washers (7), and outer bracket (5) from vehicle.
4. Remove two lubrication fittings (4) from inner and outer brackets (5 and 8).



402-426

DISASSEMBLY

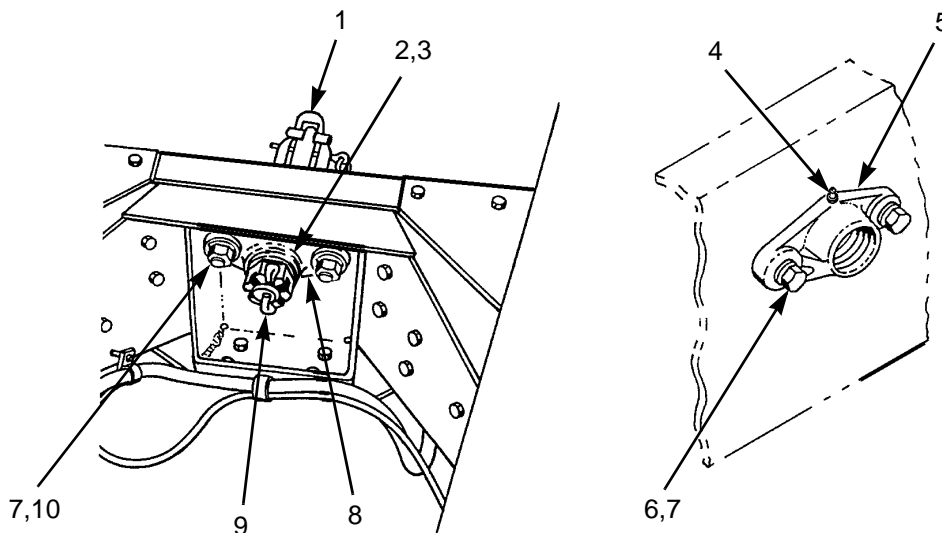
1. Remove cotter pin (12), castle nut (13), fluid passage bolt (11), and latch (14) from pintle hook (1). Discard cotter pin.
2. Remove two lubrication fittings (15) from latch (14).
3. Remove screw and chain assembly (16) from pintle hook (1).



ASSEMBLY

1. Install latch (14) on pintle hook (1) with fluid passage bolt (11), castle nut (13), and new cotter pin (12).
2. Install two lubrication fittings (15) on latch (14).
3. Install screw and chain assembly (16) on pintle hook (1).

INSTALLATION



1. Install two lubrication fittings (4) on inner and outer brackets (5 and 8).
2. Install outer bracket (5) on vehicle with two washers (7) and screws (6).

INSTALLATION - CONTINUED

3. Install inner bracket (8) on vehicle with two washers (7) and new locknuts (10).
4. Install pintle hook (1) on vehicle with washer (3) and castle nut (2).
5. Adjust castle nut (2) to allow pintle hook (4) to rotate freely.
6. Install new cotter pin (1) through castle nut (2).
7. Lubricate pintle hook (4) with GAA grease in accordance with Unit PMCS (WP 0024 00).

END OF WORK PACKAGE

TOWING BRACKET REPLACEMENT

0169 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

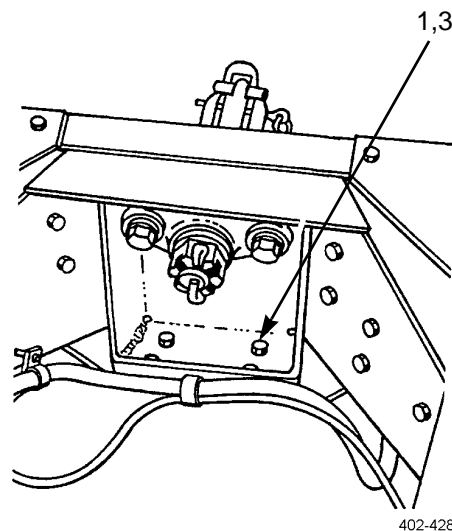
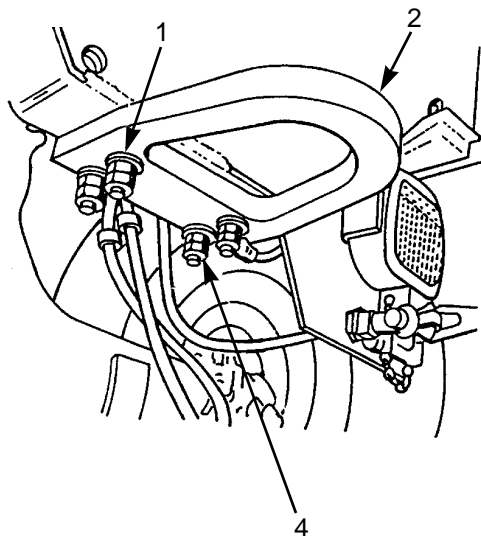
Nut, lock (P/N M45913/1-8CG5C) (8)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

Remove eight locknuts (4), eight washers (1), four bolts (3), and bracket (2). Discard locknuts.



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INSTALLATION

Install bracket (2), eight washers (1), four bolts (3), and eight new locknuts (4).

END OF WORK PACKAGE

FIFTH WHEEL ADJUSTMENT

0170 00

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

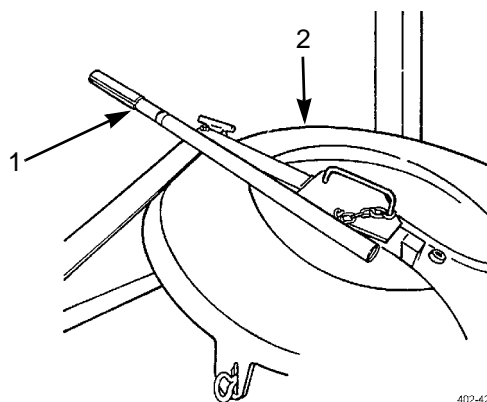
Tools and Special Tools - Continued

Gage, profile (Item 26, WP 0313 00)

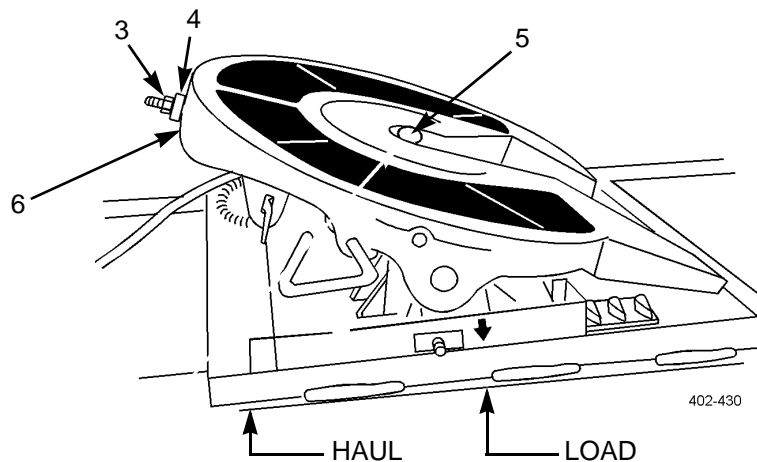
Tester, king pin lock (Item 100, WP 0313 00)

ADJUSTMENT

1. Install kingpin lock tester (1) on fifth wheel (2).



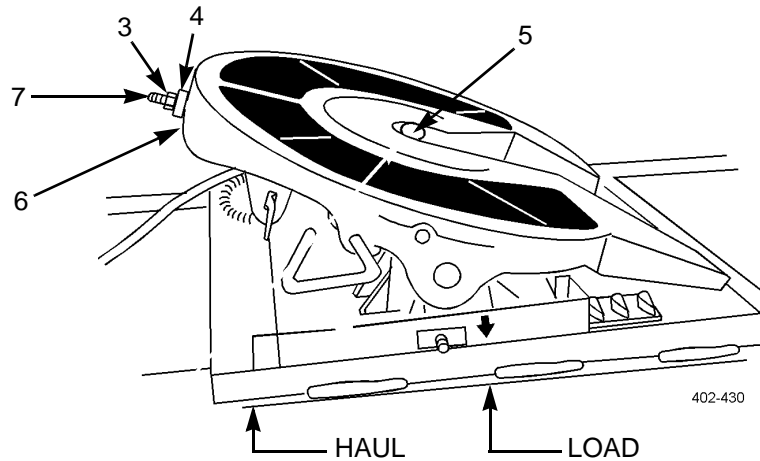
2. Close locks and insert profile gage (5).
3. Rotate rubber bushing (4) between adjustment nut (3) and casting (6).



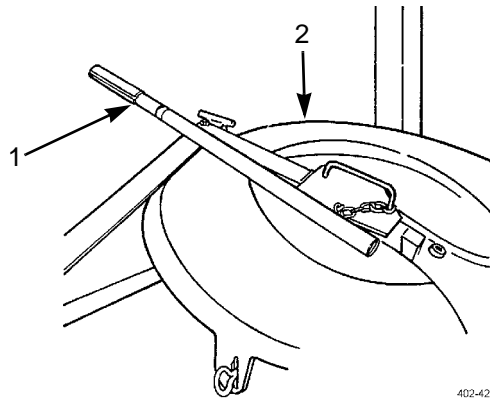
ADJUSTMENT - CONTINUED**NOTE**

Bushing should be snug, but able to rotate. If bushing does not rotate or rotates too freely, perform step 4.

4. If bushing (4) is too tight, rotate nut (3) on yoke shank (7) counterclockwise until bushing is snug. If bushing is loose, rotate nut clockwise until bushing is snug, but still rotates.



5. Verify proper adjustment by locking and unlocking fifth wheel (2) several times with lock tester (1).



6. Remove profile gage (5) and kingpin lock tester (1).

END OF WORK PACKAGE

FIFTH WHEEL REAR TILT STOPS REPLACEMENT

0170 01

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

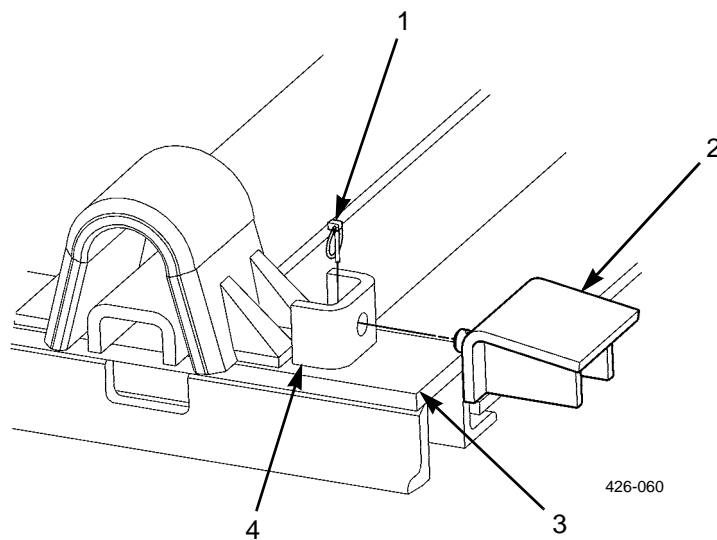
Tool kit, general mechanic's (Item 102, WP 0313 00)

NOTE

If equipped, fifth wheel rear tilt stops must be removed prior to loading a tractor/trailer combination onto a Roll-on/Roll-off (RO/RO) ship.

REMOVAL

1. Remove clip pin (1) and tilt stop (2) from back plate (4) on slide bracket (3).
2. Repeat step 1 for opposite side.

**INSTALLATION**

1. Position tilt stop (2) on back plate (4) and install clip pin (1).
2. Repeat step 1 for opposite side.

END OF WORK PACKAGE

SPARE WHEEL HOIST REPLACEMENT

0171 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing (Item 16, WP 0312 00)
Nut, lock (P/N M45913/1-10CG5C) (4)

Equipment Condition

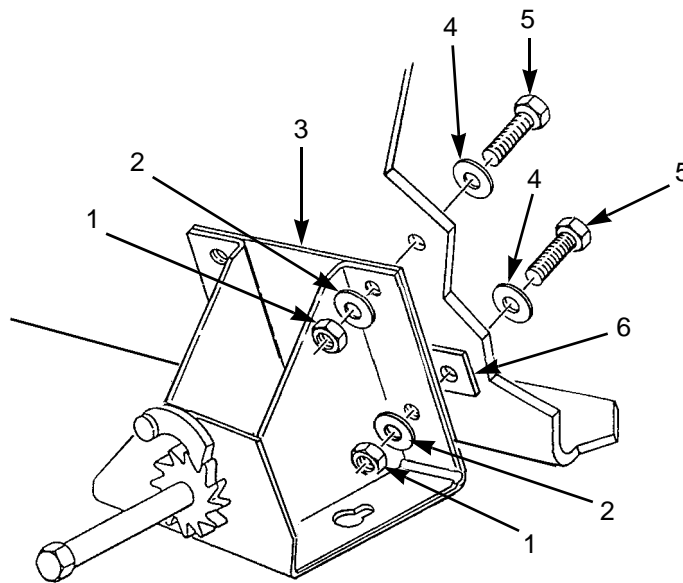
Spare tire removed (TM 9-2320-303-10)
Primary II air tank removed (WP 0130 00)

NOTE

Although slightly different in configuration, all spare wheel hoists are removed and installed in the same manner.

REMOVAL

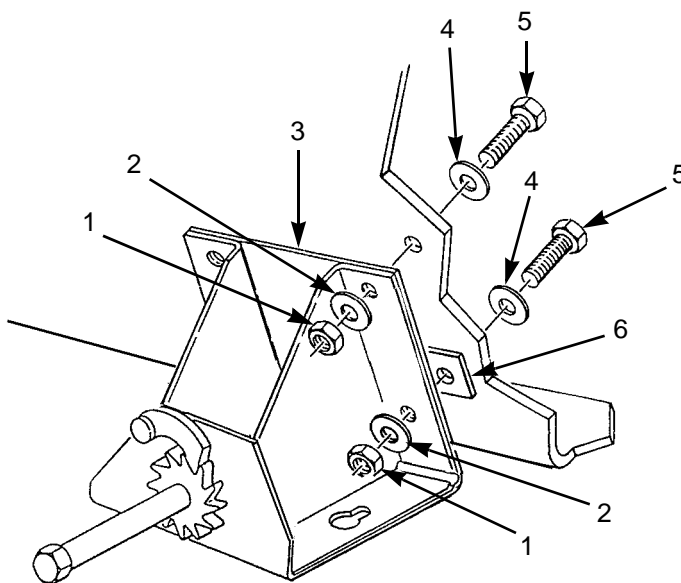
Remove four locknuts (1), four washers (2), four bolts (5), four washers (4), two spacers (6), and spare wheel hoist (3). Discard locknuts.



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SPARE WHEEL HOIST REPLACEMENT - CONTINUED**0171 00****INSTALLATION**

1. Install two washers (4) and two bolts (5).
2. Coat two spacers (6) with sealing compound on both sides and install on two bolts (5).
3. Install spare wheel hoist (3), two washers (4), two bolts (5), four washers (2), and four new locknuts (1).



402-431

4. Install primary II air tank (WP 0130 00).
5. Install spare tire (TM 9-2320-303-10).

END OF WORK PACKAGE

REAR PLATFORM REPLACEMENT

0172 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

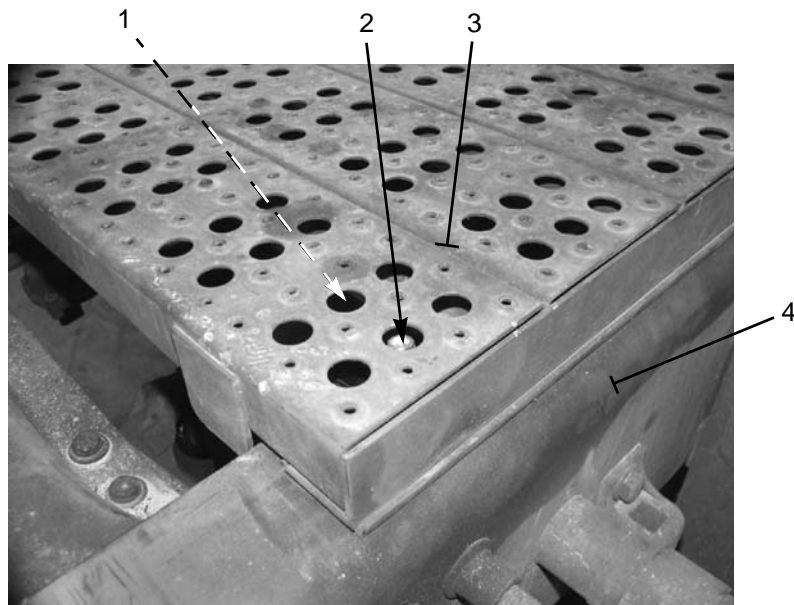
Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

1. At top of rear platform (3), loosen, but do not remove, locknut (2) on each of four clip (1) assemblies.

NOTE

- Clip assembly at left-front corner of rear platform will be removed when rear platform is removed.
 - Rotate each clip assembly 90 degrees to free clip assembly from rear platform as clip assemblies are removed.
2. Slide three clip (1) assemblies away from frame (4) and remove three clip assemblies from vehicle.
 3. Lift rear platform (3) from frame (4) and remove rear platform and one remaining clip (1) assembly from vehicle.

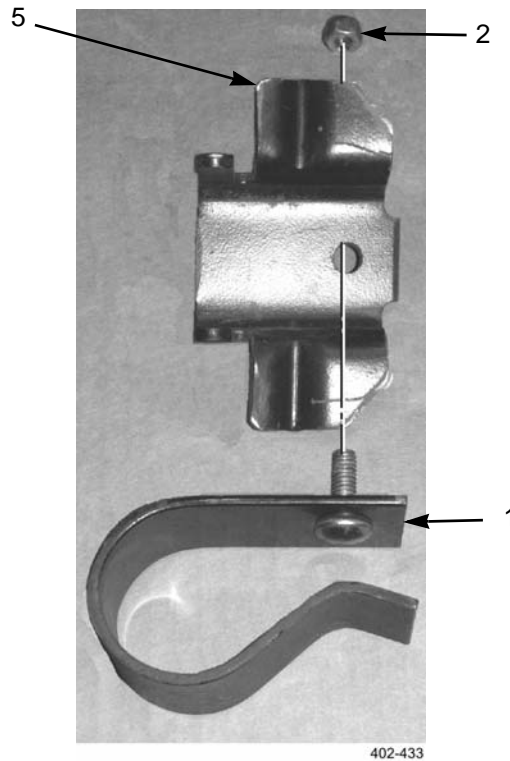


402-432

REMOVAL - CONTINUED**NOTE**

Perform step 4 for each of four clip assemblies.

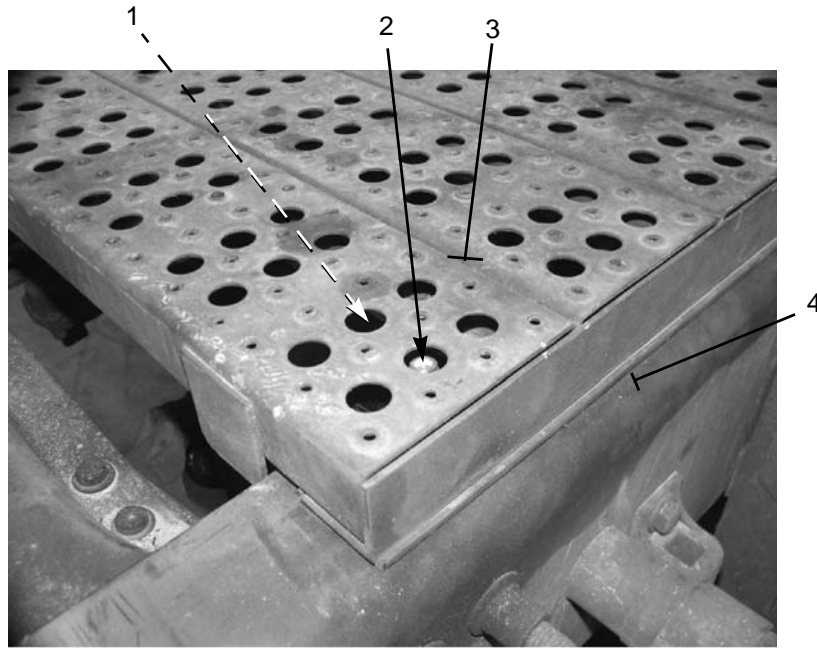
4. Remove locknut (2) and clip (1) from bracket (5).

**INSTALLATION****NOTE**

Perform step 1 for each of four clip assemblies.

1. Install clip (1) to bracket (5) with locknut (2). Do not tighten locknut.
2. Position one clip (1) assembly to right-front corner of rear platform (3) and position rear platform to frame (4) of vehicle.
3. Position remaining three clip (1) assemblies to frame (4) and rear platform (3).
4. Tighten each of four locknuts (2).

INSTALLATION - CONTINUED



402-432

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Nut, lock (P/N 23-10340-125) (14)

Personnel Required

Two

Equipment Condition

Collision warning system (CWS) antenna assembly removed (WP 0220 00)

Engine hood assembly removed (WP 0178 00)

REMOVAL

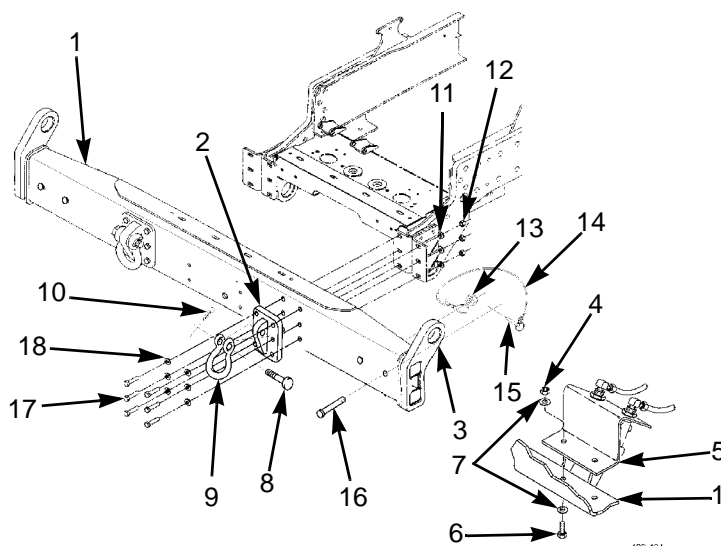
1. Remove two locknuts (4), four washers (7), two bolts (6), and bracket (5) from front bumper (1). Discard locknuts.



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

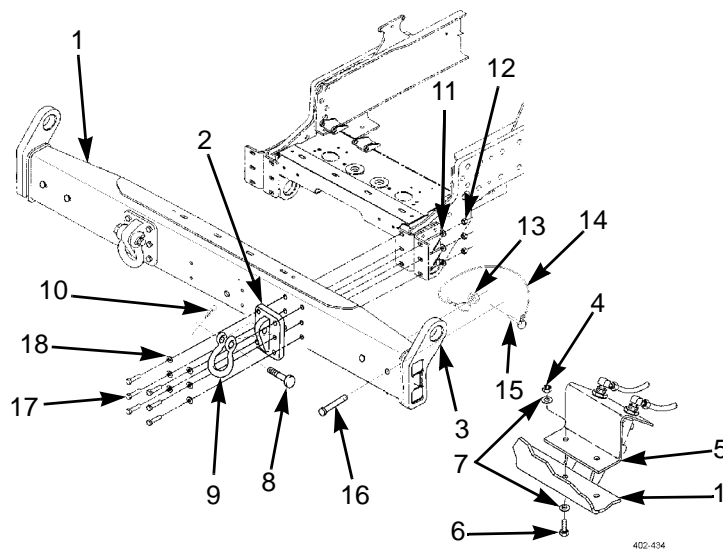
2. Attach suitable lifting device to front bumper (1) using bumper extensions (3) as attaching points.
3. For M915A4, remove lock pin (10). Unscrew bolt (8) and remove hook (9) from each tow bracket (2).



REMOVAL - CONTINUED**NOTE**

Note bolt size and location to aid in installation.

4. Remove 12 locknuts (12), washers (11), bolts (17), washers (18), two tow brackets (2), and front bumper (1) from vehicle. Discard locknuts.
5. Lower bumper (1) to ground and disconnect lifting device.
6. Remove four spring pins (15), straight pins (16), and two bumper extensions (3) from front bumper (1).
7. Remove two nuts (13) and four spring pin cables (14) from front bumper (1).

**INSTALLATION**

1. Install four spring pin cables (14) to front bumper (1) with two nuts (13).
2. Install two bumper extensions (3) on front bumper (1) with four straight pins (16), and spring pins (15).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

3. Attach suitable lifting device to front bumper (1) using bumper extensions (3) as attaching points.
4. Install front bumper (1) on vehicle with two tow brackets (2), 12 washers (18), bolts (17), washers (11), and new locknuts (12). Tighten locknuts to 180-200 lb-ft (244-271 Nm).
5. For M915A4, install hook (9), bolt (8), and lock pin (10) on each tow bracket (2).
6. Install bracket (5) on front bumper (1) with four washers (7), screws (6), and new locknuts (4).

FRONT BUMPER REPLACEMENT - CONTINUED

0173 00

INSTALLATION - CONTINUED

7. Install collision warning system (CWS) antenna assembly (WP 0220 00).
8. Install engine hood assembly (WP 0178 00).

END OF WORK PACKAGE

FRONT SHOCK ABSORBER REPLACEMENT (M915A4R2)

0173 01

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 102, WP 0313 00)
Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

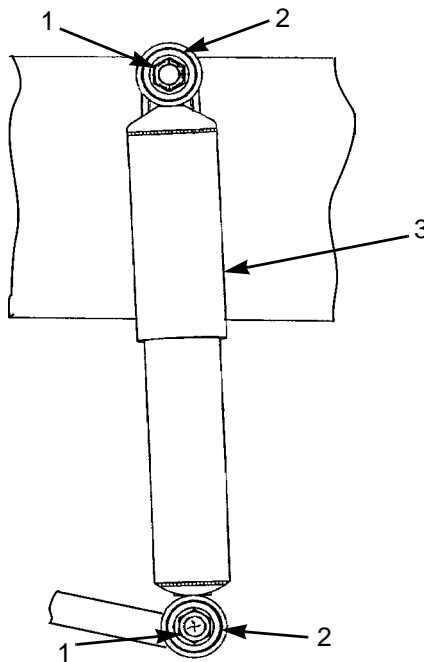
Materials/Parts

Nut, lock (P/N M45913/2-12CG5C) (2)

REMOVAL**NOTE**

Note position of shock absorber and bolts to aid in installation.

Remove two locknuts (1), washers (2), and shock absorber (3) from front of vehicle. Discard locknuts.



426-053

INSTALLATION

Install shock absorber (3) on vehicle with two washers (2) and new locknuts (1). Tighten locknuts to 120-180 lb-ft (163-244 Nm).

END OF WORK PACKAGE

BRUSH GUARD REPLACEMENT

0174 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Nut, lock (P/N M45913/1-5CBB) (6)

Nut, lock (P/N SR250000SOH) (2)

Equipment Conditions

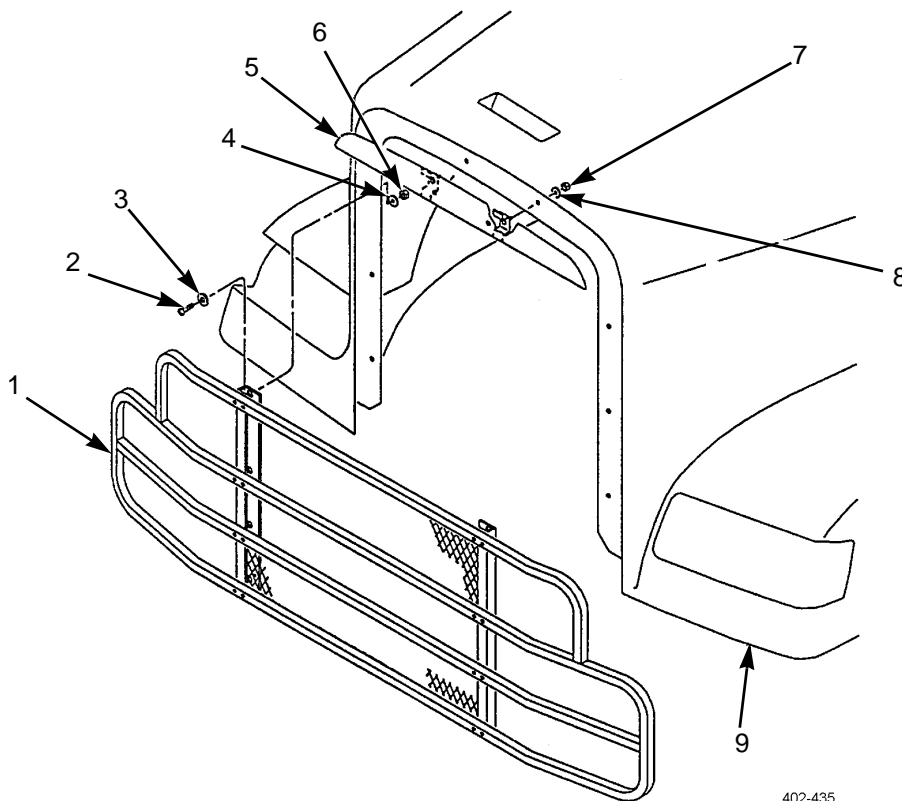
Hood opened (TM 9-2320-303-10)

REMOVAL

NOTE

Note location of mounting holes used in removal to aid in installation.

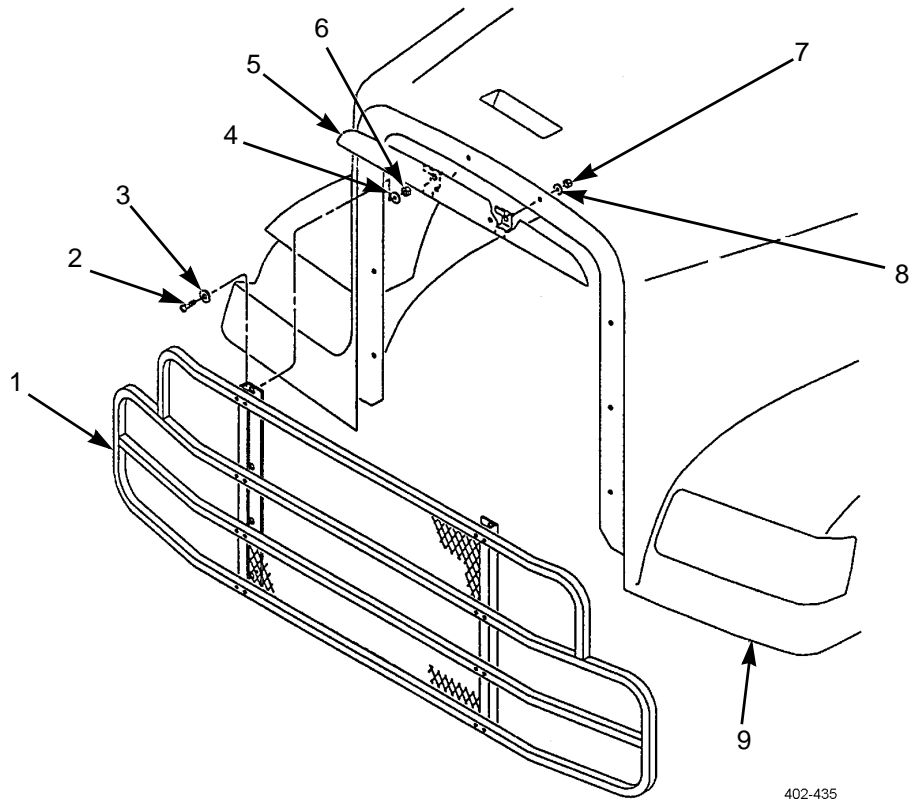
1. Remove six locknuts (6), six washers (4), six screws (2), six washers (3), and brush guard (1). Discard locknuts.
2. Remove two locknuts (7), two washers (8), and top plate (5) from hood (9). Discard locknuts.



402-435

BRUSH GUARD REPLACEMENT - CONTINUED**0174 00****INSTALLATION**

1. Install top plate (5), two washers (8), and two new locknuts (7) on hood (9).
2. Install brush guard (1), six washers (3), six screws (2), six washers (4), and six new locknuts (6).



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END OF WORK PACKAGE

CAB DOOR ADJUSTMENT

0175 00

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools - Continued

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 0-200 lb-in (Item 108, WP 0313 00)

Personnel Required

Two

Materials/Parts

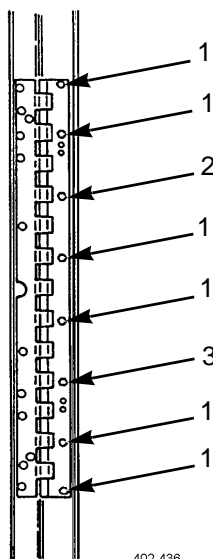
Screw, self-tapping (P/N 23-11036-810) (6)

ADJUSTMENT

NOTE

If performing cab door adjustment following repair or replacement, perform steps 3 through 19.

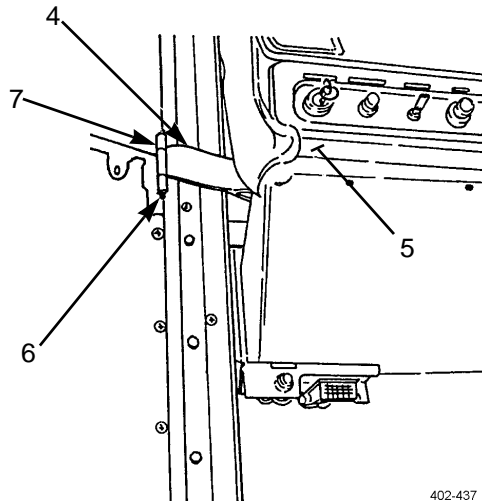
1. Remove six self-tapping screws (1). Leave two adjusting screws (2 and 3) in place. Discard self-tapping screws.



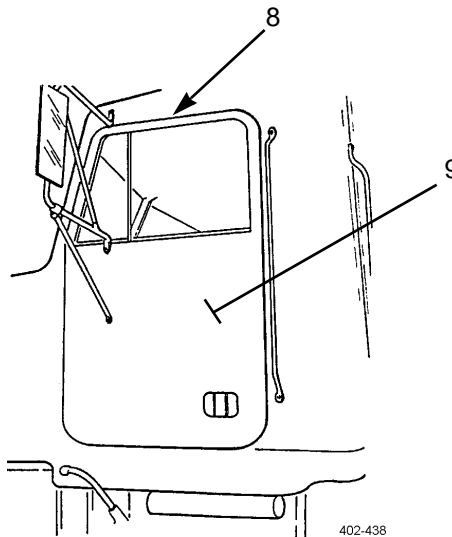
402-436

ADJUSTMENT - CONTINUED

2. Remove capnut (6) and socket head screw (7) from door check arm (4).
3. Push door check arm (4) toward dashboard (5).



4. With cab door (9) closed, measure distance between top and bottom edges of cab door and door frame (8). Measurements must be equal within 3/32 in. (2.38 mm).

**NOTE**

Perform steps 5 and 6 only if required.

5. To adjust cab door (9), loosen two adjusting screws (2 and 3) just enough to allow movement of cab door up and down to required measurement. Tighten two adjusting screws.

ADJUSTMENT - CONTINUED

6. Repeat steps 4 and 5 until cab door (9) is properly adjusted.

NOTE

Cab door is fully closed when you hear two clicks of door latch, and should not have to be slammed shut. If it is necessary to slam cab door shut, door must be adjusted.

7. With cab door (9) fully closed, check in-out position of top of cab door and flange (10) at hinge (11). Cab door must be flush $\pm 1/16$ in. (1.58 mm).

NOTE

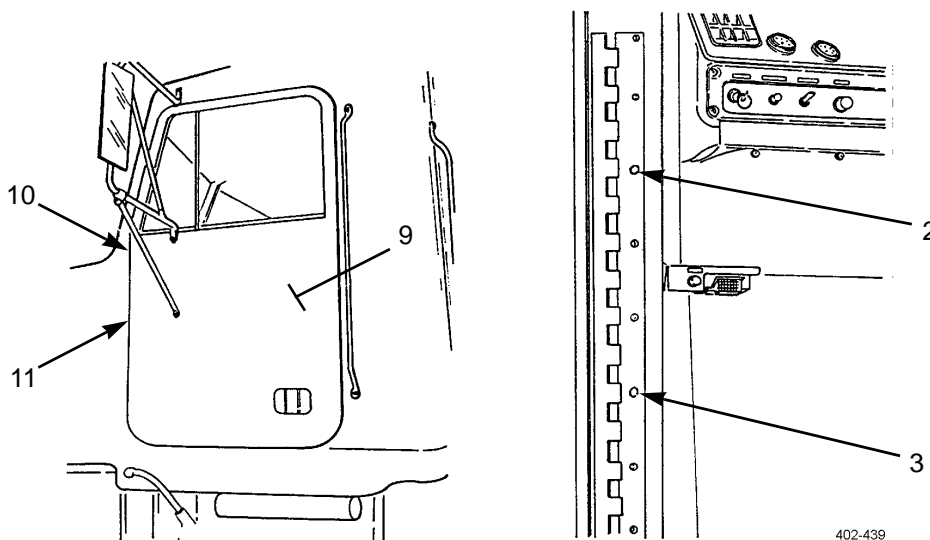
Perform steps 8 and 9 only if required.

8. To adjust top of cab door (9), loosen adjusting screw (2) and move cab door in or out to required measurement. Tighten adjusting screw.
9. Repeat steps 7 and 8 until top of cab door (9) is properly adjusted.
10. With cab door (9) fully closed, check in-out position of bottom of cab door and flange (10) at hinge (11). Cab door must be flush $\pm 1/16$ in. (1.58 mm).

NOTE

Perform steps 11 and 12 only if required.

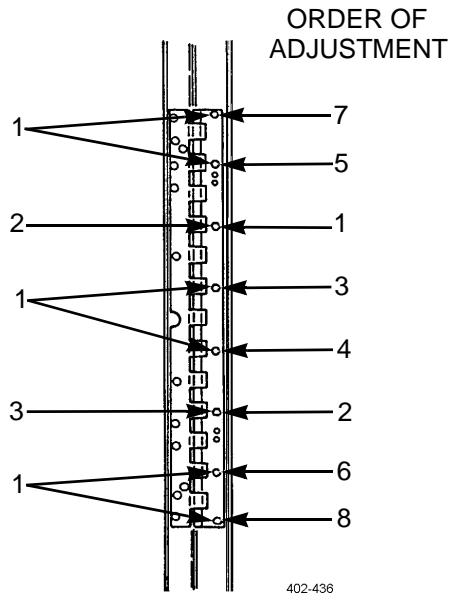
11. To adjust bottom of cab door (9), loosen adjusting screw (3) and move cab door in or out to required measurement. Tighten adjusting screw.



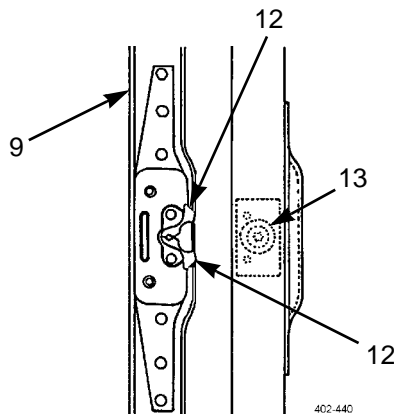
12. Repeat steps 10 and 11 until bottom of cab door (9) is properly adjusted.

ADJUSTMENT - CONTINUED

13. Install six new self-tapping screws (1) and tighten screws and two adjusting screws (2 and 3) in order shown to 120 lb-in. (1360 Ncm).



14. Close cab door (9) to within 2 in. of striker pin (13) and look to see if door latch jaws (12) will be centered on striker pin.



15. Loosen torx screw (15) and add or remove shims (14) as necessary to center striker pin (13) and door latch jaws (12).

NOTE

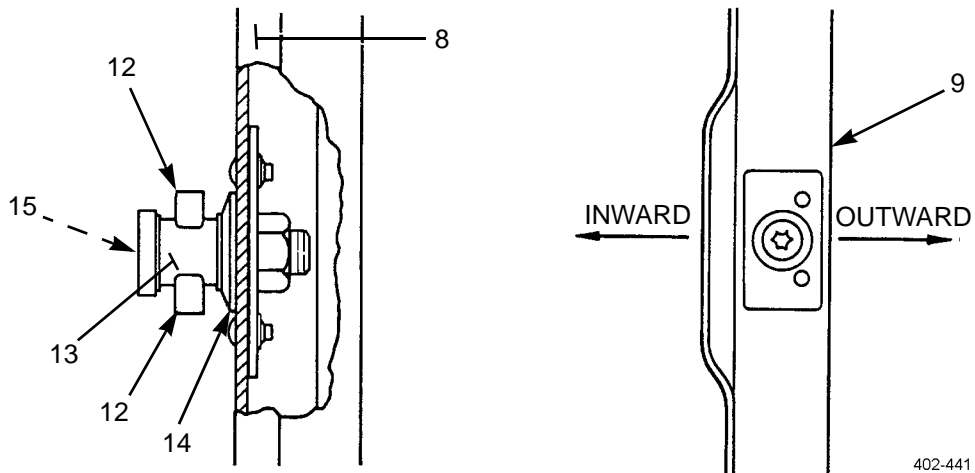
- Steps 16 through 19 must be performed from inside and outside of cab.
 - Repeat step 16 until door closes fully without difficulty.
16. Fully close cab door (9). If cab door was difficult to close or would not close, open cab door, loosen torx screw (15), and move striker pin (13) inward.
 17. Tighten torx screw (15) to 50 lb-ft (68 Nm).

ADJUSTMENT - CONTINUED

NOTE

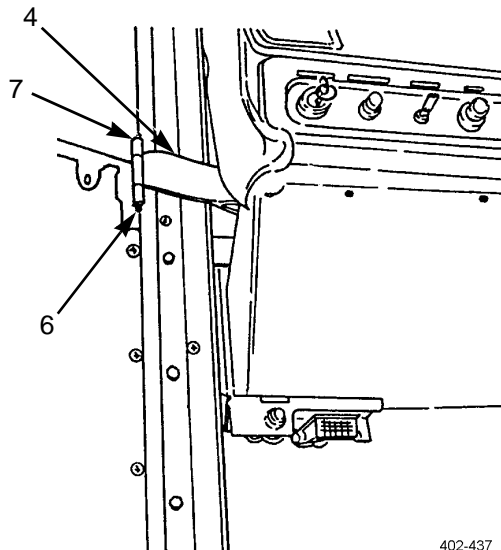
Repeat step 18 until door opens without difficulty.

18. Open cab door (9). If cab door was difficult to open or would not open, loosen torx screw (15) and move striker pin (13) outward.
19. Tighten torx screw (15) to 50 lb-ft. (68 Nm).



402-441

20. Move door check arm (4) back into position.
21. Install socket head screw (7) and capnut (6) to door check arm (4).



402-437

END OF WORK PACKAGE

CAB LINERS REPLACEMENT

0176 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Equipment Condition

Seat belts removed (WP 0187 00)

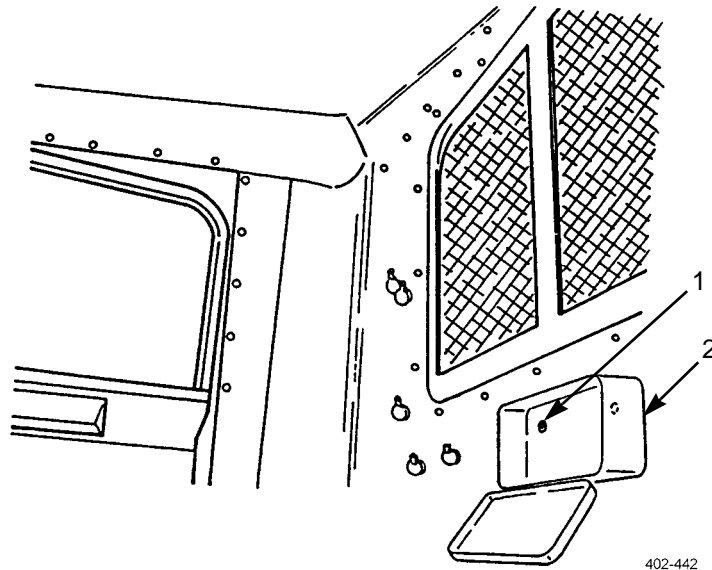
Anti-lock brake system (ABS) electronic control unit removed (WP 0104 00)

M16 rifle mounting bracket removed (WP 0208 00)

Transmission ECU and mounting plate removed (WP 0110 00)

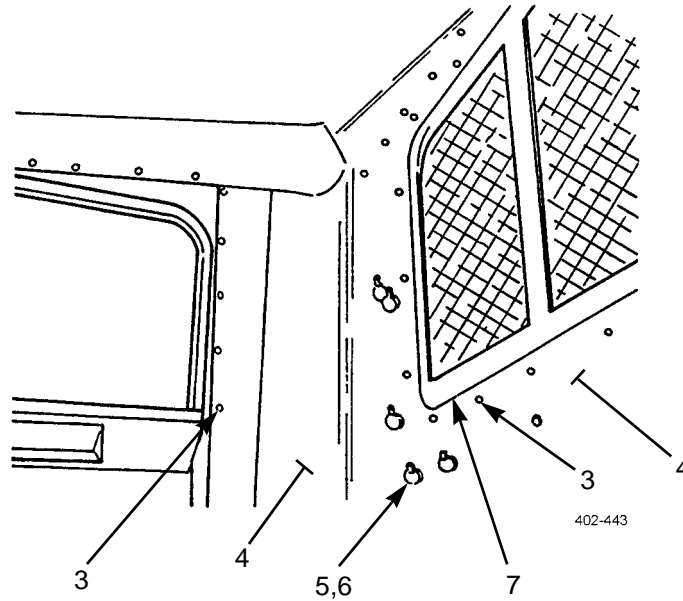
REMOVAL

1. Remove screws (1) and first aid box (2).

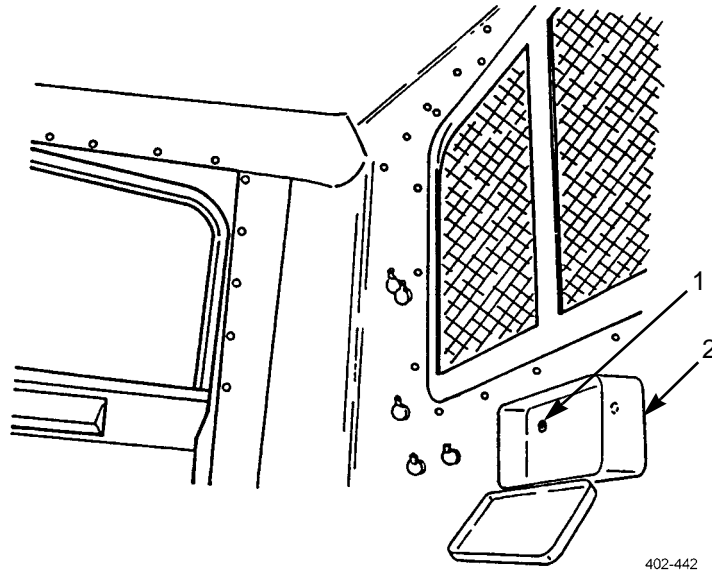


REMOVAL - CONTINUED

2. Remove screws (5) and five clamps (6).
3. Remove trim (7).
4. Remove screws (3) and cab liners (4).

**INSTALLATION**

1. Install cab liners (4) and screws (3).
2. Install trim (7).
3. Install clamps (6) and screws (5).
4. Install first aid box (2) and screws (1).

INSTALLATION - CONTINUED

5. Install seat belts (WP 0187 00).
6. Install anti-lock brake system (ABS) electronic control unit (WP 0104 00).
7. Install transmission mounting plate and ECU (WP 0110 00).
8. Install M16 rifle mounting bracket (WP 0208 00).

END OF WORK PACKAGE

HEAD LINERS REPLACEMENT

0177 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Tools and Special Tools - Continued

Wrench set, socket attachment (Item 114, WP 0313 00)

Equipment Condition

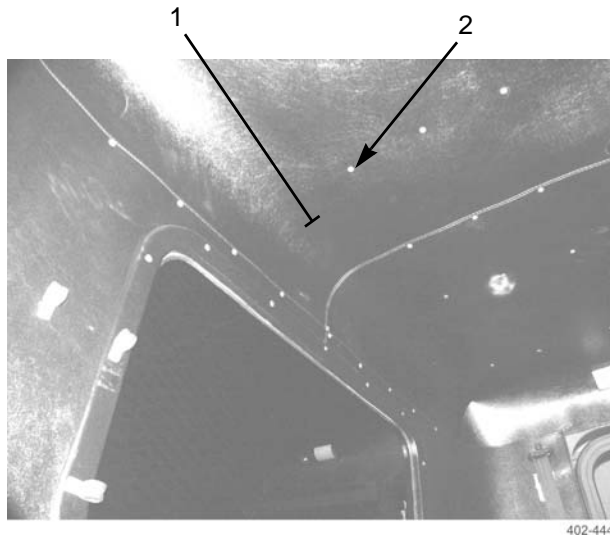
Interior light(s) removed (WP 0086 00)

REMOVAL

NOTE

Note overlap position of liner sections to aid in installation.

Remove screws (2) and head liners (1).



402-444

INSTALLATION

1. Install head liners (1) and screws (2).
2. Install interior light(s) (WP 0086 00).

END OF WORK PACKAGE

ENGINE HOOD ASSEMBLY REPLACEMENT

0178 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Personnel Required

Four

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

WP 0180 00

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Nut, lock (P/N MS51988-7) (2)

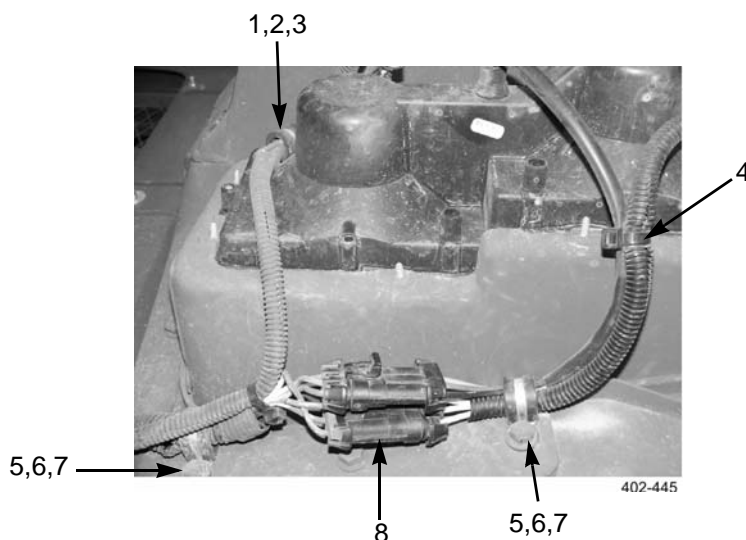
Equipment Condition

Hood opened (TM 9-2320-303-10)

REMOVAL**NOTE**

- Note location of tiedown straps to aid in installation.
- Disconnections/connections are same on both sides except for one additional connector on left side. Right side is illustrated.

1. Remove tiedown straps (4).
2. Remove two bolts (5), washers (6), and clamps (7).
3. Remove screw (1), washer (2), and clamp (3).
4. Disconnect connectors (8) (five on left side, four on right side).



REMOVAL - CONTINUED



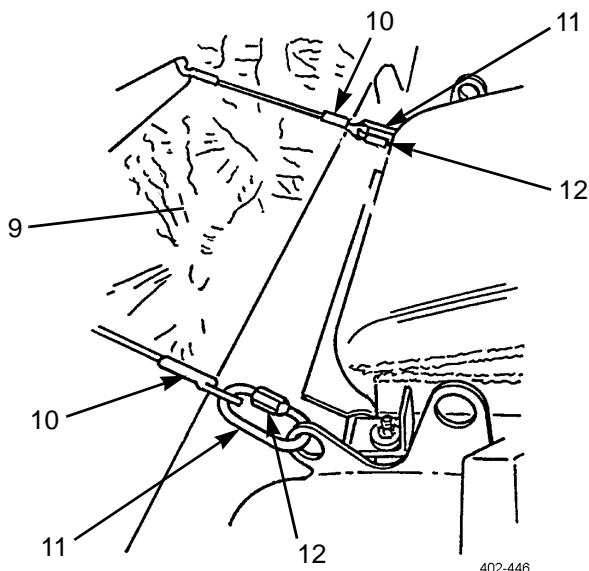
WARNING

When removing tilt assist cables, hood must be supported to prevent damage to hood or injury to personnel.

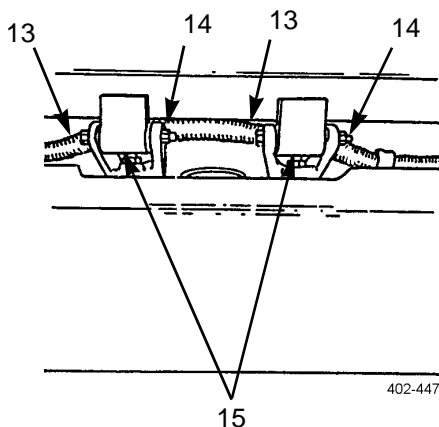
NOTE

If equipped, disconnect fog light connector on each side.

5. Support center of hood (9).
6. Open two chain links (11) by loosening two nuts (12) and remove two tilt assist cables (10) from chain links. Rotate cables, hood spring, and crossmember downwards against top of hood.



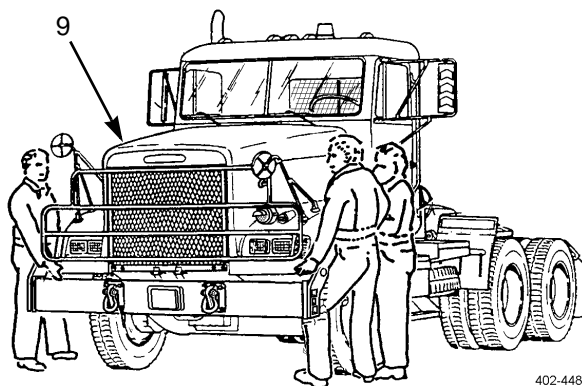
7. Close hood (9) (TM 9-2320-303-10).
8. Remove two locknuts (14) and bolts (13) from hinges (15). Discard locknuts.



REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury to personnel.

9. Using four personnel, lift hood (9) approximately 4 in (10.2 cm) and walk toward front of vehicle until hood clears vehicle.

**INSTALLATION****WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury to personnel.

1. Using four personnel, install hood (9) to vehicle aligning hinge bracket on hood with bracket on front bumper.
2. Install two bolts (13) and new locknuts (14) to hinges (15).
3. When installing tilt assist cable, hood must be supported to prevent damage to hood or injury to personnel.
4. Open and support hood (9) (TM 9-2320-303-10).
5. Install two tilt assist cables (10) in two chain links (11) and close chain links by tightening two nuts (12).

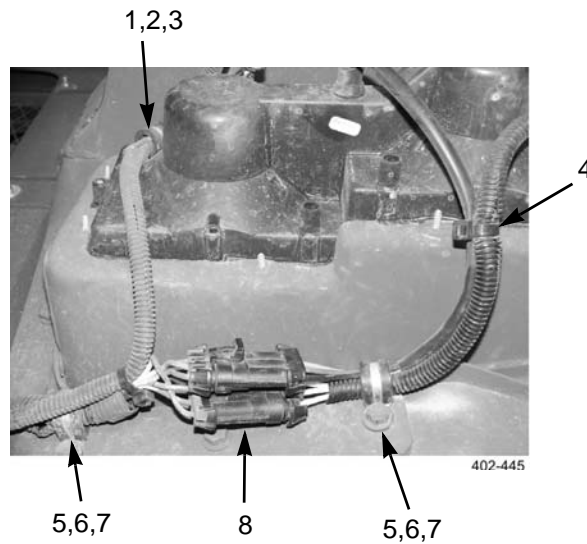
INSTALLATION - CONTINUED

6. Position harnesses and connect connectors (8) (five on left side, four on right side).

NOTE

If equipped, connect fog light connector on each side.

7. Install screw (1), washer (2), and clamp (3).
8. Install two bolts (5), washers (6), and clamps (7).
9. Install tie down straps (4).



10. Close hood (TM 9-2320-303-10).
11. Perform hood adjustment (WP 0180 00).

END OF WORK PACKAGE

HOOD ASSEMBLY REPAIR**0179 00****THIS WORK PACKAGE COVERS**

Disassembly, Assembly

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Nut, lock (P/N 23-09336-005) (4)

Nut, lock (P/N M45913/1-5CG5C)

Nut, lock (P/N M45913/1-8CG5C)

Equipment Condition

Headlights removed (WP 0079 00)

Blackout drive lights removed (WP 0100 00)

Blackout marker lights removed (WP 0101 00)

Spotter mirrors removed (WP 0198 00)

Brush guard removed (WP 0174 00)

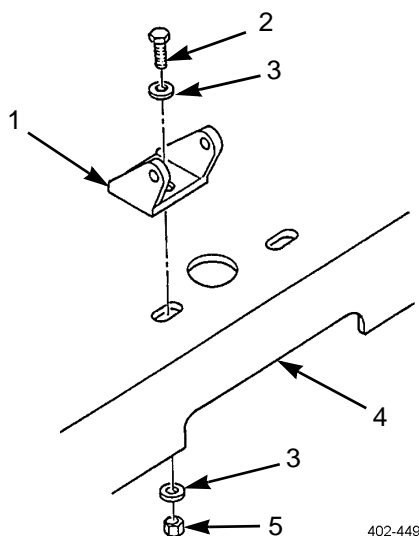
Engine hood assembly removed (WP 0178 00)

Hood liners removed (WP 0181 00)

DISASSEMBLY**NOTE**

Perform step 2 for each of two hinges. Hinges may be equipped with shims. Note quantity of shims at each hinge for installation.

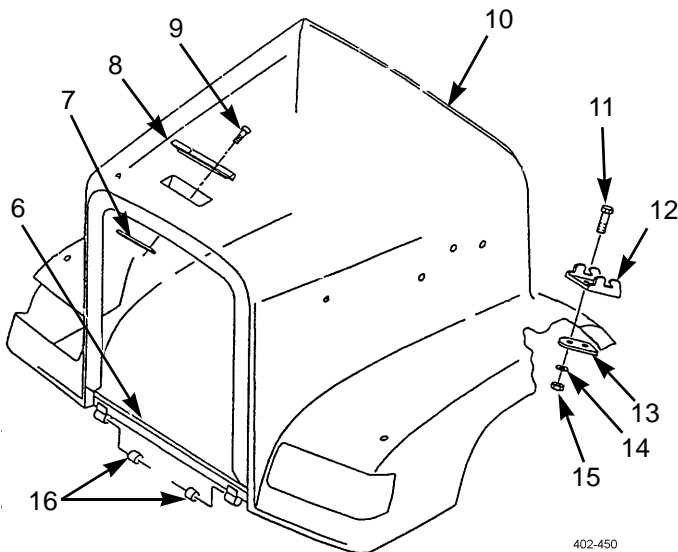
1. Remove locknut (5), two washers (3), screw (2), hinge (1), and shims, if equipped, from front crossmember (4). Discard locknut.



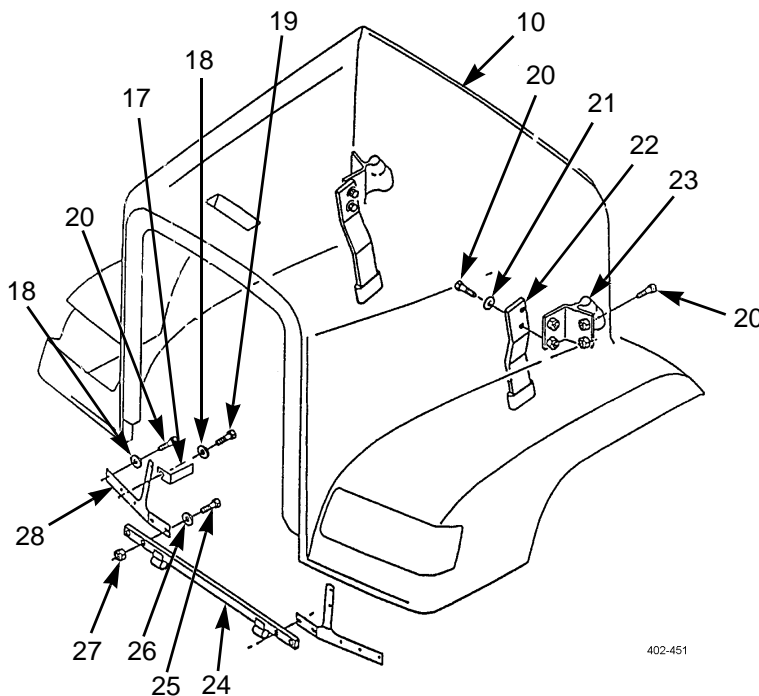
402-449

DISASSEMBLY - CONTINUED

2. Remove two screws (9), backing plate (7), and handle (8) from hood (10).
3. Remove two locknuts (15), washers (14), backing plate (13), two screws (11), and latch bracket (12) from each side of hood (10). Discard locknuts.
4. Remove two bushings (16) from crosstie (6).

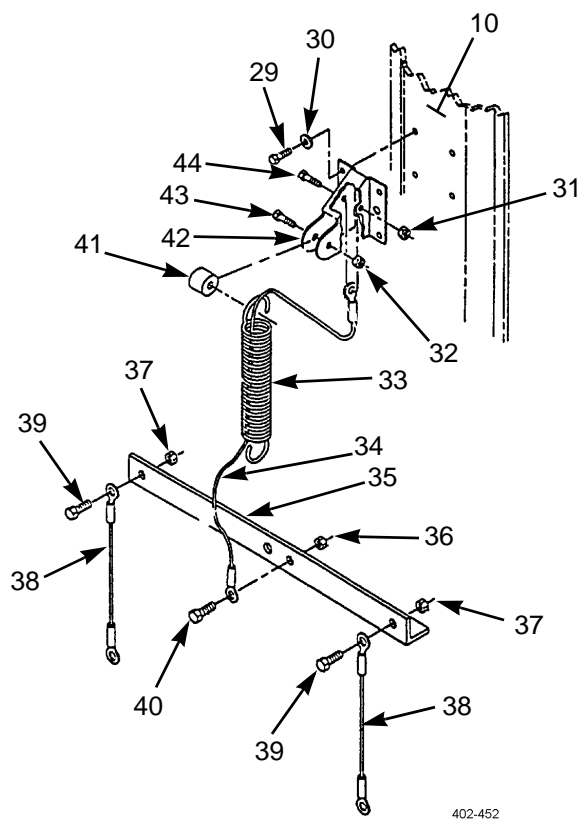


5. Remove four locknuts (27), screws (25), washers (26), and crosstie (24). Discard locknuts.
6. Remove four screws (19), washers (18), bracket (17), and crosstie plate (28) from each side of hood (10).
7. Remove four screws (20), two washers (21), hood guide (22), and mount (23) from each side of hood (10).



DISASSEMBLY - CONTINUED

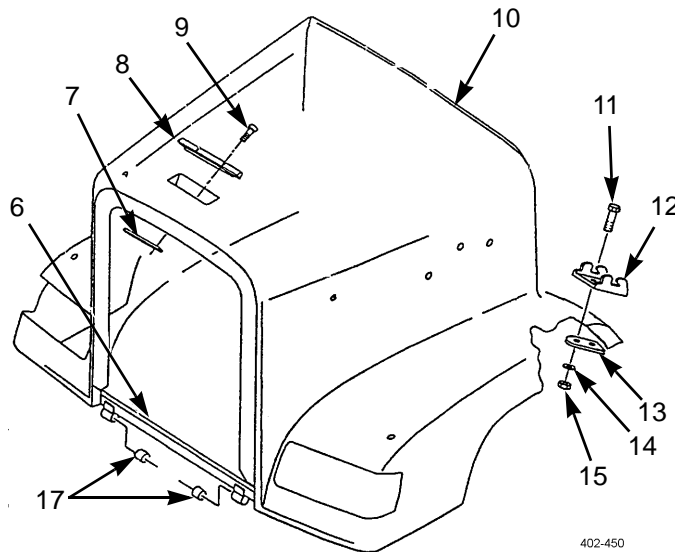
8. Remove four screws (29), washers (30), and bracket (42) from hood (10).
9. Remove spring (33), locknut (36), screw (40), cable (34), two locknuts (37), screws (39), and two cables (38) from yoke (35). Discard locknuts.
10. Remove locknut (31), screw (44), and cable (34) from bracket (42). Discard locknut.
11. Remove locknut (32), screw (43), spring (33), and spacer (41) from bracket (42). Discard locknut.

**ASSEMBLY**

1. Install spacer (41) and spring (33) on bracket (42) with screw (43) and new locknut (32).
2. Feed cable (34) through spring (33) and install on bracket (42) with screw (44) and new locknut (31).
3. Install cable (34) and two cables (38) on yoke (35) with screw (40) and new locknut (36), two screws (39), and new locknuts (37). Install spring (33) to yoke.
4. Install bracket (42) on hood (10) with four washers (30) and screws (29).
5. Install mount (23) on hood guide (22) on each side of hood (10) with two washers (21) and four screws (20).
6. Install crosstie plate (28) and bracket (17) on each side of hood (10) with four washers (18) and screws (19).
7. Install crosstie (24) on hood (10) with four washers (26), screws (25), and new locknuts (27).

ASSEMBLY - CONTINUED

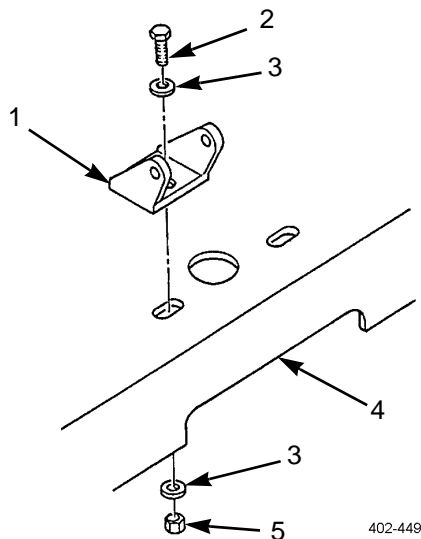
8. Install two bushings (16) in crosstie (6).
9. Install latch bracket (12) and backing plate (13) to each side of hood (10) with two screws (11), washers (14), and new locknuts (15).
10. Install handle (8) and backing plate (7) on hood (10) with two screws (9).



NOTE

Perform step 11 for each of two hinges.

11. Install shims, if equipped, and hinge (1) on front crossmember (4) with screw (2), two washers (3), and new locknut (5).



HOOD ASSEMBLY REPAIR - CONTINUED

0179 00**ASSEMBLY - CONTINUED**

12. Install hood liners (WP 0181 00).
13. Install engine hood assembly (WP 0178 00).
14. Install brush guard (WP 0174 00).
15. Install spotter mirrors (WP 0198 00).
16. Install blackout drive lights (WP 0100 00).
17. Install blackout marker lights (WP 0101 00).
18. Install headlights (WP 0079 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Adjustment Check, Adjustment

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Bar, wrecking (Item 4, WP 0313 00)

Wrench, torque, 0-300 lb-in (Item 109, WP 0313 00)

Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Nut, lock (P/N M45913/1-8CG5C) (6)

Shim(s) (P/N 17-10320-001)

Personnel Required

Two

References

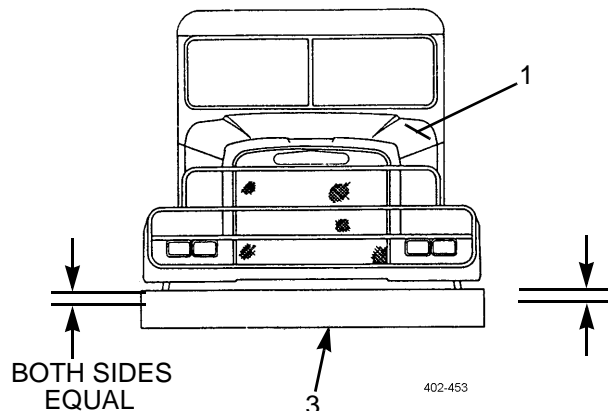
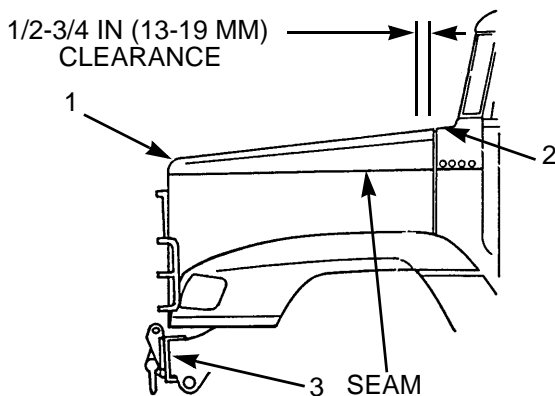
TM 9-2320-303-10

ADJUSTMENT CHECK

NOTE

Perform steps 1 through 3 to determine if hood adjustment is necessary.

1. Measure and note gap between rear edge of hood (1) and cowl (2) at seam and at 8 in (203 mm) below seam. Gap should be 1/2-3/4 in (13-19 mm).
2. Check that front of hood (1) is centered with bumper (3). Check that space between top edge of bumper (3) and lower edge of hood (1) is equal at both ends.
3. Ensure that hood (1) is not touching any components attached to frame. If any components are touching hood, identify and correct problem, and repeat steps 1 and 2.



