

TM 9-2355-106-23-2

MAINTENANCE MANUAL
VOLUME 2 OF 3
COMMERCIAL OFF-THE-SHELF (COTS)
for
INTERNATIONAL
MINE RESISTANT VEHICLE

CATEGORY I
2355-01-553-4634
CATEGORY II
2355-01-553-4636

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you know of a way to improve procedures, please let us know. Mail comments directly to: PM-MRAP, AMSTA-LC-GMM, 6501 E. 11 Mile Road, Warren, MI 48397-5000.

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Chapter 4 – MAINTENANCE INSTRUCTIONS

Chapter 4 MAINTENANCE INSTRUCTIONS

The following are maintenance tasks associated with the vehicle.

4-1 Engine

4-1.1 Charge Air Cooler (CAC) Hose Replacement

CAC HOSE REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u> Torque Wrench		<u>Equipment Required</u> General Mechanic’s Tool (GMT) Set
<u>Personnel</u> One (1) Wheeled Vehicle Mechanic		<u>Equipment Conditions</u> Battery Disconnect Switch OFF Engine shut OFF Parking brake set Transmission selector in NEUTRAL (N) Wheels chocked
<u>Material Parts</u> CAC hoses (2) Spring-loaded T-bolt clamps (4), or hose clamp, if needed.		
<u>Reference</u> Parts Manual		<u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine Verify Charge Air Cooler (CAC) system works Shut engine OFF

Chapter 4 – MAINTENANCE INSTRUCTIONS



Wear safety goggles, work gloves, and long sleeves while working around engine area. Make sure that hood of vehicle is secured so it will not fall while you are bending over engine compartment. Use extreme caution while working on engine that is still hot, it can burn you quickly. Watch for sharp edges on other engine components that can cut you. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

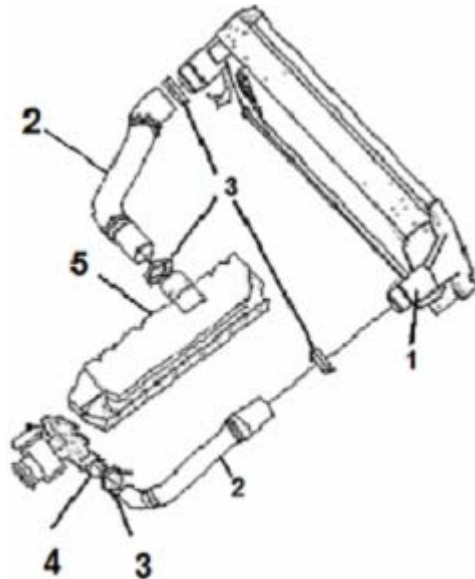


To prevent foreign materials from entering the engine, cover the turbocharger outlet and engine intake manifold while the piping is disassembled.

NOTE

Inspect the charge air cooler for damage and leaks at each oil change. Check spring-loaded clamps to see if there is sufficient bridge gap when the clamp is torqued to specification. If the bridge gap has been taken up, replace the clamp with the next smaller diameter.

a) Removal



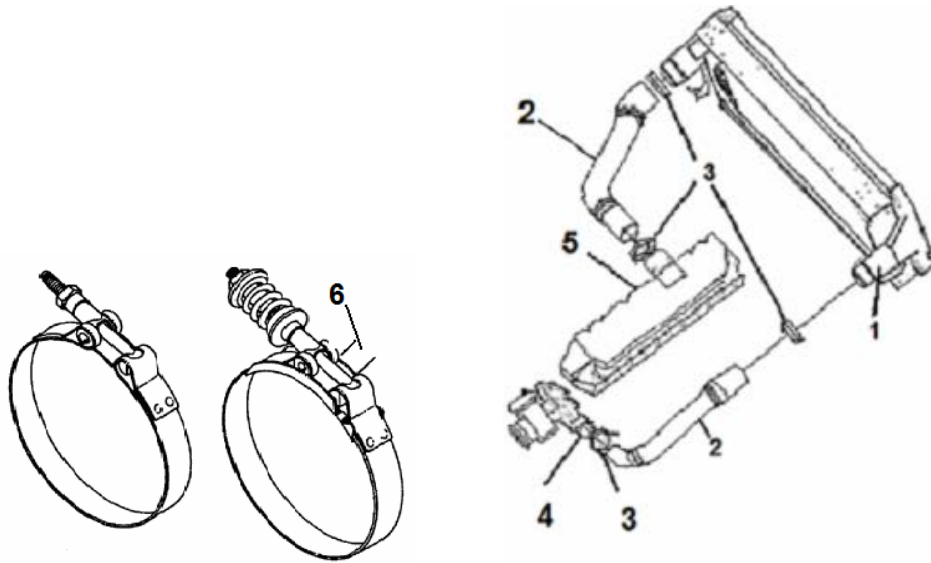
1. Thoroughly clean the exterior of the charge air cooler, hoses, and clamps before removing. This will ensure that no foreign materials will get into the engine.
2. Remove 2 ea. clamps (3) from mounting to radiator (1) and hose (2) and turbocharger (4) and hose (2).
3. Remove 2 ea clamps (3) from mounting to radiator (1) and hose (2) and engine intake manifold (5) and hose (2).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



Ensure that the clamps are in good condition, no rust or corrosion build-up on them, if there is, replace them. If the bridge gap is taken up, (minimum gap (6) is 1/8 inch (3mm)) replace with smaller diameter. Failure to comply may result in damage to equipment.



1. Inspect clamps for any signs of damage, rust, or corrosion and replace, if necessary. If using spring-loaded t-bolt clamp, assure it has the proper gap measurement, 1/8 inch (3mm) (6).
2. Slide clamps (3) on new hose (2) before attaching to radiator mounting (1), turbocharger (4), and engine intake manifold (5).
3. Install hose (2) on radiator mounting end (1) and engine intake manifold (5) and tighten clamps (3) to 50 – 60 in lbs (5.65 – 5.78 N•m).
4. Install hose (2) on radiator mounting end (1) and turbocharger (4) and tighten clamps (3) to 50-60 in-lb (5.65-5.78 N•m).

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify CAC system works.
4. Shut engine OFF.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.2 Engine Oil Filter Replacement

ENGINE OIL FILTER REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u> Oil Filter Wrench		<u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in neutral (N) Wheels chocked
<u>Personnel</u> One (1) Wheeled Vehicle Mechanic		<u>Reference</u> Parts Manual
<u>Material/Parts</u> Oil Filter Oil Filter Gasket		<u>Equipment Required</u> Drain Pan
		<u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine Shut engine OFF Battery Disconnect Switch OFF Check oil level Dispose of oil and filter Remove chocks



System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

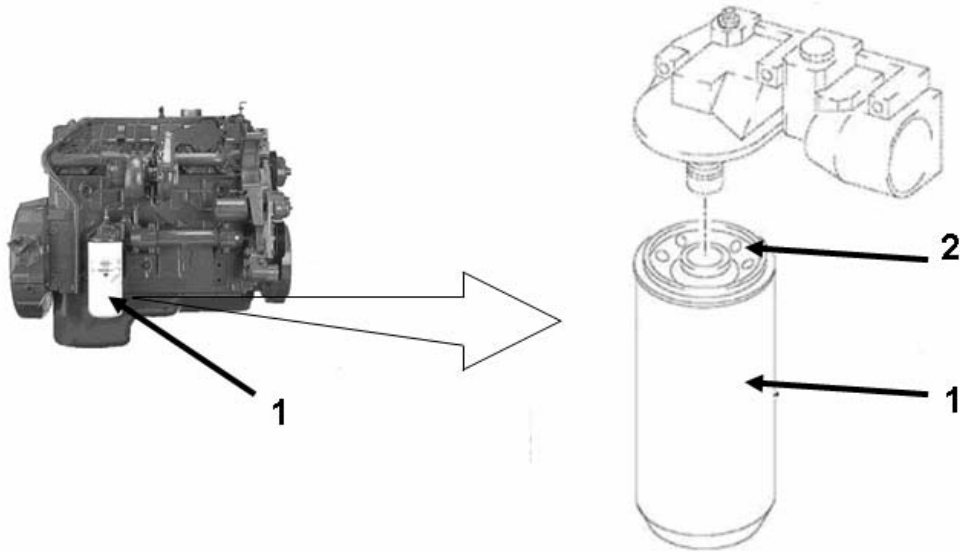
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

Position a suitable drain pan under oil filter to catch excess oil.

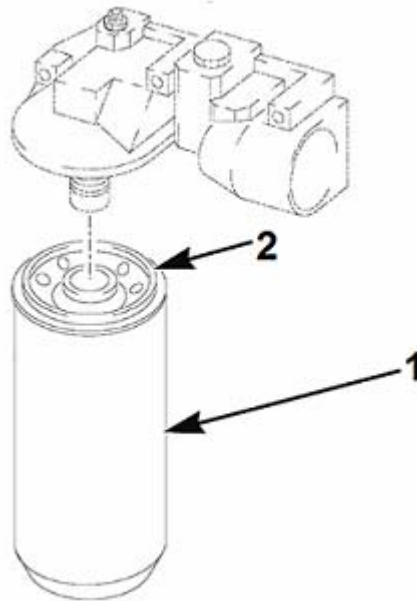
Ensure gasket from oil filter is removed with oil filter.



1. Remove oil filter (1) and gasket (2) from oil filter base.
2. Dispose of old filter (1), gasket (2), and oil in accordance with regulations.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Lightly lubricate new gasket (2) with clean oil and install on filter (1).
2. Fill new oil filter with new oil.



DO NOT use a wrench to tighten oil filter. Failure to comply may result in damage to equipment.

3. Install new oil filter (1) until gasket contacts oil filter base. Tighten oil filter (1) another one full turn by hand after gasket first contacts filter header.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Shut engine OFF.
4. Battery Disconnect Switch OFF.
5. Check oil level.
6. Dispose of oil and filter.
7. Remove chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.3 Engine Oil Drain/Fill Procedure

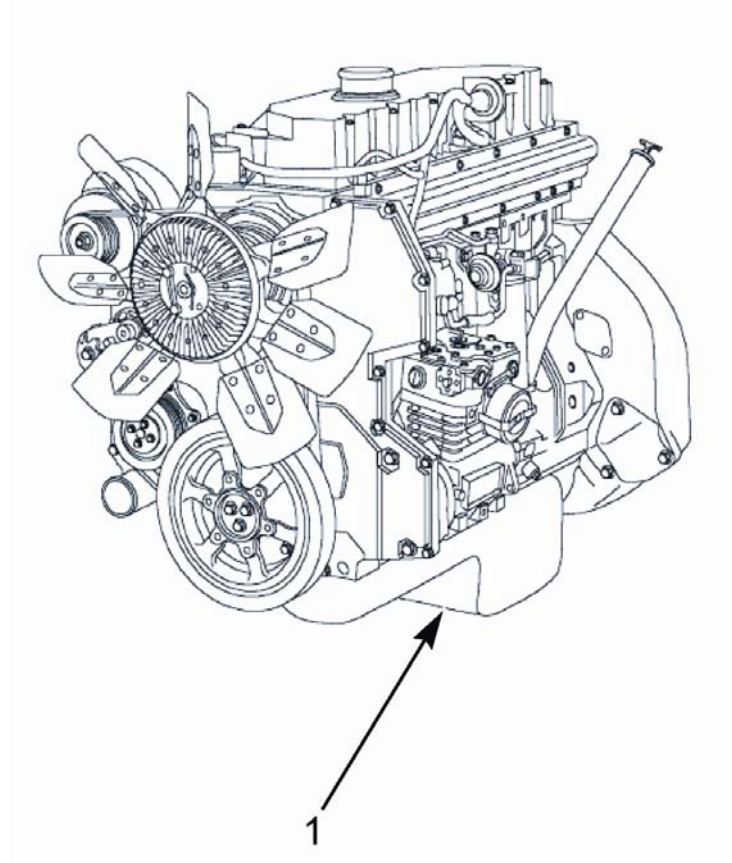
ENGINE OIL DRAIN/FILL PROCEDURE		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Oil Drain Plug Gasket Engine lubricating Oil</p>	<p><u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in neutral (N) Wheels chocked</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Drain Pan General Mechanic's Tool (GMT) Set</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine and run for 5 minutes Shut engine OFF Check oil level and top off, if needed Dispose of oil Clean lower armor plate Remove chocks</p>	



System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

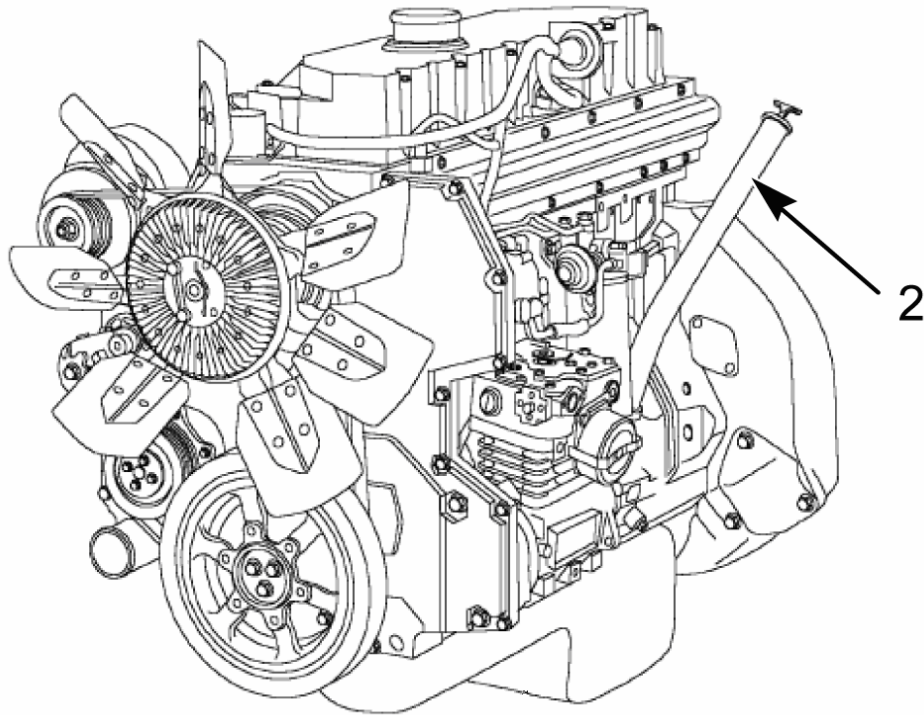


Ensure any excess oil is cleaned from lower armor plate. If not removed properly damage to equipment or injury may occur, due to fire.

1. Run engine until operating temperature is achieved, and then shut OFF.
2. Remove oil drain plug from bottom of oil pan (1). Drain oil from oil pan and install drain plug, using a new gasket.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



NOTE

STOP, periodically, during filling process and check oil level.

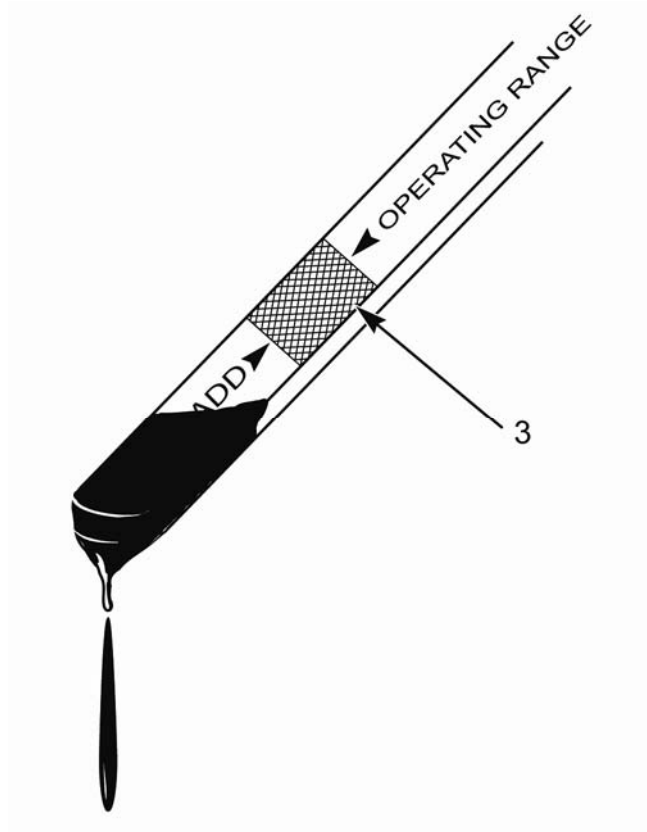
1. Fill engine through oil fill tube (2) to specified capacity with the appropriate oil type.
2. Start engine and run at low idle rpm.



Check lube oil pressure gauge reading. If there is no gauge reading, shut engine OFF immediately or damage to the engine may occur. Check for oil filter leaks.

3. Shut engine OFF, wait 15 minutes.

Chapter 4 – MAINTENANCE INSTRUCTIONS

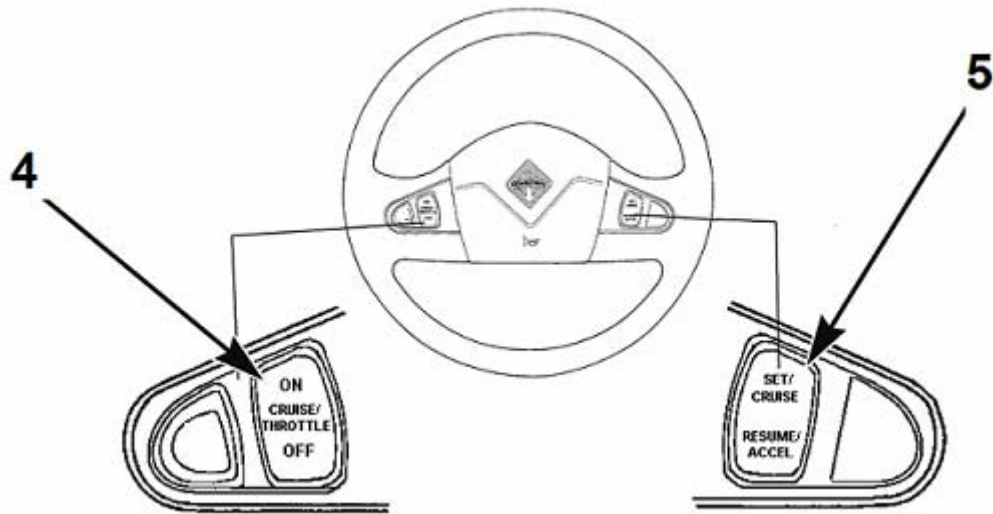


4. Recheck oil level and add oil (if needed) to bring oil level within the crosshatched operating range on gauge (3).



DO NOT overfill above the top of cross hatch of operating range this could result in engine damage.

Chapter 4 – MAINTENANCE INSTRUCTIONS



NOTE

After changing the engine oil, if the vehicle utilizes the Change Oil Message feature, reset the system as follows:

5. Set park brake.
6. Turn key switch to the IGN/ON position.
7. Depress and release both the Cruise ON (4) and Cruise RESUME/ACCEL (5) buttons simultaneously Four-times within six-seconds.
8. Depress and hold both the Cruise ON (4) and Cruise RESUME/ACCEL (5) buttons simultaneously for three-seconds.
9. Release both Cruise buttons.

NOTE

The entire sequence **MUST BE** completed within twelve (12) seconds. The Change Oil Message will now turn off and will reactivate when the next oil change is due.

c) Follow-On Maintenance

1. Dispose of oil.
2. Clean excess oil from lower armor plate.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.4 Serpentine Belt Replacement

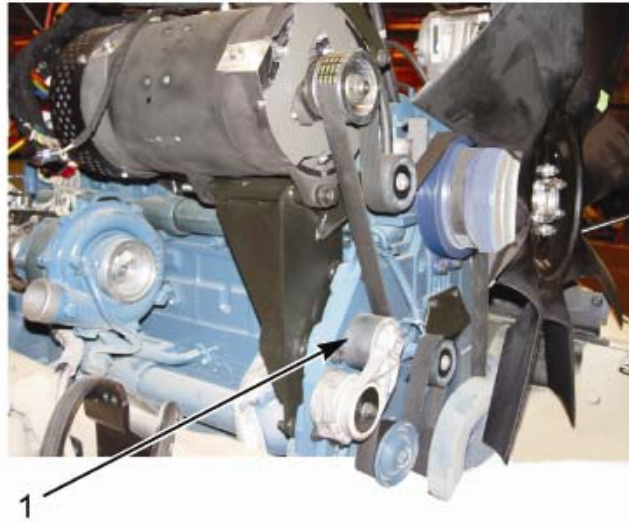
SERPENTINE BELT REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Serpentine Belt</p>	<p><u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in neutral (N) Wheels chocked</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Breaker Bar</p> <p><u>Follow-On Maintenance</u> Turbo Intake Tube installed Battery Disconnect Switch ON Start engine Verify charging system Shut engine OFF Battery Disconnect Switch OFF Check belt tension</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

To ensure proper installation, note position of belt prior to removal.



1. Check belt for worn, grease, oil soaked, and missing material.
2. Attach breaker bar to square hole of belt tensioner (1).
3. Pull breaker bar counter-clockwise, remove belt from tensioner pulley, and then release breaker bar.
4. Remove belt.

b) Installation

NOTE

When installing belt, be sure to place it around inside edge of belt tensioner.

1. Place belt around pulleys.
2. Attach breaker bar to square hole of belt tensioner (1).
3. Pull breaker bar counter-clockwise, install belt over tensioner pulley, then release pulley in a clockwise direction. Belt tensioner is automatically adjusted.
4. Remove breaker bar.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify charging system.
4. Shut engine OFF.
5. Battery Disconnect Switch OFF.
6. Check belt tension.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.5 Engine Oil Breather Hose Replacement

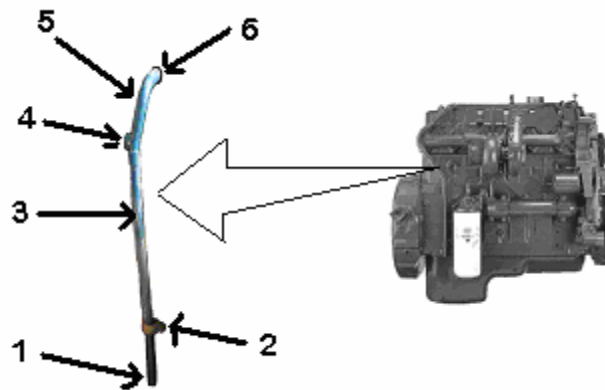
ENGINE OIL BREATHER HOSE REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Engine Oil Breather Hose O-ring</p>		<p><u>Equipment Required</u> Rags Drip Pan</p> <p><u>Equipment Conditions</u> Engine shut OFF Battery Disconnect Switch OFF Wheels chocked Parking brake set Transmission in NEUTRAL (N) Turbo-Charger intake tube removed Right Armor Removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Follow-On Maintenance</u> Install Turbo-Charger Intake Tube Clean and dispose of excess fluids Battery Disconnect Switch ON Start engine Check for leaks Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks Right Armor Install</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



With all procedures, use safety regulations for all repairs being performed. Wear protective safety goggles. Have appropriate ventilation, do not smoke or have open flames. While underneath vehicle, make sure no one is inside or if they are, they know you are under the vehicle. Failure to comply may result in damage to equipment and/or serious injury or death to personnel.



1. Place rag or suitable drip container under lower end (1) of oil breather hose (3).
2. Remove bolt for mounting bracket (2) and hose connecting to manifold.
3. Wipe up any oil leaks.
4. Place rag or suitable drip container under upper end of hose (5) and remove bolt from mounting bracket (4).
5. Remove hose (3) and O-ring (6) from upper end.

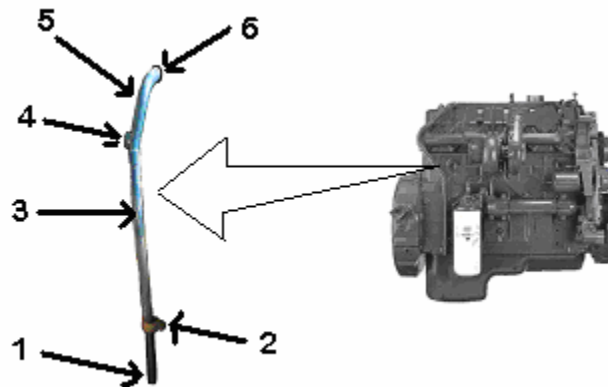


Anti-corrosion compound is toxic. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Do not get in eyes; wear chemical safety goggles and full-face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves.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

Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Apply anti-corrosion compound to bolt on the new mounting brackets (2) and (4) that come with the new breather hose. Apply lubricant to O-ring (6).
2. Apply slight pressure to upper end (5) of hose to ensure that O-ring (6) seats properly and attach mounting bracket (4).
3. Attach lower end of hose (1) to connection on manifold, and apply clamp on hose and attach mounting bracket (2).

c) Follow-On Maintenance

1. Wipe up any excess oil, anti-corrosion compound, or lubricant.
2. Reinstall Turbo Charger Intake Tube.
3. Battery Disconnect Switch ON.
4. Start engine.
5. Check for leaks.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.6 Engine Oil Pan Replacement

ENGINE OIL PAN REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Material/Parts</u> Oil Pan (1) Oil Pan Gasket (1) Mounting bolts (14 long, 8 short) RTV sealant (1) Oil drain plug (1) Oil drain plug gasket (1) Lubricating Oil, Engine (as required)</p>	<p><u>Equipment Condition</u> Engine shut OFF Master power witch OFF Parking brake set Transmission set in neutral (N) Wheels chocked Drain engine oil Belly Armor Removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Drain Pan</p> <p><u>Follow-On Maintenance</u> Dispose of oil, gasket, oil pan Battery Disconnect Switch ON Start engine Verify oil gauge operation Check for leaks Shut engine OFF Battery Disconnect Switch OFF Reinstall Belly Armor Remove chocks</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS

NOTE

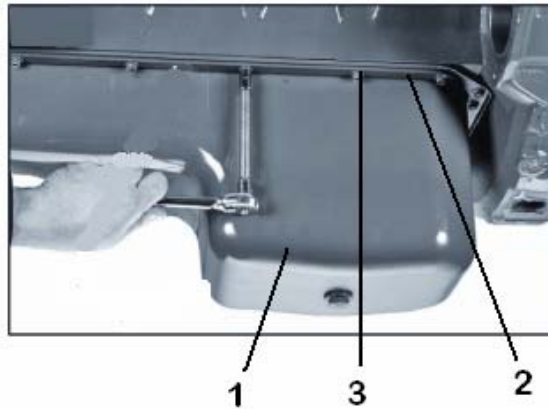
Position a suitable drain pan under oil pan to catch excess oil.

Ensure gasket from oil drain pan is removed with oil pan.

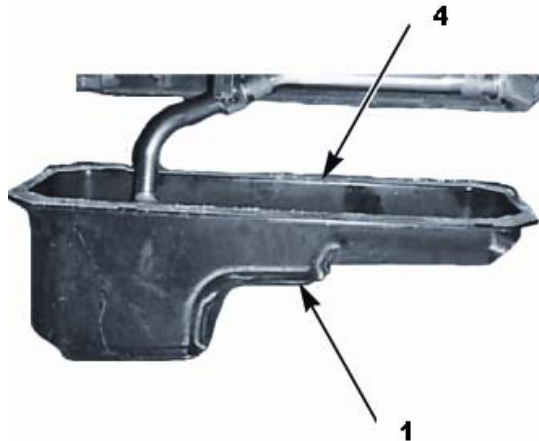


System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

a) Removal



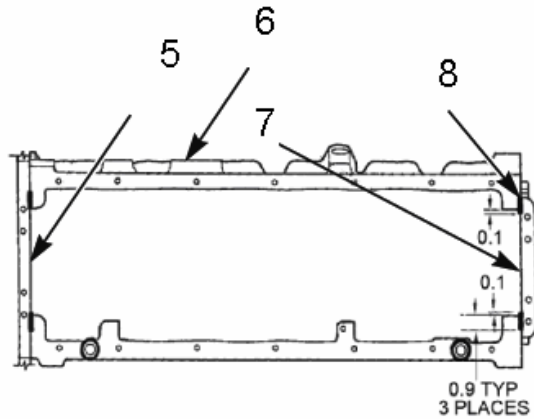
1. Position drain pan under oil pan to catch oil.
2. Remove twenty-two oil pan mounting bolts (3) securing oil pan (1).
3. Remove mounting bars (2).



4. Remove oil pan (1), and gasket (4) from crankcase.
5. Dispose of oil, gasket, and oil pan in accordance with regulations.

Chapter 4 – MAINTENANCE INSTRUCTIONS

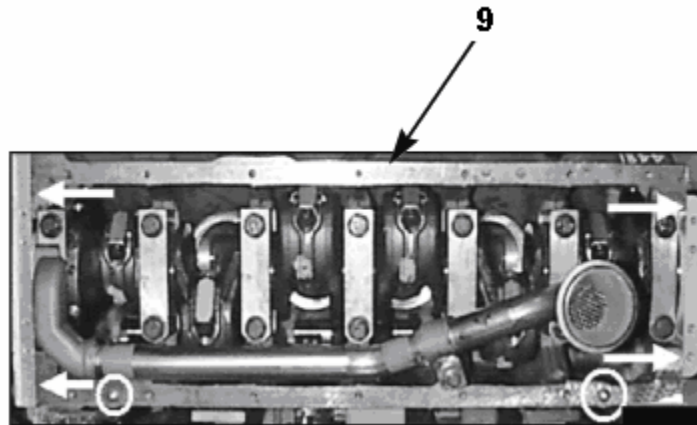
b) Installation



NOTE

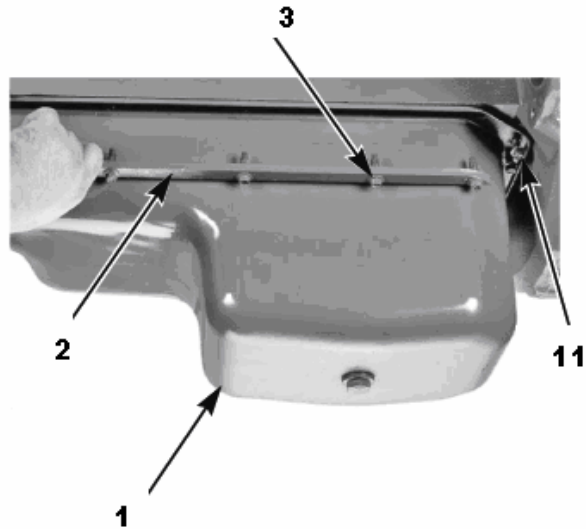
Do not apply RTV sealant more than 5 minutes before installing oil pan.

1. Apply 1/4 in. (6 mm) bead of RTV sealant where crankcase (6), rear half of front cover assembly (5); crankcase (6), and rear oil seal (7) carrier contact each other on edge of seal carrier (8).

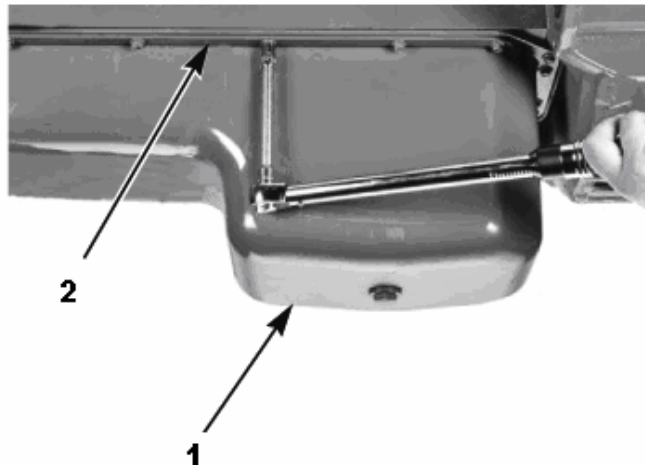


2. Apply circle of RTV around cup plug crankcase orientation holes on oil pan rails (9) of crankcase.
3. Place oil pan gasket on oil pan rails (9) so seal bed of gasket is toward crankcase and edge marked FRONT is facing front cover.

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4. Install oil pan (1) with gasket on crankcase. Install two oil pan mounting bars (2) on pan oil rail with the fourteen long mounting bolts (3).
5. Fasten oil pan to front cover and rear oil seal carrier with the eight short bolts (11).



6. Tighten all bolts on oil pan (1) and mounting bar (2) to 24 ft-lb (32 N•m).
7. Fill oil pan with oil using "Drain and Fill" procedures.

c) Follow-On Maintenance

1. Dispose of oil, gasket, and oil pan.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Verify oil gauge operation.
5. Check for leaks.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Reinstall Belly Armor.
9. Remove Chocks.

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4-1.7 Engine Assembly Replacement

ENGINE ASSEMBLY REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	
<u>Special Tools</u>	<u>Equipment Condition</u>
None	See next page
<u>Personnel</u>	<u>Reference</u>
Two (2) Wheeled Vehicle Mechanic	Parts Manual
<u>Material/Parts</u>	<u>Equipment Required</u>
Engine (1)	Suitable lifting device
A/C Line O-rings (2) for each line	Lifting chains
Fuel Line O-rings (2) for each line	Drain pan (3)
Transmission Line O-rings (2) for each line	Shackle 5/8 (2)
	<u>Follow-On Maintenance</u>
	See next page

NOTE

Engine Assembly Replacement Setup Table is continued on next page.

Chapter 4 – MAINTENANCE INSTRUCTIONS

ENGINE ASSEMBLY REPLACEMENT SETUP (Continued)

<u>Equipment Condition</u>	<u>Follow-On Maintenance</u>
Engine shut OFF	Install transmission and torque converter
Battery Disconnect Switch OFF	Install air filter assembly
Parking brake set	Install hood assembly
Transmission in NEUTRAL (N)	Install belly armor plate
Wheels chocked	Install radiator
Disconnect Batteries	Connect power steering shaft
Remove belly armor plate	Connect exhaust system
Remove hood assembly	Connect CAC pipes from radiator to engine
Remove radiator	Install fan shroud
Remove air cleaner assembly	Install power steering hoses
Drain radiator coolant	Install O-rings on A/C lines and connect
Drain engine coolant	Install O-rings on fuel lines and connect
Drain engine oil	Install O-rings on trans lines and connect
Drain air tanks and air lines	Install Generator
Drain and remove coolant overflow and surge tanks	Install Transmission
Drain, disconnect and cap fuel lines	Connect brake lines
Disconnect, mark and tag both sides of engine harness connectors and remove	Connect air lines
Remove Generator	Connect engine harness
Drain, disconnect and remove transmission and torque converter	Fill radiator, overflow and surge tank
Drain, disconnect all transmission, trans cooler, brake and air lines. Cap, mark and tag for re-installation	Fill with oil
Evacuate and discharge A/C system	Fill with power steering fluid
Disconnect, remove and cap A/C lines	Fill transmission fluid
Disconnect & remove Exhaust system	Evacuate A/C system and charge
Disconnect Turbocharger pipes	Battery Disconnect Switch ON
Disconnect CAC pipes from radiator and engine	Prime fuel system
Remove fan shroud	Start engine
Drain power steering fluid reservoir	Verify operation of systems, check for leaks
Drain, disconnect and cap power steering hoses	Re-check transmission fluid and top off
	Shut engine OFF
	Re-check oil level and top off
	Re-check coolant level and top off
	Re-check power steering fluid and top off

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a) Removal



Wear safety goggles, work gloves, long sleeves while working on vehicle engine. Allow engine to cool before disassembling, this will prevent damage to other components not being replaced. Secure hood of vehicle while working under it. No smoking or open flames while working on engine, diesel fuel is flammable and can catch fire with just a spark. Use caution when attaching lifting device that it is secured properly before lifting engine out of engine compartment. Lift slowly to ensure everything is disconnected. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

1. Disconnect engine from vehicle motor mounts and attach suitable lifting device with lifting hooks and chains.
2. Lifting engine up slowly from engine compartment to ensure everything has been disconnected.



When lifting objects overhead with suitable lifting device use extreme caution while backing up. Make sure that direct path area is clear of personnel and object. Stop and lower load as soon as possible to avoid an accident. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

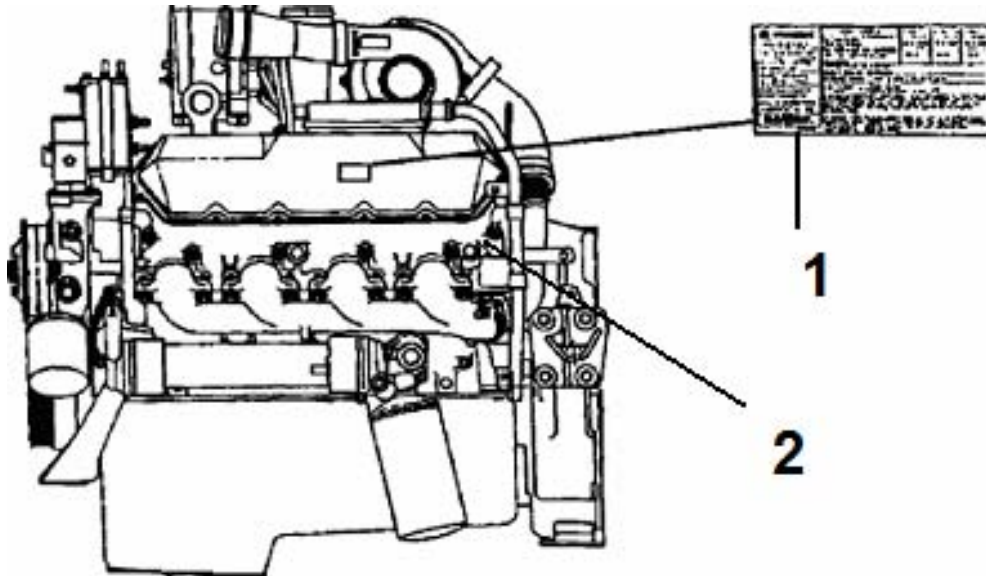
3. Once cleared of engine compartment, use extreme caution when moving with engine in air. Back up slowly and when clear of vehicle, stop, and lower engine to a more suitable level to transport to pallet.
4. Lower engine to a pallet and place blocks on each side to brace.
5. Remove suitable lifting device and chains from engine lifting mount hooks.

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b) Installation



ALWAYS verify that you have the correct part before installing part into vehicle. Installing the wrong part can damage equipment. The engine has an emission label (1) on it to identify what kind it is. Failure to comply will result in damage to equipment.



1. Remove components from old engine (2) and transfer to new one. Use caution not to damage components when removing or installing. Verify emission's label (1) is correct for this vehicle before installation.
2. Attach suitable lifting device with lifting hooks and chains. Make sure chains and hooks are secure before lifting engine out of box or pallet.
3. Only lift as high as safely needed to get to vehicle, before raising overhead.
4. Use extreme caution while engine is raised above heads and moved forward over engine compartment.
5. Slowly lower engine into engine compartment onto engine mounts. Do not remove from lifting device until engine is secured in engine mounts.
6. Remove lifting device.

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c) Follow-On Maintenance

1. Install transmission and torque converter.
2. Install air filter assembly.
3. Install hood assembly.
4. Install belly armor plate.
5. Install radiator.
6. Connect power steering shaft.
7. Connect exhaust system.
8. Connect CAC pipes from radiator to engine.
9. Install fan shroud.
10. Install power steering hoses.
11. Install O-rings on A/C lines and connect.
12. Install O-rings on fuel lines and connect.
13. Install O-rings on transmission lines and connect.
14. Connect brake lines.
15. Connect air lines.
16. Connect engine harnesses.
17. Fill radiator, overflow, and surge tank.
18. Fill with oil.
19. Fill with power steering fluid.
20. Fill with transmission fluid.
21. Evacuate A/C system and charge.
22. Battery Disconnect Switch ON.
23. Prime fuel system.
24. Start engine.
25. Verify operation of systems, check for leaks.
26. Re-check transmission fluid and top off.
27. Shut engine OFF.
28. Re-check oil level and top off.
29. Re-check coolant level and top off.
30. Re-check power steering fluid and top off.

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4-1.8 Separate Engine from Transmission Procedure

SEPARATE ENGINE FROM TRANSMISSION PROCEDURE	
This task covers:	
a) Removal	b) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Brass or Synthetic Mallet</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanics</p> <p><u>Material/Parts</u> (1) Transmission</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Belly armor removed Transmission drained Hydraulic Lines Removed Access Panel Removed Remove Engine Assembly</p> <p><u>Equipment Required</u> Suitable lifting devices (2) Suitable lifting sling Lifting chains</p> <p><u>Follow-On Maintenance</u> Remove chocks Battery Disconnect Switch ON Install transmission line Fill transmission Install Access Panel Install Belly Armor Install Engine Assembly</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS



To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

Use a brass or synthetic mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off. Serious personal injury and damage to components can result.

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

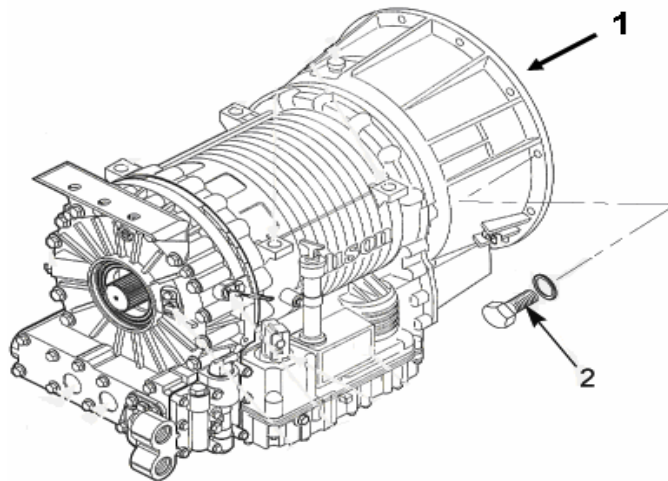
a) Removal

Uncoupling from Driveline, Engine, and Vehicle

1. Disconnect the vehicle drive shaft from the transmission output flange or yoke. Position the disconnected shaft to avoid interference when removing the transmission.
2. If transmission mountings support the rear of the engine, place a jack or other support under the engine.
3. Securely support the transmission with suitable lifting device and chains.
4. Remove inspection plate from engine bell housing.
5. Rotate torque converter flywheel until bolts are aligned. Remove 6 each bolts.
6. Disconnect transmission oil level sensor.
7. Disconnect variable speed sensor and rest of wiring harness.

NOTE

Note location of all bolts and brackets for later assembly.



8. Remove 12 each bolts (2) from bell housing (1).
9. Using suitable lifting device, move the transmission away from the engine until it is completely clear of the engine. Remove the adapter ring (if used).

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b) Follow-On Maintenance

1. Install hydraulic line.
2. Fill transmission.
3. Install access panel.
4. Install Belly armor.
5. Remove chocks.
6. Battery Disconnect Switch ON.