402-453

ADJUSTMENT

1. Tilt hood (1) to fully open position (TM 9-2320-303-10).

NOTE

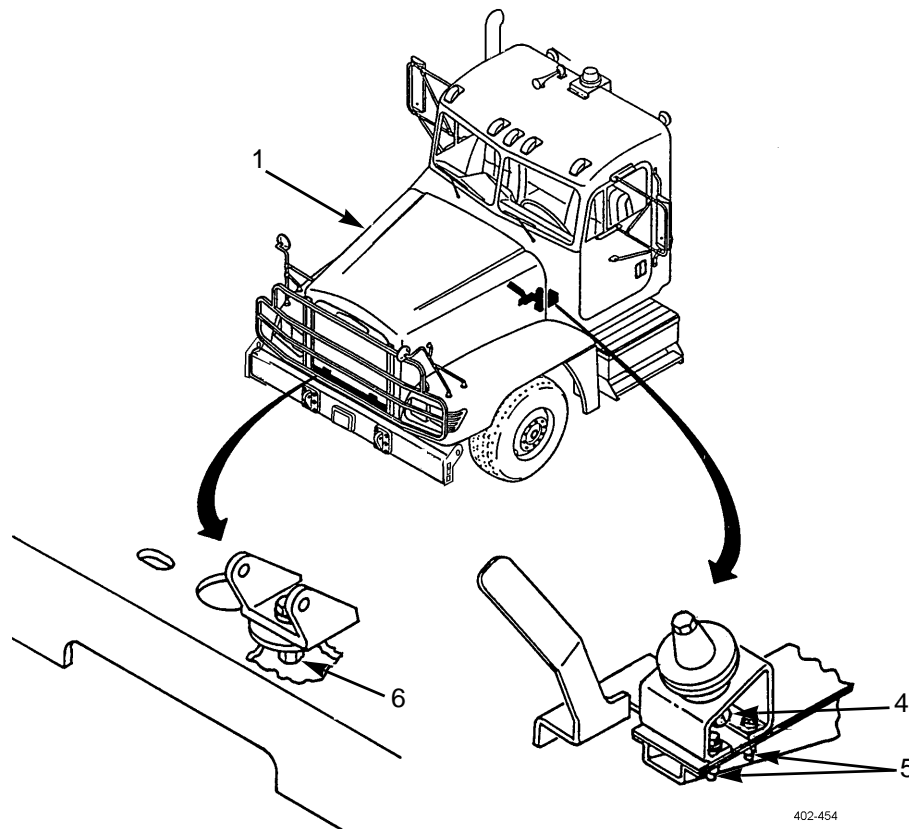
Repeat steps 2 and 3 for both sides of vehicle.

2. Loosen four locknuts (5) just enough to allow hood (1) to slide forward and backward for adjustment.
3. Loosen locknut (4) just enough to allow hood (1) to slide side-to-side for adjustment.

NOTE

- In step 4, locknut must be kept tight enough for brackets to remain stationary despite pulling force of hood tilt assist springs.
- Repeat step 4 for both nuts.

4. Loosen locknut (6) just enough to allow hood (1) to slide for adjustment.



402-454

NOTE

Prior to performing step 5, ensure that hood is centered and that components do not touch under hood when hood is lowered.

5. Close hood (1) and fasten two hood latches (7).

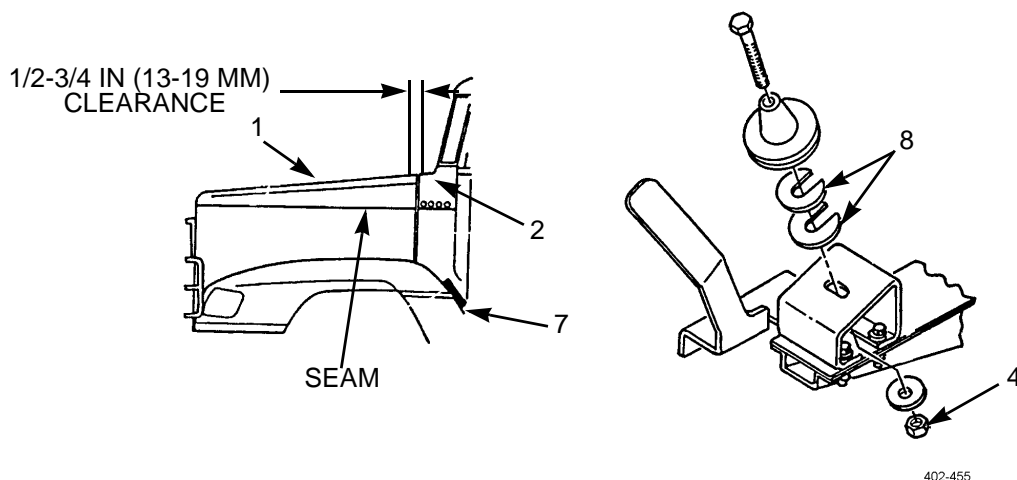
ADJUSTMENT- CONTINUED

6. Measure gap between hood (1) and cowl (2) 8 in (203 mm) below seam on both sides. Gap should be 1/2-3/4 in (13-19 mm). If gap is incorrect, move hood (1) forward or backward until gap is correct on both sides.
7. Check seams on both sides of hood (1) and cowl (2) for alignment. If seams are not aligned, note distance between seams.

NOTE

When performing step 8, use care not to disturb adjustment performed in step 6.

8. Tilt hood (1) to fully open position.
9. Loosen locknut (4) just enough to allow installation or removal of spacers (8), as necessary.
10. Install or remove spacers (8) to raise or lower hood (1) to align seams.
11. Close hood (1) and repeat steps 7 through 10 until seam is aligned.

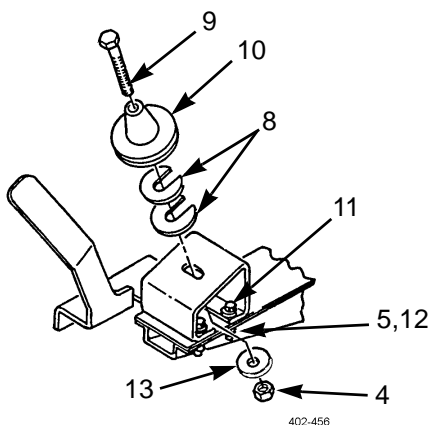


402-455

NOTE

Perform steps 12 through 20 only if all spacers have been removed and seam is still not in alignment.

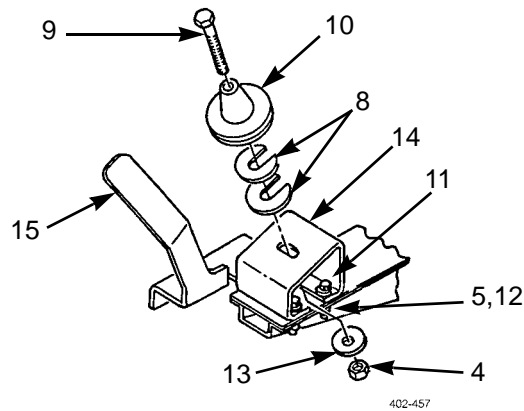
12. Remove locknut (4), washer (13), bolt (9), and locator (10). Discard locknut.
13. Remove four locknuts (5), washers (12), and screws (11). Discard locknuts.



402-456

ADJUSTMENT- CONTINUED

14. Remove hood guide (15) from under locator bracket (14). Install hood guide on top of locator bracket.
15. Install four screws (11), washers (12), and new locknuts (5) just tight enough to allow forward or backward adjustment.
16. Install locator (10), bolt (9), washer (13), and new locknut (4) just tight enough to allow for installation of spacers (8).
17. Repeat steps 8 through 11 until seam alignment is attained.
18. Tighten locknut (4) just enough to allow side-to-side movement for adjustment.

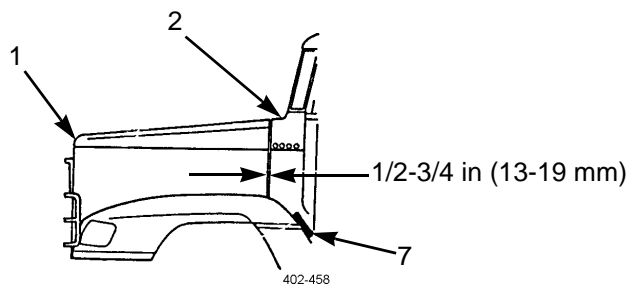


19. Repeat steps 9 through 18 for opposite side, if necessary.
20. Repeat steps 5 and 6.

NOTE

Perform step 21 only if required.

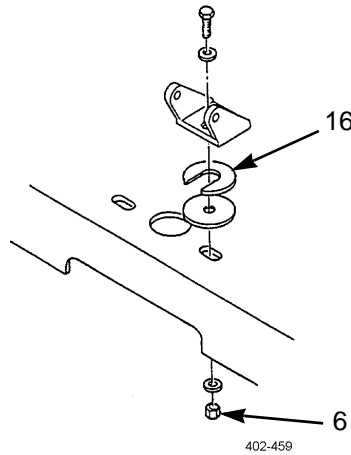
21. Close hood (1) and fasten two hood latches (7).
22. Measure and note gap between rear edge of hood (1) and cowl (2) at 1 in (25.4 mm) below seam and at 12 in (305 mm) below seam. Gap should be 1/2-3/4 in (13-19 mm).



NOTE

- Perform steps 23 through 25 if gap is not correct.
 - Repeat step 23 for both nuts.
23. Loosen locknut (6) just enough to allow for installation or removal of spacers (16).

ADJUSTMENT- CONTINUED



NOTE

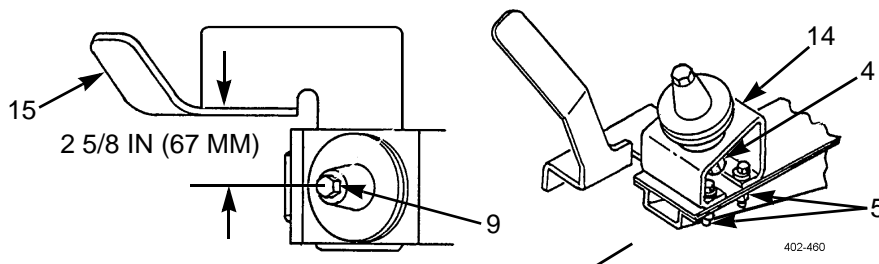
When performing step 24, amount of spacers must be equal under both hood mounting brackets. DO NOT use more than 3/4 in (19 mm) of spacers.

24. Using pry bar, raise front of hood (1) enough to insert or remove spacers (16) as needed to make gap between hood and cowl (2) equal, as measured in step 22.
25. Repeat step 22.
26. Tighten two locknuts (6) to 85 lb-ft (115 Nm).

NOTE

When performing step 27, be extremely careful to prevent movement of locator brackets (14).

27. Carefully tilt hood (1) to fully open position.
28. Measure distance between centerline of bolt (9) and outboard face of hood guide (15). Distance must be 2-5/8 in (67 mm). If necessary, move hood guide to obtain correct measurement.
29. Tighten four locknuts (5) to 178 lb-in (20 Nm).
30. Tighten locknut (4) to 70 lb-ft (95 Nm).



31. Repeat steps 29 and 30 for opposite side.

END OF WORK PACKAGE

HOOD LINER REPLACEMENT

0181 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Drill, electric, portable (Item 20, WP 0313 00)

Drill set, twist (Item 21, WP 0313 00)

Materials/Parts

Tape, double-sided (Item 43, WP 0312 00)

Materials/Parts - Continued

Tape, duct (Item 44, WP 0312 00)

Nut, lock (P/N M45913/1-8CG5C) (26)

Screw, 1/4-20x1 in (10)

Screw, self-tapping, 1/4-20x3/4 in (6)

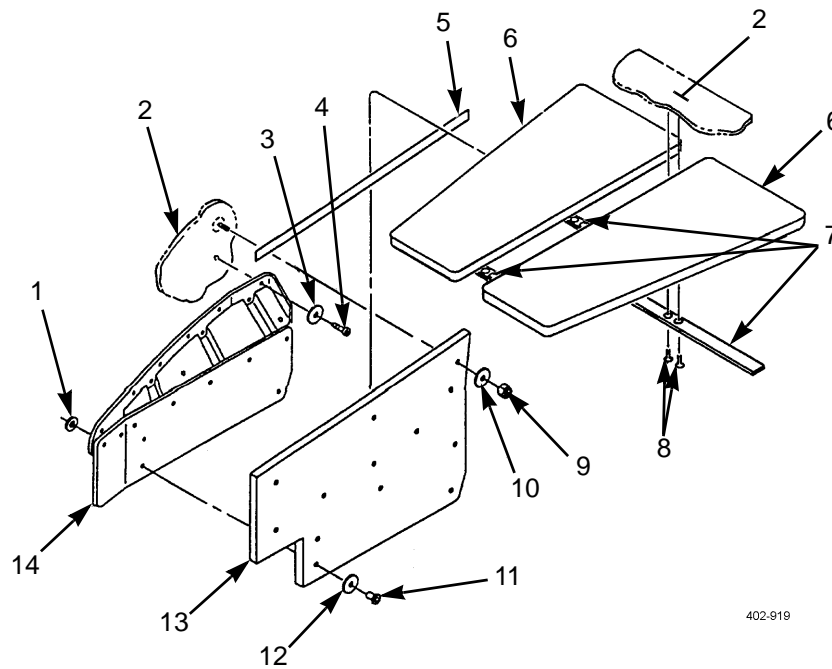
Washer, flat 1/4 in (10)

Equipment Condition

Engine hood assembly removed (WP 0178 00)

HOOD LINER REPLACEMENT- CONTINUED**0181 00****REMOVAL**

1. Cut or remove duct tape (5) between two top liners (6) and side liners (13).
2. Remove six rivets (8), three support straps (7), and two top liners (6) from hood (2). Discard rivets.
3. Remove eight locknuts (9), washers (10), five rivets (11), washers (1 and 12), and side liners (13) from hood (2). Discard locknuts, washers, and rivets.
4. Remove 10 screws (4), washers (3), and inner fender (14) from hood (2).
5. Repeat steps 3 and 4 for liner and inner fender on opposite side.



402-919

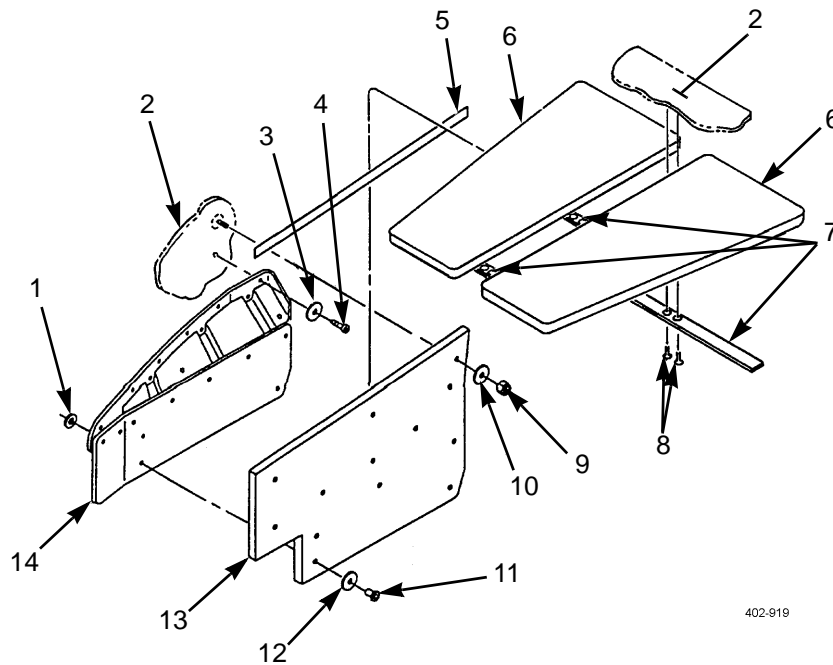
INSTALLATION

1. Install inner fender (14) to hood (2) with 10 washers (3) and screws (4).

NOTE

Use double-sided tape to hold liners in place. Rivets are replaced with self-tapping screws. Rivets with backing washers are replaced with screws and locknuts.

2. Install side liners (13) on hood (2) with five new screws (11), washers (1 and 12), eight new washers (10), and new locknuts (9).
3. Repeat steps 1 and 2 for liners and inner fenders on opposite side.
4. Install two top liners (6) on hood (2) with three support straps (7) and six new self-tapping screws (8).
5. Install duct tape (5) on each seam between two top liners (6) and side liners (13).



402-919

6. Install engine hood assembly (WP 0178 00).

END OF WORK PACKAGE

HOOD LATCH REPLACEMENT**0182 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)**Materials/Parts**

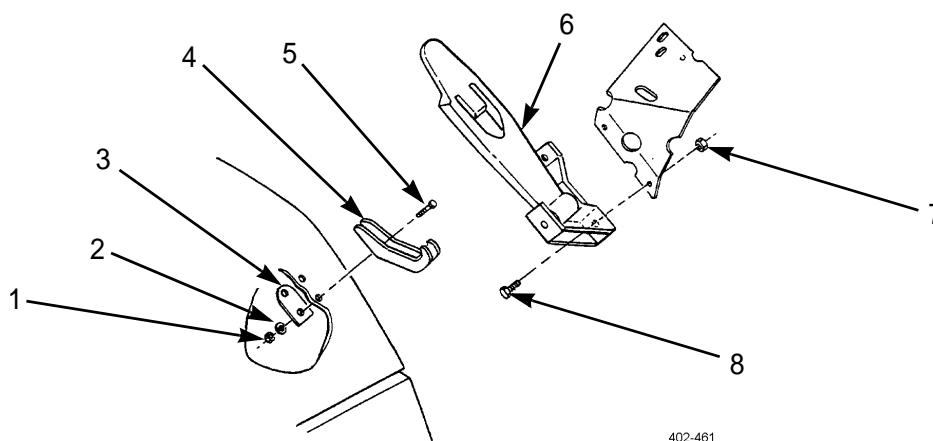
Nut, lock (P/N 23-09336-005) (2)

Nut, lock (P/N M45913/1-4CG5C) (2)

REMOVAL**NOTE**

Procedure is the same for both sides.

1. Remove two locknuts (1), two washers (2), backing plate (3), two screws (5) and hood catch (4). Discard locknuts.
2. Remove two locknuts (7), two screws (8) and hood latch (6). Discard locknuts.

**INSTALLATION**

1. Install hood latch (6), two screws (8) and two new locknuts (7).
2. Install hood catch (4), two screws (5), backing plate (3), two washers (2) and two new locknuts (1).

END OF WORK PACKAGE

HOOD PROP AND MOUNT REPLACEMENT

0183 00

THIS WORK PACKAGE COVERS

Hood Prop Removal, Hood Mount Removal, Hood Mount Installation, Hood Prop Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools - Continued

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 0-300 lb-in (Item 109, WP 0313 00)

Materials/Parts

Nut, lock (P/N M45913/1-8CG5C) (8)

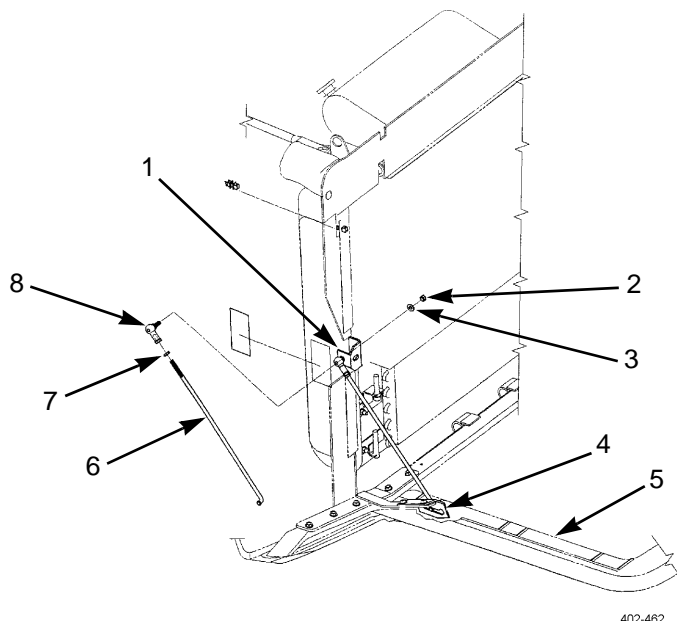
Nut, lock (P/N M45913/1-5CG5C) (2)

References

WP 0180 00

HOOD PROP REMOVAL

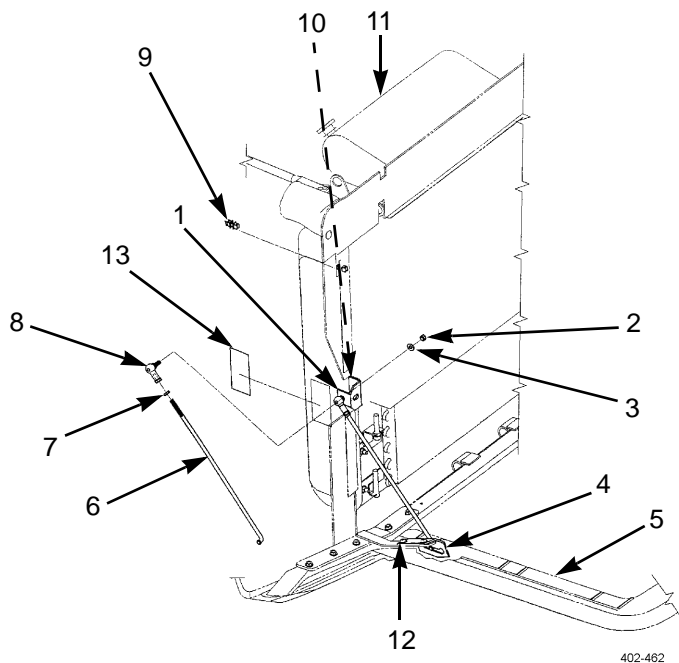
1. While supporting hood (5) in opened position, remove nut (2) and washer (3) from rod end (8).
2. Remove rod end (8) from radiator bracket (1) and remove prop (6) from hood bracket (4).
3. Loosen jamnut (7) and remove rod end (8) and jamnut from prop (6).



402.462

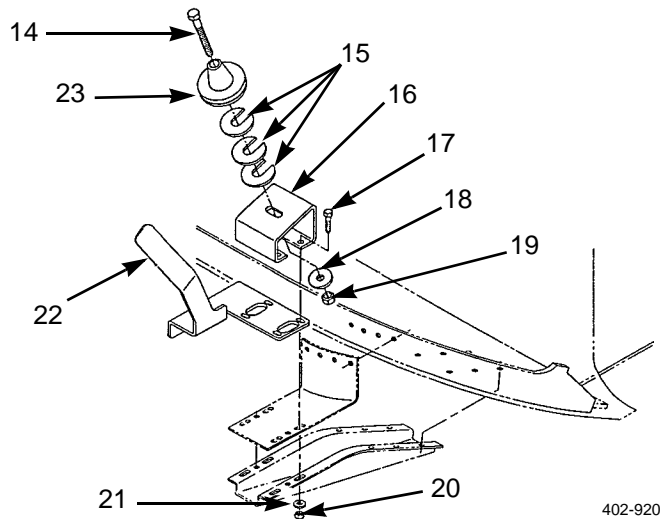
HOOD PROP REMOVAL - CONTINUED

4. Remove two screws (10) and radiator bracket (1) from radiator (11). Remove decal (13).
5. Remove two screws (12) and hood bracket (4) from hood (1).
6. Remove clip (9).

**HOOD MOUNT REMOVAL****NOTE**

Left and right hood mounts are removed and installed the same way. Left hood mount is shown.

1. Remove locknut (19), washer (18), screw (14), locator (23), and three spacers (15) from mounting bracket (16). Discard locknut.
2. Remove four locknuts (20), washers (21), screws (17), mounting bracket (16), and hood guide (22). Discard locknuts.

HOOD MOUNT REMOVAL - CONTINUED**HOOD MOUNT INSTALLATION**

1. Install hood guide (22) and mounting bracket (16) with four screws (17), washers (21) and new locknuts (20).
2. Install three spacers (15) and locator (23) to mounting bracket (16) with screw (14), washer (18) and new locknut (19).

HOOD PROP INSTALLATION

1. Install clip (9).
2. Install hood bracket (4) to hood (5) with two screws (12). Tighten screws to 40 lb-ft (54 Nm).
3. Install radiator bracket (1) to radiator (11) with two screws (10). Tighten screws to 180 lb-in (20 Nm). Install decal (13).
4. Install jam nut (7) and rod end (8) on prop (6). Rotate prop into rod end as far as it will go, then back out two to four turns.
5. Install rod end (8) to radiator bracket (1) with washer (3) and nut (2).
6. Install prop (6) end into hood bracket (4). End of prop should be against slot end closest to vehicle when hood is fully open and tilt assist cables are tight.
7. If no adjustment is required, tighten jam nut (7) against rod end (8). If adjustment is required, proceed to next step.
8. Rotate prop (6) until prop is against hood bracket slot end closest to vehicle when hood is fully open and tilt assist cables are tight.
9. Tighten jam nut (7) against rod end (8).
10. Adjust hood (WP 0180 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Maintenance Level

Unit

Personnel Required

Two

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Side marker/turn signal light removed (WP 0083 00)

Materials/Parts

Nut, lock (P/N M45913/1-8CG5C) (4)

Nut, lock (P/N M45913/1-6CG5C) (13)

REMOVAL



WARNING

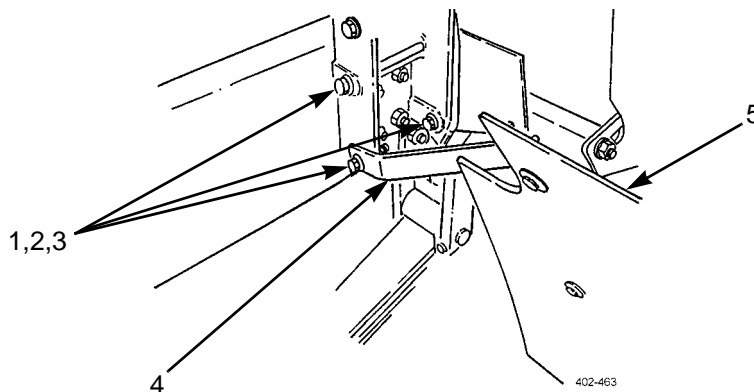


Front fender extension and splash guard are heavy and awkward to handle. Use assistance when removing these items. Failure to follow this warning may result in injury to personnel.

NOTE

Procedures for right- and left-side fender extensions are the same.

Remove four locknuts (1), eight washers (2), four bolts (3), and front fender extension (4) with splash guard (5) from vehicle. Discard locknuts.

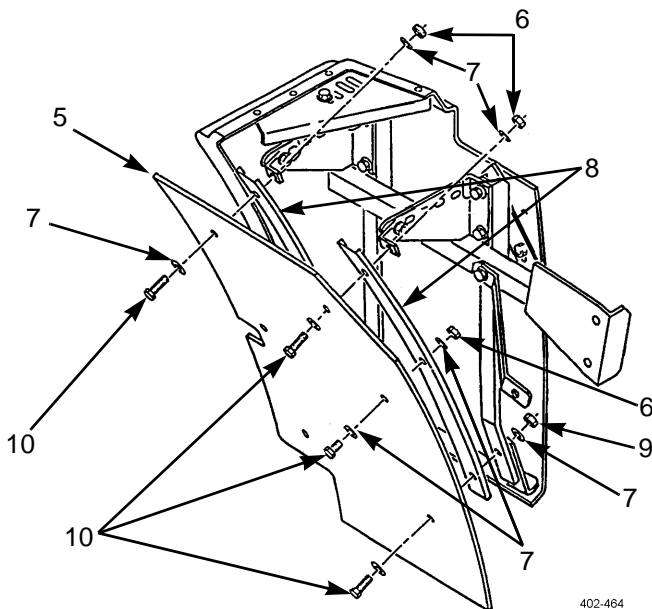


DISASSEMBLY

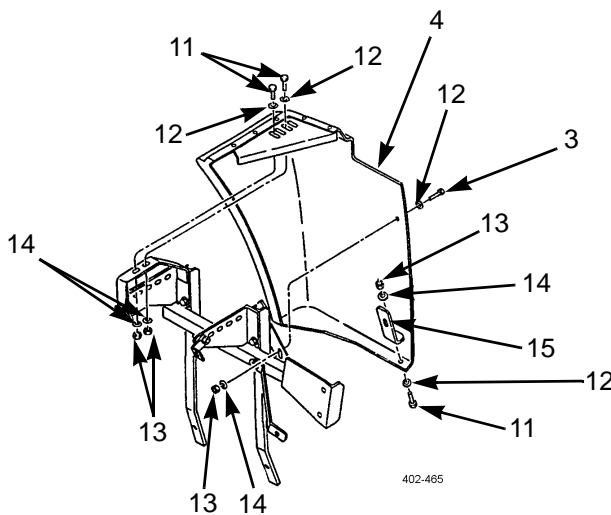
NOTE

Cap screws are different length as needed for use. Mark location of each during removal to aid during installation.

1. Remove four nuts (6), two locknuts (9), 12 washers (7), six cap screws (10), two braces (8), and splash guard (5). Discard locknuts.



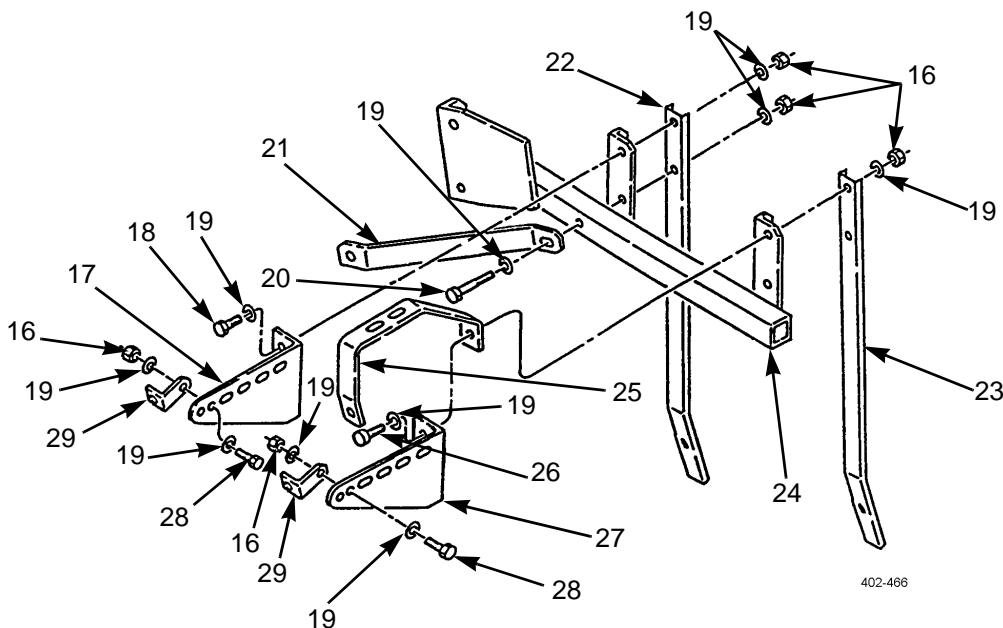
2. Remove four locknuts (13), washers (14), screws (11), washers (12), bracket (15), and front fender extension (4). Discard locknuts.



3. Remove two locknuts (16), four washers (19), two cap screws (28), and two brackets (29). Discard locknuts.

DISASSEMBLY - CONTINUED

4. Remove locknut (16), two washers (19), cap screw (20), and bracket (21). Discard locknut.
5. Remove locknut (16), two washers (19), cap screws (26), two brackets (25 and 27), and brace (23) from bracket (24). Discard locknuts.
6. Remove locknut (16), two washers (19), cap screw (18), brace (22), and bracket (17) from bracket (24). Discard locknuts.

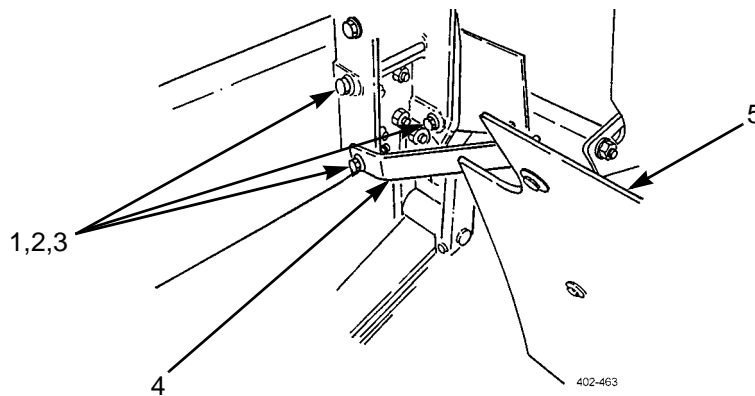
**ASSEMBLY**

1. Install bracket (17) and bracket (22), on bracket (24). Secure in place with screw (18), two washers (19), and new locknut (16).
2. Install brace (23) and brackets (25 and 27) on bracket (24). Secure in place with cap screw (26), two washers (19), and new locknut (16).
3. Install bracket (21) on bracket (24) with screw (20), two washers (19), and new locknut (16).
4. Install bracket (29) on each bracket (17 and 27). Secure with cap screw (28), two washers (19), and new locknut (16).
5. Attach bracket (15) to front fender extension (4) and secure with screw (11), two washers (12 and 14), and new locknut (13).
6. Attach front fender extension (4) with three screws (11), washers (12), washers (14), and new locknuts (13).
7. Install splash guard (5) and two braces (8) to fender extension and bracket assembly with six cap screws (10), 12 washers (7), four nuts (6), and two new locknuts (9).

INSTALLATION

Front fender extension and splash guard are heavy and awkward to handle. Use assistance when installing these items. Failure to follow this warning may result in injury to personnel.

1. Position front fender splash guard (5) and fender extension (4) on vehicle and secure in place with four bolts (3), eight washers (2), and four new locknuts (1).



2. Install side marker/turn signal light (WP 0083 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Disassembly, Assembly

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 0-300 lb-in (Item 109, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 111, WP 0313 00)

Materials/Parts

Parts kit (P/N 6107030-001)

Materials/Parts - Continued

Parts kit (P/N 6222076-001)

Parts kit (P/N 6222113-001)

Parts kit (P/N 6222133-001)

Parts kit (P/N 6222134-001)

Parts kit (P/N 6222135-001)

Parts kit (P/N 6222137-001)

Equipment Condition

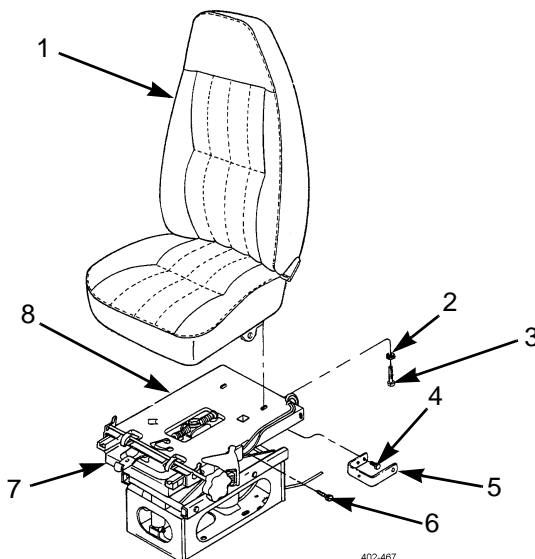
Seat removed (WP 0186 00)

DISASSEMBLY

NOTE

Both seats are repaired in the same manner.

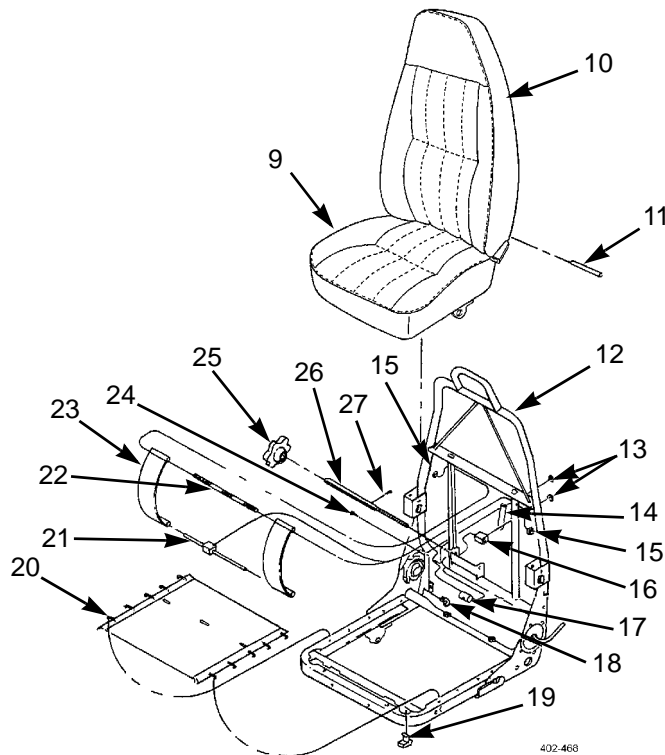
1. Adjust to rear position and remove two screws (3), washers (2), and shoulder bolts (6) from channel (8).
2. Remove seat (1) from isolator assembly (8).
3. Remove two screws (4) and bracket (5) from each side of upper plate (7).



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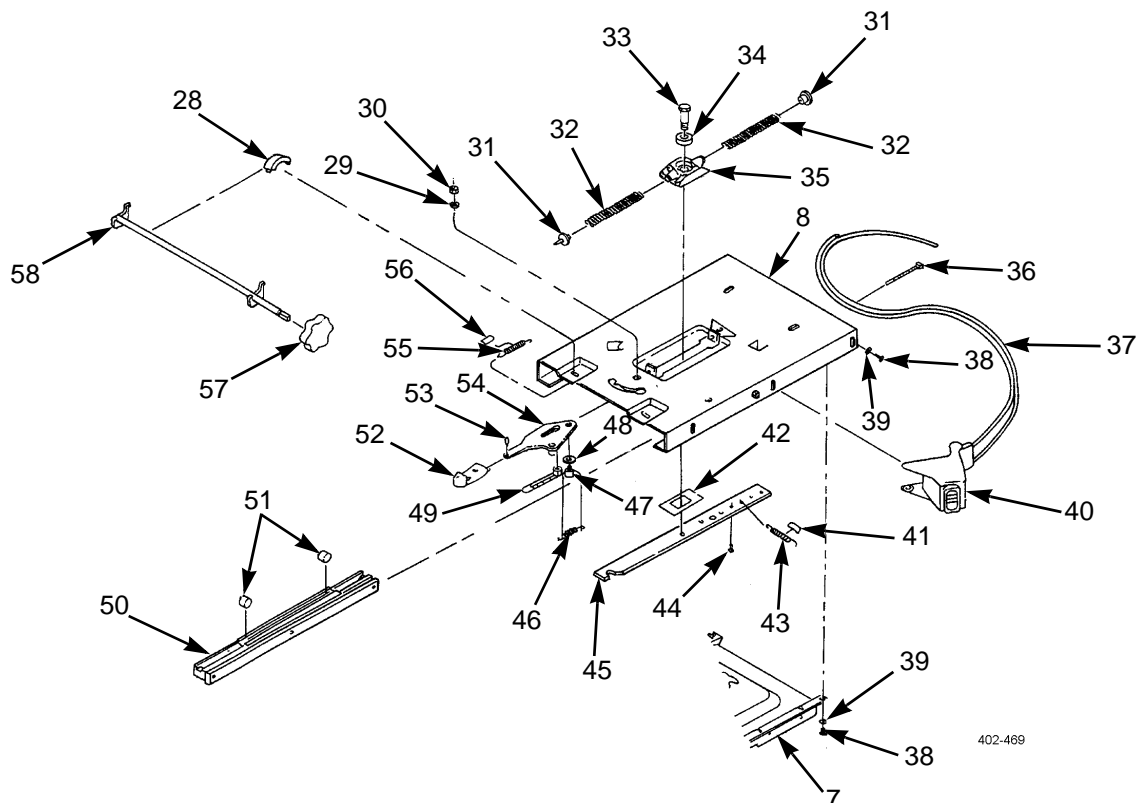
DISASSEMBLY - CONTINUED

4. Remove two wires (11) and remove back cover (10) and pad (9) from frame (12).
5. Remove seat pad support (20) and two seat tilt blocks (19).
6. Remove two pushnuts (13) and remove linkage (14) from slide shaft (21) and adjustment block (16). Discard pushnuts.
7. Remove roll pin (27), adjustment shaft (26), spacer (17), and adjustment block (16) from frame (12). Remove knob (25) from adjustment shaft. Discard roll pin.
8. Remove two pushnuts (15), support shaft (22), two springs (23), and slide shaft (21). Discard pushnuts.
9. Remove screw (24) and stop block (18).



DISASSEMBLY - CONTINUED

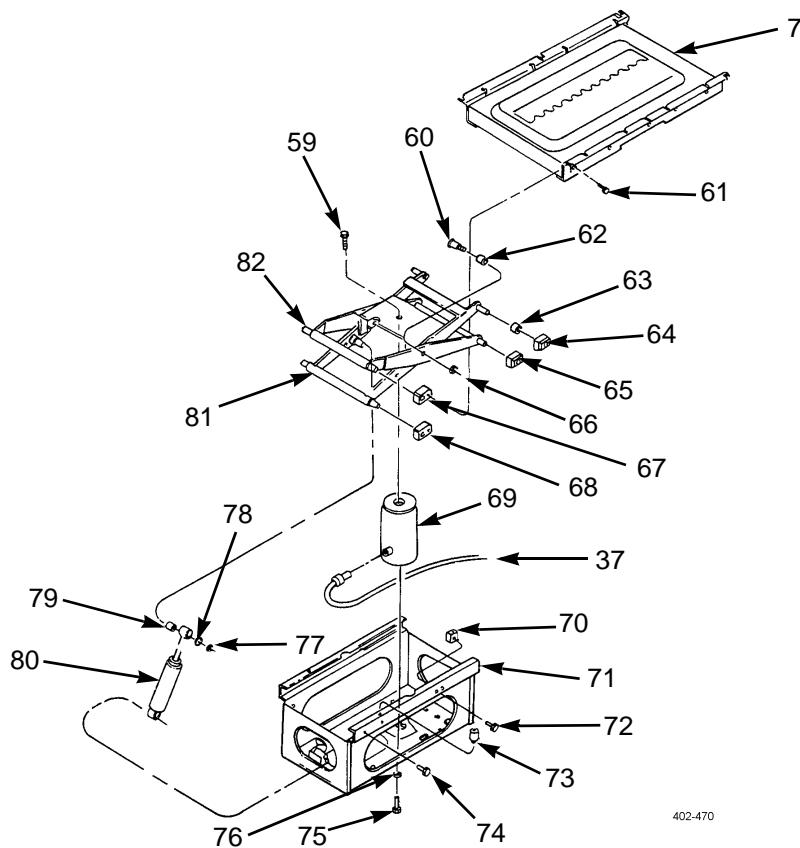
10. With isolator assembly (8) still in rear position, remove isolator spring (32) and rubber bumper (31) at rear.
11. Adjust isolator assembly (8) to forward position and remove isolator spring (32) and rubber bumper (31) at front.
12. Remove three wire ties (36) from air lines (37).
13. Remove six screws (38) and lockwashers (39) from sides of isolator assembly (8) and six screws (38) and lockwashers (39) from underside of isolator assembly to free two guide assemblies (50). Discard lockwashers.
14. Remove two guide assemblies (50) and valve mount (40) from isolator assembly (8).
15. Remove two rollers (51) from each guide assembly (50).
16. Disconnect end of spring (43) from latch bar (45).
17. Remove bolt (33), washer (34), pivot block (35), latch bar (45), and spacer (42) from isolator assembly (8). Remove screw (44) from latch bar.
18. Separate isolator assembly (8) from upper plate (7) and disconnect spring (43) and split poly loom (41) from isolator assembly.
19. Remove locknut (30), washer (29), control handle (54), spring (55), split poly loom (56), washer (48), and shoulder bolt (47) from channel (8). Discard locknut.
20. Remove spring (46), detent pin (49), pop rivet (53), and knob (52) from control handle (54). Discard pop rivet.
21. Remove two brackets (28) and tilt rod (58) from channel (8). Remove knob (37) from tilt rod.



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DISASSEMBLY - CONTINUED

22. Use blocking between upper plate (7) and riser (71) to hold upper plate in fully raised position.
23. Disconnect air line (37) from air spring (69).
24. Remove screw (59), screw (75), washer (76), and air spring (69).
25. Remove two push-on fasteners (77), washers (78), and damper (80) from lever (81) and riser (71). Discard push-on fasteners.
26. Press two bearings (79) from damper (80).
27. At front of upper plate (7), remove two screws (61) from bearing blocks (67).
28. At rear of riser (71), remove two screws (72) and stop blocks (70).
29. Remove blocking supporting upper plate (7).



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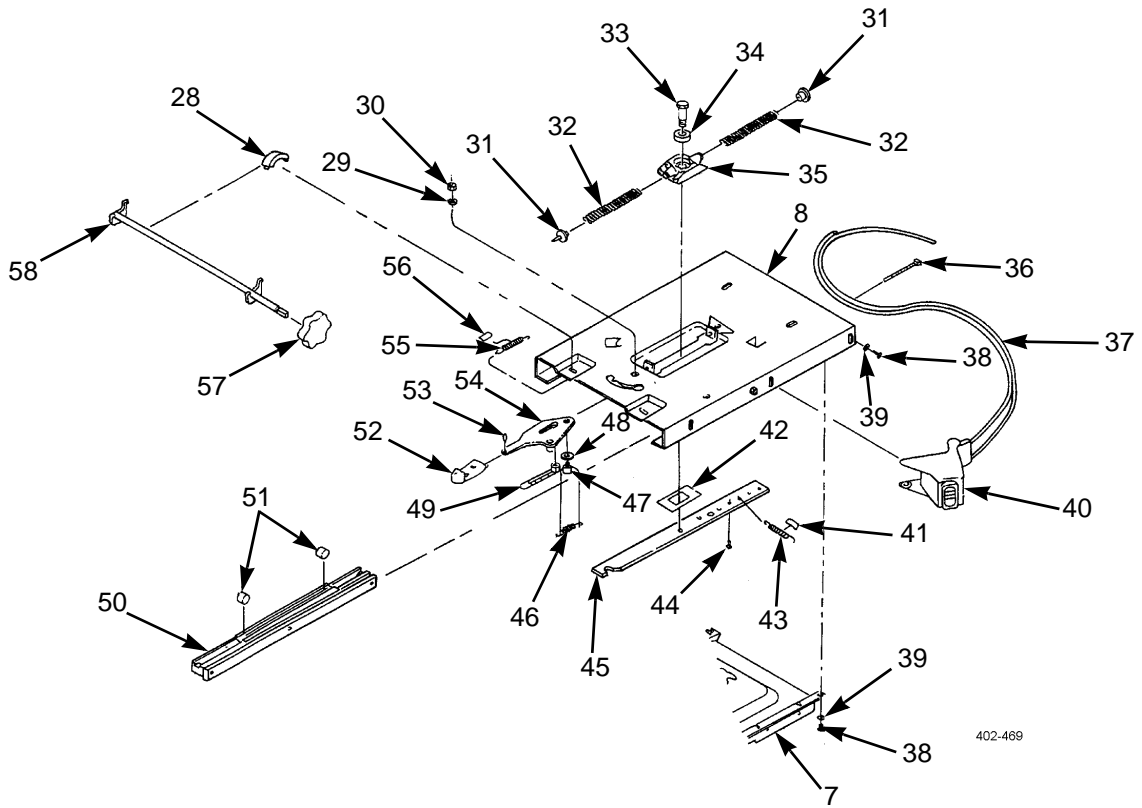
DISASSEMBLY - CONTINUED

30. Slide upper plate (7) forward and rearward to remove upper plate from bearing blocks (67) and slide blocks (64).
31. Remove bearing blocks (67) from ends of lever (82) and remove two slide blocks (64) and spacers (63) from ends of lever (81).
32. At front of riser (71), remove two screws (74) from bearing blocks (68).
33. Slide lever (81 and 82) assembly forward to remove two bearing blocks (68) and lever assembly from riser (71).
34. Remove bearing blocks (68) from ends of lever (81) and slide blocks (65) from ends of lever (82).
35. Remove two nuts (66) and shoulder bolts (60) to separate lever (81) and lever (82).
36. Press out two bearings (62) from lever (81).
37. Remove two rubber bumpers (73) from riser (71).

ASSEMBLY

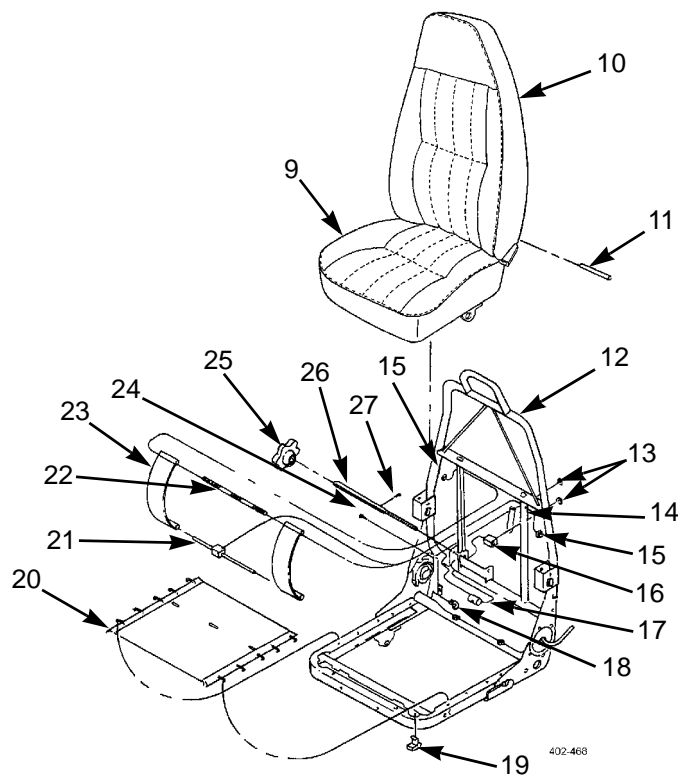
1. Install two rubber bumpers (73) to riser (71).
2. Install two bearings (62) into lever (81) with flanges of bearings on outside of lever.
3. Install lever (82) to lever (81) with two shoulder bolts (60) and nuts (66). Tighten nuts to 192-240 lb-in (22-27 Nm).
4. Install two slide blocks (65) on rear of lever (82) and two bearing blocks (68) on front of lever (81).
5. Install lever (81 and 82) assembly into riser (71) and install two screws (74) into bearing blocks (68).
6. Install two spacers (63) and slide blocks (64) on ends of lever (81) and two bearing blocks (67) on ends of lever (82).
7. Install upper plate (7) over bearing blocks (67) and slide blocks (64).
8. Install two screws (61) to bearing blocks (67).
9. Using blocking between upper plate (7) and riser (71) to hold upper plate in fully raised position.
10. At rear of riser (71), install two stop blocks (70) with two screws (72).
11. Press two bearings (79) into damper (80).
12. Install damper (80) to riser (71) and lever (81) with two washers (78) and new push-on fasteners (77).
13. Position air spring (69) with fitting facing forward.
14. Install air spring (69) with washer (76), screw (75), and screw (59). Tighten screw (59) to 180-228 lb-in (20-26 Nm). Tighten screw (75) to 108-132 lb-in (12-15 Nm).
15. Connect air line (37) to air spring (69).
16. Remove blocking supporting upper plate (7).
17. Install knob (57) to tilt rod (58) and install two brackets (28) and tilt rod to isolator assembly (8).
18. Install knob (52), new pop rivet (53), detent pin (49), and spring (46) to control handle (54).
19. Install shoulder bolt (51), washer (50), split poly loom (49), spring (48), control handle (47), washer (46), and new lock-nut (45) on channel (4).
20. Connect spring (43) and split poly loom (41) to isolator assembly (8) and position channel to upper plate (7).
21. Install screw (44) to latch bar (45) and install spacer (42), latch bar, and pivot block (35) to isolator assembly (8) with washer (34) and bolt (39). Tighten bolt to 26-34 lb-ft (35-46 Nm).
22. Connect end of spring (43) to latch bar (45).
23. Install two rollers (51) to each of two guide assemblies (50).
24. Position valve mount (40) and two guide assemblies (50) to isolator assembly (8).
25. Install six new lockwashers (39) and screws (38) underneath isolator assembly (8) and six new lockwashers (39) and screws (32) to sides of channel.
26. Secure air lines (37) with three wire ties (36).
27. Adjust isolator assembly (8) to forward position and install front isolator spring (32) and rubber bumper (31).
28. Adjust isolator assembly (8) to rear position and install rear isolator spring (32) and rubber bumper (31).

ASSEMBLY - CONTINUED



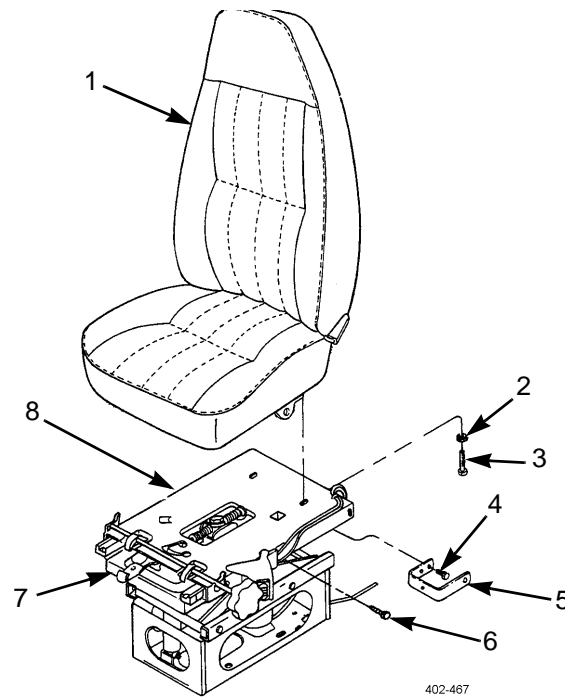
ASSEMBLY - CONTINUED

29. Install stop block (18) to seat frame (12) with screw (24).
30. Install slide shaft (21), two springs (23), support shaft (22) and two new pushnuts (15).
31. Install knob (25) to adjustment shaft (26) and install adjustment block (16), spacer (17), adjustment shaft, and new roll pin (27).
32. Install linkage (14) to adjustment block (16) and slide shaft (21) with two new pushnuts (13).
33. Install two seat tilt blocks (19) and seat pad support (20).
34. Install pad (9) and back cover (10) to frame (12) with two wires (11).



ASSEMBLY - CONTINUED

35. Install bracket (5) to each side of upper plate (7) with two screws (6). Tighten screws to 18-22 lb-ft (24-30 Nm). Position seat (1) to isolator assembly (8).
36. Install two shoulder bolts (6). Tighten bolts to 18-22 lb-ft (24-30 Nm).
37. Install two washers (2) and screws (3). Tighten screws to 18-22 lb-ft (24-30 Nm).



38. Install seat (WP 0186 00).

END OF WORK PACKAGE

SEAT REPLACEMENT

0186 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Equipment Condition

Air system drained (TM 9-2320-303-10)

Seat belt removed (WP 0187 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Goggles, industrial (Item 30, WP 0313 00)

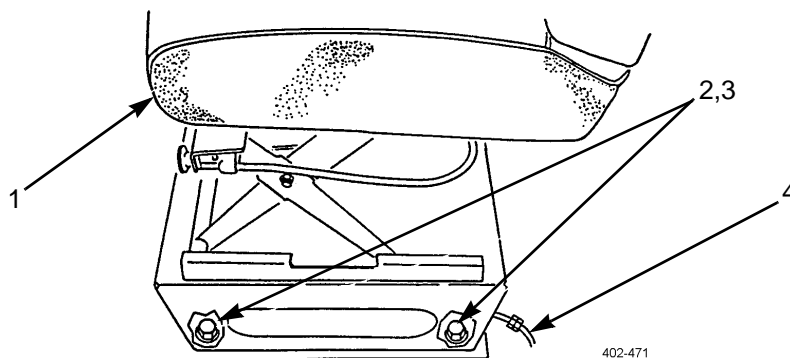
REMOVAL**WARNING**

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in serious injury to personnel.

NOTE

Steps are the same for driver or passenger seat.

1. Disconnect air line (4).
2. Remove four bolts (2), four washers (3), and seat (1).

**INSTALLATION**

1. Install seat (1), four washers (3), and four bolts (2).
2. Connect air line (4).
3. Install seat belt (WP 0187 00).

END OF WORK PACKAGE

0186 00-1 (0187 00-2 Blank)

SEAT BELT REPLACEMENT

0187 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Nut, lock (P/N 11675) (4)

Tools and Special Tools

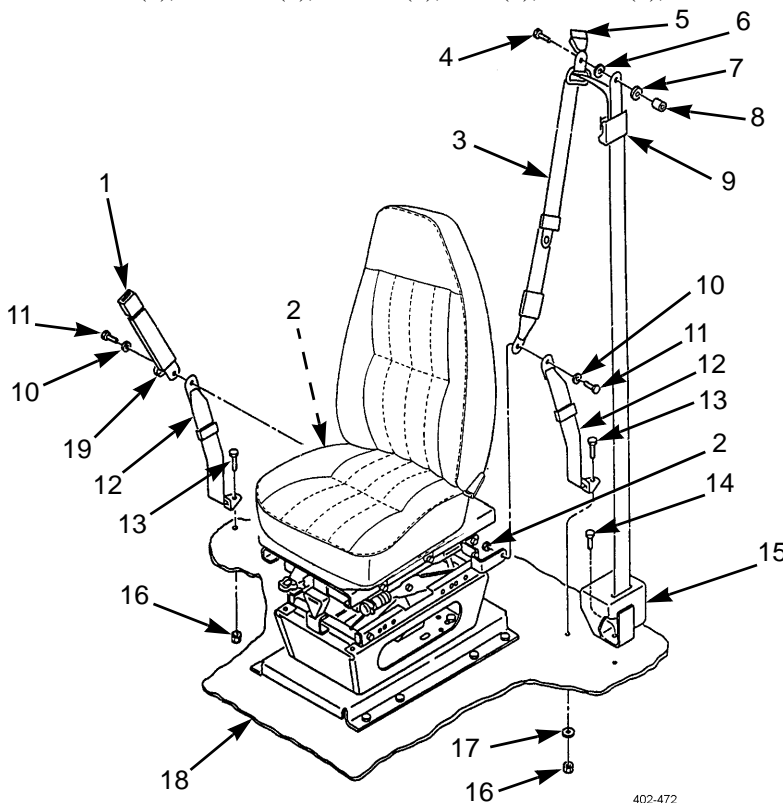
Tool kit, general mechanic's (Item 102, WP 0313 00)

NOTE

Replacement mounting hardware for seat belt is supplied with new seat belt.

REMOVAL

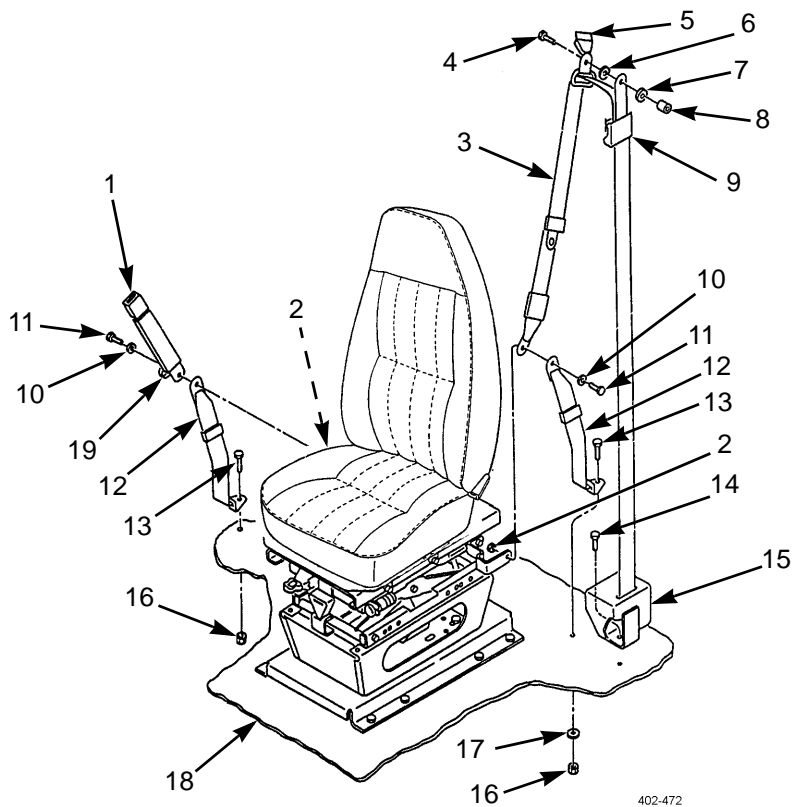
1. Remove two locknuts (16), washer (17), and two screws (13). Discard locknuts.
2. Lift cover (19) and remove two locknuts (2), screws (11), washers (10), tether belts (12), and lock belt (1). Discard locknuts.
3. Disconnect seat belt (3).
4. Lift cover (15) and remove screw (14).
5. Disconnect seat belt (3) from floor (18).
6. Lift cover (5) and remove screw (4), seat belt (3), washer (6), lock (9), washer (7), and bushing (8).



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INSTALLATION

1. Install bushing (8), washer (7), lock (9), washer (6), seat belt (3), and screw (4). Close cover (5).
2. Connect seat belt (3) and install screw (14) in floor (18).
3. Close cover (15).
4. Connect seat belt (3) and install lock belt (1), tether belts (12), washers (10), screws (11), and new locknuts (2).
5. Close cover (19). Install two screws (13), washer (17), and two new locknuts (16).



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END OF WORK PACKAGE

FLOOR MATS REPLACEMENT**0188 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Equipment Condition

Seats removed (WP 0186 00)

Seat belt tether belts removed (WP 0187 00)

ABS ECU cover removed (WP 0104 00)

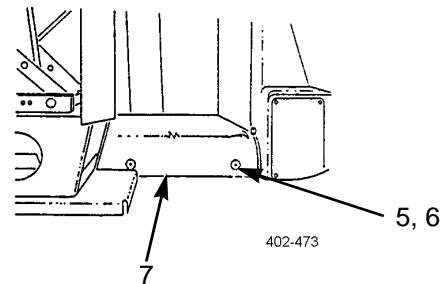
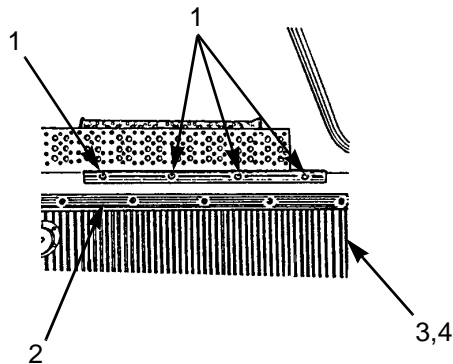
Shift tower removed (WP 0107 00)

Fire extinguisher bracket removed (WP 0196 00)

Radio bracket removed (if installed)

REMOVAL

1. Remove nine screws (1), two treadplates (2), floor mats (3), and insulation pads (4) from cab.
2. Remove 10 torx screws (5), washers (6), and floor mat (7) from cab.

**INSTALLATION**

1. Install floor mat (7) with 10 washers (6) and torx screws (5).
2. Install two insulation pads (4), floor mats (3) and treadplates (2) on cab with nine screws (1).
3. Install seat belt tether belts (WP 0187 00).
4. Install radio bracket.
5. Install shift tower (WP 0107 00).
6. Install fire extinguisher bracket (WP 0196 00).
7. Install seats (WP 0186 00).
8. Install ABS ECU cover (WP 0104 00).

END OF WORK PACKAGE

REAR FENDER REPLACEMENT

0189 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

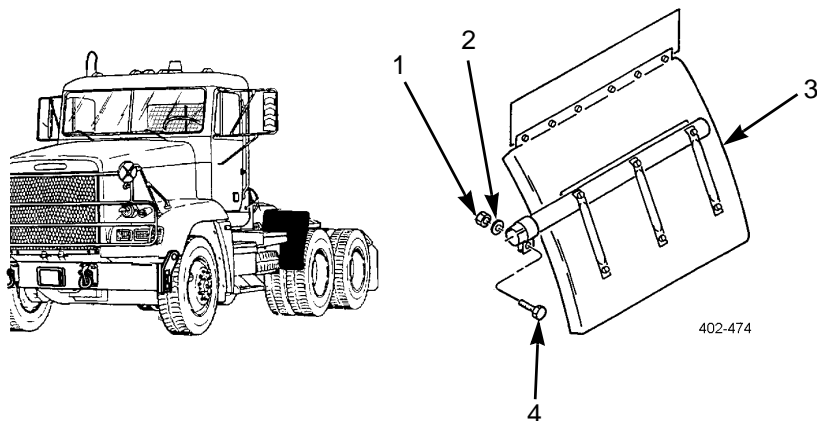
Wrench, torque, 50-250 lb-ft (Item 111, WP 0313 00)

NOTE

Right and left fenders are replaced the same way. Right rear fender is illustrated.

REMOVAL

Remove nut (1), washer (2), bolt (4), and rear fender (3) from vehicle.

**INSTALLATION**

Install rear fender (3) on vehicle with bolt (4), washer (2), and nut (1). Tighten nut to 200 lb-ft (271 Nm).

END OF WORK PACKAGE

BASIC ISSUE ITEMS (BII) STORAGE BOX AND MOUNTING BRACKET REPLACEMENT

0190 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Personnel Required

Two

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Right rear step removed (WP 0161 00)

Air supply tank removed (WP 0132 00)

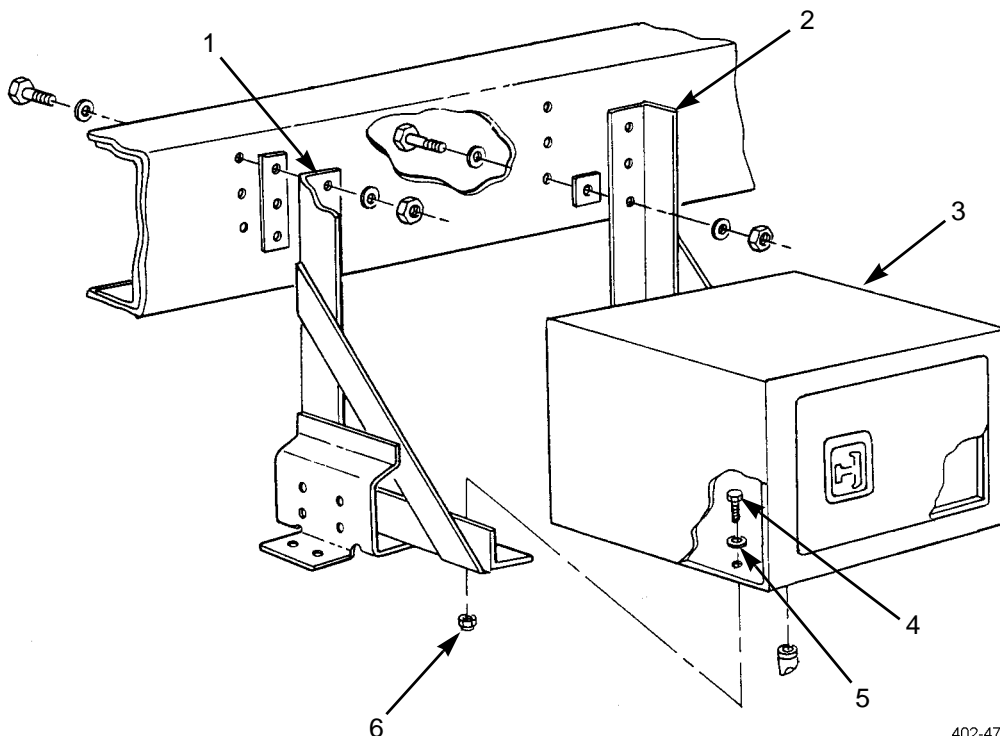
Materials/Parts

Compound, caulking (Item 12, WP 0312 00)

Nut, lock (P/N M45913/1-8CG5C) (4)

REMOVAL

1. Open tool storage box (3). Remove six nuts (6), six screws (4), six washers (5), and tool storage box from two mounting brackets (1 and 2).



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**BASIC ISSUE ITEMS (BII) STORAGE BOX AND MOUNTING BRACKET
REPLACEMENT - CONTINUED**

0190 00

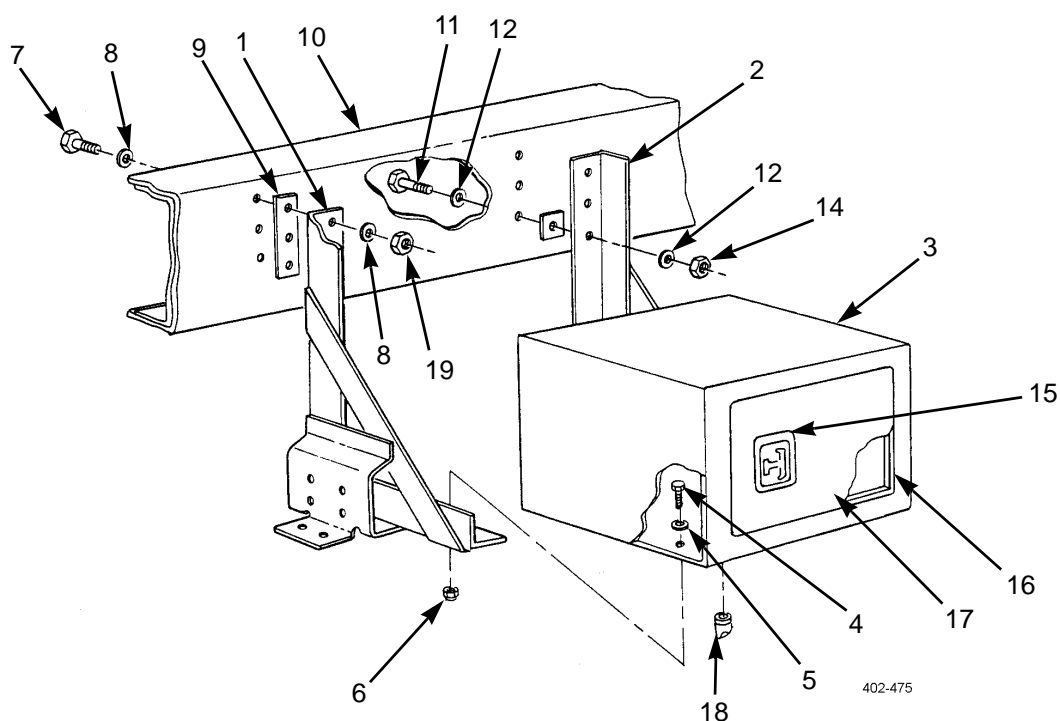
REMOVAL - CONTINUED

- Remove three nuts (19), three screws (7), six washers (8), mounting bracket (1), and spacer (9) from frame (10).