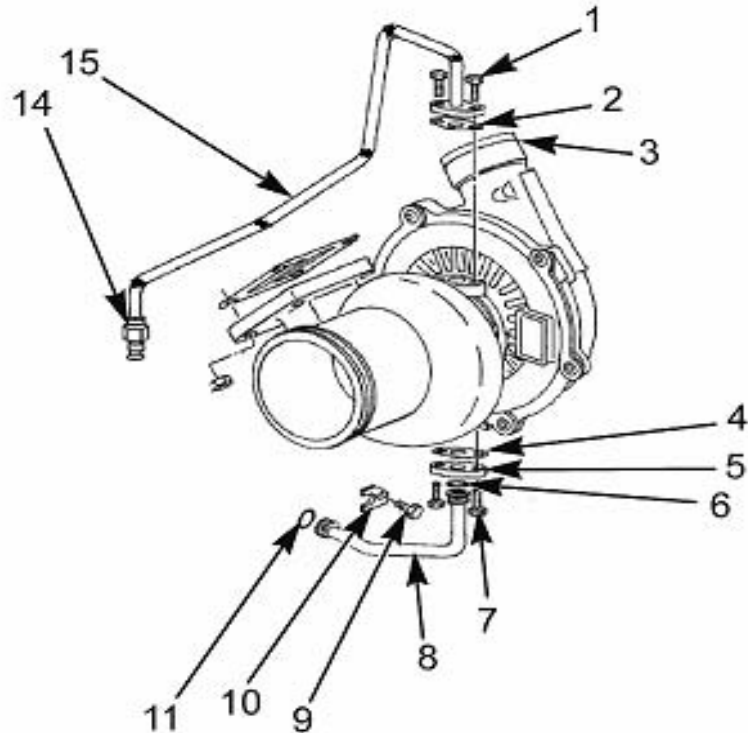
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.9 Turbocharger Assembly Replacement

TURBOCHARGER ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench ½” Drive 250 ft-lb (224N·m)</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanics</p> <p><u>Material/Parts</u> Turbocharger (1) Turbocharger Gasket (1) Exhaust Manifold Flange Gasket (1) Turbocharger Intake Cap Set ZTSE4296 (1) Oil Feed Tube O-ring (2) Oil Feed Flange Gasket (1) Drain Tube O-rings (2) Tube Flange Gasket (1) Five ounces clean engine oil Rubber Seal Ring (1)</p>	<p><u>Equipment Condition</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Right side armor plate removed Right side FSS Hose Bracket removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine Verify operation Check for leaks Shut engine OFF Battery Disconnect Switch OFF Right side armor plate installed Right side FSS Hose Bracket installed Wheel chocks removed</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



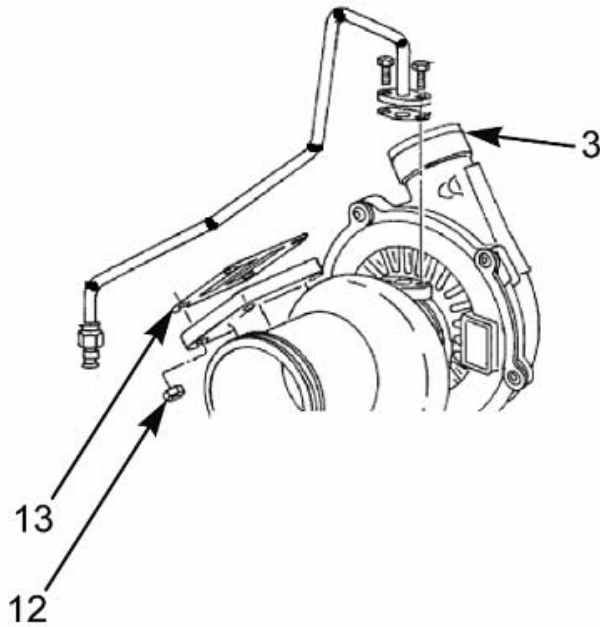
1. Remove oil feed supply tube fitting (14) located on top of oil filter header. Remove and discard tube fitting O-ring.
2. Remove two oil feed supply tube cap screws (1) on top of turbocharger housing (3).
3. Remove oil feed supply tube (15) and tube flange gasket (2) from turbocharger assembly (3). Discard flange gasket (2).
4. Loosen turbocharger oil drain tube retaining plate cap screw (9) from crankcase. Remove retaining plate (10) and cap screw (9).
5. Remove two turbocharger oil drain tube cap screws (7) at bottom of turbocharger housing.
6. Remove turbocharger oil drain tube flange (5), together with turbocharger oil drain tube (8), two - tube O-rings (6) and (11), and tube flange gasket (4) from bottom of turbocharger assembly. Discard both drain tube O-rings (6) and (11) (one on each end of drain tube) and flange gasket (4).
7. Cap all openings on turbocharger assembly. Use Turbocharger Intake Cap Set.

NOTE

Plug all Lines and Fittings when removed.

If plastic caps are not available, use duct tape to cover openings.

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8. Remove four nuts (12) holding turbocharger assembly on exhaust manifold flange.



To avoid possible engine or turbocharger damage, support turbocharger during removal and installation. Fasteners, turbocharger, and mounting plates could be bent or damaged.

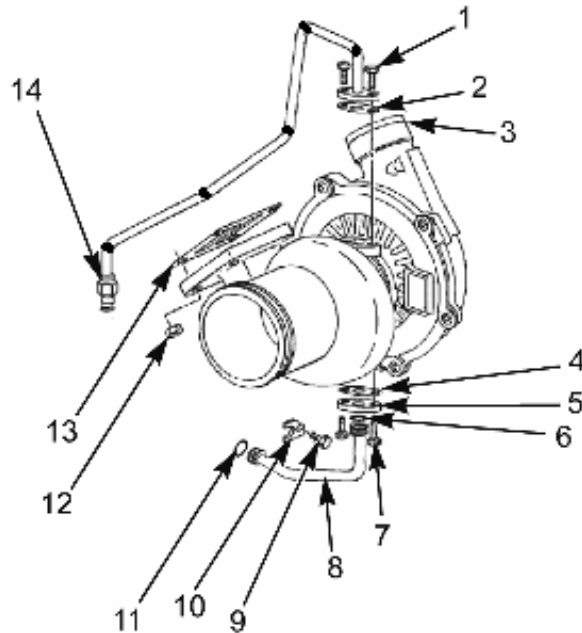
9. Remove turbocharger assembly (3), and gasket (13) from engine. Have Crew Member assist. Discard gasket.

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b) Installation



To avoid possible engine or turbocharger damage, support turbocharger during removal and installation. Fasteners, turbocharger, and mounting plates could be bent or damaged.



1. Install new gasket (13) on exhaust manifold flange.
2. Attach turbocharger assembly (3) on exhaust manifold flange and tighten nuts (12). Torque to 57 ft-lb. (71 N•m)
3. Remove the protective caps from oil inlet port (2) at turbocharger and from oil feed supply tube fitting (14) located on oil filter header.
4. Pour five ounces of clean engine oil in inlet opening (2) of turbocharger. This provides sufficient lubrication for turbocharger bearings until engine oil pressure is obtained.
5. Position new gasket (2) on turbocharger oil inlet port.
6. Install oil feed tube to turbocharger and fasten with two mounting cap screws (1).
7. Install new rubber seal ring in oil feed supply tube connector nut (14).
8. Install oil feed supply tube on tube fitting with connector nut (14).
9. Remove protective cap from oil drain port on turbocharger.
10. Lubricate two new O-rings with engine oil, install one on each end of turbocharger oil drain tube (6) and (11).
11. Position turbocharger oil drain tube (8) with new O-rings (6) and (11), tube flange (5), and flange gasket (4) on turbocharger oil drain port.
12. Fasten turbocharger oil drain tube to turbocharger and tighten bolts (7).
13. Install loose end of turbocharger oil drain tube in crankcase with retaining plate (10) and one cap screw (9).

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c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify operation of turbo-charger.
4. Check for leaks.
5. Shut engine OFF.
6. Battery Disconnect Switch OFF.
7. Reinstall right side armor plate.
8. Reinstall right side FSS nozzle bracket to armor plate.
9. Remove wheel chocks.

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4-1.10 High-Pressure Injector Pump Replacement

HIGH-PRESSURE INJECTOR PUMP REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Hand Operated Vacuum Pump (ZTSE2499)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Drain Pan</p> <p><u>Material/Parts</u> Oil Pump Gasket EOT O-ring Engine Lubricating Oil Zip Tie ¼" x 12"</p>	<p><u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in neutral (N) Wheels chocked Lt side air filter armor removed Lt side FSS nozzle bracket removed Power Distribution Armor plate removed Left Side Armor plate Removed Air filter canister removed CAC Hose removed High-pressure pump reservoir drained</p>	<p><u>Follow-On Maintenance</u> Dispose of oil and gasket Install CAC Hose Install Air Filter Canister Install left side armor plate Install Power distribution Armor Plate Install left side FSS Nozzle bracket Install air filter Battery Disconnect Switch ON Check and fill high pressure oil reservoir Start engine Verify operation Check for leaks Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks</p>

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System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.



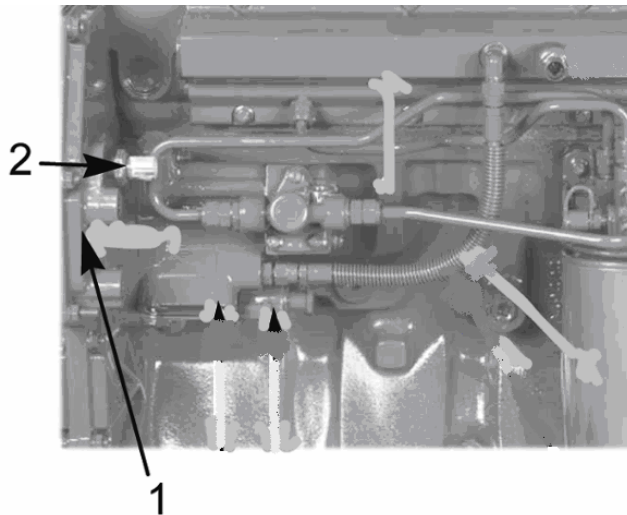
To avoid possible engine damage, make sure high-pressure pump reservoir has been drained of oil before performing this procedure.

NOTE

Position a suitable drain pan under oil filter to catch excess oil.

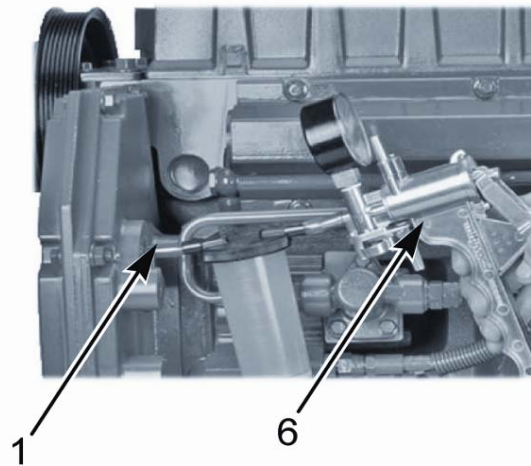
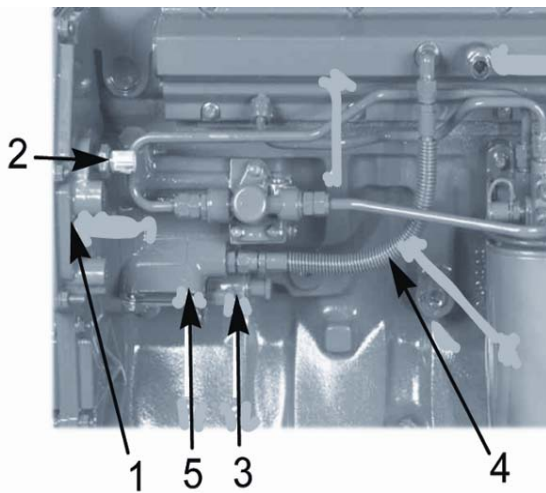
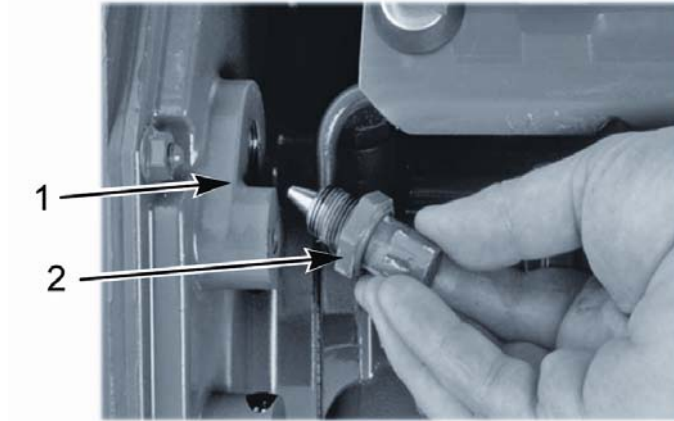
a) Removal

1. Locate Engine Oil Temperature (EOT) sensor (2) located on rear half of internal oil reservoir (1).



2. Remove EOT sensor (2) from internal oil reservoir (1).
3. Remove and discard O-ring from EOT sensor (2).

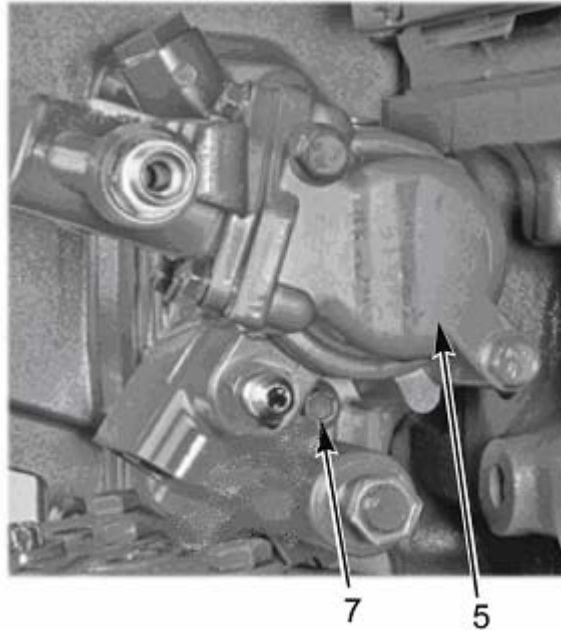
Chapter 4 – MAINTENANCE INSTRUCTIONS



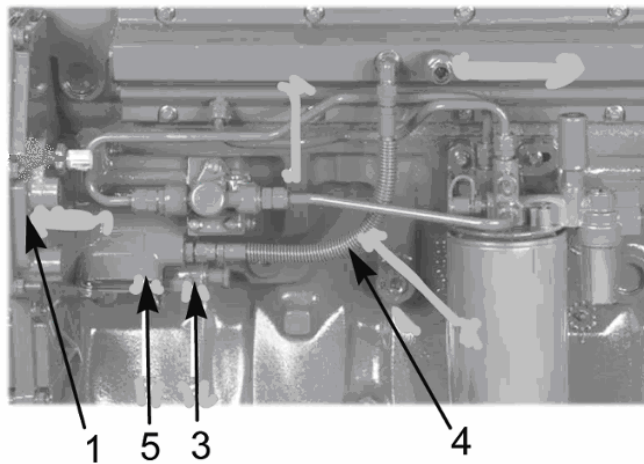
4. Insert tube from Hand Operated Vacuum Pump (6) in the EOT sensor hole located on the internal oil reservoir (1).
5. Remove oil from high-pressure pump reservoir. Dispose of oil in accordance with regulations.
6. Install EOT sensor (2) with new O-ring in the EOT sensor hole located on the internal oil reservoir (1).
7. Disconnect IPR solenoid wiring harness (3).
8. Remove high-pressure oil supply hose (4).
9. Remove and stow two high-pressure oil pump cap screws (7) from internal oil reservoir front cover.
10. Remove high-pressure oil pump (5) and gasket from internal oil reservoir. Discard gasket in accordance with regulations.

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b) Installation



1. Install new gasket in groove on internal oil reservoir front cover (1).
2. Install high-pressure pump (5) on gasket.
3. Fasten high-pressure pump to front cover with mounting bolts (7).
4. Tighten mounting bolts to 20 ft-lb (27 N•m).



5. Install IPR solenoid wiring harness (3).
6. Install high-pressure oil supply hose (4).
7. Fill and check level of high-pressure pump reservoir (1).

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c) Follow-On Maintenance

1. Dispose of oil.
2. Install CAC Hose.
3. Install Air Filter Canister.
4. Install Left Side Armor Plate.
5. Install Power Distribution Armor Plate.
6. Install Left Side FSS Nozzle Bracket.
7. Install air filter.
8. Battery Disconnect Switch ON.
9. Check and fill high-pressure oil reservoir.
10. Start engine.
11. Verify operation.
12. Check for leaks.
13. Shut engine OFF.
14. Battery Disconnect Switch OFF.
15. Remove wheel chocks.

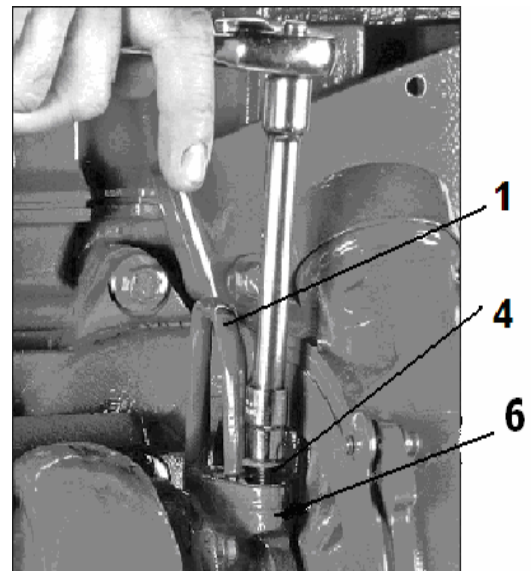
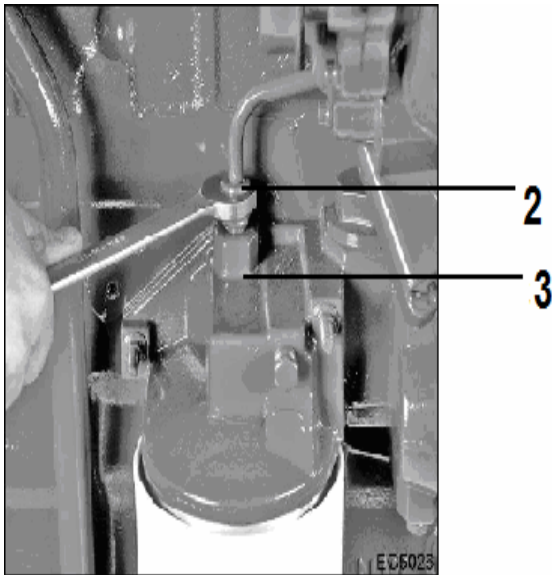
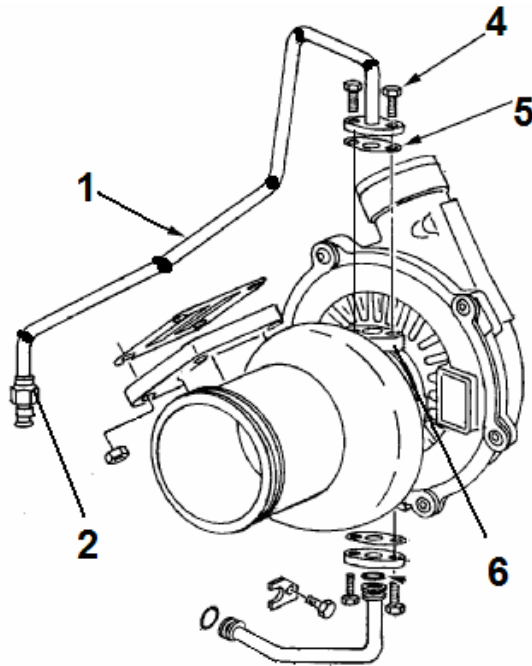
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.11 Turbocharger Lubricant Line Replacement

TURBOCHARGER LUBRICANT LINE REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Turbocharger Lubricant Line (1) O-ring (1) Gasket (1)</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p>	<p><u>Equipment Conditions</u> Shut engine OFF Battery Disconnect Switch OFF Parking brake set Transmission selector in NEUTRAL (N) Wheels chocked Right Side FSS Nozzle Bracket Removed Right Side Armor Plate Removed Turbocharger Air Inlet Tube Removed</p> <p><u>Follow-On Maintenance</u> Install Turbocharger Air Inlet Tube Install right side armor plate Install right side FSS Nozzle Bracket to armor Battery Disconnect Switch ON Start engine Check for leaks Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks</p>

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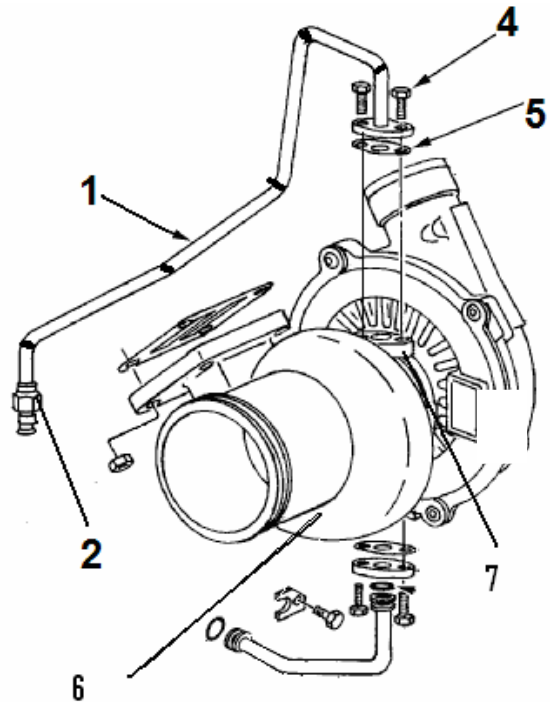
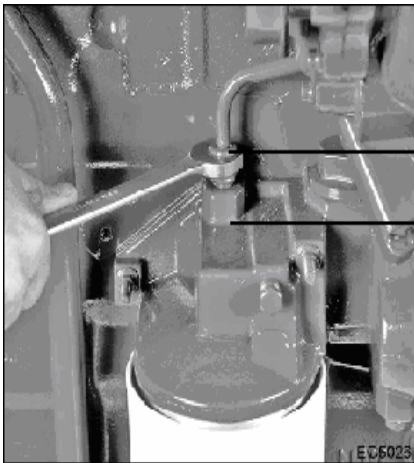
a) Removal



1. To remove oil feed supply tube (1), locate fitting (2) on top of oil filter header (3). Loosen and remove tube fitting and cap opening on filter header. Remove and discard tube nut O-ring.
2. Remove two oil feed supply tube cap screws (4) on top of turbocharger housing (6).
3. Remove oil feed supply tube (1) and tube flange gasket (5) from turbocharger assembly (6). Discard flange gasket (5). Clean oil inlet port where old gasket (5) was to ensure proper sealing of new gasket.
4. Cap openings on turbocharger assembly with plastic caps. If not available, use duct tape to cover openings until ready to install new oil feed supply tube (1).

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b) Installation



1. Remove protective caps from oil inlet port at turbocharger (6) and from oil feed supply located on oil filter header (3).
2. (Only if turbocharger was replaced), pour five-ounces of clean engine oil in oil inlet opening of turbocharger. This provides sufficient lubrication for turbocharger bearings until engine pressure is obtained. If turbocharger was not replaced, disregard this step.
3. Position new gasket (5) on turbocharger oil inlet port (7).
4. Install oil feed supply tube (1) to turbocharger (6) and fasten with two-mounting cap screws (4).
5. Install new rubber seal ring in oil feed supply tube connector fitting. (2).
6. Install oil feed supply tube (1) on tube fitting filter header (3) with connector fitting. (2).

c) Follow-On Maintenance

1. Install Turbocharger Air Inlet Tube.
2. Install Right Side Armor Plate.
3. Install Right Side FSS Nozzle Bracket to Armor.
4. Battery Disconnect Switch ON.
5. Start engine.
6. Check for leaks.
7. Shut engine OFF.
8. Battery Disconnect Switch OFF.
9. Remove wheel chocks.

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4-1.12 Air Intake Tube (To Turbo) Replacement

AIR INTAKE TUBE (TO TURBO) REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Intake Air Pipe (1) Spring-loaded & Straight T-bolt hose Clamps (3)</p> <p><u>Equipment Required</u> None</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Conditions</u> Battery Disconnect Switch OFF Parking brake set Transmission selector in NEUTRAL (N) Wheels chocked Right Side FSS Nozzle Bracket Removed Right Side Armor Plate Removed</p> <p><u>Follow-On Maintenance</u> Reinstall right side armor plate Reinstall right side FSS Nozzle bracket to armor Battery Disconnect Switch ON Start engine Verify operation Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks</p>	

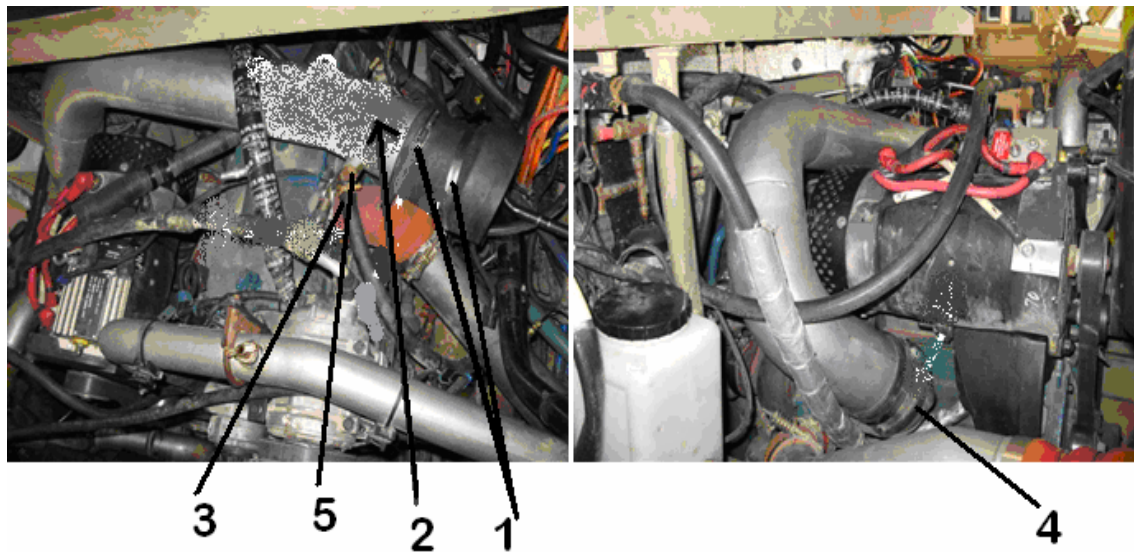
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a) Removal



Before opening the hood, make sure that there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself or an assistant between the hood and any other structure. Failure to comply may result in serious injury or death.

DO NOT touch the exhaust system components with bare hands or with your body use protective work gloves and long sleeves. DO NOT use the exhaust tailpipe as a step. It will not hold weight and will collapse. Failure to comply may result in damage to equipment and or serious burns, injury, or death to personnel.



1. Remove clamps (1) from air filter housing to air intake tube (2).
2. Remove air compressor hose (3) from air intake tube (2).
3. Remove clamp (4) from turbo inlet to air intake tube.
4. Remove air inlet tube (2) from vehicle.
5. Remove fitting (5) from air intake tube (2).

b) Installation

1. Install fitting (5) on air intake tube (2).
2. Install air inlet tube (2) on vehicle.
3. Install clamp (4) from turbo inlet to air intake tube (2).
4. Install air compressor hose (3) from air intake tube (2).
5. Install clamp (1) from air filter housing to air intake tube (2).
6. Charge intake system to check for leaks.

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c) Follow-On Maintenance

1. Reinstall Right Side Armor Plate.
2. Reinstall Right Side FSS Nozzle Bracket to Armor.
3. Battery Disconnect Switch ON.
4. Start engine.
5. Verify operation.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Remove wheel chocks.

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4-1.13 High-Pressure Injector Rail Drain Plug O-Ring Replacement

HIGH-PRESSURE INJECTOR RAIL DRAIN PLUG O-RING REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> O-rings (2)</p> <p><u>Equipment Required</u> Rags Drain pan</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Conditions</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Left Side FSS Nozzle Bracket Removed Left Side Armor Removed Air Filter Canister Removed</p>	<p><u>Follow-On Maintenance</u> Reinstall air filter Canister Battery Disconnect Switch ON Start vehicle Verify operation and check for leaks Shut engine OFF Battery Disconnect Switch OFF Install left side armor Install left side FSS Nozzle bracket to armor</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

Front and rear plug are the same. Front plug is shown.



Drain Supply Manifold

1. Place rag or suitable container by supply manifold end plug. Remove supply manifold end plug (1). Dispose of rags and engine fluids in accordance with regulations.
2. Remove and discard O-ring and backup ring.

NOTE

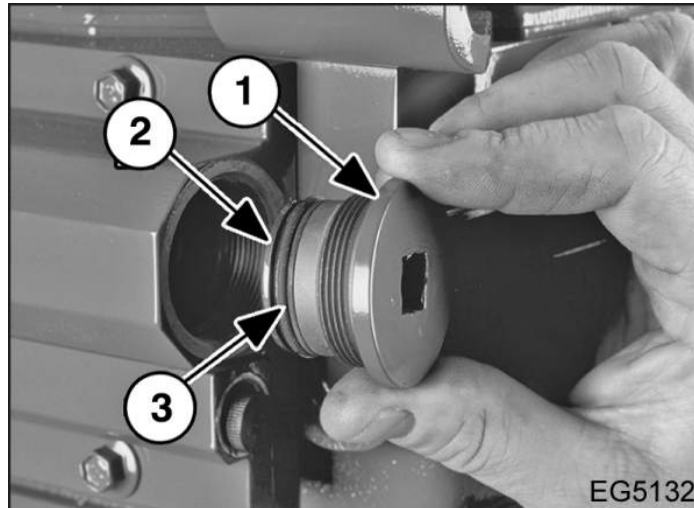
Make sure to clean old Loctite[®] from threads of end plug, prior to installation.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

NOTE

Front and rear plugs are the same. Rear plug is shown.



1. Install new O-ring (2) and backup ring (3) on end plug (1).
2. Install plug in supply manifold. Tighten plug to 60 ft-lb (81N•m).

c) Follow-On Maintenance

1. Reinstall Air Filter Canister.
2. Battery Disconnect Switch ON.
3. Start vehicle.
4. Verify operation and check for leaks.
5. Shut engine OFF.
6. Battery Disconnect Switch OFF.
7. Reinstall Left Side Armor.
8. Reinstall Left Side FSS Nozzle Bracket to Armor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.14 Exhaust Manifold Replacement

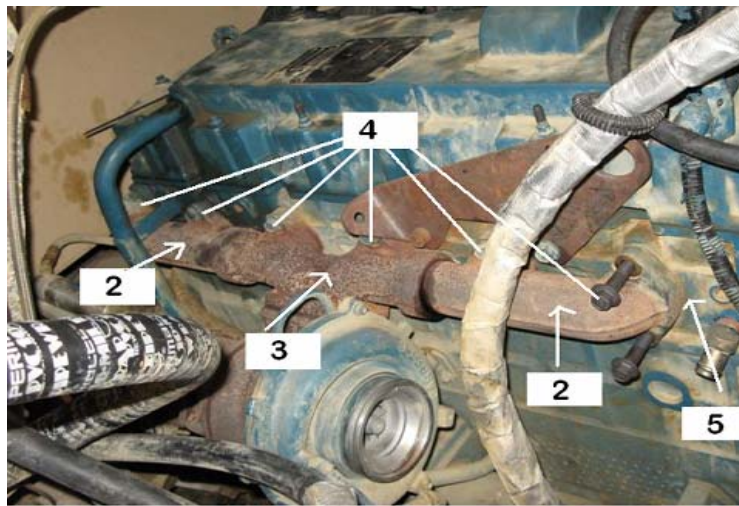
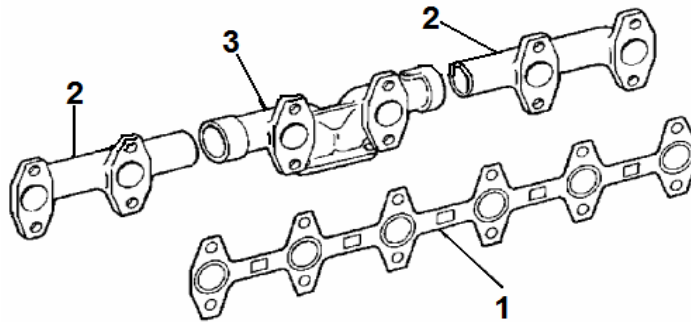
EXHAUST MANIFOLD REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		<u>Equipment Required</u>
		None
<u>Special Tools</u>		<u>Equipment Conditions</u>
Torque Wrench		Engine shut OFF
		Battery Disconnect Switch OFF
		Parking brake set
<u>Personnel</u>		Transmission selector in NEUTRAL (N)
One (1) Wheeled Vehicle Mechanic		Wheels chocked
		Right Side FSS Nozzle Bracket Removed
		Right Side Armor Plate Removed
<u>Material Parts</u>		Remove Turbocharger and components
Exhaust Manifold Sections		Remove alternator and bracket
Exhaust Manifold Gasket Kit		
		<u>Follow-On Maintenance</u>
		Install alternator and bracket
		Install turbocharger and components
		Battery Disconnect Switch ON
		Start engine
		Check for leaks
		Shut engine OFF
		Battery Disconnect Switch OFF
		Reinstall right Side Armor Plate
		Reinstall Right Side FSS Nozzle Bracket
		Remove wheel chocks
<u>Reference</u>		
Parts Manual		

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Use extreme care when working under the hood of vehicle. Hood is extremely heavy, ensure it is braced properly. Wear protective eye goggles, work gloves and long sleeves when working and or removing engine parts. Make sure that vehicle engine has time to cool before working on it. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



1. Remove the twelve mounting bolts (4) that hold the three sections of the exhaust manifold (2), (2), and (3) to the cylinder head (5).
2. Remove the exhaust manifold (2) and (3) and discard it and the one-piece gasket (1).
3. Clean any residue from old gasket off cylinder head surface.

b) Installation

1. Install new exhaust manifold gasket (1) on cylinder head (5) mounting area.
2. Put together the three sections of the exhaust manifold (2) and (3) and align them with the new gasket (1) on the cylinder head.
3. Insert mounting bolts (4) to align with manifold gasket (1), manifold sections (2) and (3) and cylinder head (5). Loosely tighten bolts.
4. Once everything is aligned, tighten bolts (4) from inside bolts to outside bolts. Tighten to 60 ft-lb (80 N•m).

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Install alternator and bracket.
2. Install turbocharger and components.
3. Battery Disconnect Switch ON.
4. Start engine.
5. Check for leaks.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Reinstall Right Side Armor Plate
9. Reinstall Right Side FSS Nozzle Bracket to Armor
10. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.15 Engine Control Module (ECM) Replacement

ENGINE CONTROL MODULE (ECM) REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Equipment Required</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Dielectric grease Engine Control Module (ECM) (1) ID Tags (if needed)</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Engine wiring harness moved to side Engine oil/Transmission oil filler tube removed</p> <p><u>Follow-On Maintenance</u> Install engine oil and transmission oil filler tube Reposition engine wiring harness Battery Disconnect Switch ON Start engine Verify operation of vehicle Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS



To avoid engine damage, make sure the key is in the OFF position before unplugging a connector or relay for the ECM, IDM, and EGR drive module. Failure to turn the key to the OFF position will cause a voltage spike and damage the electrical components.

To avoid engine damage, do not tug on any wiring harnesses while trying to remove them. If resistance is felt, find the source of resistance and free up any connectors or clips that are caught before proceeding.

NOTE

Make sure each connector has its ribbed seal in place before connecting to sensor. In some cases, during disassembly, a ribbed seal may pull out of its connector and remain on the mating socket of a sensor or actuator. A connector assembled, without appropriate ribbed seal, can become contaminated with moisture and corrode terminals, resulting in poor electrical connections.

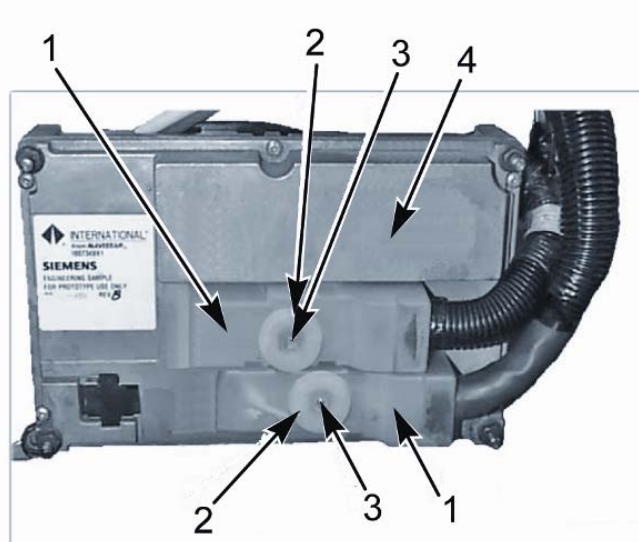
Removal procedures for the front-mounted ECM's or rear-mounted ECM's are identical except where noted.

When servicing Diamond Logic® controller, applying an approved dielectric grease to disconnected ECM connectors is encouraged. This will provide a protective, moisture tight seal that ensures ECM connectors will continue to perform effectively.

The ECM module is located on the rear, driver's side of the engine block.

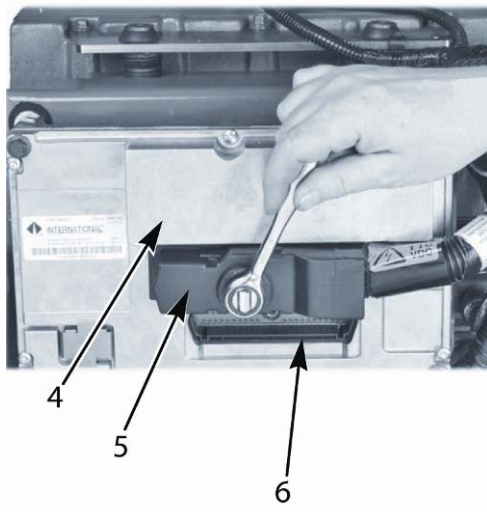
a) Removal

1. Disconnect batteries (Battery Disconnect Switch OFF).

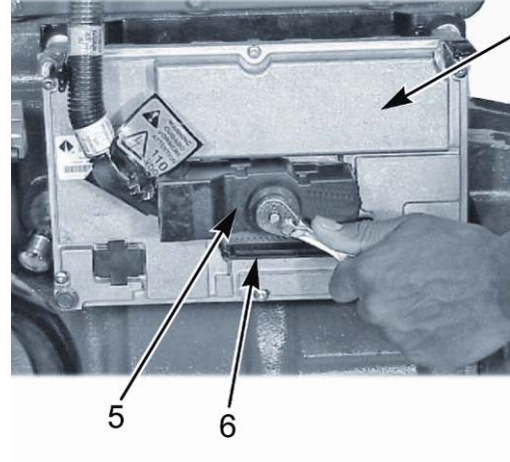


2. Remove screws (3) and connector cover shields (2) from ECM connector covers (1).
3. Remove ECM connector covers (1) from wiring harness connectors.

Chapter 4 – MAINTENANCE INSTRUCTIONS

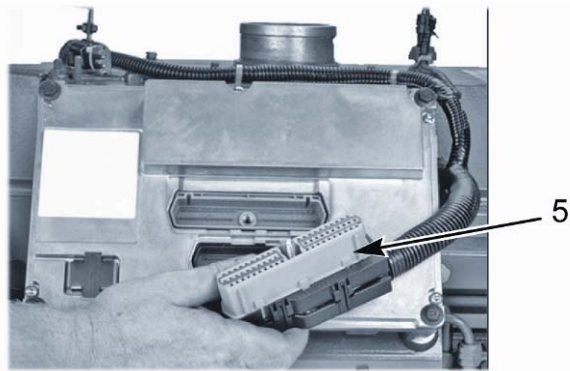


Front Mount ECM

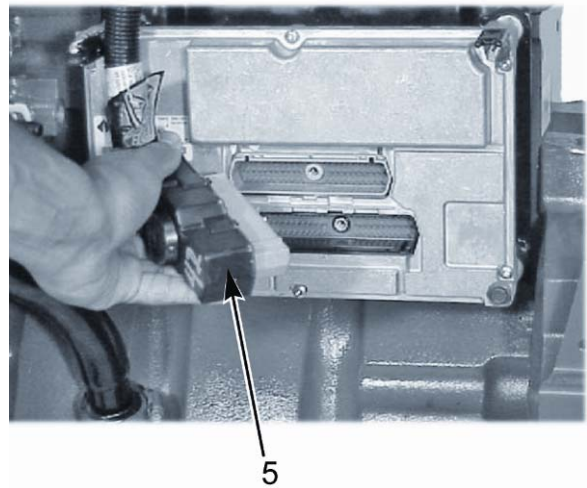


Rear Mount ECM

4. Mark wiring harness connectors (5) and (6) for reassembly.
5. Loosen chassis wiring harness connector mounting bolt and remove wiring harness (6) from ECM (4).
6. Loosen engine wiring harness connector (5) mounting bolt.



Front Mount ECM



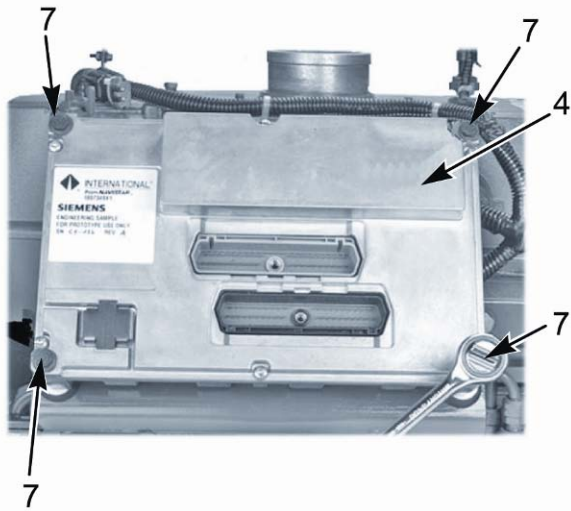
Rear Mount ECM

7. Remove engine wiring harness (5) from ECM (4).

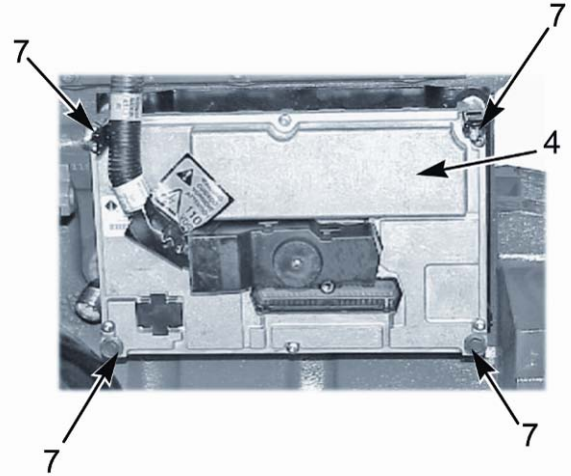
NOTE

If ECM does not have to be removed from mounting bracket, proceed to Step 10.

Chapter 4 – MAINTENANCE INSTRUCTIONS

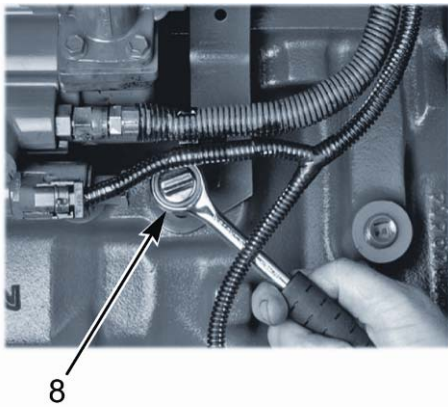


Front Mount ECM

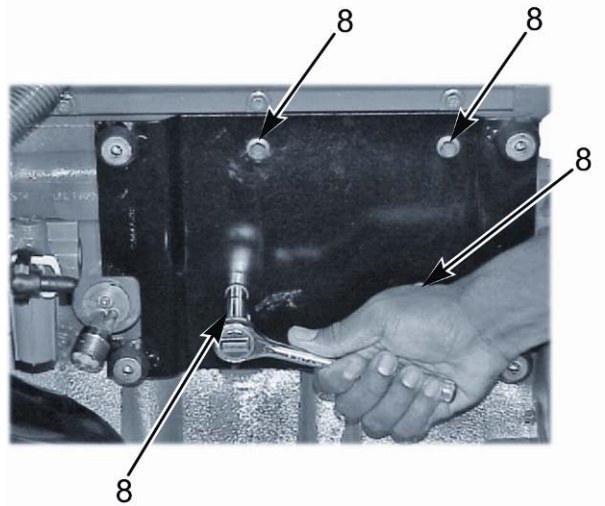


Rear Mount ECM

8. If it is necessary to remove ECM (4) from mounting bracket, remove four ECM mounting bolts (7) and lift ECM (4) from bracket.



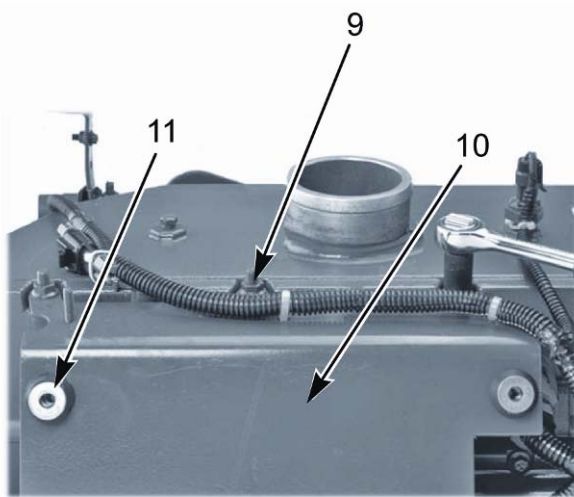
Front Mount ECM



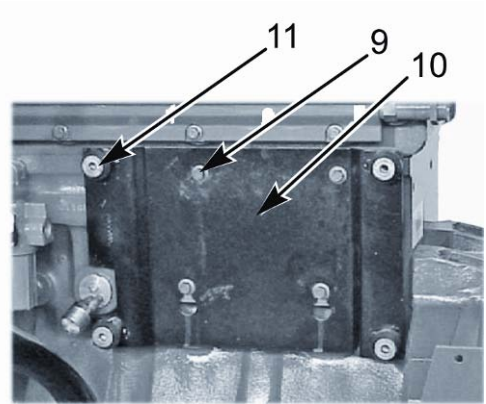
Rear Mount ECM

9. Remove bottom ECM bracket bolts (8).

Chapter 4 – MAINTENANCE INSTRUCTIONS



Front Mount ECM



Rear Mount ECM

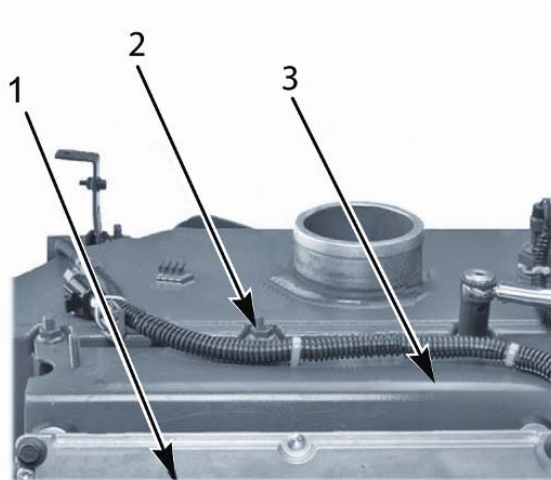
10. **Front Mounted ECM** – Remove three ECM mounting bracket top mounting nuts (9). Lift bracket (10) away from engine.
11. **Rear Mounted ECM** – Remove two ECM mounting bracket top mounting bolts (9). Lift bracket (10) away from engine.
12. Remove mounting bracket bushing and pins (11), if required.

b) Installation

NOTE

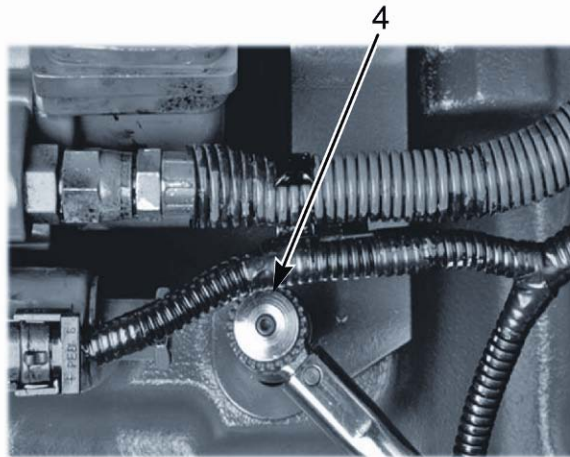
Installation procedures for the front-mounted ECM's or rear-mounted ECM's are identical except where noted.

Installing ECM and Mounting Bracket as Single Unit



1. Install ECM (1) and mounting bracket (3) on engine and tighten three top mounting nuts (2) to 20 ft-lb (27 N•m).

Chapter 4 – MAINTENANCE INSTRUCTIONS

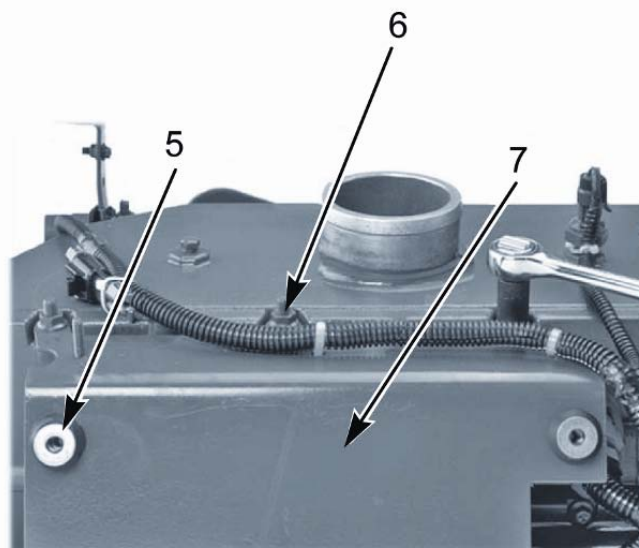


2. Install bottom ECM bracket bolt (4) and tighten bracket bolt to 20 ft-lb (27 N•m).

Install Mounting Bracket and ECM as Separate Unit

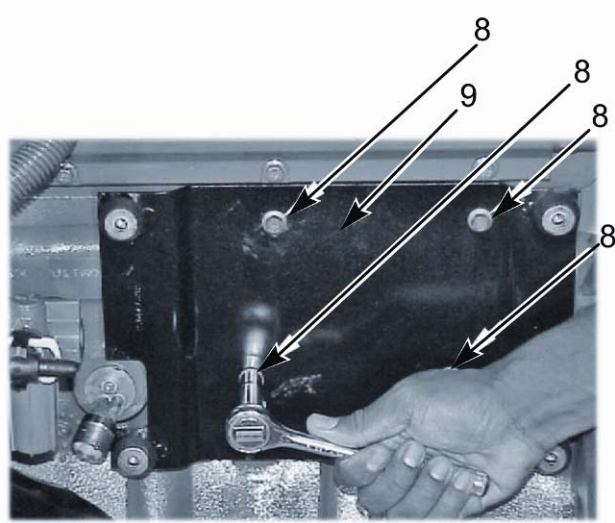
NOTE

Removal procedures for the front-mounted ECM's or rear-mounted ECM's are identical except where noted.

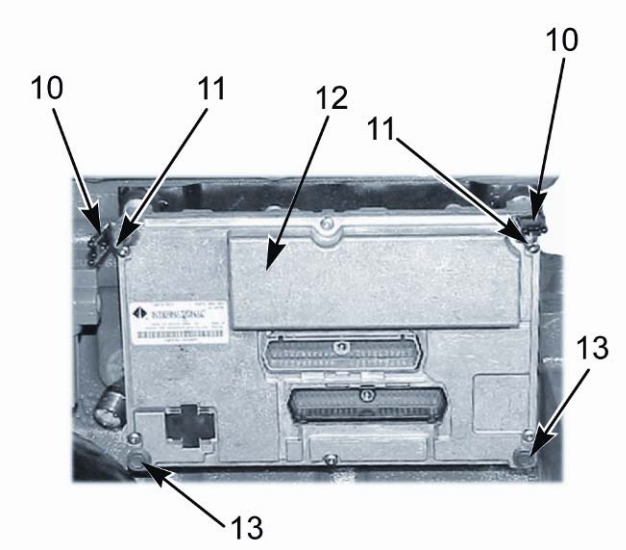


1. **Front mount ECM** - Install four nut and spacers and eight mounting bushings (5) on mounting bracket (7).
2. Install mounting bracket (7) on engine. Tighten top three mounting bolts (6) to 20 ft-lb (27 N•m).

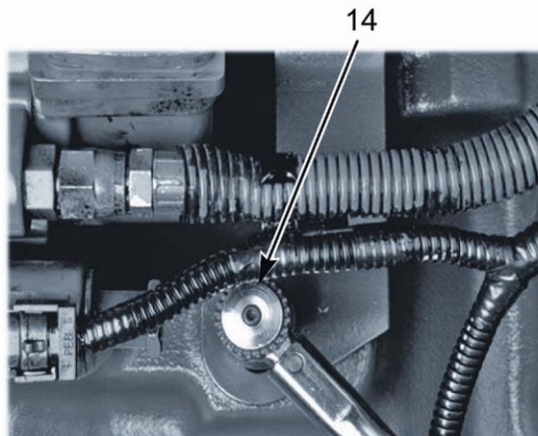
Chapter 4 – MAINTENANCE INSTRUCTIONS



3. **Rear Mount ECM** - Install top bolts (8) for mounting bracket (9) and tighten to 20 ft-lb (27 N•m).

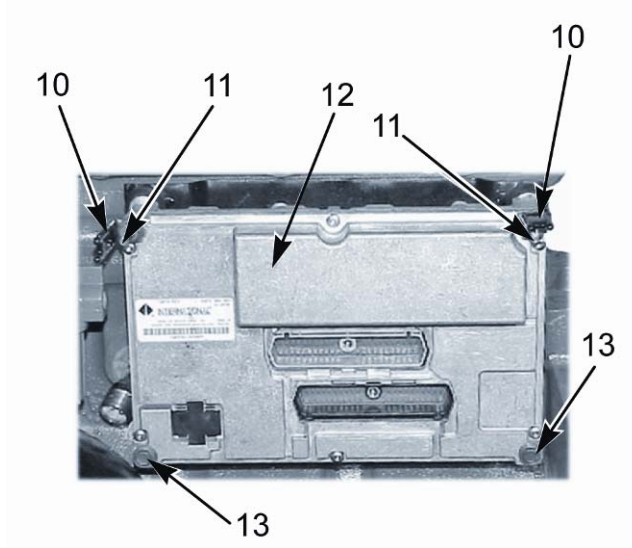


4. **Rear Mount ECM** - Attach “L” shaped brackets (10) and ECM (12) to mounting bracket with two upper bolts (11).

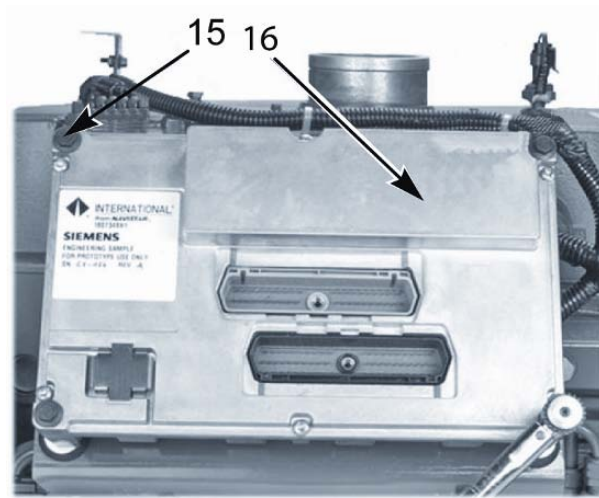


Chapter 4 – MAINTENANCE INSTRUCTIONS

5. **Front Mount ECM** - Install bottom ECM bracket bolt (14) and tighten to 20 ft-lb (27 N•m).



6. **Rear Mount ECM** - Install two lower bolts (13) and tighten to 20 ft-lb (27 N•m).



7. Install ECM (16) on mounting bracket. Tighten four mounting bolts (15) to 20 ft-lb (27 N•m).

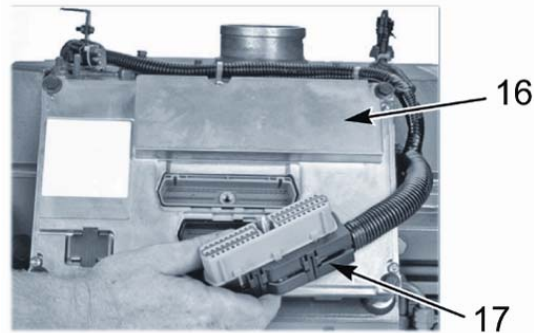
Chapter 4 – MAINTENANCE INSTRUCTIONS

NOTE

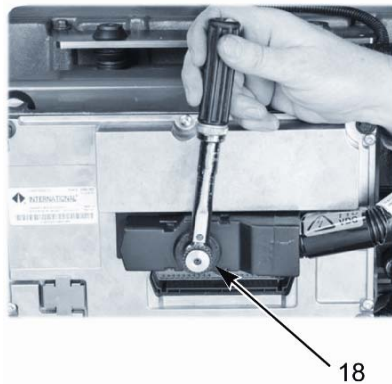
When servicing Diamond Logic® controller, applying an approved dielectric grease to disconnected ECM connectors is encouraged. This will provide a protective, moisture tight seal that ensures ECM connectors will continue to perform effectively.



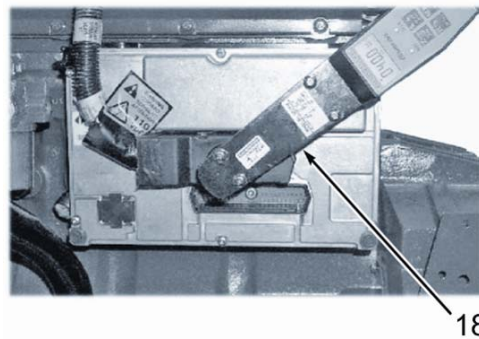
8. Apply 3/8 in. (9.5 mm) bead of approved dielectric grease to each ECM connector. Begin applying dielectric grease from bolt moving toward the ends of ECM connectors.
9. Apply Grease Instruction Label to identify ECM connectors and Diamond Logic® controller has been serviced and sealed with proper grease.



10. Connect engine wiring harness (17) to ECM (16).



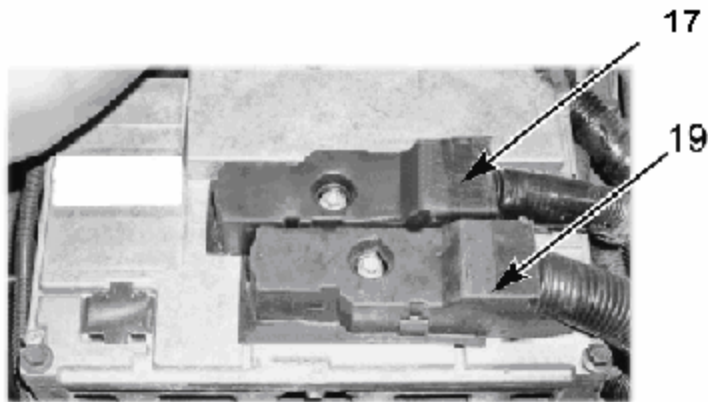
Front Mount ECM



Rear Mount ECM

11. Tighten retaining screw (18) to 50 in-lb (6 N•m).

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12. Install and connect second wiring harness (19) to ECM. Tighten retaining screw to 50 in-lb (6 N•m).
13. Install wiring harness routing clips.
14. Install connector cover shields and connector cover.
15. Connect batteries.

c) Follow-On Maintenance

1. Install engine oil and transmission oil filler tube.
2. Reposition engine wiring harness.
3. Battery Disconnect Switch ON.
4. Start engine.
5. Verify operations of vehicle.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.16 Rocker Cover and Gasket Replacement

ROCKER COVER AND GASKET REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Rocker cover (1) Gasket (1) O-ring (1) Zip Tie (1) (Optional)</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Rags</p>	<p><u>Equipment Conditions</u> Engine shut OFF Battery Disconnect Switch OFF Set parking brake Transmission in NEUTRAL (N) Wheels chocked Remove Road Draft Tube Alternator Harness Disconnected A/C Belt Removed</p> <p><u>Follow-On Maintenance</u> Install A/C Belt Install alternator harness Install Road Draft Tube Battery Disconnect Switch ON Start engine Check for leaks Shut engine OFF</p>	

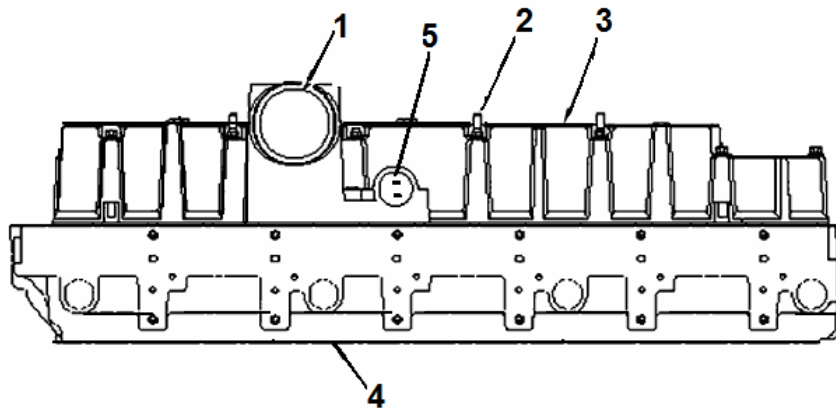
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear safety goggles, work gloves, and long sleeves when working on engine compartment. Use caution while working under the hood of the vehicle. Make sure it is secured properly. Do not smoke or have open flames around engine. Diesel fuel is flammable and can catch fire or explode. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

DO NOT disconnect A/C lines from compressor. Release of refrigerant may cause injury to personnel and/or damage to equipment or environment.



1. Remove 4 A/C compressor mounting bolts.
2. Slide off compressor and place securely on top of radiator for clearance
3. Record the locations of the stud bolts (2) and brackets with the orientation and the related parts to the rocker cover (3) intake manifold mounting. This is to ensure proper installation later.
4. Mark and tag both ends to all electrical connections, hoses, and lines needed before the removal to ensure proper installation later.
5. For rocker cover electrical connector (5), release the retaining tabs of the wiring harness connector, and push the connector body towards the inside of the rocker cover (3) and intake manifold.
6. Remove rocker cover (3) and intake manifold mounting bolts (2).
7. Remove inlet hose clamp (1) from rocker cover (3).
8. Push engine harness and road draft tube toward front of engine and out of way of cover for clearance. Zip-tie may be used to secure in appropriate location.
9. Remove the rocker cover (3) and intake manifold and gasket from the cylinder head (4).

NOTE

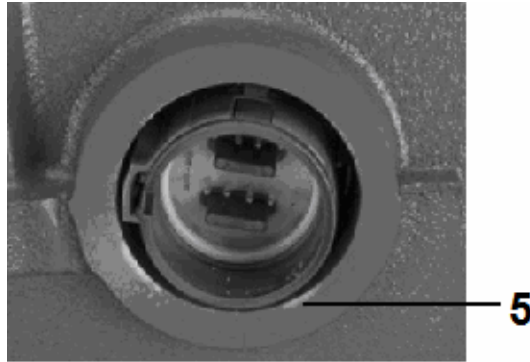
Do not use a corrosive solution on engine or related components.

10. Clean cylinder head where rocker cover gasket (4) was located.

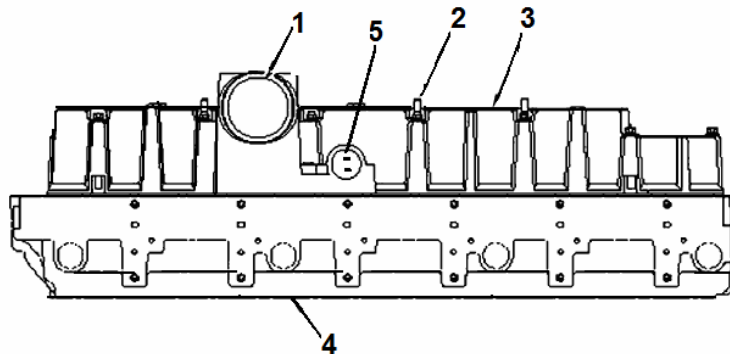
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

1. Install new gasket on the cylinder head (4).



2. Hold the rocker cover (3) and intake manifold over the engine and place a new O-ring in the wiring harness connector port (5) and push the connector in until the tabs lock into place. (You should hear a click when it goes into place correctly).
3. Install rocker cover (3) and intake manifold on the cylinder head.
4. Install mounting bolts (2) that secure the rocker cover (3) and intake manifold to the cylinder head and tighten to 13 ft-lb (18 N•m).
5. Install stud bolts (2) with associated brackets for parts and tighten to 13.ft-lb (18 N•m).
6. Reinstall A/C compressor.
7. Reinstall inlet hose clamp to rocker cover.
8. Reinstall wiring harness and clamps.



c) Follow-On Maintenance

1. Install A/C Belt harness.
2. Install alternator harness.
3. Install road draft tube.
4. Battery Disconnect Switch ON.
5. Start engine.
6. Check for leaks.
7. Shut engine OFF.
8. Battery Disconnect Switch OFF.
9. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.17 Engine Coolant Temperature (ECT) Sensor Replacement

ENGINE COOLANT TEMPERATURE SENSOR REPLACEMENT	
This task covers:	
a) Removal	b) Installation
	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Engine coolant temperature (ECT) sensor (1) O-ring (1) Dielectric Compound</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Drip Pan Rags GMT</p>	<p><u>Equipment Conditions</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Right Side FSS Nozzle Bracket Removed Right Side Armor Plate Removed Batteries Disconnected A/C Belt Removed Serpentine Belt Removed Generator Removed Generator Bracket Removed</p> <p><u>Follow-On Maintenance</u> Reinstall generator bracket Reinstall generator Reinstall Serpentine belt A/C belt reinstalled Reconnect Batteries Battery Disconnect Switch ON Start engine and run to operating temperature Check to make sure dash light for ECT has gone out and remains out on dash display Shut engine OFF Battery Disconnect Switch OFF Right side armor plate installed Right side FSS bracket installed Remove wheel chocks</p>

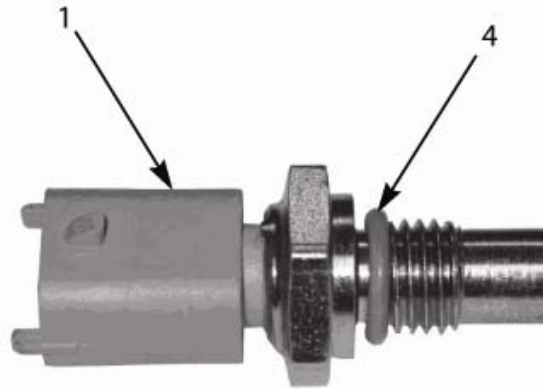
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

Engine Sensors



Do not replace sensors while engine is hot. Removing sensors while engine is hot may cause damage to the internal threads on engine block, cause sensor to break or crack in engine block, engine block could crack, or cause extremely hot coolant or oil to spill out. Failure to comply may result in damage to equipment or serious injury or death to personnel.



ECT Sensor

1. Locate the engine coolant temperature sensor (1) on the right side of the engine, near the front (2).



2. Put drip pan under engine in case coolant leaks while changing sensor.
3. Disconnect electrical connection (3) from ECT sensor.
4. Remove the sensor (1) and discard the O-ring (4).

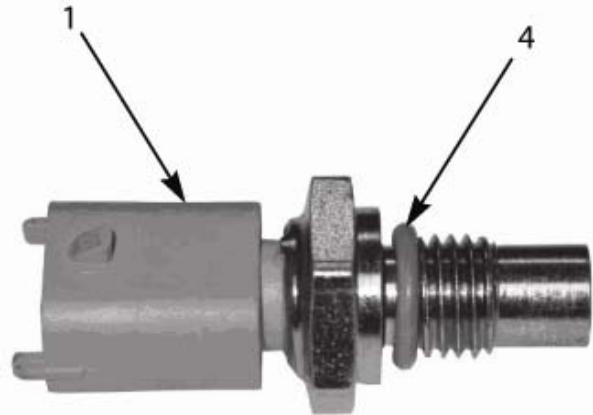
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.

**ECT Sensor**

1. Install new O-ring (4) on sensor.
2. Apply anti-corrosion to bottom couple threads of ECT sensor (1) without getting any on O-ring.
3. Install sensor in engine front cover assembly (2) and tighten.
4. Apply lubricant to electrical connector (3) and connect to sensor.
5. Clean up any spills and remove drip pan.

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c) Follow-On Maintenance

1. Reinstall generator bracket.
2. Reinstall generator.
3. Reinstall serpentine belt.
4. A/C belt reinstalled.
5. Reconnect Batteries.
6. Battery Disconnect Switch ON.
7. Start engine and run to operating temperature.
8. Check to make sure dash light for ECT has gone out and remains out on dash display.
9. Shut engine OFF.
10. Battery Disconnect Switch OFF.
11. Right side armor plate installed.
12. Right side FSS bracket installed.
13. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.18 Engine Oil Pressure (EOP) Sensor

ENGINE OIL PRESSURE SENSOR REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SET UP

Special Tools

None

Personnel

One (1) Wheeled Vehicle Mechanic

Material Parts

Engine oil pressure (EOP) sensor
(1)

O-ring (1)

Dielectric Compound

Reference

Parts Manual

Equipment Required

Drip Pan

Rags

GMT

Equipment Conditions

Engine shut OFF

Battery Disconnect Switch OFF

Parking brake set

Transmission set in NEUTRAL (N)

Wheels chocked

Follow-On Maintenance

Battery Disconnect Switch ON

Start engine and run to operating temperature

Check to make sure dash light for EOP has gone out and remains out on dash display

Shut engine OFF

Battery Disconnect Switch OFF

Remove wheel chocks

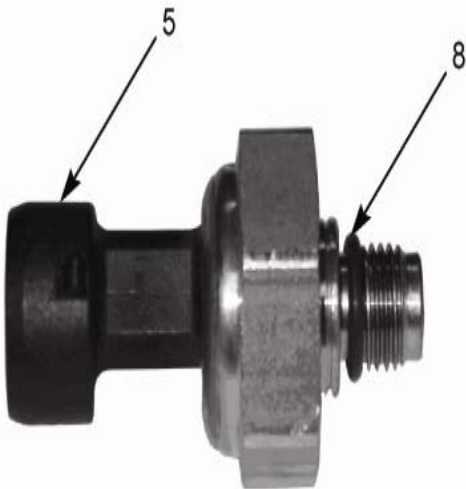
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Do not replace sensors while engine is hot. Removing sensors while engine is hot may cause damage to the internal threads on engine block, cause sensor to break or crack in engine block, engine block could crack, or cause extremely hot coolant or oil to spill out. Failure to comply may result in damage to equipment or serious injury or death to personnel.

1. Locate the engine oil pressure sensor (5) in the driver side of engine block (6) near the front.
2. Put drip pan under engine in case of oil leaks while changing sensor.



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3. Disconnect electrical connection (7) from EOP sensor.
4. Remove the sensor and discard the sensor (5) and O-ring (8).

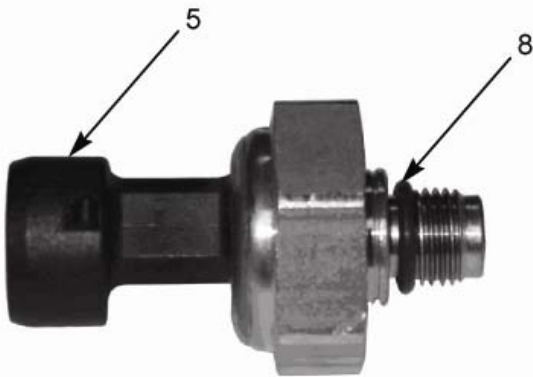
b) Installation



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

Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.

Chapter 4 – MAINTENANCE INSTRUCTIONS



1. Install new O-ring (8) on sensor.
2. Apply anti-corrosion to bottom couple threads of EOP sensor (5), without getting any on O-ring.
3. Install sensor in engine block assembly (6).
4. Apply lubricant to electrical connector (7) and connect to sensor.
5. Clean up any spills and remove drip pan.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine and run to operating temperature.
3. Check to make sure dash light for EOP has gone out and remain out on dash display.
4. Shut engine OFF.
5. Battery Disconnect Switch OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.19 Starter Motor Replacement

STARTER MOTOR REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Locknut (3) Lockwasher (3) Gasket Identification Tags Cable Ties</p>	<p><u>Equipment Condition</u> Engine shut OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Batteries Disconnected</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine to verify operation Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Before removal of any electrical component, disconnect negative ground cable from Batteries. Failure to comply may result in damage to equipment and/or serious injury or death to personnel.

NOTE

Tag and mark wires prior to removal to ensure proper installation and remove cable ties as required.

1. Remove locknuts, cables, and wires from studs on backside of starter. Discard locknuts.
2. Remove the three screws, lockwashers, starter (1) and gasket from engine. Discard lockwashers and gasket.
3. Check gasket area, clean, replace with new gasket and starter.

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b) Installation



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

1. Install gasket and starter (1) on engine with three lockwashers and screws.
2. Apply sealing compound to three locknuts.
3. Install wires and cable on studs with locknuts.
4. Tighten.

c) Follow-On Maintenance

1. Reconnect Batteries.
2. Battery Disconnect Switch ON.
3. Start engine to verify operation.
4. Shut engine OFF.
5. Battery Disconnect Switch OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.20 Engine Oil Cooler Pressure Regulator Replacement

ENGINE OIL COOLER PRESSURE REGULATOR REPLACEMENT		
This task covers:		
a) Removal	b) Cleaning	c) Inspection
d) Testing	e) Installation	f) Follow-On Maintenance
	<u>Equipment Conditions</u>	<u>Follow-On Maintenance</u>
INITIAL SET UP	Engine OFF	Install turbocharger
	Battery Disconnect Switch OFF	Install alternator
<u>Special Tools</u>	Parking brake set	Install CAC air hose
Oil Cooler Test Plate ZTSE4376	Transmission set in NEUTRAL	Reinstall Air In-Take
Torque Wrench	Wheels chocked	Install engine harness and related parts
	Right side FSS bracket removed	Re-connect batteries
<u>Personnel</u>	Right side armor plate removed	Fill oil system
One (1) Wheeled Vehicle Mechanic	Remove Turbocharger	Prime lubricating system
	Air In-Take removed	Inject oil in engine to fill filters & charger system
<u>Reference</u>	Remove charged air cooler air hose	Check oil level before engine is put back into service
Parts Manual	Drain oil	Battery disconnect Switch to the ON position
<u>Equipment Required</u>	Disconnect batteries	Right side armor plate installed
Rags	Remove alternator	Right side FSS nozzle bracket installed
Drain pan	Remove engine harness and related parts	Remove wheel chocks.
GMT		
<u>Material Parts</u>		
Oil Pressure Regulator Valve (1)		
Oil Cooler Bundle O-rings (2)		
Lubriplate™ Lubricant		
1 ft. length of 16 ga. Copper wire		
Oil Cooler O-ring Gasket (1)		
Oil filter gasket (1)		
Oil Cooler Square Cut O-ring (1)		
Water Supply Tube O-ring (1)		
Oil Filter (1)		

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



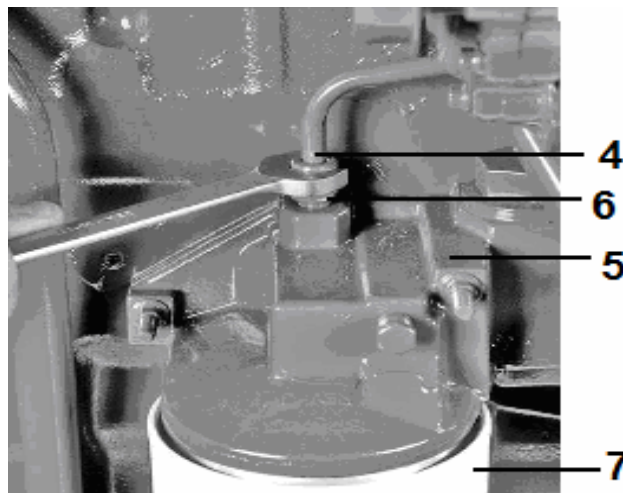
Wear safety goggles, work gloves and long sleeves when working on engine compartment. Use caution while working under the hood of the vehicle. Make sure it is secured properly. Do not smoke or have open flames around engine. Diesel fuel is flammable and can catch fire or explode. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Engine components become extremely hot during normal operation. Always allow engine to cool completely prior to performing any task or procedures on it. Working in close quarters in engine compartment can be difficult moving around. Wear proper safety equipment; safety goggles, work gloves, long sleeve or shop coat. Failure to comply may result in serious burns, cuts, or injury or death to personnel.

When working with compressed air, ensure that your safety goggles or full face shield are in place before using. Limit the air pressure to 30 psi (207 kPa) when using compressed air for cleaning to reduce the danger from flying debris. Failure to comply may result in serious injury or possible death to personnel.



To avoid possible damage to the engine, in case of bearing failure, oil cooler bundle must be replaced. Failed bearing debris cannot be removed from cooler bundle. Failure to comply will result in damage to equipment.

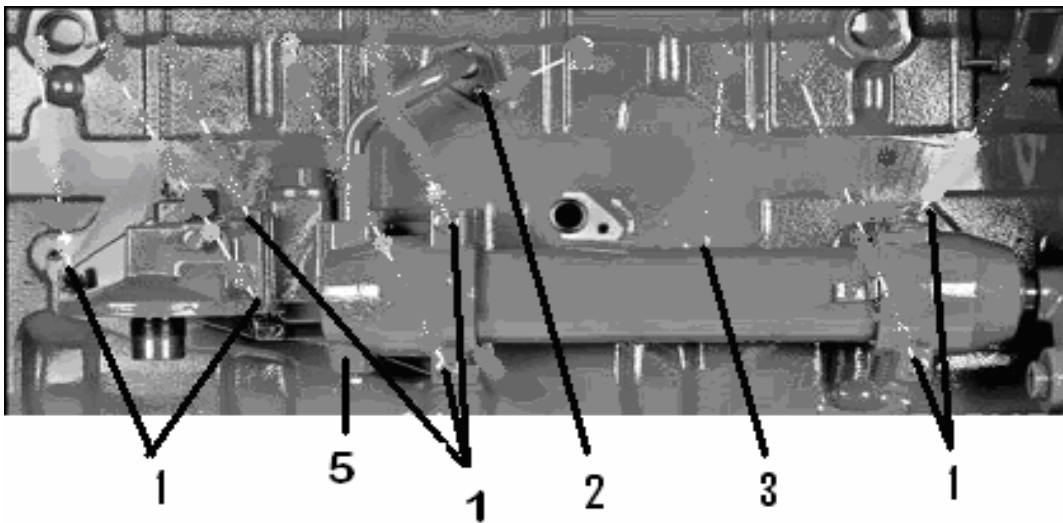
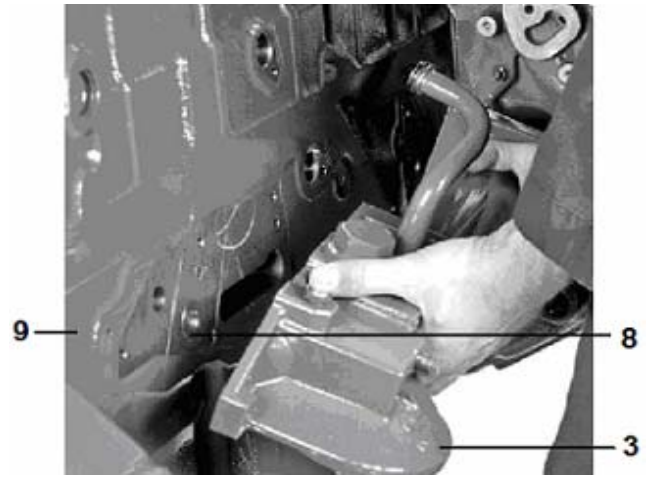
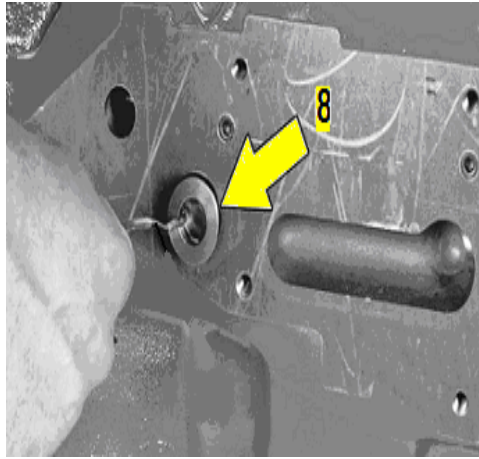


1. Loosen and remove oil feed supply tube (4) fitting (6) on top of oil filter header (5). Remove and discard tube fitting O-ring (6). Cap fitting on header for protection.
2. Loosen and remove oil filter (7). Discard oil filter in accordance with regulations.

Chapter 4 – MAINTENANCE INSTRUCTIONS

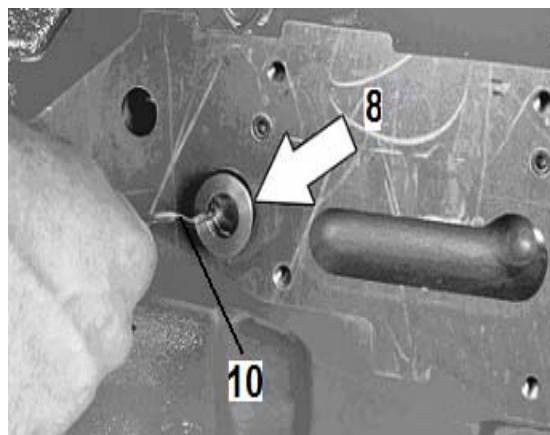
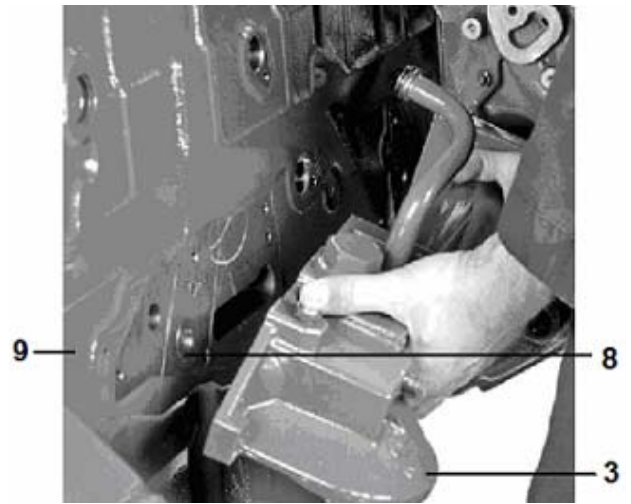
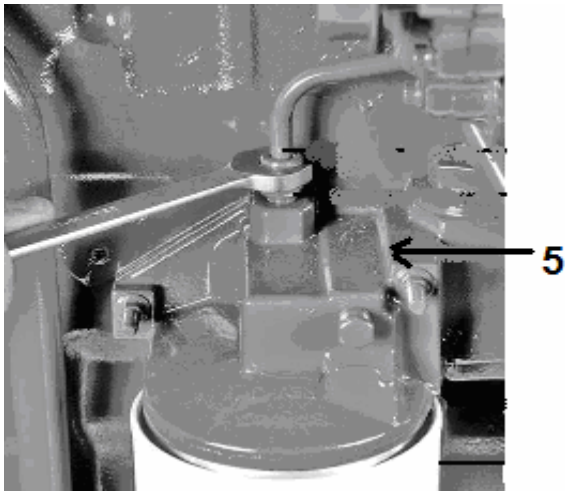
NOTE

Some severe service units have a short oil filter with an adapter installed inside the oil filter housing. DO NOT remove this adapter.



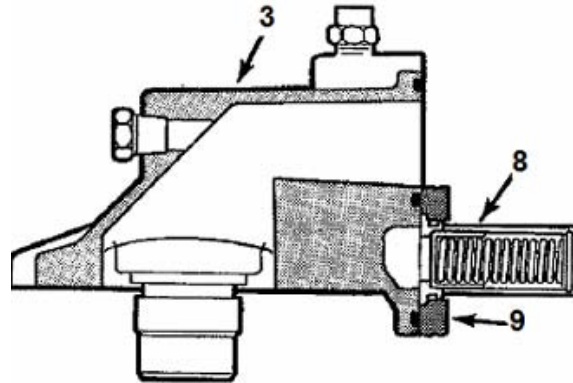
3. Remove water coolant supply tube bolt and retainer plate (2) from Engine Block (9).
4. Remove oil cooler assembly (3) seven mounting bolts (1) from Engine Block.
5. Remove oil cooler (3) with water supply tube (2) as assembly from Engine Block (9) to get access to the engine oil pressure regulator valve (8). Discard O-rings, gaskets and seals.
6. Gently tap on front of oil filter header (5), with non-metallic hammer, to loosen O-rings. Twist headers (5) and separate from cooler bundle (3).
7. Remove and inspect oil temperature control thermostat in oil filter and cooler header (3). Reinstall thermostat with new O-ring.

Chapter 4 – MAINTENANCE INSTRUCTIONS



8. Depress regulator valve (8) plunger. Insert a length of copper wire (10) through regulator valve (8). Release plunger to trap copper wire in regulator valve.
9. Pull copper wire (10) removing regulator valve (8) from crankcase (9). Discard oil pressure regulator valve.
10. Disassemble rear and front oil cooler headers (5) from oil cooler bundle (3).

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b) Cleaning



When working with compressed air, ensure that your safety goggles or full face shield are in place before using. Limit the air pressure to 30 psi (207 kPa) when using compressed air for cleaning to reduce the danger from flying debris. Failure to comply may result in serious injury or possible death to personnel.

NOTE

Do not use a corrosive solution on engine or related components.

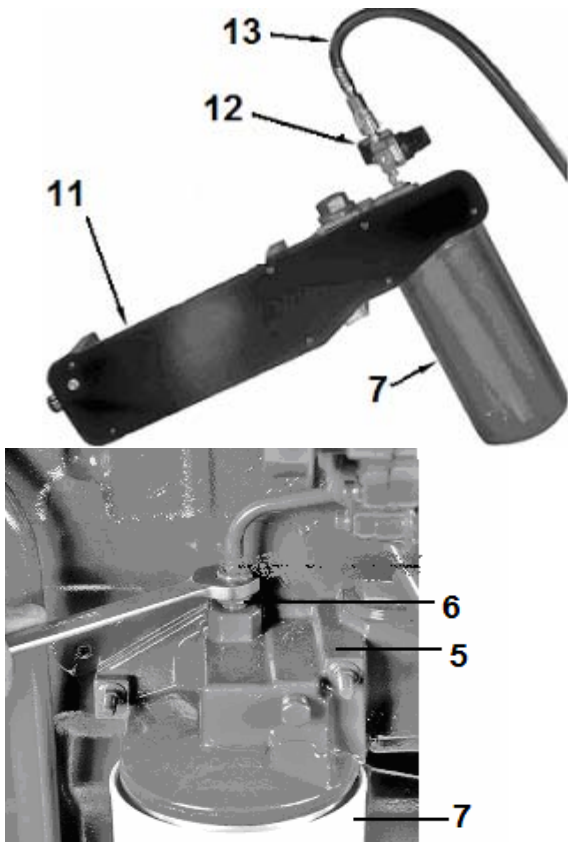
1. Immerse oil cooler, front, and filter header in suitable solvent. Flush and drain oil cooler to remove residue.
2. Dry all components thoroughly with filtered compressed air.

c) Inspection

1. Inspect oil cooler for blocked tubes and corrosion where tubes are assembled to bundle. Replace oil cooler tube bundle, if required.
2. Inspect header for blocked orifices or damaged threads at oil filter threaded insert.
3. Remove any debris that may be blocking oil flow passages.