NOTE

Note position of screws for installation.

- Remove three nuts (14), three screws (11), six washers (12), mounting bracket (2), and spacer (13) from frame (10).
- Remove drain (18) and door seal (16) from tool storage box (3).
- Remove four locknuts and latch (15) from door (17). Discard locknuts.

**INSTALLATION**

- Install latch (15) to door (17) with four new locknuts.
- Install drain (18) and new door seal (16) in tool storage box (3).
- Install spacer (13), mounting bracket (2), six washers (12), three screws (11), and three nuts (14) to frame (10).
- Install spacer (9), mounting bracket (1), six washers (8), three screws (7), and three nuts (6) to frame (10).
- Apply caulking compound to bottom of six washers (5) and install tool storage box (3), six washers, six screws (4), and six nuts (6) to mounting brackets (1 and 2).
- Close door (17).
- Install air supply tank (WP 0132 00).
- Install right rear step (WP 0161 00).

END OF WORK PACKAGE

STORAGE BOX LATCH REPLACEMENT

0191 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

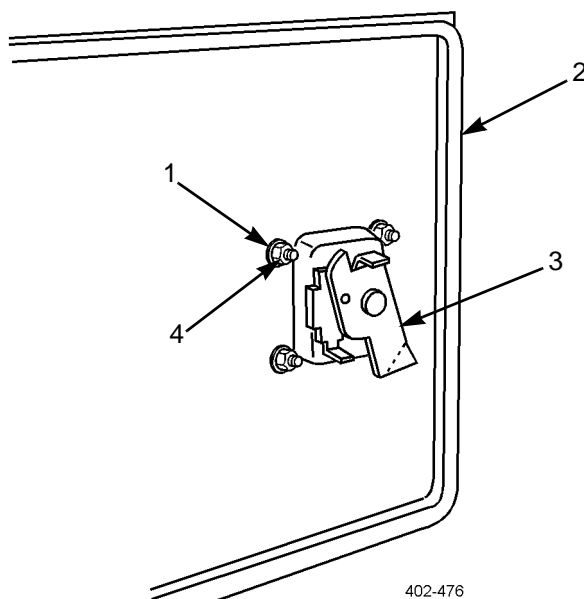
Compound, caulking (Item 12, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (4)

Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)

REMOVAL

1. Remove caulking compound from nuts (4) and circumference of latch (3).
2. Remove four locknuts (4), washers (1), and latch (3) from storage box door (2). Discard locknuts.

**INSTALLATION**

1. Install latch (3) on storage box (2) with four washers (1), and new locknuts (4).
2. Apply a bead of caulking compound to circumference of latch (3).
3. Cover locknuts (4) and threads with caulking compound.

END OF WORK PACKAGE

GRABHANDLE REPLACEMENT

0192 00

THIS WORK PACKAGE COVERS

Inside Cab Grabhandle Replacement; Outside Cab Grabhandle Replacement

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Washer, lock (P/N MS35338-141) (2)

Tools and Special Tools

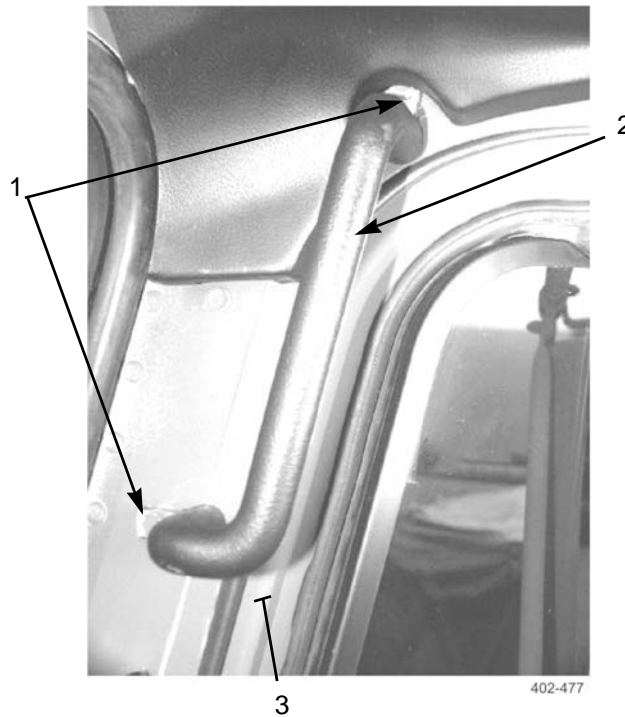
Tool kit, general mechanic's (Item 102, WP 0313 00)

References

WP 0194 00

INSIDE CAB GRABHANDLE REPLACEMENT

1. Remove cab overhead storage compartment (WP 0194 00).
2. Remove two screws (1) and grabhandle (2) from inside of cab (3).

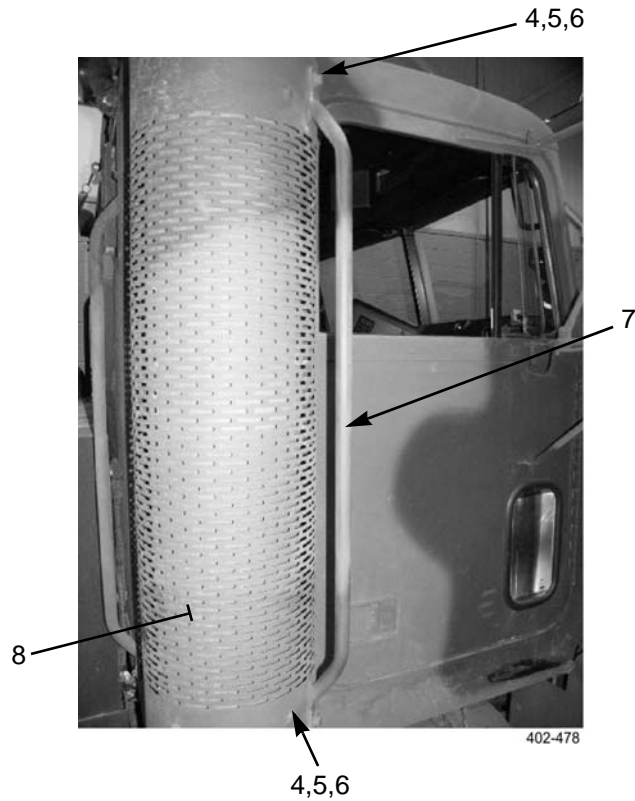


3. Install grabhandle (2) to inside of cab (3) with two screws (1).
4. Install cab overhead storage compartment (WP 0194 00).

OUTSIDE CAB GRABHANDLE REPLACEMENT**NOTE**

Perform following steps to replace each of four grabhandles on outside of cab. Grabhandle mounted to muffler is shown.

1. Remove two screws (4) lockwashers (5), washers (6) and grabhandle (7) from muffler (8). Discard lockwashers.



2. Install grabhandle (7) to muffler (8) with two washers (6), new lockwashers (5) and screws (4).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

References

TM 9-2320-303-10

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Personnel Required

Two

Materials/Parts

Compound, caulking (Item 12, WP 0312 00)

Nut, lock (P/N M45913/1-6CG5C) (3)

Nut, lock (P/N M45913/1-10CG5C) (11)

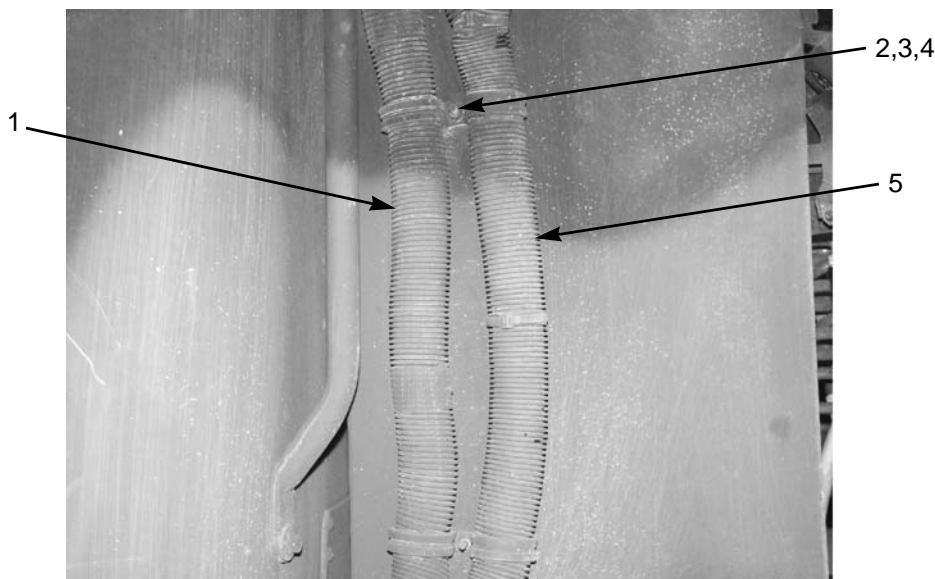
Equipment Condition

Basic Issue Items (BII) storage box removed (WP 0190 00)

Spare wheel hoist removed (WP 0171 00)

REMOVAL

1. Remove two locknuts (2), washers (3), and clamps (4) securing air tubes (5) and harnesses (1). Discard locknuts.



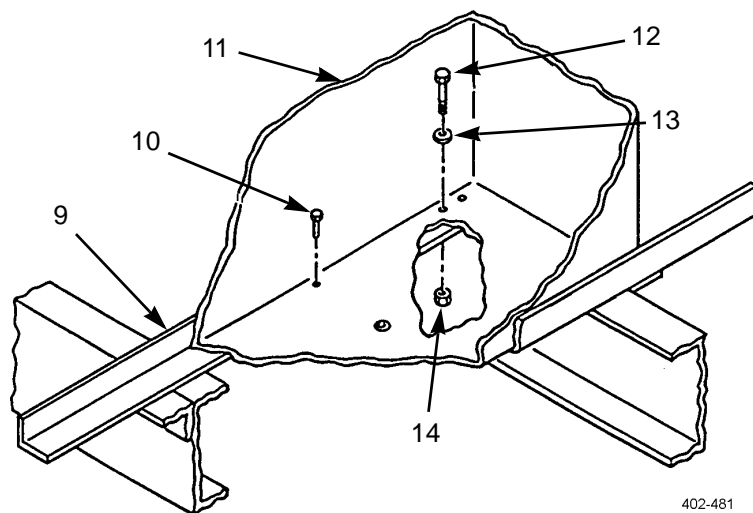
402-479

REMOVAL - CONTINUED

2. Remove two air hoses from gladhand/electrical cable bracket (TM 9-2320-303-10).
3. Disconnect air hose lanyard from beacon light bracket (TM 9-2320-303-10).
4. Remove four nuts (6) and washers (7) from bracket (8).
5. Remove bracket (8) with air lines and electrical harnesses attached and lay aside.

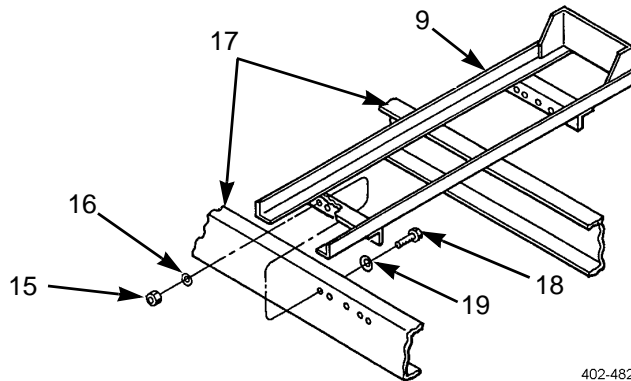


6. Remove two screws (10), four locknuts (14), screws (12), washers (13), and personal gear storage box (11) from mounting bracket (9). Discard locknuts.

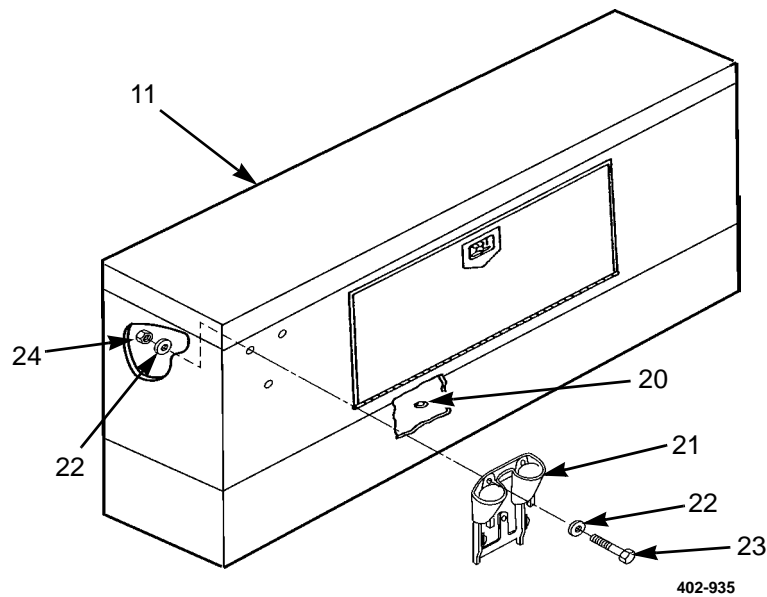


REMOVAL - CONTINUED

7. Remove seven locknuts (15), washers (16), screws (18), washers (19), and mounting bracket (9) from frame (17). Discard locknuts.



8. Remove drain (20) from personal gear storage box (11).
9. Remove three bolts (23), six washers (22), three nuts (24), and gladhand/electrical cable bracket (21) from personal gear storage box (11).



INSTALLATION

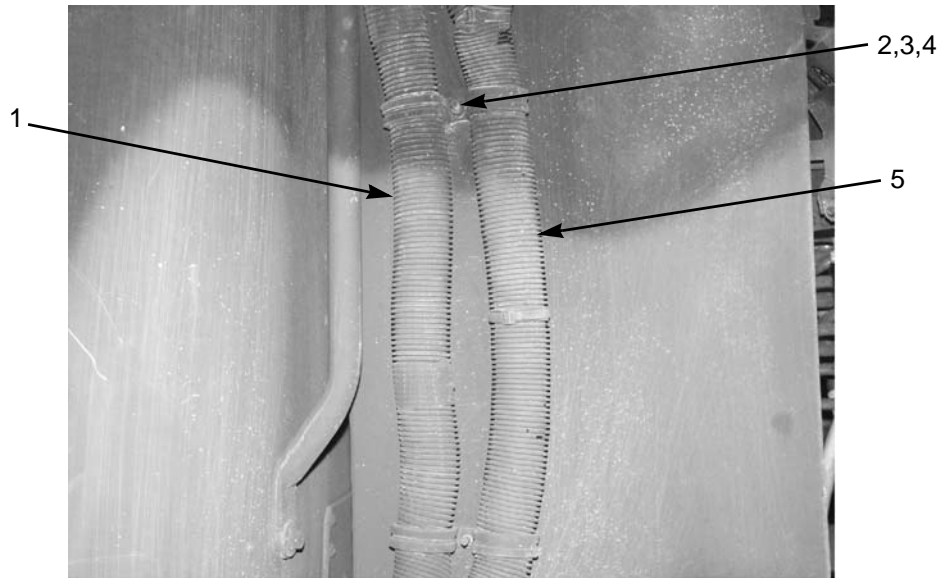
1. Install gladhand/electrical cable bracket (21) with three bolts (23), six washers (22), and three nuts (24).
2. Install mounting bracket (9) on frame (17) with seven washers (19), screws (18), washers (16), and new locknuts (15).
3. Install drain (20) in personal gear storage box (11).
4. Apply caulking compound to bottom of four washers (13). Install personal gear storage box (11), four washers, screws (12), new locknuts (14), and two screws (10) in mounting bracket (9).

**PERSONAL GEAR STORAGE BOX AND MOUNTING BRACKET REPLACEMENT
(M915A3) - CONTINUED**

0193 00

INSTALLATION - CONTINUED

5. Secure air tubes (5) and harness (1) with clamps (4), washers (3), and two new locknuts (2).



402-479

6. Install bracket (8) with air lines and electrical harnesses attached with washers (7) and four nuts (6).



402-480

7. Connect air hose lanyard to beacon light bracket (TM 9-2320-303-10).
8. Attach two air hoses to gladhand/electrical cable bracket (TM 9-2320-303-10).
9. Install spare wheel hoist (WP 0171 00).
10. Install Basic Issue Items (BII) storage box (WP 0190 00).

END OF WORK PACKAGE

CAB OVERHEAD STORAGE COMPARTMENT REPLACEMENT

0194 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Personnel Required

Two

Tools and Special Tools

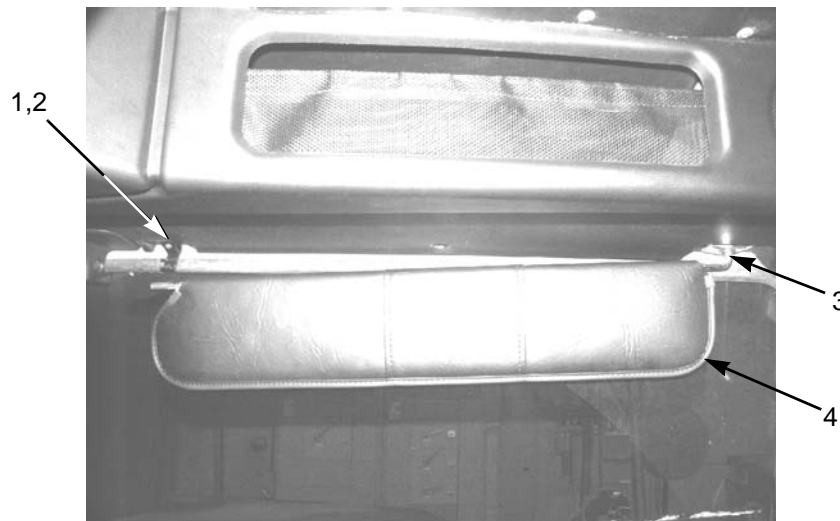
Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

NOTE

Performs steps 1 and 2 on both side of cab.

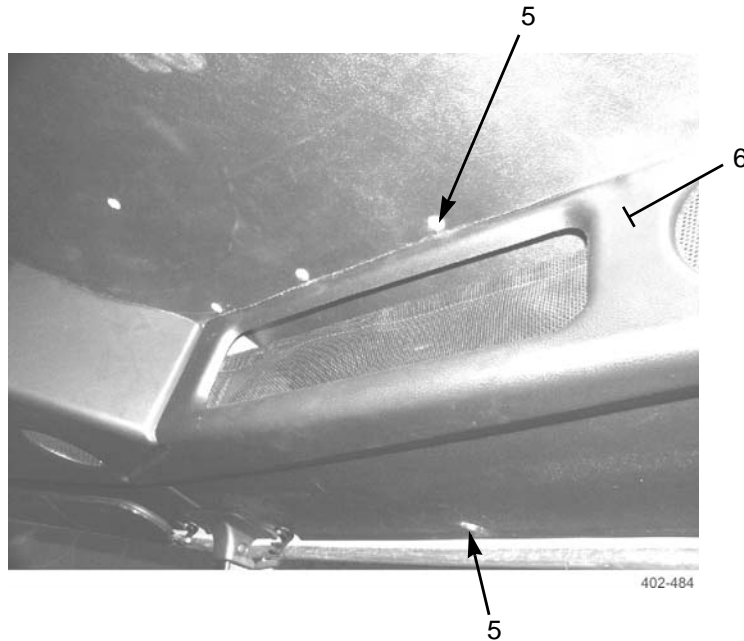
1. Remove four screws (3) and sun visor (4).
2. Remove screw (1) and sun visor clip (2).



402-483

REMOVAL - CONTINUED

3. While supporting center of compartment (6), remove screws (5) securing compartment to cab ceiling.

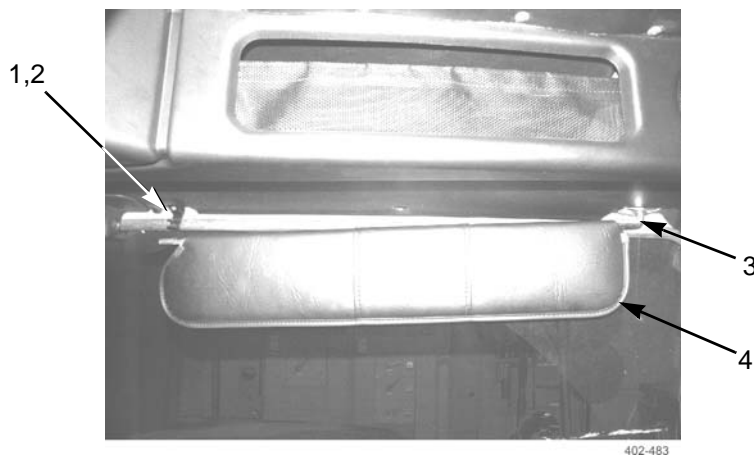
**INSTALLATION**

1. Position and support center of compartment (6).
2. Install screws (5) securing compartment (6) to cab ceiling.

NOTE

Perform steps 3 and 4 on both sides of cab.

3. Install sun visor clip (2) with screw (1).
4. Install sun visor (4) with four screws (3).



END OF WORK PACKAGE

STEERING COLUMN COVER REPLACEMENT

0195 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

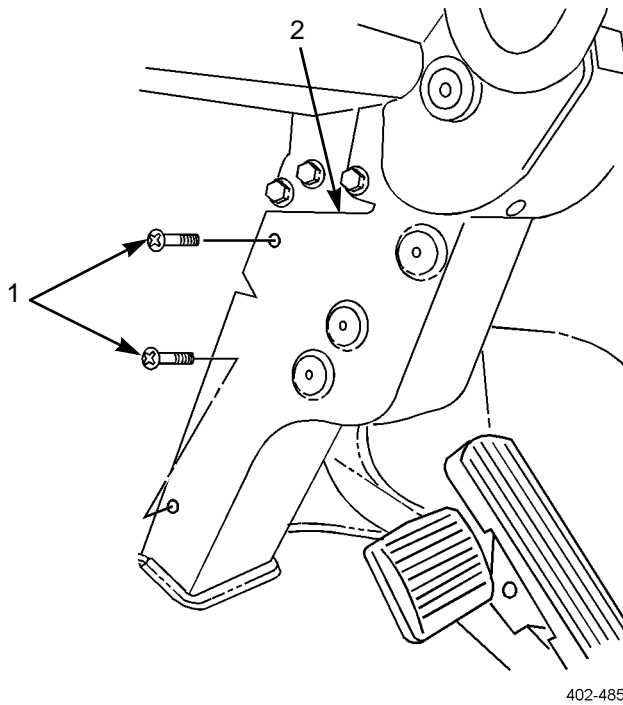
Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

Remove four screws (1) and cover (2) from steering column.

**INSTALLATION**

Install cover (2) on steering column with four screws (1).

END OF WORK PACKAGE

TRANSMISSION TUNNEL ACCESS COVER REPLACEMENT

0196 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Washer, lock (P/N MS35338-44) (12)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

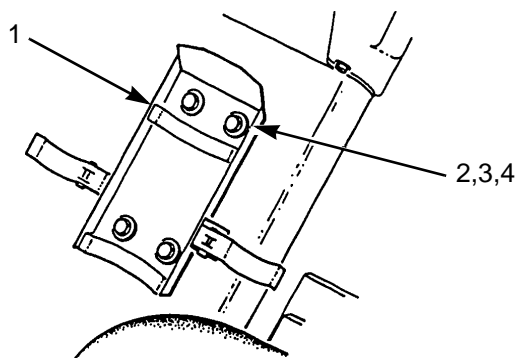
Equipment Condition

Fire extinguisher removed (TM 9-2320-303-10)

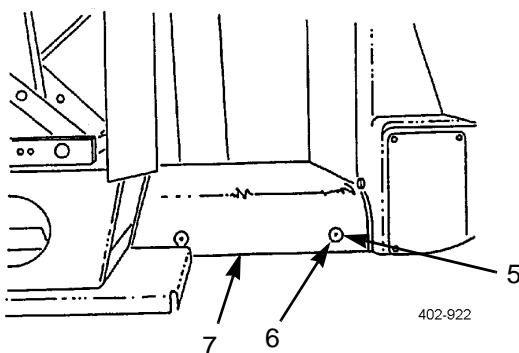
Transmission shift selector and shift tower removed (WP 0107 00)

REMOVAL

1. Remove four nuts (2), washers (3), screws (4), and fire extinguisher bracket (1) from vehicle.

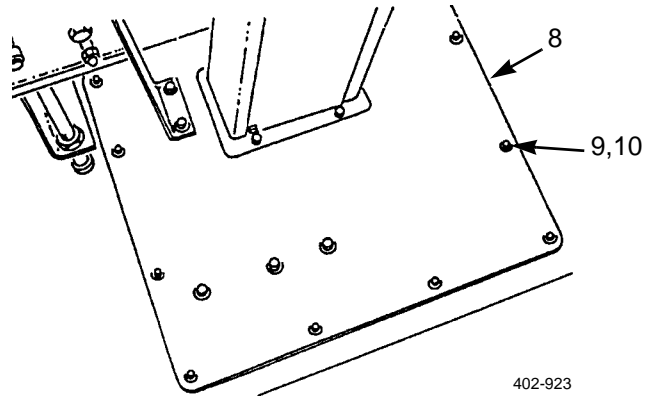


2. From front to rear, remove enough torx screws (5) and washers (6) to roll floor mat (7) back until access cover is fully visible.



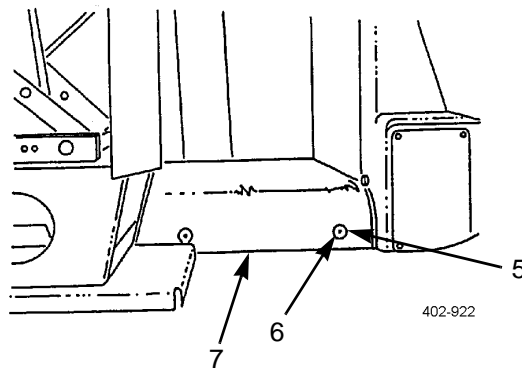
REMOVAL - CONTINUED

3. Remove 12 screws (9), lockwashers (10), and transmission tunnel access cover (8) from vehicle. Discard lockwashers.

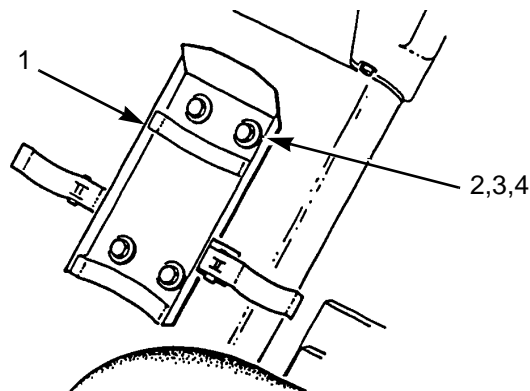


INSTALLATION

1. Install transmission tunnel access cover (8) on vehicle with 12 new lockwashers (10) and screws (9).
2. Roll floor mat (7) forward and install washers (6) and torx screws (5).



3. Install fire extinguisher bracket (1) on vehicle with four screws (4), washers (3), and nuts (2).



INSTALLATION - CONTINUED

4. Install transmission shift selector and shift tower (WP 0107 00).
5. Install fire extinguisher (TM 9-2320-303-10).

END OF WORK PACKAGE

REAR VIEW MIRROR REPLACEMENT (M915A4)

0197 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Strap, tiedown (Item 41, WP 0312 00)

Nut, lock (P/N M45913/1-4CG5C) (8)

Washer, lock (P/N 23-09983-025) (4)

Washer, lock (P/N MS45904-68) (2)

NOTE

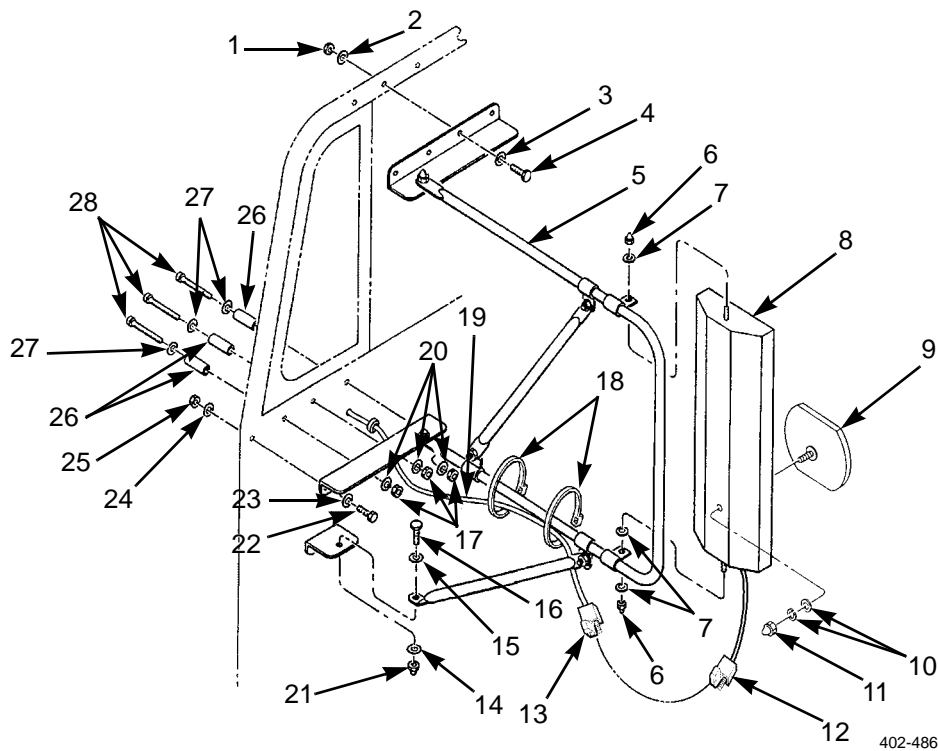
Left and right rear view mirrors are replaced the same way. Left rear view mirror is shown.

REAR VIEW MIRROR REPLACEMENT (M915A4) - CONTINUED

0197 00

REMOVAL

1. Remove nut (11), two lockwashers (10), and spotter mirror (9). Discard lockwashers.
2. Remove tiedown straps (18) securing wiring harness (19).
3. Disconnect wiring harness connector (13) from mirror harness connector (12).
4. Remove cap nut (21), washer (14), screw (16), and washer (15) from mirror (8).
5. Remove locknut (25), washer (24), screw (22), and washer (23) from mirror (8). Discard locknut.
6. Remove three locknuts (17), washers (20), socket head screws (28), washers (27), and spacers (26) from mirror (8). Discard locknuts.
7. Remove four locknuts (1), washers (2), screws (4), washers (3), and support (5) from door. Discard locknuts.
8. Remove two cap nuts (6), three lockwashers (7), and mirror (8) from support (5). Discard lockwashers.

**INSTALLATION**

1. Install mirror (8) on support (5) with three new lockwashers (7) and two cap nuts (6).
2. Install support (5) on door with four washers (3), screws (4), washers (2), and new locknuts (1).
3. Install three spacers (26), washers (27), socket head screws (28), washers (20), and new locknuts (17) on mirror (8).
4. Install washer (23), screw (22), washer (24), and new locknut (25) on mirror (8).
5. Install washer (15), screw (16), washer (14), and cap nut (21) on mirror (8).
6. Connect wiring harness connector (13) to mirror harness connector (12).
7. Secure wiring harness (19) using tiedown straps (18).
8. Install spotter mirror (9), two new lockwashers (10), and nut (11).

END OF WORK PACKAGE

REAR VIEW MIRROR REPLACEMENT (M915A4R2)

0197 01

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

References

TM 9-2320-303-10

Materials/Parts

Straps, tiedown (Item 41, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Nut, lock (P/N 23-09336-007) (2)

Washer, lock (P/N 23-09983-025) (2)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

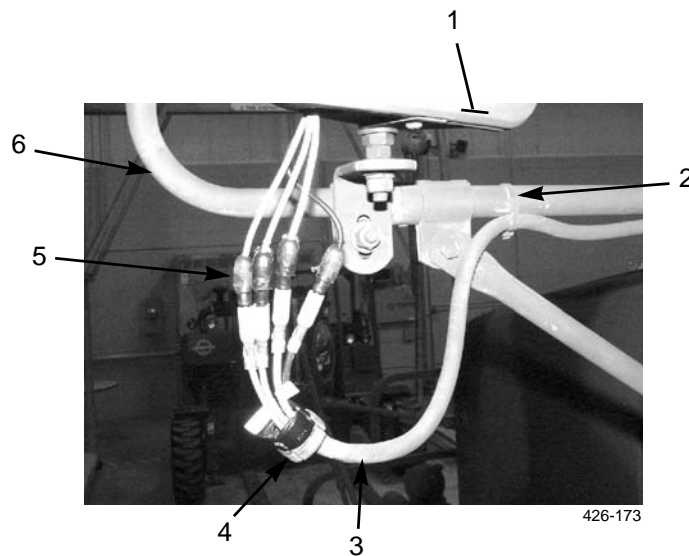
REMOVAL

1. Remove tiedown straps (2) and discard.
2. Remove grommet (4) from bottom of mirror (1) to expose four remote-control mirror connectors (5).

NOTE

Tag wires to ensure correct installation.

3. Disconnect four connectors (5) from connectors of wiring harness (3).

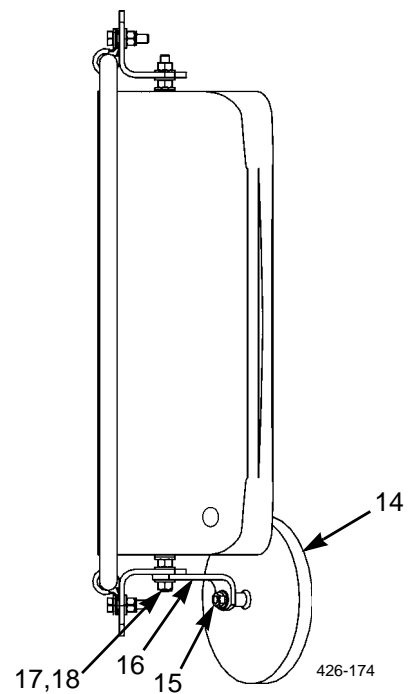
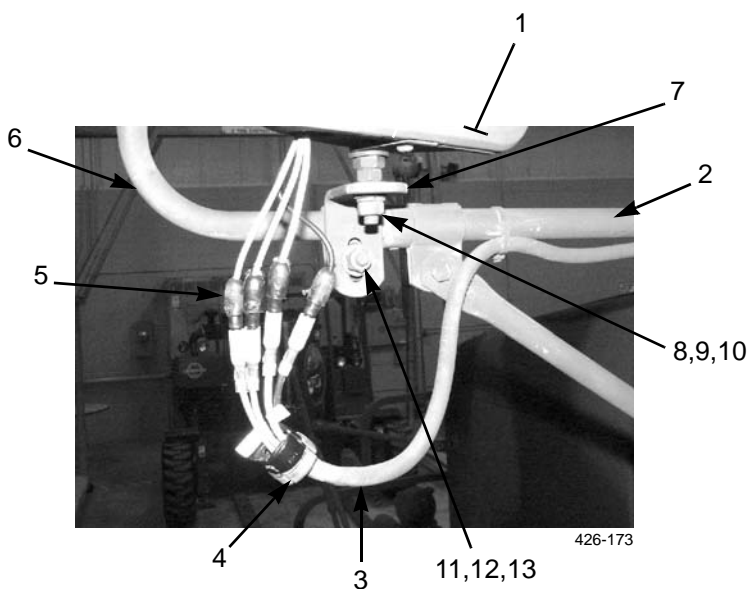


REMOVAL - CONTINUED

NOTE

Perform steps 4 and 5 at top and bottom of mirror.

4. Remove locknut (11), four washers (12), screw (13), and angle bracket (7) with mirror (1) from support (6). Discard locknut.
5. Remove nut (8), lockwasher (9), two washers (10), and angle bracket (7) from mirror (1). Discard lockwasher.
6. Remove nut (15) and spotter mirror (14) from bracket (16).
7. Remove nut (17), washer (18), and bracket (16).



NOTE

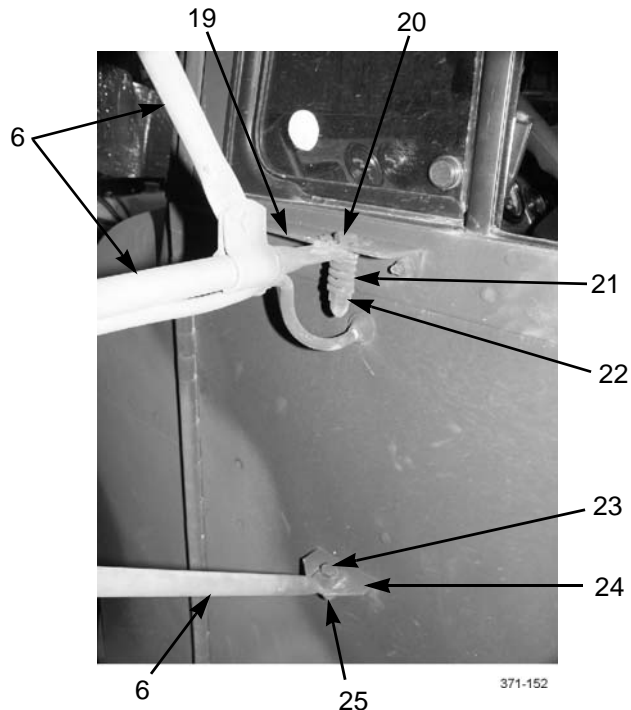
Perform steps 8 and 9 to remove mirror support from mounting brackets on cab door.

8. Remove cap nut (25) and screw (23) and separate support (6) from bracket (24).

NOTE

Note position of mounting hardware to ensure correct installation.

9. Remove cap nut (22), spring (21), screw (20), and support (6) from bracket (19) on cab door.

REMOVAL - CONTINUED**INSTALLATION****NOTE**

Perform steps 1 and 2 to install mirror support to mounting brackets on cab door.

1. Position mirror support (6) on bracket (19), install screw (20), spring (21), and cap nut (22).
2. Secure support (6) to bracket (24) with screw (23) and cap nut (25).
3. Install spotter mirror (14) on bracket (16) with nut (15).
4. Install bracket (16) with washer (18) and nut (17).

NOTE

Perform steps 5 and 6 at top and bottom of mirror.

5. Install angle bracket (7) to mirror (1) with two washers (10), new lockwasher (9), and nut (8).
6. Install mirror (1) to support (6) with screw (13), four washers (12), and new locknut (11) through angle bracket (7).
7. Connect four remote-control mirror connectors (5) to connectors of wiring harness (3).
8. Feed connectors (5) and excess wiring inside housing of mirror (1) and install grommet (4).
9. Secure wiring harness (3) on support (6) with new tiedown straps (2).
10. Check operation of mirrors (TM 9-2320-303-10).

END OF WORK PACKAGE

SPOTTER MIRROR REPLACEMENT

0198 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Nut, lock (P/N MS51922-1) (3)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Personnel Required

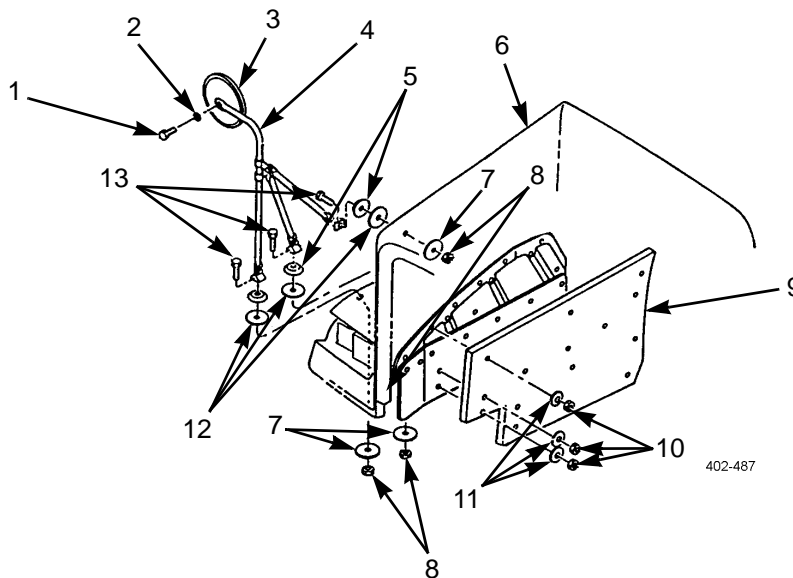
Two

Equipment Condition

Hood opened (TM 9-2320-303-10)

REMOVAL

1. Remove three locknuts (10) and washers (11) from hood liner (9). Discard locknuts.
2. Remove three nuts (8), washers (7), screws (13), mirror assembly (4), three spacers (5), and washers (12) from hood (6).
3. Remove screw (1), washer (2), and spotter mirror (3) from mirror assembly (4).



INSTALLATION

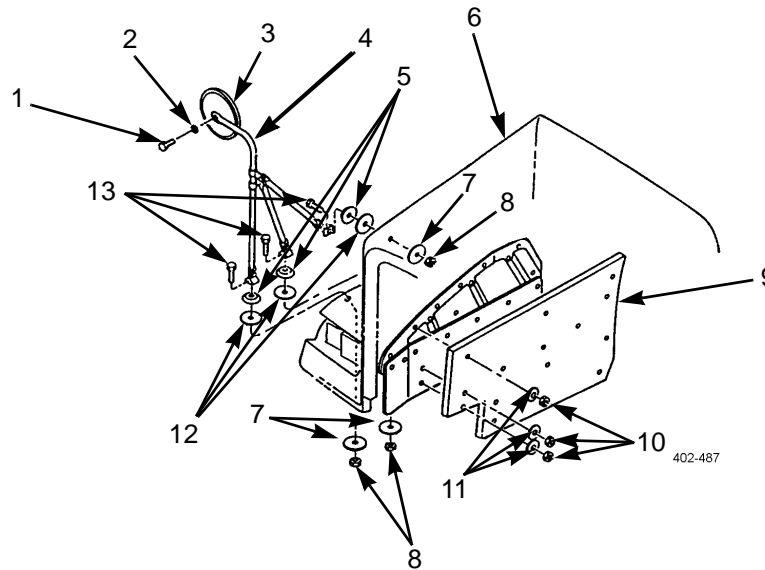
NOTE

Some replacement mirrors may not have a drain hole. Drill a 1/16 inch hole at 6 o'clock position to allow any moisture to drain.

1. Install spotter mirror (3) on mirror assembly (4) with washer (2) and screw (1).

SPOTTER MIRROR REPLACEMENT - CONTINUED**0198 00****INSTALLATION - CONTINUED**

2. Install three washers (12), spacers (5) and mirror assembly (4) on hood (6) with three screws (13), washers (7), and nuts (8).
3. Install three washers (11) and new locknuts (10) on hood liner (9).



4. Close hood and adjust mirrors (TM 9-2320-303-10).

END OF WORK PACKAGE

WINDSHIELD WIPER AND WIPER ARM REPLACEMENT**0199 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

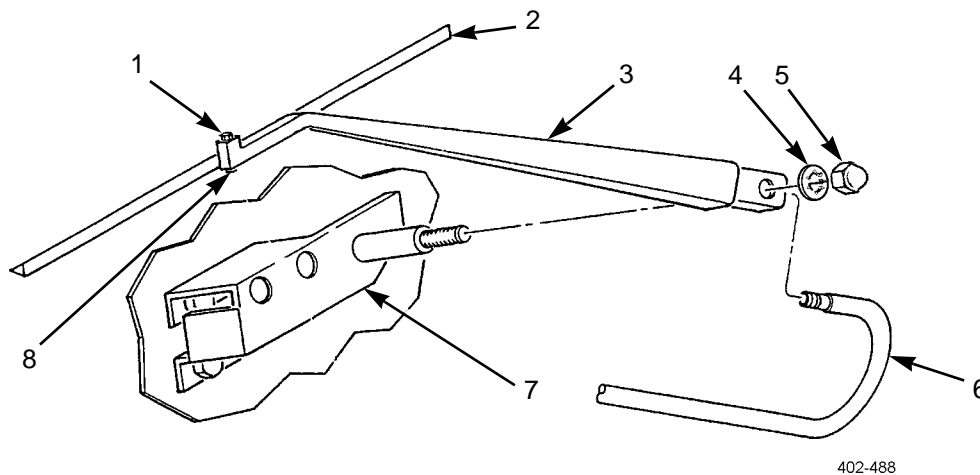
Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL**NOTE**

Procedure is the same for both windshield wipers and wiper arms.

1. Remove nut (8), screw (1), and windshield wiper (2).
2. Disconnect hose (6).
3. Remove cover (5), nut (4), and wiper arm (3) from bracket (7).

**INSTALLATION****NOTE**

Procedure is the same for both windshield wipers and wiper arms.

1. Install wiper arm (3), nut (4), and cover (5) on bracket (7).
2. Connect hose (6).
3. Install windshield wiper (2), screw (1), and nut (8).

END OF WORK PACKAGE

WINDSHIELD WIPER MOTOR AND LINKAGE REPLACEMENT**0200 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 0-200 lb-in (Item 108, WP 0313 00)

Materials/Parts

Nut, lock (P/N 23-09900-104) (2)

Seal, rubber (P/N 908028) (2)

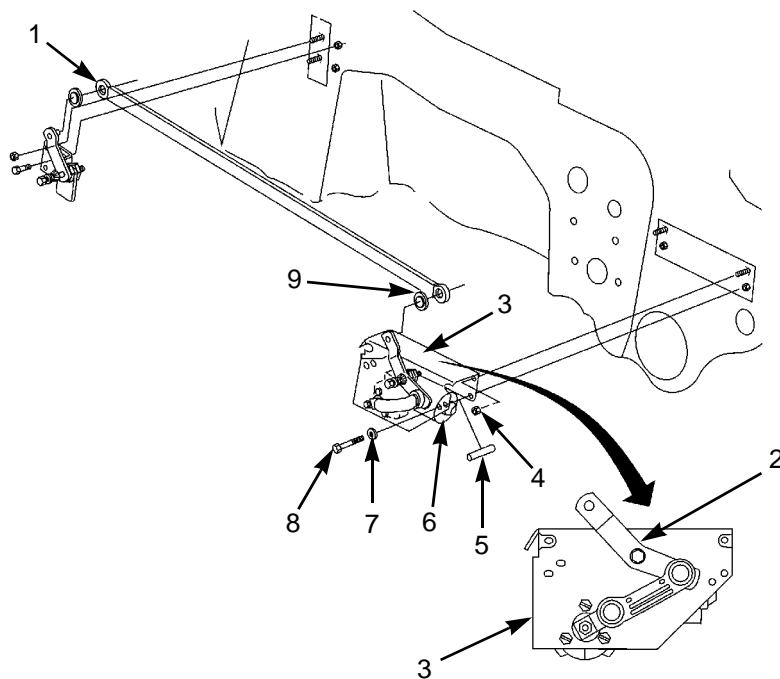
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Windshield wipers and wiper arms removed (WP 0199 00)

REMOVAL

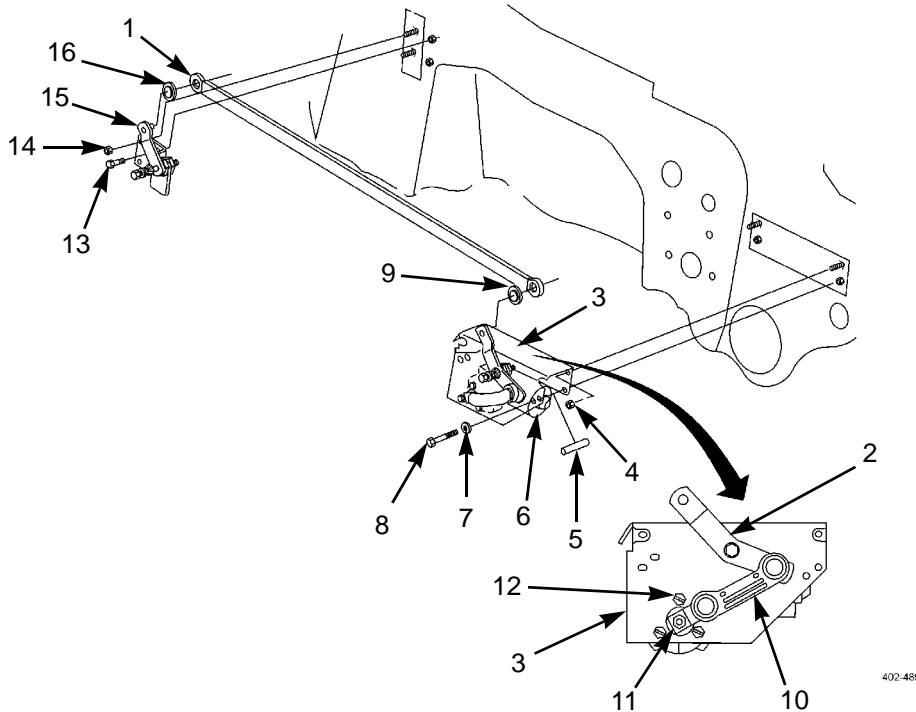
1. Pry connecting link (1) from linkage pivot bar (2).
2. Remove rubber seal (9) from ball joint of linkage pivot bar (2). Discard rubber seal.
3. Disconnect connector of wiper motor (6) from cab wiring harness.
4. Remove two locknuts (4) from bracket (3). Discard locknuts.
5. Remove two screws (8), washers (7), and spacers (5) securing bracket (3) and wiper motor (6) to firewall.
6. Remove bracket (3) and wiper motor (6).



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REMOVAL - CONTINUED

7. Remove nut (11) and pry wiper motor crank (10) from shaft of wiper motor (6).
8. Remove three screws (12) and wiper motor (6) from bracket (3).
9. Remove two nuts (14), two screws (13), and pivot assembly (15) from firewall.
10. Pry connecting link (1) from pivot assembly (15).
11. Remove rubber seal (16) from ball joint of pivot assembly (15). Discard rubber seal.

**INSTALLATION**

1. Install new rubber seal (16) to ball joint of pivot assembly (15).
2. Install connecting link (1) to pivot assembly (15).
3. Install pivot assembly (15) to firewall with two screws (13) and two nuts (14).
4. Install wiper motor (6) to bracket (3) with three screws (12). Tighten screws to 55 lb-in (621 Ncm).
5. Install wiper motor crank (10) to shaft of wiper motor (6) with nut (11).
6. Position bracket (3) and wiper motor (6) to firewall.
7. Install two spacers (5), washers (7), and screws (8). Tighten screws to 60-84 lb-in (678-949 Ncm).
8. Install two new locknuts (4) to bracket (3). Tighten nuts to 60-84 lb-in (678-949 Ncm).
9. Connect connector of wiper motor (6) to cab wiring harness.
10. Install new rubber seal (9) to ball joint of linkage pivot bar (2).
11. Install connecting link (1) to linkage pivot bar (2).
12. Install windshield wipers and wiper arms (WP 0199 00).

END OF WORK PACKAGE

VEHICLE JACK MOUNTING BRACKET REPLACEMENT

0201 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Compound, caulking (Item 12, WP 0312 00)

Tools and Special Tools

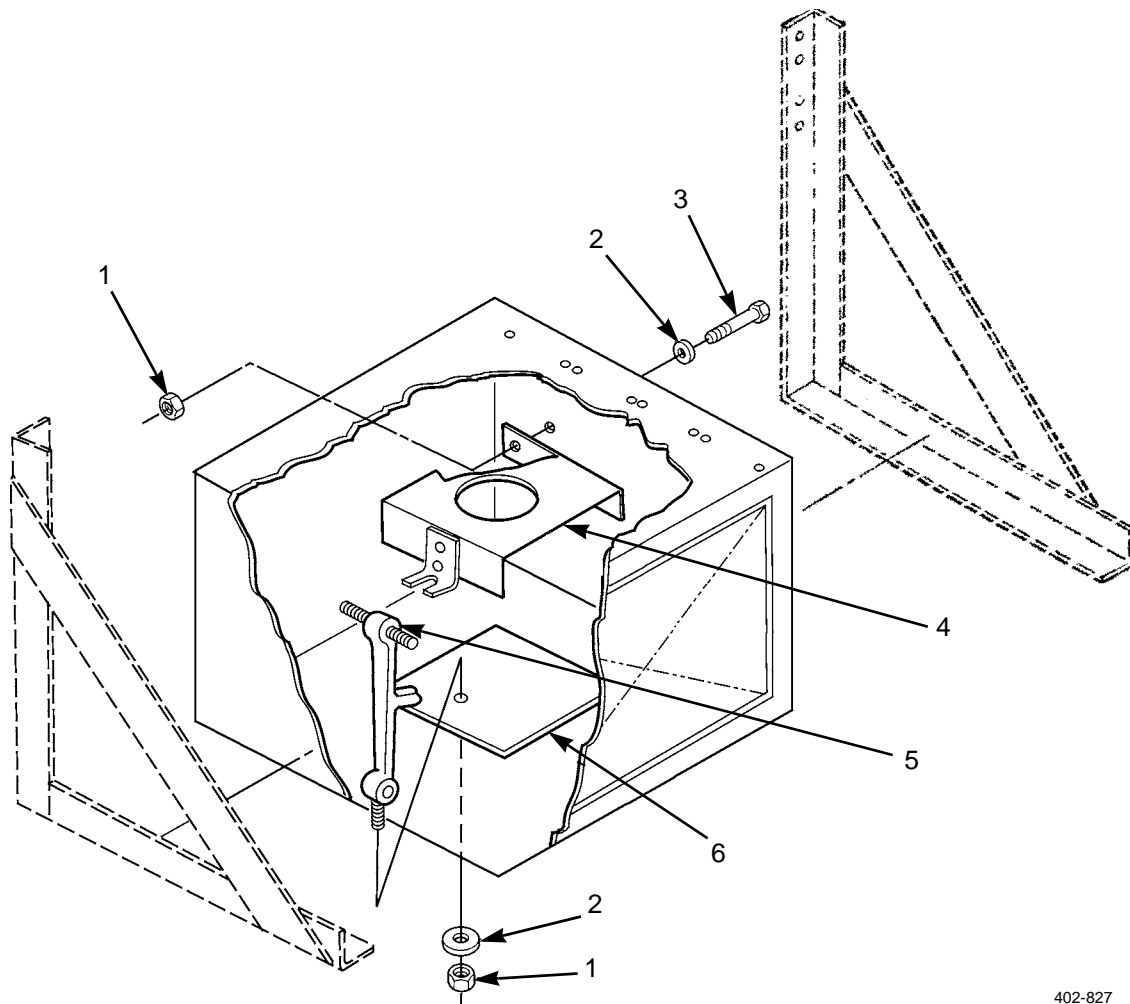
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

BII removed from box (TM 9-2320-303-10)

REMOVAL

1. Remove caulking compound from nuts and screws.
2. Remove nut (1), washer (2), and latch (5) from pad (6).
3. Remove two nuts (1), two washers (2), two screws (3), and bracket (4).



402-827

INSTALLATION

1. Install bracket (4) on storage box with two screws (3), two washers (2), and two nuts (1). Coat nuts with caulking compound.
2. Install latch (5), washer (2), and nut (1) on pad (6).
3. Place BII in storage box (TM 9-2320-303-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Air Horn Removal, Air Horn Valve Removal, Air Horn Valve Installation, Air Horn Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Compound, sealing, pipe (Item 17, WP 0312 00)

Tags, marker (Item 42, WP 0312 00)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-4CG5C) (3)

Equipment Condition

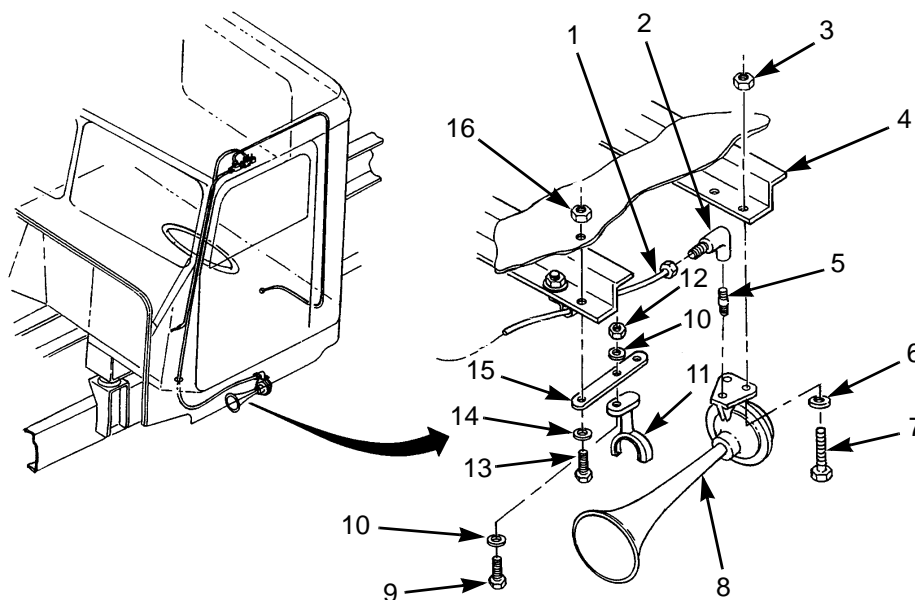
Air system drained (TM 9-2320-303-10)

Head liners removed (WP 0177 00)

Cab overhead storage compartment removed (WP 0194 00)

AIR HORN REMOVAL

1. Remove two locknuts (3), screws (7), and two washers (6) securing air horn (8) in place. Discard locknuts.
2. Separate air horn (8) from cab floor (4) and bracket (11).
3. Remove air tube (1), elbow (2), and nipple (5) from air horn (8).
4. Remove locknut (12), screw (9), two washers (10), and bracket (11) from plate (15). Discard locknut.
5. If damaged, remove nut (16), screw (13), washer (14), and plate (15) from cab floor (4).



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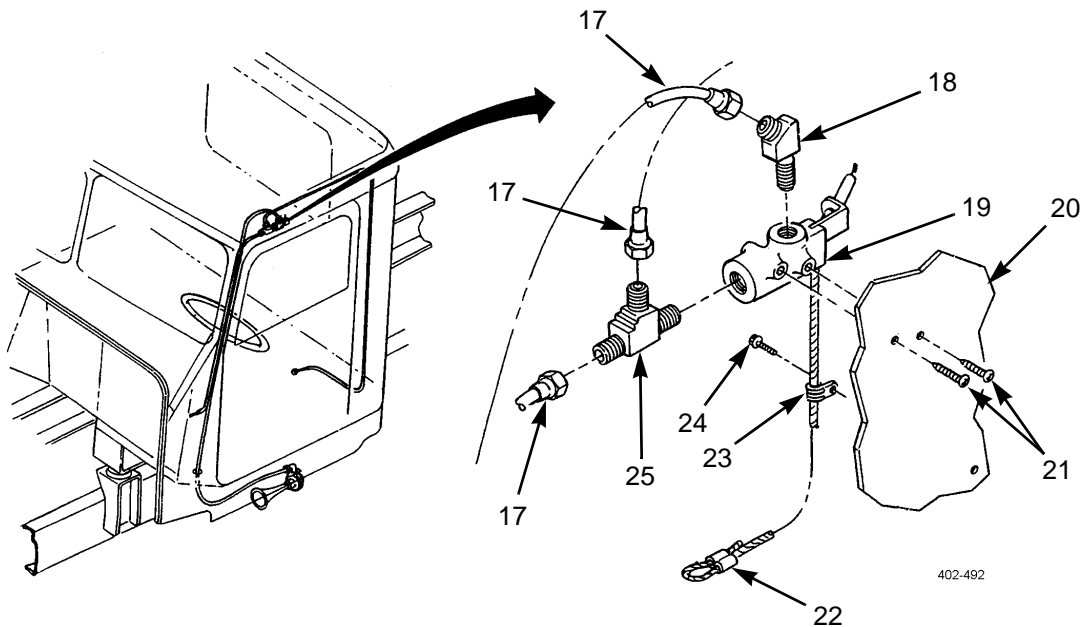
AIR HORN VALVE REMOVAL

1. Release end of pull cord (22) from cab (20).
2. Remove screw (24) and clamp loop (23) from cab (20). Remove clamp loop from pull cord (22).

NOTE

Tag tubes to aid in installation

3. Disconnect three tubes (17) and remove tee (25) and elbow (18) from valve (19).
4. Remove two screws (21) and valve (19) from cab (20).

**AIR HORN VALVE INSTALLATION****WARNING**

Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.

1. Apply a light coat of pipe sealing compound to threads of elbow (18) and tee (25).

NOTE

Ensure valve is properly positioned to allow for mounting on cab.

2. Install tee (25) and elbow (18) on valve (19) and connect three tubes (17) to fittings.
3. Install valve (19) to cab (20) and secure with two screws (21).
4. Attach pull cord (22) with clamp loop (23) to valve (19) and secure clamp loop to cab (20) with screw (24).

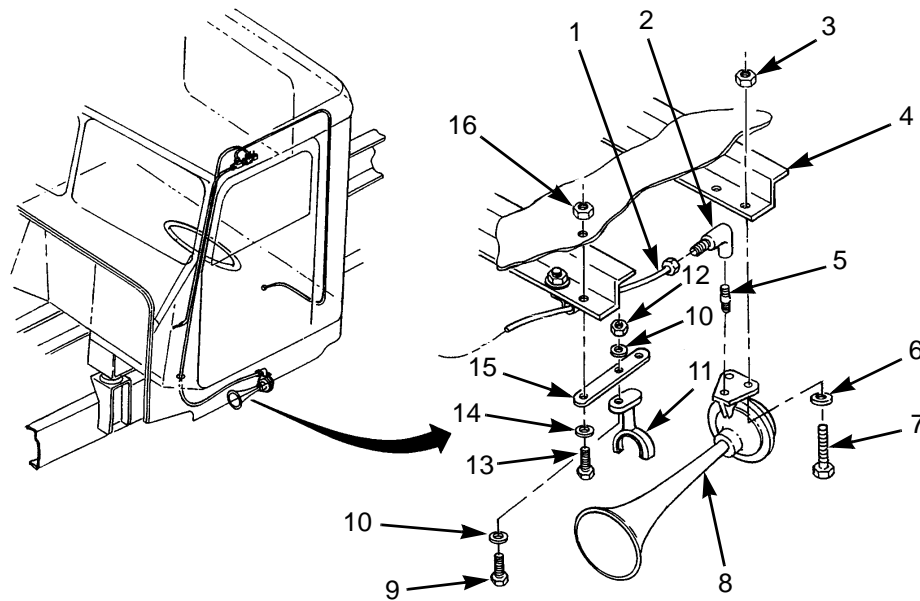
AIR HORN INSTALLATION

1. If removed, install plate (15) to cab floor (4) with washer (14), screw (13), and nut (16).
2. Install bracket (11) to plate (15) with two washers (10), screw (9) and new locknut (12).



Adhesives 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 a well-ventilated area. If adhesives or sealing compound contacts skin or clothing, wash immediately with soap and water.

3. Apply pipe sealing compound to nipple (5) and install nipple, elbow (2), and air tube (1) to air horn (8).
4. Position air horn (8) to bracket (11) and cab floor (4).
5. Secure air horn (8) in place with two washers (6), two screws (7) and new locknuts (3).



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6. Start vehicle and check for leaks in air system and operation of air horn (TM 9-2320-303-10).
7. Install head liners (WP 0177 00).
8. Install cab overhead storage compartment (WP 0194 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Drill, electric, portable (Item 20, WP 0313 00)

Tools and Special Tools - Continued

Drill set, twist (Item 21, WP 0313 00)

Riveter, blind, hand (Item 79, WP 0313 00)

Materials/Parts

Rivet, blind (4)

REMOVAL

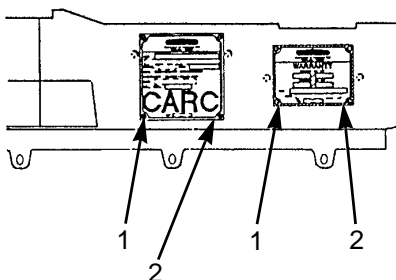
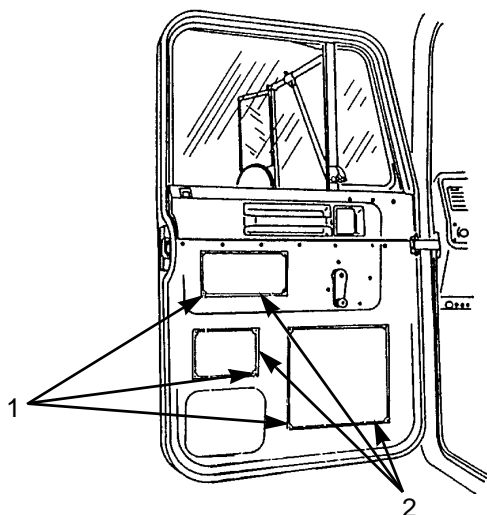
CAUTION

- If drilling in door panel, make sure window is rolled up. Failure to do so could result in damage to window.
- If drilling in dashboard panel, make sure panel is removed from dashboard. Failure to do so could result in damage to heating ducts.

NOTE

Procedures are the same for all plates.

Remove four rivets (1) and plate (2). Discard rivets.



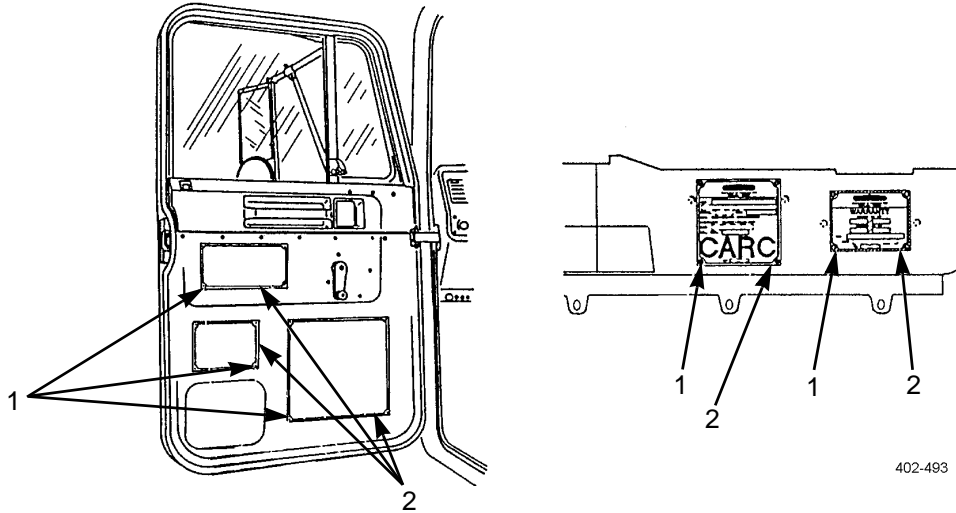
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INSTALLATION

NOTE

If installing plate on new panel, use illustration for location of drill holes.

Install plate (2) and four new rivets (1).



END OF WORK PACKAGE

WINDSHIELD WASHER RESERVOIR REPLACEMENT**0204 00****THIS WORK PACKAGE COVERS**

Pump Removal, Reservoir Removal, Pump Installation, Reservoir Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Pan, drain (Item 62, WP 0313 00)

Materials/Parts

Compound, cleaning, windshield (Item 13, WP 0312 00)

References

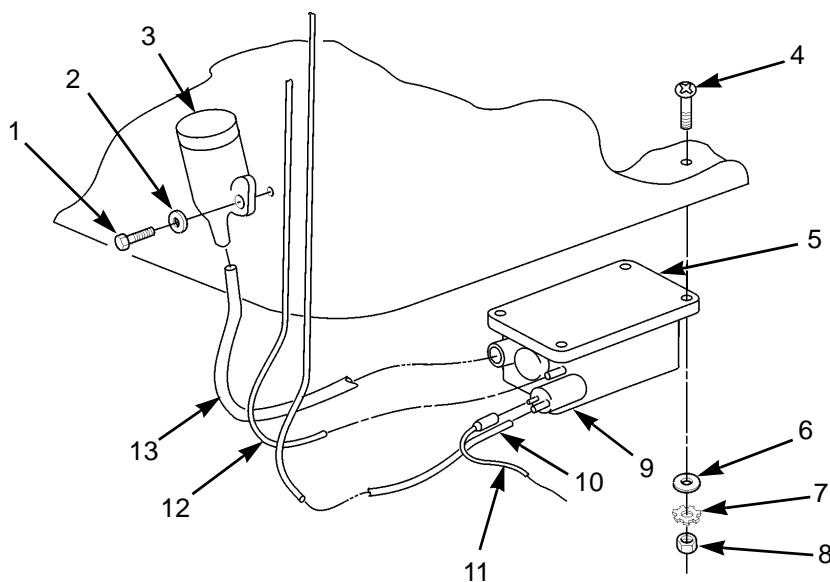
TM 9-2320-303-10

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

PUMP REMOVAL

1. Remove wiring harness connector (10) from windshield washer reservoir pump (9).
2. Remove hose (11) from pump (9) and allow windshield washer solvent to drain into a suitable container.
3. Remove pump (9) from windshield washer reservoir (5).



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RESERVOIR REMOVAL

1. Remove filler tube (13) from filler spout (3) and windshield washer reservoir (5).
2. Remove vent hose (12) from windshield washer reservoir (5).

RESERVOIR REMOVAL - CONTINUED

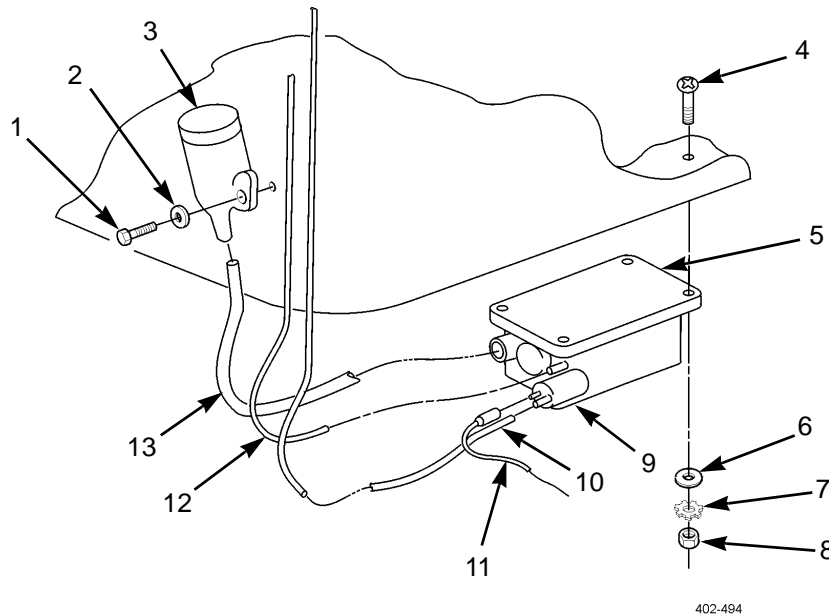
3. Remove two screws (1), washers (2), and filler spout (3) from vehicle.
4. Remove four nuts (8), washers (7), washers (6), screws (4), and windshield washer reservoir (5) from vehicle.

PUMP INSTALLATION

1. Install pump (9) on windshield washer reservoir (5).
2. Install hose (11) on windshield washer reservoir pump (9).
3. Install wiring harness connector (10) on windshield washer reservoir pump (9).

RESERVOIR INSTALLATION

1. Install windshield washer reservoir (5) on vehicle with four screws (4), washers (6), washers (7), and nuts (8).
2. Install filler spout (3) on vehicle with two washers (2) and screws (1).
3. Install vent hose (12) on windshield washer reservoir (5).
4. Install filler tube (13) on windshield washer reservoir (5) and filler spout (3).
5. Fill windshield washer reservoir (5) with windshield cleaning compound (TM 9-2320-303-10).



END OF WORK PACKAGE

CUP HOLDER REPLACEMENT**0205 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

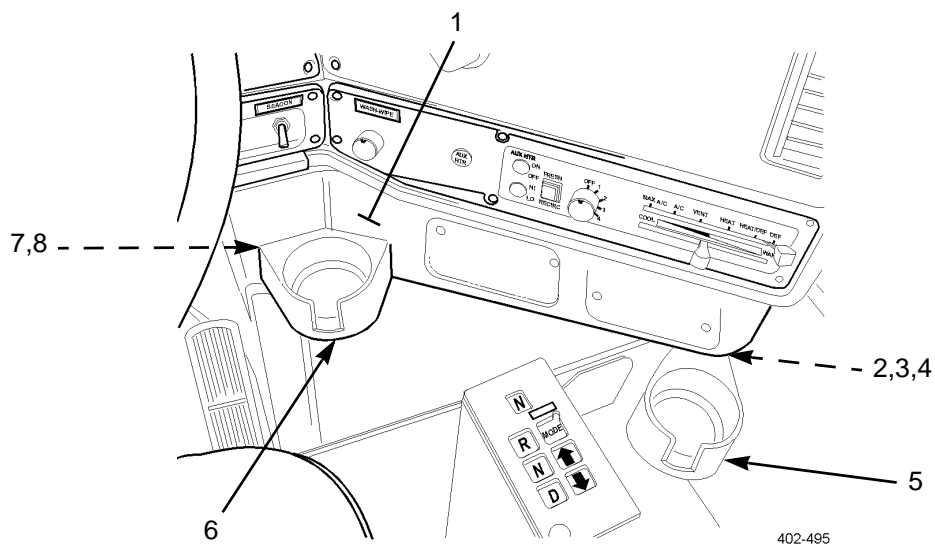
Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

1. Remove two screws (7), two flatwashers (8), and L/H cup holder (6) from dash (1).
2. Remove two screws (2), two flatwashers (3), and R/H cup holder (5) from swivel (4).
3. Remove swivel (4) from dash (1).

**INSTALLATION**

1. Position L/H cup holder (6) on dash (1) and install two flatwashers (8) and two screws (7).
2. Install swivel (4) in dash (1).
3. Position R/H cup holder (5) on swivel (4) and install two flatwashers (3) and two screws (2).
4. Ensure R/H cup holder (5) rotates freely.

END OF WORK PACKAGE

CAB ROOF AIR DEFLECTOR MAINTENANCE

0206 00

THIS WORK PACKAGE COVERS

Air Deflector Removal, Mounting Hardware Removal, Mounting Hardware Installation, Air Deflector Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench set, socket attachment (Item 114, WP 0313 00)

Materials/Parts

Nut, lock (P/N RUD/AP691) (6)

Washer, lock (P/N RUD/AP696) (8)

Personnel Required

Two

Equipment Condition

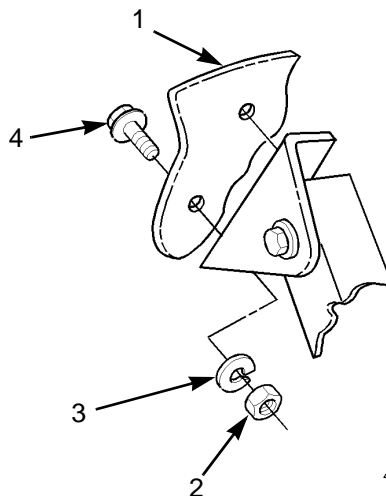
Head liners removed (WP 0177 00)

NOTE

All vehicles are not equipped with an air deflector.

AIR DEFLECTOR REMOVAL

Remove eight nuts (2), lockwashers (3), screws (4), and air deflector (1) from vehicle. Discard lockwashers.



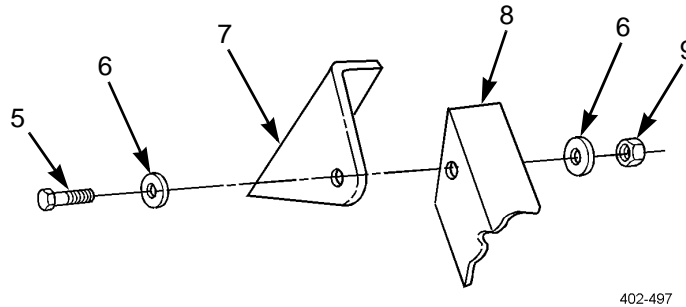
402-496

MOUNTING HARDWARE REMOVAL

NOTE

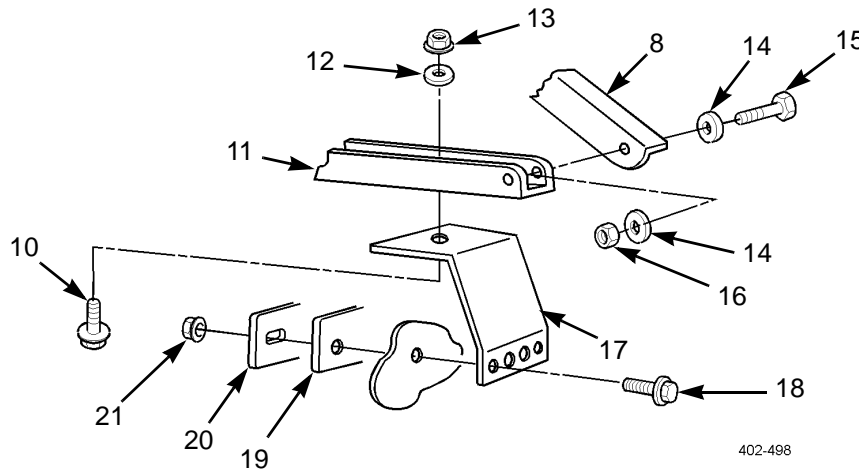
Perform steps 1 through 6 at each side of cab roof.

1. Remove locknut (9), two washers (6), screw (5), and top pivot bracket (7) from strut (8). Discard locknut.



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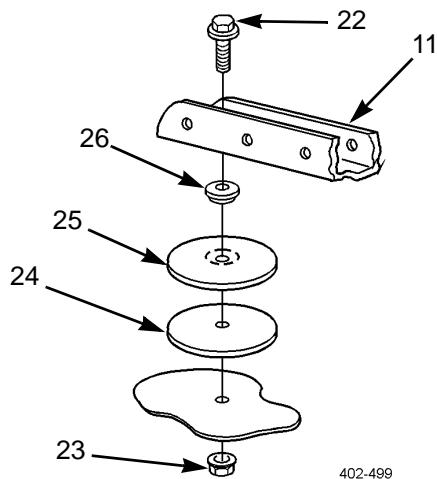
2. Remove locknut (16), two washers (14), screw (15), and strut (8) from channel (11). Discard locknut.
3. Remove nut (13), washer (12) and screw (10) and channel (11) from support bracket (17).
4. Remove two nuts (21), reinforcing plate (20), gasket (19), two screws (18), and support bracket (17) from rear of cab roof.



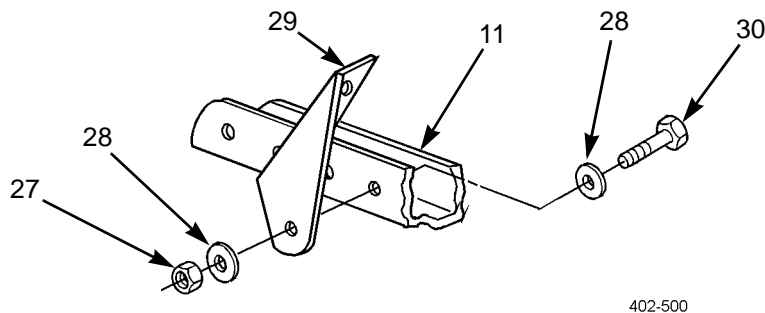
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MOUNTING HARDWARE REMOVAL - CONTINUED

- Remove two nuts (23), screws (22), channel (11), swivel spacers (26), swivel plates (25), and rubber seals (24) from cab roof.



- Remove locknut (27), two washers (28), screw (30), and bottom pivot bracket (29) from channel (11). Discard locknut.

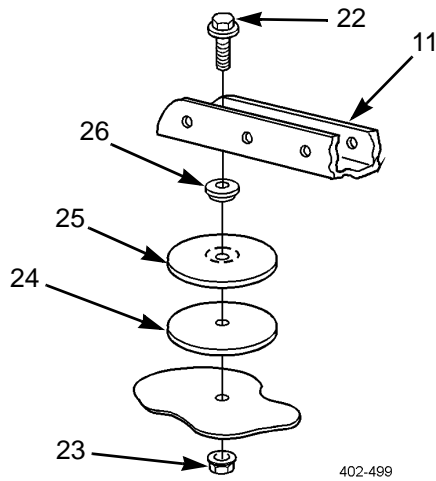
**MOUNTING HARDWARE INSTALLATION****NOTE**

Perform steps 1 through 6 at each side of cab roof.

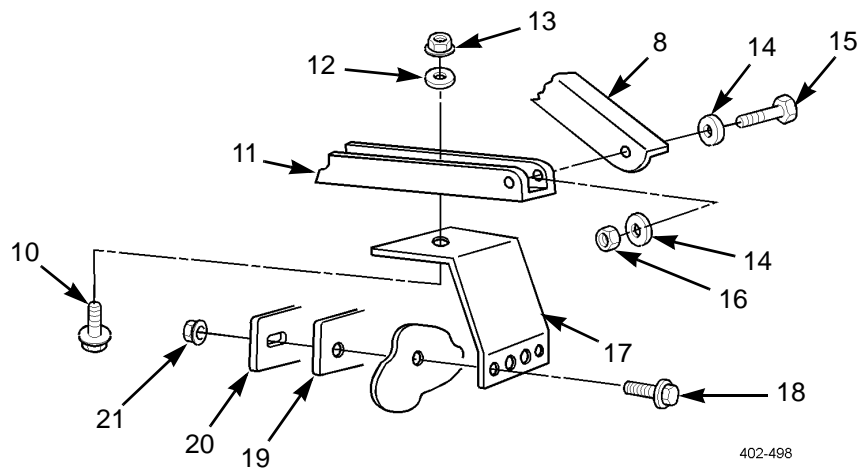
- Install bottom pivot bracket (29) on third hole from front of channel (11) with screw (30), two washers (28), and new locknut (27).

MOUNTING HARDWARE INSTALLATION

2. Install two rubber seals (24), swivel plates (25), swivel spacers (26), and channel (11) on cab roof with two screws (22) and nuts (23).

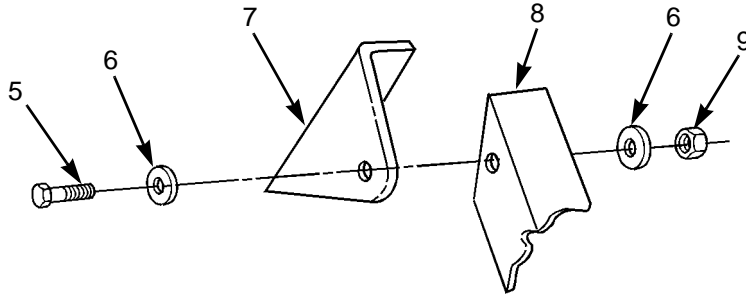


3. Install support bracket (17), gasket (19), and reinforcing plate (20) on rear of cab roof with two screws (18) and nuts (21).
4. Install channel (11) on support bracket (17) with screw (10), washer (12), and nut (13).



MOUNTING HARDWARE INSTALLATION - CONTINUED

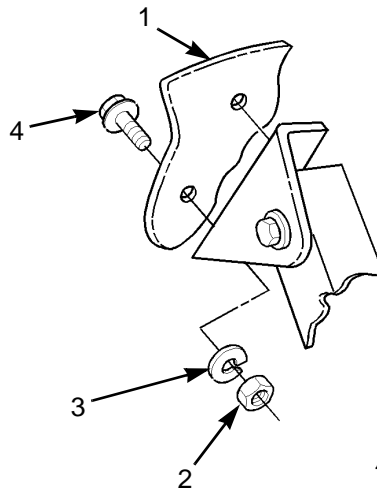
5. Install strut (8) on rear hole of channel (11) with screw (15), two washers (14), and new locknut (16).
6. Install top pivot bracket (7) on strut (8) with screw (5), two washers (6), and new locknut (9).



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AIR DEFLECTOR INSTALLATION

1. Install air deflector (1) on vehicle with eight screws (4), new lockwashers (3) and nuts (2).



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2. Install head liners (WP 0177 00).

END OF WORK PACKAGE

ARCTIC HEATER REPLACEMENT (WEBASTO)

0207 00**THIS WORK PACKAGE COVERS**

Arctic Heater Removal, Arctic Heater Fuel Pump Removal, Arctic Heater Installation, Arctic Heater Fuel Pump Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Tags, marker (Item 42, WP 0312 00)

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Personnel Required

Two

Pan, drain (Item 62, WP 0313 00)

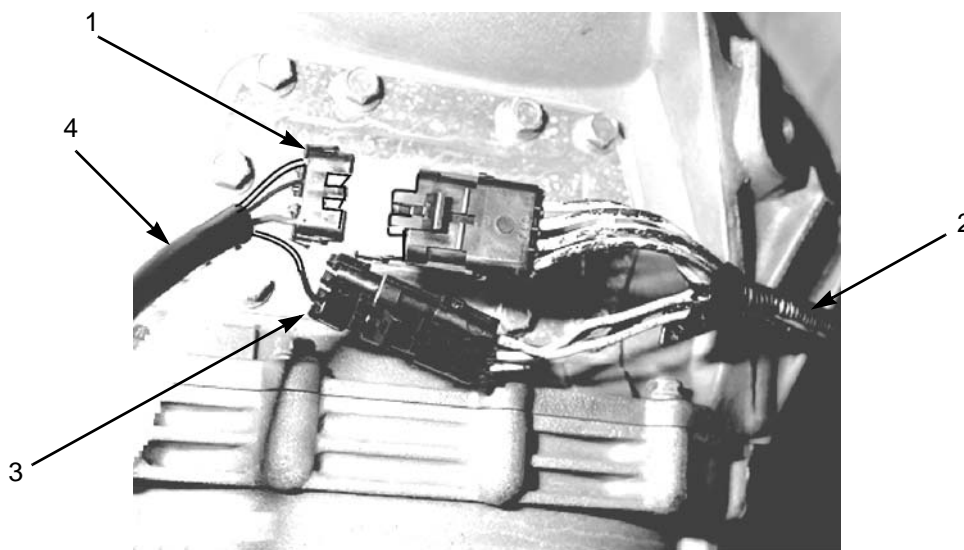
Equipment Condition

Cooling system drained (WP 0045 00)

ARCTIC HEATER REMOVAL**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel or damage to equipment.

1. At top of transmission, tag and disconnect two connectors (1 and 3) of arctic heater harness (4) from connectors of wiring harness (2).



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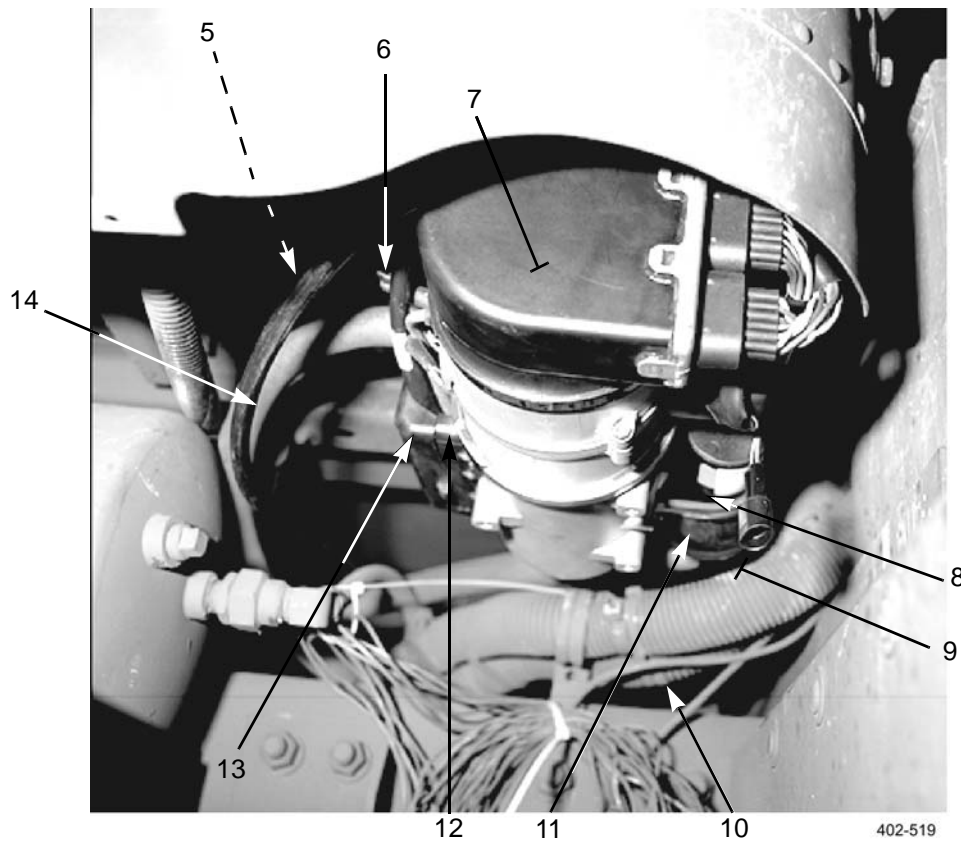
ARCTIC HEATER REMOVAL - CONTINUED

2. At left-rear of cab, loosen clamp and disconnect exhaust tube (9) from exhaust port (8) of arctic heater (7).
3. While supporting arctic heater (7), remove four nuts and screws holding arctic heater mounting bracket to cab floor.
4. Disconnect connector (6) of arctic heater (7) from connector of wiring harness (5).

NOTE

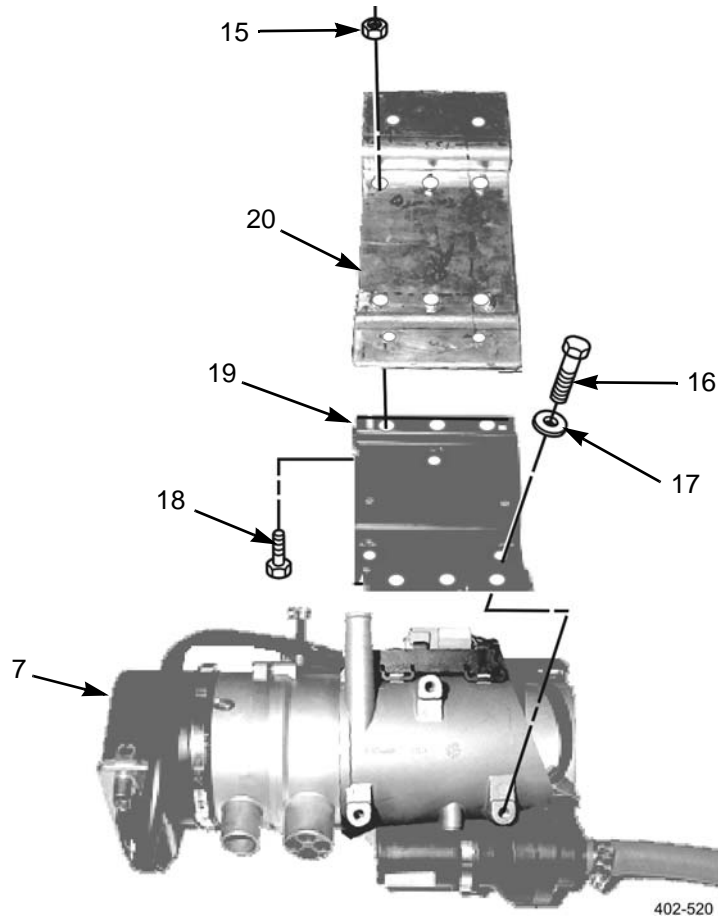
Have suitable container available to catch coolant draining from hoses.

5. Loosen clamp and disconnect coolant hose (10) from coolant pump (11) of arctic heater (7).
6. Loosen clamp and disconnect coolant hose (14) from coolant outlet port (13).
7. Loosen clamp and disconnect fuel supply hose from fuel inlet (12).
8. Remove arctic heater (7) assembly from vehicle.



ARCTIC HEATER REMOVAL - CONTINUED

9. Remove six nuts (15), screws (18) and mounting bracket (20) from adapter bracket (19).
10. Remove three screws (16), washers (17), and adapter bracket (19) from arctic heater (7).



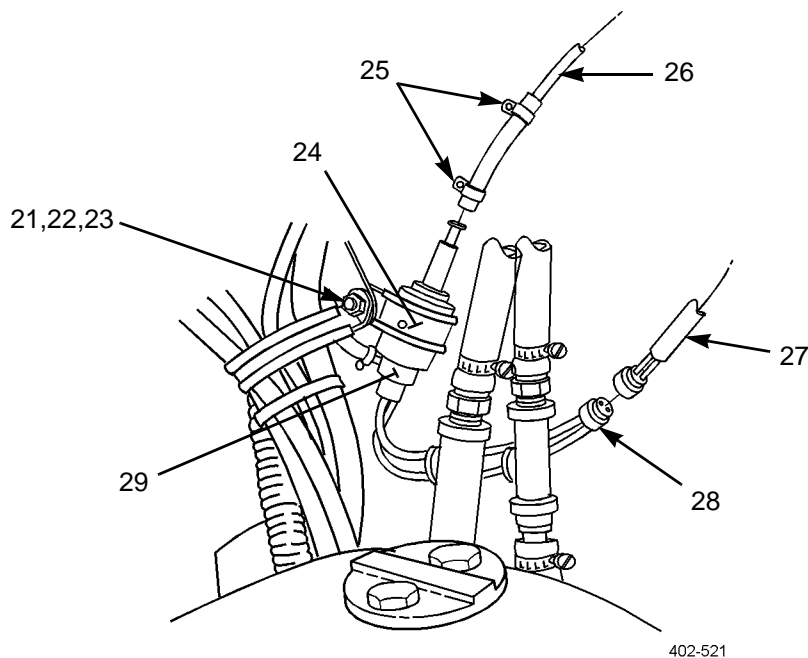
ARCTIC HEATER FUEL PUMP REMOVAL**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel or damage to equipment.

1. Remove nut (21), washer (22), screw (23), and clamp (24) from arctic heater fuel pump (29).
2. Disconnect connector (28) of arctic heater fuel pump (29) from wiring harness (27).

NOTE

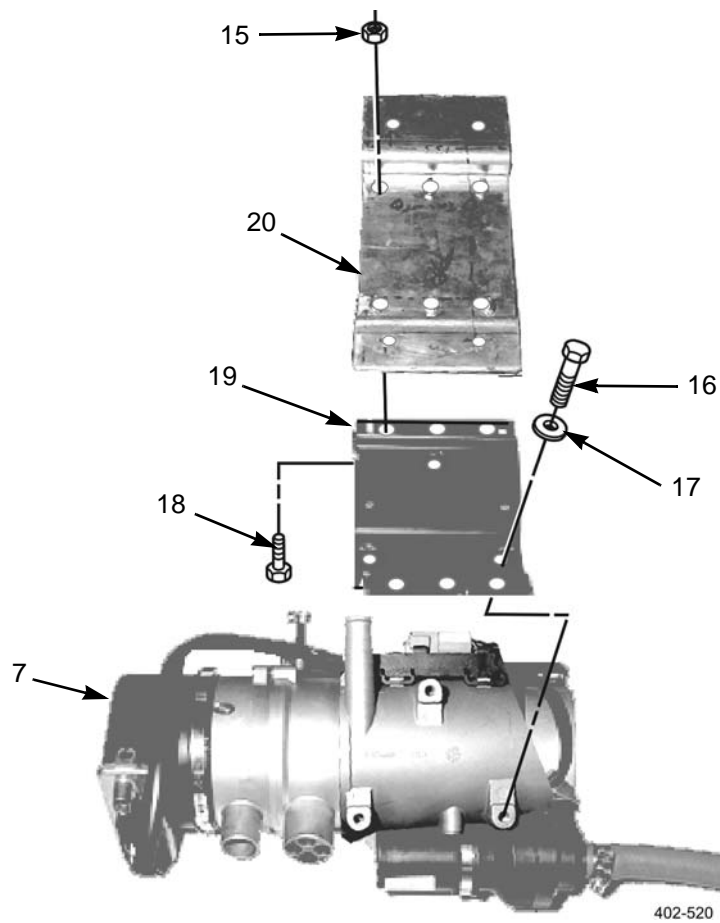
- Have a suitable container available to catch fuel draining from hoses.
 - Note position of pump for installation.
 - Perform step 3 at each end of arctic heater fuel pump.
3. Loosen clamp (25) and disconnect fuel hose (26) from arctic heater fuel pump (29).
 4. Remove arctic heater fuel pump (29) from vehicle.



ARCTIC HEATER INSTALLATION**WARNING**

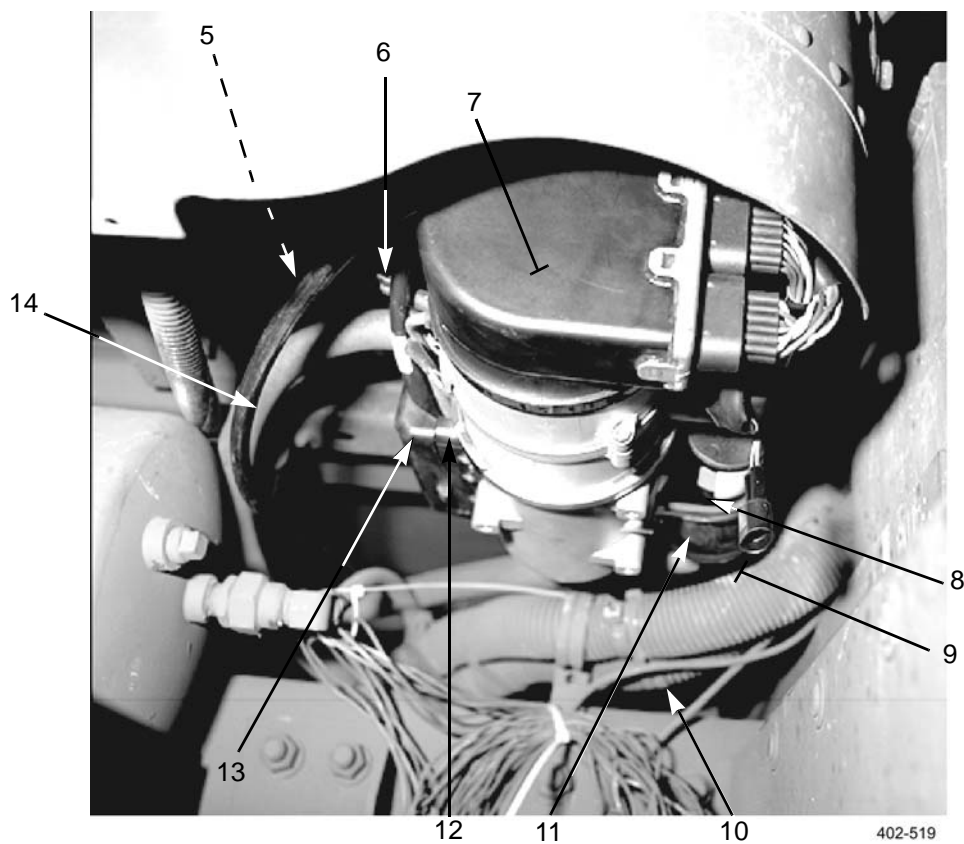
DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel or damage to equipment.

1. Install adapter bracket (19) to arctic heater (7) with three washers (17) and screws (16).
2. Install mounting bracket (20) to adapter bracket (19) with six screws (18) and nuts (15).



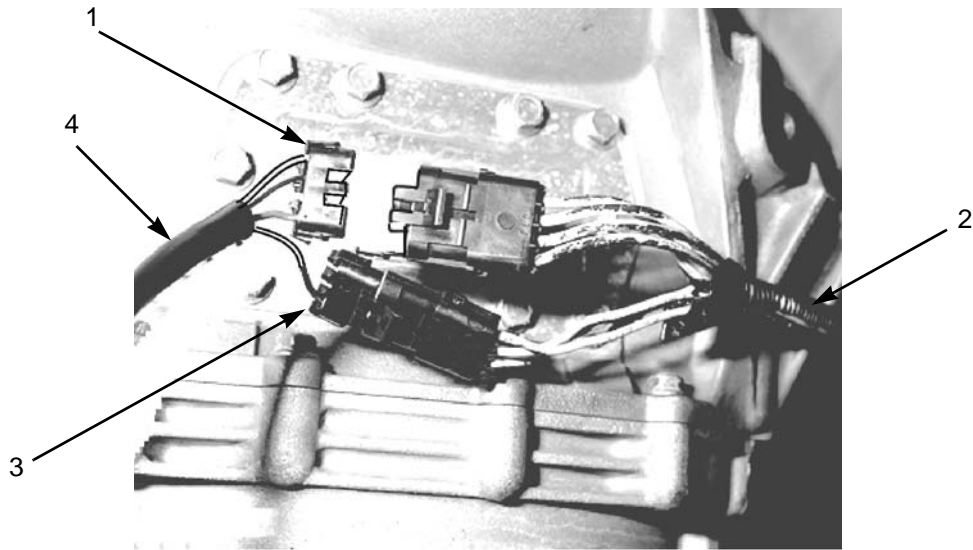
ARCTIC HEATER INSTALLATION - CONTINUED

1. Position arctic heater (7) assembly to vehicle.
2. While supporting arctic heater (7), connect fuel supply hose to fuel inlet (12) and tighten clamp.
3. Connect coolant hose (14) to coolant outlet port (13) and tighten clamp.
4. Connect coolant hose (10) to coolant pump (11) of arctic heater (7) and tighten clamp.
5. Connect connector (6) of arctic heater (7) to connector of wiring harness (5).
6. Install mounting bracket of arctic heater to cab floor with four screws and nuts.
7. Install exhaust tube (9) to exhaust port (8) of arctic heater (7) and tighten clamp.



ARCTIC HEATER INSTALLATION - CONTINUED

8. At top of transmission, connect two connectors (1 and 3) of arctic heater harness (4) to connectors of wiring harness (2).



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ARCTIC HEATER FUEL PUMP INSTALLATION**WARNING**

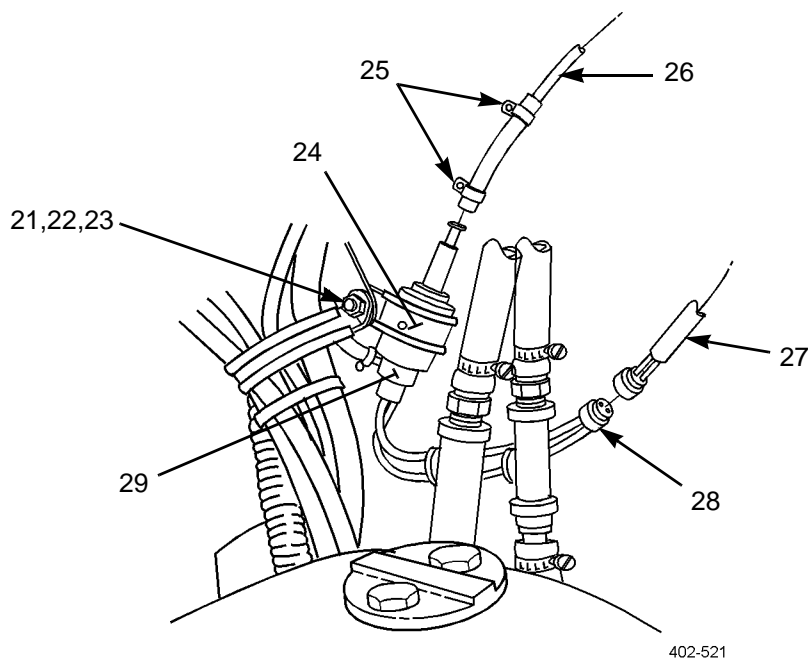
DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death to personnel or damage to equipment.

1. Position arctic heater fuel pump (29) to vehicle.

NOTE

Perform step 2 at each end of arctic heater fuel pump.

2. Connect fuel hose (26) to arctic heater fuel pump (29). Tighten clamp (25).
3. Connect connector (28) of arctic heater fuel pump (29) to wiring harness (27).
4. Install arctic heater fuel pump (29) with clamp (24), screw (23), washer (22), and nut (21).



5. Fill cooling system (WP 0045 00).

END OF WORK PACKAGE

M16 RIFLE MOUNTING BRACKET REPLACEMENT

0208 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

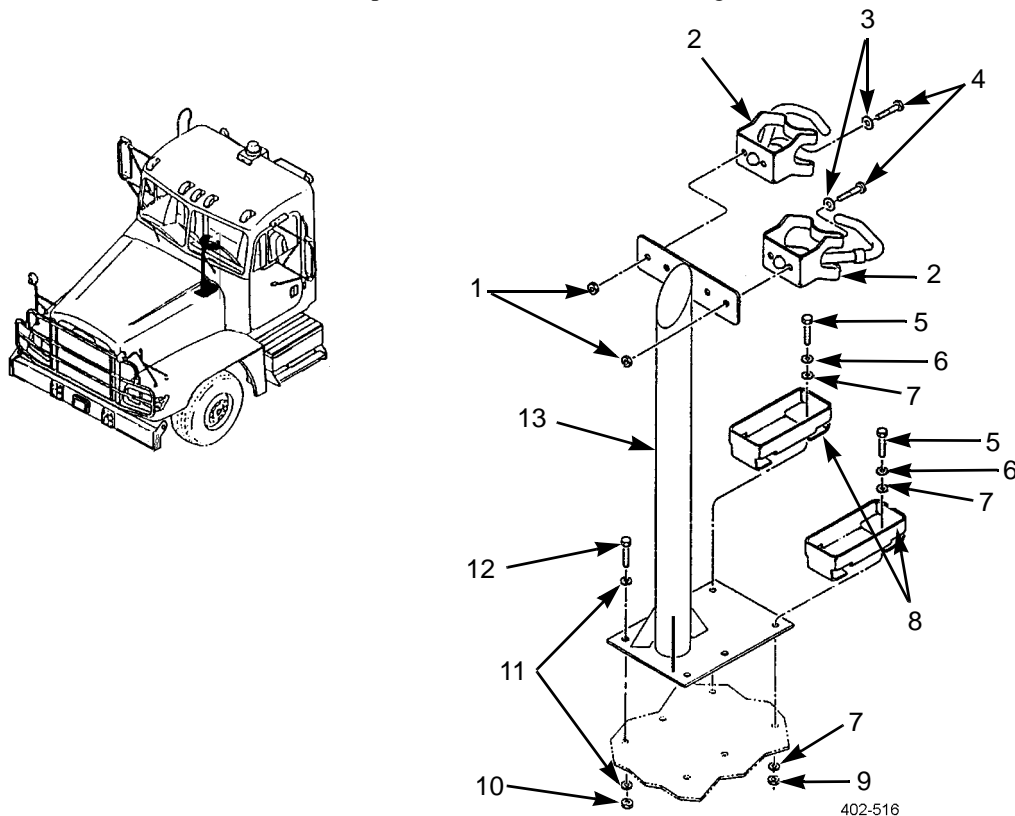
Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

REMOVAL

1. Remove four nuts (1), two catch bracket assemblies (2), four cap screws (4), and washers (3) from rifle mounting bracket (13).
2. Remove four cap screws (5), washers (6), eight washers (7), four nuts (9), and two rifle mounting supports (8) from rifle mounting bracket (13).
3. Remove two nuts (10), four washers (11), two cap screws (12), and rifle mounting bracket (13).



INSTALLATION

1. Install rifle mounting bracket (13) with four washers (11), two cap screws (12), and nuts (10).
2. Install two rifle mounting supports (8) on rifle mounting bracket (13) with eight washers (7), four washers (6), cap screws (5), and nuts (9).
3. Install two catch bracket assemblies (2) on rifle mounting bracket (13) with four washers (3), cap screws (4), and nuts (1).

END OF WORK PACKAGE

ROTATING WARNING LIGHT BRACKET REPLACEMENT

0209 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Materials/Parts

Nut, lock (P/N 115307A) (6)

Tools and Special Tools

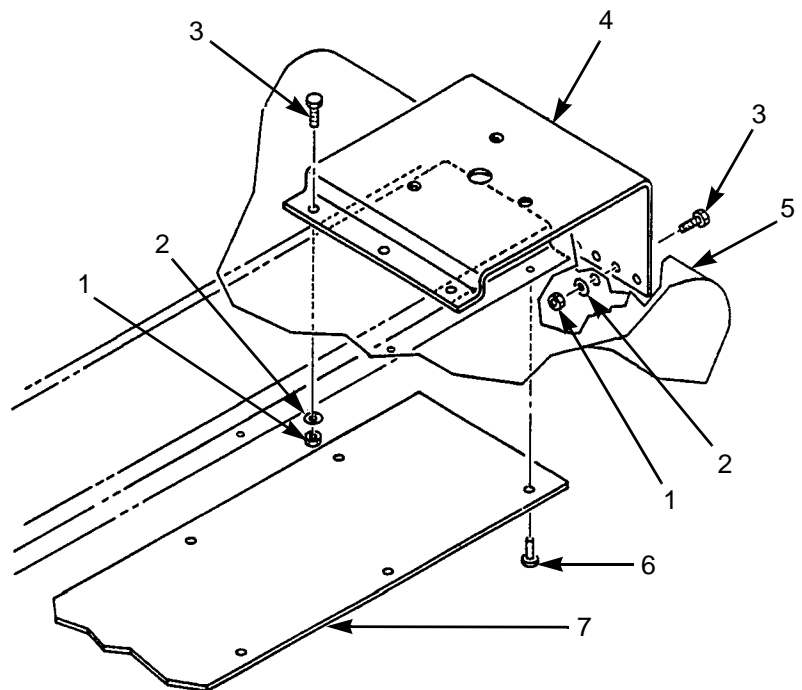
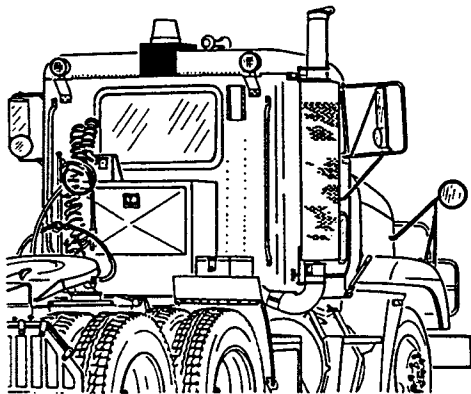
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Head liners removed (WP 0177 00)

REMOVAL

1. Remove five screws (6) and plate (7) from cab (5).
2. Remove six locknuts (1), six washers (2), six screws (3), and rotating warning light mounting bracket (4) from cab (5). Discard locknuts.

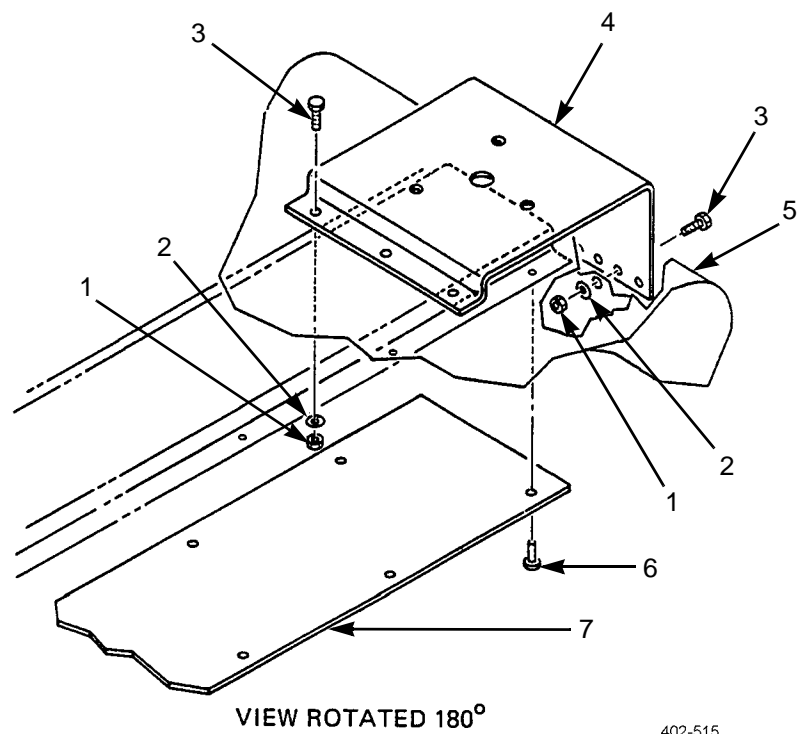
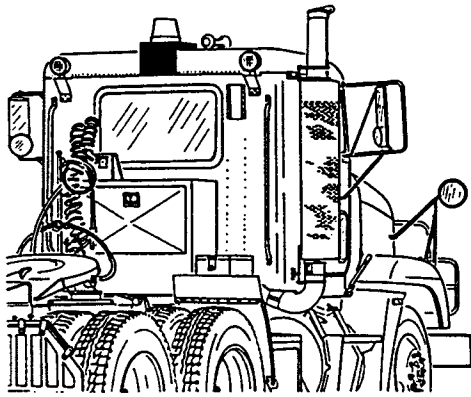


VIEW ROTATED 180°

402-515

ROTATING WARNING LIGHT BRACKET REPLACEMENT - CONTINUED**0209 00****INSTALLATION**

1. Install rotating warning light mounting bracket (4), six screws (3), six washers (2), and six new locknuts (1) on cab (5).
2. Install plate (7) and five screws (6) in cab (5).
3. Install head liners (WP 0177 00).



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END OF WORK PACKAGE

HVAC AIR CYLINDER REPLACEMENT

0210 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Materials/Parts

Nut, push (P/N BOA 702011 00)

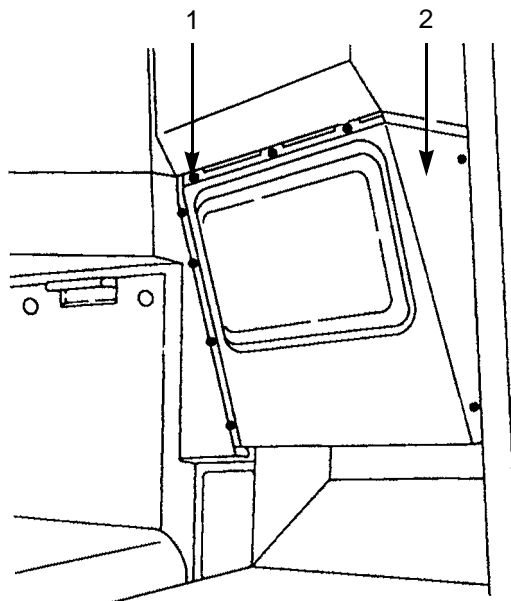
Nut, push (P/N BOA 707014 00)

Tools and Special ToolsTool kit, general mechanic's (Item 102, WP 0313
00)**References**

TM 9-2320-303-10

REMOVAL

1. Place heater/air conditioner slide lever in "DEF" position (TM 9-2320-303-10).
2. Remove nine screws (1) and dash panel (2).



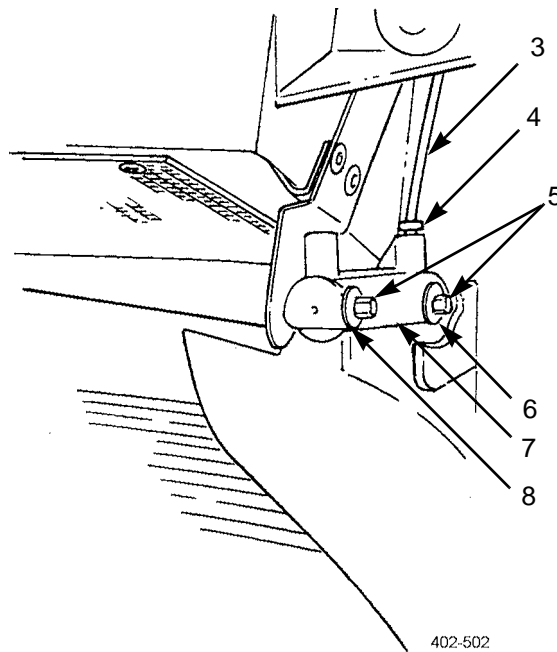
402-501

HVAC AIR CYLINDER REPLACEMENT - CONTINUED

0210 00

REMOVAL - CONTINUED

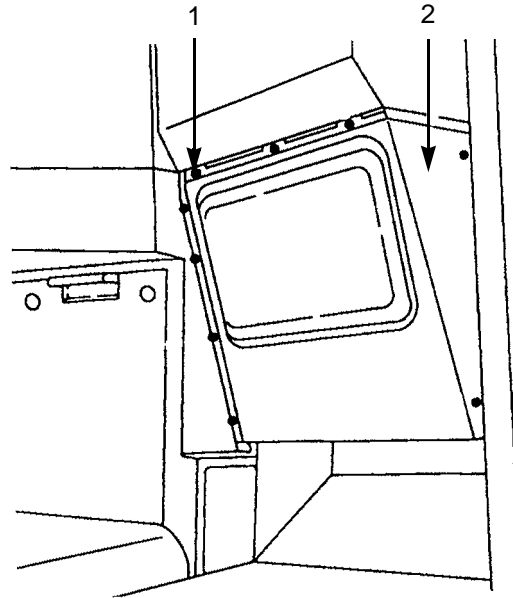
3. Disconnect air line (3) from air cylinder (7) by pushing in on cover ring (4) then pulling out on air line.
4. Remove upper push nut (8), lower push nut (6), and slide air cylinder (7) off mounting rods (5). Discard push nuts.
5. Inspect flap, rod, and bushing and replace as necessary.

**INSTALLATION**

1. Slide air cylinder (7) onto mounting rods (5) and install new upper push nut (8) and new lower push nut (6).
2. Connect air line (3) by pushing air line into cover ring (4) as far as it will go then gently pull air line back to lock it in place.
3. Test air cylinder by moving heater/air conditioner slide lever from “DEF” to “MAX AIR” (TM 9-2320-303-10). Ensure flap works freely, has full movement, and seals completely.

INSTALLATION - CONTINUED

4. Install dash panel (2) and nine screws (1).



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END OF WORK PACKAGE

HVAC BLOWER MOTOR REPLACEMENT

0211 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

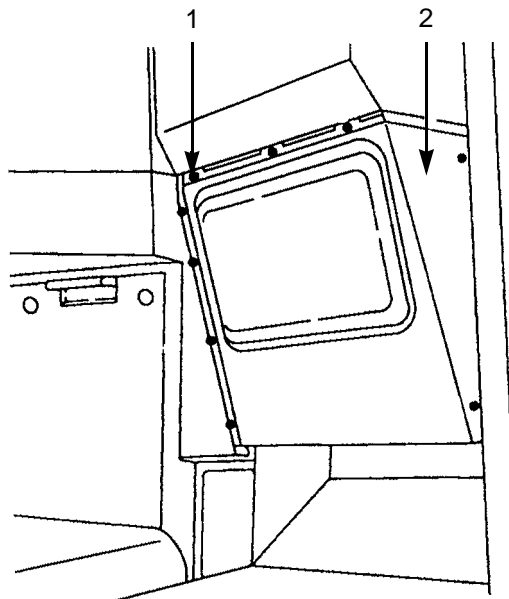
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM-2320-303-10)

REMOVAL

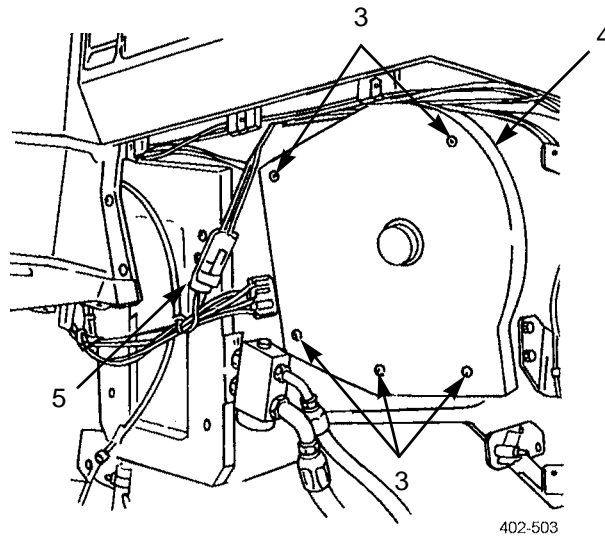
1. Remove nine screws (1) and dash panel (2).



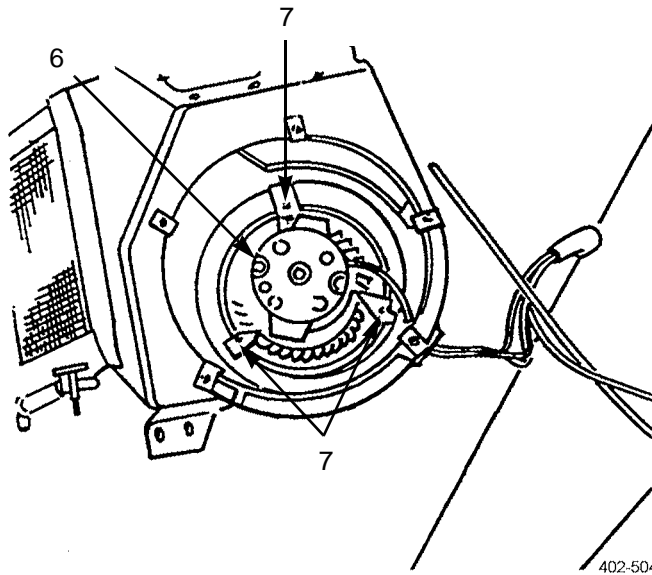
402-501

HVAC BLOWER MOTOR REPLACEMENT - CONTINUED**0211 00****REMOVAL - CONTINUED**

2. Remove five screws (3) and blower motor cover (4).
3. Disconnect blower motor connector (5).

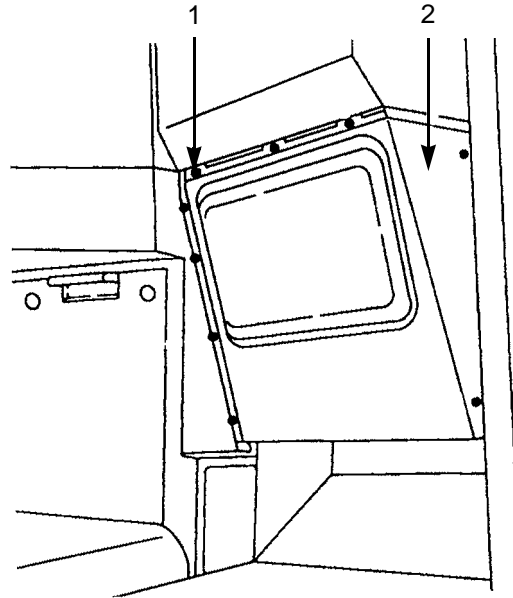


4. Remove three screws (7) and blower motor (6).

**INSTALLATION**

1. Install blower motor (6) and secure with three screws (7).
2. Connect blower motor connector (5).
3. Install blower motor cover (4) and secure with five screws (3).
4. Test blower motor (TM 9-2320-303-10).
5. Install dash panel (2) and secure with nine screws (1).

INSTALLATION - CONTINUED



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END OF WORK PACKAGE

HVAC HEATER CORE REPLACEMENT

0212 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Gloves, protective (Item 28, WP 0313 00)

Materials/Parts

Rags, wiping (Item 39, WP 0312 00)

Materials/Parts - Continued

Tags, marker (Item 42, WP 0312 00)

References

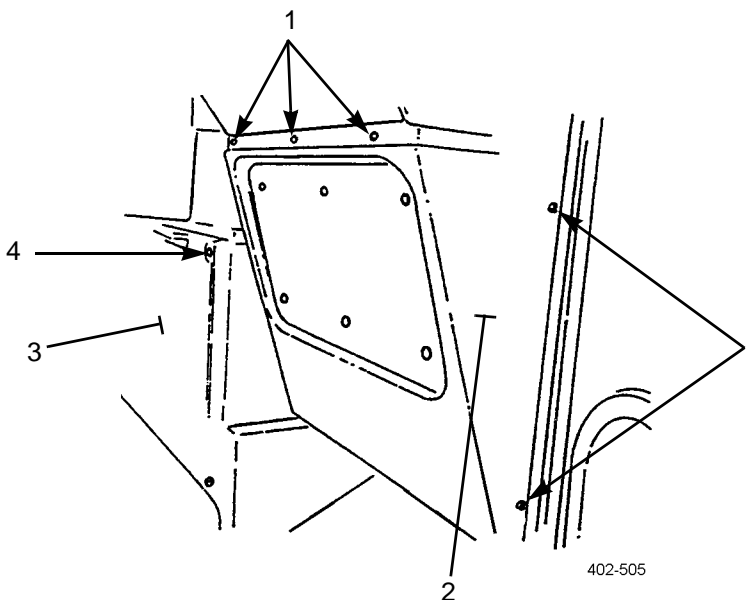
TM 9-2320-303-10

Equipment Condition

Cooling system drained (WP 0045 00)

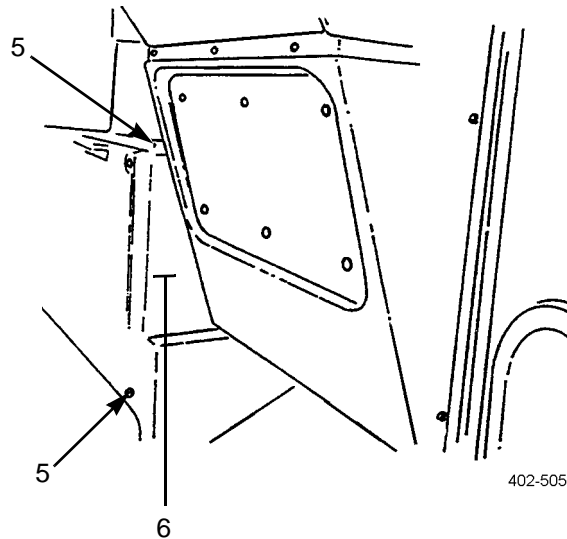
REMOVAL

1. Remove nine screws (1) and cover (2).
2. Remove three screws (4) and cover (3).

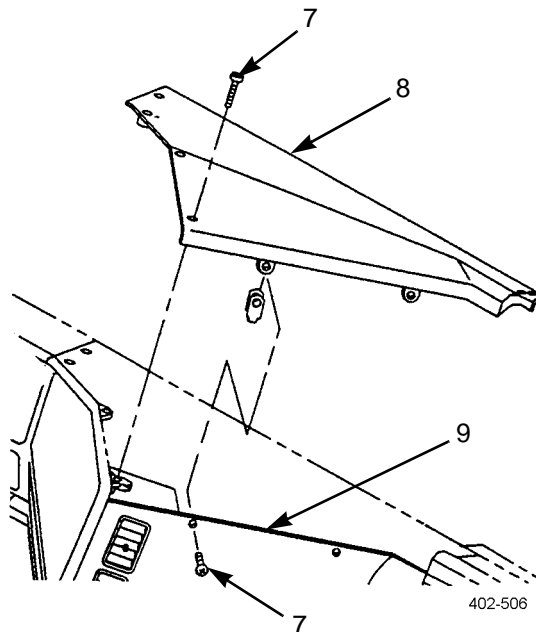


REMOVAL - CONTINUED

3. Remove two screws (5) and cover (6).

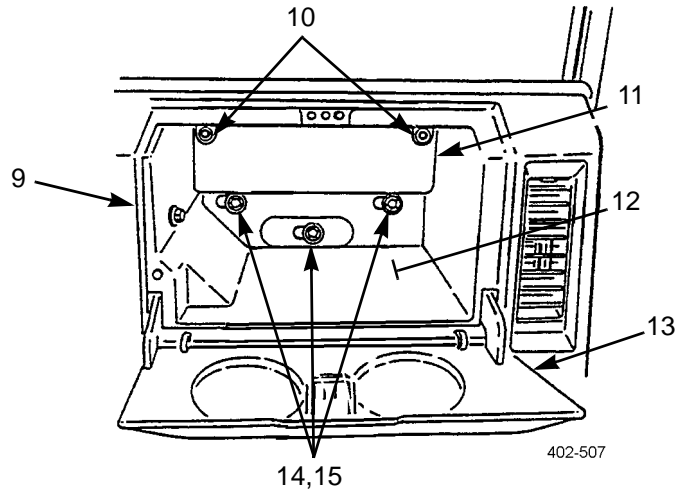


4. Remove five screws (7) and cover (8) from dash panel (9).

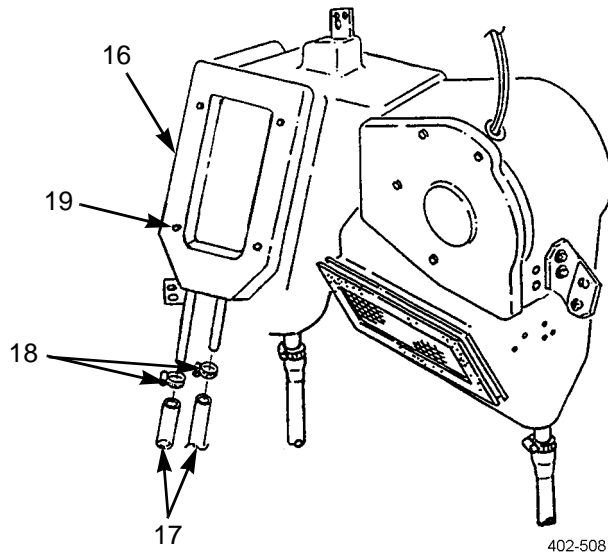


5. Open glove box door (13) and remove two screws (10) and top panel (11) from compartment (10).
6. Remove three nuts (14), spring washers (15) and compartment (12) from dash panel (9).
7. Disconnect and tag two flex hoses from ducts behind glove box.
8. Disconnect and tag air line from air cylinder behind glove box.

REMOVAL - CONTINUED



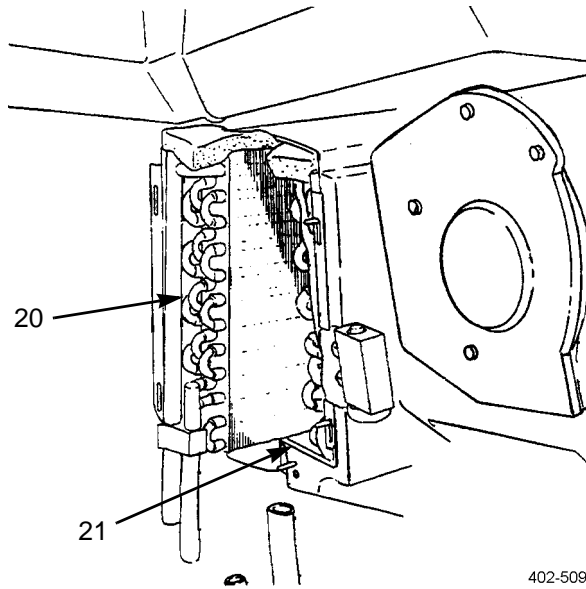
9. Place rags on cab floor, loosen two hose clamps (18), and tag and disconnect heater core hoses (17).
10. Remove four screws (19) and heater core cover (16).



REMOVAL - CONTINUED**WARNING**

Failure to wear protective gloves could result in serious skin cuts from sharp edges and fins.

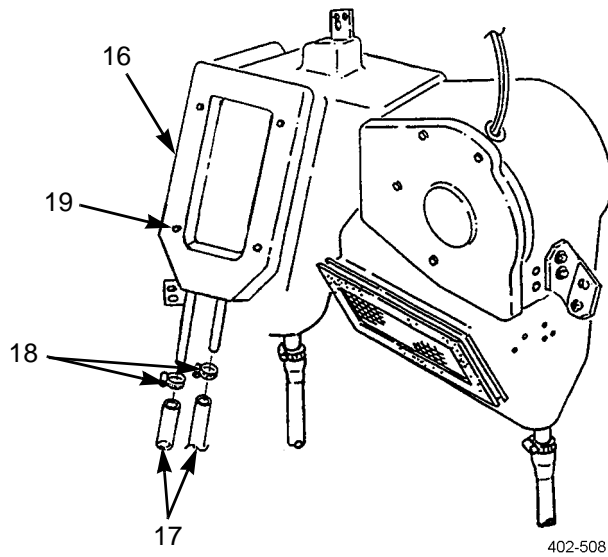
11. Wearing protective gloves, slide heater core (20) with seal up and out of housing (21).



INSTALLATION**WARNING**

Failure to wear protective gloves could result in serious skin cuts from sharp edges and fins.

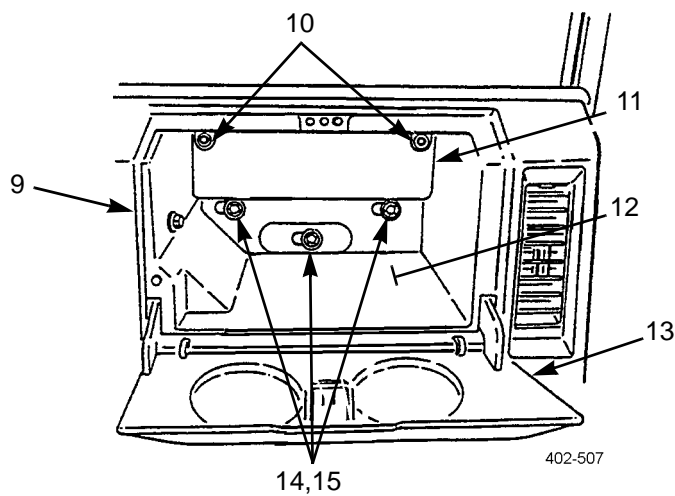
1. Wearing protective gloves, slide heater core (20) with seal into housing (21).



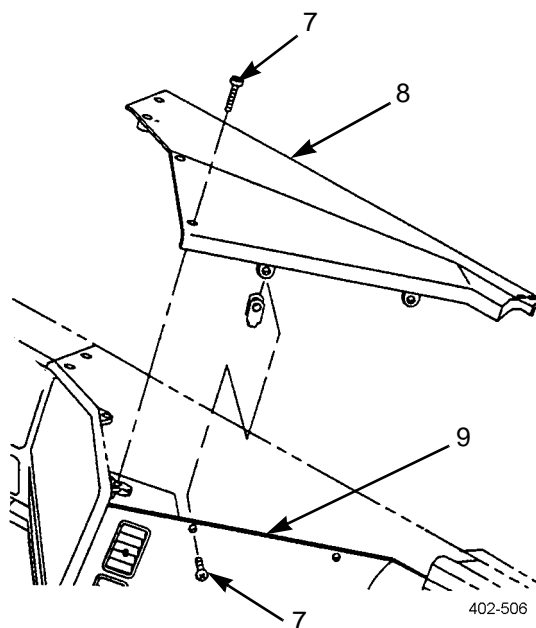
2. Install heater core cover (16) and secure with four screws (19).
3. Install heater core hoses (17) and tighten two clamps (18).

INSTALLATION - CONTINUED

4. Connect air line to cylinder behind glove box.
5. Connect two flex hoses to ducts behind glove box.
6. Fill cooling system (WP 0045 00).
7. Start vehicle and check operation of heater and air conditioner (TM 9-2320-303-10).
8. Insert compartment (12) into dash (9) and secure with three nuts (14) and spring washers (15).
9. Insert top panel (11) to compartment (12) and secure with two screws (10).

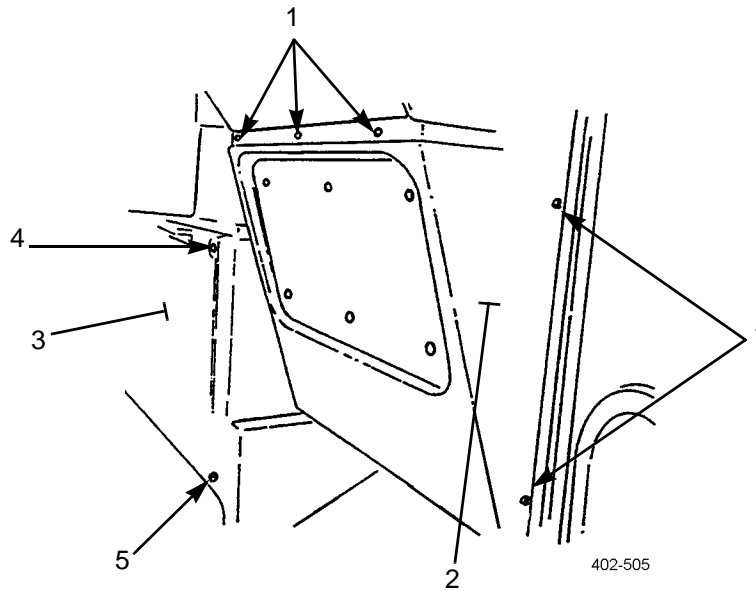


10. Position cover (8) on dash panel (9) and secure with five screws (7).



INSTALLATION - CONTINUED

11. Position cover (6) and secure with two screws (5).
12. Position cover (3) and secure with three screws (4).
13. Position cover (2) and secure with nine screws (1).



END OF WORK PACKAGE

AIR CONDITIONER RESISTOR BLOCK REPLACEMENT

0213 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

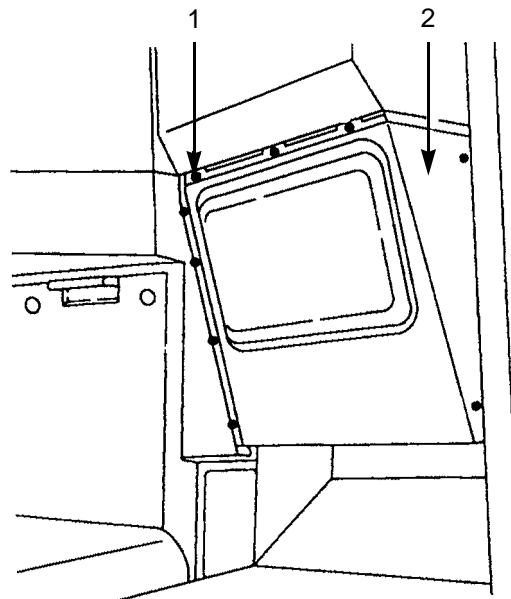
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM-2320-303-10)

REMOVAL

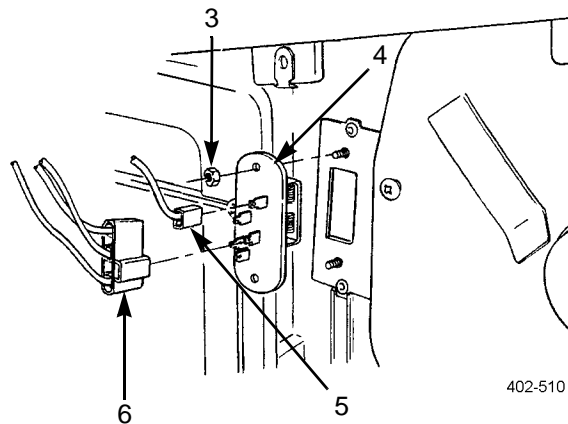
1. Remove nine screws (1) and dash panel (2).