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d) Testing



1. Fasten Oil Cooler Test Plate (11) to oil cooler header (5) with new oil cooler gaskets.
2. Install oil filter (7).
3. Install air pressure gauge (12) to oil cooler filter header (5) at turbocharger supply fitting (6).
4. Immerse assembly in a container of clean tap water.
5. Apply 100 psi (690 kPa) of air pressure (13) while assembly is immersed.
6. Inspect header castings, O-ring seals, and 1/4NPTF water side opening for leakage. Replace leaking component as required and retest.

Chapter 4 – MAINTENANCE INSTRUCTIONS

e) Installation



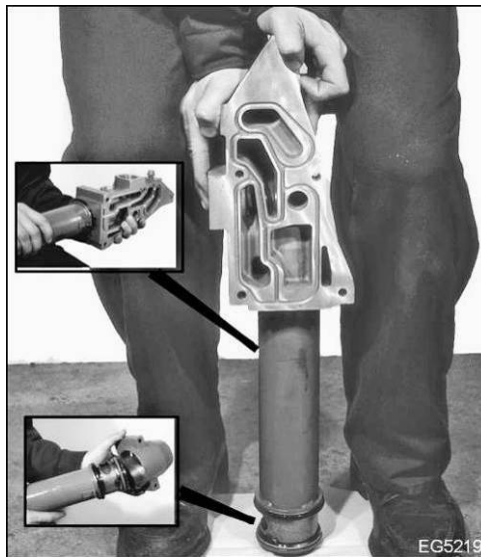
Anti-corrosion compound is toxic. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Do not get in eyes; wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves.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

Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.



To avoid engine damage, use new O-rings when assembling/installing oil cooler. Do not nick, cut, or distort O-rings during assembly/installation. Lubricate engine with oil before startup. Failure to comply will result in damage to equipment.

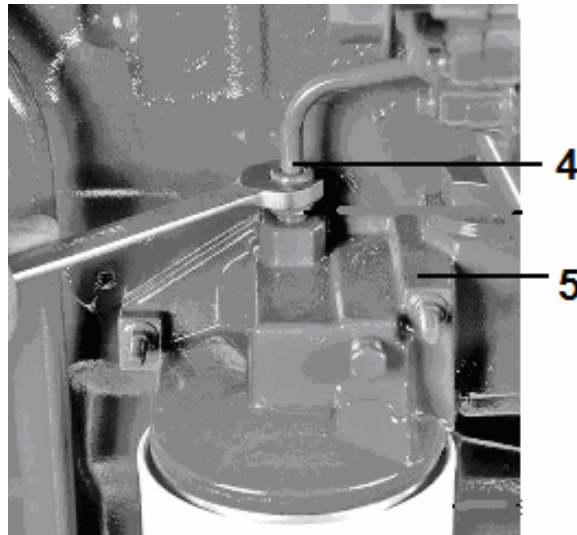
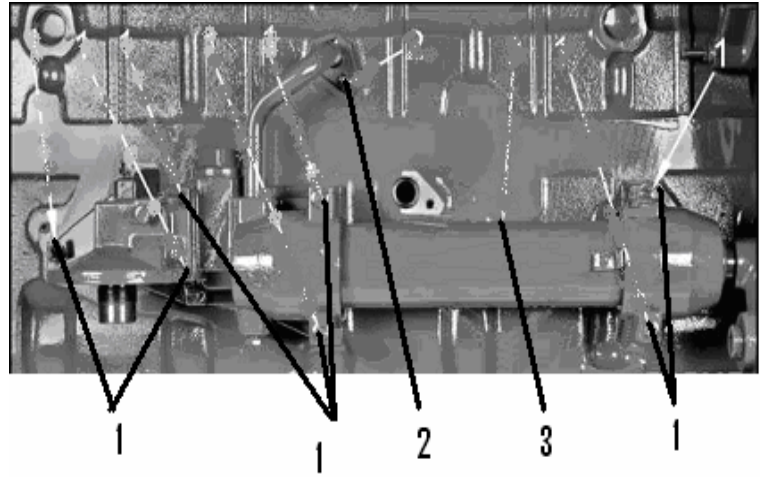
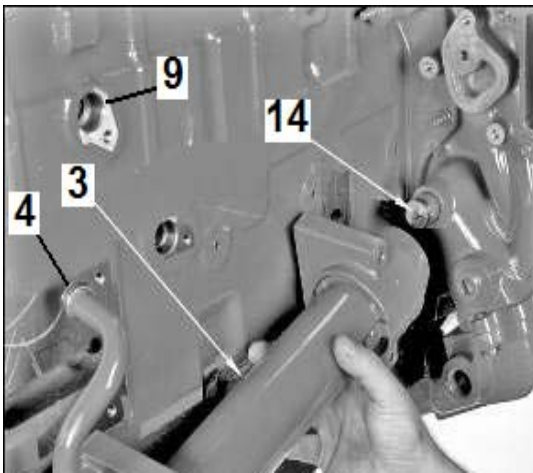
1. Apply connector lubricant to all electrical connectors that were disconnected.
2. Apply anti-corrosion compound to all mounting bolts removed during procedure.
3. Install new O-rings on oil cooler bundle. Do not nick, cut, or distort O-rings during installation.



4. Use Lubriplate™ to lubricate oil cooler bundle, header, and O-rings on cooler bundle.
5. Carefully press assembly together. Make sure locating clip of oil cooler headers (front and rear) align in slots of oil cooler bundle and header is not cocked. This procedure can be accomplished by using body weight to press assembly together.

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6. Install oil pressure regulator valve in crankcase.



7. Install water outlet tube (14) with new O-ring in front cover.
8. Install oil cooler assembly (3) with new square cut O-ring at front header and new O-ring gasket at rear header.
9. Install water inlet tube (4) in crankcase (9). Install retainer plate (2) for water coolant supply tube and tighten bolt to 15 ft-lb (20 N•m).
10. Install filter header (5) and oil cooler assembly (3) on Engine Block (9). Install seven mounting bolts (1) and tighten to 19 ft-lb (26 N•m).

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f) Follow-On Maintenance

1. Install turbocharger.
2. Install alternator.
3. Install CAC air hoses.
4. Reinstall Air Intake
5. Install engine harness and related parts.
6. Re-connect batteries.
7. Fill oil system.
8. Prime lubricating system.

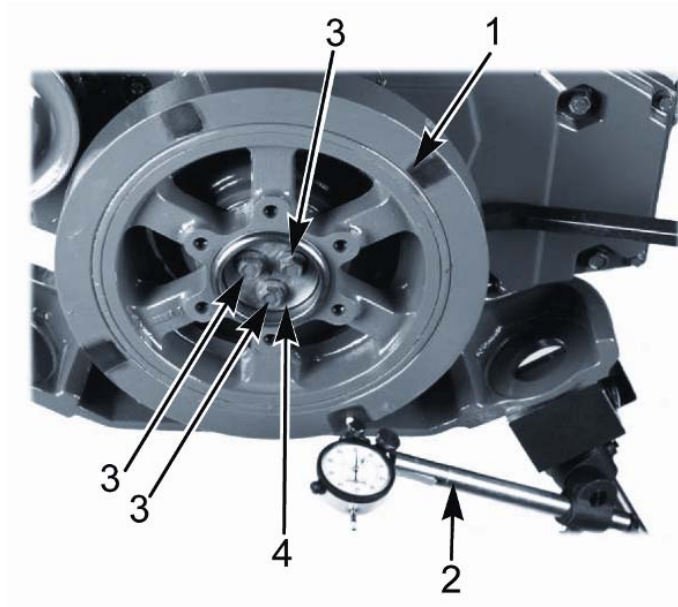


To avoid serious personal injury, possible death, and damage to vehicle or engine, do not rotate diesel engine when priming with oil. This may cause engine to accidentally start.

9. Inject sufficient oil in engine to fill oil filters and charger entire system.
10. After priming, check oil level before engine is put back in service.
11. Battery Disconnect Switch ON.
12. Start engine.
13. Verify oil pressure gauge operation.
14. Check for oil and coolant leaks.
15. Shut engine OFF.
16. Battery Disconnect Switch OFF.
17. Right side armor plate installed.
18. Right side FSS nozzle bracket
19. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



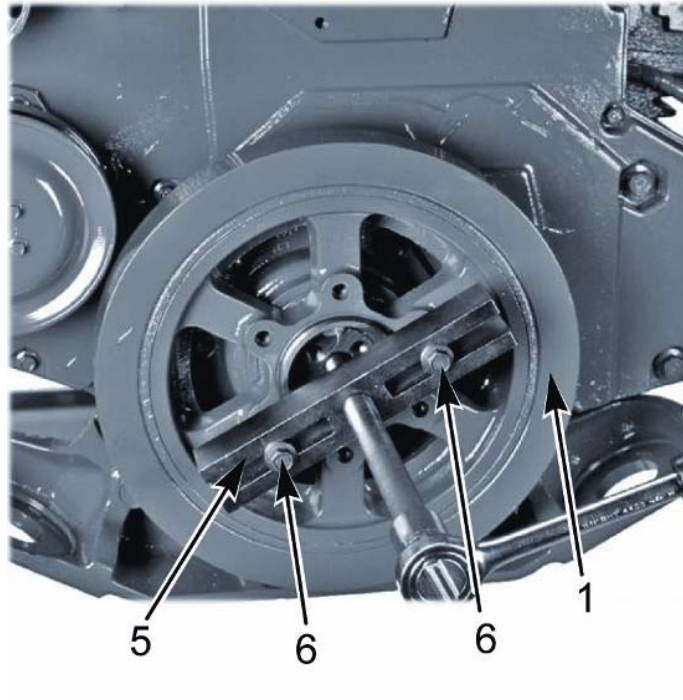
1. Remove paint from face of vibration damper (1) at four points, 90° apart.
2. Pry crankshaft forward to remove end-play.

NOTE

All crankshaft end-play should be removed prior to measuring vibration damper run-out.

3. Mount dial indicator (2) on front cover. Position indicator point on an unpainted surface and zero dial indicator.
4. Pry crankshaft forward and measure run-out, read dial indicator.
5. Repeat steps at each unpainted surface. If run-out exceeds .013mm (.0005 in), replace vibration damper.
6. Remove three vibration damper pulley bolts (3) and vibration damper retainer (4).
7. Inspect the damper bolts (3) and damper retaining plate (4). If the damper bolts are not grade 12.9, or one or more are damaged, discard the three vibration damper bolts and the vibration damper retaining plate. The damper retainer kit will be used to replace the vibration damper components. If the damper retaining plate is not 0.10 in. (2.54 mm) thick or is damaged, discard the three vibration damper bolts and the vibration damper retaining plate. The damper retainer kit will be used to replace the vibration damper components.

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8. Mount Gear and Pulley Puller (Large) (5) on vibration damper pulley (1), use bolts (6) long enough to hold puller in place. Turn forcing screw to remove vibration damper pulley (1).

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b) Installation



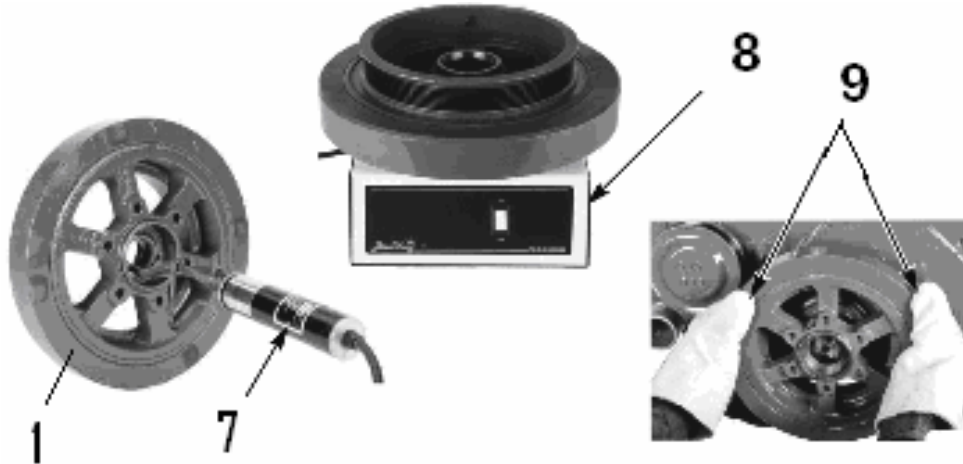
To avoid serious personal injury or possible death, use heat protecting gloves to install heated vibration damper.



To avoid possible engine damage, do not install rubber vibration damper when it is cold (room temperature).

NOTE

Make sure front mounting bracket is mounted to engine before installing vibration damper.



1. Mark rubber vibration damper (1) with 212° F (100° C) Thermo-melt Crayon.
2. Apply heat, attach Damper Heater (7) to vibration damper or place damper directly on hot plate (8).
3. When crayon mark melts, install rubber vibration damper (1) on crankshaft nose with welding or heavy insulated gloves (9). Make sure keyway on damper aligns with key on crankshaft.

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Viscous Vibration Damper



To avoid serious personal injury or possible death, use heat protecting gloves to install heated vibration damper.



To avoid possible engine damage, do not install rubber vibration damper when it is cold (room temperature).

NOTE

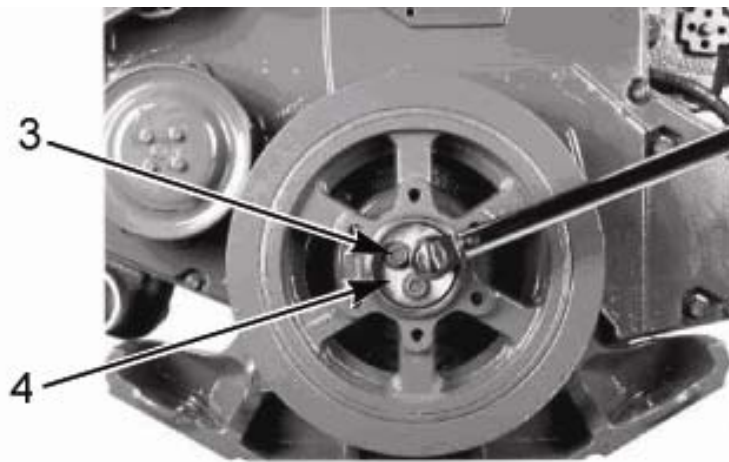
Make sure front mounting bracket is mounted to engine before installing vibration damper.

Retain Vibration Damper

NOTE

A damper retainer kit is available with grade 12.9 damper bolts and thicker damper retaining plate.

1. Install 0.10 in. (2.54 mm) thick damper retaining plate (4).
2. Install three grade 12.9 damper bolts (3).
3. Prevent crankshaft from turning, tighten damper bolts (3) in sequence, and continue until 100 ft-lb (136 N•m) torque is reached with no movement of any of the bolts.



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c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify operation.
4. Check for leaks.
5. Shut engine OFF.
6. Battery Disconnect Switch OFF.
7. Close engine hood.
8. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

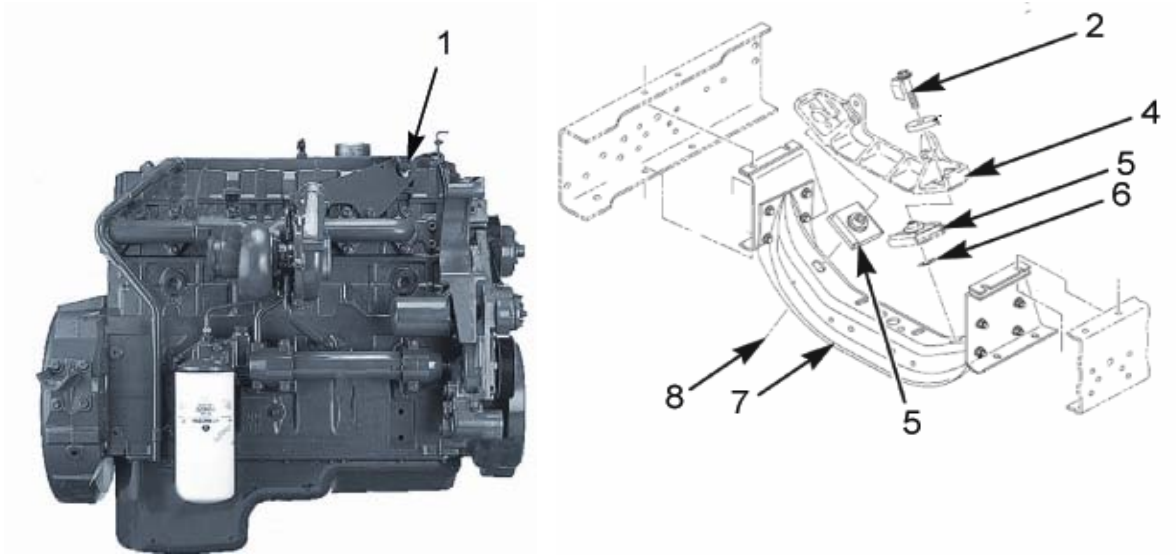
4-1.22 Front Motor Mounts Replacement

FRONT MOTOR MOUNTS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>	<u>Equipment Condition</u>	
¾" Dr. Torque Wrench	Engine shut OFF	
<u>Personnel</u>	Wheels chocked	
One (1) Wheeled Vehicle Mechanic	Battery Disconnect Switch OFF	
<u>Material/Parts</u>	Vibration damper removed	
Mount Bolt (8)	Parking brake set	
Front Engine Mount Insulator (2)	Transmission set in NEUTRAL (N)	
Insulator O-ring (2)	<u>Reference</u>	
Insulator Mount Bolt (2)	Parts Manual	
Insulator Mount Nut (2)	<u>Equipment Required</u>	
Motor Mount Bracket (1)	Engine lifting device (1)	
	<u>Follow-On Maintenance</u>	
	Install vibration damper	
	Close vehicle hood	
	Battery Disconnect Switch ON	
	Start engine	
	Check for engine shake or vibration	
	Shut engine OFF	
	Battery Disconnect Switch OFF	
	Remove wheel chocks	

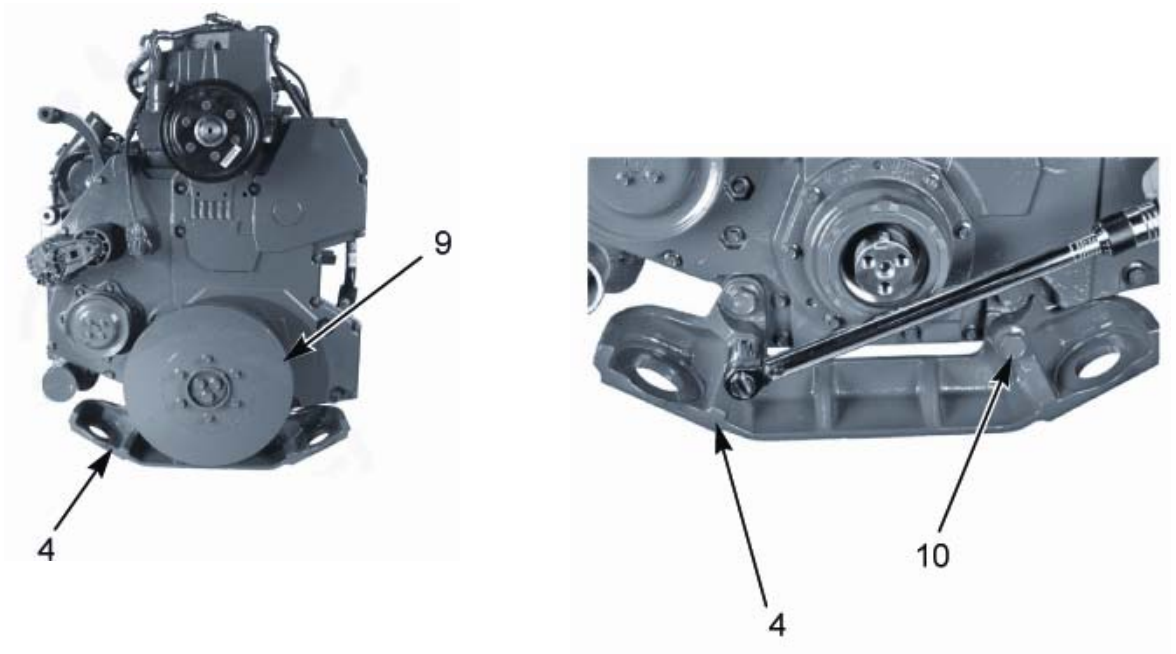
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. Open and secure engine hood.
2. Use suitable lifting device and attach to front lifting eyelet (1) on engine.



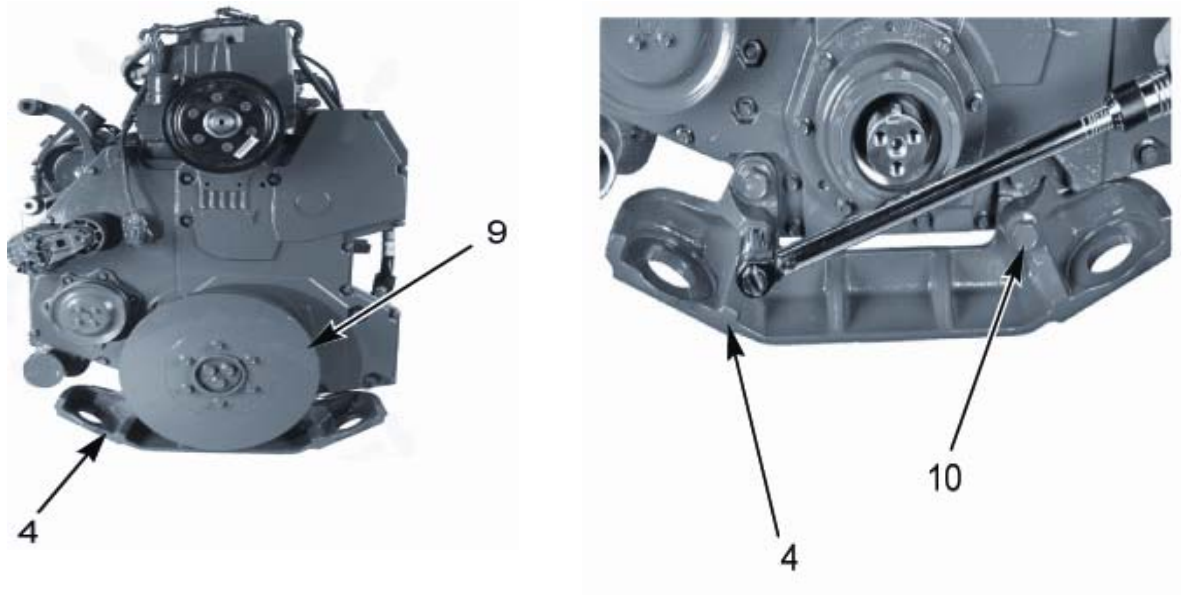
3. Remove and discard two insulator mounting bolts (2), hex nuts (8), front rubber engine mount insulators (5), O-rings (6), from crossmember (7).
4. Lift engine so front mount bracket (4) clears crossmember (7).



5. Remove vibration damper (9) from front of engine.
6. Remove and discard four mount bracket bolts (10) from front mounting bracket (4).
7. Remove and discard front mounting bracket (4).

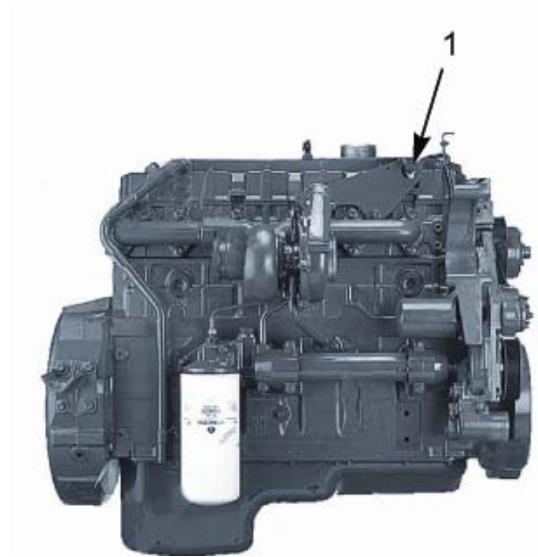
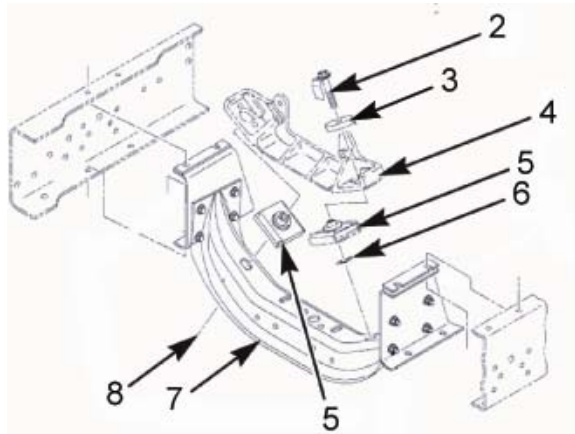
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Install new front mounting bracket (4) using four new bolts (10).
2. Torque four bolts (10) to 284 ft-lb (386 N•m).
3. Install vibration damper (9).

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4. Insert new engine mount insulators (5) and O-ring (6) between motor mount bracket (4) and crossmember (7).
5. Lower engine and front mounting bracket (4) on the crossmember (7).
6. Secure mounting bracket (4), with flanged head mounting bolts (2), going through insulators (3) and (5), O-ring (6), and crossmember (7).
7. Install hex nut (8) on flanged head mount bolts (2).
8. Remove hoist from engine lifting eyelet (1).
9. Close engine hood.

c) Follow-On Maintenance

1. Install vibration damper.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Check for shake and vibration.
5. Shut engine OFF.
6. Battery Disconnect Switch OFF.
7. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

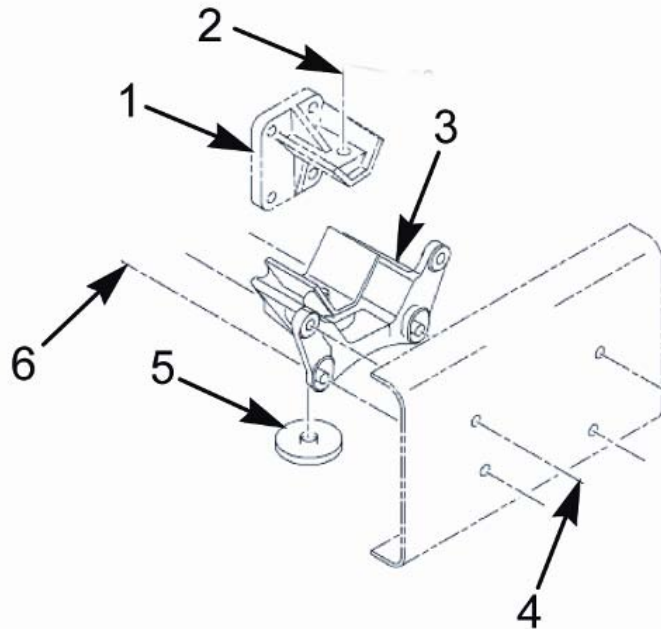
4-1.23 Rear Motor Mounts Replacement

REAR MOTOR MOUNTS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Insulator rear engine mount (2) Insulator, Rubber mounting bolt (2) Bolt, insulator mount (8) Nut, hex insulator mount (8) Bolt, flanged head (2)</p>		<p><u>Equipment Condition</u> Engine shut OFF Wheels chocked Battery Disconnect Switch OFF Engine hood open and secured Parking brake set Transmission set in NEUTRAL (N) Belly Armor Removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Suitable lifting device Lifting chains</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine Check for shake and vibration Shut engine OFF Battery Disconnect Switch OFF Close engine hood Install Belly Armor Remove wheel chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. Use suitable lifting device with chain and attach to rear lifting eyelet on engine.



2. Remove insulator mounting bolt (2) that connects engine mount bracket (1) to rear engine mount insulator (3).
3. Lift engine with rear mount bracket (1) high enough to remove rear insulator (3).
4. Remove and discard hex nuts (4), bolts (6), and insulator (5). Note location of insulator (5) for installation.
5. Remove and discard rear engine mount insulator (3).

b) Installation

1. Install new rear engine mount insulator (3) to side frame using bolts (6) and hex nuts (4).
2. Install rubber mounting bolt insulator (5) on rear engine mount insulator (3) noting location from the removal step.
3. Lower engine and engine mount bracket (1) into cradle of rear engine mount insulator (3).
4. Secure engine mount bracket to rear engine mount insulator with flanged head bolt (2).
5. Remove suitable lifting device and chain from engine lifting eyelet.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Check for shake and vibration.
4. Shut engine OFF.
5. Battery Disconnect Switch OFF.
6. Close engine hood.
7. Install Belly Armor.
8. Remove wheel chocks.

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4-1.24 Crankshaft Damper and Front Seal Assembly Replacement

CRANKSHAFT DAMPER AND FRONT SEAL ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		<u>Equipment Required</u>
		None
<u>Special Tools</u>		<u>Equipment Conditions</u>
Torque wrench		Battery Disconnect Switch OFF
Crankshaft Seal Installing Tool		Engine shut OFF
		Parking brake set
		Transmission selector in NEUTRAL (N)
		Wheels chocked
<u>Personnel</u>		Open engine hood and secure
One (1) Wheeled Vehicle Mechanic		Front Vibration Damper Removed
<u>Material Parts</u>		<u>Reference</u>
Crankshaft front seal		Parts Manual
RTV		
Thermo-melt Crayon 212°F (100°C)		<u>Follow-On Maintenance</u>
		Install front Vibration Damper
		Fill engine oil
		Battery Disconnect Switch ON
		Start engine
		Check for leaks
		Shut engine OFF
		Close Hood

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International® Mine Protected Vehicle (I-MPV) armor parts are heavy. Use care when removing or installing. DO NOT attempt to lift without the aid of an assistant and a suitable lifting device. Failure to comply may result in serious injury or death to personnel.

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing any task. DO NOT touch the exhaust system components with bare hands or with your body use protective work gloves and long sleeves. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

a) Removal

1. Remove front crankshaft oil seal.

b) Installation

1. Install front crankshaft seal with proper seal installing tool.

c) Follow on Maintenance

- a. Install Vibration Damper.
- b. Top off engine oil.
- c. Battery Disconnect Switch ON.
- d. Start engine.
- e. Check for leaks.
- f. Shut engine OFF.
- g. Close engine hood.

Chapter 4 – MAINTENANCE INSTRUCTIONS

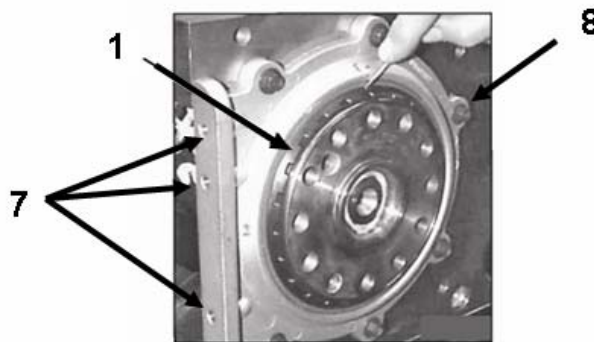
a) Removal



Wear safety goggles, work gloves, and long sleeves when working on vehicle. Avoid working on vehicle when engine is still hot, allow to cool to avoid damage or injury. When using a jack under vehicle make sure that it is positioned properly under component it is intended for and safety straps are used to avoid injury.

NOTE

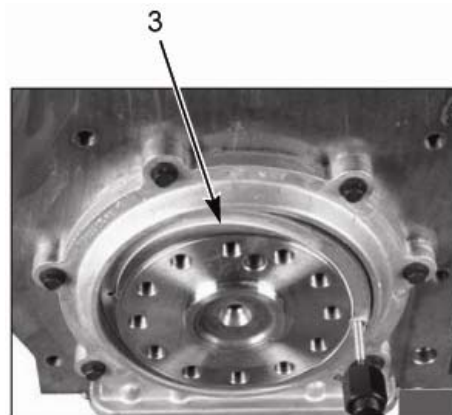
It is not necessary to remove the flywheel housing if the rear oil seal carrier, oil seal, and wear sleeve are being replaced. It is not necessary to remove the rear oil seal carrier if there is no leakage and the crankshaft is not being removed. The applicable steps should be followed.



1. Remove 4 each oil pan bolts (7).
2. Remove 6 each bolts from seal housing (8).
3. Remove seal housing (1).



When removing rear oil seal from housing be careful to avoid scratching housing.

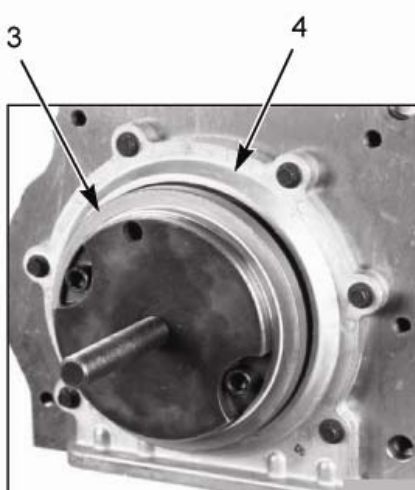


4. Remove rear oil seal (3) from carrier, discard oil seal. Use slide hammer with appropriate adapter end from Slide Hammer Puller Set (ZTSE1879).

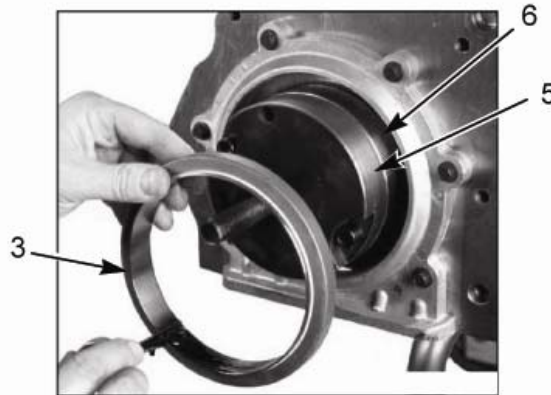
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

1. Install main oil gallery cup plug, if not already installed.
2. Clean crankshaft flange and seal carrier bore (4) thoroughly. Remove any debris.



3. Attach Rear Oil Seal (3) and Wear Sleeve Installer (ZTSE2435C) (5) with two mounting screws to crankshaft flange.



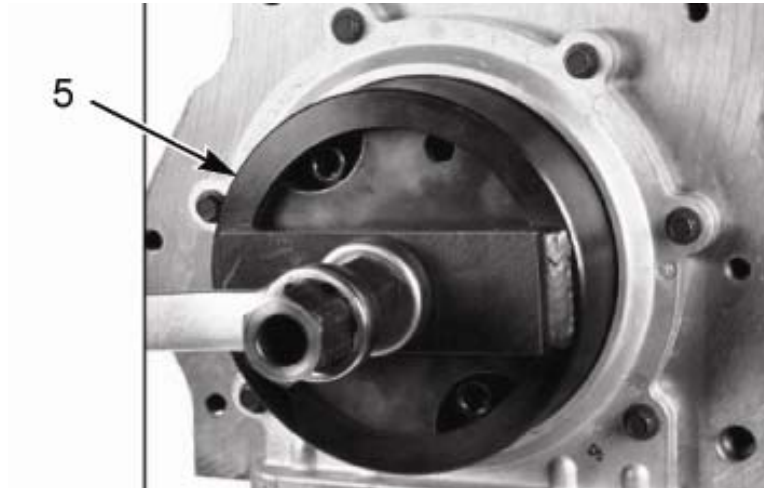
4. Coat inside diameter of wear sleeve and outside diameter of oil seal (3) with Permatex® lubricant.
5. Position oil seal and wear sleeve over crankshaft (6).

NOTE

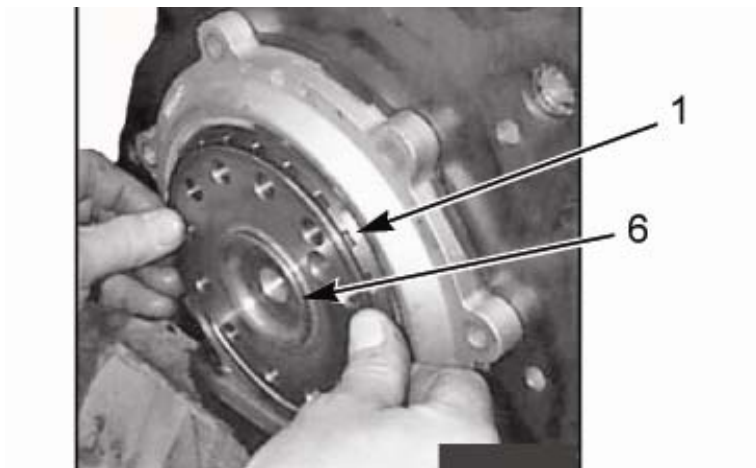
Proper use of installer tool will ensure oil seal and wear sleeve are pressed on crankshaft flange to proper depth.

6. Assemble Rear Oil Seal (3) and Wear Sleeve Installer (5) on crankshaft (6). Turn forcing nut, with appropriate sized wrench, on Rear Oil Seal and Wear Sleeve Installer until seal and sleeve are seated in bore.

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7. Remove Rear Oil Seal and Wear Sleeve Installer (5).



8. Place new pose seal (1) on end of crankshaft (6). Work pose seal on by moving pose seal in circular direction until pose seal is on completely.

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c) Follow-On Maintenance

1. Install flywheel and tighten to specification.
2. Install exhaust pipes and tighten to specification.
3. Install starter and tighten to specification.
4. Install transmission and tighten to specification.
5. Refill/top-off transmission fluid.
6. Battery Disconnect Switch ON.
7. Start engine.
8. Verify operation.
9. Check for leaks.
10. Shut engine OFF.
11. Remove chocks.

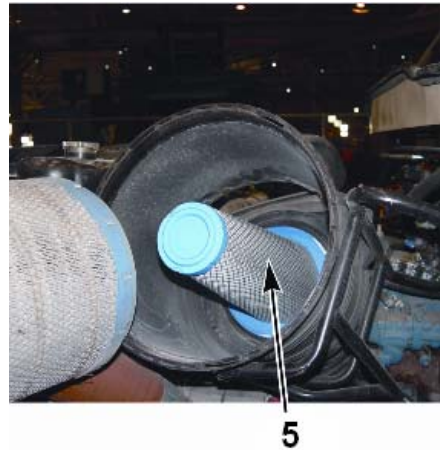
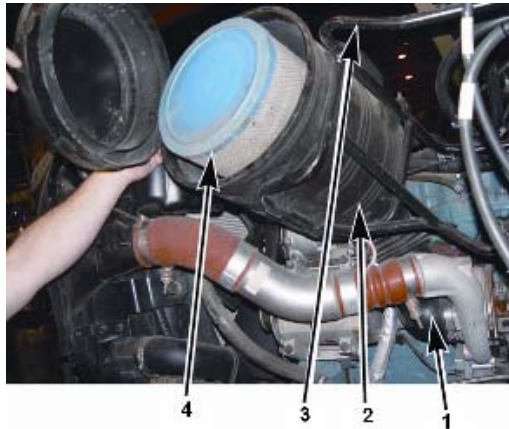
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.26 Air Cleaner Assembly Replacement

AIR CLEANER ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Engine hood open and secured
<u>Personnel</u>		<u>Reference</u>
One (1) Wheeled Vehicle Mechanic		Parts Manual
<u>Material/Parts</u>		<u>Equipment Required</u>
Air Cleaner Cover Assembly Filter Element Primary (1) Filter Element Secondary (1)		None
		<u>Follow-On Maintenance</u>
		Battery Disconnect Switch ON Start engine Verify operation of center console gauge Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks Close engine hood

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a) Removal



1. Loosen screw securing hose clamp on the bottom side of the air cleaner assembly (2).
2. Remove the two hex nuts securing air cleaner assembly (2) to air cleaner support bracket (3).
3. Remove Air restriction tube.
4. Disconnect electrical air sensor.

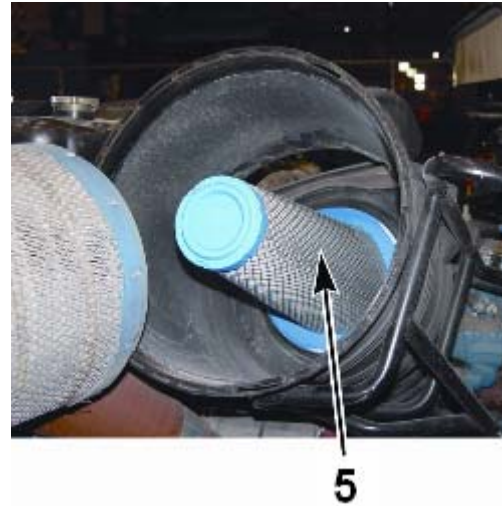
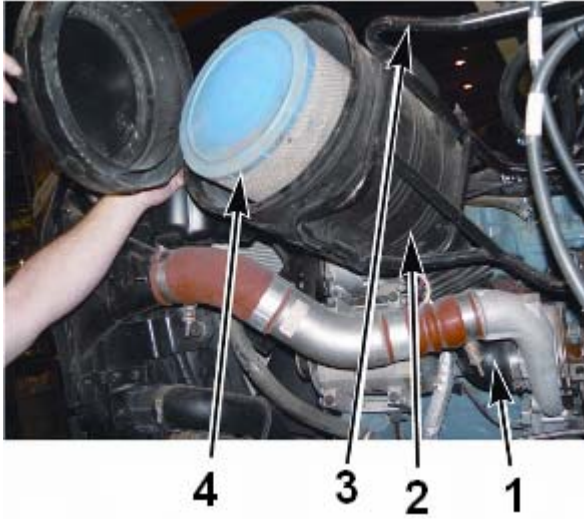
NOTE

DO NOT bump the filter while in the housing; it can raise a cloud of dust that can enter the clean side piping to the turbocharger.

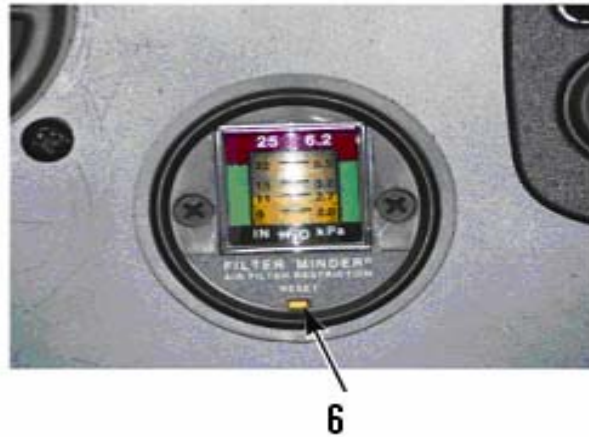
5. Remove air cleaner assembly.
6. Remove electrical air sensor for canister.
7. Remove air cleaner assembly (2) from air cleaner hose (1).
8. Remove primary air filter (4) and secondary air filter (5) from the air cleaner assembly (2).