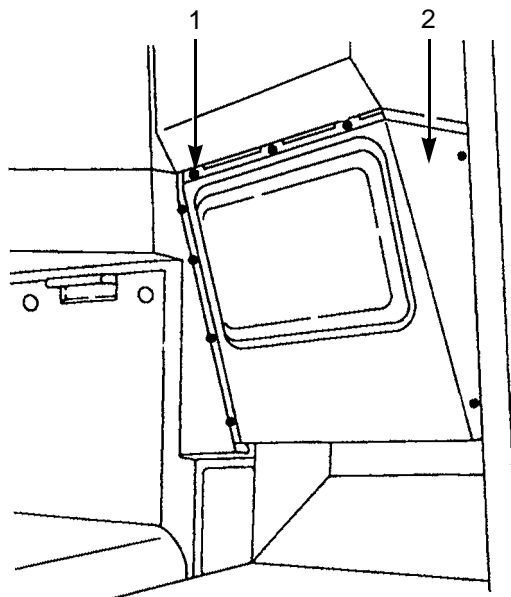
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REMOVAL - CONTINUED

2. Disconnect harness connector (5) from resistor block (4).
3. Disconnect harness connector (6) from resistor block (4).
4. Remove two nuts (3) and resistor block (4).

**INSTALLATION**

1. Install resistor block (4) with new locknuts (3).
2. Connect harness connector (5) to resistor block (4).
3. Connect harness connector (6) to resistor block (4).
4. Test blower motor (TM 9-2320-303-10).
5. Install dash panel (2) and secure with nine screws (1).

**END OF WORK PACKAGE**

AIR CONDITIONER THERMOSTATIC SWITCH REPLACEMENT

0214 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

References

TM 9-2320-303-10

Tools and Special Tools

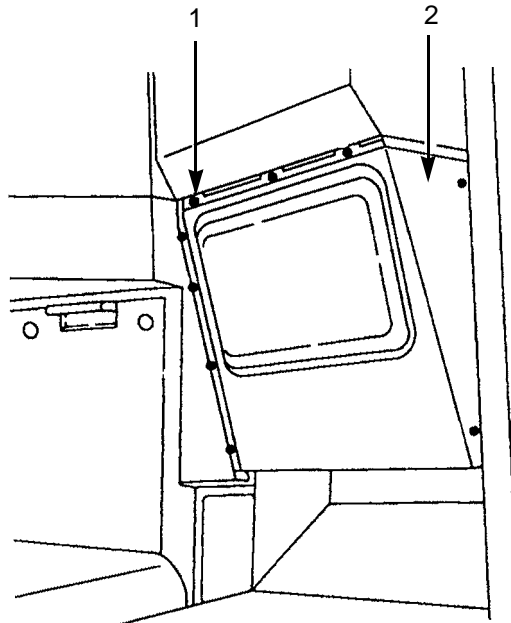
Tool kit, general mechanic's (Item 102, WP 0313 00)

Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Remove nine screws (1) and dash panel (2).



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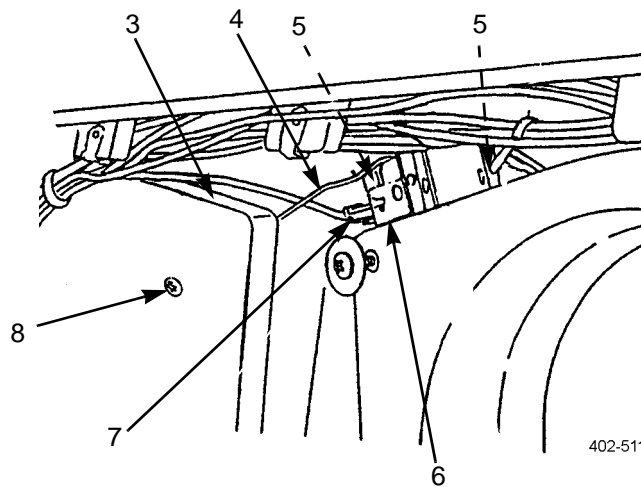
REMOVAL - CONTINUED

2. Disconnect wiring harness connector (7) from thermostatic switch (6).
3. Remove four screws (8) and heater core cover (3).

NOTE

Mark thermostatic switch sensor tube at entry point in evaporator to aid in installation.

4. Remove two screws (5) and thermostatic switch (6) with sensor tube (4) attached.

**INSTALLATION**

1. Transfer measurement from old sensor tube (4) to new sensor tube, if installing a new thermostatic switch (6).

CAUTION

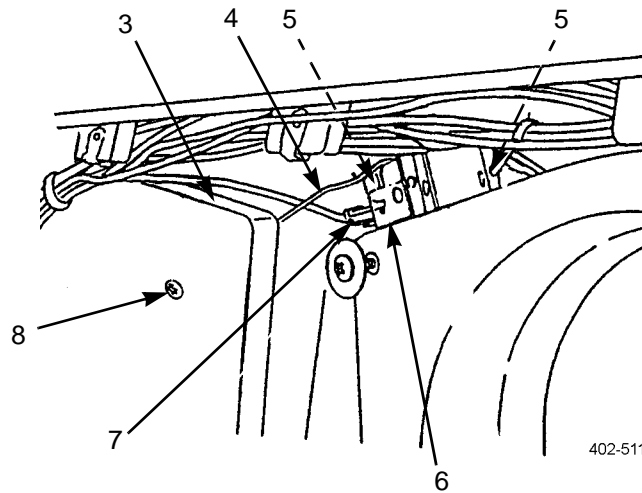
Use care when installing thermostatic switch sensor tube in evaporator. Using too much force will cause tube to bend or kink.

2. Carefully insert sensor tube (4) into evaporator to a depth equal to mark on sensor tube.

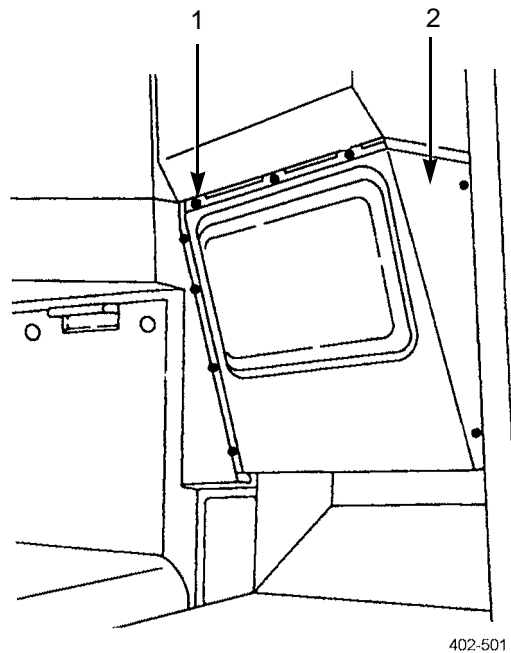
INSTALLATION - CONTINUED**NOTE**

Sensor tube must be in contact with evaporator coil fin and be at least 4 in (10 cm) in evaporator.

3. Install thermostatic switch (6) with two screws (5).
4. Install heater core cover (3) with four screws (8).
5. Connect wiring harness connector (7) to thermostatic switch (6).
6. Start vehicle and check operation of air conditioner (TM 9-2320-303-10).



7. Install dash panel (2) and nine screws (1).



END OF WORK PACKAGE

AIR CONDITIONER BINARY SWITCH REPLACEMENT

0215 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 0-200 lb. in (Item 108, WP 0313 00)

Materials/Parts

Oil, lubricating, refrigerant (Item 34, WP 0312 00)

References

TM 9-2320-303-10

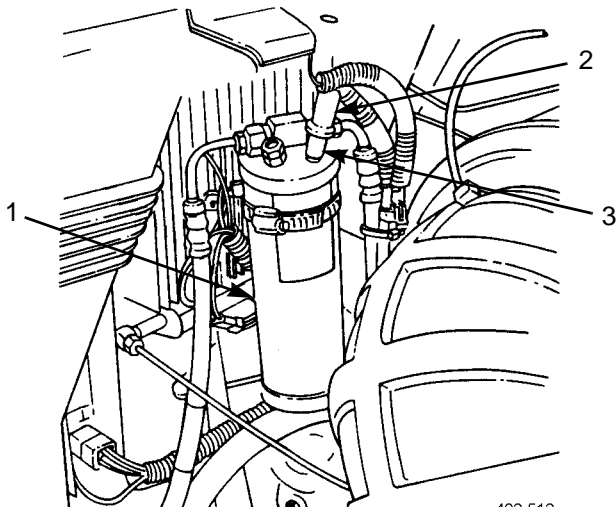
Equipment Condition

Master battery switch in OFF position (TM 9-2320-303-10)

Hood opened (TM 9-2320-303-10)

REMOVAL

1. Disconnect harness connector (2) from binary switch (3).
2. Remove binary switch (3) from receiver-drier (1).



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INSTALLATION

1. Lubricate new o-ring with refrigerant oil, then install over male threads of receiver-drier coupling.
2. Install binary switch (3) on receiver-drier (1) and tighten to 20-25 lb-ft (24-34 Nm).
3. Connect harness connector (2).
4. Close hood (TM 9-2320-303-10).
5. Operate air conditioner system (TM 9-2320-303-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Oil, refrigerant (Item 34, WP 0312 00)

Materials/Parts - Continued

Rags, wiping (Item 39, WP 0312 00)

References

TM 9-2320-303-10

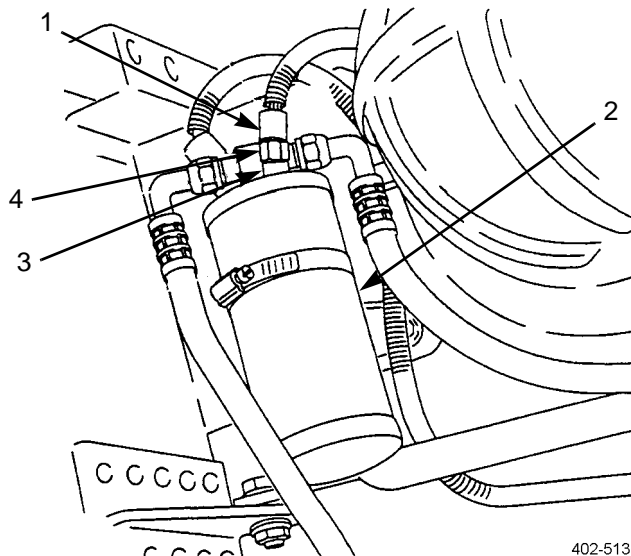
Equipment Condition

Hood opened (TM 9-2320-303-10)

Master battery switch in OFF position (TM 9-2320-303-10)

REMOVAL

1. Disconnect harness connector (1) from fan cycling switch (4).
2. Unscrew fan cycling switch (4) from coupling (3) on receiver-dryer (2). Remove and discard preformed packing.



INSTALLATION

1. Lubricate new preformed packing with refrigerant oil and install over male threads of coupling (3) on receiver-dryer (2).
2. Screw fan cycling switch (4) into coupling (3). Tighten switch to 20-25 lb-ft (27-34 Nm).
3. Connect harness connector (1) to fan cycling switch (4).

INSTALLATION - CONTINUED

4. Close hood (TM 9-2320-303-10).
5. Start vehicle and check operation of air conditioner (TM 9-2320-303-10).

END OF WORK PACKAGE

AIR CONDITIONER COMPRESSOR MAGNETIC CLUTCH REPLACEMENT**0217 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Holder, clutch (Item 34, WP 0313 00)

Puller kit, universal (Item 72, WP 0313 00)

Tools and Special Tools - Continued

Wrench, torque, 0-200 lb-in (Item 108, WP 0313 00)

Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

References

TM 9-2320-303-10

Equipment Condition

Alternator belt removed (WP 0059 00)

REMOVAL

- Using clutch holding tool to keep pulley from rotating, remove retaining bolt (1) and washer (2) from center of pulley rotor assembly (3).

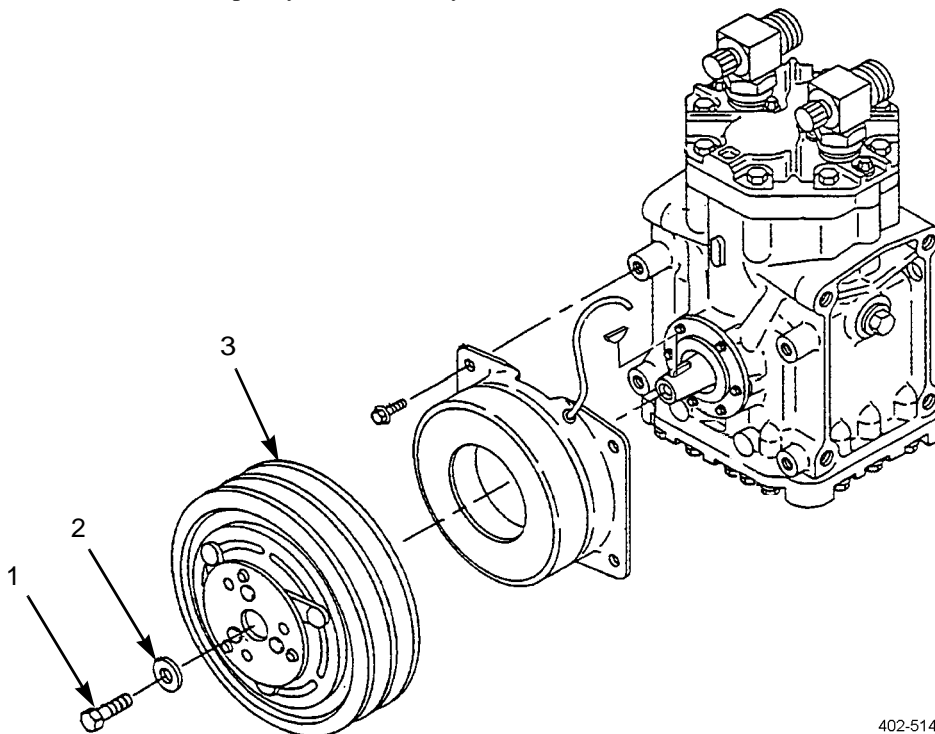
CAUTION

DO NOT try to remove pulley rotor assembly by prying or hammering. Failure to follow this caution could result in equipment damage.

NOTE

Use a 5/8-11 bolt that is long enough to serve as clutch remover.

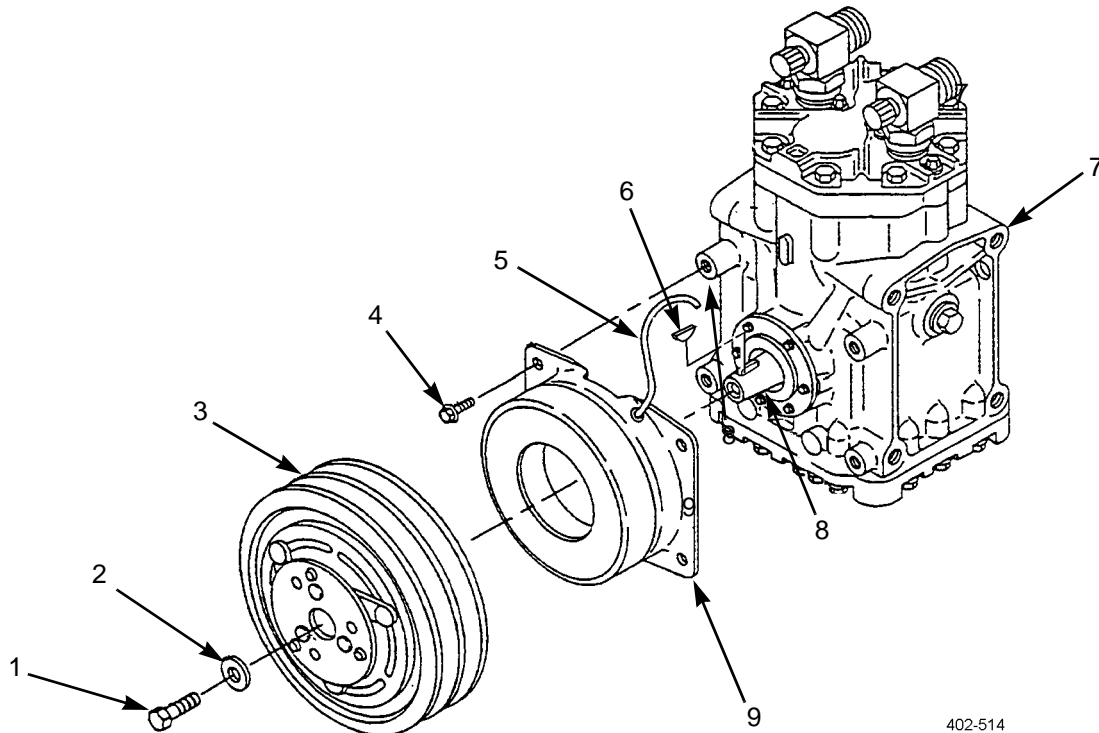
- Install puller kit bolt in hub of pulley rotor assembly (3).



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REMOVAL - CONTINUED

3. Tighten puller kit bolt to remove pulley rotor assembly (3) from compressor shaft (8). Remove woodruff key (6) from compressor shaft. Retain woodruff key for later use.
4. Remove field coil electrical lead (5).
5. Remove four bolts (4) and field coil assembly (9) from compressor (7).

**INSTALLATION**

1. Install field coil assembly (9) on compressor (7) with four bolts (4). Tighten bolts to 96 lb-in (1084 Ncm).
2. Install woodruff key (6) and pulley rotor assembly (3) on compressor shaft (8) taking care to properly align and seat shaft and hub keyways.
3. Install washer (2) and retaining bolt (1) on pulley rotor assembly (3). Using clutch holding tool to keep pulley from rotating, tighten retaining bolt to 20 lb-ft (27 Nm).
4. Turn pulley rotor assembly (3) by hand to ensure that assembly moves freely without interference with field coil assembly (9).
5. Install field coil electrical lead (5).
6. Verify clutch engages when air conditioner switch is in ON position (TM 9-2320-303-10).
7. Install alternator belt (WP 0059 00).
8. Start vehicle and check operation of air conditioner (TM 9-2320-303-10).

END OF WORK PACKAGE

AIR CONDITIONER SYSTEM LEAK TEST

0218 00

THIS WORK PACKAGE COVERS

Inspection, Test

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Tools and Special Tools - Continued

Gloves, chemical (Item 27, WP 0313 00)

Goggles (Item 30, WP 0313 00)

Leak detector, refrigerant (Item 54, WP 0313 00)

INSPECTION



WARNING



- Liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Use care to prevent refrigerant from touching your skin or eyes. Serious injury or blindness may result if you come in contact with liquid refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in fire or explosion, which could cause personal injury.

NOTE

- Refrigerant is odorless. As a result, all of it may leak away and not be noticed until system stops cooling. All vehicle refrigerant systems lose some refrigerant depending on the condition of system. Higher loss rates signal a need to locate and repair leaks.
 - Leaks are most often found at the compressor hose connections and at various fittings and joints in system. If unapproved replacement hoses are installed, refrigerant can be lost through hose permeation.
1. Visually inspect refrigerant system for air conditioning lubricant leakage and corrosion and damage to lines, hoses, and other components.
 2. Visually inspect lowest points of fittings, hoses, and lines for indication of lubricant leakage.

TEST

Use a leak detector in accordance with the manufacturer's instruction manual and check for refrigerant leakage at hose connections, fittings, and areas where leakage might occur. If leaks are detected, notify Direct Support Maintenance.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Vertical Alignment, Horizontal Alignment

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 102, WP 0313 00)
- CTIS/CWS PC card (Item 65, WP 0313 00)
- Level, digital (Item 55, WP 0313 00)
- Tester, Pro-link diagnostic reader (Item 99, WP 0313 00)

Support Equipment

Suitable Target Vehicle

Personnel Required

Three

Equipment Condition

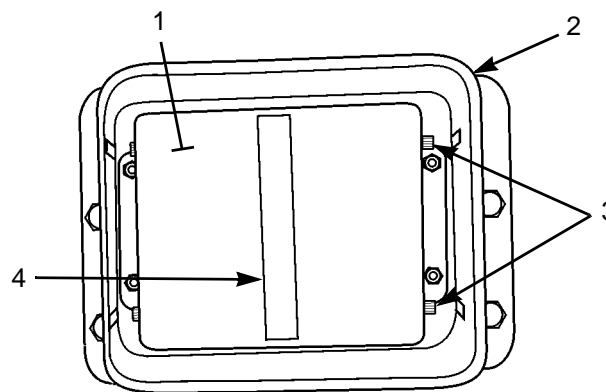
Vehicle parked on level ground

NOTE

- To ensure accurate alignment of CWS antenna, vertical and horizontal ground surface angles must be known in relation to level and compensated for during antenna alignment.
- Always perform vertical alignment first.

VERTICAL ALIGNMENT

1. Place digital level (4) vertically on CWS antenna (1). Take reading to determine which direction antenna must be adjusted.
2. Loosen four screws (3) on side of CWS antenna (1) enough to allow repositioning of antenna without free travel.



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3. Holding digital level (4) vertically on CWS antenna (1), pivot top or bottom of antenna until reading on level is at least 1 degree below vertical (88.0-89.0 degrees).
4. Proceed to horizontal alignment.

HORIZONTAL ALIGNMENT

1. Place a straight edge horizontally across center of antenna protective guard (2).
2. Measure distance between right front of antenna face and straight edge. Record the distance.
3. Measure distance between left front of antenna face and straight edge. Record the distance.
4. If the measured distances are within 1/8 inch of each other, proceed to step 8. If not, proceed to next step.
5. Move antenna in required direction to achieve equal distances between antenna protective guard and straight edge.
6. Recheck vertical alignment reading.
7. Repeat steps 2, 3, and 6 until measured distances are within 1/8 inch (0.3175 cm) of each other.
8. Tighten four screws (3).
9. Connect PRO-LINK and load CWS PC card.
10. On PRO-LINK, go to Diagnostic Menu.
11. Select CHECKOUT and press ENTER.
12. Select ANTENNA TEST and press ENTER.

NOTE

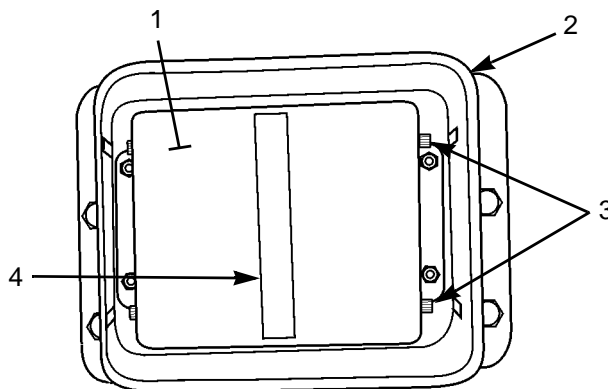
To achieve maximum results, a flat, straight stretch of road is required and both vehicles must maintain consistent and constant lane position and speed.

13. With target vehicle driving between 150 and 200 feet (46 – 61 m) in front of host vehicle, observe azimuth reading on PRO-LINK. Reading must be +/- 0.2.
14. If reading exceeds +/- limit, stop vehicle and proceed to next step. If not, proceed to step 18.
15. Loosen four screws (3) on side of antenna (1) enough to allow repositioning of antenna without free travel.

NOTE

Perform the following adjustments while facing the antenna.

16. If reading exceeded limit on positive side, pivot right side of antenna away from bumper.
17. If reading exceeded limit on negative side, pivot left side of antenna away from bumper.
18. Tighten four screws (3).



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19. Repeat step 13.
20. Repeat vertical and horizontal alignment until criteria for both alignments are met.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Antenna Assembly Replacement, Central Processing Unit (CPU) Replacement, Driver Display Unit (DDU) Replacement, Side Sensor Replacement, Side Sensor Display Replacement

INITIAL SETUP

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Materials/Parts

Nut, lock (P/N M45913/1-4CG5C) (4)

Materials/Parts - Continued

Nut, lock (P/N M45913/1-8CG5C) (4)

References

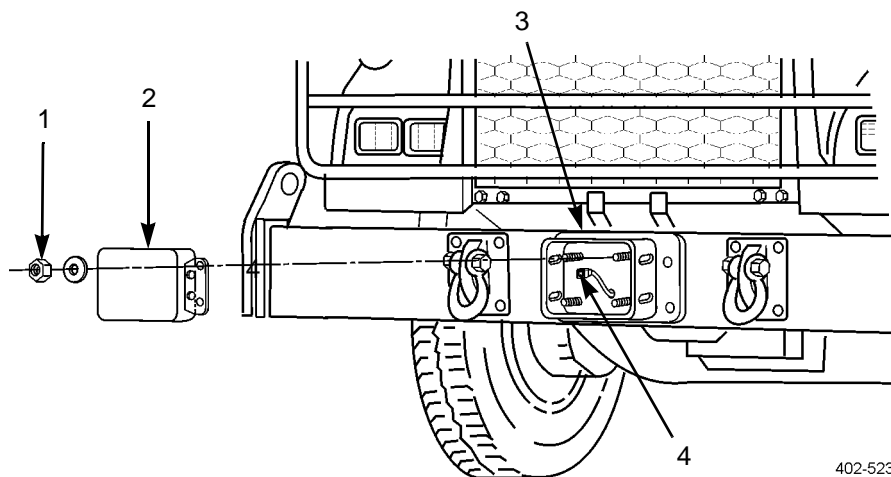
TM 9-2320-303-10

WP 0150 00

WP 0219 00

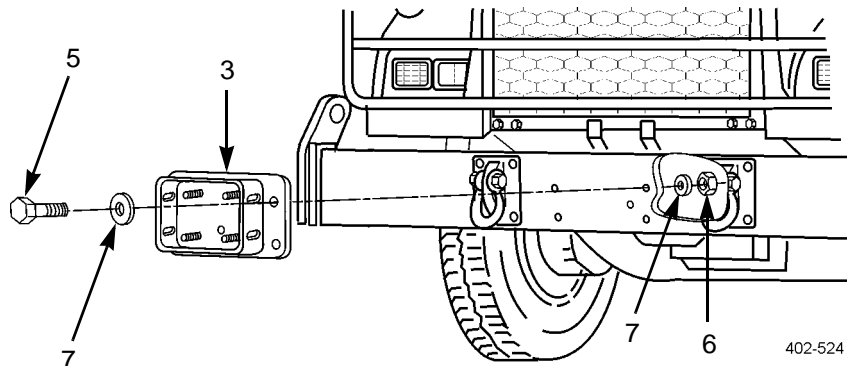
ANTENNA ASSEMBLY REPLACEMENT

1. Remove four locknuts (1) and pull CWS antenna (2) out from bracket (3). Discard locknuts.
2. Disconnect harness connector (4) from CWS antenna (2). Remove antenna.



ANTENNA ASSEMBLY REPLACEMENT - CONTINUED

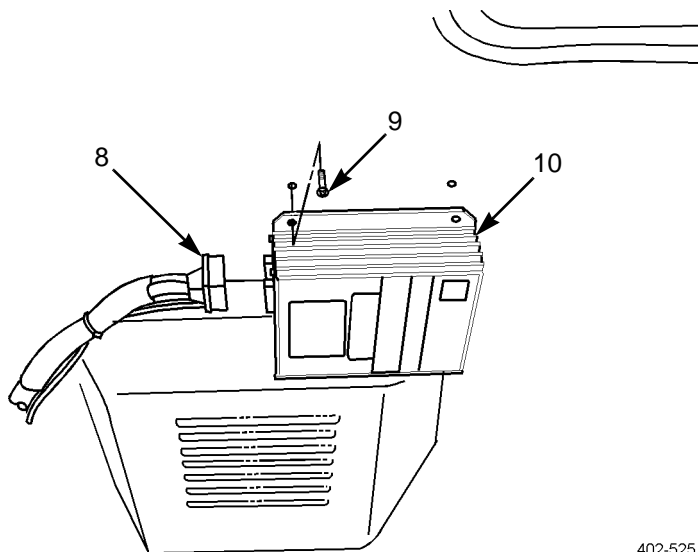
3. If damaged, remove four bolts (5), eight flat washers (7), four locknuts (6), and bracket (3) from vehicle. Discard locknuts.



4. If removed, install bracket (3) on vehicle with four bolts (5), eight flat washers (7) and four new locknuts (6).
5. Connect harness connector (4) to CWS antenna (2).
6. Install CWS antenna (2) on bracket (3) with four nuts (1).
7. Align antenna assembly (WP 0219 00).

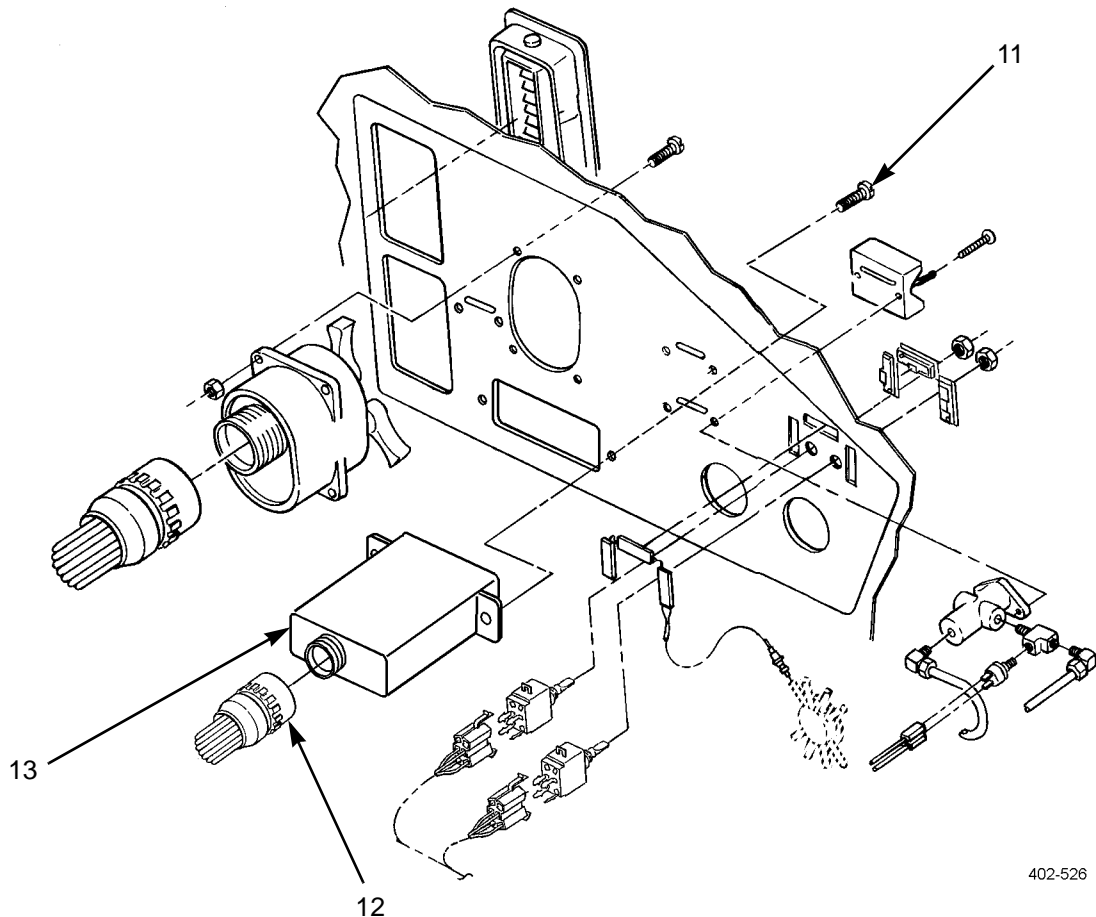
CENTRAL PROCESSING UNIT (CPU) REPLACEMENT

1. Disconnect harness connector (8) from CPU (10).
2. Remove four screws (9) and CPU (10) from cab wall.
3. Install CPU (10) on cab wall with four screws (9).
4. Connect harness connector (8) to CPU (10).
5. Align antenna assembly (WP 0219 00).



DRIVER DISPLAY UNIT (DDU) REPLACEMENT

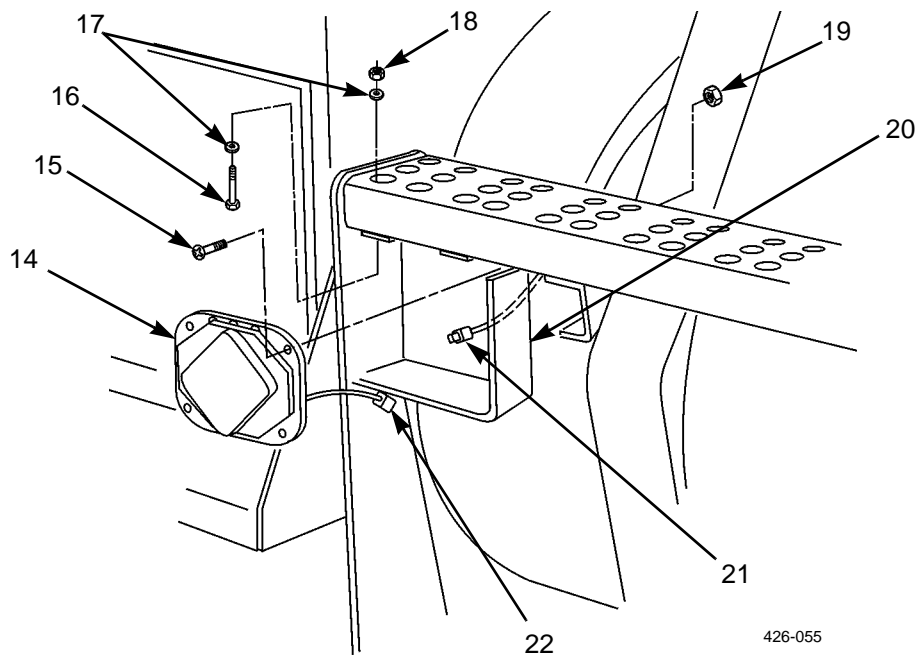
1. Drain vehicle air system (TM 9-2320-303-10).
2. Disconnect parking brake and trailer air supply valves (WP 0150 00).
3. Disconnect harness connector (12) from DDU (13).
4. Remove two screws (11) and DDU (13) from dash panel.
5. Install DDU (13) on dash panel with two screws (11).
6. Connect harness connector (12) to DDU (13).
7. Connect parking brake and trailer air supply valves (WP 0150 00).
8. Perform CWS self-test (TM 9-2320-303-10).



SIDE SENSOR AND BRACKET REPLACEMENT**NOTE**

Although slightly different in configuration, all side sensors and brackets are removed and replaced in the same matter.

1. Disconnect chassis harness connector (21) from side sensor harness connector (22).
2. For M915A4, remove four screws (15), four nuts (19), and side sensor (14) from bracket (20).
3. For M915A4R2, remove three screws (15), three nuts (19), and side sensor (14) from bracket (20).
4. Remove four screws (16), eight washers (17), four nuts (18), and bracket (20).
5. Position bracket (20) and install four screws (16), eight washers (17), and four nuts (18).
6. For M915A4, position side sensor (14) and install four screws (15) and three nuts (19).
7. For M915A4R2, position side sensor (14) and install three screws (15) and three nuts (19).
8. Connect side sensor harness connector (22) to chassis harness connector (21).
9. Perform CWS self-test (TM 9-2320-303-10).

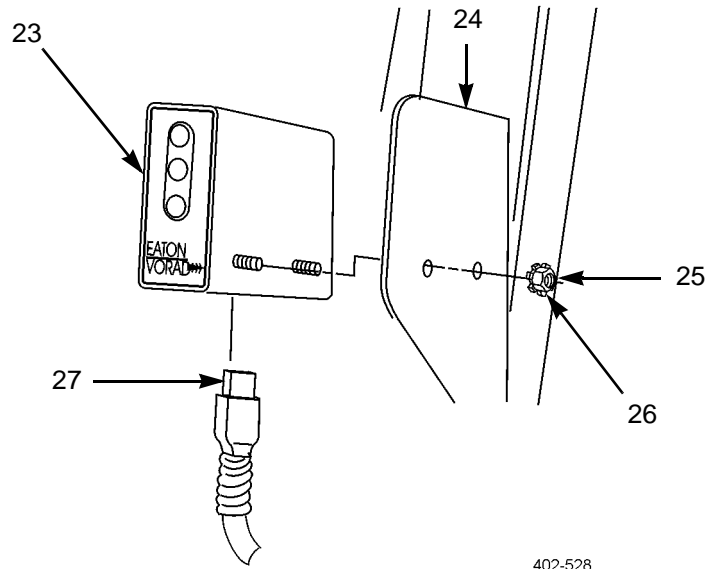


426-055

SIDE SENSOR DISPLAY REPLACEMENT

1. Disconnect harness connector (27) from side sensor display (23).
2. Remove two nuts (25), star washers (26), and side sensor display (23) from bracket (24).
3. Install side sensor display (23) on bracket (24) with two star washers (26) and nuts (25).
4. Connect harness connector (27) to side sensor display (23).
5. Perform CWS self-test (TM 9-2320-303-10).

SIDE SENSOR DISPLAY REPLACEMENT - CONTINUED



END OF WORK PACKAGE

M13 DECONTAMINATION KIT MOUNTING BRACKET REPLACEMENT**0221 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Maintenance Level**

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 102, WP 0313 00)

Tools and Special Tools - Continued

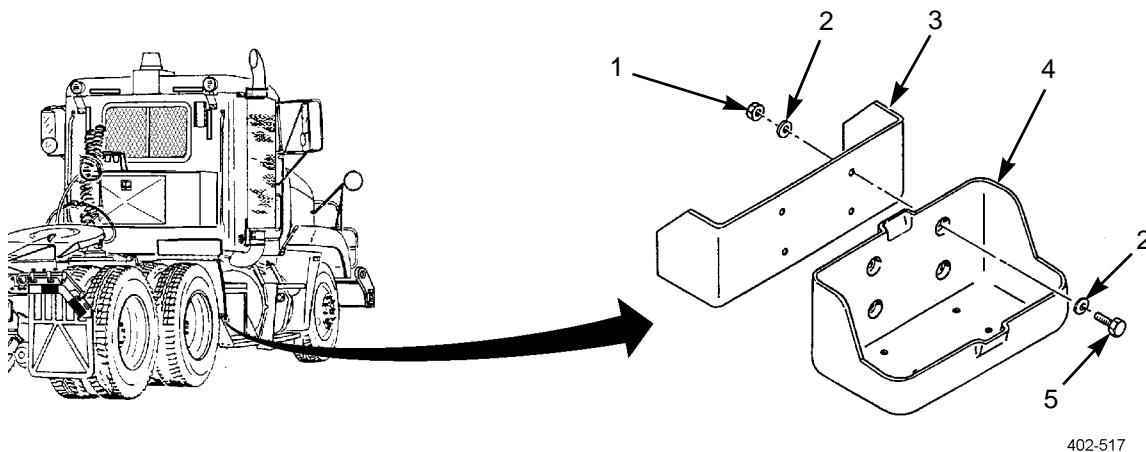
Wrench, torque, 15-75 lb-ft (Item 110, WP 0313 00)

Materials/Parts

Nut, self-locking (P/N M45913/1-5CBB) (2)

REMOVAL

1. Open door of personal gear storage box (3).
2. Remove four self-locking nuts (1), eight washers (2), four cap screws (5), and M13 decontamination kit mounting bracket (4) from side of personal gear storage box (3). Discard self-locking nuts.

**INSTALLATION**

1. Install M13 decontamination kit mounting bracket (4) on side of personal gear storage box (3) with four cap screws (5), eight washers (2), and four new self-locking nuts (1).
2. Tighten four self-locking nuts (1) to 22 lb-ft (30 Nm).
3. Close door of personal gear storage box (3).

END OF WORK PACKAGE

CHAPTER 5
SUPPORTING INFORMATION

SCOPE

This work package lists all forms, field manuals, technical bulletins, technical manuals, and other publications referenced in this manual and which apply to Unit, Direct Support, and General Support Maintenance of the M915A4.

PUBLICATIONS INDEXES

The following indexes should be consulted frequently for latest changes or revisions and for new publications relating to material covered in this technical manual.

Consolidated Index of Army Publications and Blank Forms DA Pam 25-30
 Functional User's Manual for the Army Maintenance Management System. DA Pam 738-750
 U.S. Army Equipment Index of Modification Work Orders. DA Pam 750-10

FORMS

Refer to DA Pam 738-750, *The Army Maintenance Management System (TAMMS)*, for instructions on the use of maintenance forms.

Equipment Inspection and Maintenance Worksheet DA Form 2404, DA Form 5988-E
 Equipment Log Assembly (Records) DA Form 2408
 Maintenance Request Form. DA Form 2407
 Preventive Maintenance Schedule and Record DD Form 314
 Processing and Deprocessing Record for Shipment, Storage and Issue of Vehicles and Spare Engines DD Form 1397
 Product Quality Deficiency Report. SF Form 368
 Recommended Changes to Equipment Technical Publications DA Form 2028-2
 Recommended Changes to Publications and Blank Forms. DA Form 2028
 Report of Discrepancy (ROD). SF Form 364

FIELD MANUALS

Camouflage FM 5-20
 First Aid Manual FM 4-25.11
 Metal Body Repair and Related Operations FM 43-2
 Operation and Maintenance of Ordnance Material in Extreme Cold Weather (0°F to -65°F) FM 9-207
 Rigging FM 5-725

TECHNICAL BULLETINS AND SUPPLY BULLETINS

Color, Marking, and Camouflage Painting of Military Vehicles, Construction Equipment,
 and Materials Handling Equipment TB 43-0209
 Corrosion Prevention and Control Including Rustproofing Procedures for Tactical Vehicles and Trailers TB 43-0213
 Solder and Soldering TB SIG 222
 Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems TB 750-651
 Warranty Bulletin for M915 Family of Vehicles. TB 9-2320-303-15

REFERENCES - CONTINUED

0307 00

TECHNICAL MANUALS

Administrative Storage of Equipment TM 740-90-1

Cooling Systems: Tactical Vehicles TM 750-254

Engine, Diesel: 6 Cylinder In-line, Turbocharged Cummins Model NTC-400 TM 9-2815-225-34&P

Inspection, Care, and Maintenance of Antifriction Bearings TM 9-214

Materials Used for Cleaning, Preserving, Abrading and Cementing Ordnance
 Materiel and Related Materials, Including Chemicals TM 9-247

Operator's and Organizational Maintenance Manual Including Repair
 Parts and Special Tool List for Decontaminating Apparatus, Portable TM 3-4230-214-12&P

Operator's, Unit, Direct Support and General Maintenance Manual for
 Care, Maintenance, Repair and Inspection of Pneumatic Tires and Inner Tubes TM 9-2610-200-14

Operator's, Organizational, Direct Support, and General Support Maintenance
 Manual for Lead-acid Storage Batteries TM 9-6140-200-14

Operator's Manual for M915A4 TM 9-2320-303-10

Operator's Manual for Welding Theory and Application TM 9-237

Operator's, Unit, Direct Support Maintenance Manual with RPSTL for M917A2
 and M917A2 w/MCS Dump Truck Body TM 5-3805-264-14&P

Painting Instruction for Field Use TM 43-0139

Preservation, Packaging, and Packing of Military Supplies and Equipment TM 38-230-1 & TM 38-230-2

Procedures for Destruction of Tank-automotive Equipment to Prevent Enemy Use TM 750-244-6

Repair Parts and Special Tools Lists for M915A4 TM 9-2320-303-24P

Use of Antifreeze Solutions, Antifreeze Extender, Cleaning Compounds, and
 Test Kit in Engine Cooling Systems TM 750-651

OTHER PUBLICATIONS

Abbreviations and Acronyms ASME Y14.38-1999

Allison Transmission:

 Operator's Manual SA2157J

 Parts Catalog SA2456B

 Principles of Operation SA2454B

 Service Manual SA2457B

 Troubleshooting Manual SA2973

Army Medical Department Expendable/Durable Items CTA 8-100

Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items CTA 50-970

Fuels and Lubricants Standardization Policy for Equipment Design, Operation, and Logistic Support AR 70-12

Vehicle, Wheeled, Preparation for Shipment and Limited Storage of MIL-V-62038E

END OF WORK PACKAGE

THE ARMY MAINTENANCE SYSTEM MAC

1. This introduction provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.
2. The MAC immediately following the introduction designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown in the MAC (WP 0309 00) in column (4) as:

Field - includes subcolumns:

- C - Operator/Crew
- O - Unit
- F - Direct Support

Sustainment - includes subcolumns:

- H - General Support
- D - Depot

3. The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.
4. The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

MAINTENANCE FUNCTIONS

Maintenance functions are limited to and defined as follows:

1. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).
2. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.
3. **Service.** Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint or to replenish fuel, lubricants, chemical fluids or gases.
4. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.
5. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.
6. **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
7. **Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating or fixing into position a spare, repair part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.
8. **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and its assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.
9. **Repair.** The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

MAINTENANCE FUNCTIONS - CONTINUED**NOTE**

The following definitions are applicable to the "repair" maintenance function:

- Services - Inspect, test, service, adjust, align, calibrate, and/or replace.
 - Fault location/troubleshooting - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).
 - Disassembly/assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).
 - Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.
10. **Overhaul.** That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.
11. **Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

EXPLANATION OF COLUMNS IN THE MAC, TABLE 1

1. **Column (1) - Group Number.** Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).
2. **Column (2) - Component/Assembly.** Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.
3. **Column (3) - Maintenance Function.** Column (3) lists the functions to be performed on the item listed in Column (2). (For a detailed explanation of these functions refer to "Maintenance Functions" outlined above).
4. **Column (4) - Maintenance Level.** Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field - includes subcolumns:

- C - Operator/Crew
- O - Unit
- F - Direct Support

Sustainment - includes subcolumns:

- H - General Support
- D - Depot

EXPLANATION OF COLUMNS IN THE MAC, TABLE 1 - CONTINUED**NOTE**

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS CODE column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

5. **Column (5) - Tools and Equipment Reference Code.** Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE, and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.
6. **Column (6) - Remarks Code.** When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries (Table 3).

EXPLANATION OF COLUMNS IN THE TOOLS AND TEST EQUIPMENT REQUIREMENTS, TABLE 2

1. **Column (1) - Tool or Test Equipment Reference Code.** The tool and test equipment reference code correlates with a code used in column (5) of the MAC.
2. **Column (2) - Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.
3. **Column (3) - Nomenclature.** Name or identification of the tool or test equipment.
4. **Column (4) - National Stock Number (NSN).** The NSN of the tool or test equipment.
5. **Column (5) - Tool Number.** The manufacturer's part number, model number or type number.

EXPLANATION OF COLUMNS IN THE REMARKS, TABLE 3

1. **Column (1) - Remarks Code.** The code recorded in column (6) of the MAC.
2. **Column (2) - Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

END OF WORK PACKAGE

MAINTENANCE ALLOCATION CHART (MAC)

0309 00

Table 1. MAC for the M915A4 Family of Vehicles.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
01	ENGINE							E	
03	FUEL SYSTEM								
0301	Fuel Injector Assembly	Replace Repair			2.0 1.8		54,75 54,75		
0302	Fuel Pump	Replace			0.5		75		
0304	Air Cleaner Assembly	Replace		0.3			75		
	Air Intake Assembly	Replace		0.2			75		
0305	Turbocharger	Replace Repair			0.8	3.0	2,53,54,75 54,75		
	Wastegate	Adjust Replace			0.2 0.5		24,75 75		
0306	Tanks, Lines, Fittings, Headers								
	Fuel Tank	Inspect Replace	0.1	0.1			56,75		
	Fuel Hoses, Lines, and Fittings	Replace		0.5			74		
0309	Fuel Filter Elements	Service Replace	0.1		0.3		56		
0311	Engine Starting Aids								
	Ether Starting Aid	Inspect Replace Repair Service	0.1		1.0 0.5 0.5		75 75 75		
0312	Electronic Throttle Assembly	Replace		0.3			75		
04	EXHAUST SYSTEM								
0401	Muffler and Pipes								
	Muffler	Inspect Replace	0.1	0.1			75		
	Exhaust Pipe	Inspect Replace	0.1	0.1	1.3		75		

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD			SUSTAINMENT			
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
0501	Radiator Assembly	Service Replace Repair	0.1	0.3 0.7	0.5			56 45,46,56,75 55	A
0502	Fan Shroud	Replace		1.0			75		
0503	Thermostat Housing	Replace Repair		0.5 0.5			75 17,34,75		
0504	Water Pump Assembly	Replace		3.0			56,75		
0505	Fan Assembly								
	Fan Drive Support	Replace			0.6		54,75		
	Fan Clutch and Drive	Replace Repair		2.0		1.5	75 54,75		
	Fan Belt	Inspect Replace	0.1	0.5			75		
	Spindle and Housing	Replace Repair		1.5		3.0	54,75 75		
0508	Water Filter	Replace		0.3			56		
06	ELECTRICAL SYSTEM								
0601	Generator, Alternator								
	Alternator	Test Replace Repair		0.3 0.3		0.5		47,55,57,70 75 55,74	
	Drive Belt	Inspect Replace	0.1	0.5			75		
0603	Starter	Replace Repair		1.5		2.0	75 60,80		
0605	Ignition Components								
	Engine Harnesses (Electrical)	Test Replace Repair		0.2 0.3	1.0			57 75 57,75	
	Engine Harnesses (Electronic)	Test Replace		0.3		0.5		57 75	
	Injector Wiring Harness	Test Replace Repair		0.2		1.0 0.3		18,57,75 54 54,67,76	
0607	Instrument Panel								

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
06	ELECTRICAL SYSTEM - Continued								
	Instrument Panel Switches	Replace		0.3				75	
	Turn Signal Switches	Replace		0.3				75	
0608	Miscellaneous Items								
	ABS ECU	Test		0.3				1,42,66,70	
		Replace		0.5				75	
	Transmission ECU	Test		0.3				17,42,66,70	
		Replace		0.5				75	
	Collision Warning System (CWS) ECU	Test		0.3				16,42,66,70	
		Replace		0.3				75	
		Repair		0.3				75	
	Fuse, Relay, and Circuit Breaker Panel	Inspect	0.1						
		Replace		0.1				75	
0609	Lights								
	Headlights	Inspect	0.1						
		Adjust		0.3				75	
		Repair		0.2				75	
	Taillights	Inspect	0.1						
		Replace		0.2				75	
	Blackout Lights	Inspect	0.1						
		Replace		0.2				75	
	Side Marker Lights	Inspect	0.1						
		Replace		0.3				75	
	Fog Lamps (If Equipped)	Replace		0.3				75	
		Repair		0.2				75	
	Marker Clearance Lights	Inspect	0.1						
		Replace		0.3				75	
0610	Sending Units and Warning Switches								
	Air Pressure Warning Sensors	Replace		0.5				75	
	ABS Sensors	Replace		0.5				75	
0611	Horn, Siren								
	Electric Horn	Replace		0.2				75	
0612	Batteries								

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
06	ELECTRICAL SYSTEM - Continued								
	Batteries	Test		0.2				57	B
		Replace		0.5				75	
	Master Battery Switch	Replace		0.5				75	
0613	Chassis Wiring Harnesses								
	Chassis Harness	Test		0.2				57	
		Replace			2.0			75	
		Repair		0.3				57,75	
	Cab Harness	Test		0.2				57	
		Replace			2.0			75	
		Repair		0.3				57,75	
	ABS, Electrical Harnesses	Test		0.2				57	
		Replace		0.5				75	
	Overhead Cab Harness	Test		0.2				57	
		Replace			0.2			75	
		Repair			0.3			57,75	
07	TRANSMISSION								
0705	Transmission Shifting Components								
	Shift Tower Controls	Replace		0.3				75	
		Repair		1.5				75	
	Wiring Harness	Replace		0.5				75	
	Sensors	Replace		0.3				75	
	Control Module	Replace				1.0		75	
0710	Fill/Check Tube	Replace		0.3				75	
	Yoke	Replace			0.3			75	
	Transmission Assembly	Service		1.0				56,75	
		Test		0.3	0.5			17,70	
		Replace			8.0			4,6,7,54, 59,75	
		Repair				10.0		6,7,8,9,10, 22,24,27,28,29, 30,32,37,38, 43,49,50, 51,52,54, 57,58,62,75,78	

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL				(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE	
			FIELD		SUSTAINMENT				
			UNIT		DS	GS			DEPOT
			C	O	F	H			D
07	TRANSMISSION - Continued								
	Torque Converter	Replace		0.5			41,75		
		Repair			1.0		14,31,54,81		
	Flex Plate and Ring Gear	Replace		8.0			44,54,75		
	Flywheel Assembly	Replace		1.0			41,54,75		
		Repair			0.8		54,75		
	Oil Pan	Replace		0.5			57,75		
	Transmission Filters	Replace		0.5			57,75		
0721	Oil Cooler and Hoses	Replace		0.5			57,75		
09	PROPELLER SHAFTS								
0900	Propeller Shaft Assembly	Inspect	0.1	0.2					
		Service		0.2			56		
		Replace		1.9			57,75		
		Repair		1.0			57,75		
10	FRONT AXLE								
1000	Front Axle Assembly	Inspect	0.3						
		Service		0.1			56,75		
		Align		1.0			56,75		
		Replace			4.5		54,75		
		Repair			4.0		54,75		
1004	Tie Rod Knuckle	Replace			0.8		75		
		Repair			1.0		56,75		
11	REAR AXLE								
1100	Forward-rear Axle	Inspect	0.1						
		Service		0.2			56,63,75		
		Replace			4.5		54,75		
		Repair				8.0	56,75		
	Rear-rear Axle	Inspect	0.1						
		Service		0.2			56,63,75		
		Replace			3.0		54,75		
		Repair				8.0	55,75		
1102	Differential	Replace				1.0	55,75		
		Repair				10.5	20,55,63,75		
12	BRAKES								
1202	Service Brakes								

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
12	BRAKES - Continued								
	Hanging Brake Assembly	Replace		1.0				75	
		Repair		0.3				75	
	Front Brakes	Inspect		0.7					
		Service		0.1				75	
		Adjust		0.5				75	
		Replace		2.0				56,75	
	Rear Brakes	Inspect		0.7					
		Service		0.1				75	
		Adjust		0.5				75	
		Replace		2.0				56,75	
1206	Slack Adjusters	Replace		0.3				68,75	
1208	Airbrake System								
	Brake Chambers	Inspect	0.1	0.2					
		Replace		1.3				75	
	Air Dryer	Service		0.5				75	
		Replace		0.5				75	
		Repair			0.8			54,75	
	Foot Brake Valve	Replace		0.2				75	
		Repair				1.0		54,75	
	Air Valves	Replace		0.3				75	
	Air Reservoir	Replace		0.3				75	
	ABS Valves	Replace		0.5				75	
		Repair		0.5				75	
1209	Air Compressor	Replace		1.0				56,75	
13	WHEELS								
1311	Wheel Assembly	Service	0.1						
		Inspect	0.1	0.5					
		Replace	1.0					56,75	
		Repair		0.1				56,75	
	Rear Hub and Drum	Replace		0.5				56,75	
		Repair				1.0		56,75	
	Front Hub and Drum	Replace		0.5				56,75	
		Repair				1.0		21,56,75	
	ABS Tone Ring	Replace		0.5				25,75	
1313	Tires	Replace		0.1				56,75	
		Repair				0.5		75	
								C	

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
14	STEERING								
1401	Mechanical Steering Gear Assembly								
	Steering System	Inspect	0.8	1.0					
		Test		1.0					
		Service		0.3	0.3		56,75		
	Steering Wheel	Replace		1.0			55,75		
	Tilt/Telescope Steering Column	Replace			1.0		75		
	Steering Universal Joint and Shaft	Replace		3.0			75		
		Repair		1.0			5,11,12,13,36,75,79		
1407	Steering Gear	Replace			0.5		54,75		
		Repair				2.5	3,26,31,33,55,64,65,75,80		
1410	Power Steering Pump	Test			0.3		73,75		
		Replace			0.7		54,75		
1411	Power Steering Hoses	Inspect		0.1					
		Replace		0.5			75		
1413	Reservoir Assembly and Bracket	Service	0.1						
		Replace		1.0			75		
		Repair		1.0			57,75		
15	FRAME ASSEMBLY								
1501	Frame Components	Inspect	0.5	0.5					
		Replace			2.1		55,75		
	Ramp Assembly	Inspect	0.1						
		Replace			0.3		55,75		
1503	Pintle Hook	Inspect	0.1	0.2					
		Service		0.1			56		
		Replace		0.5			75		
		Repair		0.5			75		
1504	Spare Tire Carrier	Replace		1.0			75		
		Repair		0.5			75		
1506	Fifth Wheel								
	Fifth Wheel Assembly	Inspect	0.3						
		Service		0.3			56		
		Adjust		1.0			15,71,72,75		
		Replace			2.0		60,75		
		Repair			1.0		75		

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
16	SPRINGS AND SHOCKS								
1601	Springs, Front	Replace			1.0			54,75	
	Springs, Rear	Replace			4.0			54,75	
1605	Torque Rods	Replace			1.0			54,75	
18	BODY, CAB, AND HOOD								
1801	Body, Cab, and Hood Cab Assembly	Inspect Replace Repair	0.1			4.0 3.0		61,75 55,75,77	
	Doors	Replace Repair			0.4 0.7			75 75	
	Hood	Adjust Replace Repair		0.3 0.5		2.0		75 57,75 54,75	
1802	Fenders, Windshield, Glass								
	Windshield and Windows	Inspect Replace	0.1		1.5			54,75	
	Quarter Fender	Replace		0.4				75	
1805	Floor Covers	Replace		1.0				75	
1806	Seats								
	Seat Belt Assembly	Inspect Replace	0.1	0.5				75	
	Seat Assembly	Inspect Replace Repair	0.1	0.2 0.5 2.0				75 54,75	
1808	Storage Boxes	Replace Repair		0.5 0.5				75 75	
22	BODY, CHASSIS, ACCESSORY ITEMS								
2202	Accessory Items								
	Mirrors	Replace Repair		0.5 0.5				75 75	
	Windshield Washer and Motor	Service Replace	0.1	1.2				75	

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
22	BODY, CHASSIS, ACCESSORY ITEMS - Continued								
2210	Data Plates	Replace		0.2				75	
33	SPECIAL PURPOSE KITS								
3303	Arctic Personnel and Engine Heater Kit	Install Replace		2.0 1.0				75 75	
3307	Air Deflector Kit	Replace		1.0				75	
34	ARMAMENT MATERIAL								
3402	Rifle Mounting Kit	Replace		0.5				75	
42	ELECTRICAL EQUIPMENT								
4209	Beacon Warning Light Kit	Install Replace		0.5 0.5				75 75	
47	GAGES (NON- ELECTRICAL)								
4701	Tachometer and Cable	Replace		0.5					
4702	Air Pressure Gages	Replace		0.5				75	
52	REFRIGERATION, AIR CONDITIONER/ HEATER, AND AIR CONDITIONING COMPONENTS								
5200	Heater/Air Conditioner System	Inspect Service Replace Repair	0.1		1.5 2.0 1.0			39 39,48,69,75 54,75 54,75	
	Heater/Air Conditioner Controls	Replace		0.2				75	
5201	Compressor Drive Compressor Clutch Belt Compressor	Replace Replace Replace		0.8 1.0	1.0			19,75 56,75 54,75	
5217	Valves and Lines	Replace			0.5			39,48,75	
5230	Condenser	Replace			1.0			39,48,75	
	Receiver-dryer	Replace			1.0			39,48,75	

Table 1. MAC for the M915A4 Family of Vehicles - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
68	WARNING AND SIGNALING DEVICES								
6806	Collision Warning System (CWS)	Inspect Align Repair	0.1	1.0 0.5	1.0			40,75 16,70,75	
91	CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL (CBR) EQUIPMENT								
9120	M13 Decontamination Mounting Kit	Replace		0.5				75	
9131	Harness, M22 Chemical Agent Alarm	Replace Repair		0.3	0.5			75 75	

Table 2. Tools and Test Equipment Requirements for the M915A4 Family of Vehicles.

(1) TOOL OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
1	O	ABS Test Adapter	4910-01-372-3128	446 300 3140
2	F	Adapter, Torque Wrench	5120-00-215-8200	0TCEDBX15-16
3	F	Adjusting Tool, Worm Shaft	5120-01-371-7369	J37070
4	F	Barring Tool, Engine	5120-01-322-3498	J36237
5	F	Block		5255
6	F	Bracket, Mounting	5340-01-475-3497	J41445
7	F	Bracket, Vehicular Components	2590-01-475-7886	J35926-A
8	H	Bushing, Sleeve	3120-01-475-1603	J37041
9	H	Compressor, Spring	5120-01-476-9381	J41462
10	H	Compressor, Spring	5120-01-476-9379	J35924
11	F	Cover		5250
12	H	Extractor		5226
13	H	Extractor		5227
14	H	Gage, Profile	5220-01-388-1460	J-38548-A
15	O	Gage, Profile	5220-01-357-4913	TF-0237
16	H	Handle, Driver	5120-00-677-2259	J8092
17	O	Handle, Driver	5120-00-977-5578	J7079-2
18	O	Harness, Wiring	6150-01-354-2604	J 35751
19	O	Holder, Clutch	5120-01-439-0305	99-499
20	F	Holding Bar, Pinion	5120-01-455-0436	J 3453-1
21	O	Indicator, Dial	5210-00-402-9619	J7872
22	H	Inserter and Remover	5120-01-476-9378	J37030-3
23	F	Inserter and Remover, Bearing/Bushing	5120-01-338-7182	J25447-B
24	H	Inserter and Remover, Spring	5120-01-388-5623	J35923-2
25	O	Inserter, ABS Ring	5120-01-479-4986	CM/107119
26	F	Inserter, Bearing and Bushing	5120-01-354-2943	J 37071
27	H	Inserter, Bearing and Bushing	5120-01-475-7610	J39954
28	H	Inserter, Bearing and Bushing	5120-01-475-7608	J37033
29	H	Inserter, Bearing and Bushing	5120-01-476-9377	J37038
30	H	Inserter, Bearing and Bushing	5120-01-477-2749	J37040
31	H	Inserter, Bearing and Bushing	5120-01-475-7609	J39949
32	H	Inserter, Bearing and Bushing	5120-01-476-9380	J37036
33	F	Installation Tool, Seal	5120-01-354-0468	J 37073

Table 2. Tools and Test Equipment Requirements for the M915A4 Family of Vehicles - Continued.

(1) TOOL OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
34	O	Installer, Seal	5120-00-977-5579	J8550
35	F	Installer, Seal	5120-01-441-1065	J42381
36		Installer, Seal		5257
37	F	Installer, Seal, Input	5120-01-492-7522	J37032
38	F	Installer, Seal, Output	5120-01-492-7521	J37031
39	O	Leak Detector, Refrigerant Gas	4940-01-387-0948	16600
40	O	Level, Digital	5210-01-494-0899	J38460-A
41	F	Lifting, Bracket, Flywheel	5120-01-116-6049	J-24365
42	O	MSD/ICE	6625-01-493-8968	13580880
43	H	Parts Kit, Valves	4810-01-477-1579	J-33163
44	F	Pin, Shoulder, Headless	5315-01-333-2771	J36235
45	O	Pliers, Hose Clamp		J-38185
46	O	Plier, Slip Joint	5120-00-537-3375	18P
47	F	Pliers, Retaining Ring	5120-01-322-6888	J36347
48	F	Reclaimer, Refrigerant	4250-01-396-8928	EEAC304D
49	H	Remover, Wheel Bearing Cup	5120-00-784-6482	J3940
50	H	Ring, Retaining	5325-01-475-4635	J37030-1
51	H	Ring, Retaining	5325-01-475-4745	J37030-2
52	H	Seal Installer	5120-01-481-2193	8HE542
53	F	Shield, Turbo Protective	4910-01-127-7959	J26554-A
54	F	Shop Equipment, Automotive, DS Maintenance, Basic	4910-00-754-0705	SC4910-95CLA31
55	F	Shop Equipment, Automotive, DS Maintenance, Set A	4910-00-348-7696	SC4910-95CLA02
56	O	Shop Equipment, Automotive, Unit Maintenance, Common #1	4910-00-754-0654	SC4910-95CLA74
57	O	Shop Equipment, Automotive, Unit Maintenance, Common #2	4910-00-754-0650	SC4910-95CLA72
58	O	Shop Equipment, Automotive, DS Maintenance, Suppl. 1	4910-00-754-0707	SC4910-95CLA63
59	F	Shop Equipment, Automotive, DS Maintenance, Suppl. 2	4910-00-754-0706	SC4910-95CLA62
60	F	Slider, Spring Compression	4910-01-165-6015	TFTLN-2500
61	F	Sling, Beam Type	3940-01-353-8561	J-39520

Table 2. Tools and Test Equipment Requirements for the M915A4 Family of Vehicles - Continued.

(1) TOOL OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER	(5) TOOL NUMBER
62	H	Socket, Socket Wrench	5120-01-478-8622	J39534
63	O	Socket, Socket Wrench	5130-01-389-8450	BWD482
64	F	Socket, Socket Wrench	5120-01-355-4791	XE-16
65	F	Spanner Attachment, Socket Wrench	5120-01-353-8490	J 37464
66	O	SPORT/ICE	6625-01-445-0085	13580703
67	O	Stripper, Wire Hand	5110-01-355-0848	J35615
68	O	Template, Slack Adjuster (See WP 0300 00)		Manufactured
69	F	Test Set	6685-01-438-5088	J38509
70	O	Tester, PRO-Link, Diagnostic Reader		J38500-H
	O	• Adapter, Connector, 6-pin	5935-01-477-7230	J38500-60A
	O	• Adapter, Connector, 9-pin		J-38500-90
	O	• PC Card, ABS	7025-01-482-9014	J-38500-4100C
	O	• PC Card, CTIS/CWS	7025-01-482-8911	J-38500-1300I
	O	• PC Card, Transmission	7025-01-482-8961	J-38500-1800A
	O	• Tester, PRO-Link	4910-01-491-0701	J-38500-1A
	O	•• Adapter, Electrical	5935-01-353-2532	J 34812-1
	O	•• Adapter, PC Card	7025-01-482-8761	J-38500-1500C
	O	•• Cable Assembly, Special	6150-01-353-9708	J 38500-2
71	O	Tester, Kingpin Lock	4910-01-157-3571	TFTLN-5001
72	O	Tester, Kingpin Lock	4910-01-157-3572	TFTLN-1500
73	F	Tester, Power Steering	4910-01-160-3618	J26487-C
74	F	Tool Kit, Automotive Fuel and Electrical System Repair	5180-00-754-0655	SC5180-95-CL-B08
75	O	Tool Kit, General Mechanic's	5180-01-481-8389	DFP389J
76	O	Tool Kit, Internal Combustion Engine	5180-01-358-5231	J 35888-60
77	H	Tool Kit, Metal Worker's	5180-00-596-1510	SC5180-90-CL-N19
78	H	Tool Kit, Transmission	5180-01-476-2361	J-37035
79	F	Tool, Bearing		5256
80	H	Tool, Torque Converter Bolt	5120-01-493-8389	J38564

Table 3. Remarks for the M915A4 Family of Vehicles.

(1) REMARKS CODE	(2) REMARKS
A	Refer to TM 750-254 (cooling systems) for additional information.
B	Refer to TM 9-6140-200-14 (batteries) for additional information.
C	Refer to TM 9-2610-200-14 (tires) for additional information.
D	Requires SRA for ECU programming/disposition.
E	All maintenance procedures for engine and engine components are found in TM 9-2815-225-34&P.

END OF WORK PACKAGE

ILLUSTRATED LIST OF MANUFACTURED ITEMS**0310 00****SCOPE**

1. This work package includes complete instructions for making items authorized to be manufactured or fabricated at Unit, Direct Support, and General Support Maintenance.
2. A Part Number Index in alphanumeric order is provided in Table 1 for cross-referencing the part number of the item to be manufactured to Table 2, which covers fabrication criteria.
3. All bulk materials needed for manufacture of an item are listed by part number or specification number.

PART NUMBER INDEX**Table 1. Part Number Index.**

PART NUMBER	NAME	TABLE NUMBER
FITC-02	Cable, Special Purpose	2
NT10010-BKX13	Tube, Nylon	2
NT10010-BKX16	Tube, Nylon	2
NT10010-BKX40	Tube, Nylon	2
NT10010-BKX175	Tube, Nylon	2
PFT-4A	Tubing, Nonmetallic	2
PFT-4A-BLK-100X13	Tube, Nylon	2
PFT-4A-BLK-100X46	Tube, Nylon	2
PFT-4A-BLK-100X48	Tube, Nylon	2
PFT-4A-BLK-100X54	Tube, Nylon	2
PFT-4A-BLK-100X70	Tube, Nylon	2
PFT-4A-BLK-100X78	Tube, Nylon	2
PFT-4A-BLK-100X85	Tube, Nylon	2
PFT-4A-BLK-100X93	Tube, Nylon	2
PFT-4A-BLK-100X159	Tube, Nylon	2
PFT-4A-BLK-100X225	Tube, Nylon	2
PFT-6B-BLK-100X6	Tube, Nylon	2
PFT-6B-BLK-100X15	Tube, Nylon	2
PFT-6B-BLK-100X18	Tube, Nylon	2
PFT-6B-BLK-100X25	Tube, Nylon	2
PFT-6B-BLK-100X34	Tube, Nylon	2
PFT-6B-BLK-100X36	Tube, Nylon	2
PFT-6B-BLK-100X40	Tube, Nylon	2
PFT-6B-BLK-100X42	Tube, Nylon	2
PFT-6B-BLK-100X52	Tube, Nylon	2
PFT-6B-BLK-100X53	Tube, Nylon	2
PFT-6B-BLK-100X70	Tube, Nylon	2

Table 1. Part Number Index - Continued.

PART NUMBER	NAME	TABLE NUMBER
PFT-6B-BLK-100X75	Tube, Nylon	2
PFT-6B-BLK-100X79	Tube, Nylon	2
PFT-6B-BLK-100X100	Tube, Nylon	2
PFT-6B-BLK-100X113	Tube, Nylon	2
PFT-6B-BLK-100X115	Tube, Nylon	2
PFT-6B-BLK-100X119	Tube, Nylon	2
PFT-6B-BLK-100X120	Tube, Nylon	2
PFT-6B-BLK-100X130	Tube, Nylon	2
PFT-6B-BLK-100X149	Tube, Nylon	2
PFT-6B-BLK-100X150	Tube, Nylon	2
PFT-6B-BLK-100X159	Tube, Nylon	2
PFT-8B-BLK-100X1	Tube, Nylon	2
PFT-8B-BLK-100X7	Tube, Nylon	2
PFT-8B-BLK-100X36	Tube, Nylon	2
PFT-8B-BLK-100X50	Tube, Nylon	2
PFT-8B-BLK-100X60	Tube, Nylon	2
PFT-8B-BLK-100X78	Tube, Nylon	2
PFT-8B-BLK-100X100	Tube, Nylon	2
PFT-8B-BLK-100X115	Tube, Nylon	2
PFT-8B-BLK-100X121	Tube, Nylon	2
PFT-8B-BLK-100X130	Tube, Nylon	2
PFT-8B-BLK-100X140	Tube, Nylon	2
P52-6738	Coupling, Assembly	2
04-9323-013	Pipe, Flex	2
05-09562-005	Hose, Neoprene	2
05-09562-006	Hose, Straight	2
05-09564-008	Hose, Neoprene	2
05-12538-036	Hose	2
05-12539-043	Hose, Straight	2
05-15224-004	Hose, Rubber	2
06-18131-000	Liner, Plywood	2
12-13366-040	Tube, Nylon	2
12-13367-045	Tube, Nylon	2
12-13367-060	Tube, Nylon	2
12-13367-105	Tube, Nylon	2
12-13367-142	Tube, Nylon	2
12-13367-200	Tube, Nylon	2

Table 1. Part Number Index - Continued.

PART NUMBER	NAME	TABLE NUMBER
12-13370-037	Tube, Nylon	2
12-13371-037	Tube, Nylon	2
12-13374-006	Tube, Nylon	2
12-13472-019	Tube, Nylon	2
12-13473-040	Tube, Nylon	2
18-11197-001X10	Trim, Edging	2
22-21952-004	Hose	2
22-21952-018	Hose	2
22-21952-020	Hose	2
22-21952-048	Hose	2
22-21952-052	Hose	2
22-21952-063	Hose, Heater	2
22-28607-018	Hose, Heater	2
22-28607-061	Hose, Rubber	2
22-30167-030	Hose, Heater	2
22-30168-003	Hose, Heater	2
22-30168-034	Hose, Heater	2
22-35191-010	Seal	2
22-35281-016	Hose, Rubber	2
22-35281-030	Hose, Rubber	2
22-35282-025	Hose, Rubber	2
22-35282-090	Hose, Rubber	2
22-35282-135	Hose, Rubber	2
23323FX-48	Hose, Nonmetallic	2
350359X0.3	Hose, Coolant	2
350359X1.8	Hose, Coolant	2
350359X3.5	Hose, Coolant	2
350359X3.8	Hose, Coolant	2
4246-0410X5	Tubing, Nylon	2
47336AX	Hose, Nonmetallic	2
47338AX	Hose, Nonmetallic	2
48-00050-206X6	Tape, Foam	2
48-00081-038X24	Hose	2
48-00099-150X3	Hose	2
48-00100-010X5	Tubing, Nylon	2
48-00100-010X10	Tubing, Nylon	2
48-00100-010X15	Tubing, Nylon	2

Table 1. Part Number Index - Continued.

PART NUMBER	NAME	TABLE NUMBER
48-00100-812X15	Tubing, Nylon	2
48-00100-812X18	Tubing, Nylon	2
48-00100-814X16	Tubing, Nylon	2
48-00100-815X15	Tubing, Nylon	2
48-00100-816X6	Tubing, Nylon	2
48-00100-816X18	Tubing, Nylon	2
48-00100-816X48	Tubing, Nylon	2
48-00100-829X12	Tubing, Nylon	2
48-00100-829X36	Tubing, Nylon	2
48-00100-829X56	Tubing, Nylon	2
48-00101-010X7	Tube, Nylon	2
48-00101-010X48	Hose	2
48-00101-010X72	Hose	2
48-00101-010X96	Hose	2
48-00101-010X144	Hose	2
48-00101-010X180	Hose	2
48-00101-010X264	Hose	2
48-00101-020X24	Hose, Nonmetallic	2
48-00101-020X48	Hose, Nonmetallic	2
48-00101-020X96	Hose, Nonmetallic	2
48-00101-020X120	Hose, Nonmetallic	2
48-00101-022X1	Tube, Nylon	2
48-00101-030X10	Tube, Nylon	2
48-00101-030X108	Hose, Nonmetallic	2
48-00121-016X30	Hose	2
48-00121-016X53	Hose	2
48-02014-008X48	Hose	2
48-02015-012X24	Hose, Rubber	2
48-02217-025X5	Conduit, Nonmetallic	2
48-02217-025X36	Tubing, Nonmetallic	2
48-02217-050X3	Conduit	2
48-02217-050X8	Conduit	2
48-02217-062X3	Conduit	2
48-02217-062X105	Conduit	2
48-02217-075X57.08	Conduit	2
48-02218-050X105	Conduit	2
48-02218-075X12	Conduit	2

Table 1. Part Number Index - Continued.

PART NUMBER	NAME	TABLE NUMBER
48-02454-106X27	Tape, Foam	2
48-02454-206X12	Tape, Ureth Foam	2
48-02471-001X8	Seal, Door	2
48-02471-001X55	Seal	2
5156170	Hose	2
68240R-276	Conduit	2
77551	Hose	2
77620-7.5	Hose	2

Table 2. Manufactured Items.

PART NUMBER	NAME	MANUFACTURED FROM	DESCRIPTION
FITC-02	CABLE, SPECIAL PURPOSE	M83420/1-005	144 IN LONG
NT10010-BKX13	TUBE, NYLON	3250-1010	40 IN LONG
NT10010-BKX16	TUBE, NYLON	3250-1010	13 IN LONG
NT10010-BKX40	TUBE, NYLON	3250-1010	40 IN LONG
NT10010-BKX175	TUBE, NYLON	3250-1010	175 IN LONG
PFT-4A	TUBING, NONMETALLIC	PFT-4A BLACKX1300	CUT TO FIT
PFT-4A-BLK-100X13	TUBE, NYLON	PFT-4A BLACKX1300	13 IN LONG
PFT-4A-BLK-100X46	TUBE, NYLON	PFT-4A BLACKX1300	46 IN LONG
PFT-4A-BLK-100X48	TUBE, NYLON	PFT-4A BLACKX1300	48 IN LONG
PFT-4A-BLK-100X54	TUBE, NYLON	PFT-4A BLACKX1300	54 IN LONG
PFT-4A-BLK-100X70	TUBE, NYLON	PFT-4A BLACKX1300	70 IN LONG
PFT-4A-BLK-100X78	TUBE, NYLON	PFT-4A BLACKX1300	78 IN LONG
PFT-4A-BLK-100X85	TUBE, NYLON	PFT-4A BLACKX1300	85 IN LONG
PFT-4A-BLK-100X93	TUBE, NYLON	PFT-4A BLACKX1300	93 IN LONG
PFT-4A-BLK-100X159	TUBE, NYLON	PFT-4A BLACKX1300	159 IN LONG
PFT-4A-BLK-100X225	TUBE, NYLON	PFT-4A BLACKX1300	225 IN LONG
PFT-6B-BLK-100X6	TUBE, NYLON	3250-061	6 IN LONG
PVT-6B-BLK-100X15	TUBE, NYLON	3250-061	15 IN LONG
PFT-6B-BLK-100X18	TUBE, NYLON	3250-061	18 IN LONG
PFT-6B-BLK-100X25	TUBE, NYLON	3250-061	25 IN LONG

Table 2. Manufactured Items - Continued.

PART NUMBER	NAME	MANUFACTURED FROM	DESCRIPTION
PFT-6B-BLK-100X34	TUBE, NYLON	3250-061	34 IN LONG
PFT-6B-BLK-100X36	TUBE, NYLON	3250-061	36 IN LONG
PFT-6B-BLK-100X40	TUBE, NYLON	3250-061	40 IN LONG
PFT-6B-BLK-100X42	TUBE, NYLON	3250-061	42 IN LONG
PFT-6B-BLK-100X52	TUBE, NYLON	3250-061	52 IN LONG
PFT-6B-BLK-100X53	TUBE, NYLON	3250-061	53 IN LONG
PFT-6B-BLK-100X70	TUBE, NYLON	3250-061	70 IN LONG
PFT-6B-BLK-100X75	TUBE, NYLON	3250-061	75 IN LONG
PFT-6B-BLK-100X79	TUBE, NYLON	3250-061	79 IN LONG
PFT-6B-BLK-100X100	TUBE, NYLON	3250-061	100 IN LONG
PFT-6B-BLK-100X113	TUBE, NYLON	3250-061	113 IN LONG
PFT-6B-BLK-100X115	TUBE, NYLON	3250-061	115 IN LONG
PFT-6B-BLK-100X119	TUBE, NYLON	3250-061	119 IN LONG
PFT-6B-BLK-100X120	TUBE, NYLON	3250-061	120 IN LONG
PFT-6B-BLK-100X130	TUBE, NYLON	3250-061	130 IN LONG
PFT-6B-BLK-100X149	TUBE, NYLON	3250-061	149 IN LONG
PFT-6B-BLK-100X150	TUBE, NYLON	3250-061	150 IN LONG
PFT-6B-BLK-100X159	TUBE, NYLON	3250-061	159 IN LONG
PFT-8B-BLK-100X1	TUBE, NYLON	C608-100BLK	15 IN LONG
PFT-8B-BLK-100X7	TUBE, NYLON	C608-100BLK	7 IN LONG
PFT-8B-BLK-100X36	HOSE, NONME.	C608-100BLK	36 IN LONG
PFT-8B-BLK-100X50	TUBE, NYLON	C608-100BLK	50 IN LONG
PFT-8B-BLK-100X60	TUBE, NYLON	C608-100BLK	60 IN LONG
PFT-8B-BLK-100X78	TUBE, NYLON	C608-100BLK	78 IN LONG
PFT-8B-BLK-100X100	TUBE, NYLON	C608-100BLK	100 IN LONG
PFT-8B-BLK-100X115	TUBE, NYLON	C608-100BLK	115 IN LONG
PFT-8B-BLK-100X121	TUBE, NYLON	C608-100BLK	121 IN LONG
PFT-8B-BLK-100X130	TUBE, NYLON	C608-100BLK	130 IN LONG
PFT-8B-BLK-100X140	TUBE, NYLON	C608-100BLK	140 IN LONG
P52-6738	COUPLING ASSEMBLY	24032	CUT TO FIT
04-9323-013	PIPE, FLEX	R342S5 25	13 IN LONG
05-09562-005	HOSE, NEOPRENE	24244	5 IN LONG

Table 2. Manufactured Items - Continued.

PART NUMBER	NAME	MANUFACTURED FROM	DESCRIPTION
05-09562-006	HOSE, STRAIGHT	24240	6 IN LONG
05-09564-008	HOSE, NEOPRENE	24248	8 IN LONG
05-12538-036	HOSE, STRAIGHT	4230-0174	36 IN LONG
05-12539-043	HOSE, RUBBER	28430	43 IN LONG
05-15224-004	LINER, PLYWOOD	24228	4 IN LONG
06-18131-000	TUBE, NYLON	CS122-56 GRADE CD INTERIOR TYPE	7X7.5 IN
12-13366-040	TUBE, NYLON	PFT-4A BLACKX1300	40 IN LONG
12-13367-045	TUBE, NYLON	3250-061	45 IN LONG
12-13367-060	TUBE, NYLON	PFT-4A BLACKX1300	60 IN LONG
12-13367-105	TUBE, NYLON	3250-061	105 IN LONG
12-13367-142	TUBE, NYLON	PFT-4A BLACKX1300	142 IN LONG
12-13367-200	TUBE, NYLON	PFT-4A BLACKX1300	200 IN LONG
12-13370-037	TUBE, NYLON	PFT-4A BLACKX1300	37 IN LONG
12-13371-037	TUBE, NYLON	PFT-4A BLACKX1300	37 IN LONG
12-13374-006	TUBE, NYLON	3250-061	6 IN LONG
12-13472-019	TUBE, NYLON	PFT-4A BLACKX1300	19 IN LONG
12-13473-040	TUBE, NYLON	PFT-4A BLACKX1300	40 IN LONG
18-11197-001X10	TRIM, EDGING	48-02188-001	10 FT LONG
22-21952-004	HOSE	4230-0002	4 IN LONG
22-21952-018	HOSE	4230-0002	18 IN LONG
22-21952-020	HOSE	4230-0002	20 IN LONG
22-21952-048	HOSE	4230-0002	48 IN LONG
22-21952-052	HOSE	4230-0002	52 IN LONG
22-21952-063	HOSE, HEATER	4230-0002	63 IN LONG
22-28607-018	HOSE, HEATER	350357	18 IN LONG
22-28607-061	HOSE, RUBBER	MS521301A203R	6 IN LONG
22-30167-030	HOSE, HEATER	4230NX-5/8	30 IN LONG
22-30168-003	HOSE, HEATER	4230NX-3/4	3 FT LONG
22-30168-034	HOSE, HEATER	4230NX-3/4	34 IN LONG
22-35191-010	SEAL	48-02412-525	CUT TO FIT
22-35281-016	HOSE, RUBBER	35055	16 IN LONG
22-35281-030	HOSE, RUBBER	35055	30 IN LONG

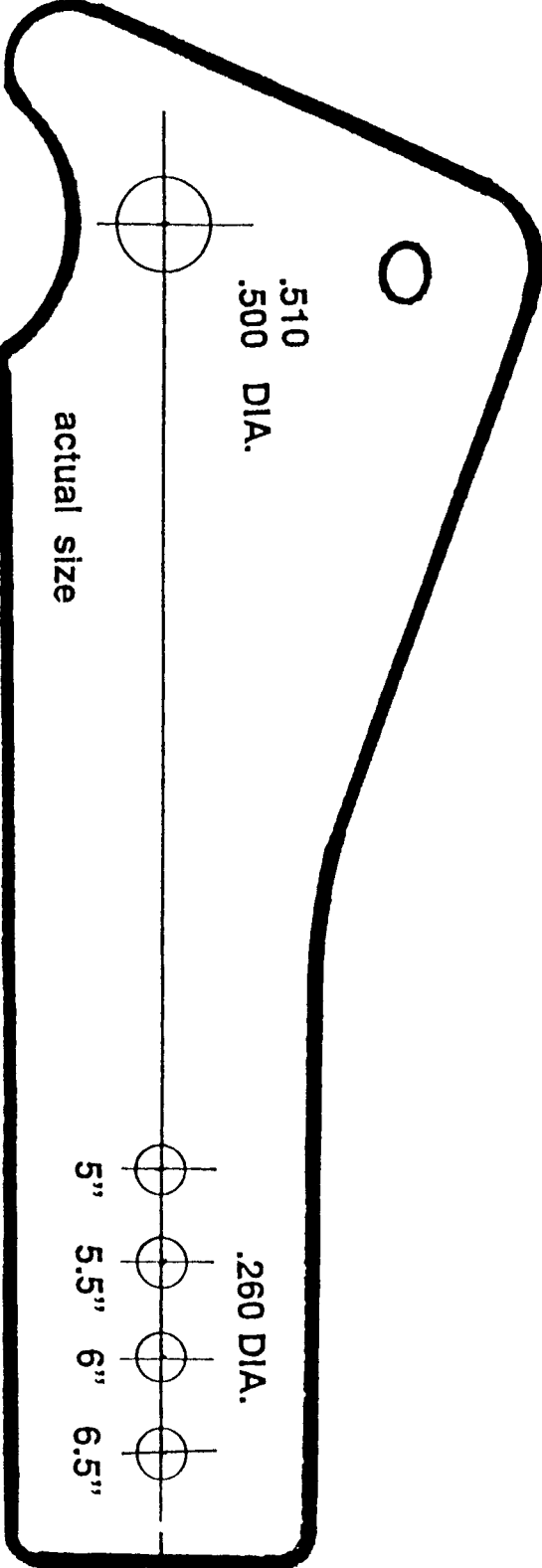
Table 2. Manufactured Items - Continued.

PART NUMBER	NAME	MANUFACTURED FROM	DESCRIPTION
22-35282-025	HOSE, RUBBER	35056	25 IN LONG
22-35282-090	HOSE, RUBBER	35056	90 IN LONG
22-35282-135	HOSE, RUBBER	35056	135 IN LONG
23323FX-48	HOSE, NONMETALLIC	3250-061	48 IN LONG
350359X0.3	HOSE, COOLANT	4230-0174	0.3 FT LONG
350359X1.8	HOSE, COOLANT	4230-0174	1.8 FT LONG
350359X3.5	HOSE, COOLANT	4230-0174	3.5 FT LONG
350359X3.8	HOSE, COOLANT	4230-0174	3.8 FT LONG
4246-0410X5	TUBING, NYLON	PFT-4A BLACKX1300	5 FT LONG
47336AX	HOSE, NONMETALLIC	FC350-06	12 IN LONG
47338AX	HOSE, NONMETALLIC	FC350-10	19 IN LONG
48-00050-206X6	TAPE, FOAM	V532X 3/4 INX200FT	6 FT LONG
48-00081-038X24	HOSE	28430	24 IN LONG
48-00099-150X3	HOSE	24224	3 IN LONG
48-00100-010X5	TUBING, NYLON	PFT-4A BLACKX1300	5 FT LONG
48-00100-010X10	TUBING, NYLON	PFT-4A BLACKX1300	10 FT LONG
48-00100-010X15	TUBING, NYLON	PFT-4A BLACKX1300	15 FT LONG
48-00100-812X15	TUBING, NYLON	C602	15 IN LONG
48-00100-812X18	TUBING, NYLON	C602	18 IN LONG
48-00100-814X16	TUBING, NYLON	C602	16 IN LONG
48-00100-815X15	TUBING, NYLON	C602	15 IN LONG
48-00100-816X6	TUBING, NYLON	C602	6 IN LONG
48-00100-816X18	TUBING, NYLON	C602	18 IN LONG
48-00100-816X48	TUBING, NYLON	C602	48 IN LONG
48-00100-829X12	TUBING, NYLON	C602	12 IN LONG
48-00100-829X36	TUBING, NONMETALLIC	4246-02277	36 IN LONG
48-00100-829X56	TUBING, NYLON	C602	56 IN LONG
48-00101-010X7	TUBE, NYLON	3250-061	7 FT LONG
48-00101-010X48	HOSE	PFT-6B-BLK-100	48 IN LONG
48-00101-010X72	HOSE	PFT-6B-BLK-100	72 IN LONG
48-00101-010X96	HOSE	PFT-6B-BLK-100	96 IN LONG
48-00101-010X144	HOSE	PFT-6B-BLK-100	144 IN LONG

Table 2. Manufactured Items - Continued.

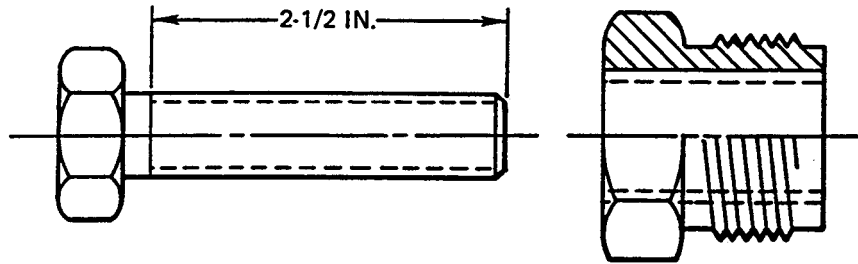
PART NUMBER	NAME	MANUFACTURED FROM	DESCRIPTION
48-00101-010X180	HOSE	PFT-6B-BLK-100	180 IN LONG
48-00101-010X264	HOSE	PFT-6B-BLK-100	264 IN LONG
48-00101-020X24	HOSE, NONMETALLIC	C608-100BLK	24 IN LONG
48-00101-020X48	HOSE, NONMETALLIC	C608-100BLK	48 IN LONG
48-00101-020X96	NOSE, NONMETALLIC	C608-100BLK	96 IN LONG
48-00101-020X120	HOSE, NONMETALLIC	C608-100BLK	120 IN LONG
48-00101-022X1	TUBE, NYLON	48-00101-022	1 FT LONG
48-00101-030X10	TUBE, NYLON	3250-1010	10 FT LONG
48-00101-030X108	HOSE, NONMETALLIC	3250-1010	108 IN LONG
48-00121-016X30	HOSE	48-00121-016	30 IN LONG
48-00121-016X53	HOSE	48-00121-016	53. IN LONG
48-02014-008X48	HOSE	4251-0125	48 FT LONG
48-02015-012X24	HOSE, RUBBER	881-12	24 IN LONG
48-02217-025X5	CONDUIT, NONMETALLIC	64498R	5 FT LONG
48-02217-025X36	TUBING, NONMETALLIC	64498R	36 IN LONG
48-02217-050X3	CONDUIT	68237R	3 FT LONG
48-02217-050X8	CONDUIT	68237R	8 IN LONG
48-02217-062X3	CONDUIT	68237R	3 FT LONG
48-02217-062X105	CONDUIT	48-02218-050	105 IN LONG
48-02217-075X57.08	CONDUIT	68240R	57.08 IN LONG
48-02218-050X105	CONDUIT	48-02218-050	105 IN LONG
48-02218-075X12	CONDUIT	48-02218-075	12 IN LONG
48-02454-106X27	TAPE, FOAM	4516 5/8 in	27 IN LONG
48-02454-206X12	TAPE, URETH FOAM	V40624	12 FT LONG
48-02471-001X8	SEAL, DOOR	48-02471-001	8 FT LONG
48-02471-001X55	SEAL	48-02471-001	5.5 FT LONG
5156170	HOSE	MS521301A206R	2.5 IN LONG
68240R-276	CONDUIT	68240R	276 IN LONG
77551	HOSE	IC-26-31C	7.5 IN LONG
77620-7.5	HOSE	IC-26-31C	82 IN LONG

Table 2. Manufactured Items - Continued.

PART NUMBER	NAME	
	AUTOMATIC SLACK ADJUSTER INSTALLATION TEMPLATE	

FABRICATED TOOLS1. **Item 1.**a. **Materials.**

- (1) Capscrew, Hex, 1/2 x 2-1/2 x 13 UNC, P/N 23-9440-300
- (2) Sleeve, P/N 166JX



342-889

b. **Fabrication Notes.**

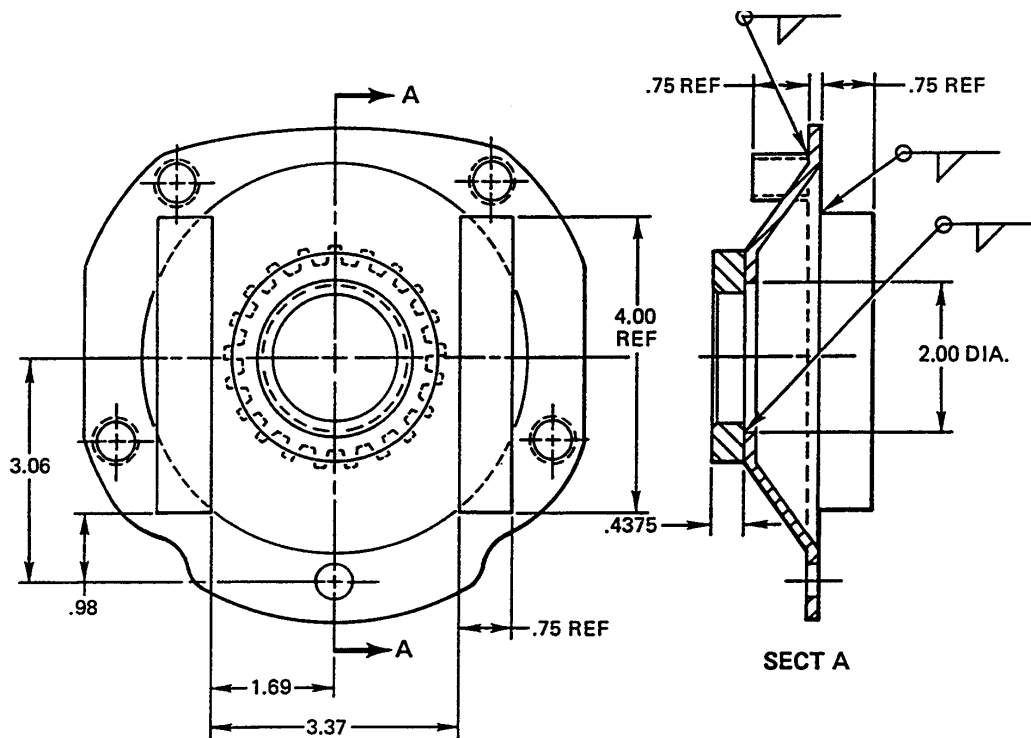
- (1) Drill and tap sleeve, P/N 166JX, for 1/2 x 13 UNC thread.
- (2) Extend length of thread to 2-1/2 in.
- (3) Install screw in sleeve as shown.

FABRICATED TOOLS - CONTINUED

2. **Item 2.**

a. **Materials.**

- (1) Cover Plate, P/N 5122281
- (2) Coupling, P/N 5141773
- (3) Bar Stock, 3/4 x 1/2 x 4 in (2)
- (4) Tubing, Heavy Wall, 1/2 in Inside Diameter, 3/4 in Long (4)



342-890

b. **Fabrication Notes.**

- (1) Cut 2 in diameter hole in center of raised portion of cover plate, P/N 5122281.
- (2) Cut 7/16 in from end of coupling, P/N 5141773.
- (3) Weld four tube sections onto raised side of cover plate, centered on four bolt holes as shown.
- (4) Place shim(s) and 7/8 in section of coupling in hub of either air compressor or air compressor drive. Install cover plate using two bolts to secure it to air compressor or drive. Ensure that coupling contacts cover plate.

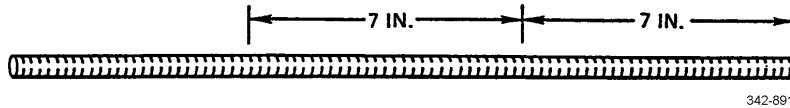
FABRICATED TOOLS - CONTINUED

- (5) Tack weld coupling to cover plate. Remove cover plate from air compressor or drive and finish welding coupling to cover plate. Ensure that inside diameter of coupling is free of excess weld.
- (6) Weld two pieces of bar stock to opposite side of cover plate as shown.

3. **Item 3.**

a. **Materials.**

Rod, 1/2 x 20 x 13 UNC, P/N 1 213X20INLGSTL



342-891

b. **Fabrication Notes.**

- (1) Cut two 7 in lengths.
- (2) Remove all burrs and sharp edges.

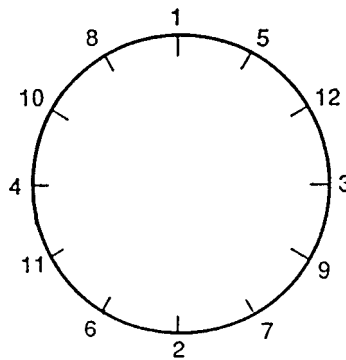
END OF WORK PACKAGE

SCOPE

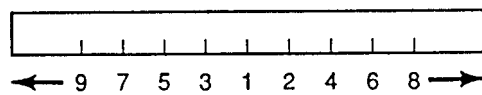
This work package lists standard torque values and provides general information for applying torque. Special torque values and tightening sequences are indicated in the maintenance procedures for applicable components.

GENERAL

1. Always use torque values listed in Table 1 when a maintenance procedure does not give a specific torque value.
2. Unless otherwise indicated, standard torque tolerance shall be $\pm 10\%$.
3. Torque values listed are based on clean, dry threads. Reduce torque by 10% when engine oil is used as a lubricant. Reduce torque by 20% if new plated cap screws are used.
4. Cap screws threaded into aluminum may require reductions in torque of 30% or more of Grade 5 cap screw torque. Cap crew threaded into aluminum must also attain two cap screw diameters of thread engagement.
5. If the maintenance procedures do not specify a tightening order, use the following guides:
 - a. Unless otherwise specified, lubricate threads of fasteners with oil (Item 26 or 27, WP 0319 00).
 - b. When tightening fasteners above 30 lb-ft (41 Nm), use the torque pattern but only tighten to 70 percent of final value (multiply final value by 0.7). Repeat pattern until final value is reached.
 - c. Tighten circular patterns using circular torque pattern. Tighten straight patterns using straight torque pattern.



CIRCULAR TORQUE PATTERN



STRAIGHT TORQUE PATTERN

CAUTION

If replacement cap screws are of higher grade than originally supplied, use torque specifications for the original. This will prevent equipment damage due to overtightening.

Table 1. Torque Limits.








CURRENT USAGE	MUCH USED	MUCH USED	USED AT TIMES	USED AT TIMES
QUALITY OF MATERIAL	INDETERMINATE	MINIMUM COMMERCIAL	MEDIUM COMMERCIAL	BEST COMMERCIAL
SAE Grade Number	1 or 2	5	6 or 7	8
Cap Screw Head Markings			 	  
Manufacturer's marks may vary				
These are all SAE Grade 5 (3 line)				
CAP SCREW BODY SIZE INCHES - THREAD	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)
1/4 20 28	5 (7) 6 (8)	8 (11) 10 (14)	10 (14)	12 (16) 14 (19)
5/16 18 24	11 (15) 13 (18)	17 (23) 19 (26)	19 (26)	24 (33) 27 (37)
3/8 16 24	18 (24) 20 (27)	31 (42) 35 (47)	34 (46)	44 (60) 49 (66)
7/16 14 20	28 (38) 30 (41)	49 (66) 55 (75)	55 (75)	70 (95) 78 (106)
1/2 13 20	39 (53) 41 (56)	75 (102) 85 (115)	85 (115)	105 (142) 120 (163)
9/16 12 18	51 (69) 55 (75)	110 (149) 120 (163)	120 (163)	155 (210) 170 (231)
5/8 11 18	83 (113) 95 (129)	150 (203) 170 (231)	167 (226)	210 (285) 240 (325)
3/4 10 16	105 (142) 115 (156)	270 (366) 295 (400)	280 (380)	375 (508) 420 (569)
7/8 9 14	160 (217) 175 (237)	395 (536) 435 (590)	440 (597)	605 (820) 675 (915)
1 8 14	235 (319) 250 (339)	590 (800) 660 (895)	660 (895)	910 (1234) 990 (1342)

Table 2. Refrigerant Line Torque Specifications.

OUTSIDE DIAMETER OF METAL TUBE (in)	TORQUE FOR STEEL TUBES* lb-ft (Nm)	TORQUE FOR ALUMINUM OR COPPER TUBES* lb-ft (Nm)
1/4	10-15 (14-20)	6-8 (8-11)
3/8	20-25 (27-34)	11-13 (15-18)
1/2	30-35 (41-47)	15-20 (20-27)
5/8	35-40 (47-54)	21-27 (28-37)
3/4	35-40 (47-54)	28-33 (38-45)

* When tightening fittings, always use torque reading for softer metal when unlike metals are used.

END OF WORK PACKAGE

EXPENDABLE AND DURABLE ITEMS LIST

0312 00**SCOPE**

This work package lists expendable and durable items you will need to maintain the M915A4. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, *Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items)*, or CTA 8-100, *Army Medical Department Expendable/Durable Items*.

EXPLANATION OF COLUMNS

1. **Column (1) - Item Number.** This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item [e.g., Use antifreeze (Item 6, WP 0312 00)].
2. **Column (2) - Level.** This column identifies the lowest level of maintenance that requires the listed item.
 - C - Operator/Crew
 - O - Unit Maintenance
3. **Column (3) - National Stock Number (NSN).** This is the NSN assigned to the item which you can use to requisition it.
4. **Column (4) - Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number (P/N).** This provides the other information you need to identify the item.
5. **Column (5) - Unit of Measure (U/M).** This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Table 1. Expendable and Durable Items List .

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
1	O	8040-00-877-9872	ADHESIVE (71984) RTV732-3OZTUBE 3 Ounce Tube	OZ
2	O	8040-00-664-4318	ADHESIVE: General Purpose, Type II (18876) 9995460 1 Pint Can	PT
3	O	8040-01-250-3969	ADHESIVE: Loctite (05972) 242	OZ
4	F	8040-01-129-7171	ADHESIVE: Loctite (05972) 620	OZ
5	O	8040-00-142-9823	ADHESIVE: Silicone Rubber (81349) MIL-A-46106	KIT
6	C	6850-00-181-7929 6850-00-181-7933 6850-00-181-7940	ANTIFREEZE: Permanent, Ethylene Glycol, Inhibited (81349) MILA46153 1 Gallon Bottle 5 Gallon Can 55 Gallon Drum	GAL GAL GAL
7	C	6850-00-174-1806	ANTIFREEZE: Permanent, Type: Arctic Grade (81349) MIL-A-11755 55 Gallon Drum	GAL
8	F	5340-00-450-5718	CAP SET: Protective, Dust and Moisture Seal (19207) 10935405	EA
9	O		CAULK: Strip (75037) 08578 60 Strips, 1 Foot Long Each, Black	EA
10	H	5350-00-584-5454	CLOTH: Abrasive, Emery, Fine (80204) ANSI B74.18 50-Sheet Package	EA
11	O	8030-00-597-5367	COMPOUND: Antiseize, High Temperature (73165) 51008 25 pound can	LB
12	O	8030-01-241-9727	COMPOUND: Caulking (21106) MORTITE B-2 90 Foot Roll	FT

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
13	C	6850-00-926-2275	COMPOUND: Cleaning, Windshield (81348) O-C-1901 16 Ounce Can	OZ
14	F		COMPOUND: Gasket Forming, Silicone (05972) 77MA 8 Ounce Tube	OZ
			(05972) 77C 13 Ounce Cartridge	OZ
15	F	8030-00-111-2762 8030-00-111-2763	COMPOUND: Sealing (05972) 29031 50 CC Bottle Box of 10 Bottles, 10 CC Each Bottle	CC CC
16	O	8030-01-392-3276	COMPOUND: Sealing: Dissimilar Metal Protection (71961) 6099 1 Gallon Can	GAL
17	O	8030-00-081-2286 8030-00-081-2327	COMPOUND: Sealing, Pipe (05972) 079-21 50 CC Bottle Box of 10 Bottles, 10 CC Each Bottle	CC CC
18	C	7930-00-282-9699	DETERGENT: General Purpose, Liquid (81348) P-D-220 1 Gallon Can	GAL
19	O	3439-00-255-9935	FLUX: Soldering (58536) A-A-51145 TY1 FORM A 1 Pound Can	LB
20	C	9140-00-286-5286 9140-00-286-5287 9140-00-286-5288 9140-00-286-5289	FUEL: Diesel, DF-1 Grade, Winter (81346) ASTM D 975 Bulk 5 Gallon Can 55 Gallon Drum, 16 Gage 55 Gallon Drum, 18 Gage	GAL GAL GAL GAL
21	C	9140-00-286-5294 9140-00-286-5295 9140-00-286-5296 9140-00-286-5297	FUEL: Diesel, DF-2 Grade (81346) ASTM D 975 Bulk 5 Gallon Can 55 Gallon Drum, 16 Gage 55 Gallon Drum, 18 Gage	GAL GAL GAL GAL

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
22	F	9150-00-119-9291 9150-00-269-8255	GREASE: Aircraft (81343) AMS-G-4343 2 Ounce Tube 1.75 Pound Can	OZ LB
23	C	9150-01-197-7693 9150-01-197-7688 9150-01-197-7690 9150-01-197-7692 9150-01-197-7691	GREASE: Automotive and Artillery, GAA (81349) M-10924 14 Ounce Cartridge (M-10924-B) 1-1/4 Ounce Tube (M-10924-A) 2-1/4 Pound Can (M-10924-C) 35 Pound Can (M-10924-E) 120 Pound Drum (M10924-F)	OZ OZ LB LB LB
24	O	9150-01-066-1823	GREASE: Silicone (53711) 5205453 Box of 12 tubes, 5.3 ounces each	OZ
25	O	9150-01-326-5424	GREASE: Molybdenum Disulfide (39428) 1062K97 14 Ounce Cartridge	OZ
26	C	9150-00-402-4478 9150-00-402-2372 9150-00-491-7197	OIL: Lubricating, OEA, Arctic (81349) MIL-L-46167 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
27	C	9150-00-189-6727 9150-00-186-6668 9150-00-191-2772	OIL: Lubricating, OE/HDO 10 (81349) MIL-L-2104 1 Quart Can 5 Gallon Can 55 Gallon Drum, 18 Gage (MILL2104)	QT GAL GAL
28	C	9150-01-152-4117 9150-01-152-4118 9150-01-152-4119	OIL: Lubricating, OE/HDO 15/40 (81349) MIL-L-2104 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
29	C	9150-00-186-6681 9150-00-188-9858 9150-00-189-6729	OIL: Lubricating, OE/HDO 30 (81349) MIL-L-2104 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
30	C	9150-00-189-6730 9150-00-188-9862	OIL: Lubricating, OE/HDO 40 (81349) MILL2104 1 Quart Can 55 Gallon Drum	QT GAL

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
31	C	9150-01-035-5390 9150-01-035-5391	OIL: Lubricating, GO 75 (81349) MIL-PRF-2105 1 Quart Can 5 Gallon Can	QT GAL
32	C	9150-01-035-5392 9150-01-313-2191 9150-01-035-5395 9150-01-035-5394	OIL: Lubricating, GO 80/90 (81349) MIL-PRF-2105 1 Quart Can 1 Gallon Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL GAL
33	C	9150-01-048-4591 9150-01-035-5395 9150-01-035-5396	OIL: Lubricating, GO 85/140 (81349) MIL-PRF-2105 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
34	C	9150-01-410-8972	OIL: Lubricating, Refrigerant Compressor, Synthetic Ester (59595) CAPELLA HFG-68NA 1 Quart Can	QT
35	O	8010-01-141-3949	PAINT: Heat Resisting, White (87187) 1505 13 Ounce Can, Pressurized Spray	OZ
36	H	8010-01-329-6150	PASTE: Prussian Blue, Bearing Surface, Permatex (62377) 35V 2 Ounce Tube	OZ
37	H	9150-00-250-0926	PETROLATUM, TECHNICAL (81348) VV-P-236 1.75 Pound Can	LB
38	F	8040-01-024-6993	PRIMER: Adhesive (05972) 73656 6 Ounce Can	OZ
39	C	7920-00-205-1711	RAG: Wiping (64067) 7920-00-205-1711 50 Pound Bale	LB
40	O	3439-00-555-4629	SOLDER: Lead-tin Alloy, Rosin Core (81348) QQ-S-571 1 Pound Spool	LB

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
41	O		STRAP: Tiedown, Electrical Components Box of 100	EA
		5975-00-984-6582	(96906) MS3367-1-0 6 Inch Length, 1.75 Inch Maximum Bundle, Black	
		5975-00-935-5946	(96906) MS3367-2-1 13.35 Inch Length, 4 Inch Maximum Bundle, Brown	
		5975-00-903-2284	(96906) MS3367-4-0 4 Inch Length, Black	
42	O		TAG: Marker (64067) 9905-00-537-8954	
		9905-00-537-8954	Bundle of 50	EA
43	O		TAPE: Double-sided (7X678) 4970	YD
44	O		TAPE: Duct, 2 Inches Wide (39428) 1791K70	
		5640-00-103-2254	60 Yard Roll	YD
45	O		TAPE: Insulation, Electrical (75037) 33	
		5970-00-989-1485	260 Inch Roll	IN
46	F		TAPE: Insulation, Thermal 2 Inches Wide (73030) HS7495-618	
		5640-00-580-6276	30-Foot Length	FT
47	F		TETRAFLUOROETHANE: Technical, Refrigerant, R-134A Type (4V886) R134A	
		6830-01-439-0614	43-Pound Cylinder	LB
48	F	5180-00-754-0643	TOOL KIT: Body and Fender Repair (50980) SC5180-90-N34	EA
49	F	8305-01-301-1031	WIPES: Lint-free (28480) 92193W	EA
50	O		WIRE: Nonelectrical (81346) ASTM A641	
		9505-00-596-0191	5 Pound Coil	LB

END OF WORK PACKAGE

TOOL IDENTIFICATION LIST

0313 00**SCOPE**

This work package lists all common tools and supplements and special tools/fixtures needed to maintain the M915A4.

EXPLANATION OF COLUMNS IN THE TOOL IDENTIFICATION LIST

1. **Column (1) - Item Number (No.)**. This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., Tool kit, general mechanic's, Item 102, WP 0320 00).
2. **Column (2) - Item Name**. This column lists the item by noun nomenclature and other descriptive features (e.g., PC Card, Transmission).
3. **Column (3) - National Stock Number**. This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.
4. **Column (4) - Part Number/CAGEC**. Indicates the primary number used by the manufacturer (individual, company, firm, corporation or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. The manufacturer's Commercial and Government Entity Code (CAGEC) is also included.
5. **Column (5) - Reference**. This column identifies the authorizing supply catalog or RPSTL for items listed in this work package.

TOOL IDENTIFICATION LIST - CONTINUED

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TOOL IDENTIFICATION LIST

Table 1. Tool Identification List .

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
1	Adapter, Test, ABS	4910-01-372-3128	446 300 3140 (78500)	TM 9-2320-302-24P
2	Adapter, Torque Wrench	5120-01-493-9093	J38564 (33287)	TM 9-2320-302-24P
3	Adapter Kit, Mechanical Test	4940-01-353-7038	J 28593 (33287)	TM 9-2320-302-24P
4	Bar, Wrecking: 30 in length	5120-00-293-0665	55-130 (57068)	SC 4910-95-A72
5	Barring Tool, Engine	5120-01-322-3498	J36237 (33287)	TM 9-2320-302-24P
6	Bracket, Mounting	5340-01-475-3497	J41445 (33287)	TM 9-2320-302-24P
7	Bracket, Vehicular Components	2590-01-475-7886	J35926-A (33287)	TM 9-2320-302-24P
8	Bushing, Sleeve	3120-01-475-1603	J37041	TM 9-2320-302-24P
9	Caliper, Micrometer, Outside	5210-00-540-2973	T230RL (57163)	SC 4910-95-A02
10	Caps, Vise Jaw: 4 in.	5120-00-221-1506	A-A-2938 (58536)	SC 4910-95-A31
11	Clamp, C	5120-00-203-6431	534251 (08292)	SC 4910-95-A31
12	Compressor, Spring	5120-01-476-9379	J35924 (33287)	TM 9-2320-302-24P
13	Compressor, Spring	5120-01-476-9381	J41462 (33287)	TM 9-2320-302-24P
14	Compressor, Spring	5120-01-353-2522	J24203-3 (33287)	TM 9-2320-302-24P
15	Compressor Unit, Reciprocating	4310-00-752-9633	MIL-C-52980 (81349)	SC 4910-95-A74
16	Crowfoot Attachment Set, Socket	5120-01-429-1110	214FC (55719)	GSA Catalog
17	Cutter, Tube	4710-01-451-8753	PTC001 (93061)	GSA Catalog
18	Dial Indicator Set	5210-00-794-9178	J-05959-A (33287)	SC 4910-95-A31
19	Dispenser, Sealant	5120-00-061-1283	45RCT (88736)	SC 4910-95-A31
20	Drill, Electric, Portable: 3/8 in size	5130-00-935-7354	6635 (55111)	SC 4910-95-A74
21	Drill Set, Twist	5133-00-293-0983	800434 (19203)	SC 4910-95-A74
22	Driver, Bushing	5120-01-353-2521	PT 4365-1 (33287)	TM 9-2320-302-24P
23	Gage, Depth, Micrometer: 0-6 in. Range	5210-00-619-4045	52-225-015 (1E258)	GSA Catalog
24	Gage, Oil Level		99-431 (0W4A6)	GSA Catalog
25	Gage, Profile	5220-01-388-1460	J-38548-A (33287)	TM 9-2320-302-24P
26	Gage, Profile	5220-01-357-4913	TF-0237 (74410)	TM 9-2320-302-24P
27	Gloves, Chemical and Oil Protective: rubber	8415-00-641-4601	ZZ-G-381 (81348)	SC 4910-95-A74
28	Gloves, Protective	8415-01-138-2495	PD 412A-07878-37001 (1DBW0)	
29	Gloves, Welder's	8415-00-268-7859	A-A-50022 (58536)	SC 4910-95-A31
30	Goggles, Industrial	4240-00-052-3776	A-A-1110 (58536)	SC 4910-95-A74

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
31	Handle, Driver	5120-00-977-5578	J7079-2 (33287)	TM 9-2320-302-24P
32	Harness, Wiring	6150-01-354-2604	J 35751 (33287)	TM 9-2320-302-24P
33	Heat Gun	4940-01-037-7268	6966C (78976)	GSA Catalog
34	Holder, Clutch	5120-01-439-0305	99-499 (07BE6)	TM 9-2320-302-24P
35	Holding Bar, Pinion	5120-01-455-0436	J 3453-1 (33287)	TM 9-2320-302-24P
36	Indicator, Dial	5210-00-402-9619	J7872 (33287)	TM 9-2320-302-24P
37	Insertor, ABS Ring	5120-01-479-4986	107119 (4N501)	TM 9-2320-302-24P
38	Insertor and Remover	5120-01-476-9378	J37030-3 (33287)	TM 9-2320-302-24P
39	Insertor and Remover, Bearing and Bushing	5120-01-338-7182	J25447-B (33287)	TM 9-2320-302-24P
40	Insertor and Remover, Spring	5120-01-388-5623	J35923-2 (33287)	TM 9-2320-302-24P
41	Insertor, Bearing and Bushing	5120-01-475-7610	J39954 (33287)	TM 9-2320-302-24P
42	Insertor, Bearing and Bushing	5120-01-475-7608	J37033 (33287)	TM 9-2320-302-24P
43	Insertor, Bearing and Bushing	5120-01-476-9377	J37038 (33287)	TM 9-2320-302-24P
44	Insertor, Bearing and Bushing	5120-01-477-2749	J37040 (33287)	TM 9-2320-302-24P
45	Insertor, Bearing and Bushing	5120-01-475-7609	J39949 (33287)	TM 9-2320-302-24P
46	Insertor, Bearing and Bushing	5120-01-476-9380	J37036 (33287)	TM 9-2320-302-24P
47	Insertor, Seal	5120-01-492-7522	J37032 (33287)	TM 9-2320-302-24P
48	Insertor, Seal	5120-01-441-1065	J42381	
49	Insertor, Seal	5120-01-492-7521	J37031 (33287)	TM 9-2320-302-24P
50	Installer, Seal	5120-00-977-5579	J8550 (33287)	TM 9-2320-302-24P
51	Installer, Seal	5120-01-481-2193	8HE542 (45152)	TM 9-2320-302-24P
52	Jack, Hydraulic, Hand: 12 ton capacity	5120-00-224-7330	67224 (07505)	SC 4910-95-A74
53	Lathe, Brakedrum	4910-01-028-9849	4100 (4T928)	SC 4910-95-A31
54	Leak Detector, Refrigerant Gas	4940-01-387-0948	16500 (07295)	TM 9-2320-302-24P
55	Level, Digital		J 38460-A (33287)	TM 9-2320-302-24P
56	Lift, Transmission and Differential	4910-00-585-3622	49 (79260)	SC 4910-95-A31
57	Lifting Bracket, Flywheel	5120-01-116-6049	J-24365 (33287)	TM 9-2320-302-24P
58	MSD/ICE	6625-01-493-8968	13580880 (18876)	TM 9-2320-302-24P
59	Multimeter	6625-01-265-6000	27 W/ACCE (89536)	SC 4910-95-A31
60	Multimeter, Digital	6625-01-139-2512	T00377 (55026)	SC 4910-95-A72
61	Multiplier, Torque Wrench	5120-00-169-2986	PD1201 (92059)	SC-4910-95-A31
62	Pan, Drain: 4 gallon capacity	4910-00-387-9592	450 (05463)	SC 4910-95-A74
63	Parts Kit, Valves	4810-01-477-1579	J-33163 (33287)	TM 9-2320-302-24P
64	PC Card, ABS	7025-01-482-9014	J-38500-1800A (33287)	TM 9-2320-302-24P
65	PC Card, CTIS/CWS	7025-01-482-8911	J-38500-1300E	TM 9-2320-302-24P

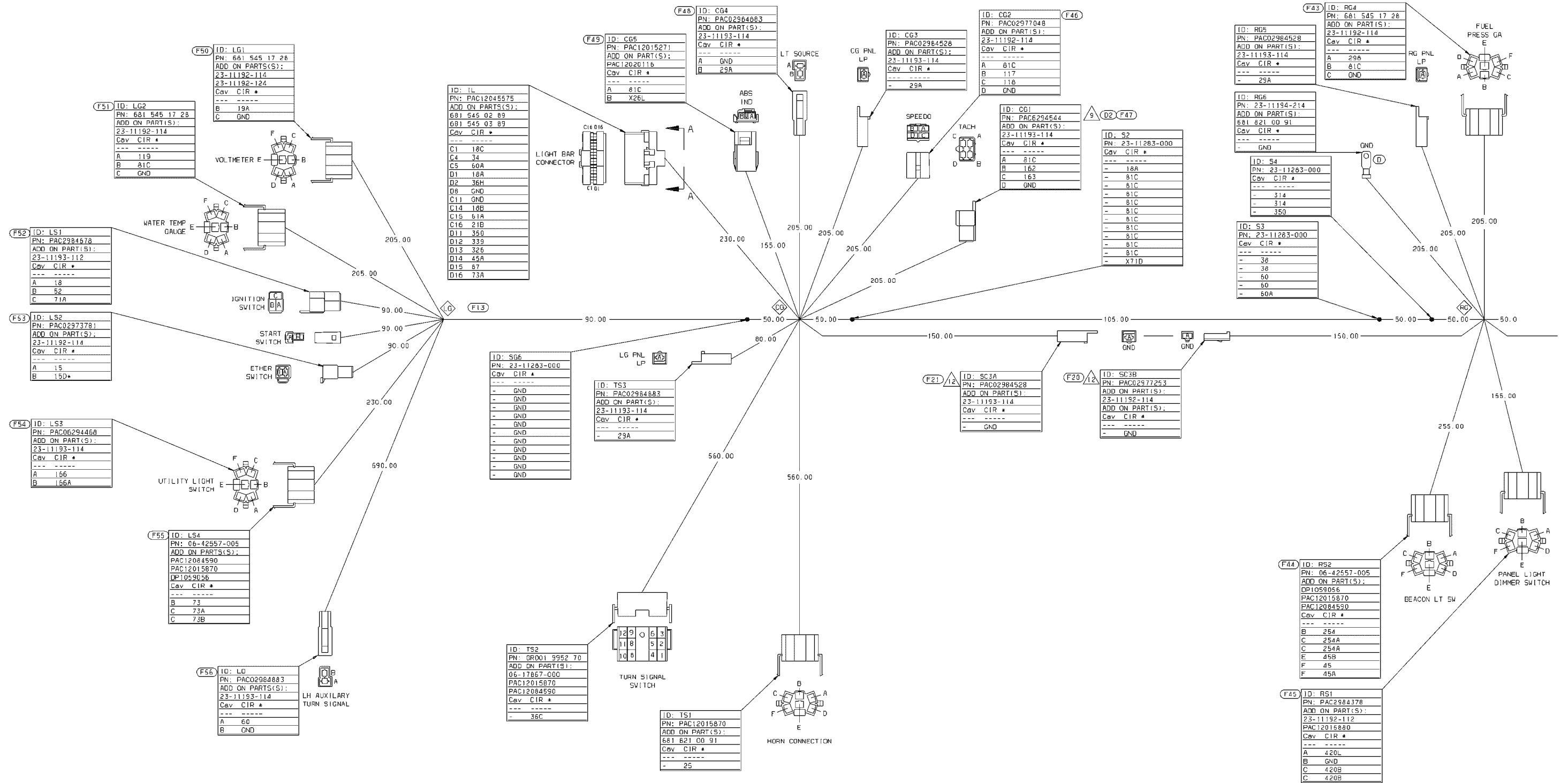
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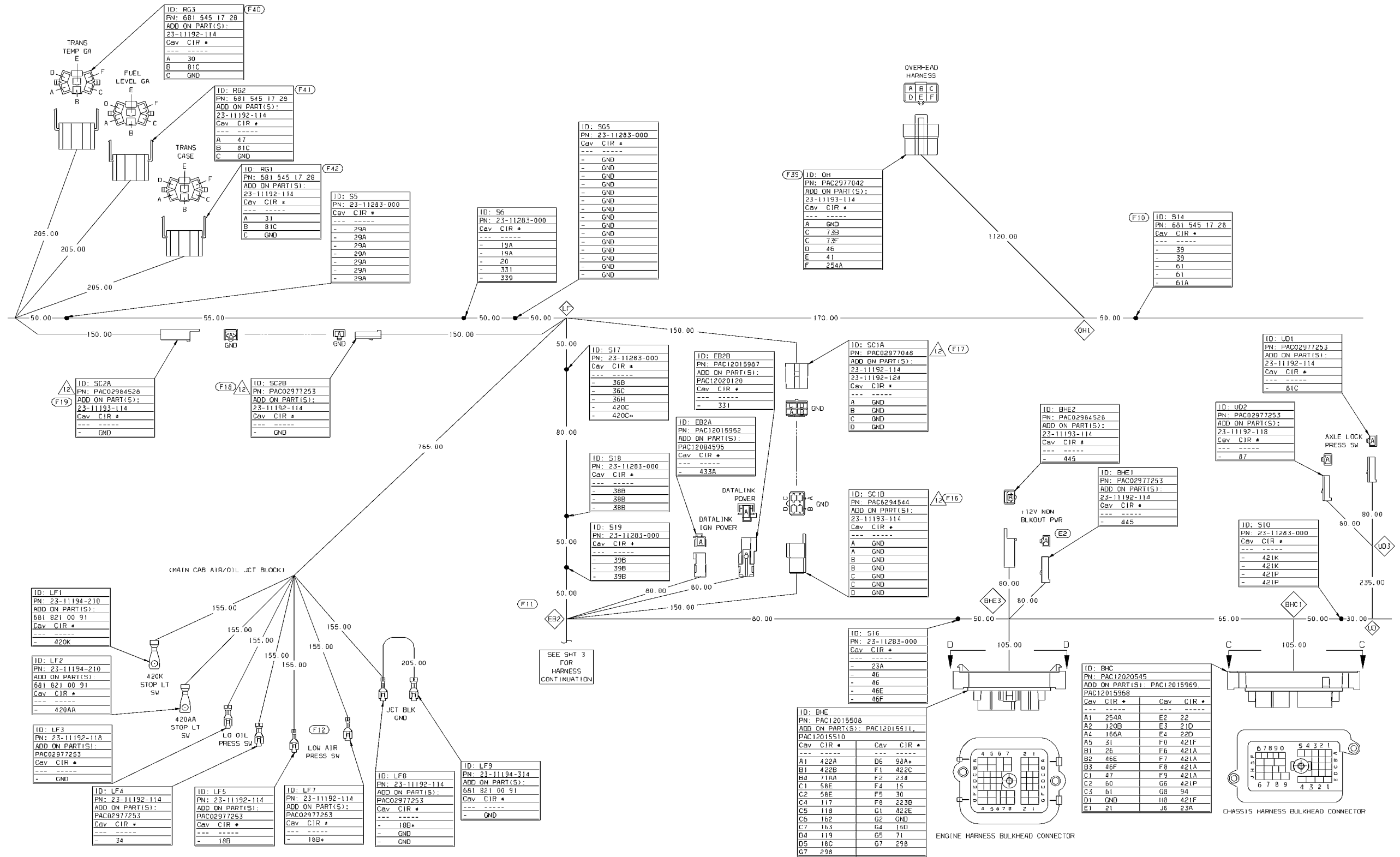
(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
66	PC Card, Transmission	7025-01-482-8961	J38500-303 (33287)	TM 9-2320-302-24P
67	Pliers, Hose Clamp		J-38185	TM 9-2320-302-24P
68	Pliers, Retaining Ring: internal, 0.120 in. diameter, 3.15-6.5 in. ring diameter	5120-00-293-0186	7082060 (19207)	SC 4910-95-A31
69	Pliers, Retaining Ring: internal, 1.75 to 2 in. ring size	5120-00-293-0045	0300 (79136)	SC 4910-95-A31
70	Pliers, Slip Joint	5120-00-537-3375	18P	TM 9-2320-302-24P
71	Press, Arbor, Hand Operated	3444-00-449-7295	26A49 (79805)	SC 4910-95-A31
72	Puller Kit, Universal	5180-00-313-9496	1178 (45225)	SC 4910-95-A72
73	Puller Kit, Universal	5180-00-423-1596	1677SPECIAL (45225)	SC 4910-95-A31
74	Puller Kit, Universal	5180-01-048-2153	J24171A (33287)	TM 9-2320-302-24P
75	Reclaimer, Refrigerant	4250-01-396-8928	EEAC304 (55719)	GSA Catalog
76	Remover, Wheel Bearing Cup	5120-00-784-6482	J3940 (33287)	TM 9-2320-302-24P
77	Ring, Retaining	5325-01-475-4635	J37030-1 (33287)	TM 9-2320-302-24P
78	Ring Retaining	5325-01-475-4745	J37030-2 (33287)	TM 9-2320-302-24P
79	Riveter, Blind, Hand	5120-00-017-2849	98 (54402)	SC 4910-95-A74
80	Scale	4910-00-707-9178	J-00544-A (33287)	TM 9-2320-302-24P
81	Shop Equipment, Automotive Vehicle	4910-00-754-0705	SC 4910-95CLA31	
82	Shop Equipment, Automotive Vehicle	4910-00-348-7696	SC 4910-95CLA02	
83	Shop Equipment, Automotive Vehicle	4910-00-754-0706	SC 4910-95CLA62	
84	Slider, Spring Compressor	4910-01-165-6015	TFTLN-2500 (74410)	TM 9-2320-302-24P
85	Sling, Beam Type	3940-01-353-8561	J-39520 (33287)	GSA Catalog
86	Sling, Nylon	2835-01-078-2081	4-8FTx2IN (91796)	GSA Catalog
87	Socket, Socket Wrench	5130-01-389-8450	BWD482 (55719)	TM 9-2320-302-24P
88	Socket, Socket Wrench	5120-01-322-1123	J36003-A (33287)	TM 9-2320-302-24P
89	Socket, Socket Wrench	5120-01-478-8622	J39534 (33287)	TM 9-2320-302-24P
90	Soldering Gun	3439-00-618-6623	D550-3 (97049)	SC 4910-95-A74
91	Spanner		5229	TM 9-2320-302-24P
92	SPORT/ICE	6625-01-445-0085	13580703 (18876)	TM 9-2320-302-24P
93	Spreader, Sling	3940-01-354-9446	J39517 (45225)	TM 9-2320-302-24P
94	Stripper, Wire, Hand	5110-01-355-0848	J35615 (33287)	TM 9-2320-302-24P
95	Switch, Pressure	5930-01-475-0242	J33884-A (33287)	TM 9-2320-302-24P
96	Tape, Measuring: 50 feet long	5210-00-554-7085	403 (37163)	SC 4910-95-A72
97	Test Set	6685-01-438-5088	J38509 (33287)	
98	Tester, Power Steering	4910-01-160-3618	J26487-C (33287)	TM 9-2320-302-24P
99	Tester, PRO-LINK Diagnostic Reader	4910-01-343-3508	J 38500-H (33287)	TM 9-2320-302-24P

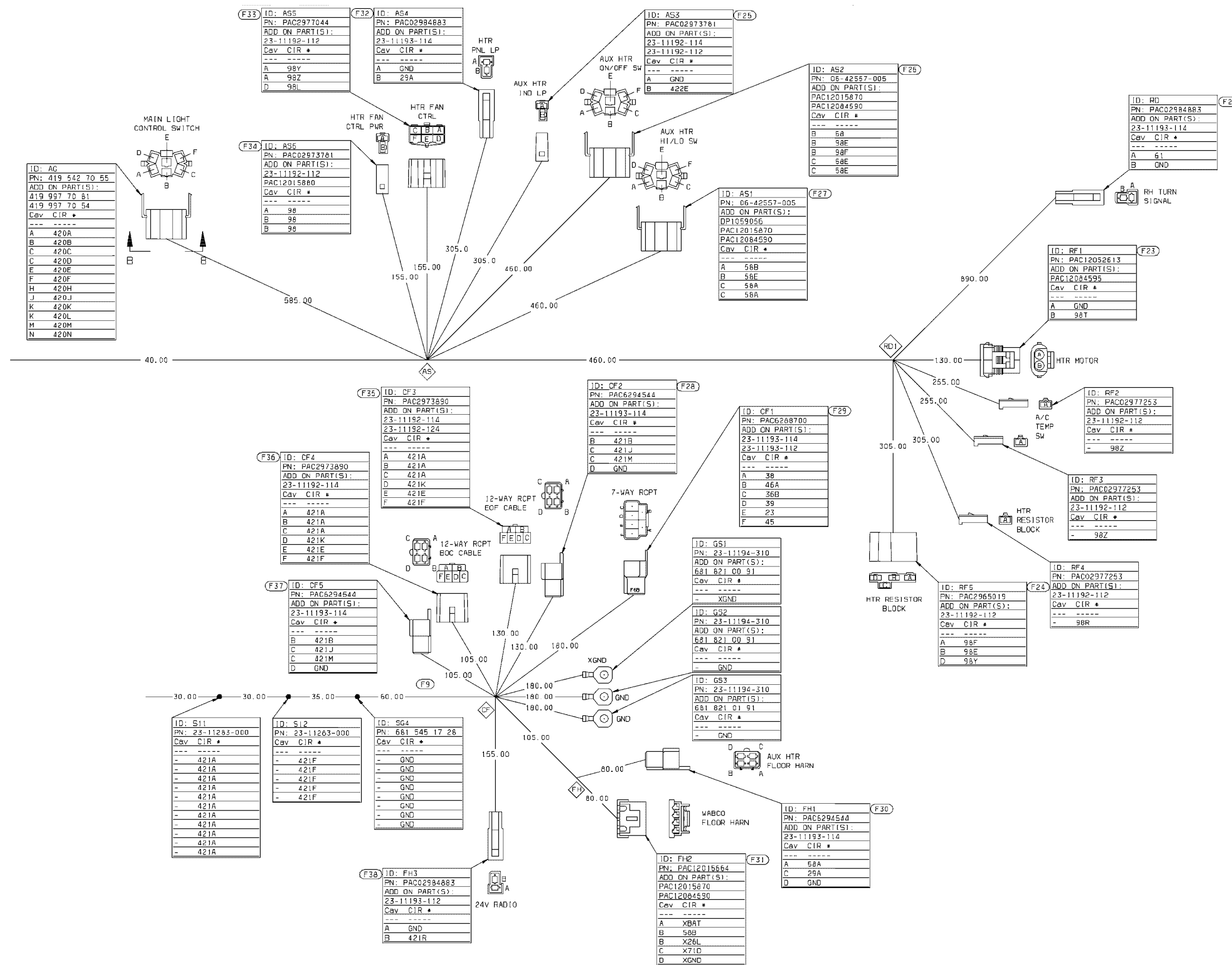
Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
100	Tester, Kingpin Lock	4910-01-157-3571	TFTLN-5001 (74410)	TM 9-2320-302-24P
101	Tool Kit, Electrical Connector Repair	5180-00-876-9336	7550526 (19204)	SC 4910-95-A72
102	Tool Kit, General Mechanic's: Automotive	5180-01-481-8389	SC5180-90-N26 (50980)	SC 5180-95-N26
103	Tool Kit, Metal Worker's	5180-00-596-1510	SC5180-90-CL-N19	SC5180-90-CL-N19
104	Tool Kit, Transmission	5180-01-476-2361	J-37035 (33287)	
105	Trestle, Hoist, Portable: 7 ton capacity	3950-00-251-8013	306 (79805)	SC 4910-95-A72
106	Vise, Machinist's	5120-00-293-1439	504M2 (79416)	SC 4910-95-A74
107	Wrench, Strap	5120-00-020-2947	2432097 (10001)	SC 4910-95-A74
108	Wrench, Torque: 3/8 in drive, 0-200 lb-in capacity	5120-00-853-4538	F200I (90947)	SC 4910-95-A72
109	Wrench, Torque: 3/8 in drive, 0-300 lb-in capacity	5120-00-776-1841	2163993 (10001)	SC 4910-95-A74
110	Wrench, Torque: 3/8 in drive, 15-75 lb-ft capacity	5120-01-355-1734	QC2FR75 (55719)	SC 4910-95-A74
111	Wrench, Torque: 50-250 lb-ft capacity	5120-01-042-0982	VB-2503MFR (27464)	SC 4910-95-A74
112	Wrench, Torque: 3/4 in drive, 100-600 lb-ft capacity	5120-01-113-9564	7379 (45225)	SC 4910-95-A72
113	Wrench Set, Socket: 3/4 in drive	5120-00-204-1999	FEDSTD353 (06542)	SC 4910-95-A72
114	Wrench Set, Socket Attachment: screwdriver, torx, 1/4 and 3/8 in drive	5120-01-178-6342	J-29843 (33287)	GSA Catalog

END OF WORK PACKAGE







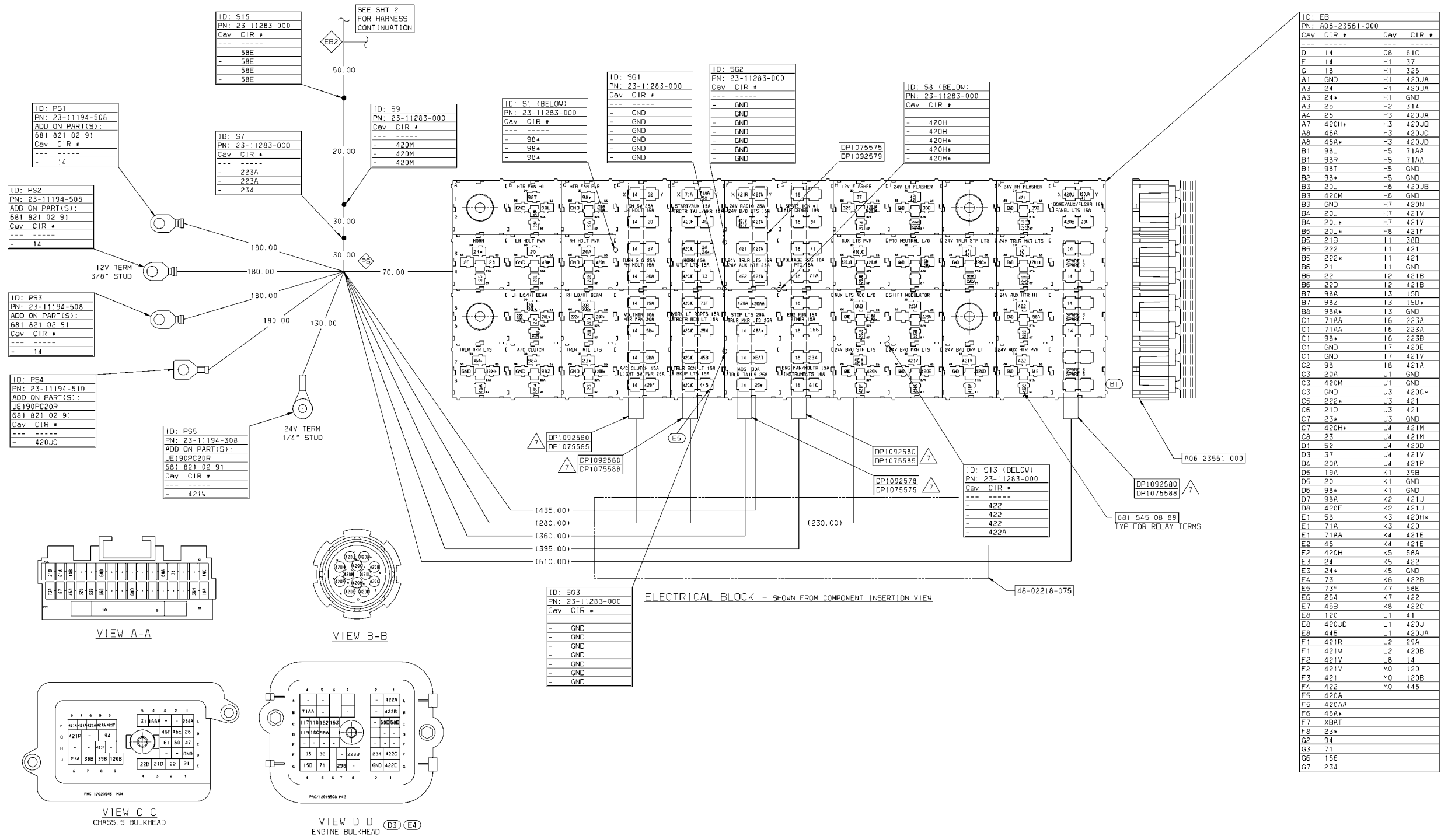
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HARN-DASH, MN, GVG, BASIC
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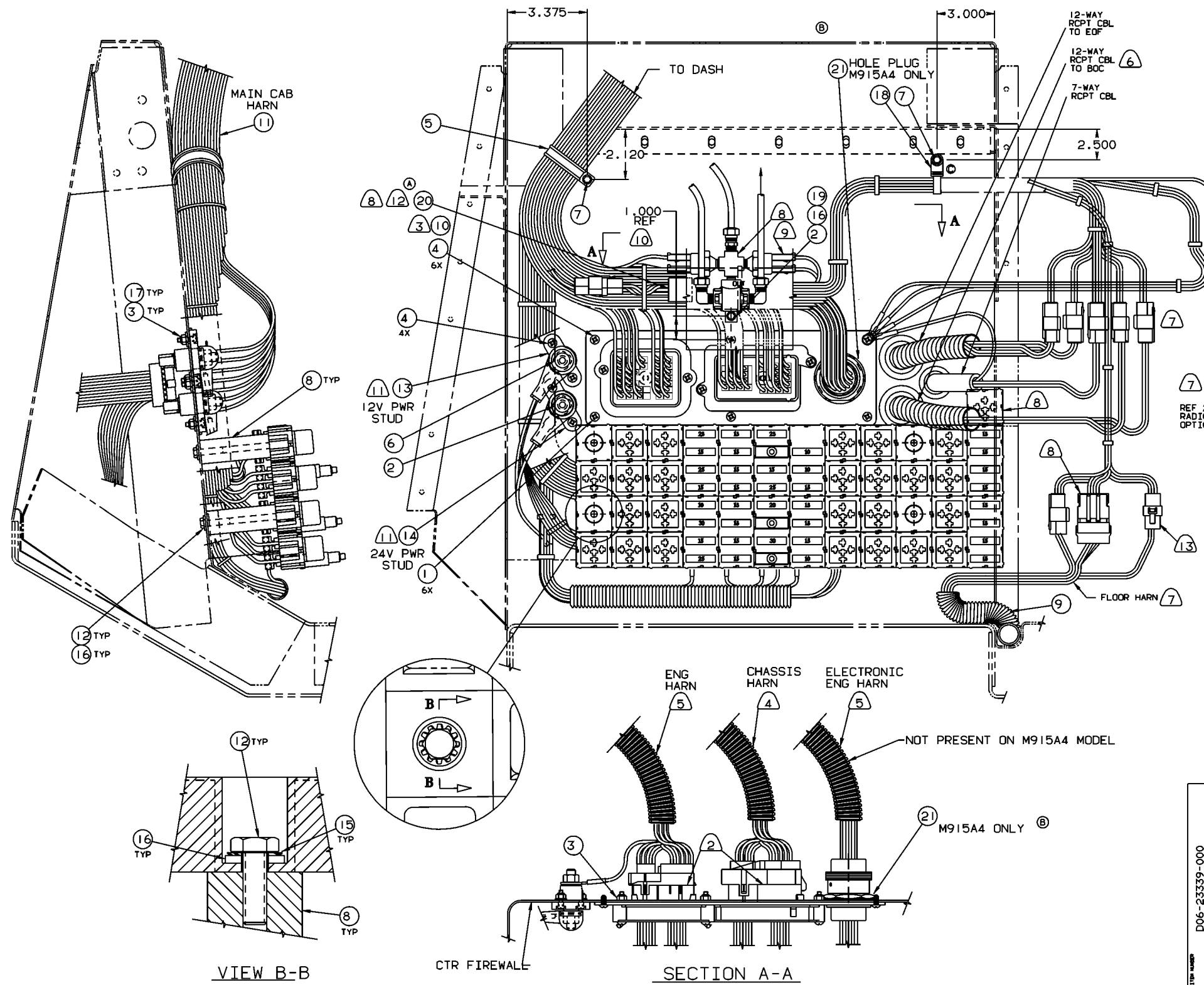
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10	07/24/85

FREIGHTLINER LLC

REVISIONS: 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

HARN-DASH, MN, GVG, BASIC
MILITARY BASIC HARN 915/916 & 917

A06-28950 F 3 of 4



RELEASE NUMBER	ZONE	REVISION DESCRIPTION	BY	DATE	APP'D
PB1048-10	-	INITIAL RELEASE	DJP	06/14/95	R.B
P2355-06	A	ADDED REF 20 & C-G DELTA 12.	GBJ	05/22/96	KVM
B10292-44	B	4A ADDED REF 21 (HOLE PLUG)	JRT	08/24/98	JLT
H50636-14	C	2C ADDED NOTE 13	GPH	04/26/00	CAC

- 1 ROUTE AND CLAMP WIRING TO AVOID CHAFING.
- 2 APPLY ELECTRICAL SEALANT GREASE 48-02439-000 INTO CONNECTORS FOR WEATHER RESISTANT SEAL.
- 3 APPLY 48-02454-206 SEALANT BETWEEN ITEM 21 PLATE AND FIREWALL.
- 4 SEE SPEC MODULE 288 FOR CHASSIS HARN.
- 5 SEE SPEC MODULE 286 FOR ENG HARN.
- 6 SEE SPEC MODULE 296/297 FOR 7-WAY AND 12-WAY TRLR RCPT.
- 7 ROUTING SHOWN OUT OF POSITION FOR CLARITY ONLY. INSTALL WIRING AND CONNECTORS INSIDE OF ELECTRICAL CENTER.
- 8 THIS IS AN OPTIONAL COMPONENT AND MAY NOT BE PRESENT FOR ALL MODELS. SEE VEHICLE SPEC FOR SPECIFIC PART NUMBERS AND CALLOUTS.
- 9 REF. CIRCUIT X30 AND GND FOR ABS DEEP CYCLE (IF PRESENT).
- 10 REF. CIR 87* AND 81C FOR AXLE LOCK PRESS SW (916/917 ONLY). FOR 915 THE PRESS SWITCH IS MOUNTED BEHIND THE AG PANEL AND A JUMPER HARN IS USED. SEE VEHICLE SPEC.
- 11 APPLY 48-00118-002 SEALANT BETWEEN TERMINAL BLOCK AND FIREWALL.
- 12 SEE SPEC MODULE 148.
- 13 SEE SPEC MODULE 311 FOR DRL FLOOR HARNESS CALLOUT.