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b) Installation



1. Inspect the filter elements for a damaged or non-resilient rubber gasket. Inspect the filter element body for dents or excessive pleat bunching. If any of the mentioned conditions exist, obtain a new service element. Install the new elements using the Air Filter Element Replacement procedure.
2. Install secondary element (5) and primary element (4) into the new air cleaner assembly (2).
3. Install electrical air sensor to canister.
4. Install air cleaner assembly (2) on the cleaner support bracket (3) using two hex nuts.
5. Install air cleaner hose (4) to the bottom of air cleaner assembly (2). Secure clamp screw.
6. Reconnect air restrictor gauge tube.



NOTE

When servicing is completed, reset the air restriction gauge on the instrument panel by pushing the reset button (6) and releasing it. The AMBER indicator will drop below the window. Now the air restriction gauge is ready for the next operating cycle.

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c) Follow-On Maintenance

- a. Battery Disconnect Switch ON.
- b. Start engine.
- c. Verify operation of center console gauge.
- d. Shut engine OFF.
- e. Battery Disconnect Switch OFF.
- f. Remove wheel chocks.
- g. Close engine hood.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.27 Charge Air Cooler Assembly Replacement

CHARGE AIR COOLER ASSEMBLY REPLACEMENT	
This task covers:	
a) Removal	b) Installation
	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Material Parts</u> Charge Air Cooler (1) Spring-loaded & Straight T-bolt Hose Clamps (4)</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p>	<p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission selector in NEUTRAL (N) Wheels chocked Left side FSS Nozzle Bracket Removed Right Side FSS Nozzle Bracket Removed Left Side Armor Plate Removed Right Side Armor Plate Removed Remove CAC air hoses Hood Removed Remove armor grill</p> <p><u>Follow-On Maintenance</u> Reinstall armor grill Reinstall Hood Left side armor plate installed Left side FSS Nozzle bracket installed on armor Right side FSS nozzle bracket installed on armor Battery Disconnect Switch ON Start engine Verify operation of system Shut engine OFF Battery Disconnect Switch OFF Remove wheel chocks</p>

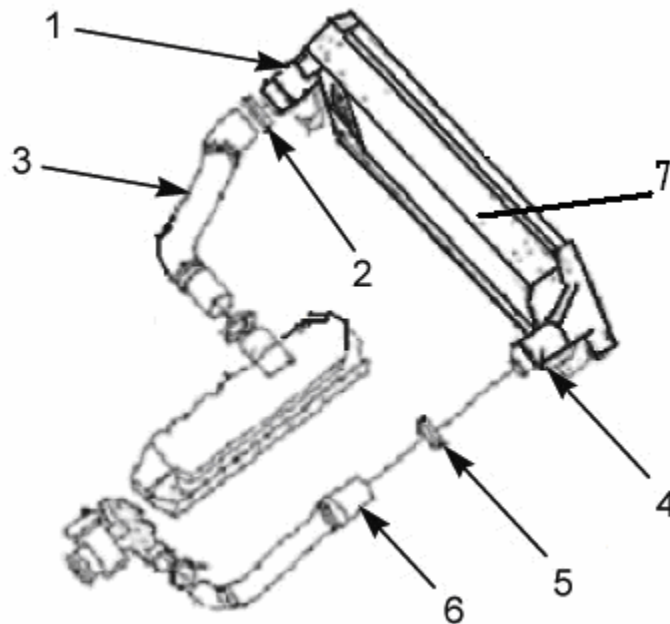
Chapter 4 – MAINTENANCE INSTRUCTIONS



Before opening the hood, make sure that there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself or an assistant between the hood and any other structure. Failure to comply may result in serious injury or death.

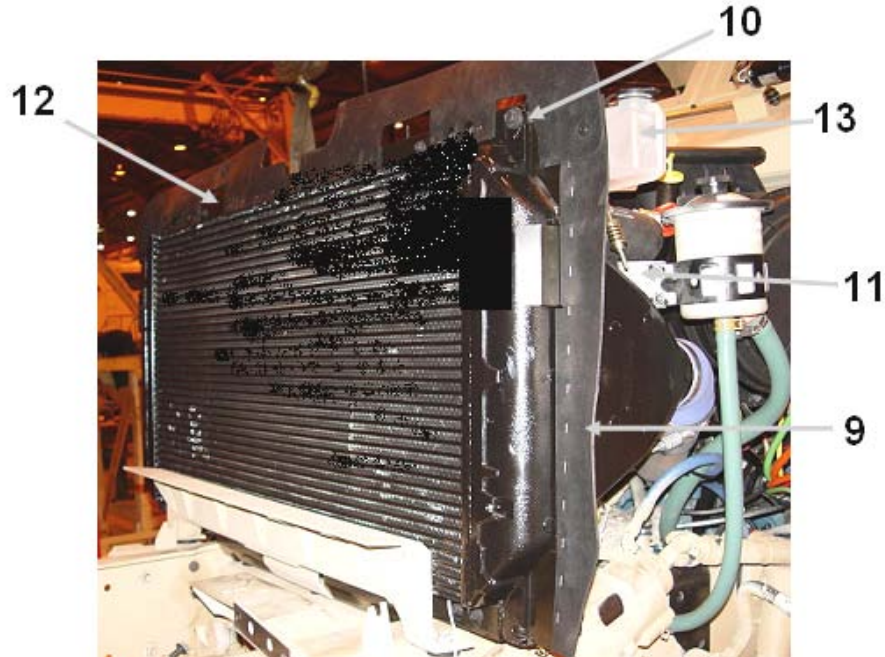
DO NOT touch the exhaust system components with bare hands or with your body use protective work gloves and long sleeves. DO NOT use the exhaust tailpipe as a step. It will not hold weight and will collapse. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

a) Removal

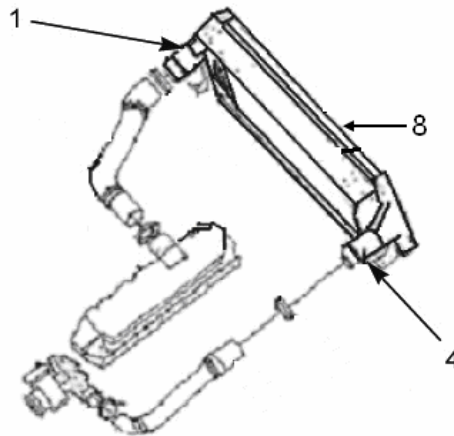


1. Inspect clamps (2) and (5) and hoses (3) and (6) before removing charge air cooler ends (1) and (4).
2. Loosen clamp (2) and (5) on the end of exhaust (6) and intake (3) hoses right at the charge air cooler ends (1) and (4) attached to the radiator core (7) support.
3. Remove exhaust pipe hose (6) and cover end with towel and remove the charge air cooler (4) from radiator core support and dispose of.
4. Remove intake pipe hose (3) and cover end with clean towel and remove the charge air cooler (1) from the radiator core support and dispose of.

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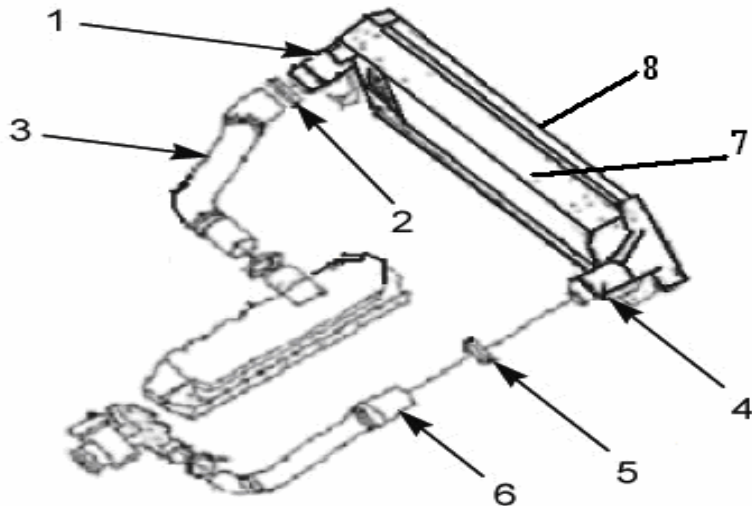


5. Remove 9 bolts from radiator to hood seal (9).
6. Remove 4 mounting bolts (10) from cooler to Radiator.
7. Remove Power Steering Reservoir Bracket (11) to Radiator.
8. Remove Radiator Reservoir (12) and Bracket from Radiator.
9. Remove over-flow tank (13).
10. Disconnect charge air cooler ends (1 and 4) from charge air cooler (8) in accordance with local regulations.



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b) Installation



1. Inspect new charge air cooler parts for signs of damage. If damage is found, DO NOT INSTALL, throw them away and replace.
2. Install new charge air cooler (8) to radiator (7) and tighten to 47 ft-lb (64 N•m).
3. Install intake side charge air cooler (1) and tighten mounting bolts to 47 ft-lb (64 N•m).
4. Reinstall over-flow tank.
5. Reinstall power steering reservoir bracket to radiator.
6. Reinstall radiator reservoir and bracket to radiator.
7. Reinstall 9 mounting bolts to hood seal on radiator.
8. Uncover and install intake pipe (3) to charge air cooler (1) and tighten clamp (2) to 50-60 in-lb (5.65-5.78 N•m).
9. Install exhaust side charge air cooler (4) and tighten mounting bolts to 47 ft-lb (64 N•m).
10. Uncover and install exhaust pipe (6) to charge air cooler (4) and tighten clamp (5) to 50-60 in-lb (5.65-5.78 N•m).

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c) Follow-On Maintenance

1. Reinstall armor grill.
2. Reinstall Hood.
3. Left side armor plate installed.
4. Right side armor plate installed.
5. Left side FSS nozzle bracket installed on armor.
6. Right side FSS nozzle bracket installed on armor.
7. Battery Disconnect Switch ON.
8. Start engine.
9. Verify operation of system.
10. Shut engine OFF.
11. Battery Disconnect Switch OFF.
12. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-1.28 Air Hose Pressure Test

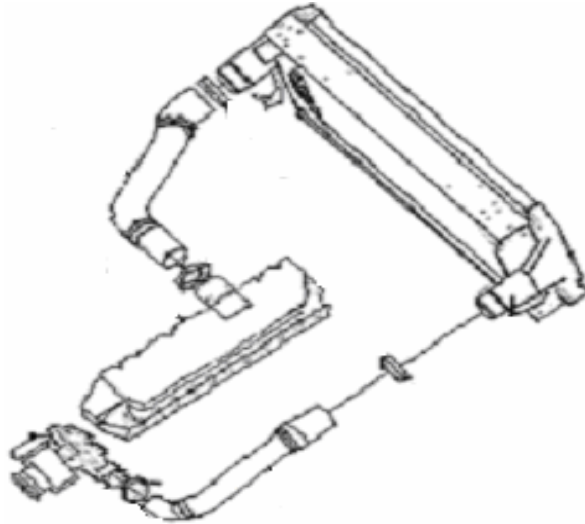
AIR HOSE PRESSURE TEST		
This task covers:		
a) Inspection	b) Connecting Testing Tool	c) Testing
d) Installation		e) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> CAC Leakage Tester ZTSE-4341 Stop Watch</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Material Parts</u> Exhaust Air Pipe (1) Intake Air Pipe (1) Spring-loaded & Straight T-bolt hose Clamps (4)</p>		<p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking Brake Set Transmission Selector in NEUTRAL (N) Wheels chocked Engine hood opened and secured Remove CAC air hoses L & R FSS Removed Air filter canister removed L & R Armor Removed</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Install CAC Air Hoses Install Air Filter Canister Start engine Verify operation Check for leaks Shut engine OFF Battery Disconnect Switch OFF Install L&R Armor Install L&R FSS Remove wheel chocks Close engine hood</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Inspection

NOTE

Charge air coolers are not required to be leak-proof. DO NOT test the cooler core for leakage by submerging it in a radiator test tank. Almost all cooler units will show leakage if they are submerged. It is not necessary to remove the charge air cooler from the vehicle to perform this test.



1. Before performing this test, visually inspect the core, tanks and welds for cracks and holes.
2. If the cooler fails this visual inspection, replace the charge air cooler.

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b) Connecting Testing Tool

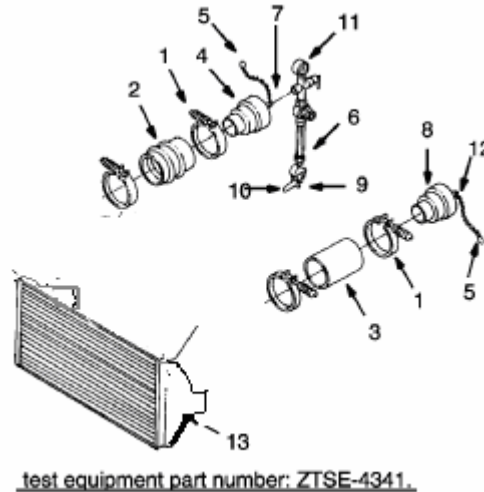
Charge Air Cooler Inlet Connection (Turbocharger Exhaust “Hot” Side)



To prevent foreign matter from entering the engine, cover the turbocharger exhaust and intake piping while the charge air cooler is disconnected. Failure to comply may result in damage to equipment.

NOTE

Use the following procedure to test the charge air cooler for excessive leakage.



test equipment part number: ZTSE-4341.

1. Disconnect the turbocharger exhaust piping from the charge air cooler hose (2).
2. Install the gauge coupler (4) to the charge air cooler hose (2). Secure the coupler with a clamp (1) so it is air tight. Tighten the clamp, to the valve, in accordance with the torque chart at the end of this task.
3. Connect the safety chain (5) to any convenient capscrew on the radiator bracket.



To prevent the possibility of the coupler blowing off the charge air cooler hose during the test, connect the safety chain before applying air pressure to the system. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

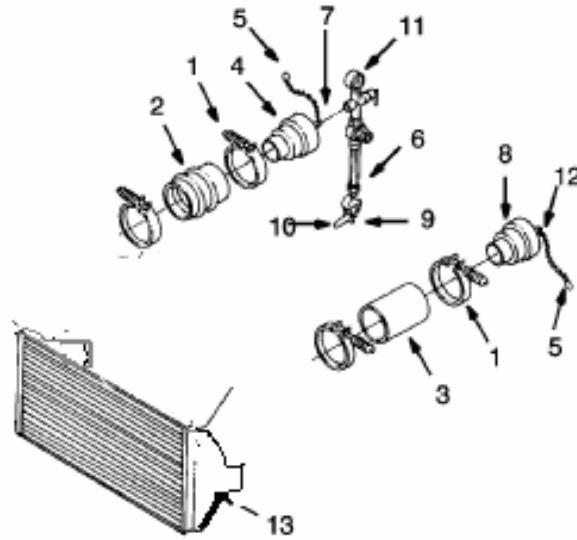
4. Install the gauge-regulator assembly (6) on the gauge coupler (4) at the quick disconnect fitting (7) on the coupler (4).

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Charge Air Cooler Outlet Connection (Engine Air Intake “Cold” Side)



To prevent foreign mater from entering the engine, cover the turbocharger exhaust and intake piping while the charge air cooler is disconnected. Failure to comply may result in damage to equipment.



test equipment part number: ZTSE-4341.

1. Disconnect the engine air intake piping (3) from the charge air cooler hose.
2. Install the bleed-off coupler (8) to the charge air cooler hose (3). Secure the coupler (8) with a clamp (1) so it is air tight. Tighten the clamp to the value in the torque chart at the end of this task.
3. Connect the safety chain to any convenient capscrew on the radiator.



To prevent the possibility of the coupler blowing off the charge air cooler hose during the test, connect the safety chain before applying air pressure to the system. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

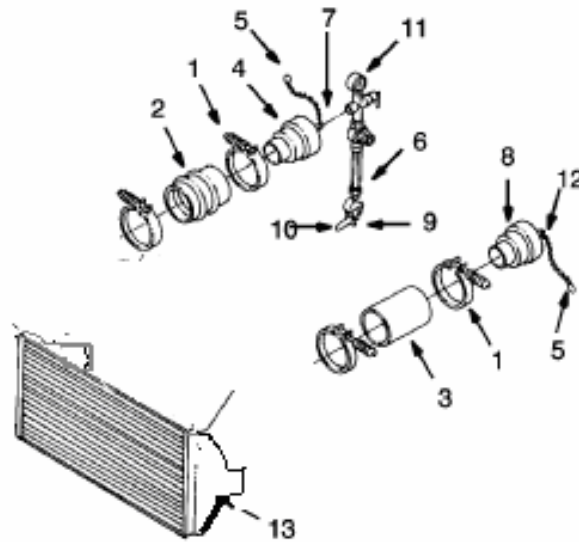
Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Testing

1. Connect a filtered air supply to the quick disconnect fitting (9) on the gauge-regulator assembly (6).



To prevent the adapters from blowing off during the test, increase air pressure slowly. After testing, relieve the pressure slowly through the bleed valve before removing the test equipment from the charge air cooler. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



test equipment part number: ZTSE-4341.

2. Open the air valve (10) slightly, and increase the air pressure slowly until the air gauge (11) reads 30 psi (205kPa). Close the air valve (10) and monitor the air gauge (11) with a stop watch for 15 seconds. Note and decrease in pressure.
3. Repeat the entire test three times to verify test.
 - a. The charge air cooler (13) passes if the pressure drop is 5 psi (34 kPa) or less in 15 seconds.
If the charge air cooler passes, the test is complete. Bleed air from the system by depressing the bleed-off valve (12) on the bleed-off coupler (8). Remove the air hose, gauge-regulator assembly (6), and both couplers (4) and (8). Install hoses.
 - b. The charge air cooler (13) fails if the pressure drop is more than 5 psi (34 kPa) in 15 seconds.
Check for air leaks by using a pump spray bottle to apply a soapy solution to the hoses and the charge air cooler hose connections and test equipment. No bubbles should appear.
If the charge air cooler fails or any hoses or clamps fail, replace the defective part. Assemble the charge air cooler and hoses; tighten the hose clamps to the value in the torque chart at the end of this task. Repeat the air leak test three times to verify test.

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d) Installation

1. Disconnect filtered air supply by the quick connect fitting (9) and remove testing equipment.
2. Install the charge air cooler hoses (2) and (3) on the exhaust and intake sides of the engine.
3. Install the intake to radiator charged air hose by sliding clamps (1) over the hose before attaching to radiator support and rocker cover/intake manifold.
4. Install the exhaust to radiator charged air hose by sliding clamps (1) over the hose before attaching to the radiator support and turbocharger.
5. Tighten clamps to specification: (See chart on next page)

Spring-loaded and Straight T-bolt Hose Clamps		
Pipe	Torque	
Material	For New Hoses	For Heat-Set Hoses
Aluminum	50-60 in-lb (5.65-6.78 N•m)	50 in-lb (5.65 N•m)
Steel	65-75 in-lb (7.34-8.37 N•m)	65 in-lb (7.34 N•m)

e) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Install CAC Air Hoses.
3. Install Air Filter Canister.
4. Start engine.
5. Verify operation.
6. Check for leaks.
7. Shut engine OFF.
8. Battery Disconnect Switch OFF.
9. Install L&R Armor.
10. Install L&R FSS Nozzle Bracket.
11. Close engine hood.
12. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-2 Fuel

4-2.1 Engine Fuel Hoses and Tubes Replacement

ENGINE FUEL HOSES AND TUBES REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Fuel hoses & Tubes O-rings (4 to 6) Hose/fuel line Clip w/bolt & nut (10) Zip Ties (10)</p> <p><u>Equipment Required</u> Suitable lifting devices Suitable lifting slings Suitable rated jack stand Drain Pan Rags Connector lubricant</p> <p><u>Reference</u> Parts Manual</p>		<p><u>Equipment Conditions</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF Parking brake set Vehicle parked on flat level surface Transmission in NEUTRAL (N) RS FSS Nozzle Bracket removed RS Armor Plate Removed Belly and fuel tank armor removed</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Prime fuel system Check fuel lines and hoses for leaks Start engine Verify fuel gauge Verify system operation Shut engine OFF Battery Disconnect Switch OFF Install belly and tank armor Remove suitable listing devices Remove suitable rated jack stand Install RS Armor Install RS FSS Nozzle Bracket Remove wheel chocks</p>

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Use suitable floor jack and jack stand to lift vehicle to a safe level. Do not work under vehicle or work alone with the fuel tank and cage while it is supported by tank jack. Failure to comply may result in damage to equipment and/or serious injury or death to personnel.

Diesel fuel is flammable. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel. Failure to comply may result in equipment damage and/or serious injury or death to personnel.

No open flames or smoking allowed around diesel fuel. Diesel fuel is flammable and could cause an explosion or fire if exposed to flames, sparks or heat. Have fire extinguisher on hand when working with fuel systems. Failure to comply may result in damage to equipment and/or serious injury or death to personnel.

Wear protective eyewear while working with systems under pressure. Make sure that engine is shut off, Master Powered or disconnect switch is turned off, wheels are chocked, transmission is in neutral/park, parking brake is set before starting service procedure on engine. Failure to comply may result in damage to equipment or serious injury or death to personnel.

Dispose of used parts, rags, containers and engine fluids according to regulations. Failure to comply may result in equipment damage and/or serious injury or death to personnel.

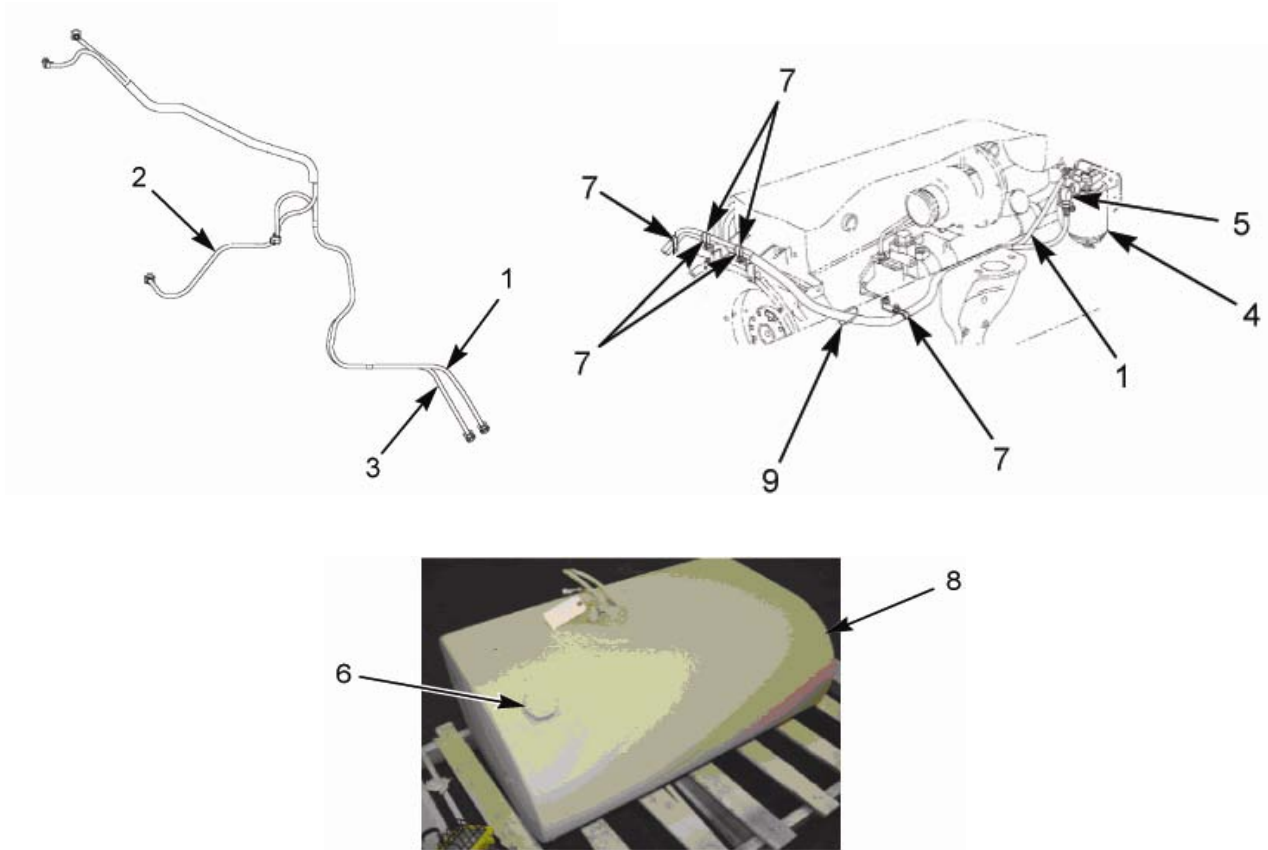
Make sure the vehicle engine has time to cool down before continuing with procedure. Use extreme caution – hot fuel can ignite easily. Wear safety goggles and have fire extinguisher on hand. Failure to comply may result in serious injury or death to personnel.



Label all electrical connections and hoses before removal to ensure proper installation. Failure to comply may result in damage to equipment.

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a) Removal



1. With suitable lifting device and rated jack stand for this vehicle, lift front of vehicle to suitable height for working.
2. De-pressurize fuel lines (1), (2), and (3) and open fuel tank cap (6) to release pressure build-up in lines.
3. Label all connections from fuel/water filter (4) to fuel tank (8) to ensure that lines and hoses are installed properly.



When removing fuel lines and hoses notice the routing of both to ensure the new lines are routed the same way. Mark with tape, if need be, to remember correct routing. Not routing the correct way will shorten the length of the fuel lines/hoses and they will not reach their destination or will have access and possible cause for kinks/binds in the lines which can cause fuel interruptions.

4. Pull clips (7) with bolt and nut and cut zip ties (9) off fuel lines and if clips need to be replaced, replace them.
5. Place rag and drain pan under lines and disconnect them. The quick connect (5) lines may still be under pressure, use care when disconnecting them.
6. Wipe up any fuel that has spilled and continue to next connection.

Chapter 4 – MAINTENANCE INSTRUCTIONS



Use extreme caution when working under vehicle. Make sure you have safety goggles on, fire extinguisher on hand and another personnel close by. Failure to comply may result in serious injury or death to personnel.

7. Replace or empty drain pan, if it gets full of fuel in appropriate regulation container.

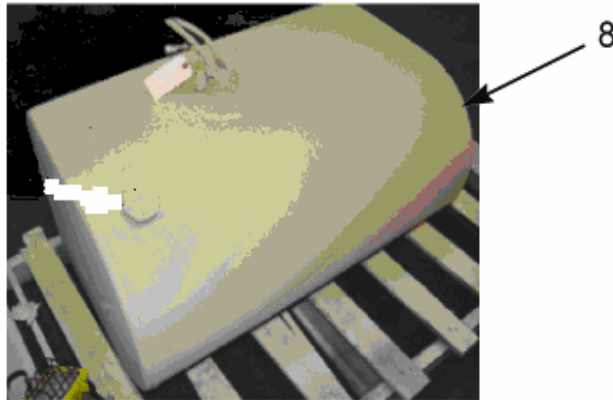
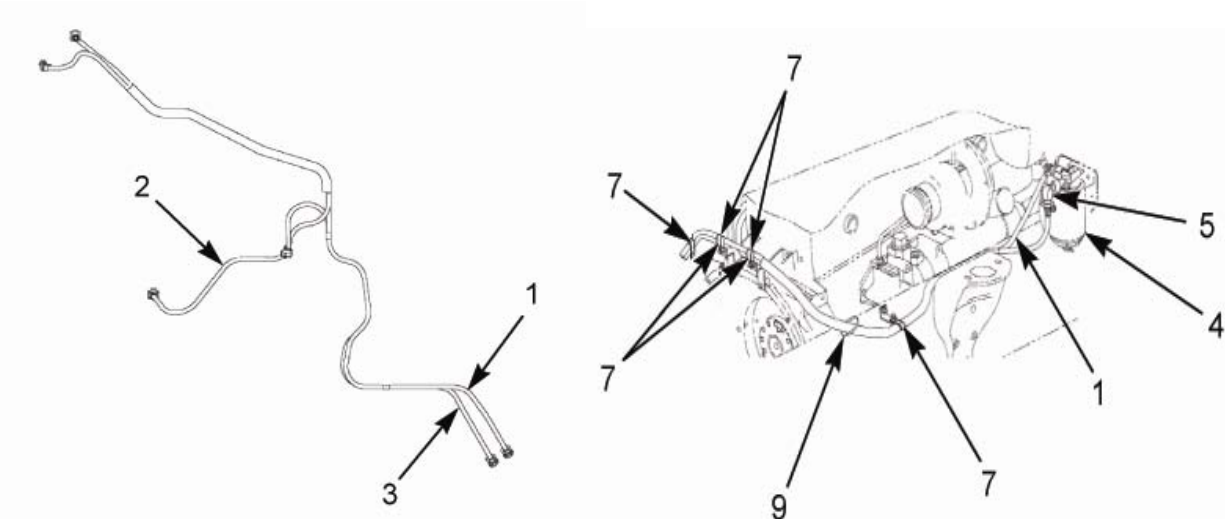
b) Installation



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

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

Chapter 4 – MAINTENANCE INSTRUCTIONS



1. Apply anti-corrosion compound to clips (7) and connector lubricant to any connectors that were disconnected prior to removal of fuel lines/hoses.
2. Following the same routing in reverse order from fuel tank (8) to fuel/water filter (4).
3. Install new fuel lines/hoses (1), (2), and (3), with new O-rings at both ends of the fuel lines, if needed.
4. Install new hoses/tubes, checking clamps (7) before installing, if signs of rust or corrosion on clamps, bolts or nuts replace them.
5. Check and re-check all connections. With quick connect lines (5) you should hear a click when the connector goes into place. Make sure you have attached a new o-ring on quick connect before installing failure to do this will cause a fuel leak.
6. The hoses/tubes should not be pushed any farther on installation point than the old hoses/tubes removed. Clean ends when hoses/tubes are to be installed to ensure proper installation and clamping.

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7. Install all fuel line, hoses and tubes holding clips (7) and zip ties (9) so lines stay in place and will not rattle or cause fuel lines to bind, pinch or kink.
8. Clean up any fuel spills on the ground or around the engine before lowering vehicle to the ground.

c) Follow-On Maintenance

1. Remove jack stand.
2. Remove floor jack.
3. Battery Disconnect Switch ON.
4. Prime fuel system.
5. Start engine.
6. Check for leaks.
7. Verify dash gauge.
8. Shut engine OFF.
9. Battery Disconnect Switch OFF.
10. Belly and Fuel tank armor.
11. RS Armor.
12. RS FSS.
13. Remove wheel chocks.

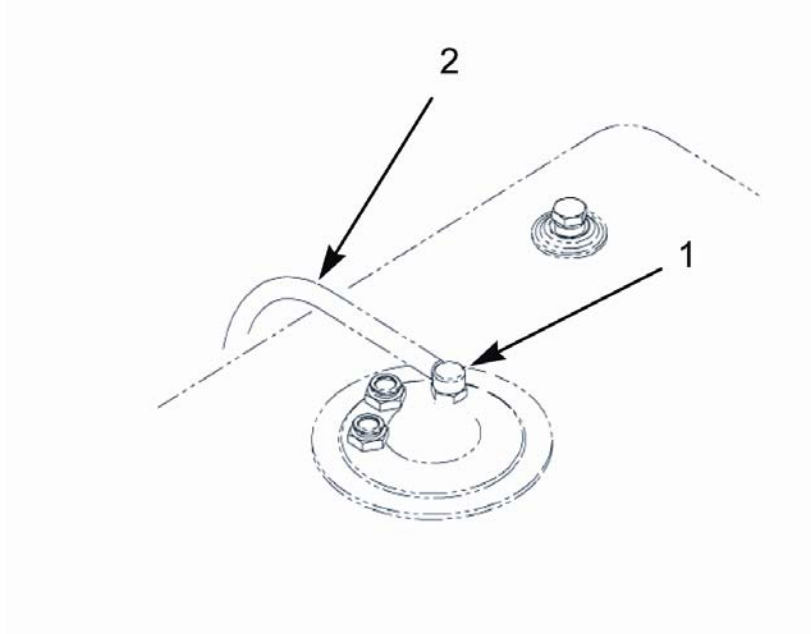
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-2.2 Fuel Level Sending Unit Replacement

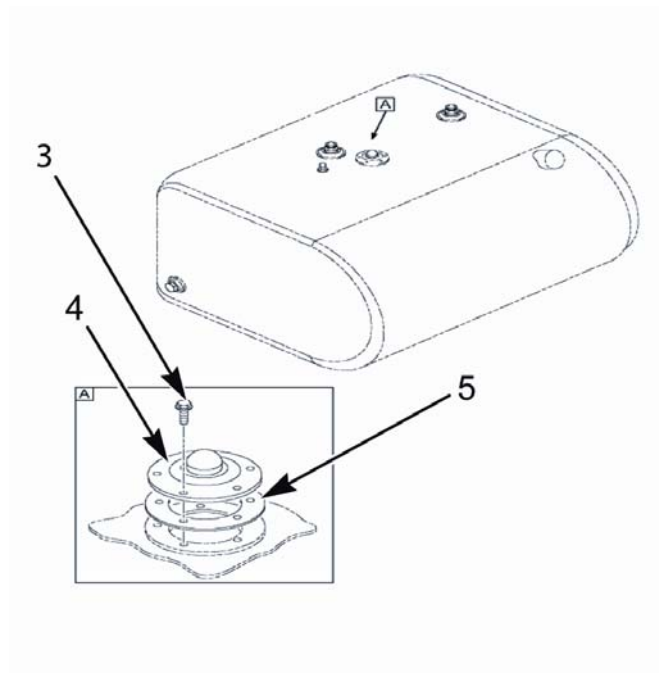
FUEL LEVEL SENDING UNIT REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Equipment Required</u> Suitable lifting device Suitable lifting sling</p> <p><u>Material Parts</u> Screws (5) Gasket (1) Sending Unit (1) Fuel Line with Fitting (1) Sealing Compound (1) Connector Lubricant (1)</p>		<p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission set in neutral (N) Fuel tank armor removed Tank removed Wheels chocked</p> <p><u>Reference</u> Parts Manual</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Prime fuel system Start engine Verify fuel gauge and system operation Check for leaks Shut engine OFF Battery Disconnect Switch OFF Install fuel tank armor Remove wheel chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Disconnect clamp on connector (1) from ventilator line (2).
2. Remove ventilator line (2) from connector (1).



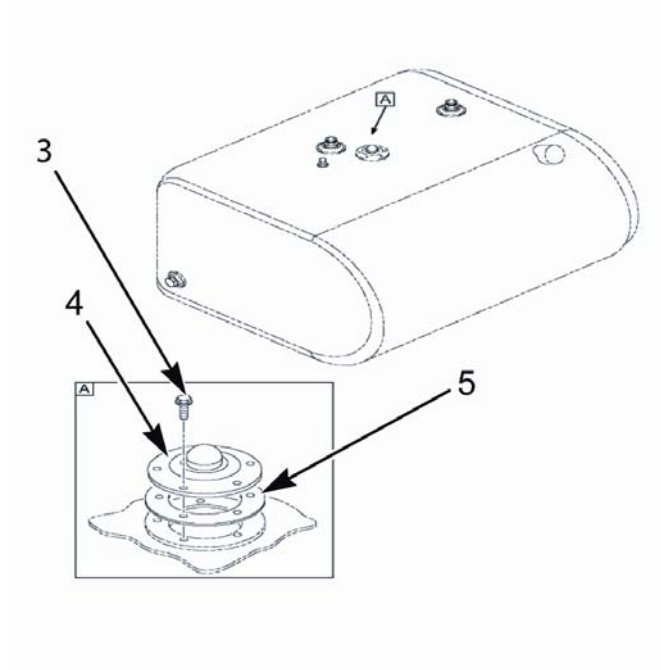
3. Remove five screws (3), gasket (5), sending unit (4), from fuel tank. Discard screws (3), gasket (5), and sending unit (4).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

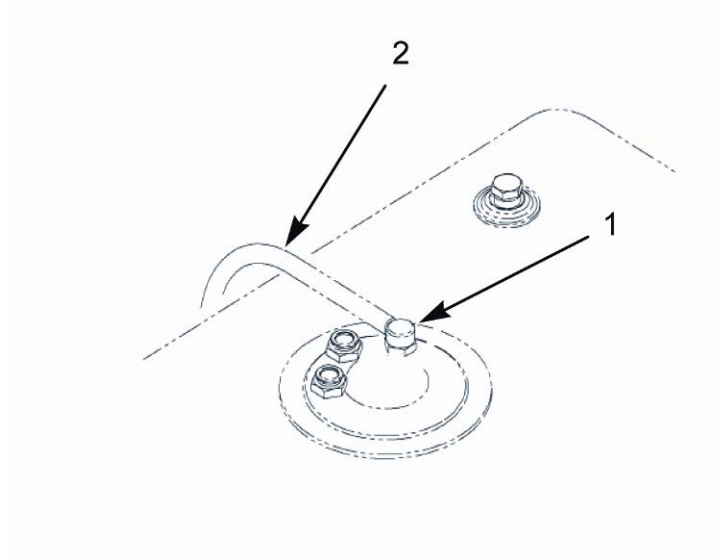


1. Apply sealing compound to both sides of gasket (5) and screws holes (3).
2. Install sending unit (4) and gasket (5) on fuel tank with five screws (3).



Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact a physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.

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3. Apply lubricant to connector (1).
4. Connect and clamp line ventilator (2) to connector (1).

c) Follow-On Maintenance

1. Install fuel tank.
2. Battery Disconnect Switch ON.
3. Prime fuel system.
4. Start engine.
5. Verify fuel gauge and system operation.
6. Check for leaks.
7. Shut engine OFF.
8. Battery Disconnect Switch OFF.
9. Install fuel tank armor.
10. Remove wheel chocks.

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4-2.3 Fuel Tank and Bracket Replacement

FUEL TANK AND BRACKETS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Inspection
d) Follow-On Maintenance		
INITIAL SETUP		
<p><u>Special Tools</u> Torque Wrench</p> <p><u>Materials/Parts</u> Fuel tank Strap brackets (2) Cage brackets (2) Hex nuts (2) O-Rings (3 to 4) Locator pin (2) Cotter pin (2)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Equipment Required</u> Drain pan Rags Suitable lifting device Suitable lifting sling Suitable rated jack stand</p>	<p><u>Equipment Condition</u> Engine OFF Wheels chocked Remove belly and fuel tank armor Drain fuel lines Battery Disconnect Switch OFF Parking brake set Transmission in NEUTRAL (N)</p> <p><u>Reference</u> Parts Manual</p> <p><u>Follow-On Maintenance</u> Install belly and fuel tank armor Remove wheel chocks</p>	

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Do not use tank jack to lift vehicle, only used to support fuel tank while straps are removed to replace tank. Use suitable floor jack and jack stand to lift vehicle to a safe level. Do not work under vehicle or work alone with the fuel tank and cage while it is supported by tank jack. Failure to comply may result in damage to equipment and/or serious injury or death to personnel.

Make sure that vehicle is parked on a flat level surface, with engine shut OFF, Battery disconnect Switch turn OFF and/or disconnected, wheels chocked and parking brake set. Keep all open flames, flammable materials, ignition sources, and sparks away from diesel fuel, it is flammable. Failure to comply may result in equipment damage and/or serious injury or death to personnel.

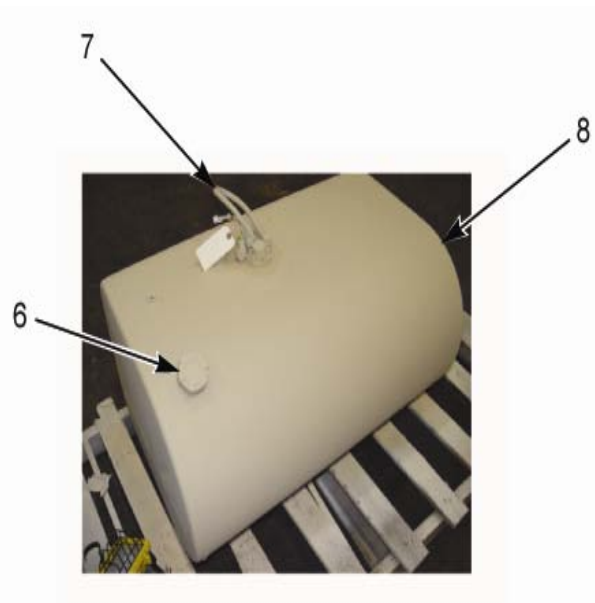
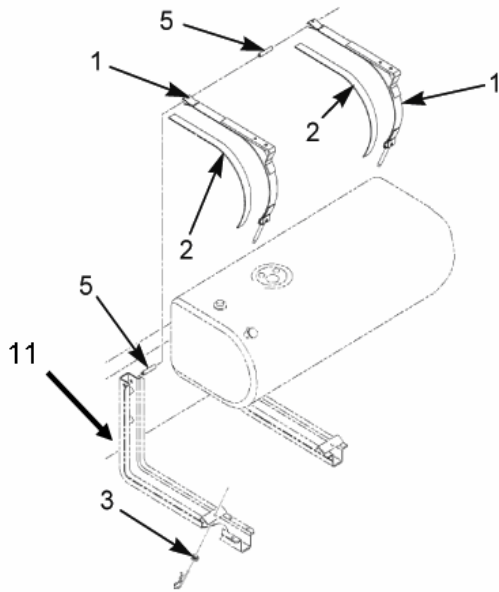
Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious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



Label all electrical connections and hoses before removal to ensure proper installation. Failure to comply may result in damage to equipment.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



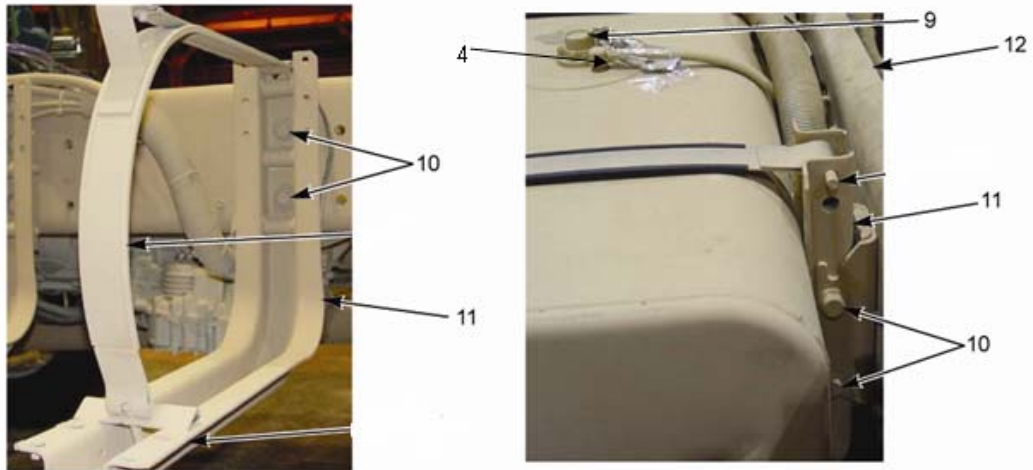
1. Open fuel tank cap (6), release pressure in fuel lines (7) and disconnect fuel lines.
2. Remove drain plug from bottom of tank and drain fuel into drain pan.

NOTE

The fuel tank assembly is heavy. Removal of the tank will require the help of an assistant.

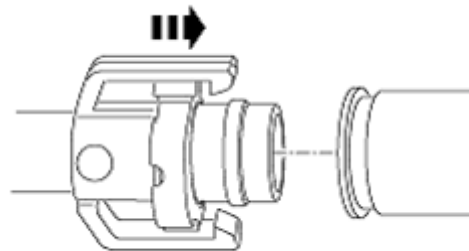
3. With suitable lifting device under the center of the tank assembly (8), raise the jack until it makes contact with the bottom of the tank (8).
4. Secure tank to jack before loosening bracket straps.
5. Remove locknut (3) from each of the tank's holding brackets (1).
6. Remove locater pin (5) from each strap and remove straps (1) and strap linings (2).
7. With personnel assistance, remove fuel tank (8) from vehicle cage (11) and lower to floor.
8. Clean the top of the tank before removing the sending unit cover and hose connections to reduce contamination issues.
9. If the tank (8) still contains a small amount of fuel, drain it into a suitable container now.

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10. Transfer the following components from the old tank to the replacement tank:

- a. Fuel sending unit cap and screws (9).
- b. Vent hose fittings for vent hose (4).
- c. Fuel supply and return hose fittings with new O-rings.



11. Dispose of the old fuel tank and any fluid filled rags according to regulations.

12. Remove four bolts and nuts (10) each from fuel tank cage (11) to body frame (12) and discard.

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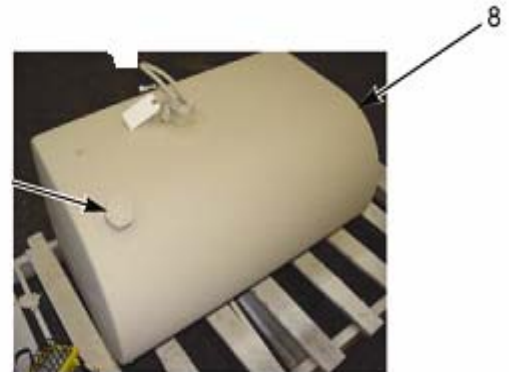
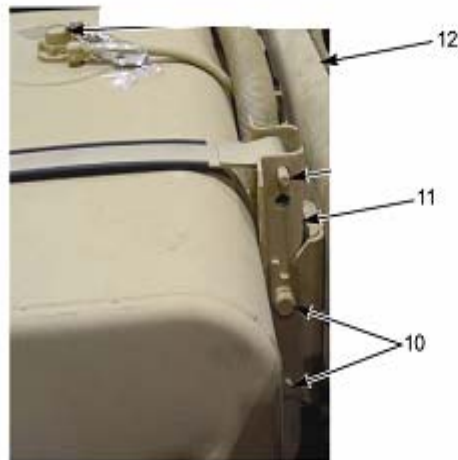
b) Installation



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

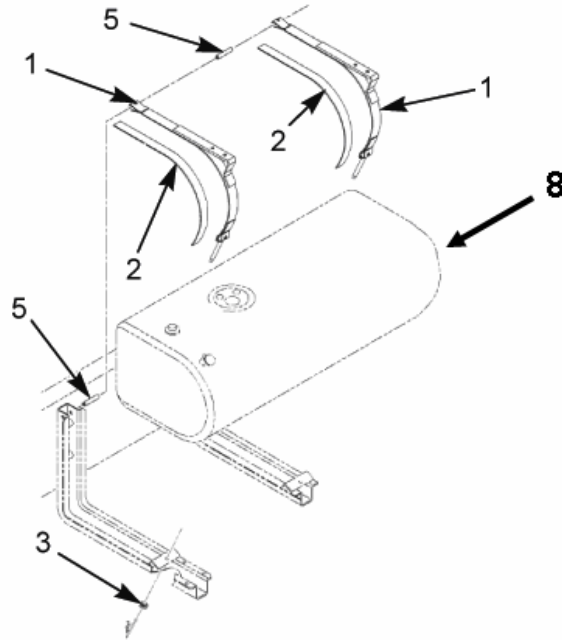
NOTE

The fuel tank assembly is heavy. Installation of the tank into the cage will require the help of an assistant.



1. Apply anti-corrosion compound to nuts and bolts for fuel tank cage to frame.
2. Align cage (11) and bolts and nuts (10) to frame (12) and tighten to 196 ft-lb (365 N•m).
3. Make sure all transferred parts from old tank are secure.
4. Position fuel tank (8) on suitable lifting device and lift into place.

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5. Insert new strap (1) and locater pin (5) into place on both sides of tank (8) and insert lining (2) to strap supports (1).
6. Start tightening the mounting bracket locknut (3) on both straps to tank (8) and align the straps before tightening to 24 ft-lb (32 N•m).



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

7. Apply lubricant to electrical connectors and connect them.
8. Connect the supply and return fuel lines with new O-ring and lock the fittings into place.
9. Connect the vent hose to the tank fitting and install the hose clamp.
10. Fill the fuel tank.

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c) Inspection

1. Check all fuel lines and electrical connections.
2. Reconnect batteries or switch on Battery disconnect Switch.
3. Battery Disconnect Switch ON.
4. Prime the fuel system.
5. Check for fuel leaks at the new fuel tank.
6. Verify gauge operation.
7. Battery Disconnect Switch OFF.

d) Follow-On Maintenance

1. Install belly and fuel tank armor.
2. Remove wheel chocks.

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4-2.4 Fuel Primer Regulator Replacement

FUEL PRIMER REGULATOR REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>	<u>Equipment Required</u>	
Torque Wrench	Rags	
	Drain pan	
<u>Personnel</u>	<u>Equipment Conditions</u>	
One (1) Wheeled Vehicle Mechanic	Engine shut OFF	
<u>Material Parts</u>	Battery Disconnect Switch OFF	
Fuel Regulator (1)	Parking brake set	
Loctite ® lubricant	Transmission set in NEUTRAL (N)	
	Wheels chocked	
	Drain fuel line pressure	
<u>Reference</u>	<u>Follow-On Maintenance</u>	
Parts Manual	Battery Disconnect Switch ON	
	Prime fuel system	
	Check for leaks	
	Start engine	
	Re-check for leaks	
	Verify operation	
	Shut engine OFF	
	Battery Disconnect Switch OFF	
	Remove wheel chocks	

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Wear proper safety goggles and work gloves when fueling vehicle or working with fuel system. DO NOT use open flames or smoke, use caution around electrical components that you don't cause a spark which can explode fuel fumes. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

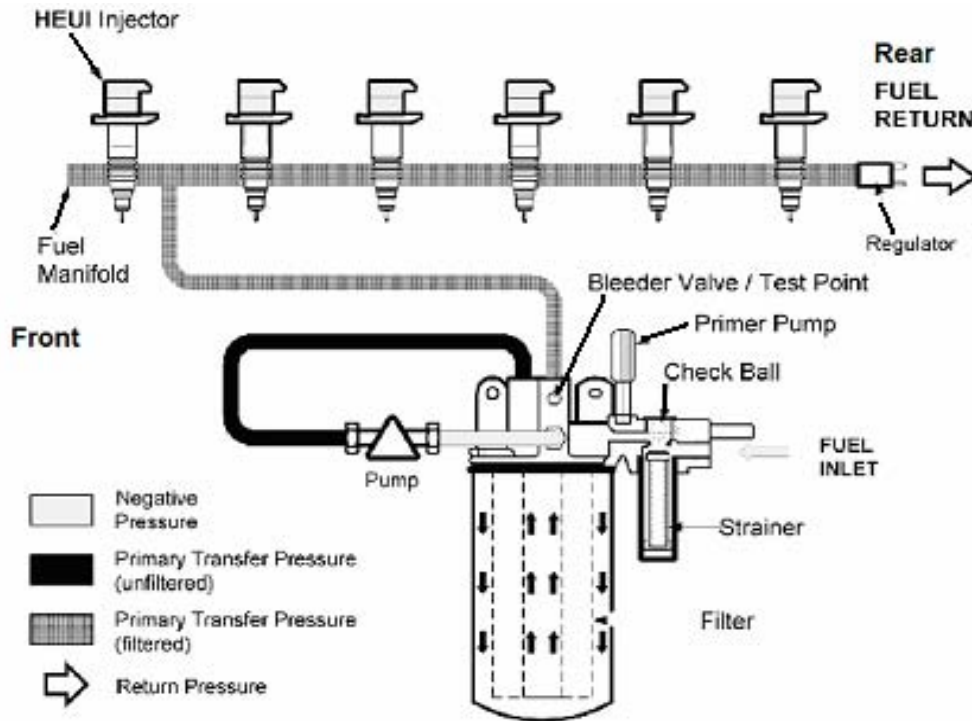
DO NOT loosen fuel lines at filter housing to bleed fuel system. Periodic loosening of fittings will result in increased wear of threads. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.

NOTE

Supply oil rail manifold must be drained prior to removing fuel primer regulator to prevent any leakage in cylinder bore.

a) Removal



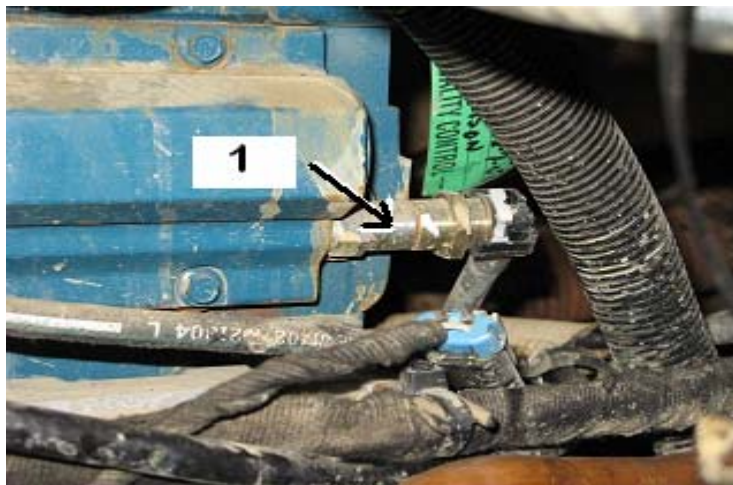
Chapter 4 – MAINTENANCE INSTRUCTIONS

NOTE

Plug may be accessible through dog house (2) access panel, if equipped.



1. Place rags or suitable container at back of engine side of supply manifold end plug.
2. Remove supply manifold end plug (1). Dispose of end plug or fuel primer regulator along with rags and engine fluids in accordance with regulations.



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b) Installation

1. Apply Loctite® to end plug threads and install plug/ fuel primer regulator in supply manifold. Tighten plug to 26 lb-ft (35 N•m).

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Prime fuel system.
3. Check for leaks.
4. Start vehicle.
5. Verify operation.
6. Re-check for leaks.
7. Shut engine OFF.
8. Battery Disconnect Switch OFF.
9. Remove wheel chocks.

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4-2.5 Fuel/Water Separator Filter Replacement

FUEL/WATER SEPARATOR FILTER REPLACEMENT	
This task covers:	
a) Inspection	b) Installation c) Follow-On Maintenance
INITIAL SET UP	
<u>Special Tools</u>	<u>Equipment Required</u>
None	Fuel drain pan Filter wrench/strap
<u>Personnel</u>	<u>Equipment Conditions</u>
One (1) Wheeled Vehicle Mechanic	Wheels chocked Engine shut OFF Right Armor removed FFS bracket removed
<u>Material Parts</u>	<u>Reference</u>
Fuel/Water Separator Fuel/Water Separator Gasket	Parts Manual
	<u>Follow-On Maintenance</u>
	Check for leak Remove chocks Dispose of fuel/water separator and diesel fuel in accordance with regulations Right Armor Install FSS bracket installed



To avoid damage to engine and the possibility of personal injury, be sure to dispose of fuel in a proper container clearly stating diesel fuel.

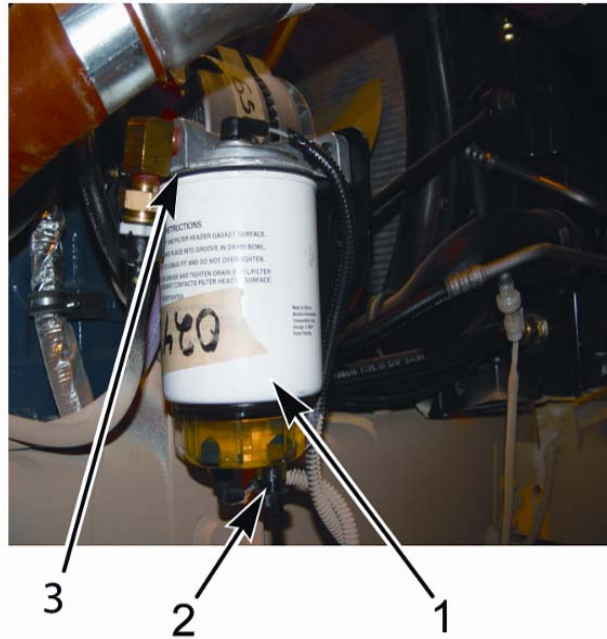
NOTE

Fuel/Water separator filter is located on the right side frame rail, in front of tire.

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a) Removal

1. Place fuel drain pan under fuel/water separator.



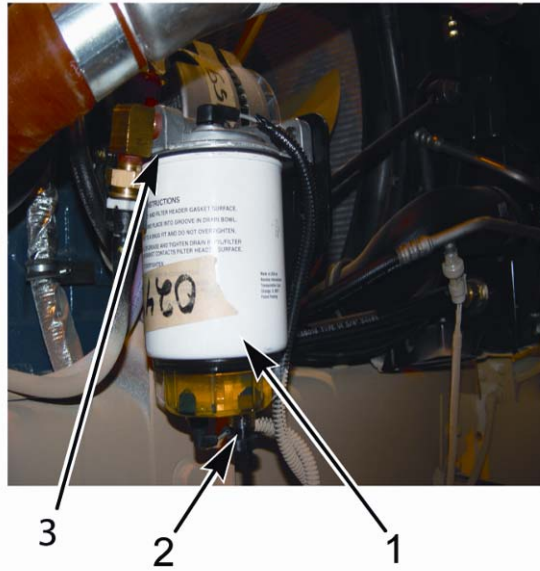
2. Remove electrical connector (2) from fuel/water separator.
3. Using an appropriate filter wrench/strap, loosen and remove fuel/water separator (1) from the fuel/water separator header. Remove and dispose of fuel/water separator and fuel/water separator gasket (3).
4. Remove fuel drain pan and dispose of diesel fuel.

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b) Installation

NOTE

Install dry. Do not add fuel to new fuel filter.



1. Install new fuel/water separator gasket (3) on new fuel/water separator (1).
2. Lubricate fuel/water separator gasket (3) with clean diesel fuel.
3. Install new fuel/water separator (1) and tighten until gasket touches on fuel/water separator header.
4. Tighten by hand an additional ½ turn.
5. Install electrical connector (2) to fuel/water separator.
6. Check for leaks.

c) Follow-On Maintenance

1. Dispose of fuel/water separator and diesel fuel in accordance with regulations.

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4-2.6 Fuel/Water Separator Assembly Purge and Replacement

FUEL/WATER SEPARATOR ASSEMBLY PURGE AND REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) WHEELED VEHICLE MECHANIC</p> <p><u>Material Parts</u> Secondary fuel/water separator filter (1) O-rings (2) Dielectric Compound Anti-Corrosion Compound</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Required</u> Rags Drain pan</p> <p><u>Equipment Conditions</u> Battery Disconnect Switch OFF Batteries disconnected Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Right side FSS Nozzle Bracket removed Right side Armor Plate removed Fuel lines drained</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Prime fuel line system Start engine Verify operation of system Check for leaks Shut engine OFF Battery Disconnect Switch OFF Install right side armor plate Install right side FSS nozzle Bracket Remove wheel chocks</p>	

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a) Removal

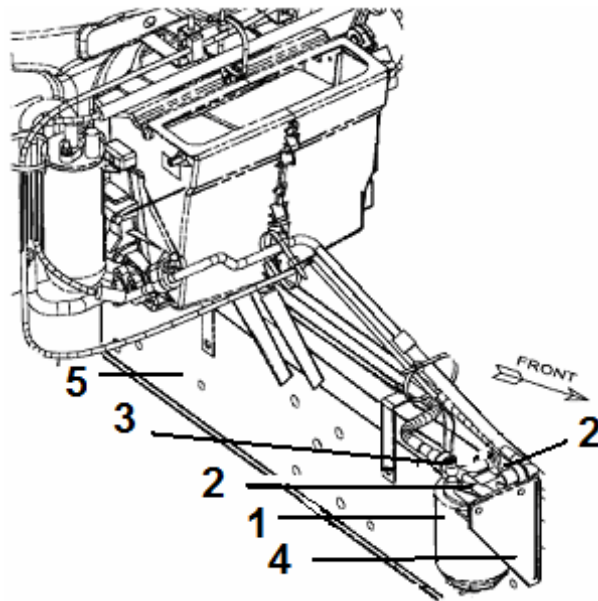


Wear proper safety goggles and work gloves when fueling vehicle or working with fuel system. DO NOT use open flames or smoke, use caution around electrical components that you don't cause a spark which can explode fuel fumes. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

Fuel is flammable and can explode. Keep fuel away from open flame and keep fire extinguisher within easy reach when working with fuel. DO NOT work on fuel system when engine is hot. Fuel can be ignited by hot engine. Smoking is prohibited while working with fuel. Never use gasoline to clean parts. Failure to comply may result in serious injury or death to personnel.

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

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



1. Clean up any spilled fuel after draining fuel lines (2) and discard of rags and fuel in accordance with regulations.
2. Raise vehicle high enough with suitable lifting device to install suitable rated jack stand and lower vehicle onto jack stand (if needed).
3. Disconnect electrical connector (3).
4. With rag around fuel lines to secondary fuel/water separator filter (1), disconnect fuel lines (2) and clean up any fuel that spills.
5. Remove mount bolts connecting filter to mounting bracket (4) on frame rail (5).
6. Clean up any fuel spills and discard filter (1) and o-rings from fuel lines (2).

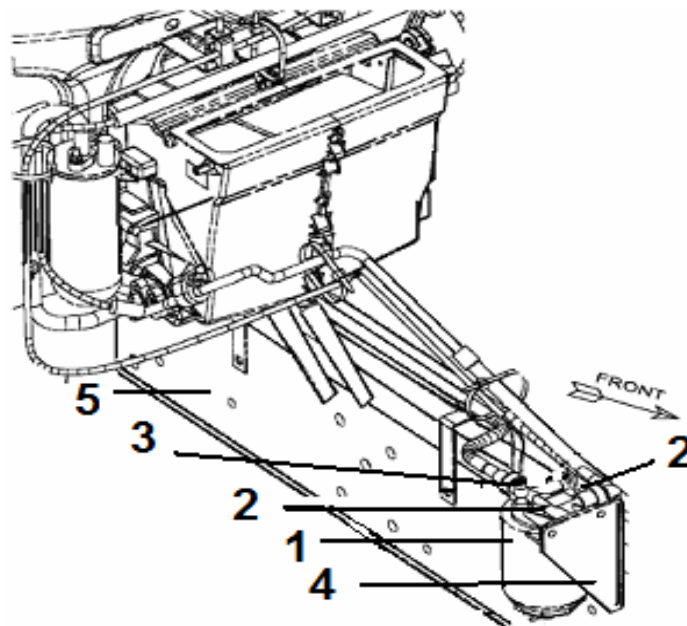
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

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



1. Apply connector lubricant to electrical connector (3).
2. Apply anti-corrosion compound to mounting bolts to bracket (4).
3. Install O-rings into fuel lines (2) and install onto filter (1).
4. Install filter (1) onto mounting bracket (4) on frame rail (5) with mounting bolts and tighten to specification.
5. Connect electrical connector (3).
6. Raise vehicle high enough to remove jack stand and lower vehicle to ground (if needed).

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c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Prime fuel line system.
3. Start engine.
4. Verify operation of system.
5. Check for leaks.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Install right side armor plate.
9. Install right side FSS nozzle bracket.
10. Remove wheel chocks.

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4-2.7 Fuel Pump Replacement

FUEL PUMP REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SET UP	<u>Equipment Conditions</u>
<u>Special Tools</u>	Engine shut OFF
Torque Wrench	Wheels chocked
	Master Powered
	Left side FSS nozzle bracket removed
	Left side armor
	Air filter canister removed
	CAC tube removed
<u>Personnel</u>	
One (1) Wheeled Vehicle Mechanic	
<u>Material Parts</u>	<u>Follow-On Maintenance</u>
Fuel Pump	Reconnect batteries
Gasket	Prime fuel system
	Start vehicle
	Check for leaks
	Shut off vehicle
<u>Reference</u>	Reconnect air filter canister
Parts Manual	CAC tube installed
	Reinstall Left Side armor plate
<u>Equipment Required</u>	Reinstall Left Side FSS nozzle bracket
Drain Pan	
Rags	

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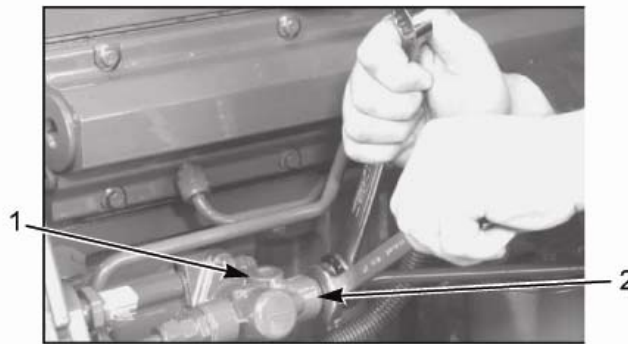
No smoking or open flames around diesel fuel, flammable and could cause explosion or fire if exposed. Have fire extinguisher on hand when working with fuel systems. Failure to comply may result in damage to equipment and serious injury or death to personnel.

Wear protective eyewear while working with systems under pressure. Failure to comply may result in serious injury or death to personnel.

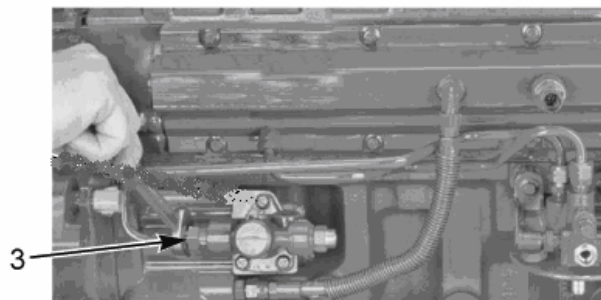
Make sure that engine is shut OFF, Master Powered or disconnect switch is turned OFF, wheels are chocked, transmission is in neutral/park, parking brake is set before starting service procedure on engine. Failure to comply may result in damage to equipment or serious injury or death to personnel.

Dispose of used parts, rags, containers and engine fluids according to regulations. Failure to comply may result in equipment damage or serious injury or death to personnel.

a) Removal



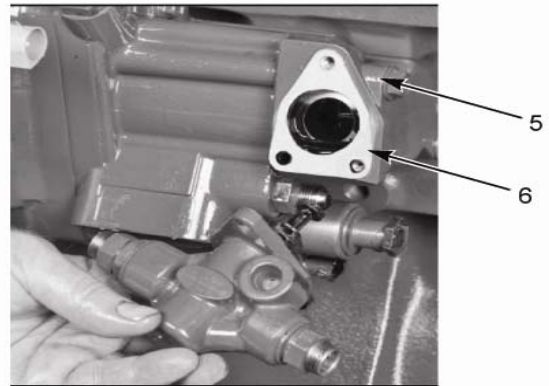
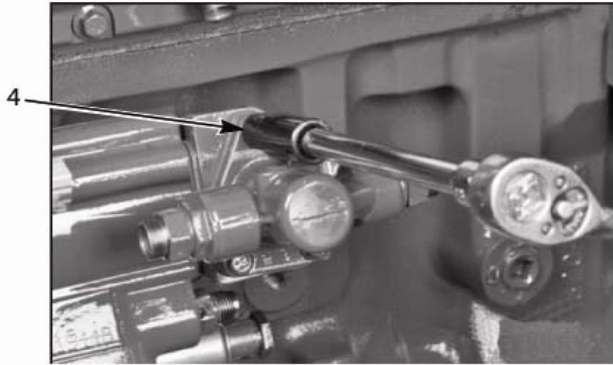
1. Remove ether vent fitting from CAC tube.
2. Remove CAC tube.
3. Place rag or suitable container under supply pump (1) inlet fuel line fitting (2).
4. Loosen the supply pump inlet fuel line (2) slowly and drain any fuel from line. Disconnect and remove fuel from line.
5. Discard rag or suitable container according to regulations and cover fuel header openings.



6. Loosen fitting on the fuel supply line (3) from fuel filter header to supply manifold and drain any fuel from line. Remove fuel filter header-to-supply pump line.

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7. Dispose of rags, containers, and engine fluids according to regulations and cover additional fuel header openings.



8. Loosen three supply pump bolts (4) from the high-pressure pump and remove pump from mounting location (5).
9. Clean fuel supply pump mounting surface and inspect it for any signs of damage, check for straightness, and assure no burrs or cracks.
10. Make sure you clean the old gasket (6) off the mounting surface before installing new gasket and pump for proper fit and sealing to avoid leaks.

b) Installation



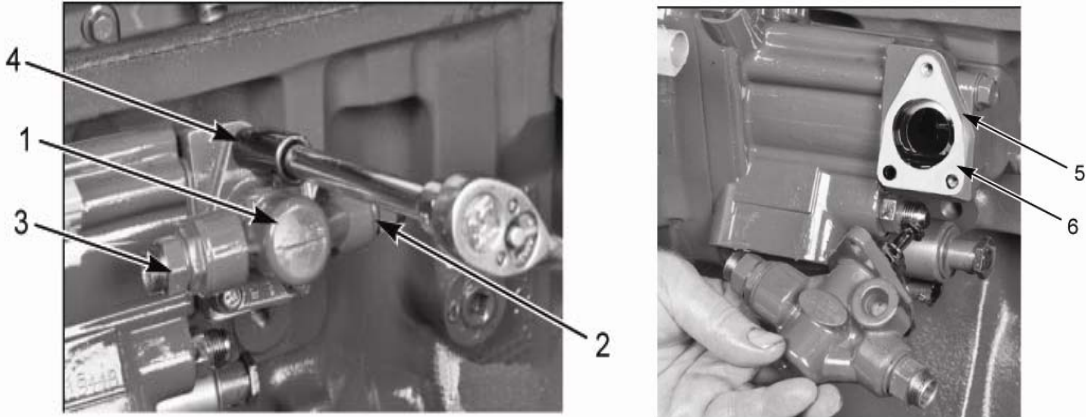
Anti-corrosion compound is toxic. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Do not get in eyes; wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves.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

Do not over tighten bolts for fuel pump or cross thread connections on fuel lines. This will interfere with sealing and operation of fuel pump. If seal is not complete, or lines leak due to cross threads, fuel pump will not operate properly and vehicle may not run. Starting vehicle with no fuel pressure in lines or pump will cause damage to equipment and/or serious injury or death to personnel.



To ensure proper installation of fuel supply pump, verify the mounting surface is clean of old gasket material so new one will seal properly. Failure to comply may result in equipment damage.

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1. Install gasket (6) to mounting surface (5).
2. Apply anti-corrosion compound to bolts and threads of fuel line connections.
3. Install fuel supply pump (1) with three bolts (4) and align gasket (6) and pump (1) with bolts (4). Tighten to 13 ft-lb (18 N•m).
4. Install fuel lines (2) and (3) to both sides of fuel supply pump (1), do not cross thread when making connection. After pump (1) and lines (2 & 3) are installed properly, clean up all fuel leakage and dispose of rags and containers according to regulations.
5. Install CAC Tube.
6. Install ether vent fitting on CAC tube.

c) Follow-On Maintenance

1. Reconnect batteries.
2. Prime fuel system.
3. Start vehicle.
4. Check for leaks.
5. Shut-off vehicle.
6. Reconnect air filter canister.
7. Install CAC tube.
8. Reinstall left side armor plate.
9. Reinstall left side FSS nozzle bracket.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-2.8 Fuel Filter and Strainer Replacement

FUEL FILTER AND STRAINER REPLACEMENT	
This task covers:	
a) Removal	b) Installation
c) Follow-On Maintenance	
<p>INITIAL SET UP</p> <p><u>Special Tools</u> Filter wrench/strap 1 1/8 in. or 29 mm (12 point) socket</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Fuel Filter Filter Gasket Strainer Strainer Cover Strainer Cover O-ring</p>	<p><u>Equipment Required</u> Fuel drain pan</p> <p><u>Equipment Conditions</u> Wheels chocked Engine OFF Air Canister removed Left side armor removed Left side FSS nozzle bracket removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Follow-On Maintenance</u> Dispose of fuel/water separator and diesel fuel in accordance with regulations. Install Air Canister Install left side armor plate Install left side FSS nozzle bracket</p>

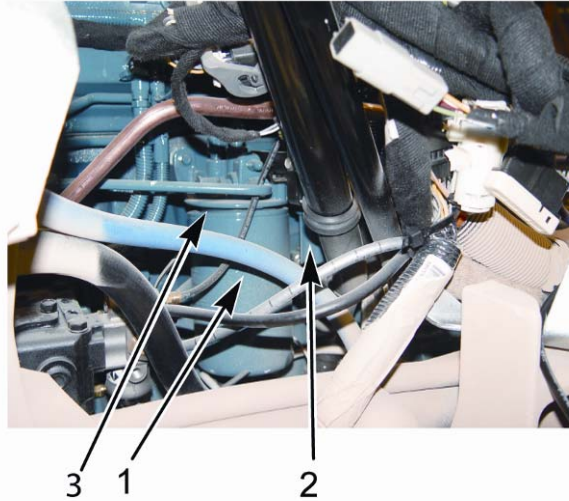


To avoid damage to engine and the possibility of personal injury, be sure to dispose of fuel in a proper container clearly stating diesel fuel.

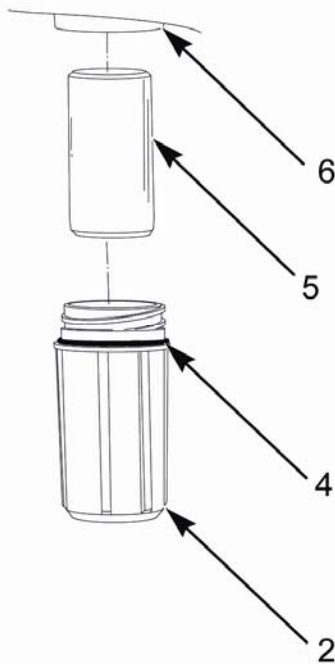
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. Place fuel drain pan under fuel filter and fuel strainer assemblies.



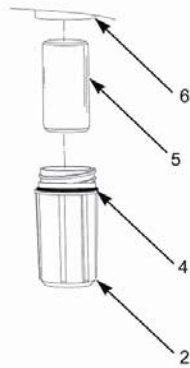
2. Using an appropriate filter wrench/strap, loosen and remove fuel filter (1) from the fuel filter header. Remove and dispose of fuel filter and fuel filter gasket (3).



3. Using a 1-1/8 in. or 29mm (12 point) socket, remove strainer cover (2), located behind fuel filter, from the filter strainer assembly (6). Remove and dispose of strainer cover (2), O-ring (4), and strainer (5).
4. Remove fuel drain pan and dispose of diesel fuel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

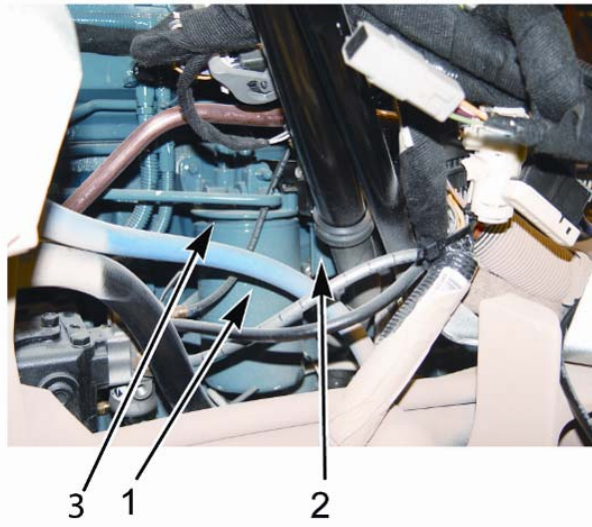


Install new strainer (5) into strainer cover (2) using new O-ring (4) as follows:

1. Install new O-ring (4) on strainer cover (2).
2. Lubricate O-ring (4) with clean diesel fuel.
3. Install strainer cover (2) containing new strainer (5) and O-ring (4) to header assembly (6).
4. Hand-tighten strainer cover (2) until strainer cover (2) touches header assembly (6).
5. Tighten strainer cover (2) by hand an additional ½ turn.

NOTE

Install dry. Do not add fuel to new fuel filter.



6. Install new filter gasket (3) on new fuel filter (1).
7. Lubricate fuel filter gasket (3) with clean diesel fuel.
8. Install new fuel filter (1) and tighten on fuel filter header.
9. Tighten by hand an additional ½ turn.

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

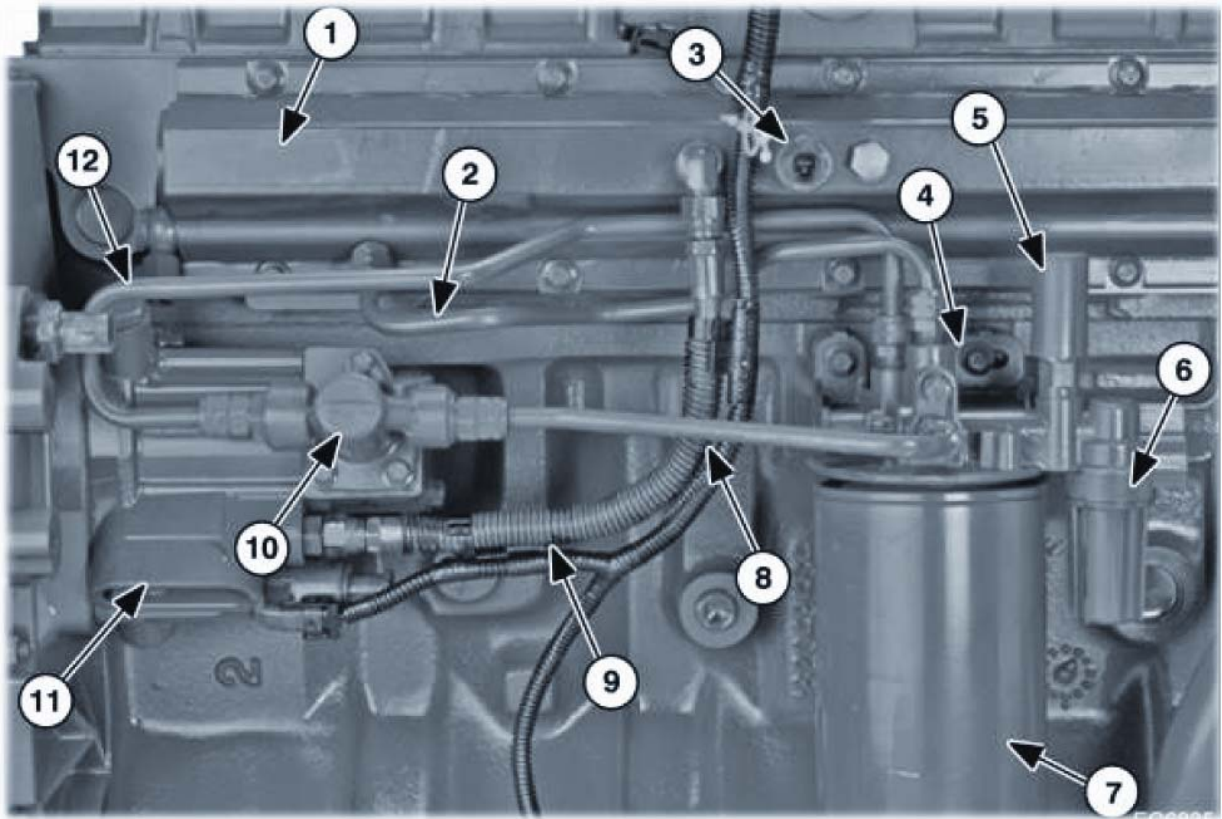
1. Dispose of fuel filter, fuel strainer, and diesel fuel in accordance with regulations.
2. Install air filter canister.
3. Install left side armor plate.
4. Install left side FSS nozzle bracket.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-2.9 Fuel Primer Pump Assembly Replacement

FUEL PRIMER PUMP ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> Fuel System Cap Set ZTSE4294 (2)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Hand Primer Pump Asy (1) Banjo Connections (if req) (3) Copper Sealing Gaskets (if req) (3)</p> <p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Conditions</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF Left Side FSS nozzle bracket removed Left Side Armor Plate Removed Air Filter Canister Removed Left Side CAC Tube Removed</p> <p><u>Follow-On Maintenance</u> Remove wheel chock Battery Disconnect Switch ON Install left side CAC Tube Install left side Air Filter Canister Install left side FSS Nozzle bracket Install left side Armor plate</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS

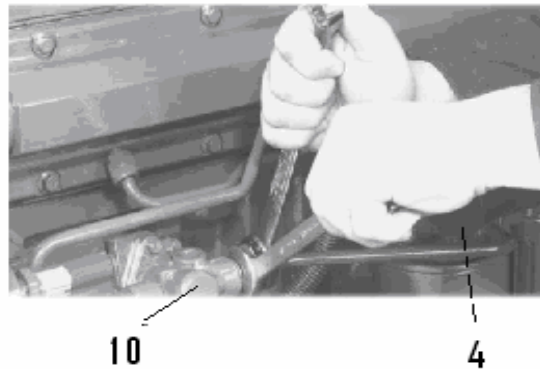


- | | |
|--|--|
| (1) Supply Manifold | (7) Fuel Filter |
| (2) Fuel Filter Header-To-Supply Manifold Line | (8) Fuel Filter Header-To-Supply Pump Line |
| (3) Injector Control Pressure (ICP) Sensor | (9) High-Pressure Pump-To-Supply Manifold Hose |
| (4) Fuel Filter Header | (10) Supply Pump |
| (5) Hand Primer Pump | (11) High-Pressure Pump |
| (6) Fuel Filter Strainer | (12) Supply Pump-To-Fuel Filter Line |

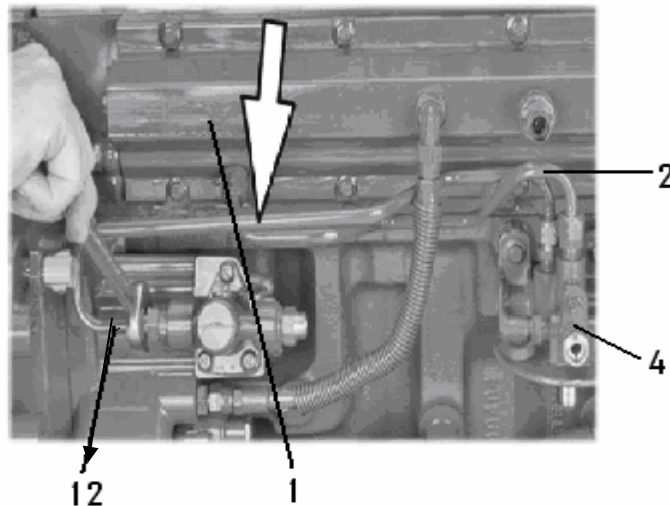
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. Place rag or suitable fuel catch container under supply pump inlet fuel line fitting.

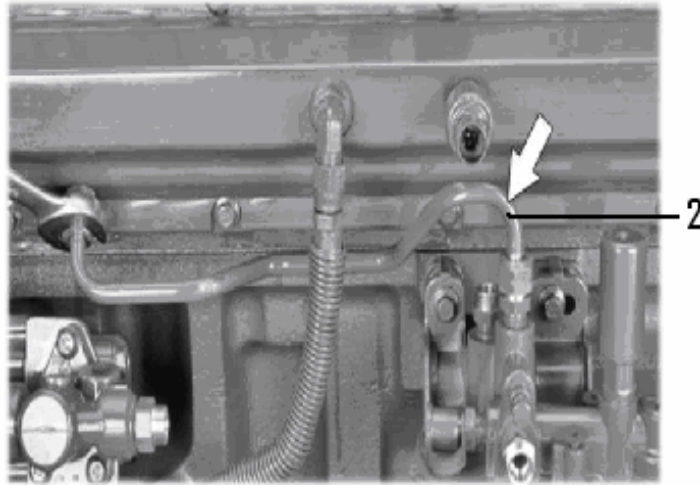


2. Loosen supply pump (10) inlet fuel line fitting; drain line.
3. Disconnect and remove fuel filter header (4) to supply pump line.
4. Dispose of rags, containers, and engine fluid in accordance with regulations.
5. Cover fuel header (4) openings. Use Fuel System Cap Set.

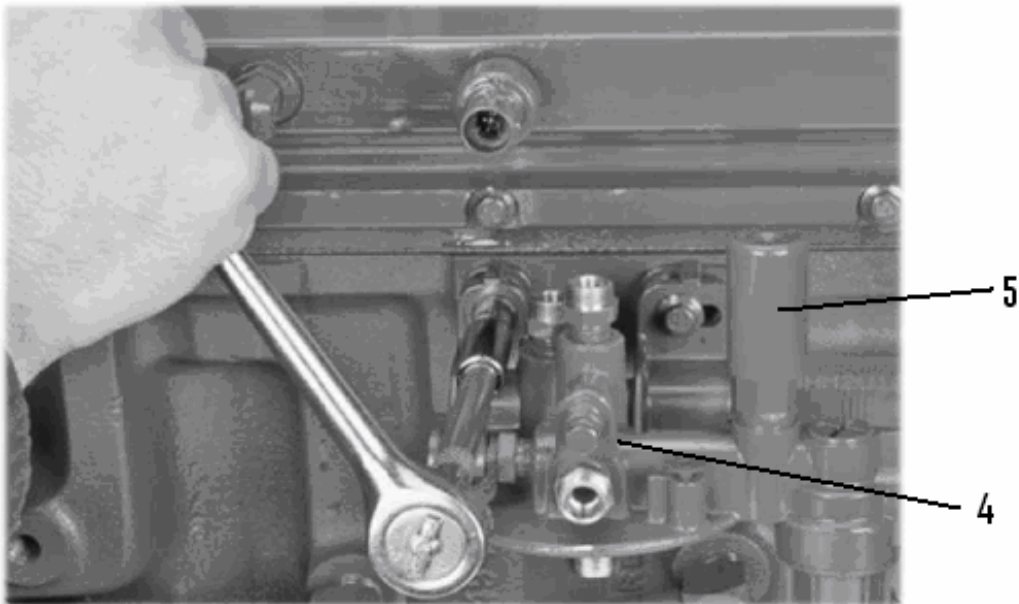


6. Place rag or suitable fuel catch container under final fuel inlet line (12).
7. Loosen fitting on final fuel filter inlet line; drain line.
8. Remove final fuel filter inlet line (12).
9. Dispose of rags, containers, and engine fluid in accordance with regulations.
10. Cover fuel header openings. Use Fuel System Cap Set.
11. Place rag or suitable fuel catch container under fuel filter header (4) to supply manifold (1).
12. Loosen fitting on fuel filter header to supply manifold line (2) from fuel filter header to supply manifold drain line.

Chapter 4 – MAINTENANCE INSTRUCTIONS



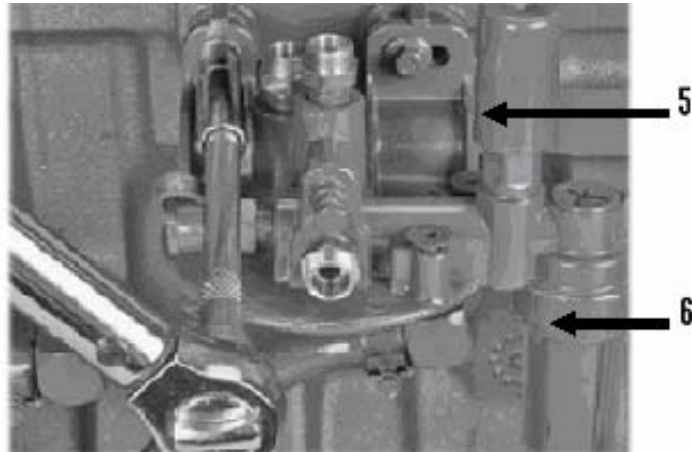
13. Remove fuel filter header to supply manifold line (2).
14. Dispose of rags, containers, and engine fluid in accordance with regulations.
15. Cover additional fuel header openings. Use Fuel System Cap Set.