FREIGHTLINER LLC

THE INFORMATION CONTAINED HEREIN IS PROPRIETARY DATA, AND IS NOT FOR DISSEMINATION OR DISCLOSURE, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED, EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.

DESIGNED BY DJP	DATE 06/14/95	UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ANSI STANDARD Y14.5M-1992, WITH EXCEPTIONS PER FREIGHTLINER EOM SECT 307.	THIRD ANGLE PROJECTION	UNITS OF MEASURE INCH
CHECKED BY RJB	DATE 06/15/95	RESPONSIBLE ENGR DJP	DATE 06/15/95	RESPONSIBLE MFG. ENR. M. PLUNKOWSKI
APPROVED BY KVM	DATE 06/15/95	DESCRIPTION INSTL-ELEC CTR, MAIN CAB 320A1 CAB 915/916/917 US ARMY		
FORMING NUMBER D06-23339		REVISION LETTER C	SHEET NUMBER 1 OF 1	

D06-23339-000

Table with columns: F/L CTR NO, SAE CTR NO, WIRE ITEM NO, FROM (LOC, TERM, SEAL INSL, CONN CAV POS), TO (LOC, TERM, SEAL INSL, CONN CAV POS), APPROX LENGTH -000, CIRCUIT DESCRIPTION. Includes rows 14M1 to 71A.

A17, A18, A19, A20, A21, A22, A23, A24, A25, A26, A27, A28, A29, A30, A31, A32, A33, A34, A35, A36, A37, A38, A39, A40, A41, A42, A43, A44, A45, A46, A47, A48, A49, A50, A51, A52, A53, A54, A55, A56, A57, A58, A59, A60, A61, A62, A63, A64, A65, A66, A67, A68, A69, A70, A71, A72, A73, A74, A75, A76, A77, A78, A79, A80, A81, A82, A83, A84, A85, A86, A87, A88, A89, A90, A91, A92, A93, A94, A95, A96, A97, A98, A99, A100

Table with columns: F/L CTR NO, SAE CTR NO, WIRE ITEM NO, FROM (LOC, TERM, SEAL INSL, CONN CAV POS), TO (LOC, TERM, SEAL INSL, CONN CAV POS), APPROX LENGTH -000, CIRCUIT DESCRIPTION. Includes rows 71AA to 254A.

B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13, B14, B15, B16, B17, B18, B19, B20, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31, B32, B33, B34, B35, B36, B37, B38, B39, B40, B41, B42, B43, B44, B45, B46, B47, B48, B49, B50, B51, B52, B53, B54, B55, B56, B57, B58, B59, B60, B61, B62, B63, B64, B65, B66, B67, B68, B69, B70, B71, B72, B73, B74, B75, B76, B77, B78, B79, B80, B81, B82, B83, B84, B85, B86, B87, B88, B89, B90, B91, B92, B93, B94, B95, B96, B97, B98, B99, B100

Table with columns: F/L CTR NO, SAE CTR NO, WIRE ITEM NO, FROM (LOC, TERM, SEAL INSL, CONN CAV POS), TO (LOC, TERM, SEAL INSL, CONN CAV POS), APPROX LENGTH -000, CIRCUIT DESCRIPTION. Includes rows 254A to 421M.

C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100

TM 9-2320-303-24-1

- 1 UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00106.
2 CONNECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END.
3 SINGLE ITEM USED IN MULTIPLE LOCATIONS.
4 CONNECT TOGETHER.
5 1587 CIRCUIT PAIRS (1587A, +C, +E, +S +T, +W) ARE TO BE TWISTED TOGETHER AT A MINIMUM RATE OF ONE TWIST PER INCH.
6 SOLDER WIRE DIRECTLY TO INDICATED PIN ON ITEM #53 NATO LIGHT SWITCH CONNECTOR PER SHOP PRACTICE.
7 LOCATE SPLICE BELOW FDM.
8 AFTER CONNECTING ITEM 120 BUZZER ASSEMBLY, SECURE WITH ITEM 35 TIE WRAPS IN LOCATION INDICATED BETWEEN EB1 AND EB2. EDGE OF BUZZER MUST BE UNDER WIRE.

Table with columns: ITEM NUMBER, ITEM NUMBER, DESCRIPTION, QUANTITY, UNIT, REFERENCE. Contains assembly instructions for various components.

Table with columns: ITEM NUMBER, ITEM NUMBER, DESCRIPTION, QUANTITY, UNIT, REFERENCE. Contains assembly instructions for various components.

Table with columns: ITEM NUMBER, ITEM NUMBER, DESCRIPTION, QUANTITY, UNIT, REFERENCE. Contains assembly instructions for various components.

A

- 10 APPLY TAPE AROUND BASE OF CONNECTOR AT LEAST TWO WRAPS.
11 LOCATIONS PS1, PS2 AND PS3 ARE DIMENSIONED TO CONDUIT.
12 DRESS AND TIE STRAP ELECTRICAL BLOCK AS SHOWN IN THE VIEW.

Main assembly parts list table with columns: QTY, ITEM NUMBER, DESCRIPTION, REFERENCE. Lists various electrical components and their quantities.

Main assembly parts list table with columns: QTY, ITEM NUMBER, DESCRIPTION, REFERENCE. Lists various electrical components and their quantities.

Table with columns: QTY, ITEM NUMBER, DESCRIPTION, REFERENCE. Contains assembly parts list for a specific section.

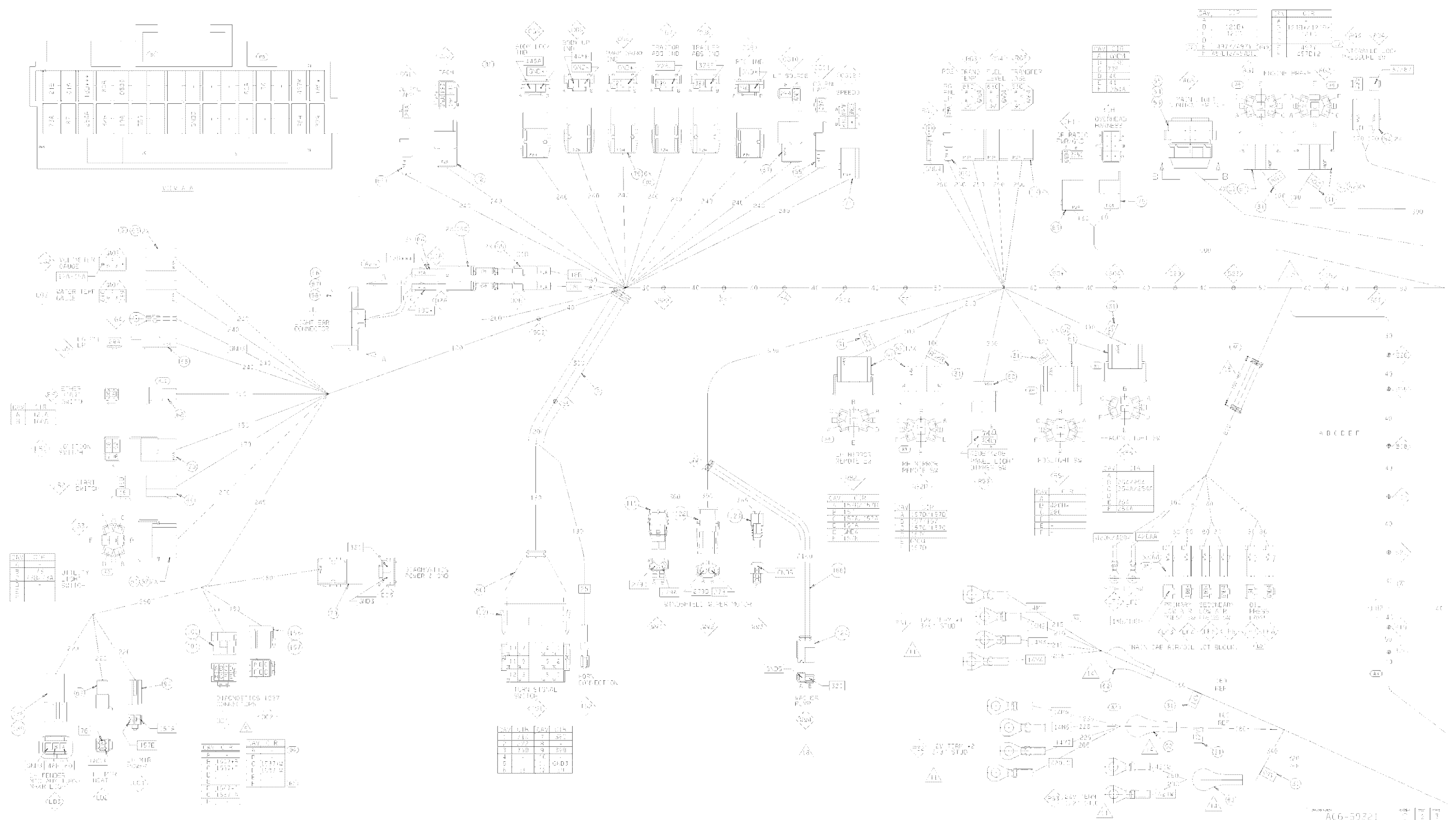
Table with columns: QTY, ITEM NUMBER, DESCRIPTION, REFERENCE. Contains assembly parts list for a specific section.

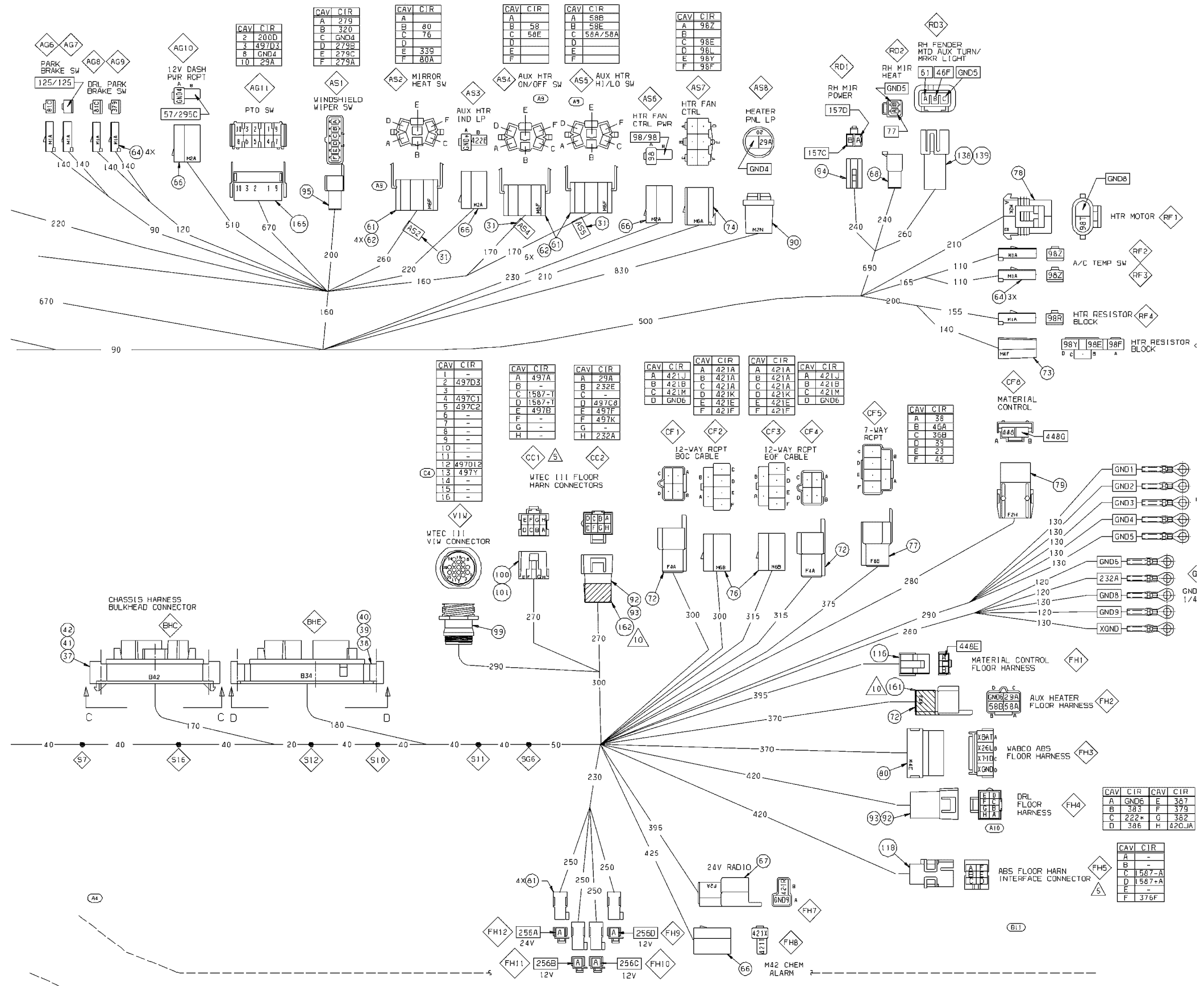
Table with columns: QTY, ITEM NUMBER, DESCRIPTION, REFERENCE. Contains assembly parts list for a specific section.

Table with columns: ITEM NUMBER, DESCRIPTION. Contains assembly parts list for a specific section.

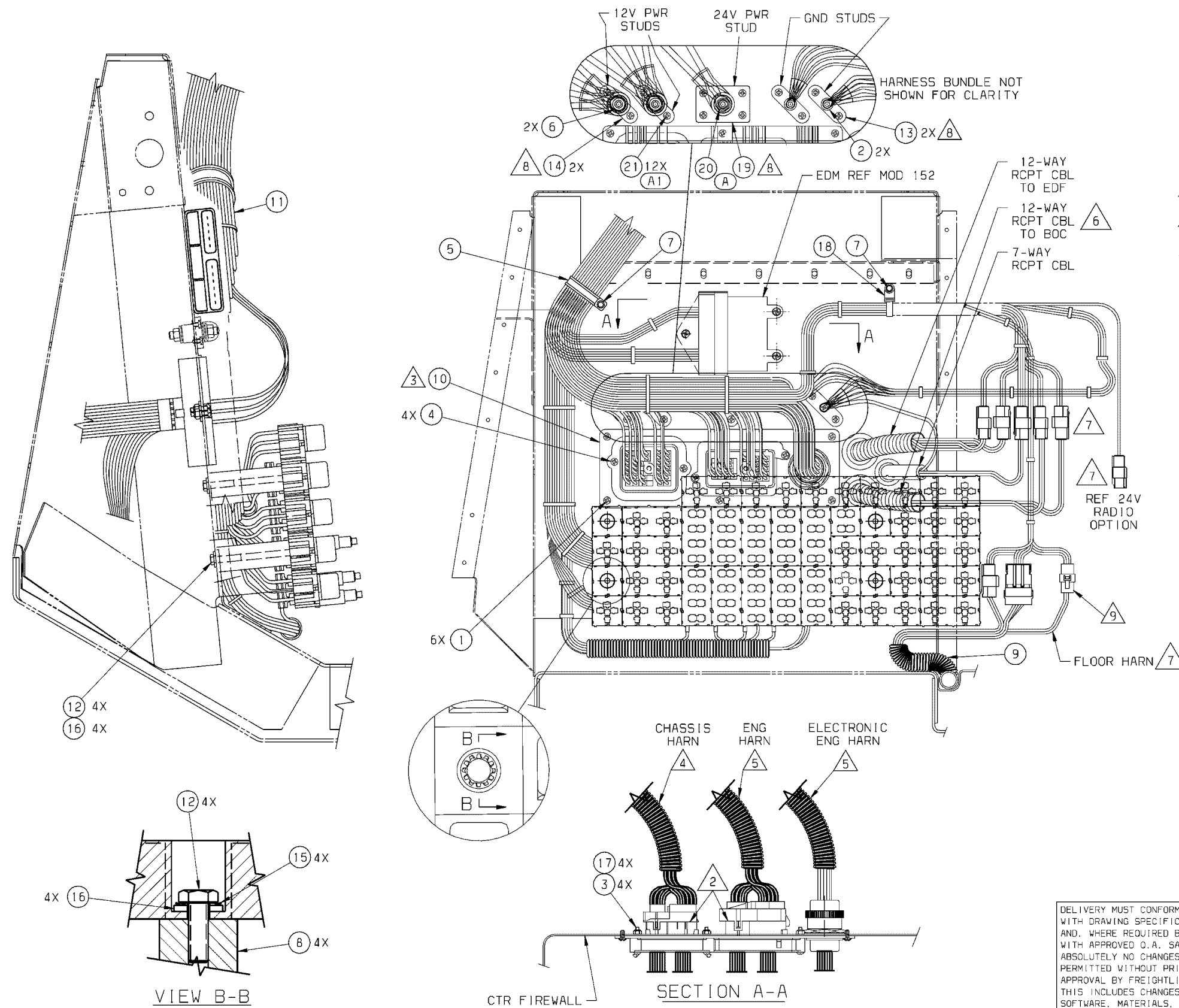
Table with columns: ITEM NUMBER, DESCRIPTION. Contains assembly parts list for a specific section.

Freightliner LLC logo and approval stamp area with fields for DATE, BY, and DESCRIPTION.





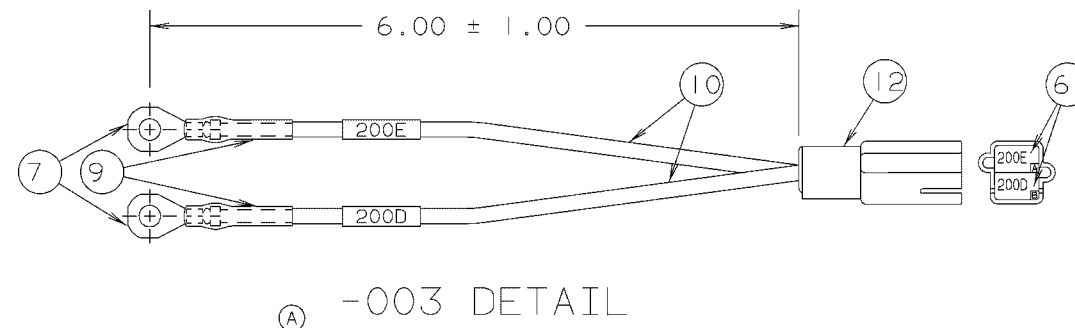
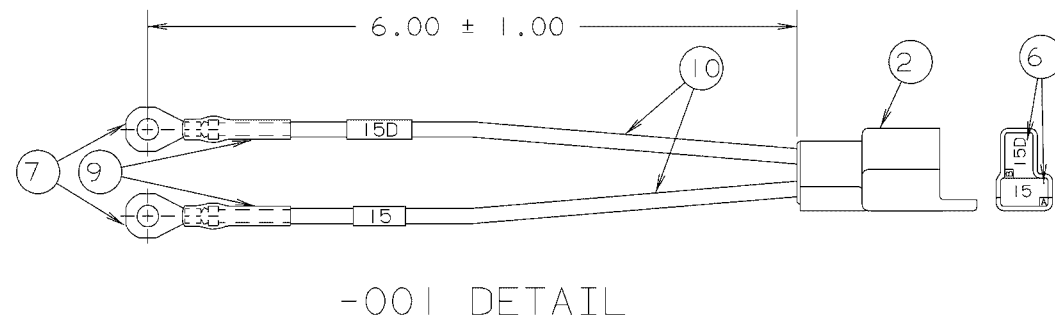
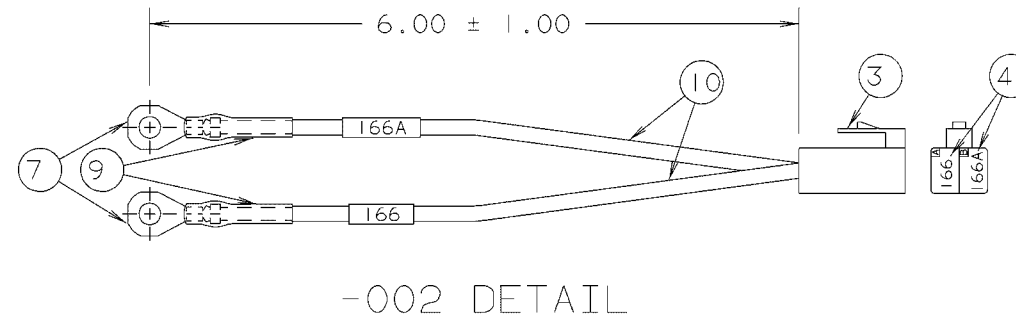
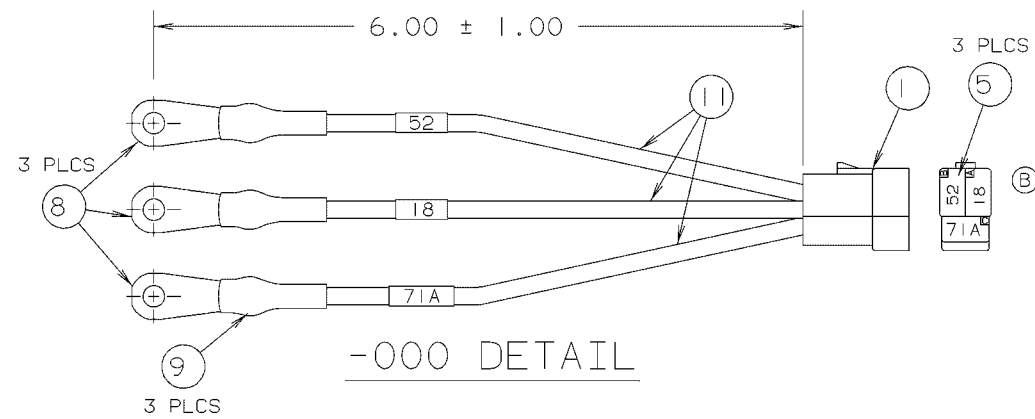
RELEASE NUMBER	REV	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
P10107-23	-	XX	INITIAL RELEASE	REN	03/06/01	RJH
P10107-74	A	D5	24V STUD GRAPHICS REVISED & ITEM REF#'S 19,20 WERE 6,14	M2S	04/26/01	RJH
	A1	D5	ITEM 21 WAS 4, QTY WAS *10X*			



1. ROUTE AND CLAMP WIRING TO VOID CHAFING.
- 2 APPLY ELECTRICAL SEALANT GREASE 48-02439-000 INTO CONNECTORS FOR WEATHER RESISTANT SEAL.
- 3 APPLY 48-02454-205 SEALANT BETWEEN ITEM 21 PLATE AND FIREWALL.
- 4 SEE SPEC MODULE 288 FOR CHASSIS HARN.
- 5 SEE SPEC MODULE 286 FOR ENG HARN.
- 6 SEE SPEC MODULE 296/297 FOR 7-WAY AND 12-WAY TRLR RCPT.
- 7 ROUTING SHOWN OUT OF POSITION FOR CLARITY ONLY. INSTALL WIRING AND CONNECTORS INSIDE OF ELECTRICAL CENTER.
- 8 APPLY 48-00118-002 SEALANT BETWEEN TERMINAL BLOCK AND FIREWALL.
- 9 SEE SPEC MODULE 311 FOR DRL FLOOR HARNESS CALLOUT.

DELIVERY MUST CONFORM EXACTLY WITH DRAWING SPECIFICATIONS AND, WHERE REQUIRED BY O.A., WITH APPROVED O.A. SAMPLES. ABSOLUTELY NO CHANGES ARE PERMITTED WITHOUT PRIOR APPROVAL BY FREIGHTLINER LLC. THIS INCLUDES CHANGES TO: SOFTWARE, MATERIALS, INTERNAL COMPONENTS, MANUFACTURING PROCESSES.

FREIGHTLINER LLC			
THE INFORMATION CONTAINED HEREIN IS PROPRIETARY DATA, AND IS NOT FOR DISSEMINATION OR DISCLOSURE, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED, EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.			
MATERIAL APPROVAL	DATE	UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ANSI STANDARD Y14.5M-1982, WITH EXCEPTIONS PER FREIGHTLINER EDN SECT 307.	
XXX	XX/XX/XX		
DRAWN BY	DATE	CHECKED BY	DATE
RICHARD NERIA	03/05/01	M2S-SIDDALL	03/05/01
RESPONSIBLE ENGINEER	DATE	THIRD ANGLE PROJECTION	UNIT OF MEASURE
M2S-SIDDALL	03/05/01		MM
APPROVED BY	DATE	WFO DESIG/PURCH AGENT	DATE
RICK HENRY	03/05/01	MIKE PLUNGOCHAR	03/13/01
DESCRIPTION INSTL-ELEC CENTER, MAIN CAB			
SUPPLEMENTARY DESCRIPTION 320A1 M915A3-22 M916A3 M917A2			
ITEM/DRAWING NUMBER	REVISION LETTER	SHEET NUMBER	
D06-40331	A	1 OF 1	



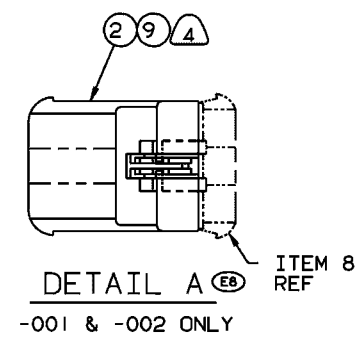
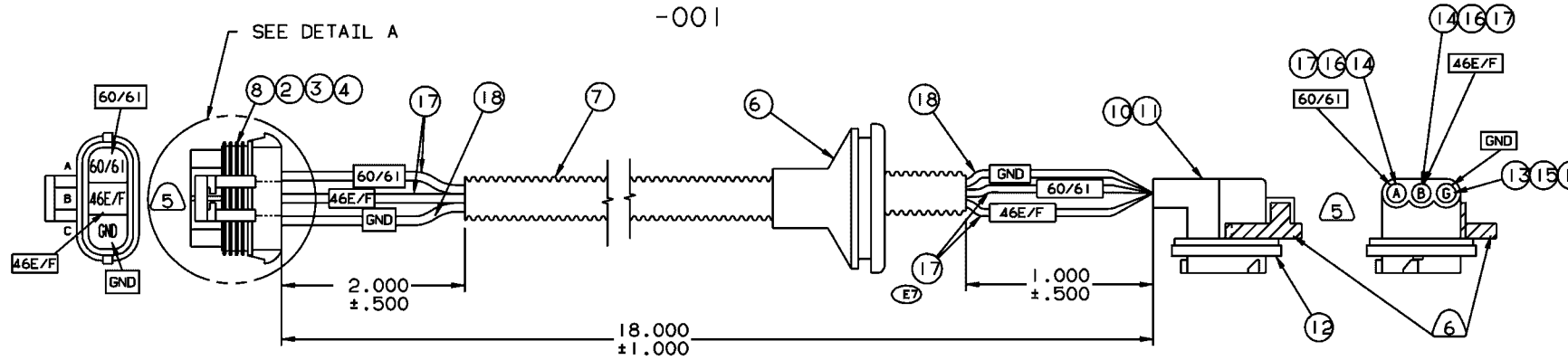
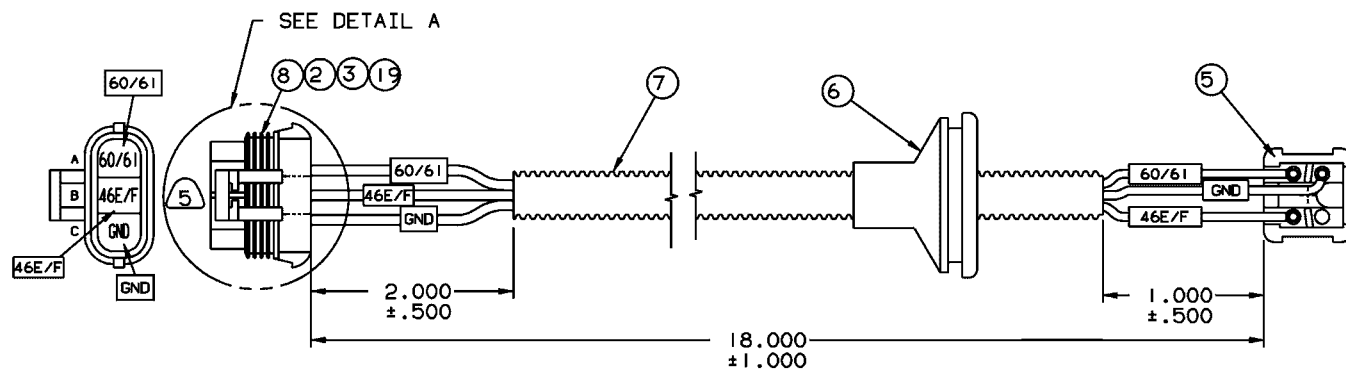
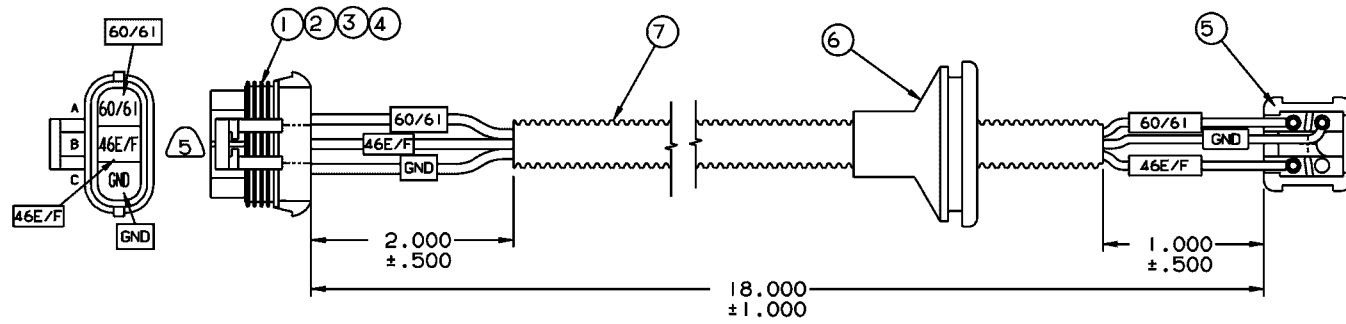
- 1 INSTALL TERMINALS PER F/L PROCESS SPEC #49-00052.
- 2 STAMP CIRCUIT NUMBER EVERY 1 TO 3 INCHES ALONG WIRE.
- 3 APPLY A 1 INCH PIECE OF ITEM 9 HEAT SHRINK OVER EACH RING TERMINAL AS SHOWN.
- 4 PART NUMBER TO BE APPLIED PER F/L PROCESS SPEC #49-00051.
- 5 CONECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END.

QTY	UNIT	DESCRIPTION	PART NUMBER	NAME OF PART	MATERIAL	ITEM	
1			PAC 8911922	CONN,HSG,2-BLD	F2C	12	
		1.5'	----	WIRE,#12 AWG SXL,WHT	48-02223-129	11	
	1'	1'	----	WIRE,#14 AWG SXL,WHT	48-02223-149	10	
	.16'	.16'	.25'	----	TUBE,HEAT SHRINK	48-02461-025	9
	1		3	23-11194-210	TERM,RING	#10-12 AWG TO #10 STUD	8
	2	2		23-11194-214	TERM,RING	#14-16 AWG TO #10 STUD	7
			3	23-11192-112	TERM,BLD,FEM,56 SRS	#12 AWG	5
	2			23-11192-114	TERM,BLD,FEM,56 SRS	#14-16 AWG	4
	1			PAC 2977373	CONN,PLUG,2-BLD	M2B	3
		1		PAC 2984883	CONN,HSG,2-BLD	F2A	2
			1	PAC 2984378	CONN,PLUG,3-BLD	M3A	1
-003	-002	-001	-000	MFR. PART NUMBER	NAME OF PART	MATERIAL	ITEM

LTR.	JOB NO.	DATE	BY	APPR.	FROM	CHANGE INFORMATION	10
B	P07639-R5	11-23-99	JEW	JEW TLH		-000 SWAPPED CKTS 18&52. ADDED NOTE 5	
A	PB1000	05-23-89	DHW	TCA KVM		ADDED -003 ASSY	
-	PB1000	04-05-89	DHW	TCA KVM		INITIAL RELEASE	

PTO SWITCH		ETHER SW HARN		START SW HARN		IGN SW HARN		FREIGHTLINER LLC PORTLAND, OREGON		THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY DATA OF FREIGHTLINER LLC AND IS NOT FOR DISSEMINATION OR DISCLOSURE IN WHOLE OR IN PART. FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.		
THIRD ANGLE PROJECTION		UNLESS OTHERWISE NOTED UNITS = INCHES		DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ANSI Y14.5 - 1973 WITH EXCEPTIONS PER FREIGHTLINER E.O.M. SECTION 307								
DRAWN BY	DHW	04-05-89	286 HARN		JUMPER SW PANEL							
DFTG. CHECKED	TCA	04-05-89	PRIMARY ITEM		2ND DESC.							
DESIGN APPROVAL	DHW	04-05-89	LOCATION		MFR.							
MFG. APPROVAL			IGN,START,ETHER & PTO SWS		ADDITIONAL INFORMATION							
FINAL APPROVAL	KVM	04-05-89	SCALE	SHEET	DRAWING NUMBER	CHG. LTR.						
			NONE	1 OF 1	A06-18247	B						

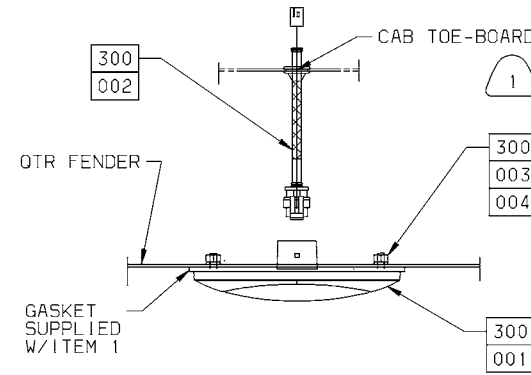
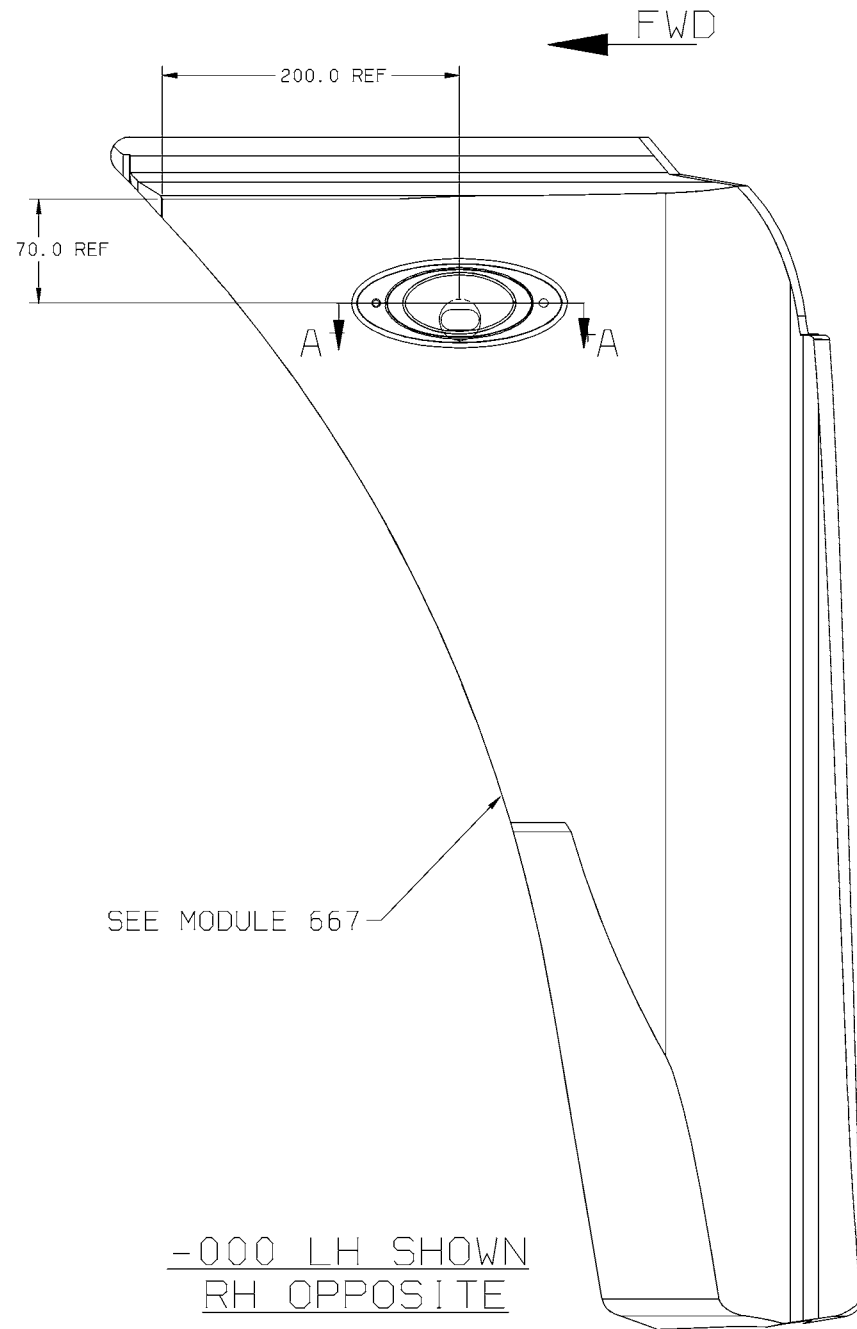
RELEASE NUMBER	REV	ZONE	REVISION DESCRIPTION	BY	DATE	APP
PL0362-02	D		REVISED AND REDRAWN.	R.L.	04/01/93	NDP
	D1	A2	ADDED -001 AND -002.			
	D2	A5	ADDED NOTES 4 & 5	R.L.	04/08/94	NDP
PL0362-27	E	A5	REV'D NOTE 4 & ADDED NOTE 6.	R.L.	04/08/94	NDP
	E1	B3	ITEM 15 WAS PAC12052388			
	E2	B3	ITEM 14 WAS PAC12092059			
	E3	B3	ITEM 13 WAS PAC12092030			
	E4	B3	ITEM 12 WAS PAC12020720			
	E5	B3	ITEM 11 WAS PAC12064953			
	E6	B3	ITEM 10 WAS PAC12092377			
	E7	B5	WIRE WAS ITEM 16.			
	E8	A8	ADDED DETAIL A.			
	E9	A3	UPDATED PLUG.			
PA2120-W9	F	C2	ADDED ITEM #19	TLD	11/08/95	JMR



1. POSITION WIRES AS SHOWN.
POSITION "A" FOR TURN SIGNAL
POSITION "B" FOR SIDE MARKER
POSITION "C" FOR GROUND
- 2 UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00052.
3. STAMP CIRCUIT NUMBER EVERY 3" TO 6" OVER ENTIRE LENGTH OF WIRE.
- 4 THESE ARE EXTRA PARTS FOR SERVICE REPLACEMENT OF HARNESS WHEN MATING HARNESS HAS OLD STYLE SERIES 630 CONNECTOR. REMOVE OLD STYLE 630 CONNECTOR, ITEMS 2 OR 9. SEE DETAIL A.
- 5 ALL CONNECTORS SHOWN FROM WIRE INSERTION END.
- 6 ITEM 10, PAC12066592, LOCKING ARM IS TO BE REMOVED BY HEADLAMP VENDOR PRIOR TO INSTALLING HARNESS ASSEMBLY ONTO LAMP BEZEL ASSEMBLY, REF P/N A06-20853.

	3		PAC12059258	SEAL 14GA SX L SXL	19	
	2'		48-02223-189	WIRE, 18 AWG, SXL	18	
	3'		48-02223-149	WIRE, 14 AWG, SXL	17	
	2		PAC12015360	SEAL, 14 GA SXL	16	
E1	1		PAC12015284	SEAL, 18 GA SXL	15	
E2	2		PAC12066639	TERM	14	
E3	1		PAC12066638	TERM	13	
E4	1		PAC12129909	GASKET	12	
E5	1		PAC12066542	INSERT, WDG BASE	11	
E6	1		PAC12066592	SOCKET	10	
	1	1	PAC12124686	HOUSING, 3-PIN 4	9	
E9	1	1	PAC12124685	PLUG, 3-PIN	8	
	15"	15"	48-02217-038	CONDUIT-TUBING	7	
	1	1	GRO01 9233 71	GROMMET	6	
	1	1	A06-17231-000	CONNECTOR ASSY	5	
	3	3	PAC12052387	SEAL 14GA SXL	4	
	3	3	PAC12052455	TERM FEM, 630 SEALED M/P	3	
	2	2	PAC12045699	LOCK, SECONDARY 4	2	
E9			1	PAC12065793	PLUG, 3-PIN	1

QUANTITY	QUANTITY	QUANTITY	ITEM NUMBER	DESCRIPTION	REF
FREIGHTLINER LLC					
THE INFORMATION CONTAINED HEREIN IS PROPRIETARY DATA, AND IS NOT FOR DISSEMINATION OR DISCLOSURE, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED, EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.					
MATERIAL APPROVAL		DATE		UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ANSI STANDARD Y14.3M-1992, WITH EXCEPTIONS PER FREIGHTLINER EDM SECT 307.	
DRAWN BY R.LARRY		DATE 03/18/93		THIRD ANGLE PROJECTION	
CHECKED BY ARC		DATE 03/12/93		UNIT OF MEASURE INCH	
RESPONSIBLE ENGINEER R.LARRY		DATE 03/23/93		RESPONSIBLE MFG. ENGR. B.MOSHOFSKY	
APPROVED BY M.PRANGER		DATE 04/01/93		DATE 04/23/93	
DESCRIPTION HARN/SCKT-T S/MRKR,FLD					
SUPPLEMENTARY DESCRIPTION FLD-AERO					
ITEM/ORDRNG NUMBER A06-17188				REVISION LETTER SHEET NUMBER F 1 OF 1	



VIEW A-A

RELEASE NUMBER	REV. LTR	ZONE	REVISION DESCRIPTION	BY	DATE	APPRO.
P13621-06	-	-	INITIAL RELEASE	DWD	01/29/01	JLT
P13621-44	A	-	REMOVED HOLE PATTERN "A"	DWD	05/11/01	JLT

DELIVERY MUST CONFORM EXACTLY WITH DRAWING SPECIFICATIONS AND, WHERE REQUIRED BY O.A., WITH APPROVED O.A. SAMPLES. ABSOLUTELY NO CHANGES ARE PERMITTED WITHOUT PRIOR APPROVAL BY FREIGHTLINER LLC. THIS INCLUDES CHANGES TO: SOFTWARE, MATERIALS, INTERNAL COMPONENTS, MANUFACTURING PROCESSES.

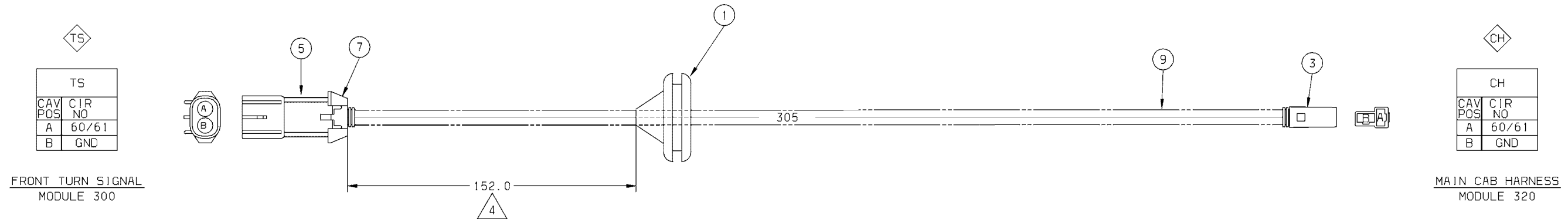
CONTRACT NUMBER
DAAE07-00-D-S022
PCPN
64678

1 INSTALL ITEMS 1, 3 & 4 AND TORQUE TO 24 TO 36 IN LB.

D06-39670-000 INSTL-LED TURN/MARKER LT, FNDR	FREIGHTLINER[®] LLC	
	THE INFORMATION CONTAINED HEREIN IS PROPRIETARY DATA, AND IS NOT FOR DISSEMINATION OR DISCLOSURE, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED, EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.	
	MATERIAL APPROVAL DATE D. DEAVILLE 01/29/01	UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ASME STANDARD Y14.5M-1994, WITH EXCEPTIONS PER FREIGHTLINER EOGM 0960-K17.
	CHECKED BY P. MURKEND 02/15/01	THIRD ANGLE PROJECTION
	RESPONSIBLE ENGINEER D. DEAVILLE 01/29/01	UNITS OF MEASURE MM
APPROVED BY J. TUBBS 02/02/01	MFG ENGR/MARK AGENT KEN SHAW 02/06/01	
DESCRIPTION INSTL-LED TURN/MARKER LT, FNDR SUPPLEMENTARY DESCRIPTION 300A1 MILITARY, TL 07302Y		
ITEM/DRAWING NUMBER D06-39670	REVISION LETTER A	SHEET NUMBER 1 OF 1

F/L CIR NO	SAE CIR NO	WIRE ITEM NO	FROM			TO			APPROX LENGTH -000	CIRCUIT DESCRIPTION		
			LOC	TERM ITEM NO	SEAL INSL NO	CONN CAV POS	LOC	TERM ITEM NO			SEAL INSL NO	CONN CAV POS
60/61	1313	2	TS	6	8	A	CH	4	-	A	305	TURN SIGNAL LP SPLY,RH/LH
GND	1204	2	TS	6	8	B	CH	4	-	B	305	GND,GENERAL CAB/CHASSIS

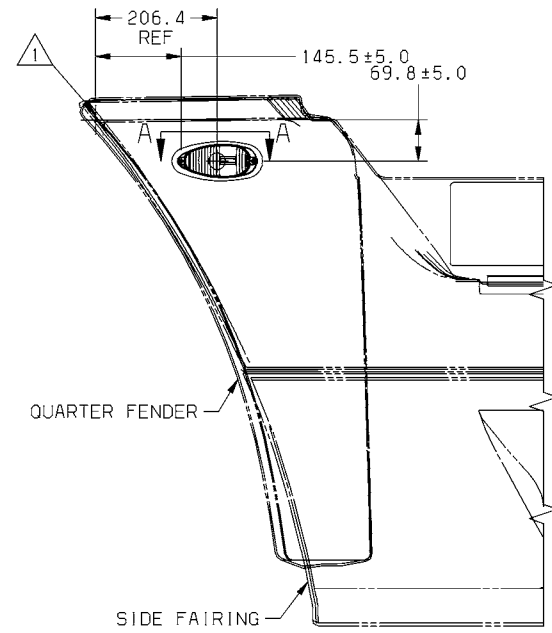
RELEASE NUMBER	REV LTR	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
P17957-01	-	-	INITIAL RELEASE	JEW	02/10/02	CAC



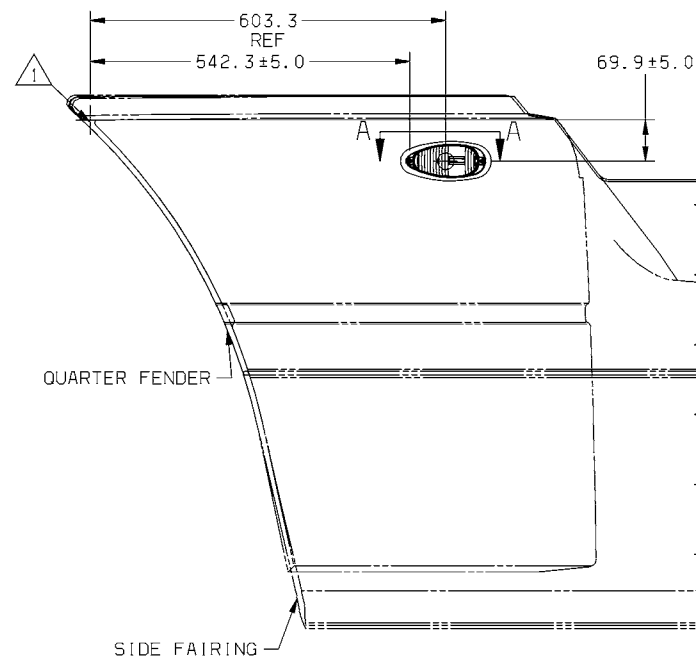
- 1 UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00106.
- 2 CONNECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END.
- 3 DIMENSION VALUES SHOWN REPRESENT THE LENGTH TO THE BACK (BUNDLE) END OF THE CONNECTOR OR TO THE POINT INDICATED BY THE ARROW. THIS CONVENTION DIFFERS FROM THE METHOD STATED IN 49-00106.
- 4 DIMENSION IS FOR REFERENCE ONLY.

QTY	ITEM NUMBER	DESCRIPTION	REF
.9'	48-02217-025	CONDUIT-NYL, 6MM, FLEX, BLK, SLIT	9
2	23-12497-001	SEAL-CABLE, MP280-WP, BLU, 14S-12	8
1	PAC15300014	LOCK-TERM, 2CAV, MP280S, F&M, BLUE	7
2	PAC12129497	TERM-MALE, MP280S, 12-14AWG	6
1	PAC15300002	RCPT-2CAV, MP280S, BLK	5
2	23-11192-114	TERM-FEM, 56SER, NIB, 14-16AWG	4
1	PAC02973781	PLUG-2CAV, 56SER, BLK	3
2'	48-02493-144	CABLE-GXL, 14GA, YELLOW, LOW TNSN	2
1	681 997 05 81	GROMMET-RUBBER, CONICAL, SPECIAL	1

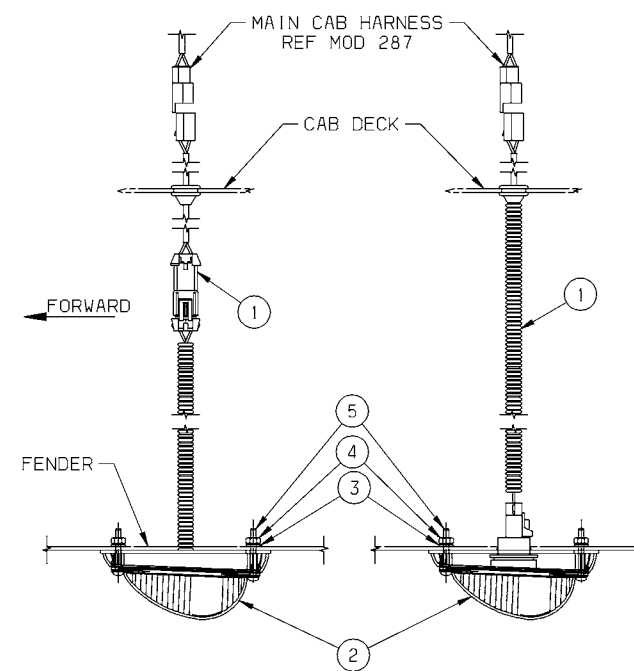
ITEM NUMBER A06-43550-000	DESCRIPTION HARN-LIGHT, SIGNAL, FENDER	FREIGHTLINER LLC			
		DELIVERY MUST CONFORM EXACTLY WITH DRAWING SPECIFICATIONS AND, WHERE REQUIRED BY O.A., WITH APPROVED O.A. SAMPLES. ABSOLUTELY NO CHANGES ARE PERMITTED WITHOUT PRIOR APPROVAL BY FREIGHTLINER LLC. THIS INCLUDES CHANGES TO: SOFTWARE, MATERIALS, INTERNAL COMPONENTS, MANUFACTURING PROCESSES.			
		THE INFORMATION CONTAINED HEREIN IS PROPRIETARY DATA, AND IS NOT FOR DISSEMINATION OR DISCLOSURE, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED, EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.			
		MATERIAL APPROVAL XXX	DATE XX/XX/XX	UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ANSI STANDARD Y14.5M-1982, WITH EXCEPTIONS PER FREIGHTLINER EGM SECT 307.	
DRAWN BY J. WHITING	DATE 02/08/02	CHECKED BY D. WHITELEY	DATE 02/08/02	THIRD ANGLE PROJECTION	
RESPONSIBLE ENGINEER P. BRANDT	DATE 02/08/02	APPROVED BY C. COVERDILL	DATE 02/08/02		
DESCRIPTION HARN-LIGHT, SIGNAL, FENDER		MFG ENGR/PURCH AGENT J. GOMEZ	DATE 02/16/02	UNITS OF MEASURE MM	
SUPPLEMENTARY DESCRIPTION 30003 JUMPER HARN THRU DECK		ITEM/DRAWING NUMBER A06-43550			
REVISION LETTER -		SHEET NUMBER 1 OF 1			



FLD120 SET BACK AXLE
LH SHOWN, RH OPPOSITE

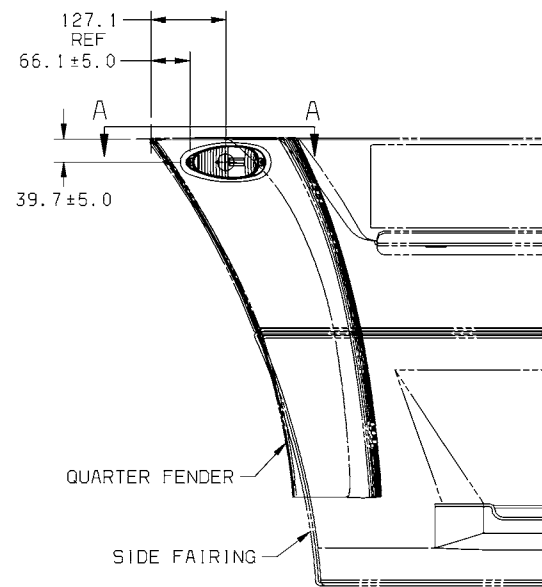


FLD120 SET FORWARD AXLE
LH SHOWN, RH OPPOSITE

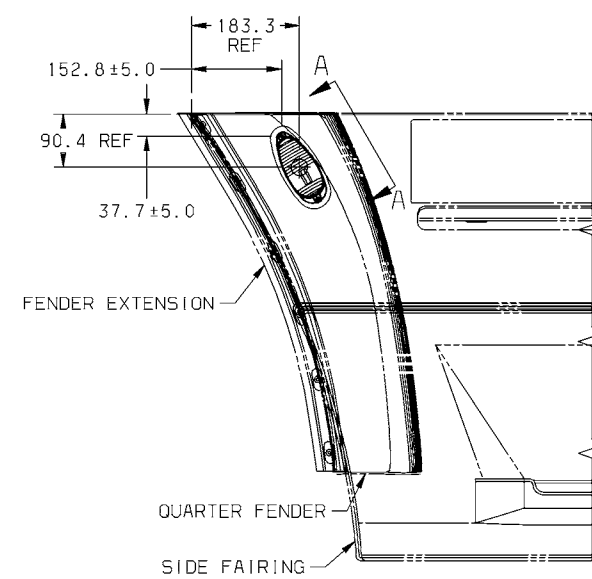


VIEW A-A
-000

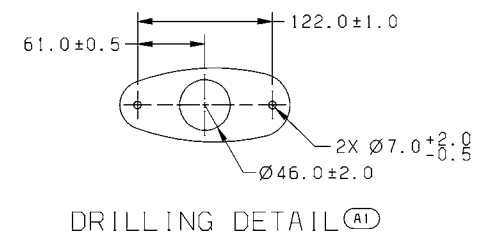
VIEW A-A
-001



FLD112 SET BACK AXLE
LH SHOWN, RH OPPOSITE



FLD112 SET BACK AXLE
W/FENDER EXTENSION
LH SHOWN, RH OPPOSITE



① DIMENSION TAKEN FROM FORWARD EDGE OF FLAT FLANGE OF STATIONARY FENDER.

② 2. TORQUE FASTENERS TO 6-8 Nm (4.4-5.9 FT-LBS)

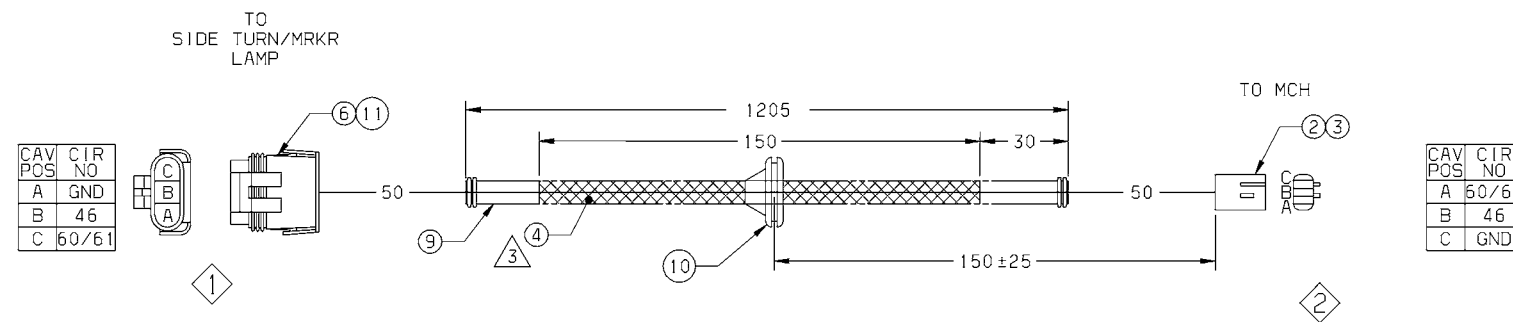
DELIVERY MUST CONFORM EXACTLY WITH DRAWING SPECIFICATIONS AND, WHERE REQUIRED BY O.A., WITH APPROVED O.A. SAMPLES. ABSOLUTELY NO CHANGES ARE PERMITTED WITHOUT PRIOR APPROVAL BY FREIGHTLINER LLC. THIS INCLUDES CHANGES TO: SOFTWARE, MATERIALS, INTERNAL COMPONENTS, MANUFACTURING PROCESSES.

RELEASE NUMBER	REV	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
P00511-06	-	-	INITIAL RELEASE	AJD	09/22/97	ANF
P18972-04	A	A2	ADDED -001	ACH	04/22/03	CPJ
	A1	B2	UPDATED DRILLING			
	A2	A4	ADDED TORQUE SPEC.			

D06-27767-001		D06-27767-000		D06-27767-000	
ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
	INSTL-TRN SIG, AUX, FLD, FNDR		INSTL-TRN SIG, AUX, FLD, FNDR		INSTL-TRN SIG, AUX, FLD, FNDR
FREIGHTLINER® LLC					
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DRAWN BY D. PORTER		DATE 09/22/97		UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ASME STANDARD Y14.5M-1994, WITH EXCEPTIONS PER FREIGHTLINER EOSH 0950-K17.	
CHECKED BY J. ELMORE		DATE 04/23/03		THIRD ANGLE PROJECTION	
RESPONSIBLE ENGINEER D. PORTER		DATE 04/23/03		UNIT OF MEASURE MM	
APPROVED BY A. FRESHWATER		DATE 04/23/03		MFG ENG/PURCH AGENT L. DETRICK	
DATE 04/22/03		DATE 04/22/03		DATE 04/22/03	
DESCRIPTION INSTL-TRN SIG, AUX, FLD, FNDR					
SUPPLEMENTARY DESCRIPTION 300A1 FLD/D2					
ITEM/ORDINIG NUMBER D06-27767				REVISION LETTER A	
				SHEET NUMBER 1 OF 1	

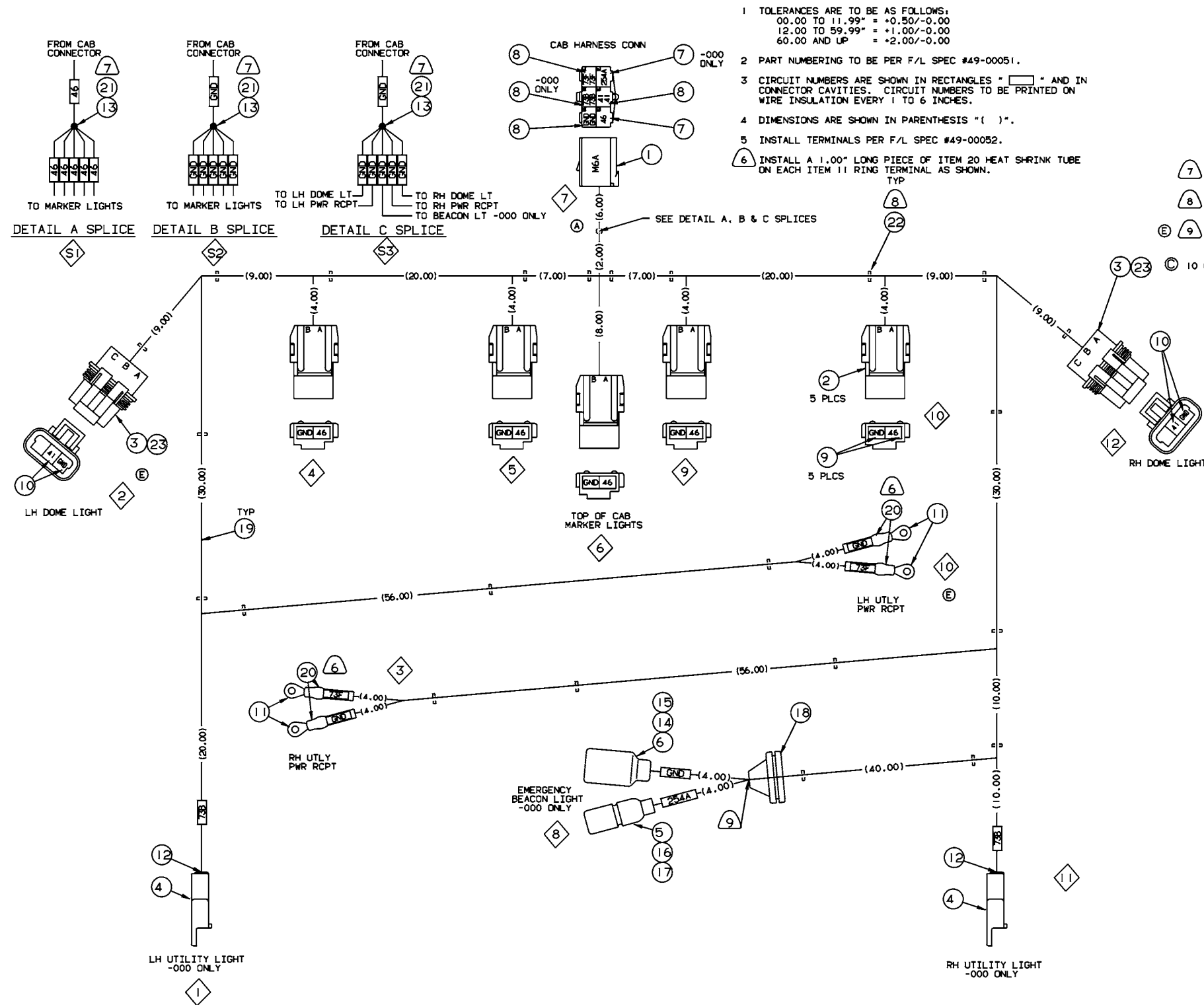
RELEASE NUMBER	REV	ZONE	REVISION DESCRIPTION	BY	DATE	APPD.
P10107-19	-	XX	INITIAL RELEASE	MOD	01/31/01	RJH
P10107-76	A	B3	ADDED ITEM 11	MOD	04/28/01	RJH
	A1	B3	REPLACED AMP COMPONENTS WITH PAC PART NUMBER.			

F/L CIR NO	SAE CIR NO	WIRE ITEM NO	FROM			TO			APPROX LENGTH -000	CIRCUIT DESCRIPTION		
			LOC	TERM ITEM NO	SEAL INSL NO	CONN CAV POS	LOC	TERM ITEM NO			SEAL INSL NO	CONN CAV POS
60/61	1313	1	2	5		A	1	7	8	C	1305	TURN SIG LP SPLY, RH/LH FR
46	1303	1	2	5		B	1	7	8	B	1305	MARKER LP SPLY, TRACTOR
GND	1204	1	2	5		C	1	7	8	A	1305	GND, GENERAL CAB/CHASSIS



- 1 UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00106.
- 2 CONNECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END.
- 3 TAPE CONDUIT WITH 50% TAPE OVERLAP TO PROVIDE DOUBLE THICKNESS.

A	1	PAC12052845	LOCK-TERM, 3CAV, MP150S-M & F	11	
	1	681 997 05 81	GROMMET-RUBBER, CONICAL, SPECIAL	10	
	3.9'	48-02218-025	CONDUIT-POL THN, 6MM, FLEX, GRAY	9	
	A1	3	PAC12052924	SEAL-CABLE, MP150, DK RED, REEL	8
	A1	3	PAC12048074	TERM-FEM, MP150S, 16/18	7
	A1	1	PAC12059595	PLUG-3CAV, MP150S, BLK	6
	3	PAC12047767	TERM-FEM, MP150, 16GXL-18AWG	5	
	2.0'	48-00126-007	MSC-3/4 BLK TAPE-MMM15	4	
	1	PAC12047783	LOCK-TERM, 3CAV, MP150-PLUG	3	
	1	PAC12047781	PLUG-3CAV, MP150, BLK,	2	
	12.8'	48-25085-108	CABLE-TXL, 16/1. GA, GRY, LOW TNSN	1	
	QTY	ITEM NUMBER	DESCRIPTION	REF	
ITEM NUMBER: A06-39668-000	DESCRIPTION: HARN-JMPR, SIDE TURN/MRKR LAMP		FREIGHTLINER® LLC		
	DELIVERY MUST CONFORM EXACTLY WITH DRAWING SPECIFICATIONS AND, WHERE REQUIRED BY O.A., WITH APPROVED O.A. SAMPLES. ABSOLUTELY NO CHANGES ARE PERMITTED WITHOUT PRIOR APPROVAL BY FREIGHTLINER LLC. THIS INCLUDES CHANGES TO: SOFTWARE, MATERIALS, INTERNAL COMPONENTS, MANUFACTURING PROCESSES.				
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	MATERIAL APPROVAL		DATE		
	XXX	XXX	UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ASME STANDARD Y14.5M-1994, WITH EXCEPTIONS PER FREIGHTLINER EOHM 0950-K17.		
	DRAWN BY: M. DAVIS	DATE: 01/31/01			
	CHECKED BY: C. ZUBIETA	DATE: 01/31/01	THIRD ANGLE PROJECTION	UNITS: MM	
	RESPONSIBLE ENGINEER: C. ZUBIETA	DATE: 01/31/01			
	APPROVED BY: R. HENRY	DATE: 01/31/01	MFG ENGR/SUPV AGENT: M. PUNCOCHAR	DATE: 05/04/01	
	DESCRIPTION: HARN-JMPR, SIDE TURN/MRKR LAMP				
	SUPPLEMENTARY DESCRIPTION: 30003 GVG-M915, M916, M917				
	ITEM/DRAWING NUMBER: A06-39668		REVISION LETTER: A	SHEET NUMBER: 1 OF 1	



- 1 TOLERANCES ARE TO BE AS FOLLOWS:
 00.00 TO 11.99" = +0.50/-0.00
 12.00 TO 59.99" = +1.00/-0.00
 60.00 AND UP = +2.00/-0.00
- 2 PART NUMBERING TO BE PER F/L SPEC #49-00051.
- 3 CIRCUIT NUMBERS ARE SHOWN IN RECTANGLES " " AND IN CONNECTOR CAVITIES. CIRCUIT NUMBERS TO BE PRINTED ON WIRE INSULATION EVERY 1 TO 6 INCHES.
- 4 DIMENSIONS ARE SHOWN IN PARENTHESIS "()".
- 5 INSTALL TERMINALS PER F/L SPEC #49-00052.
- 6 INSTALL A 1.00" LONG PIECE OF ITEM 20 HEAT SHRINK TUBE ON EACH ITEM 11 RING TERMINAL AS SHOWN.

- 7 INSTALL A 1.50" LONG PIECE OF ITEM 21 HEAT SHRINK TUBE ON EACH ITEM 13 SPLICE TERMINAL AS SHOWN.
- 8 SECURE WIRE BUNDLES APPROXIMATELY AS SHOWN WITH ITEM 22 ELECTRICAL TAPE.
- 9 APPLY SILICONE SEALANT BETWEEN BOTH WIRES AND THE GROMMET. PROCESS TO BE COMPLETED AT THE ASSEMBLY PLANT.
- 10 CONN END VIEWS SHOW THE TERMINAL END, NOT WIRE INSERTION END.

RELEASE NUMBER	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
PB1000	-	INITIAL RELEASE	CHM	03/21/89	KVM
PB1033-30	B	2A ADDED -001, REVISED DWG FORMAT	BLD	11/29/95	KRM
P1227A-L2	C	2C ADDED NOTE 10	MSS	03/27/01	RLM
P18406-B0	D	-- ADDED REFERENCE DESIGNATORS	GPH	09/17/02	NLL
P18406-C0	E	4B DELTA 13 ADDED	NLL	03/02/04	NLL
		3C LOCATION DATA ADDED			
		2E ADDED ITEM 23			

QTY	UNIT	PART NUMBER	DESCRIPTION	REF
2	2	PAC12034145	SEC LOCK	23
3'	3'	48-00126-007	TAPE, ELEC. BLACK	22
4'	4'	48-02461-038	TUBE, HT SHRINK, 3/8	21
3'	3'	48-02461-025	TUBE, HT SHRINK, 1/4	20
81'	117'	48-02223-149	WIRE, #14 AWG, SXL	19
	1	23-10998-010	GROMMET, WIRE, 86 GROV., .25 ID	18
	1	ARU8338562	INSULATOR, TERM, #14-16 AWG	17
	1	ARU8338564	TERM, SOCK, FEM, #14-16 AWG	16
	1	ARU8338567	WASHER, C, TERM #14-16 AWG	15
	1	ARU572929	TERM, PIN, MALE, #14-16 AWG	14
3	3	23-11283-000	TERM, SPLICE CLIP	13
	2	23-11193-114	TERM, BLD, MALE, #14-16 AWG	12
4	4	AI 60770-2	TERM, RING, #14 AWG - #6 STUD	11
4	4	PAC12066214	TERM, BLD, FEM, 280, #14-16 AWG	10
10	10	PAC12020116	TERM, BLD, MALE, 280, #14-16 AWG	9
3	4	23-11192-124	TERM, BLD, FEM, 56SRS, (2#14 AWG)	8
1	2	23-11192-114	TERM, BLD, FEM, 56SRS, 14-16 AWG	7
	1	ARU8338566	CONN, HSG, 1-PIN (MS27142-2)	6
	1	ARU8338561	CONN, PLUG, 1-PIN (MS27144-1)	5
	2	PAC02984528	CONN, HSG, FEM, 1-BLD (F1A)	4
2	2	PAC12040977	CONN, PLUG, 3-BLD (280 METPK)	3
5	5	PAC12015271	CONN, HSG, 2-BLD (280 METPK)	2
1	1	PAC2977044	CONN, PLUG, 6-BLD (M6A)	1

FREIGHTLINER LLC

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DESIGNED BY B. MEAD	DATE 11/29/95	THIRD ANGLE PROJECTION	SCALE 1/16" = 1"
CHECKED BY BLD	DATE 11/29/95	APPROVED BY KRM	DATE 11/29/95

UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ANSI STANDARD Y14.5M-1982, WITH EXCEPTIONS PER FREIGHTLINER EGM SECT 307.

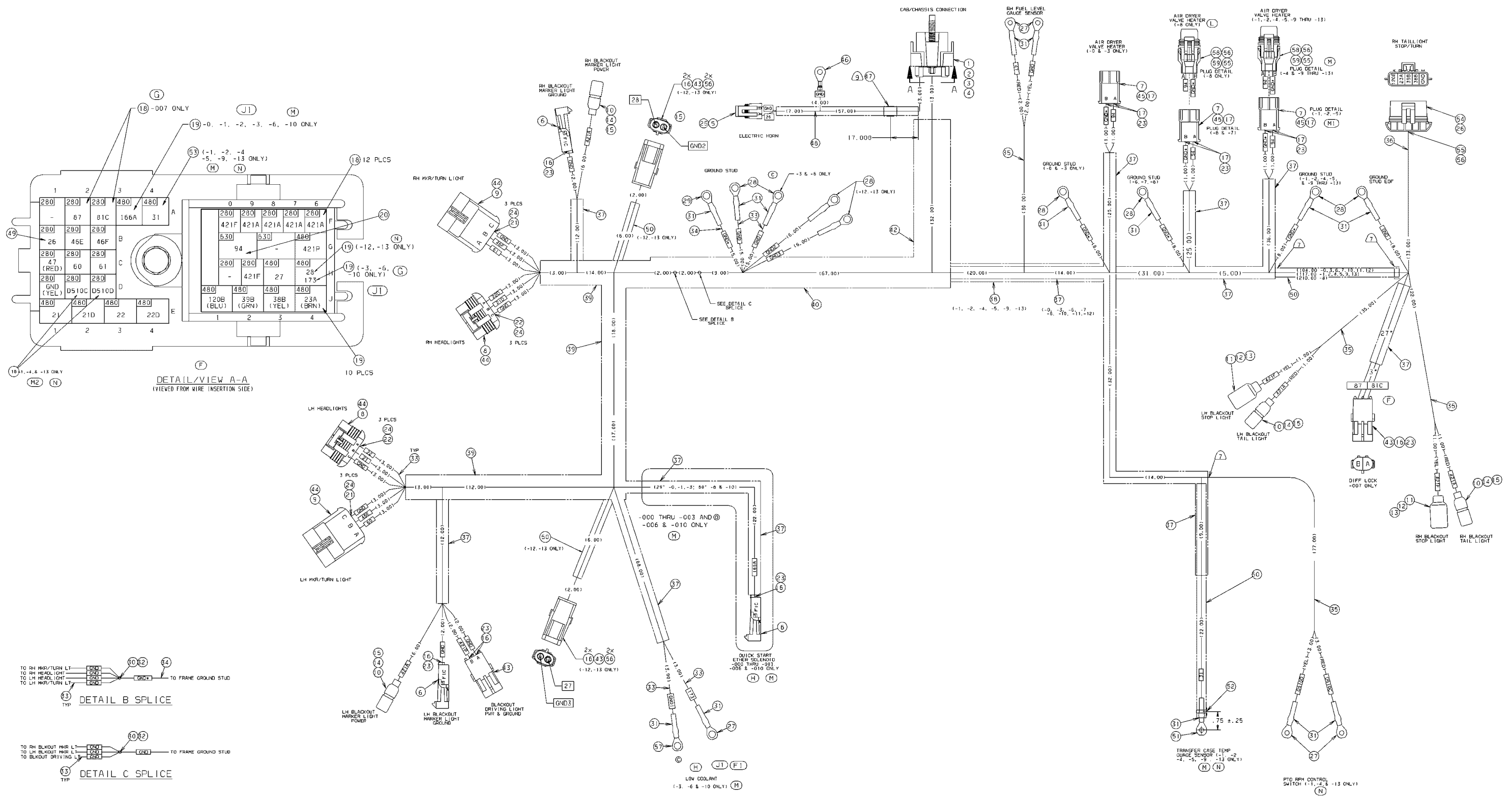
REVISIONS:

REV	DATE	DESCRIPTION
1	11/29/95	INITIAL RELEASE
2A	11/29/95	ADDED -001, REVISED DWG FORMAT
2C	03/27/01	ADDED NOTE 10
2E	03/02/04	ADDED ITEM 23

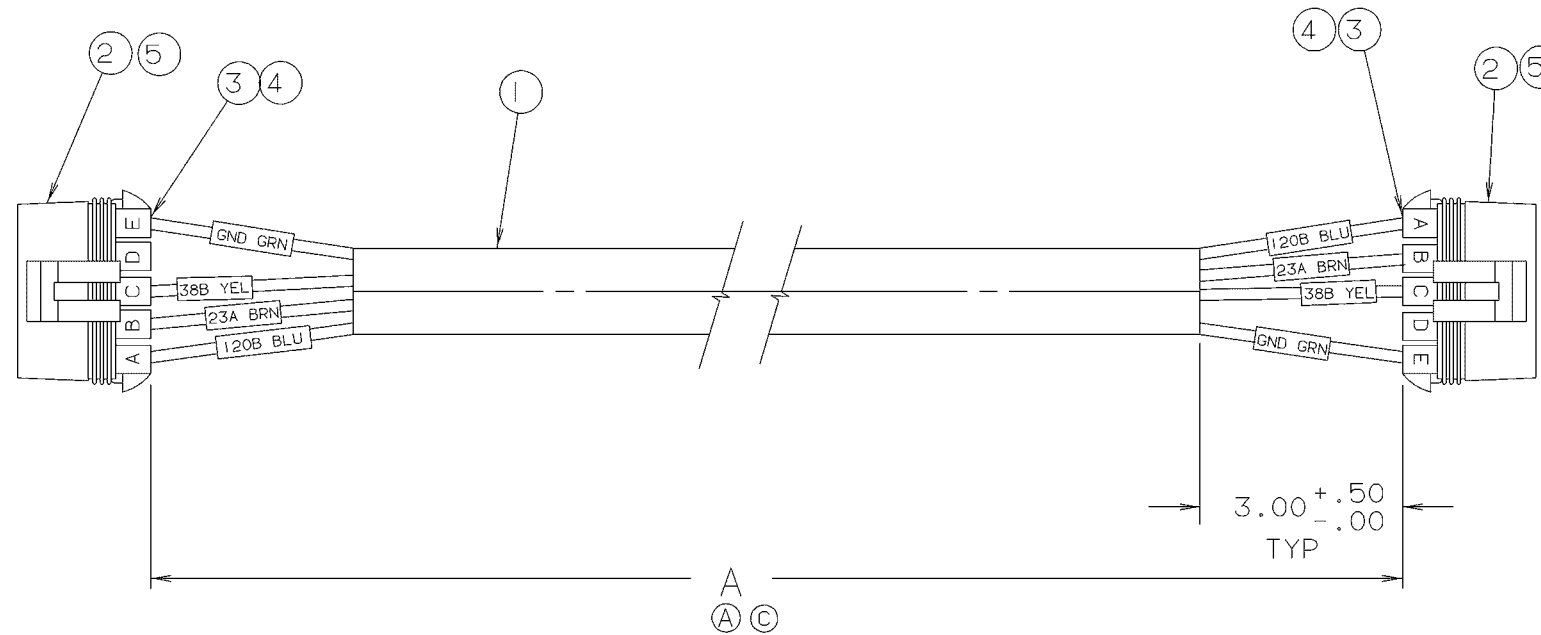
ITEM NUMBER: A06-18212-001
 DESCRIPTION: HARNESS OVERHEAD M917
 ITEM NUMBER: A06-18212-000
 DESCRIPTION: HARNESS OVERHEAD M915/M916

ITEM NUMBER: A06-18212
 DESCRIPTION: HARNESS OVERHEAD CAB
 SUPPLEMENTARY DESCRIPTION: 3200DI MILITARY VEHICLE

ITEM NUMBER: A06-18212
 REVISION LETTER: E
 SHEET NUMBER: 1 OF 1



COLOR CODE	CIRCUIT NO. ^④	FUNCTION
BLU	120B	BACKUP LIGHT
BRN	23A	TAIL LIGHT
YEL	38B	LH TURN LIGHT
GRN	GND	LH GROUND



- ① INSTALL TERMINALS PER FREIGHTLINER SPEC 49-00052.
- ② STAMP OR LABEL OUTER CABLE JACKET AS REQUIRED.
- ③ TOLERANCE (ON BASIC DIM)
 0.00 TO 11.99 +.50 -.00
 12.00 TO 59.99 +1.00 -.00
 60.00 AND UP +2.00 -.00
- ④ CIR CALLOUTS FOR REF ONLY.

③	③	③	③	"A" - DIM				
②	2	2	2	PAC 15324857	LOCK-TERM, 5CAV MP280S, PLUG, BLK		5	
②	8	8	8	23-12497-001	SEAL-CABLE, MP280-WP BLU, 14S-12		4	
②	8	8	8	PAC 12129493	TERM, FEMALE, 280 M/P		3	
②	2	2	2	681 545 31 28	PLUG, 4 WAY		2	
①	38"	181"	66"	48-02339-440	CABLE, 4 COND, 14AWG		1	
	-002	-001	-000	MFR. DASH NO.	PART NUMBER	NAME OF PART	MATERIAL	ITEM

LTR.	JOB NO.	DATE	BY	APPR.	FROM	CHANGE INFORMATION	10
G	P17957-01	03-25-02	JEW	JEW MLC	WERE PAC12015360 AND PAC15324857		
F	P01358-07	06-08-99	JRT	JRT JLT	-002 FROM 30" TO 38"		
E	902164-09	08-11-97	JRT	GBJ KRH	ADDED -002		
D	P3550J-06	04-26-96	BDB	KRH	ITEMS 3 & 4 CHANGED		
C	499165-01	04-23-92	JRT	DHW CAM	ADDED -001 & "A" DIM		
B	P0003G	02-26-90	DDM	DDM DJL	ITEM 5 WAS 681 545 10 89		
A	P9242D	08-24-89	CD	DDM DJL	ITEM 1 66" WAS 60", DIM 66.00 REF WAS 60.00 REF, 60.00 WAS 54.00		

⑥ ③

FREIGHTLINER LLC
PORTLAND, OREGON

THE INFORMATION CONTAINED HEREIN IS THE PROPRIETARY DATA OF FREIGHTLINER LLC AND IS NOT FOR DISSEMINATION OR DISCLOSURE IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SUBMITTED EXCEPT AS AUTHORIZED IN WRITING BY FREIGHTLINER LLC.

THIRD ANGLE PROJECTION	UNLESS OTHERWISE NOTED UNITS = INCHES	DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ANSI Y14.5 - 1973 WITH EXCEPTIONS PER FREIGHTLINER E.O.M. SECTION 307	
DRAWN BY	RED	03-15-89	ASSY, HARNESS-TAIL LIGHT PRIMARY DESC. GROTE 2ND DESC. LOCATION MFR.
DTG. CHECKED	DDM	03-15-89	
DESIGN APPROVAL	DDM	03-15-89	
MFG. APPROVAL	F. CROW	05-03-89	
FINAL APPROVAL	DJL	05-05-89	ADDITIONAL INFORMATION SCALE: FULL SHEET: 1 of 1 DRAWING NUMBER: A06-18319 CHG. LTR.: G

F/L CIR NO	SAE CIR NO	WIRE ITEM NO	FROM			TO			APPROX LENGTH -000	APPROX LENGTH -001	APPROX LENGTH -002	CIRCUIT DESCRIPTION
			LOC	TERM ITEM NO	SEAL INSL NO	CONN CAV POS	LOC	TERM ITEM NO				
39B	1316	1	1A	11	12	C	4	7	450	450	450	STOP/TURN SPLY, RH EOF
38B	1313	1	1A	11	12	D	6	7	950	950	950	STOP/TURN SPLY, LH EOF
120B	1322	1	1A	11	12	A	S3	2	700	700	700	BACK-UP LAMP SPLY
120B	1322	25	5	14	15	3	S3		925	925	925	BACK-UP LAMP SPLY
120B	1322	25	7	14	15	3	S3		350	350	350	BACK-UP LAMP SPLY
120B	1322	1	8	27	16		S3	3			525	BACK-UP LAMP SPLY
23A	1315	1	1A	11	12	B	S2	2	550	550	550	TAIL LP SPLY, TRAILER
23A	1315	1	4	7			S2		500	500	500	TAIL LP SPLY, TRAILER
23A	1315	1	6	7			S2	3	400	400	400	TAIL LP SPLY, TRAILER
GND	1204	1	1A	11	12	E	S1	2	400	400	400	GND, GENERAL CAB/CHASSIS
GND	1204	1	4	7			S1		350	350	350	GND, GENERAL CAB/CHASSIS
GND	1204	25	5	14	15	1	S1		625	625	625	GND, GENERAL CAB/CHASSIS
GND	1204	1	6	7			S1	3	550	550	550	GND, GENERAL CAB/CHASSIS
GND	1204	25	7	14	15	1	S1		650	650	650	GND, GENERAL CAB/CHASSIS
GND	1204	1	8	27	16		S1				825	GND, GENERAL CAB/CHASSIS
421A*	1303	1	2	13			4	7	750			BLACKOUT MARKER LP SPLY
421A	1303	1	3	13			6	7	900			BLACKOUT MARKER LP SPLY
421A*	1303	1	1B	23	12	A	4	7		450	450	BLACKOUT MARKER LP SPLY
421A	1303	1	1B	23	12	B	6	7		950	950	BLACKOUT MARKER LP SPLY
421F*	1316	1	2	7			4	7	750			BLACKOUT STOP LP, 24V
421F	1316	1	3	7			6	7	900			BLACKOUT STOP LP, 24V
421F*	1316	1	1B	23	12	C	4	7		450	450	BLACKOUT STOP LP, 24V
421F	1316	1	1B	23	12	D	6	7		950	950	BLACKOUT STOP LP, 24V

C8 B1

C8 B1

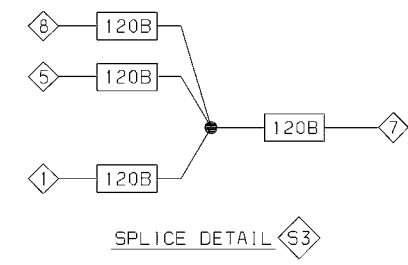
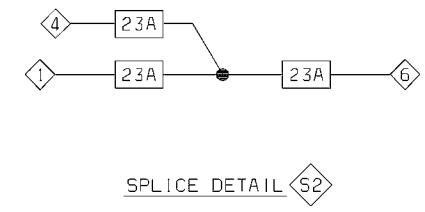
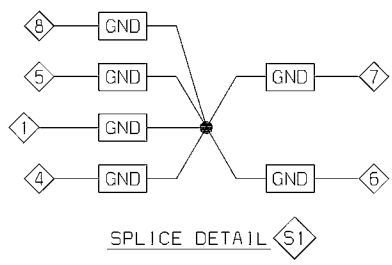
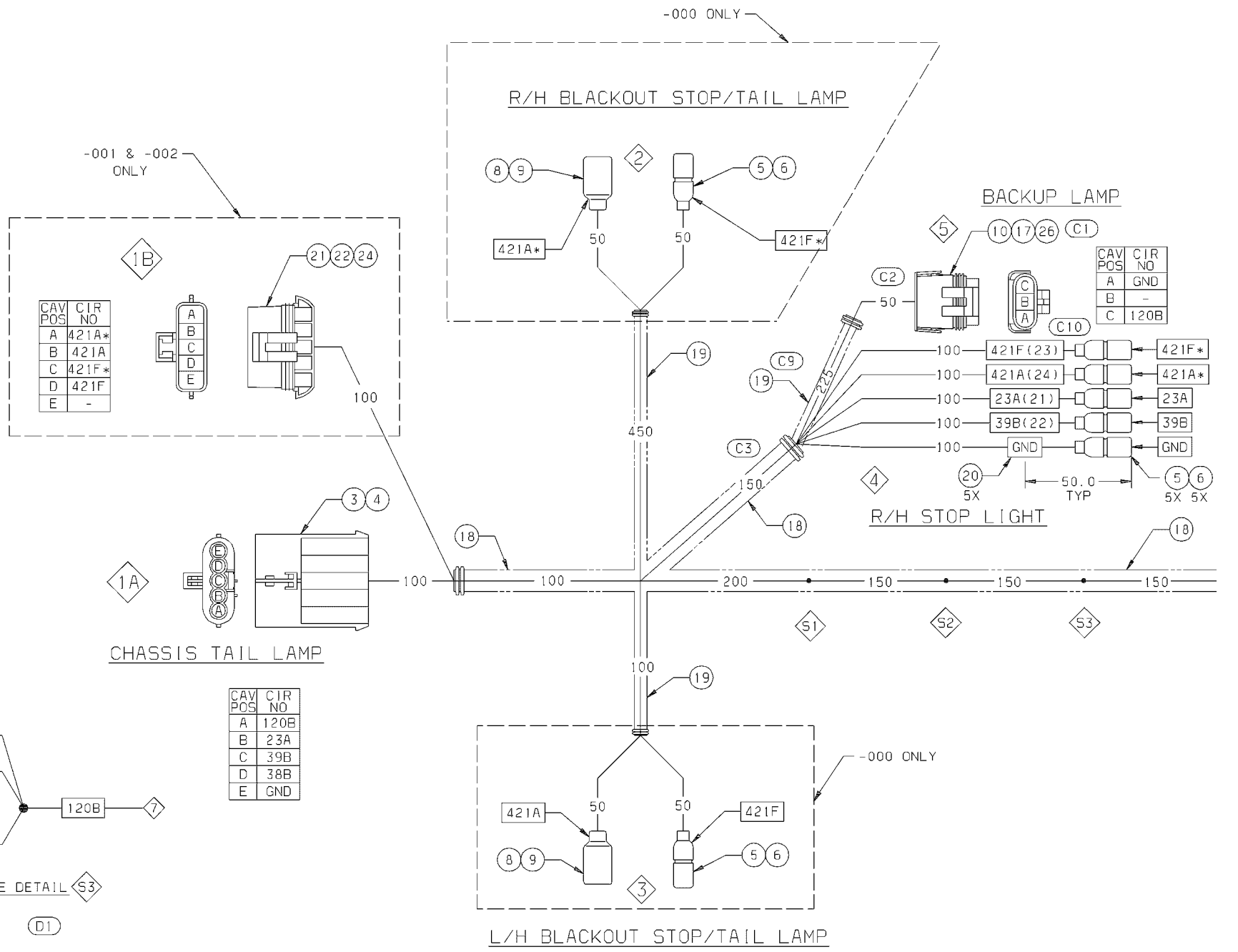
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C7

C7

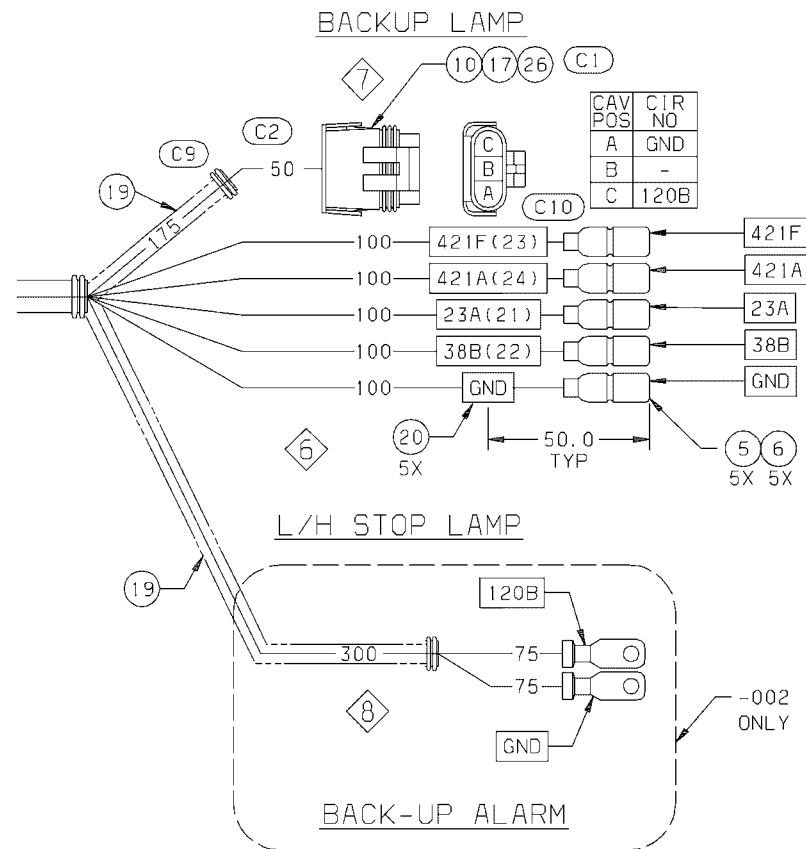
C7

C7



D1

RELEASE NUMBER	REV	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
P10107-13	-	XX	INITIAL RELEASE	MDD	01/03/01	R,JH
P10107-18	A	A2	REVISED PART NUMBERS	MDD	02/09/01	R,JH
P10107-42	B	A2	ADDED ITEM NO. 25			
	B1	D11	WIRE ITEM NUMBER WAS: 1			
	B2	A3	-000 ITEM 1 QTY WAS 32.4' -001 ITEM 1 QTY WAS 30.7'	REN	03/08/01	R,JH
P10107-84	C	C3	ADDED ITEM NO. 26	MDD	04/28/01	R,JH
	C1	--	REPLACED AMP WITH PAC PART NO.			
	C2	C5/C4	DIM WAS 150			
	C3	C6	DIM WAS 50			
	C4	A3	-000 ITEM 1 QTY WAS 25.6'			
		A3	-001 ITEM 1 QTY WAS 24.1'			
	C5	C3	ITEM 25 QTY WAS 6.6'			
	C6	C3	ITEM 18 QTY WAS 2.6'			
	C7	--	ADDED 100MM TO OVERALL LENGTH			
	C8	--	ADDED 200MM TO OVERALL LENGTH			
C9	--	ADDED CONVULUTE TO BACKUP LAMP BREAKOUT.				
C10	--	REVISED LABELS: 23 WAS 24 24 WAS 23				
P10107-81	D	C3	ADDED -002 HARN & ITEM 27	MDD	06/06/01	R,JH
	D1	A9	REVISED SPLICE DETAILS			



- UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00106.
- CONNECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END.
- SEE SPLICE DETAIL.

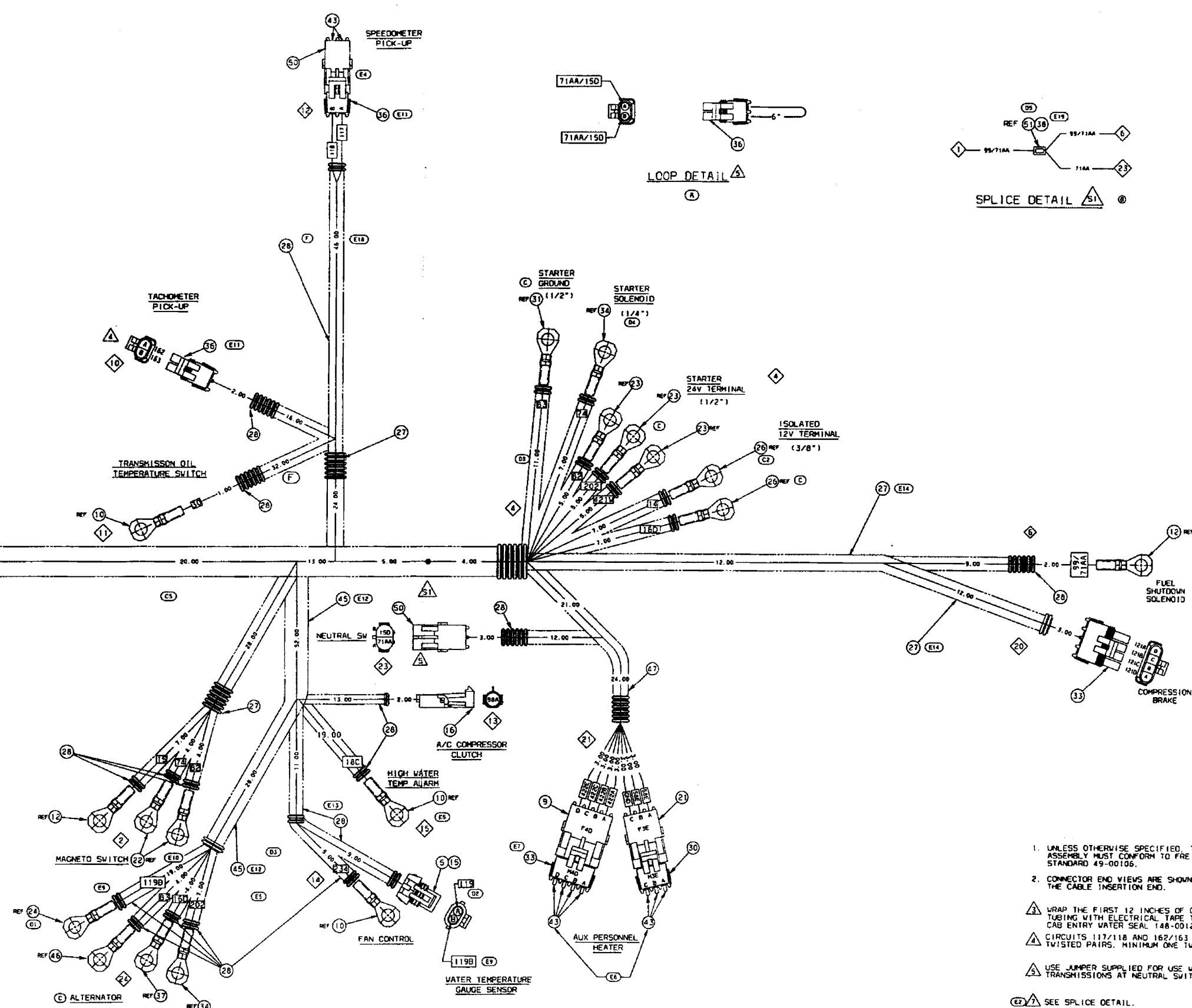
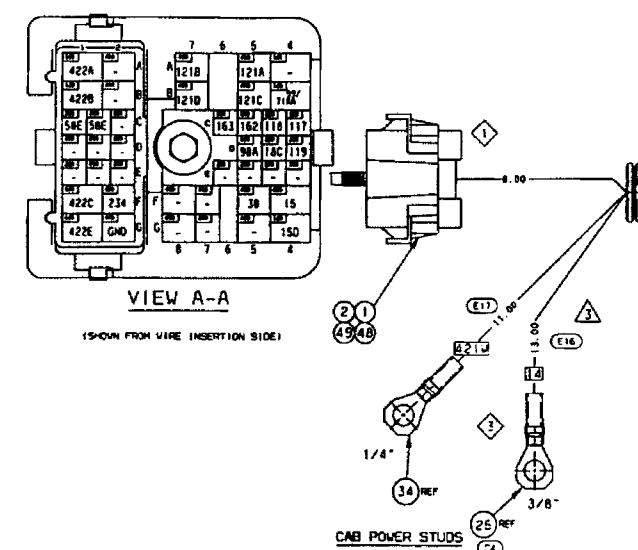
(D)	2	-	-	23-11194-214	TERM-RING, #10 STUD, 14/16	27
(C)	2	2	2	PAC12059168	SEAL-CAVITY PLUG, MP150	26
(C5)	8.4'	8.4'	8.4'	48-02223-169	CABLE-SXL, 16GA, WHITE, LOW TNSN	25
(B)	1	1	-	PAC12010300	SEAL-CAVITY PLUG, MP280-WP, GRN	24
	4	4	-	PAC12129493	TERM-FEM, MP280S, 12-14AWG	23
	1	1	-	PAC12084891	PLUG-5CAV, MP280S, MD GRAY	22
	1	1	-	PAC15324857	LOCK-TERM, 5CAV, MP280S, PLUG, BLK	21
	10	10	10	PACR62979	LABEL	20
(C9)	2.3'	1.3'	1.8'	48-02217-025	CONDUIT-NYL, 6MM, FLEX, BLK, SLIT	19
(C6)	2.9'	2.9'	2.9'	48-02217-050	CONDUIT-NYL, 13MM, FLEX, BLK, SLIT	18
(C1)	2	2	2	PAC12052845	LOCK-TERM, 3CAV, MP150S-M & F	17
(C1)	5	3	3	48-02461-038	TUBE-HT SHRINK, 3/8", BLK, D-WALL	16
(C1)	4	4	4	PAC12052924	SEAL-CABLE, MP150, DK RED, REEL	15
(C1)	4	4	4	PAC12048074	TERM-FEM, MP150S, 16/18	14
	-	-	2	ARU572929	TERM-BULLET, MALE, #14	13
	9	9	5	PAC12015360	SEAL-CABLE, MP280-WP, BLUE, REEL	12
	5	5	5	PAC12129493	TERM-FEM, MP280S, 12-14AWG	11
(C1)	2	2	2	PAC12059595	PLUG-3CAV, MP150S, BLK	10
	-	-	2	ARU8338567	LOCK, C-WASHER, TERM, #14AWG	9
	-	-	2	ARU8338566	HOUSING-CONN, 1-PIN, FEM, #14	8
	10	10	12	ARU8338564	TERM-BULLET, FEM, #16-12, CLS BRL	7
	10	10	12	ARU8338562	INSULATOR SLEEVE, FEM TERM, #14	6
	10	10	12	ARU8338561	PLUG-CONN, 1-PIN, MALE, #14	5
	1	1	1	PAC12084673	LOCK-TERM, 5CAV, MP280S-RCPT	4
	1	1	1	PAC12186400	RCPT-5CAV, MP280S, GRAY	3
	5	3	3	PAC00821240	SPLICE CLIP, CABLE, 2.4-6.5 MM2	2
(C4)	29.5'	25.1'	26.7'	48-02223-149	CABLE-SXL, 14GA, WHITE, LOW TNSN	1
	QTY	QTY	QTY	ITEM NUMBER	DESCRIPTION	REF

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
(D) A06-39306-002	HARN-JUMPER, TAILLIGHT	(A) A06-39306-001	HARN-JUMPER, TAILLIGHT	(A) A06-39306-000	HARN-JUMPER, TAILLIGHT

DELIVERY MUST CONFORM EXACTLY WITH DRAWING SPECIFICATIONS AND, WHERE REQUIRED BY O.A., WITH APPROVED O.A. SAMPLES. ABSOLUTELY NO CHANGES ARE PERMITTED WITHOUT PRIOR APPROVAL BY FREIGHTLINER LLC. THIS INCLUDES CHANGES TO: SOFTWARE, MATERIALS, INTERNAL COMPONENTS, MANUFACTURING PROCESSES.

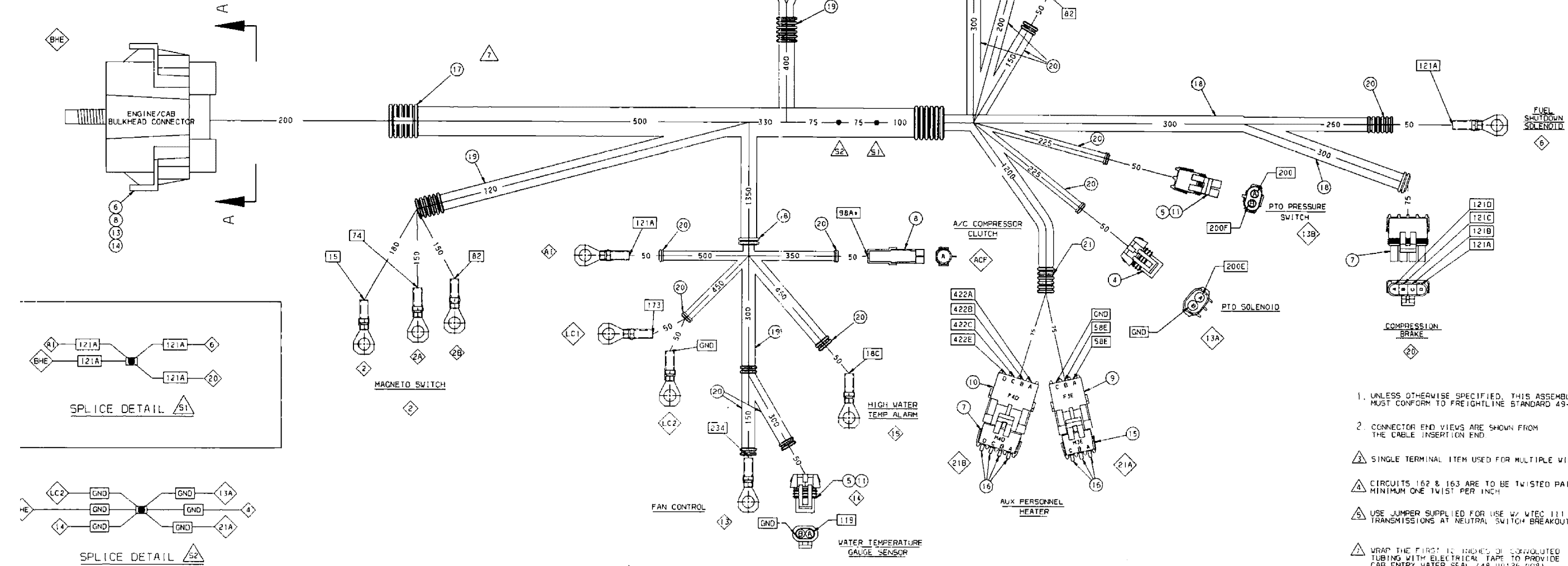
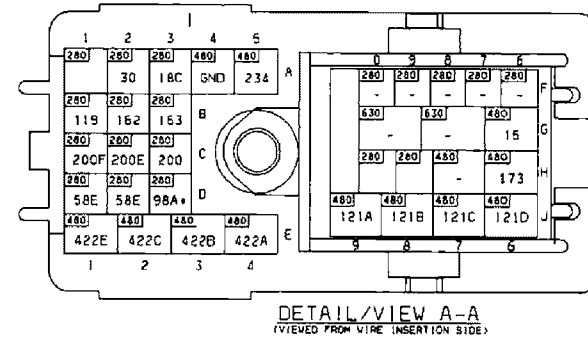
FREIGHTLINER LLC	
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MATERIAL APPROVAL XXX DATE XX/XX/XX	UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ASME STANDARD Y14.5M-1994, WITH EXCEPTIONS PER FREIGHTLINER EDSM 0900-K17.
DRAWN BY M. DAVIS DATE 12/21/00	THIRD ANGLE PROJECTION
CHECKED BY C. ZUBIETA DATE 12/21/00	RESPONSIBLE ENGINEER C. ZUBIETA DATE 12/21/00
APPROVED BY R. HENRY DATE 12/21/00	MFG ENGR/PURCH AGENT M. PLUNCOCHAR DATE 06/06/01
DESCRIPTION HARN-JUMPER, TAILLIGHT	
SUPPLEMENTARY DESCRIPTION 29402 GVG	
DRAWING NUMBER A06-39306	REVISION LETTER D
SHEET NUMBER 1 OF 1	

F/CIR	WIRE ID	FROM LOC	FROM TER	FROM INCL	FROM POS	TO LOC	TO TER	TO INCL	TO POS	APPROX LENGTH	CIRCUIT DESCRIPTION	
C2	14	29	3	29	44	-	4	29	44	52.00	CAB POWER-12V	
	421V	25	3	24	44	-	4	23	44	58.00	CAB POWER-24V	
	19	20	1	6	-	F4	2	12	44	63.00	ENGINE START	
	180	20	1	6	-	G4	23	8	39	98.00	NEUTRAL SW LAD SIGNAL	
C	160	29	24	37	44	-	4	26	44	113.00	ALTERNATOR SW LAD SIGNAL	
	13C	19	1	3	-	H0	15	15	44	99.00	H00 ALARM	
	30	19	1	4	-	H0	15	15	44	99.00	TRANS OIL TEMP SENSOR	
	71AA	20	23	8	39	-	E1	51	59	40.00	NEUTRAL SW PWR	
	74	25	2	22	44	-	4	24	44	41.00	STARTER POWER	
	82	25	2	22	44	-	4	23	44	39.00	HAG SW POWER	
C	83	29	24	45	44	-	4	31	44	117.00	ALTERNATOR DMC	
	90A	19	1	4	-	D0	13	10	39	A	75.00	A/C COMPRESSOR CLUTCH
	99/71AA	20	1	8	-	B4	51	1	1	-	IGN ACC PWR	
	99/71AA	20	6	12	44	-	S1	1	1	-	FUEL SHUTDOWN SOLENOID	
E1A	117	32	1	3	-	CA	12	14	39	A	111.00	SPEEDOMETER
	118	32	1	3	-	CS	12	14	39	B	111.00	SPEEDOMETER
	119	19	1	3	-	DA	14	17	35	A	108.00	WATER TEMP GAUGE SENSOR
C6	121A	19	1	4	-	A5	20	14	39	D	77.00	COMPRESSION BRAKE
	121B	19	1	4	-	A7	20	14	39	C	77.00	COMPRESSION BRAKE
	121C	19	1	4	-	B0	20	14	39	B	77.00	COMPRESSION BRAKE
	121D	19	1	4	-	B7	20	14	39	A	77.00	COMPRESSION BRAKE
E1A	162	32	1	3	-	CA	10	14	39	A	83.00	TACHOMETER
	163	32	1	3	-	C7	10	14	39	B	83.00	TACHOMETER
C	202	25	24	34	44	-	4	23	44	114.00	ALTERNATOR 24V OUTPUT	
	234	19	1	4	-	F2	14	10	44	-	FAN CONTROL	
	422A	20	21	8	39	A	1	7	-	A1	58.00	AUX MTR-FLAME DET SW
	422B	20	21	8	39	B	1	7	-	B1	58.00	AUX MTR-MOTOR PWR
	422C	20	21	8	39	C	1	7	-	F1	58.00	AUX MTR-POWER QUT
	422E	20	21	8	39	D	1	7	-	D1	58.00	AUX MTR-FLAME DET L1
	58E	19	1	3	-	C1	21	18	38	A	58.00	AUX MTR-WATER PUMP
	58E	19	1	3	-	C2	21	18	38	B	58.00	AUX MTR-FUEL PUMP
	58D	20	1	8	-	G2	21	6	39	C	58.00	AUX MTR-DND
E3	119B	19	24	24	44	-	14	17	25	B	67.00	WTR TMP DND
	71AA/150	19	23	40	39	A	23	40	39	B	6.00	NEUTRAL SW JUMPER



- UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00106.
- CONNECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END.
- WRAP THE FIRST 12 INCHES OF CONVOLUTED TUBING WITH ELECTRICAL TAPE TO PROVIDE CAB ENTRY WATER SEAL (48-00126-00B).
- CIRCUITS 117/118 AND 162/163 ARE TO BE TWISTED PAIRS. MINIMUM ONE TWIST PER INCH.
- USE JUMPER SUPPLIED FOR USE W/ VTEC 111 TRANSMISSIONS AT NEUTRAL SWITCH BREAKOUT.
- SEE SPLICE DETAIL.

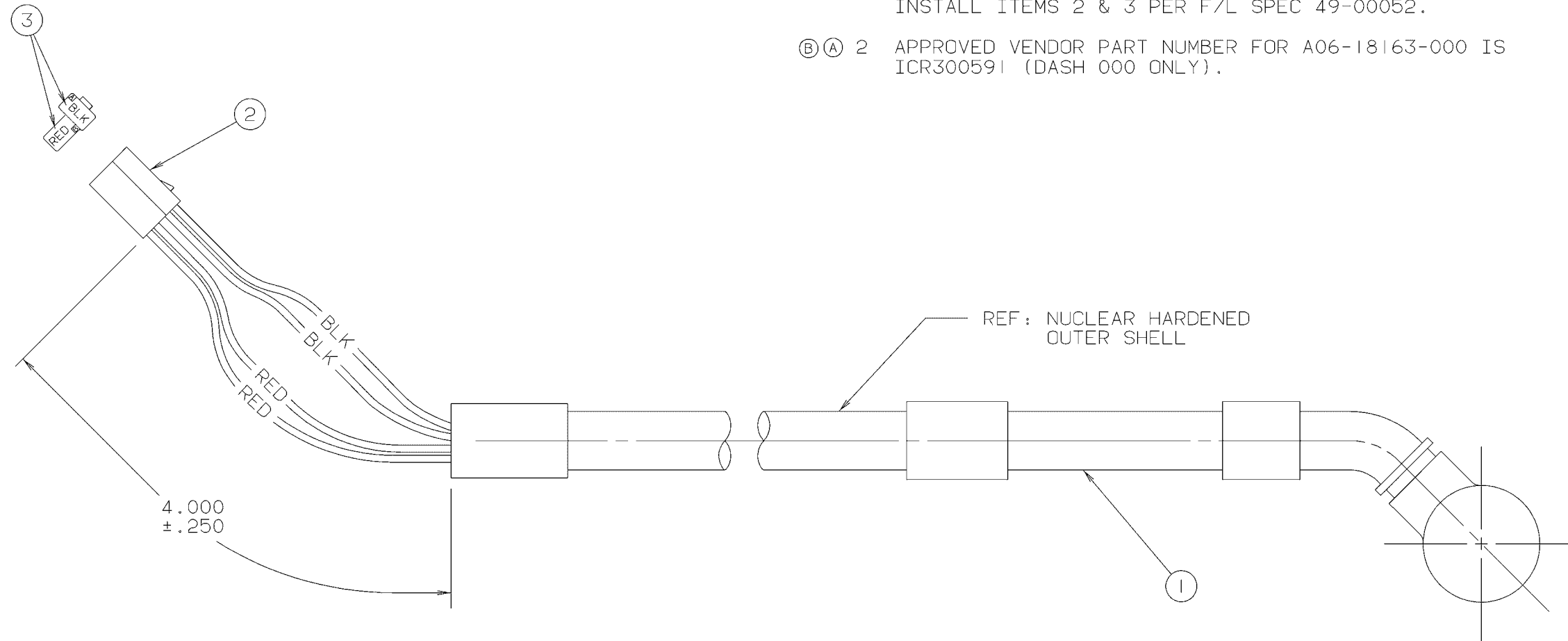
F/L CIR NO	SAE CIR NO	WIRE ITEM NO	LOC	FROM	TO	APPROX LENGTH	CIRCUIT DESCRIPTION
				TERMINAL NO	TERMINAL NO	-000	
15	1004	1	BHE	23	G6	27 37	START SIG SW OUTPUT
30	1405	1	BHE	24	A2	27 33	TRANS OIL TEMP SIG MAIN GAUGE
74	1004	2	4A	36 37	2A	36 37	STARTER SOL SPLY
82	1004	2	4B	36 37	2B	36 37	MAG SW SPLY, STARTER
119	1421	1	BHE	24	B1	29 32	WTR TEMP GAUGE SIG CAB
162	1406	1	BHE	24	B2	10 26 32	TACHOMETER GAUGE + SIG ENG RPM
163	1406	1	BHE	24	B3	10 26 32	TACHOMETER GAUGE - SIG ENG RPM
200	1413	1	BHE	24	C3	13B	PTO IND LP SIG
234	2202	1	BHE	23	A5	27 33	FAN SOL SPLY, ENG
121A	1502	1	A1	38 31	S1	34 31	ENG BK THROT SV SPLY, LKOUT
121A	1502	1	BHE	23	J9	73/ 73/	ENG BK THROT SV SPLY, LKOUT
121A	1502	1	20	26 32	A	73/ 73/	ENG BK THROT SV SPLY, LKOUT
121A	1502	1	6	27 33	S1	73/ 73/	ENG BK THROT SV SPLY, LKOUT
121B	1502	1	BHE	23	J8	20 26 32	ENG BK DASH SV #1 SPLY
121C	1502	1	BHE	23	J7	20 26 32	ENG BK SOL SPLY #1
121D	1502	1	BHE	23	J6	20 26 32	ENG BK SOL SPLY #2
173	1420	1	LC1	27 31	BHE	24	WTR LEVEL IND LP SIG
18C	1416	1	BHE	24	A3	15 27 33	<OLD>HIGH WTR TEMP LAMP SPLY
200E	1510	1	BHE	24	C2	13A	PTO SOL SPLY, TRANS
200F	1510	1	BHE	24	C1	13B	<OLD>PTO PRESS SW SPLY
422A	2304	3	BHE	28	E4	21B	<OLD>HTR 24V PWR SPLY
422B	2304	3	BHE	28	E3	21B	<OLD>HTR 24V RUN PWR SPLY
422C	2304	3	BHE	28	E2	21B	<OLD>HTR 24V HIGH PWR SPLY
422E	2304	3	BHE	28	E1	21B	<OLD>HTR IND LP SIG
58E	2304	1	BHE	24	D1	21A	<OLD>HTR H1/L0 SW & PUMP SPLY
58E	2304	1	BHE	24	D2	21A	<OLD>HTR H1/L0 SW & PUMP SPLY
98A*	2301	1	BHE	24	D3	ACF	HVAC, MAIN, RES, LOW MOT SP SPLY
GND	1204	3	BHE	28	A4	S2	GND, GENERAL CAB/CHASSIS
GND	1204	3	21A	-	C	S2	GND, GENERAL CAB/CHASSIS
GND	1204	1	14	29 32	B	S2	GND, GENERAL CAB/CHASSIS
GND	1204	3	4	30 31	S2	73/ 73/	GND, GENERAL CAB/CHASSIS
GND	1204	1	13A	26 32	B	S2	GND, GENERAL CAB/CHASSIS
GND	1204	1	LC2	27 31	-	S2	GND, GENERAL CAB/CHASSIS



1. UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINE STANDARD 49-01
2. CONNECTOR END VIEWS ARE SHOWN FROM THE CABLE INSERTION END
3. SINGLE TERMINAL ITEM USED FOR MULTIPLE WIRE
4. CIRCUITS 162 & 163 ARE TO BE TWISTED PAIRS MINIMUM ONE TWIST PER INCH
5. USE JUMPER SUPPLIED FOR USE W/ WTEC 111 TRANSMISSIONS AT NEUTRAL SWITCH BREAKOUT
6. WRAP THE FIRST 12 INCHES OF UNSHROTTLED TUBING WITH ELECTRICAL TAPE TO PROVIDE CAB ENTRY WATER SEAL (44 00126 0081)

1 CABLE IS SUPPLIED BY THE MILITARY WITH (2) 3/8 LUG RING TERMINALS ON ONE END. REMOVE THE RING TERMS & INSTALL ITEMS 2 & 3 PER F/L SPEC 49-00052.

ⓑ ⓐ 2 APPROVED VENDOR PART NUMBER FOR A06-18163-000 IS ICR300591 (DASH 000 ONLY).



LTR.	JOB NO.	DATE	BY	APPR.	FROM	CHANGE INFORMATION	TO
B	PB1038-49	03-08-94	BUD	BUD KRH		ADDED -001 CHG NOTE 2 (-000 ONLY)	
A	P0273H-01	05-14-91	MGP	MGP KRH		ADDED NOTE 2.	
-	PB1000	03-21-89	MCH	DHW DN		INITIAL RELEASE	

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2	2		23-11192-124	RCPT, FEM, 2-WIRE	2 X 14 AWG	3
1	1	PAC	2973781	PLUG, 2-BLADE	M2A	2
1		GFE	A3014039-4	CABLE ASSY	5' LG	1
	1	GFE	A3014039-2	CABLE ASSY	13' LG	1
-001	-000	MFR. DASH NO.	PART NUMBER	NAME OF PART	MATERIAL	ITEM

FREIGHTLINER LLC
PORTLAND, OREGON

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THIRD ANGLE PROJECTION UNLESS OTHERWISE NOTED UNITS = INCHES DIMENSIONS AND TOLERANCES IN ACCORDANCE WITH ANSI Y14.5 - 1973 WITH EXCEPTIONS PER FREIGHTLINER E.O.M. SECTION 307

DRAWN BY	M.HARP	03-21-89	749 CABLE ASSY RADIO
CHKD. BY	D.WIXOM	03-21-89	
DESIGN APPROVAL	M.HARP	03-21-89	915/RADIO PWR CABLE ASSY
MFG. APPROVAL			
FINAL APPROVAL	NICHOLS	03-22-89	

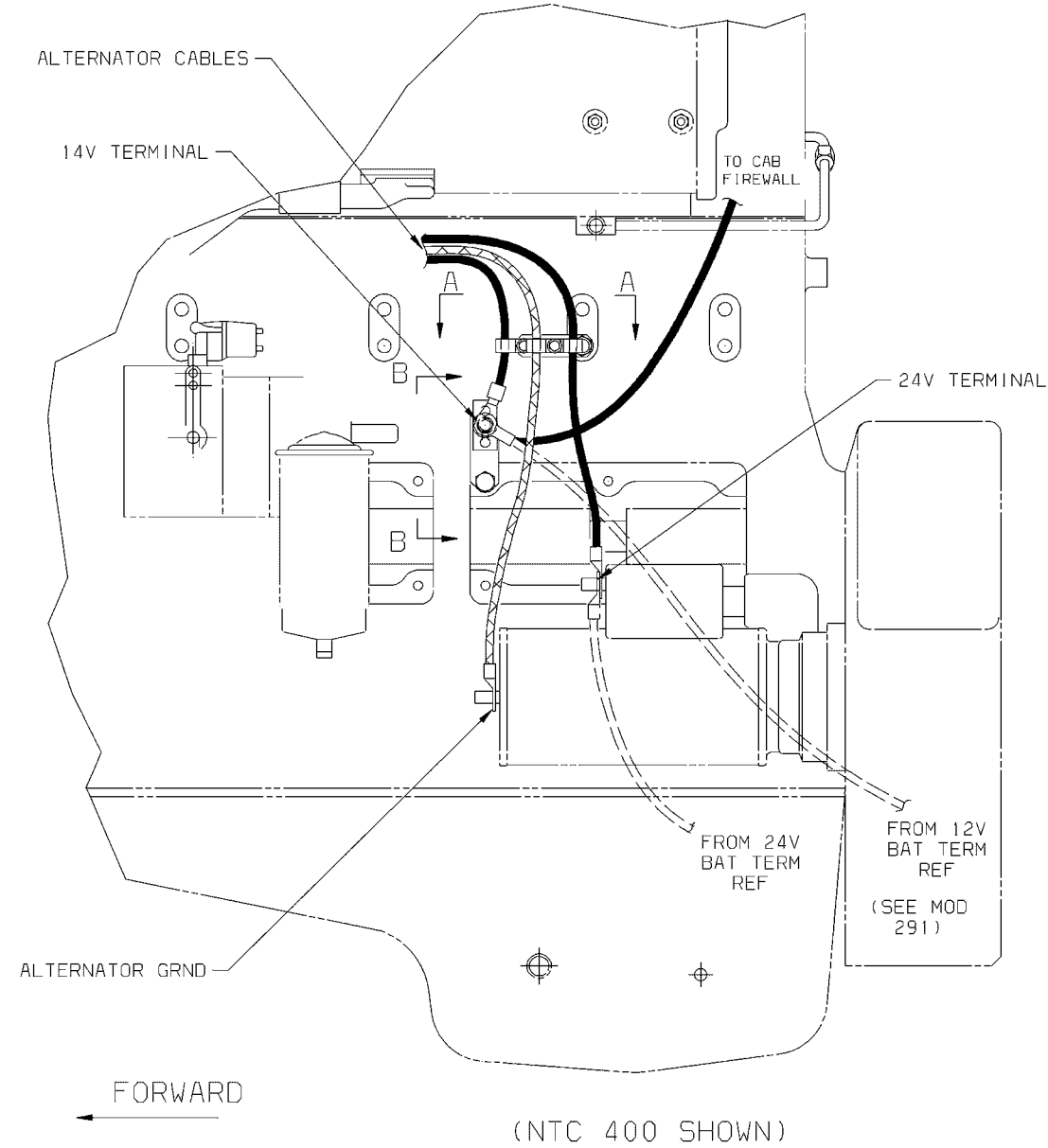
CONTRACT NUMBER: DAAE07-88-C-J915

SCALE: FULL SHEET: 1 OF 1

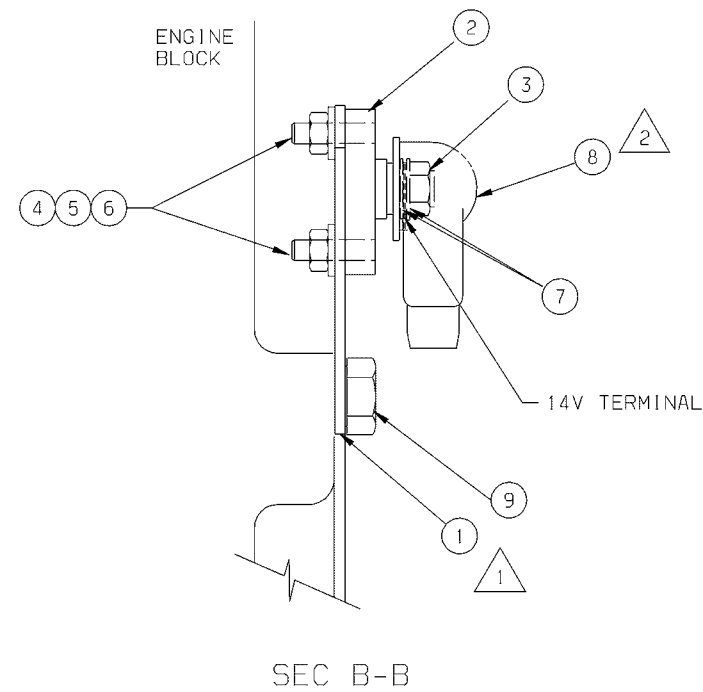
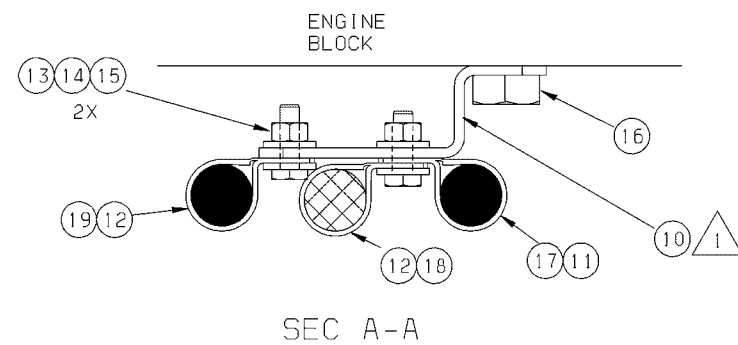
LOCATION: MFR. A06-18163

CHG. LTR.: B

RELEASE NUMBER	REV LTR	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
P26619-09	-	-	INITIAL RELEASE	R2C	01/09/06	MIG

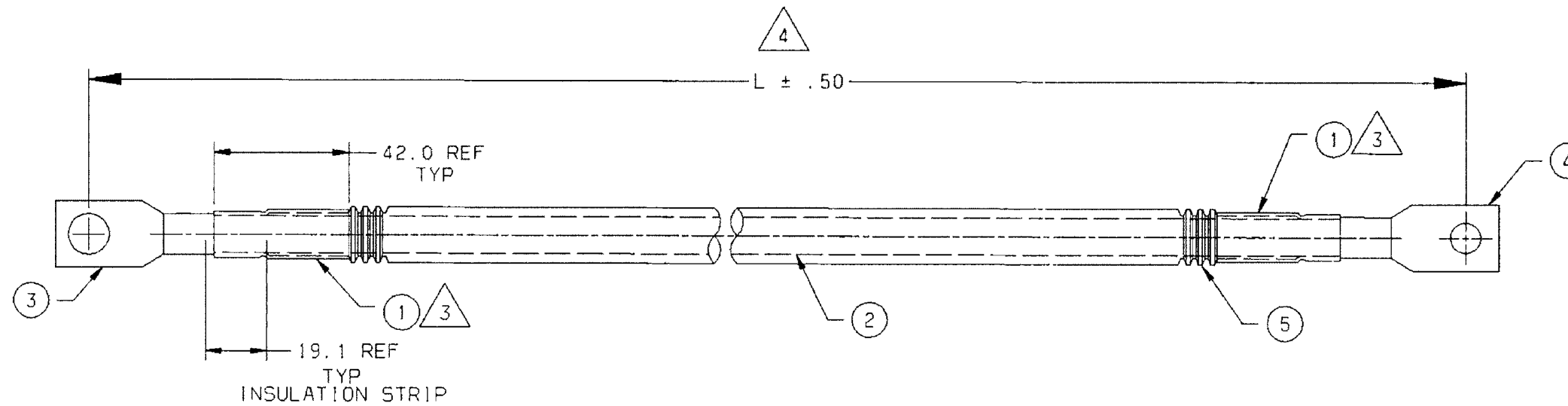


- 1 INSTALL ITEM 2 12V PWR TERM ON ITEM 1 BRKT AS SHOWN. MOUNT ITEM 1 BRKT TO ENG BLOCK USING EXISTING BOLT HOLE AND 9/16 UNF BOLT. MAY BE PROVIDED WITH ENGINE
- 2 SLIDE ITEM 8 BOOT OVER THE END OF THE 12 BATTERY CABLE, PRIOR TO INSTALLATION ON PWR TERM. INSURE THAT THE BAT CABLE IS ON TOP OF THE OTHER TERMINALS. SPRAY CONNECTION WITH ELECTRICAL SEALANT, AND POSITION THE BOOT OVER THE TERMINALS.



MATERIAL APPROVAL		DATE		UNLESS OTHERWISE NOTED, DIMENSIONS AND TOLERANCES ARE DEFINED ACCORDING TO ASME STANDARD Y14.5M-1994, WITH EXCEPTIONS PER FREIGHTLINER EOSH 09E0-K17	
DRAWN BY	R. CACCIATORE	DATE	01/09/06	THIRD ANGLE PROJECTION	UNITS OF MEASURE MM
CHECKED BY	M. GHITEA	DATE	01/09/06		
RESPONSIBLE ENGINEER	M. GHITEA	DATE	01/09/06		
APPROVED BY	M. GHITEA	DATE	01/09/06	MFG ENGR/PURCH AGENT	DATE O. COLLETT 01/23/06
DESCRIPTION INSTL-12V PWR TERM, 12/24V ALT					
SUPPLEMENTARY DESCRIPTION 125A1 GVG, M915A4R2					
ITEM/DRAWING NUMBER	D06-60573			REVISION LETTER	SHEET NUMBER
				-	1 OF 1

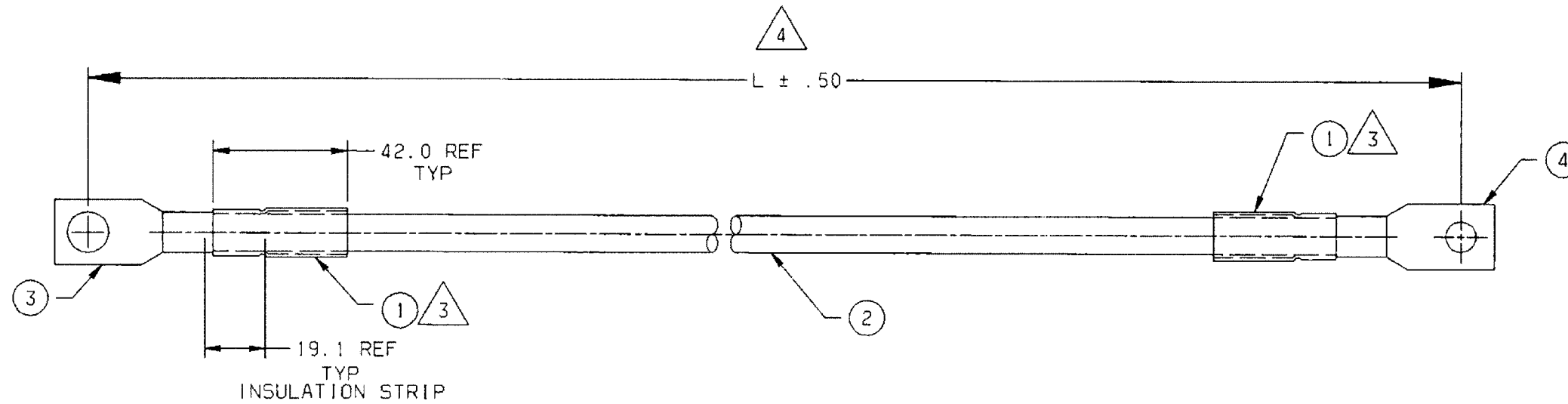
RELEASE NUMBER	REV	ZONE	REVISION DESCRIPTION	BY	DATE	APPD
P09074-01	-		INITIAL RELEASE	TMR	06/29/99	KVM
P09074-05	A		REVISED TITLE	VCR	08/05/99	RJH



1. UNLESS OTHERWISE SPECIFIED, THIS ASSEMBLY MUST CONFORM TO FREIGHTLINER STANDARD 49-00052.
2. ASSEMBLY MUST WITHSTAND A MINIMUM PULL FORCE OF 450 LBS.
3. SHRINK INSULATOR OVER CONNECTION.
4. "L" = ASSY DASH NUMBER IN INCHES. EXAMPLE: A06-33246-108 HAS AN "L" DIMENSION OF 108 INCHES "L" DIMENSION OF -000 = "CUT TO FIT".
5. AS REQUIRED, APPROX 7 INCHES LESS THAN "L" DIMENSION.

5	48-25360-015	15MM RED CONVOLUTE TUBING	5																																																				
1	23-10379-023	TERM. LUG. BAT CABLE, 2/0, 3/8"	4																																																				
1	23-10379-021	TERM. LUG. BAT CABLE, 2/0, 1/2"	3																																																				
A/R	48-02252-000	CABLE-BATTERY/STARTER, RED, 2/0	2																																																				
2	06-14801-001	BATT CABLE INSULATOR	1																																																				
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A/R	48-02230-000	CABLE-BATTERY/STARTER, BK, 2/0	2
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DRAWN BY T. RAINFORTH		06/29/99	
CHECKED BY H. SCHATZ		06/30/99	
RESPONSIBLE ENGINEER M. SCHATZ		06/30/99	
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MFG ENGR/PURCH AGENT J. GOMEZ		DATE 7/2/99	
DESCRIPTION CABLE-NEG, 2/0, BLK, 1/2 X 3/8			
SUPPLEMENTARY DESCRIPTION 12501 2/0 OUTPUT			
ITEM/DRAWING NUMBER A06-33247		REVISION LETTER A	SHEET NUMBER 1 OF 1

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By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:


SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0513902

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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended changes, if possible).	
	0014 00-2	4-17				POC is incorrect.	
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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

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THE METRIC SYSTEM AND EQUIVALENTS

<p>Linear Measure</p> <p>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</p> <p>Weights</p> <p>1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces 1 Kilogram = 1000 Grams = 2.2 Pounds 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons</p> <p>Liquid Measure</p> <p>1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces</p>	<p>Square Measure</p> <p>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</p> <p>Cubic Measure</p> <p>1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet</p> <p>Temperature</p> <p>$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$ 212° Fahrenheit is equivalent to 100° Celsius 90° Fahrenheit is equivalent to 32.2° Celsius 32° Fahrenheit is equivalent to 0° Celsius $9/5 \text{ C}^{\circ} + 32 = \text{F}^{\circ}$</p>
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APPROXIMATE CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Sq Inches	Sq Centimeters	6.451
Sq Feet	Sq Meters	0.093
Sq Yards	Sq Meters	0.836
Sq Miles	Sq Kilometers	2.590
Acres	Sq Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Sq Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

To Change	To	Multiply By
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Sq Inches	0.155
Sq Meters	Sq Feet	10.764
Sq Meters	Sq Yards	1.196
Sq Kilometers	Sq Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Sq Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