16. Remove two fuel filter header (4) (hand primer pump) mounting bolts from crankcase.
17. Remove hand primer pump (5).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

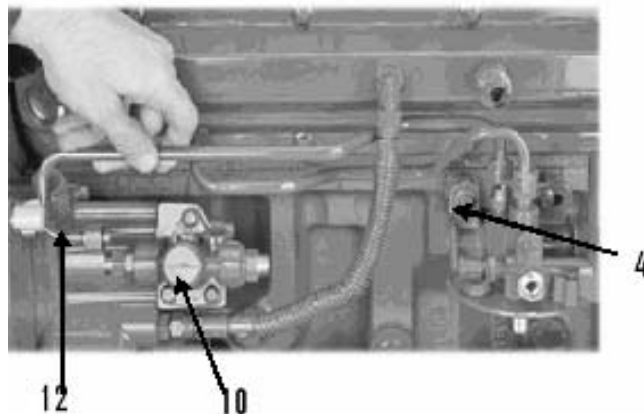


1. Install fuel filter header (hand primer pump) (5) on crankcase mounting pad using two mounting bolts and washers. Tighten mounting bolts to 13 ft-lb (18 N•m).
2. Remove nylon cap on top of fuel strainer (6). Verify priming pump check ball is in place.

NOTE

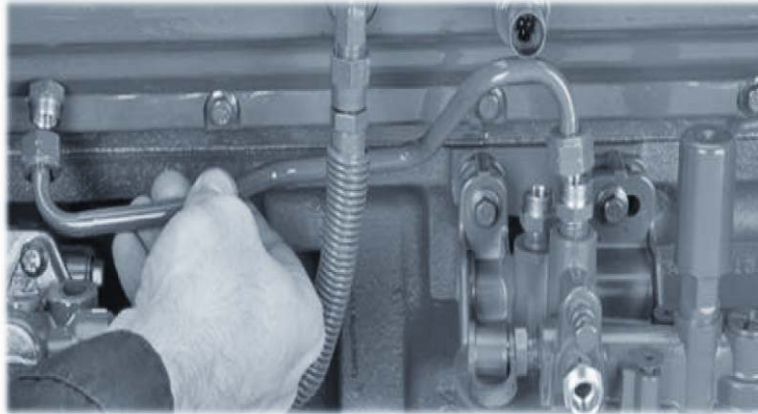
If the check ball is not in place, the priming pump will not work.

3. Remove protective caps from fuel supply pump (10) and fuel filter header (4) inlet ports.



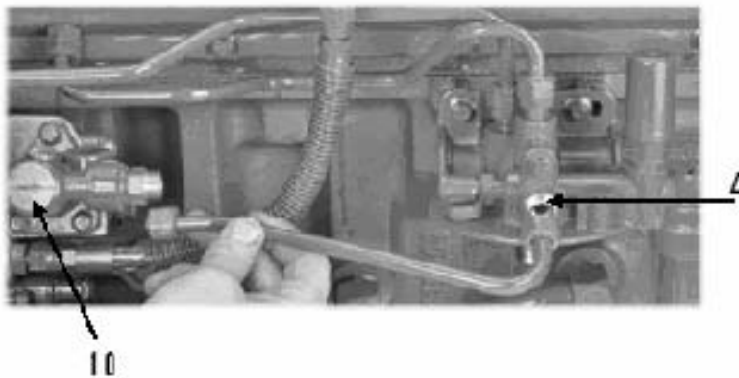
4. (a) **For fuel lines with banjo connections:** Install supply pump (10) return to fuel filter header return line (12) with banjo connections and new copper sealing gaskets. Tighten banjo connections to 26 ft-lb (35 N•m).
4. (b) **For threaded fitting fuel line:** Install supply pump (10) return to fuel filter header return line (12) fittings on supply pump and fuel filter header. Tighten fittings.

Chapter 4 – MAINTENANCE INSTRUCTIONS



5. (a) **For fuel lines with banjo connections:** Install fuel filter header to supply manifold fuel line (2) with banjo connections and new copper sealing gaskets. Tighten to 26 ft-lb (35 N•m).

5. (b) **For treaded fitting fuel line:** Install fuel filter header to supply manifold fuel line (2) fittings on supply pump and fuel filter header. Tighten fittings.



6.(a) **For fuel lines with banjo connections:** Install fuel filter header (4) to supply pump (10) line with banjo connections and new copper sealing gaskets. Tighten to 26 ft-lb (35 N•m).

6.(b) **For treaded fitting fuel line:** Install fuel header fittings supply pump (10) and fuel filter header (4). Tighten fittings.

c) Follow-On Maintenance

1. Install left side CAC tube.
2. Install Air Filter canister.
3. Install left side armor plate.
4. Install left side FSS nozzle filter bracket.
5. Remove chocks.
6. Battery Disconnect Switch ON.

Chapter 4 – MAINTENANCE INSTRUCTIONS

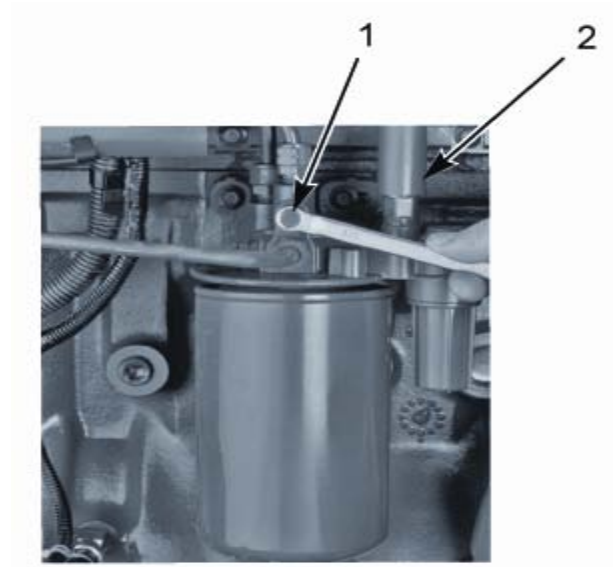
4-2.10 Fuel Priming Sequence

FUEL PRIMING SEQUENCE	
This task covers:	
a) Priming	b) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) WHEELED VEHICLE MECHANIC</p> <p><u>Material Parts</u> None</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Equipment Conditions</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF Left side armor plate removed Left side FSS nozzle bracket removed Air filter canister removed</p> <p><u>Follow-On Maintenance</u> Remove wheel chock Battery Disconnect Switch ON Reinstall Air filter Canister Reinstall left side armor plate Reinstall left side FSS nozzle</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Priming

1. Place rag or suitable container under bleed screw in fuel filter header.
2. Loosen bleed screw in fuel filter header (1).
3. Operate priming pump (2) until pump discharges solid fuel at bleed screw. Tighten bleed screw. Dispose of rags, containers, and engine fluids in accordance with regulations.



NOTE

Do not crank engine for more than 15 seconds.

4. Crank engine for 15 seconds or until engine starts.
5. Operate engine until it runs smoothly.
6. Dispose of fuel in drain pan and soaked rags in accordance with local regulations.

b) Follow-On Maintenance

1. Remove chocks.
2. Battery Disconnect Switch ON.
3. Reinstall air filter canister.
4. Reinstall left side armor plate.
5. Reinstall left side FSS nozzle bracket.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-2.11 Ether (Cold) Start Assembly Replacement

ETHER (COLD) START ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<u>Equipment Required</u>		
INITIAL SET UP		
<u>Special Tools</u>		
None		
<u>Personnel</u>		
One (1) Wheeled Vehicle Mechanic		
<u>Material Parts</u>		
Ether Bottle Replacement (1)		
Dielectric Grease		
Anti-corrosion compound		
<u>Reference</u>		
Parts Manual		
<u>Equipment Conditions</u>		
Battery Disconnect Switch OFF		
Parking brake set		
Transmission set in NEUTRAL (N)		
Wheels chocked		
Left side FSS nozzle bracket removed		
Left side armor plate removed		
<u>Follow-On Maintenance</u>		
Battery Disconnect Switch ON		
Start engine with ether start		
Shut engine OFF		
Left side armor plate installed		
Left side FSS nozzle bracket installed.		
Remove wheel chocks		

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



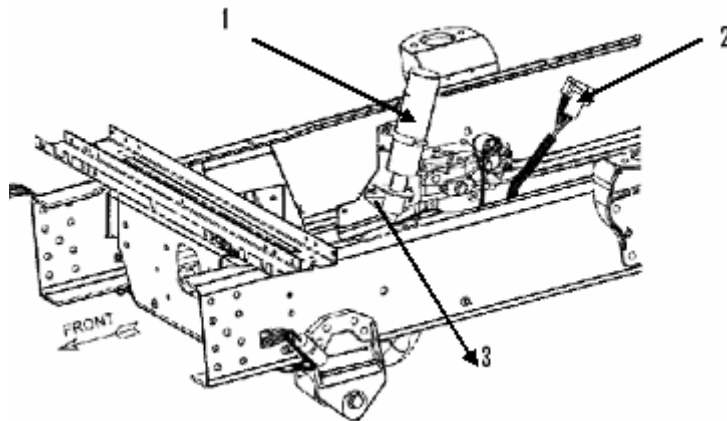
Use care when working around ether canister as ether canisters are pressurized and flammable. Keep away from flames, DO NOT incinerate or puncture canister, keep away from temperatures above 120°F (49°C). DO NOT store spare in cab. It contains hazardous materials and must be handled with care and disposed of in accordance with current directives. Avoid ether liquid to contact skin, eyes and breathing fumes. Use approved respirator with dual organic vapor/mist and particulate cartridge. If swallowed, DO NOT INDUCE VOMITING. Contact immediate medical attention. Failure to comply may result in serious injury or death to personnel.

Wear proper safety goggles and work gloves when fueling vehicle or working with fuel system. DO NOT use open flames or smoke, use caution around electrical components that you don't cause a spark which can explode fuel fumes. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

Use suitable floor jack and jack stand to lift vehicle to a safe level. Do not work under vehicle or work alone with the fuel tank and cage while it is supported by tank jack. Failure to comply may result in damage to equipment and/or serious injury or death to personnel.

Dispose of used parts, rags, containers and engine fluids according to regulations. Failure to comply may result in equipment damage and/or serious injury or death to personnel.

Use extreme caution when working under vehicle. Make sure you have safety goggles on, fire extinguisher on hand and another personnel close by. Failure to comply may result in serious injury or death to personnel.



1. If necessary, lift vehicle high enough to work and install suitable rated jack stand.
2. Locate ether bottle (1) in the engine compartment area near the left frame rail. Disconnect electrical connection (2).
3. Remove mounting strap bolts (3) and disconnect ether bottle. Discard of ether bottle in accordance with regulations.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

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

1. Apply connector lubricant to electrical connector.
2. Apply anti-corrosion compound to mounting bolts.
3. Install new ether bottle in mounting bracket and bolt into place. Tighten bolts.
4. Connect electrical connector.
5. Raise vehicle high enough with suitable lifting device to remove suitable jack stand and lower vehicle to the ground and remove lifting device.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Shut engine OFF.
3. Reinstall left side armor plate.
4. Reinstall left side FSS Nozzle.
5. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-3 Exhaust

4-3.1 Exhaust Pipe Replacement

EXHAUST PIPE REPLACEMENT					
This task covers:					
a) Removal	b) Installation	c) Follow-On Maintenance			
<p>INITIAL SET UP</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top; padding: 5px;"> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Exhaust pipe from muffler to transfer case (1) Exhaust pipe from transfer case to turbo pipe (1) C-clamps (2) if needed</p> <p><u>Equipment Required</u> Belly Armor Removal Kit Suitable rated jack stands</p> </td> <td style="width: 33%; vertical-align: top; padding: 5px;"> <p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking Brake Applied Transmission set in NEUTRAL (N) Wheels chocked Remove muffler Remove belly armor</p> <p><u>Reference</u> Parts Manual</p> </td> <td style="width: 33%; vertical-align: top; padding: 5px;"> <p><u>Follow-On Maintenance</u> Install muffler Tighten exhaust clamps. Battery Disconnect Switch ON Start engine Check exhaust system for leaks Shut engine OFF Battery Disconnect Switch OFF Install belly armor</p> </td> </tr> </table>			<p><u>Special Tools</u> None</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Exhaust pipe from muffler to transfer case (1) Exhaust pipe from transfer case to turbo pipe (1) C-clamps (2) if needed</p> <p><u>Equipment Required</u> Belly Armor Removal Kit Suitable rated jack stands</p>	<p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking Brake Applied Transmission set in NEUTRAL (N) Wheels chocked Remove muffler Remove belly armor</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Follow-On Maintenance</u> Install muffler Tighten exhaust clamps. Battery Disconnect Switch ON Start engine Check exhaust system for leaks Shut engine OFF Battery Disconnect Switch OFF Install belly armor</p>
<p><u>Special Tools</u> None</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Exhaust pipe from muffler to transfer case (1) Exhaust pipe from transfer case to turbo pipe (1) C-clamps (2) if needed</p> <p><u>Equipment Required</u> Belly Armor Removal Kit Suitable rated jack stands</p>	<p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking Brake Applied Transmission set in NEUTRAL (N) Wheels chocked Remove muffler Remove belly armor</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Follow-On Maintenance</u> Install muffler Tighten exhaust clamps. Battery Disconnect Switch ON Start engine Check exhaust system for leaks Shut engine OFF Battery Disconnect Switch OFF Install belly armor</p>			

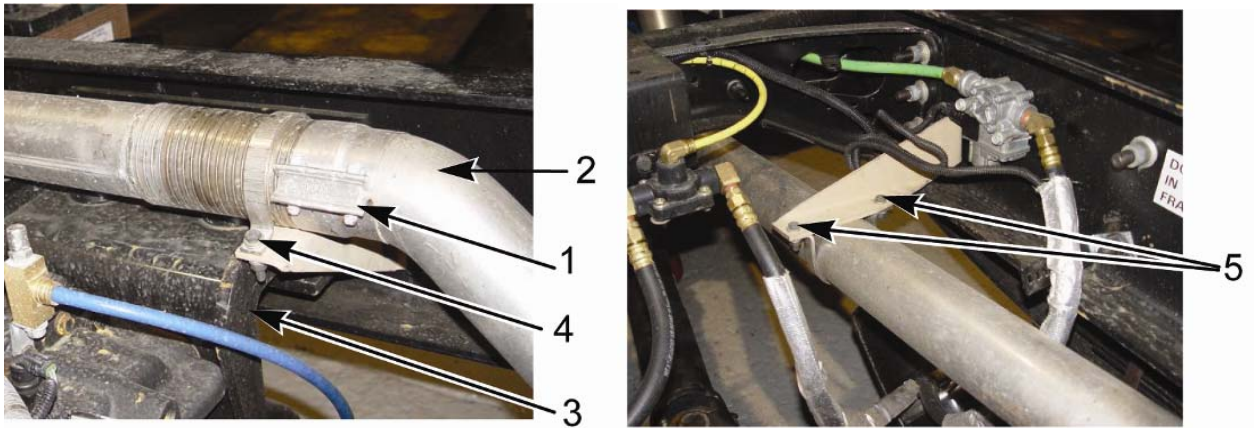
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



DO NOT touch the exhaust system components with bare hands or with your body use protective work gloves and long sleeves. DO NOT use the exhaust tailpipe as a step. It will not hold weight and will collapse. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

Do not remove hot exhaust system from vehicle, bolts can stretch, crack and break easier when hot. Personnel should wear appropriate work gloves and long sleeves. Allow exhaust system to cool before loosening bolts on C-clamps, this will avoid any damage to any of the exhaust pipes. Failure to comply may result in damage to equipment and/or cause serious burns and/or injury or death to personnel.



1. Loosen and remove the large two-bolt C-clamp (1) from exhaust pipe (2) at the transfer case mounting bracket (3).
2. Loosen mounting bolts on U-bracket (4) so exhaust pipe pieces can be separated.
3. Loosen and remove mounting bolts from U-bracket (5) at crossmember just forward of rear axle.
4. Slightly twist exhaust pipe (2) back and forth to separate pieces at transfer case mounting bracket (3) and remove exhaust pipe (2).
5. Discard exhaust pipe in accordance with local regulations.

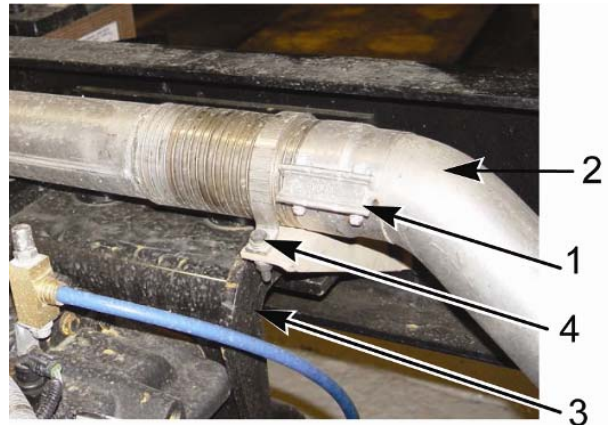
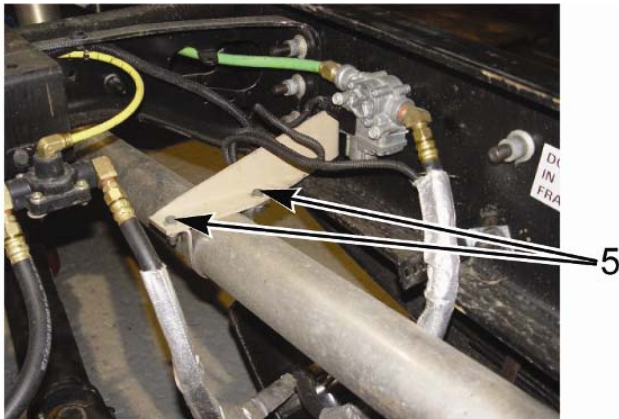
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

1. Apply anti-corrosion compound to mounting and clamp bolts.
2. Weave exhaust pipe through underside of vehicle to mounting spots.
3. Insert end of exhaust pipe (2) to existing pipe at transfer case mounting bracket (3).
4. Loosely install U-bracket mounting bracket (4) and C-clamp (1). Do not tighten until entire exhaust is installed.
5. Loosely install exhaust pipe to mounting U-bracket (5) at crossmember just forward of rear axle.



c) Follow-On Maintenance

1. Install muffler.
2. Tighten exhaust clamps.
3. Battery Disconnect Switch ON.
4. Start engine.
5. Check the exhaust system for leaks.
6. Shut engine OFF.
7. Battery Disconnect Switch OFF.
8. Install Belly Armor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-3.2 Muffler and Shield Replacement

MUFFLER AND SHIELD REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Reference</u> Parts manual</p> <p><u>Material Parts</u> Muffler C- clamps Exhaust Shield</p> <p><u>Equipment Required</u> None</p>	<p><u>Equipment Conditions</u> Engine OFF Wheels Chocked Parking Brake Applied Transmission set in NEUTRAL (N) Battery Disconnect Switch OFF</p>	<p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Start engine Check for exhaust leaks Shut engine OFF Battery Disconnect Switch OFF</p>

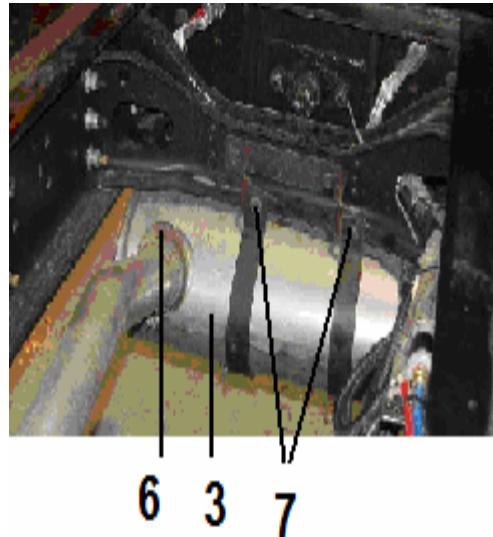
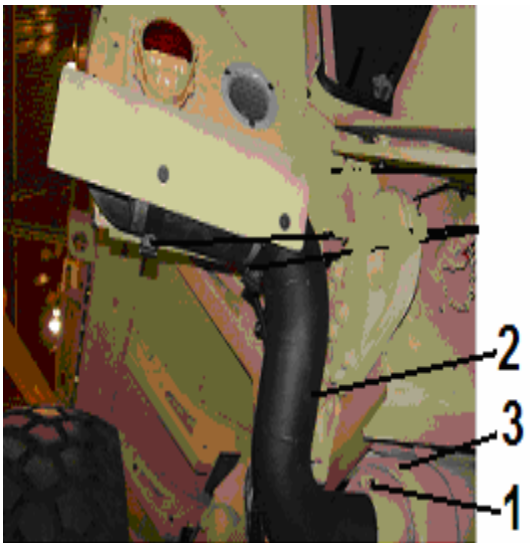
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



DO NOT touch the exhaust system components with bare hands, or with your body without use of protective work gloves and long sleeves. DO NOT use the exhaust tailpipe as a step. It will not hold weight and will collapse. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

Do not remove hot exhaust system from vehicle, bolts can stretch, crack and break easier when hot. Personnel should wear appropriate work gloves and long sleeves. Allow exhaust system to cool before loosening bolts on c-clamps, this will avoid any damage to any of the exhaust pipes. Failure to comply may result in damage to equipment and/or cause serious burns and/or injury or death to personnel.

**Muffler**

1. Make sure exhaust system is cool enough to work on and have appropriate work gloves on.
2. Loosen bolt on C-clamp (1) and remove exhaust tail pipe (2) to muffler (3).
3. Remove C-clamp from exhaust pipe (6) on side of muffler (3).
4. Loosen and remove the two holding strap bolts (7) that hold the muffler (3) up and remove muffler from vehicle.

Shield on Tail Pipe

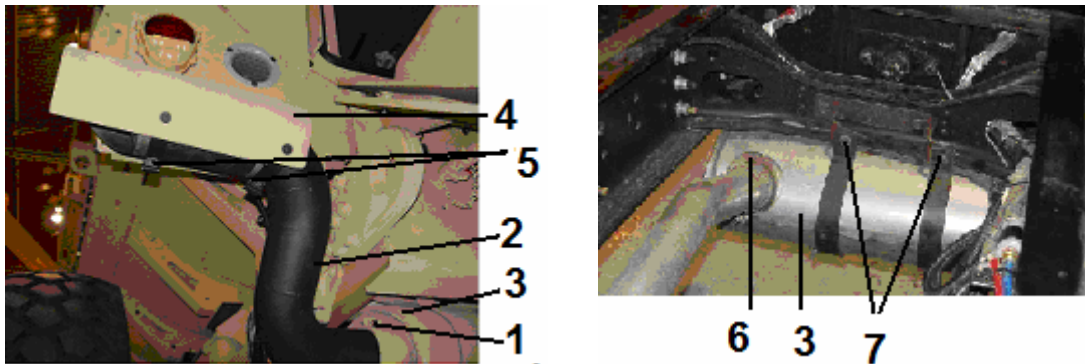
1. Loosen bolts on C-clamps (5) and remove shield (4).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

**Shield**

1. Apply anti-corrosion compound to bolts.
2. Align and install bolts on c-clamps (5) to shield (4) and then tighten all clamps.

Muffler

1. Apply anti-corrosion compound to bolts.
2. Install bolts to holding straps (7) around muffler (3) and tighten loosely.
3. Insert side section of exhaust pipe (6) to side of muffler (3), install C-clamp, insert tail pipe section (2) to end of muffler (3), install C-clamp (1). Align exhaust pipe, tail pipe and muffler so exhaust does not twist and tighten all clamps to 50-60 in-lb (5.65 to 5.78 N•m).

c) **Follow-On Maintenance**

1. Battery Disconnect Switch ON.
2. Start engine.
3. Check exhaust system for leaks.
4. Shut engine OFF.
5. Battery Disconnect Switch OFF.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-4 Cooling

4-4.1 Cooling System Flush/Refill Procedure

COOLING SYSTEM FLUSH/REFILL PROCEDURE		
This task covers:		
a) Flush	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Reference</u> Parts Manual</p> <p><u>Material/Parts</u> Antifreeze/Coolant</p>		<p><u>Equipment Condition</u> Engine OFF Wheels chocked Left side FSS nozzle bracket removed Left side Armor plate removed</p> <p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Follow-On Maintenance</u> Check coolant level and temperature rating Left side armor plate installed Left side FSS nozzle bracket installed</p>



During normal vehicle operation cooling system can become very hot. Allow cooling system to cool prior to servicing cooling system. Failure to comply may result in serious injury or death to personnel.

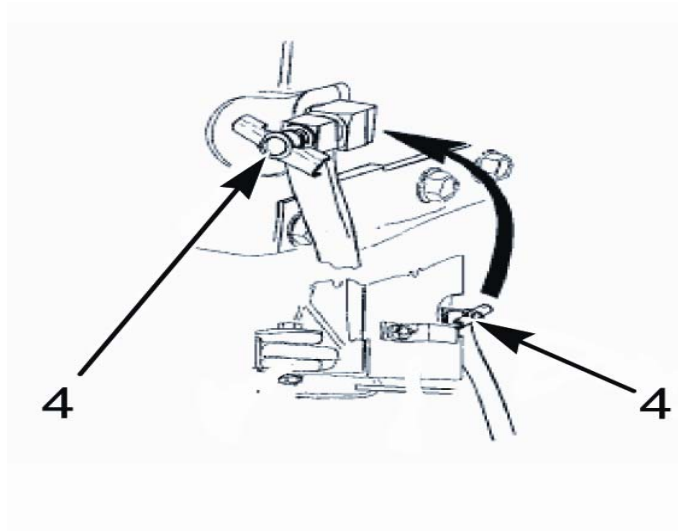
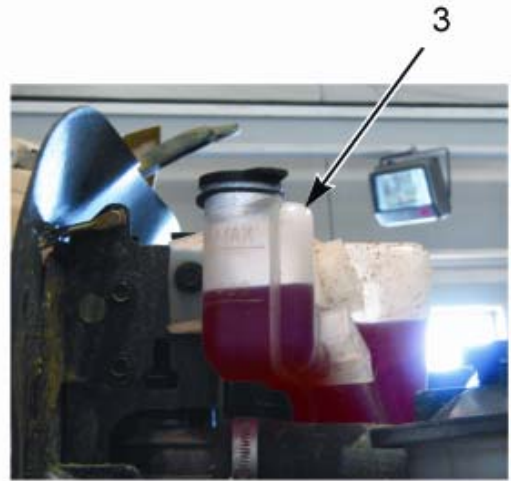
Turn cap on surge tank one half turn and stop prior to removing cap completely. Pressure must be relieved from tank prior to removal of cap. Failure to comply may result in injury to personnel.

NOTE

Vehicle should be parked on level surface when performing this task.

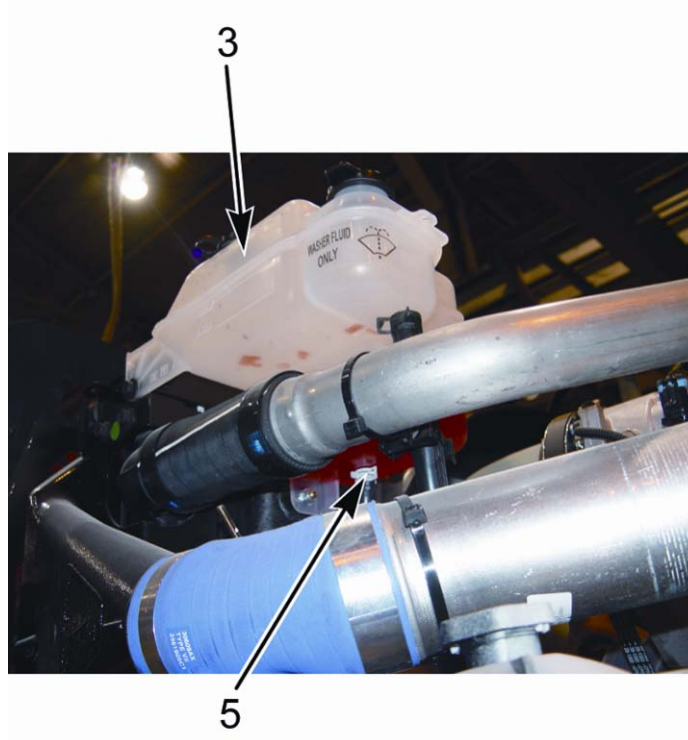
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Flush

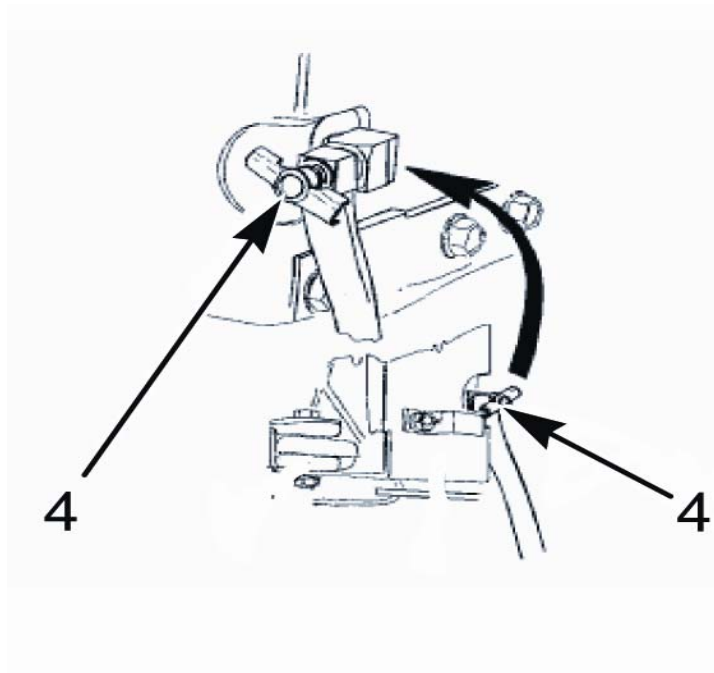


1. Push down on radiator cap (1) and slowly turn counterclockwise to relieve pressure.
2. Turn radiator cap (1) on radiator (2) ½ turn and remove cap from radiator.
3. Remove cap from overflow tank (3).
4. Position a suitable drain pan under radiator drain pet cock (4).
5. Open pet cock on bottom of radiator (2), and completely drain coolant from radiator.

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6. Remove hose (5) from overflow tank (3) and completely drain overflow tank (3).
7. When drained, install hose (5) on overflow tank (3).



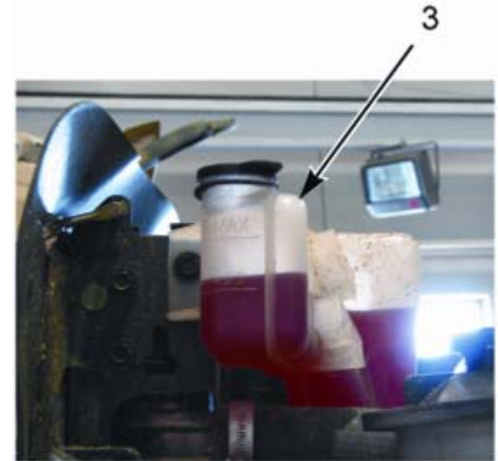
8. Close pet cock (4) on bottom of radiator.

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b) Installation

NOTE

Ensure all pet cocks are closed, hoses are connected, and drain plugs installed before filling the radiator.



1. Fill radiator (2) with 50/50 coolant mix until full.



Ensure all personnel stay clear of radiator while engine is running. Air in radiator will be released which may cause hot coolant to spray out. Failure to comply may result in serious injury to personnel.

2. Start engine and run engine until normal operating temperature is reached.
3. Shut off engine.
4. Install radiator cap (1) on radiator (2).
5. Remove cap (3) from overflow tank (3).
6. Fill overflow tank (3) with coolant until level is at the MAX mark.
7. Install cap (3) on overflow tank (3).

c) Follow-On Maintenance

1. Check coolant level and temperature rating.
2. Left side armor plate.
3. Left side FSS nozzle bracket installed.

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4-4.2 Engine Water Pump Assembly Replacement

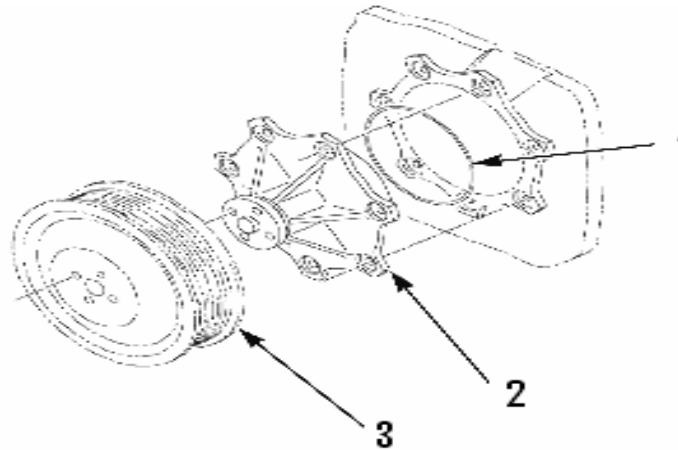
ENGINE WATER PUMP ASSEMBLY REPLACEMENT				
This task covers:				
a) Removal	b) Installation	c) Follow-On Maintenance		
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Material/Parts</u> Water Pump Water Pump Seal</p> <p><u>Reference</u> Parts Manual</p> </td> <td style="width: 50%; vertical-align: top;"> <p><u>Equipment Condition</u> Engine OFF Parking brake set Wheels chocked Radiator drained A/C belt removed Engine serpentine belt removed</p> <p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Follow-On Maintenance</u> Adjust pulley belt tension Fill radiator A/C belt installed Engine serpentine belt installed</p> </td> </tr> </table>			<p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Material/Parts</u> Water Pump Water Pump Seal</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Condition</u> Engine OFF Parking brake set Wheels chocked Radiator drained A/C belt removed Engine serpentine belt removed</p> <p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Follow-On Maintenance</u> Adjust pulley belt tension Fill radiator A/C belt installed Engine serpentine belt installed</p>
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic One (1) Crew Member</p> <p><u>Material/Parts</u> Water Pump Water Pump Seal</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Condition</u> Engine OFF Parking brake set Wheels chocked Radiator drained A/C belt removed Engine serpentine belt removed</p> <p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Follow-On Maintenance</u> Adjust pulley belt tension Fill radiator A/C belt installed Engine serpentine belt installed</p>			

NOTE

Prior to removing the water pump, the radiator should be drained.
Water pump pulley belt tension should be relieved.

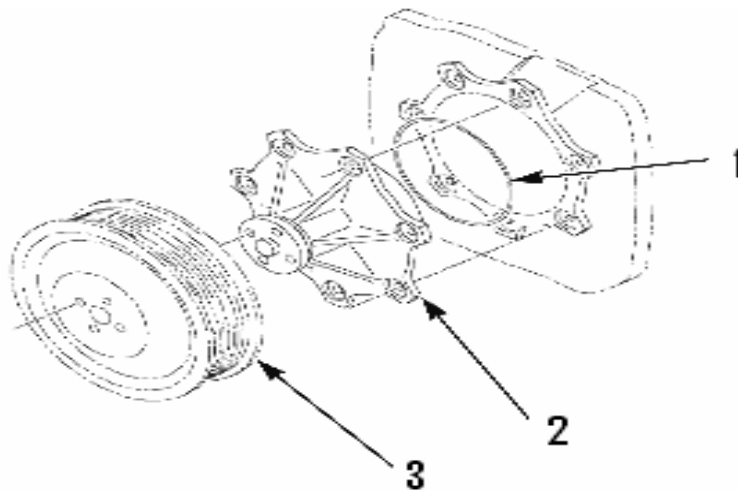
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove four pulley bolts and remove water pump pulley (3).
2. Remove bolts securing water pump assembly (2).
3. Remove water pump and discard water pump seal (1).

b) Installation



1. Install a new water pump seal (1) on the new water pump assembly (2).
2. Install new water pump assembly (2) on the front cover and install two bolts.
3. Install remaining bolts securing water pump assembly finger tight.
4. Tighten all bolts securing water pump assembly (2) to 13 ft-lb (17 N•m).
5. Install pump pulley (3) on water pump assembly.

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6. Install four bolts securing water pump pulley to water pump assembly.
7. Tighten all bolts securing water pump pulley (3) to 60 in-lb (6.8 N•m).

c) Follow-On Maintenance

1. Reinstall engine serpentine belt.
2. Install A/C Belt.
3. Fill radiator with coolant.
 1. Start engine and bring engine up to operating temperature and check for leaks.
 2. Shut off engine.
 3. Check coolant level, (fill if required).
 4. Remove drain pan and dispose of contents.

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4-4.3 Radiator Replacement

RADIATOR REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<i>INITIAL SET UP</i>		
	<u>Equipment Conditions</u>	<u>Follow-On</u>
	Engine shut OFF	Install CAC assembly
<u>Special Tools</u>	Battery Disconnect Switch OFF	Install CAC hoses
None	Parking brake set	Install armor grille
	Transmission set in NEUTRAL (N)	Connect transmission lines
	Wheels chocked	Install surge tank, overflow reservoir
	Disconnect electrical connectors	Connect coolant hoses
	Drain radiator	Install engine hood and adjust
<u>Personnel</u>	Drain surge tank, overflow reservoir	Fill radiator with ELC coolant
One Wheeled Vehicle Mechanic	Remove surge tank, overflow reservoir	Connect electrical connectors
	Remove engine hood	Battery Disconnect Switch ON
<u>Material Parts</u>	Disconnect coolant hoses	Start engine
Radiator	Disconnect, drain, plug transmission lines	Run to operating temperature
	Remove armor grille	Check and verify gauge operation
	Disconnect CAC hoses	Check and verify heater operation
<u>Reference</u>	Remove CAC assembly	Shut engine OFF
Parts Manual		Battery Disconnect Switch OFF
	<u>Equipment Required</u>	Top off coolant overflow & surge tank
	Suitable lifting device	Close engine hood
	Suitable lifting sling	Remove wheel chocks
	Drain pan (1 or 2)	
	Rags	

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a) Removal

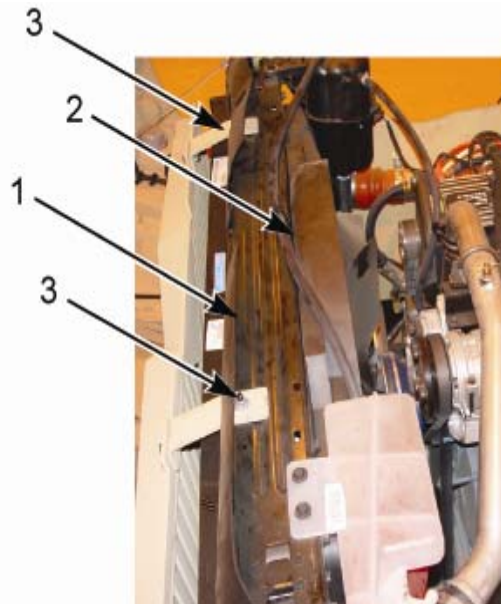


Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

International® Mine Protected Vehicle (I-MPV) armor parts are heavy. Use care when removing or installing. DO NOT attempt to lift without the aid of an assistant and a suitable lifting device. Failure to comply may result in serious injury or death to personnel.

Engine components become extremely hot during normal operation. Allow engine to cool completely prior to performing any task. DO NOT touch the exhaust system components with bare hands or with your body use protective work gloves and long sleeves. Failure to comply may result in damage to equipment and or serious burns, injury or death to personnel.

Cooling system components become pressurized and extremely hot during normal operation. Use extreme care when working around hot components. DO NOT open hot radiator cap under pressure, hot coolant can/will spray out. Failure to comply may result in serious injury or death to personnel.



1. With suitable lifting device and lifting sling (3) securely attached to the front of radiator (1). (where CAC assembly was attached) Loosen and remove the mounting bolts top and bottom and frame rail for the radiator.
2. Lift radiator just high enough to clear vehicle chassis and lower to floor or pallet.
3. Remove fan shroud assembly (2) and set aside for later.
4. Discard defective radiator (1) in accordance with local regulations.

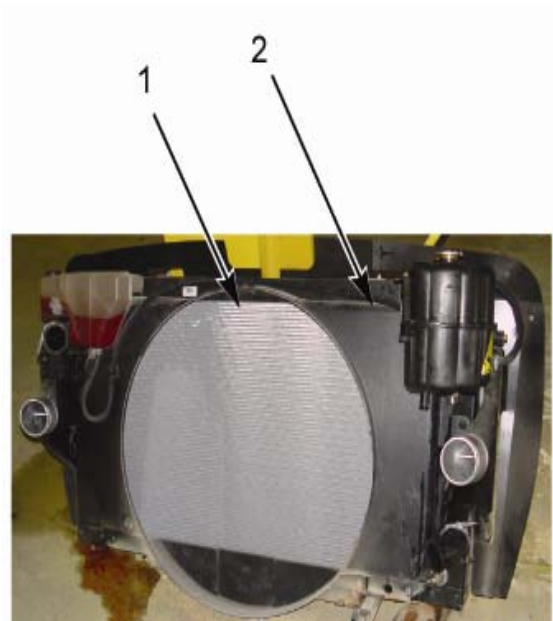
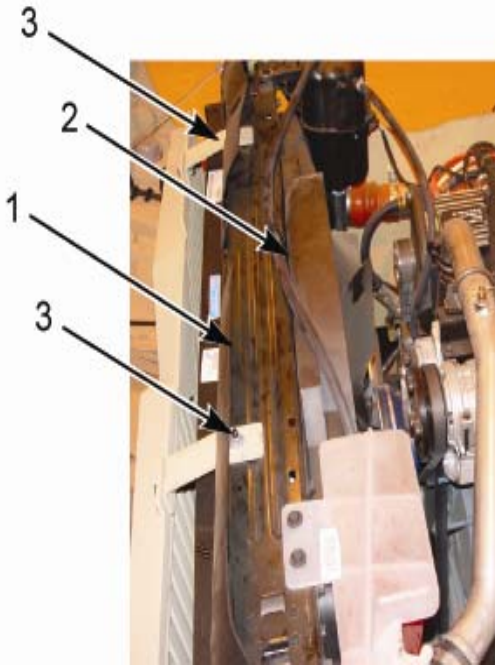
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

1. Inspect new radiator (1) to obvious damage before installing.
2. Install fan shroud (2) with mounting bolts to new radiator (1) and tighten.
3. Attach and secure lifting sling (3) to radiator (1) and with suitable lifting device, raise just high enough to clear vehicle and set into position.
4. Attach radiator (1) with mounting bolts to top and bottom of frame rail and tighten to specification.
5. Remove lifting sling (3) from radiator (1) top after it is secure into place.



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c. Follow-On Maintenance

1. Install CAC assembly.
2. Install CAC hoses.
3. Install armor grille.
4. Connect transmission lines.
5. Install surge tank and overflow reservoir.
6. Connect coolant hoses.
7. Install engine hood and adjust.
8. Fill radiator with ELC coolant.
9. Connect electrical connectors.
10. Battery Disconnect Switch ON.
11. Start engine.
12. Run to operating temperature.
13. Check and verify gauge operation.
14. Check and verify heater operation.
15. Shut engine OFF.
16. Battery Disconnect Switch OFF.
17. Top off coolant overflow reservoir and surge tank.
18. Close and secure engine hood.
19. Remove wheel chocks.

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4-4.4 Cooling Fan Replacement

COOLING FAN REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Fan Assembly Radiator Shroud Mounting Bolts Fan Mounting Bolts</p>	<p><u>Equipment Condition</u> Parking brake set Wheels chocked Radiator shroud removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Install radiator shroud</p>	

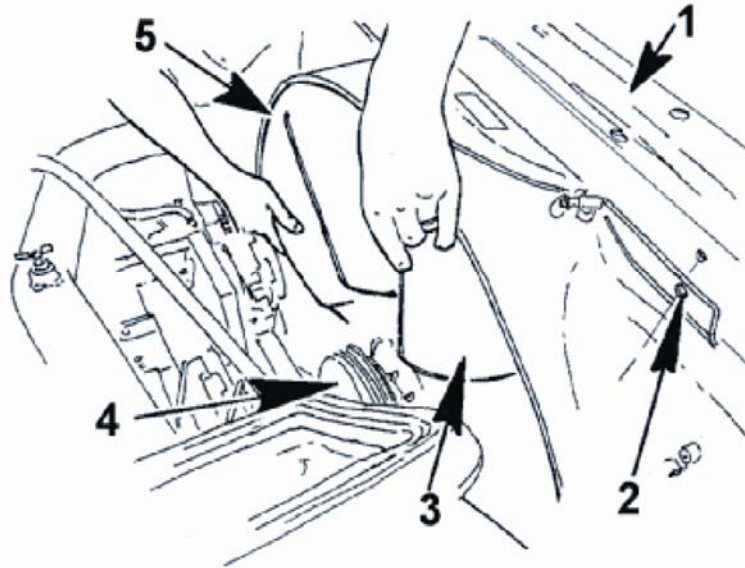
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

Prior to removing the fan, the radiator shroud must be removed.

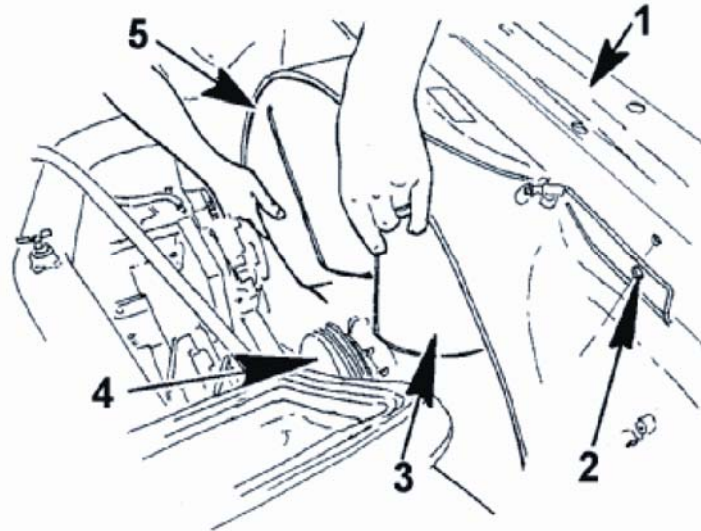
1. Beginning at the upper mounting bolts of the radiator / fan shroud assembly, loosen and remove the shroud mounting bolts (2) from radiator (1).



2. With the shroud mounting bolts (2) removed, place the shroud assembly (3) back and over the fan assembly (3).
3. Locate the fan mounting bolts on the fan drive hub (4). Loosen and remove fan mounting bolts from the fan drive hub (4).
4. Remove the fan (3) from the fan drive hub (4).
5. Remove both fan (3) and radiator shroud (5) from chassis.

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b) Installation



1. Install the fan (3) on the fan drive hub (4).
2. Locate the fan mounting bolts on the fan drive hub (4).
3. Install the fan mounting bolts on the fan drive hub (4).
4. Install the radiator shroud (5) on the chassis.
5. Secure radiator shroud (5) to radiator top frame (1) with mounting bolts (2).
6. Beginning at the upper mounting bolts of the radiator/fan shroud assembly, install and tighten the shroud mounting bolts (2).

c) Follow-On Maintenance

1. Install radiator shroud.

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4-4.5 Cooling Fan Actuator Solenoid Replacement

COOLING FAN ACTUATOR SOLENOID REPLACEMENT		
This task covers:		
a) Removal Installation	b)	c) Follow-On Maintenance
INITIAL SET UP		<u>Equipment Required</u> None
<u>Special Tools</u> None		<u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission in NEUTRAL (N) Wheels chocked Air intake tube removed Air intake canister removed
<u>Personnel</u> One (1) WHEELED VEHICLE MECHANIC		
<u>Material Parts</u> None		
<u>Reference</u> Parts Manual		<u>Follow-On Maintenance</u> Reinstall air intake tube Reinstall air intake canister Battery Disconnect Switch ON Start engine Verify operation Shut engine OFF Remove chocks

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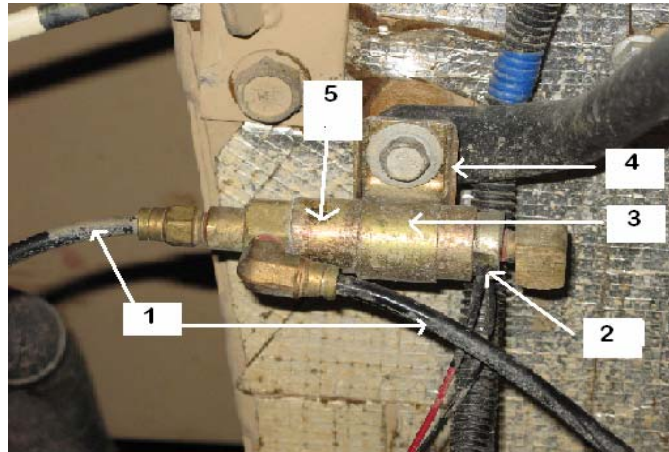
a) Removal



Drain all air from the air system before removing air lines or hose. Failure to do so could result in personal injury and/or death.

Whenever any component is serviced or removed from the air system, set the parking brake and chock the wheels to prevent it from moving while the service is being performed. Failure to do so could result in personal injury and/or death.

1. Remove two lines (1) from actuator. Disconnect electrical plug (2) from unit.
2. Remove actuator clamp (3) from bracket (4).
3. Remove actuator (5) from clamp.



b) Installation

1. Reinstall fittings to new actuator as needed.
2. Replace actuator (5) into clamp.
3. Place actuator clamp (3) into bracket (4).
4. Install electrical plug (2) into unit. Connect two lines to actuator.

c) Follow-On Maintenance

1. Install Air Intake Tube.
2. Install Air Intake Canister.
3. Battery Disconnect Switch ON.
4. Start engine.
5. Verify operation and check for leaks.
6. Shut engine OFF.
7. Remove wheel chocks.

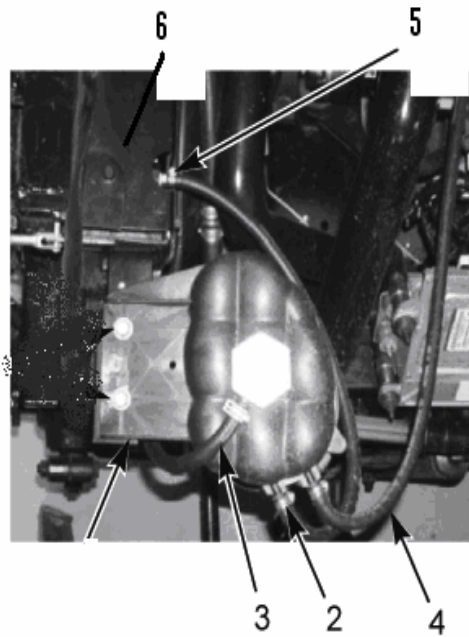
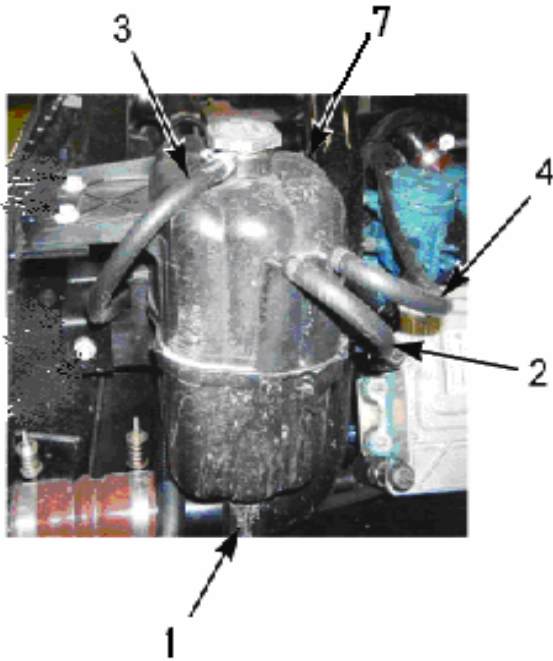
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4-4.6 Surge Tank Replacement

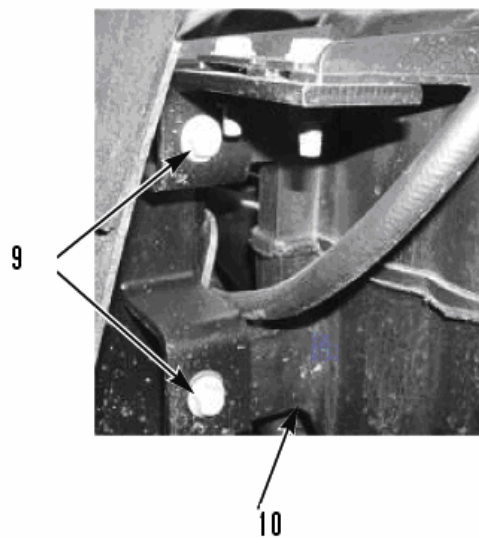
SURGE TANK REPLACEMENT	
This task covers:	
a) Removal	b) Installation
c) Follow-On Maintenance	
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Compression clamp (3) Worm style clamp (2) Surge tank mount bolts (4) Surge tank (1)</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Condition</u> Engine OFF Wheels chocked Engine cooled down</p> <p><u>Equipment Required</u> Drain Pan Rags</p> <p><u>Follow-On Maintenance</u> Fill with coolant Start engine Check for leaks Remove wheel chocks</p>

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a) Removal

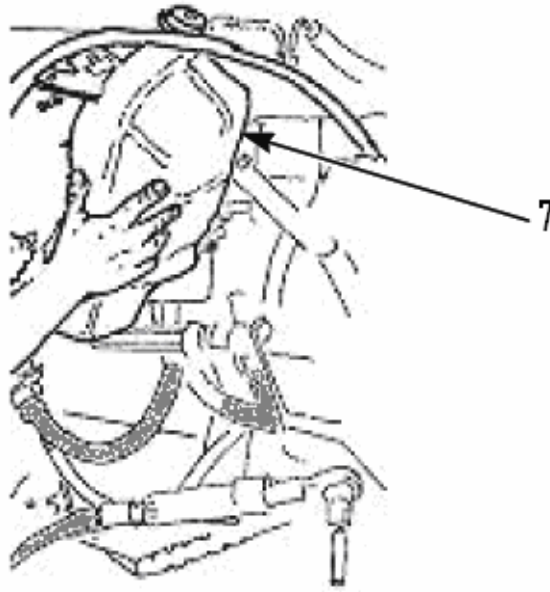


1. Check tank for coolant; drain if necessary by disconnecting the bottom hose (1) from the surge tank (7).
2. Loosen the compression clamp (5) securing the upper radiator surge hose (2) at the radiator (6), and disconnect the hose.
3. Loosen the compression clamp securing the overflow surge hose (3) at the overflow bottle and disconnect the hose.
4. Loosen the compression clamp securing the surge hose (4) coming from the upper engine fitting, and disconnect, if necessary.



5. Loosen and remove 2 surge tank mounting bolts (9) from surge tank mounting bracket (10).

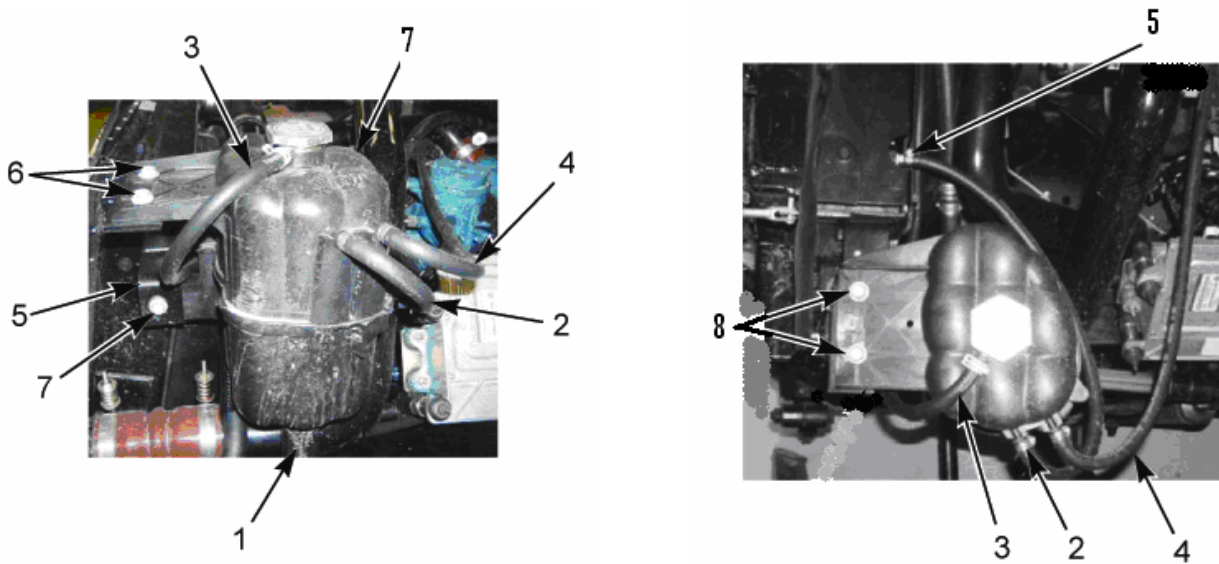
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6. Move or remove the surge tank (7).

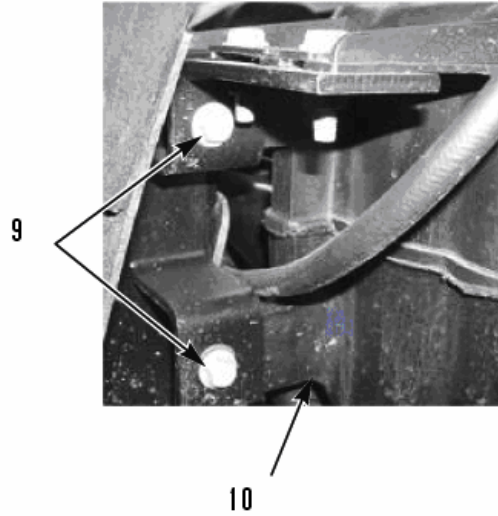
b) Installation

1. Check the condition of surge tank for leaks or damage before installing.

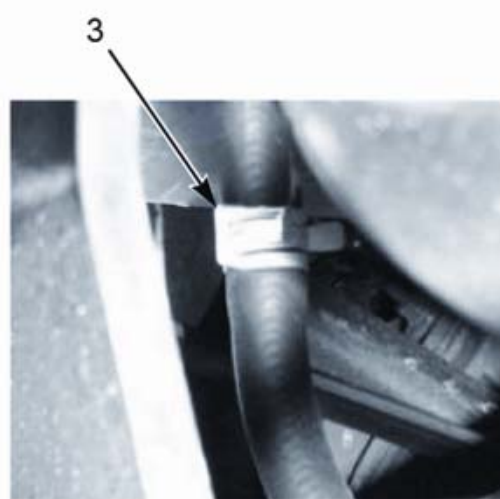


2. Locate new surge tank (7) on radiator surge tank mounting bracket (10), and install upper mounting bolts (8).

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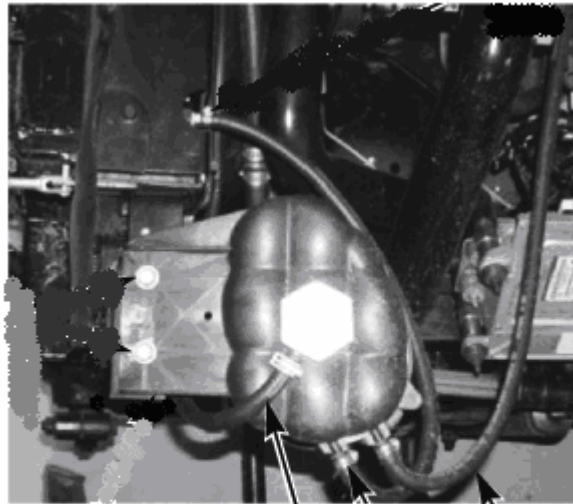


3. Align side-mounting holes in surge tank with holes in surge tank mounting bracket and install nuts (9).
4. Tighten 2 bolts and 2 nuts.
5. Reattach the bottom hose (1) to the engine thermostat housing using a worm-style clamp (if previously removed).
6. Reattach the upper radiator surge hose (2) to the radiator using a compression clamp.



7. Reattach the overflow surge hose (3) to the overflow tank using a compression clamp.

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8. Reattach the upper engine fitting surge hose (4) (if it was removed) using a worm-style clamp.

c) Follow-On Maintenance

1. Fill with coolant.
2. Start engine.
3. Check for leaks.
4. Remove chocks.

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4-4.7 Radiator Shroud Replacement

RADIATOR SHROUD REPLACEMENT	
This task covers:	
a) Removal	b) Installation
	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Equipment Required</u> Rags</p> <p><u>Reference</u> Parts Manual</p> <p><u>Material Parts</u> Zip Ties (as required)</p>	<p><u>Equipment Conditions</u> Battery Disconnect Switch OFF Engine OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Driver overflow tank removed Passenger surge tank removed Remove fan</p> <p><u>Follow-On Maintenance</u> Install fan Check alignment of shroud and fan,nuts,and bolts tightened. Install passenger surge tank Install driver overflow tank Battery Disconnect Switch ON Start engine Verify operation and clearance of radiator shroud and fan Check for leaks Shut engine OFF and close hood Remove chocks</p>

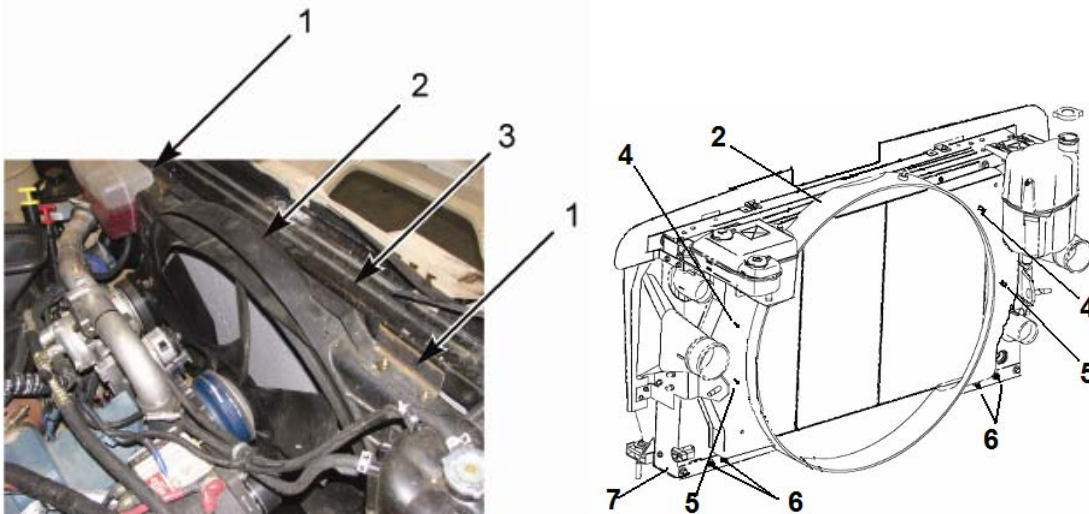
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a) Removal



Engine components become extremely hot during normal operation. Always allow engine to cool completely prior to performing any task or procedures on it. Working in close quarters in engine compartment can be difficult moving around. Wear proper safety equipment; safety goggles, work gloves, long sleeve or shop coat. Failure to comply may result in serious burns, cuts, or injury or death to personnel.

The I-MPV engine hood is extremely heavy, secure hood after raising it to ensure safety of personnel working in the engine compartment. Failure to comply may cause serious injury or death to personnel.



1. Remove two bolts (1) holding the top frame bracket of radiator shroud (2) to radiator core support bracket (3).
2. Remove four nuts (4) from studs (5) holding top frame bracket of radiator shroud (2).
3. Remove two nuts off studs on each side of radiator core support bracket.
4. Remove four bolts (6) on bottom of radiator core support bracket (7) and radiator shroud.
5. Loosen transmission oil cooler fitting and move to side to allow clearance for shroud removal.

NOTE

DO NOT completely remove transmission oil cooler fittings from Radiator.

6. Lift radiator shroud off of studs and out of vehicle.

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b) Installation

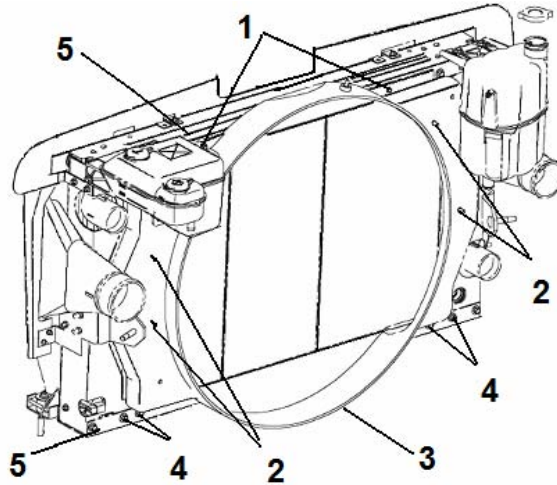


Anti-corrosion compound is toxic. Use only in well-ventilated area. Use approved respirator with dual organic vapor/mist and particulate cartridge. **DO NOT** get in easy; wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant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

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



All nuts and bolts will be finger tightened when first mounting. This is to ensure proper alignment of all pieces and to eliminate the possibility of failure to component. Failure to comply may result in damage to equipment.



1. Apply anti-corrosion compound to bolts and nuts.
2. Install new radiator shroud (3) over side studs (2) on radiator core support bracket (5) and attach nuts loosely.
3. Install bottom radiator core support bracket bolts (4) to radiator shroud (3) and tighten loosely.
4. Install top frame bracket to top studs (1) on radiator shroud (3) and install nuts loosely.
5. Install top frame bracket bolts to radiator core support bracket (5) loosely.
6. Reposition and tighten transmission oil cooler fitting.
7. Nuts and bolts can not be tightened to specification until fan is installed to ensure fan does not hit radiator shroud.

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c) Follow-On Maintenance

1. Install fan.
2. Check alignment of shroud to fan and tighten bolts and nuts to specification.
3. Install passenger surge tank.
4. Install driver overflow tank.
5. Battery Disconnect Switch ON
6. Start engine.
7. Verify operation and clearance of radiator shroud and fan.
8. Check for leaks.
9. Shut engine OFF and close hood.
10. Remove wheel chocks.

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4-4.8 Radiator Pressure Cap Replacement

RADIATOR PRESSURE CAP REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Wheels chocked Engine cooled down
<u>Personnel</u>		
One (1) Wheeled Vehicle Mechanic		
<u>Material/Parts</u>		<u>Reference</u>
Radiator cap (1)		Parts Manual
		<u>Equipment Required</u>
		Thick heavy cloth
		<u>Follow-On Maintenance</u>
		Check engine temperature



To avoid personal injury or death from hot coolant or steam scalding, use the following procedure to remove the pressure cap from the cooling system. Allow the engine to cool. Wrap a thick cloth around the cap. Unscrew cap slowly, then pause to allow pressure to release.

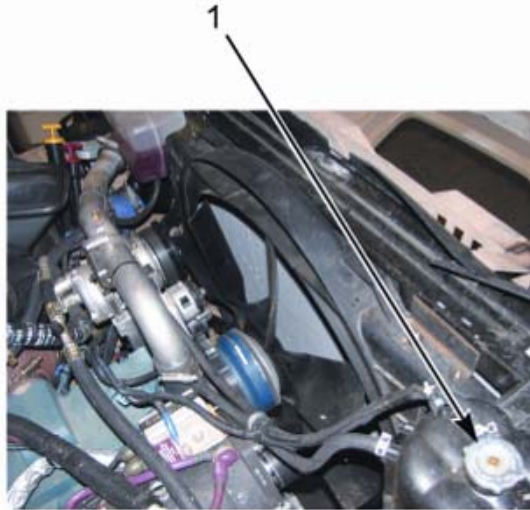


If the coolant should get extremely low and the engine gets very hot, let the engine cool for approximately 15 minutes before adding coolant. Then add coolant with the engine running. Adding cold coolant to a hot engine can crack the cylinder head or crankcase.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. Allow the engine to cool.



2. Wrap a thick heavy cloth around the radiator pressure cap (1).
3. Push the pressure cap (1) down and then slowly turn it counter-clockwise to loosen it to the first “notch” position.
4. Pause for a moment to allow the pressure and or steam to escape. This will avoid possible scalding by hot water or steam.
5. Continue to push down and turn the pressure cap counter-clockwise and then remove it. Keep your face away from the cap opening.

b) Installation

1. Install new pressure cap on overflow tank.
2. Push down and turn cap clockwise to first notch “position”.
3. Continue to turn cap clockwise past “notch” position to fully tighten cap.

c) Follow-On Maintenance

1. Check engine temperature gauge for proper heating.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-4.9 Cooling Fan Drive Assembly Replacement

COOLING FAN DRIVE ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) WHEELED VEHICLE MECHANIC</p> <p><u>Equipment Required</u> Drain pan Rags</p> <p><u>Reference</u> Parts Manual</p>		<p><u>Equipment Conditions</u> Battery Disconnect Switch OFF Engine OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked Engine fan belt removed (Serpentine) Engine fan removed A/C belt removed</p> <p><u>Follow-On Maintenance</u> Install fan Install A/C belt Install engine fan belt (Serpentine) Battery Disconnect Switch ON Start engine Verify operation and clearance of radiator Shroud and Fan Shut engine OFF and close hood Remove chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS



Engine components become extremely hot during normal operation. Always allow engine to cool completely prior to performing any task or procedures on it. Working in close quarters in engine compartment can be difficult moving around. Wear proper safety equipment; safety goggles, work gloves, long sleeves or shop coat. Failure to comply may result in serious burns, cuts, or injury or death to personnel.

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

DO NOT attempt to restrict fan blade rotation during engine operation. DO NOT operate a vehicle with a drive or fan blades that are malfunctioning or are externally damaged. Improper use of application or modification of a viscous fan drive or fan that it carries can result in damage to the fan drive. Failure to comply may also result in equipment damage and or serious injury or death to personnel.

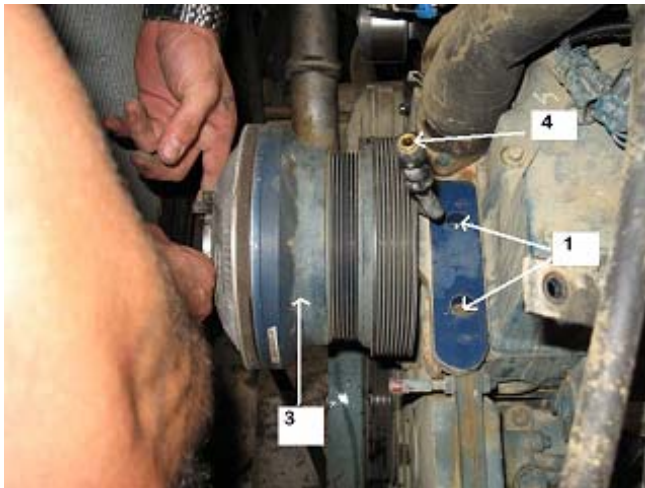
DO NOT disconnect A/C lines from compressor. Release of refrigerant may cause injury to personnel, or damage to equipment and/or environment.

NOTE

Note location and position of bracket prior to removal to ensure proper installation

a) Removal

1. Remove 4 bolts from A/C compressor with out disconnecting line. Set compressor to side for clearance.



2. Remove 2 bolts from top of bracket (1), and 2 bolts from front of bracket (2) to remove drive pulley (3).
3. Disconnect air line (4) from fan drive.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Connect air line (4) to fan drive.
2. Install 2 bolts in top of bracket (1) and 2 bolts in front of bracket (2) to install drive pulley (3).
3. Reinstall A/C compressor using 4 bolts.

c) Follow-On Maintenance

1. Install fan.
2. Install A/C belts.
3. Install engine fan belt (Serpentine).
4. Battery Disconnect Switch ON.
5. Start engine.
6. Verify operation and clearance of shroud.
7. Shut engine OFF.
8. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5 Electrical

4-5.1 400 Amp Alternator Replacement

400 AMP ALTERNATOR REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Overhead Crane/Heavy Lift Torque Wrench</p> <p><u>Reference</u> Parts Manual</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanics</p> <p><u>Equipment Required</u> Overhead Crane/Heavy Lift Mechanics Tool Box</p> <p><u>Material/Parts</u> Lockwashers (2 ea) Locknut (2 ea) Dielectric Grease Sealing Compound Identification Tags Regulator</p>	<p><u>Equipment Condition</u> Engine OFF Battery Disconnect Switch OFF Transmission in neutral (N) Parking brake set Wheels chocked Battery disconnected Remove voltage regulator Remove alternator belt Serpentine belt removed</p>	<p><u>Follow-On Maintenance</u> Install alternator belt Install voltage regulator Reconnect battery Battery Disconnect Switch ON Start vehicle Check voltage gauge Remove wheel chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

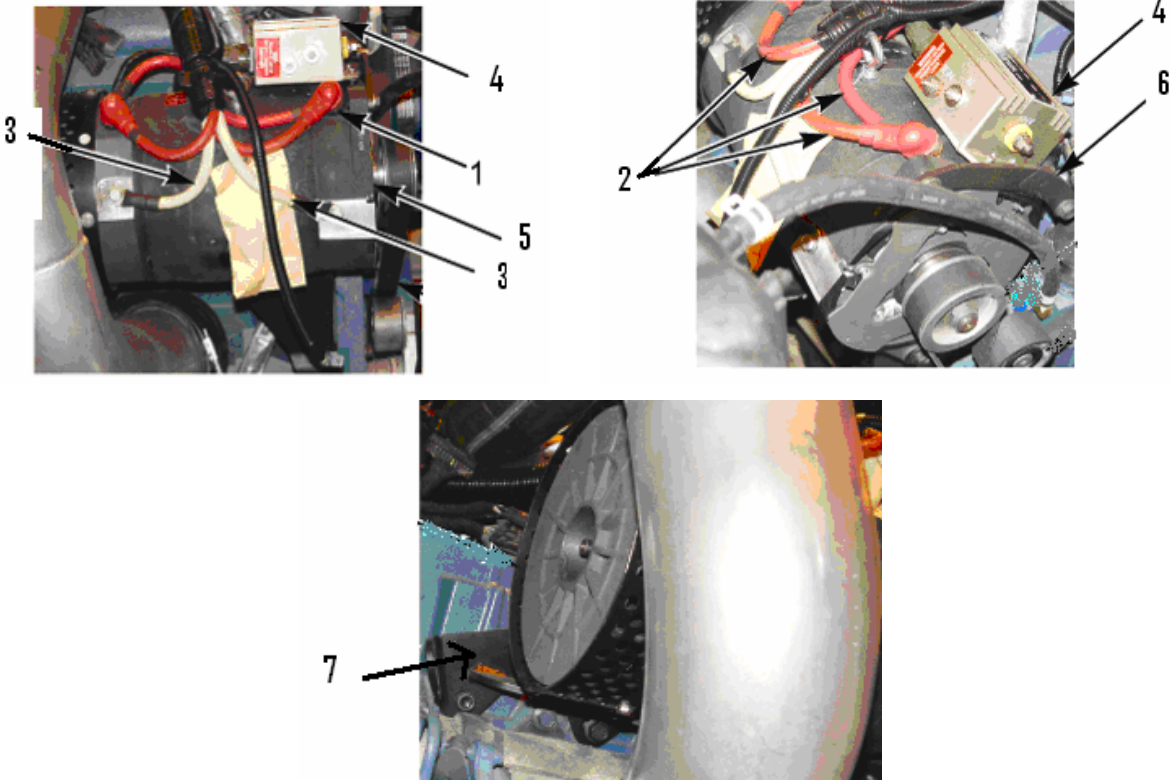


Before working on any electrical components, turn Battery Disconnect Switch to off position. Make sure you properly secure hood of vehicle after lifting to ensure that it does not fall while you are working in the engine compartment area. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

a) Removal



Alternator is extremely heavy and awkward. Use suitable lifting device and have Crewmember assist. Injury to personnel and/or equipment may result.



NOTE

Before the removal of the alternator, tag and mark all wires and connections prior to removal to ensure proper installation of new part.

1. Remove lock nuts (1) on red positive wires (2) and white negative wires (3) connections on top side of alternator and with all other connections and tag and label them.
2. Remove wire connectors to regulator (4) from the alternator.
3. Loosen and remove three bolts from front alternator (5) mounting bracket (6),
4. Loosen and remove three bolts from rear alternator mounting brace (7).
5. Use extreme care when removing alternator, it is heavy and in an awkward position in engine compartment. Remove alternator (5) from vehicle and set on ground or pallet.

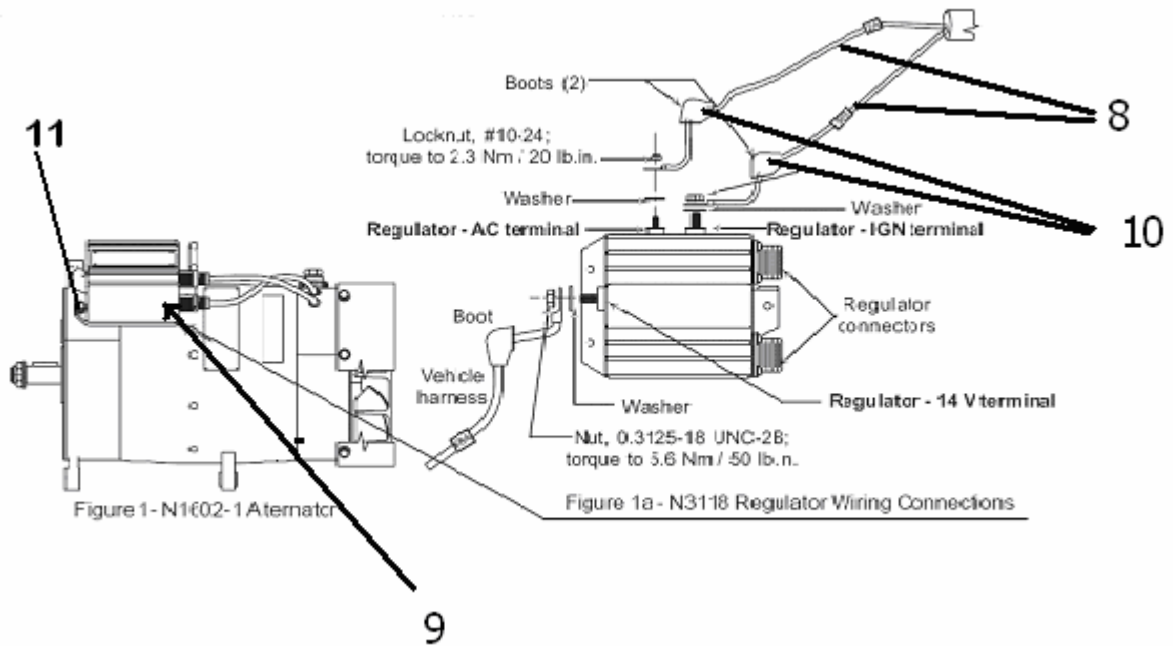
Chapter 4 – MAINTENANCE INSTRUCTIONS

NOTE

Regulator must be removed from 400 Amp Alternator Assembly, following the removal of Alternator Assembly from vehicle, and re-installed on replacement Alternator.

Mark and/or tag all wires and connectors on Regulator, prior to its removal from Alternator Assembly.

6. Label and remove 2 wires (8) and 2 cannon plugs (10) on alternator's regulator (9).



7. Remove 3 bolts (11) attaching regulator to alternator.
8. Remove regulator from top of alternator.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

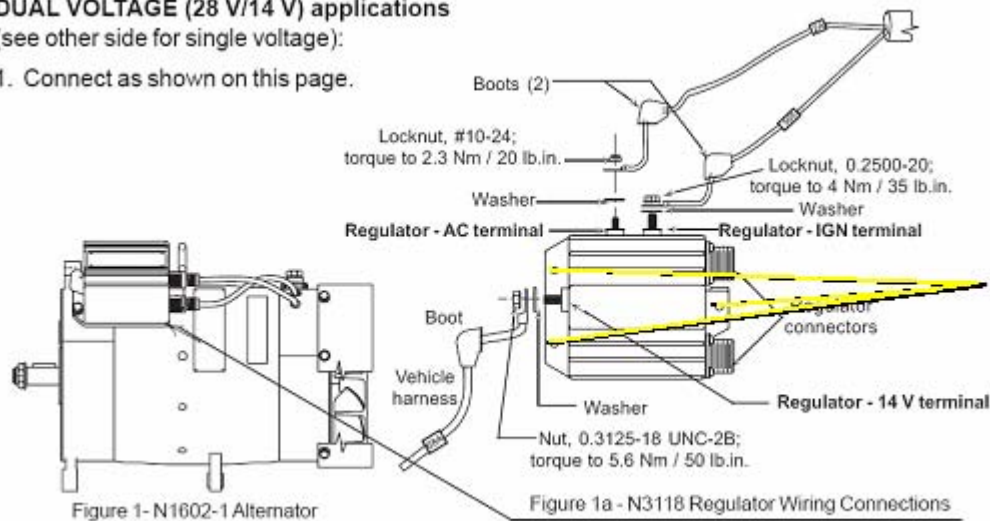


Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious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

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

DUAL VOLTAGE (28 V/14 V) applications
(see other side for single voltage):

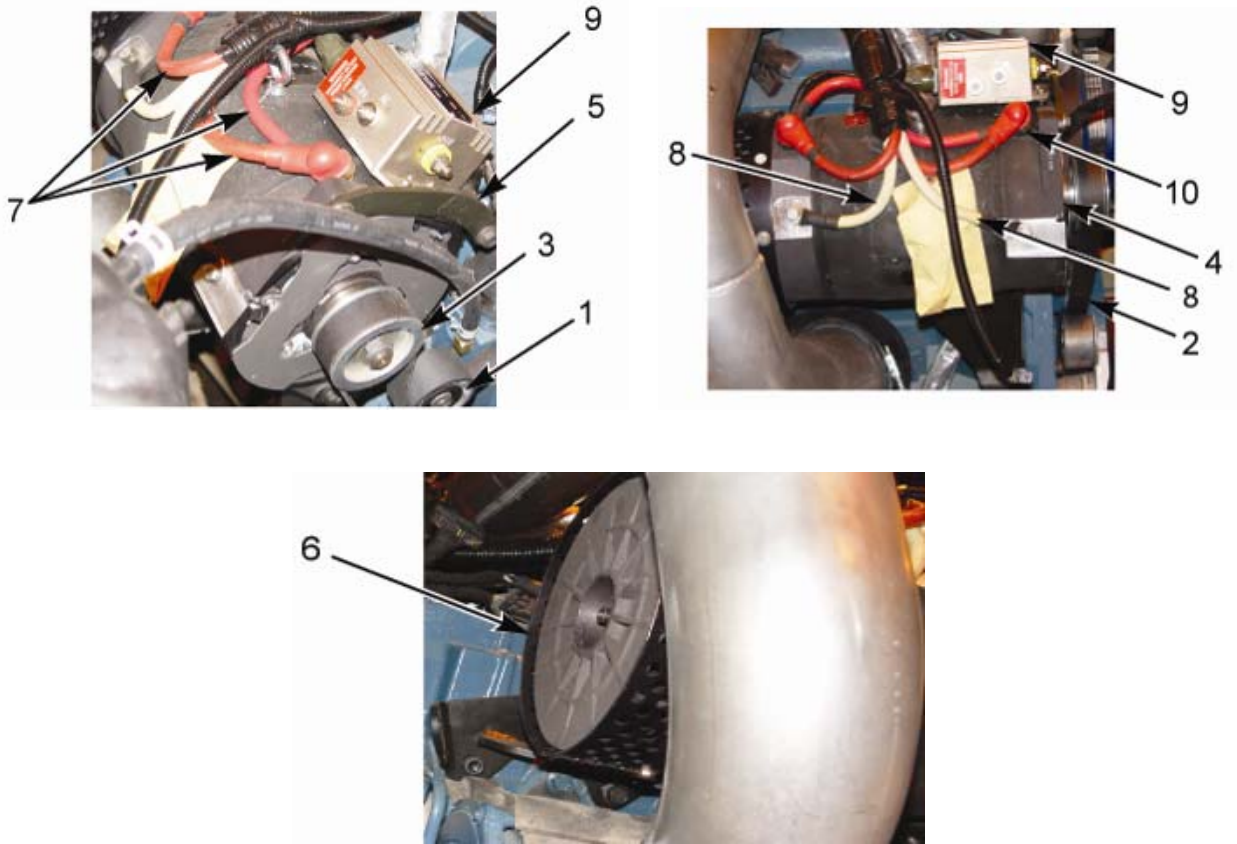
1. Connect as shown on this page.



11

1. Inspect new alternator for any signs of visible damage before installing on vehicle.
2. Install regulator that was removed from previous alternator, onto the new alternator prior to installing on the vehicle. Torque 3 regulator mounting bolts (11) to 15 ft-lb (20 N•m).
3. Connect 2 cannon plugs and wiring to alternator's regulator.

Chapter 4 – MAINTENANCE INSTRUCTIONS



4. Slide alternator (4) into rear mounting brace (6) and line-up mounting holes, install bolts.
5. Line up front bracket (5) mounting holes with three mounting bolts, install bolts.
6. Apply connector lubricant to all connectors.
7. Apply sealing compound to wires (7) and (8) and lock nuts (10).
8. Reconnect all wire connectors on alternator (4) and positive and negative cables.
9. Tighten alternator mounting bolts to 120 ft-lb (163 N•m).

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) **Follow-On Maintenance**

- a. Install alternator belt.
- b. Install voltage regulator.
- c. Reconnect batteries.
- d. Battery Disconnect Switch ON.
- e. Start vehicle.
- f. Check voltage gauge.
- g. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.2 Electrical System Computer Test and Replacement

ELECTRICAL SYSTEM COMPUTER TEST

This task covers:

- a) Test
- b) Removal
- c) Installation
- d) Follow-On Maintenance

INITIAL SET UP

Special Tools

ESC Breakout Box ZTSE-4477

Equipment Required

None

Personnel

One (1) Wheeled Vehicle Mechanic

Equipment Conditions

- Engine OFF
- Battery Disconnect Switch OFF
- Batteries disconnected
- Parking brake set
- Transmission in NEUTRAL (N)
- Wheels chocked

Material Parts

Electronic System Control Module

Reference

Parts Manual

Follow-On Maintenance

- Re-connect batteries
- Battery Disconnect Switch ON
- Start engine
- Verify operation
- Shut engine OFF
- Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Test



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Engine components become extremely hot during normal operation. Always allow engine to cool completely prior to performing any task or procedures on it. Working in close quarters in engine compartment can be difficult moving around. Wear proper safety equipment; safety goggles, work gloves, long sleeves, or shop coat. Failure to comply may result in serious burns, cuts, or injury or death to personnel.



When replacing the Electronic System Controller (ESC) make sure that the new replacement unit has been programmed for vehicle. Failure to comply may result in damage to equipment.

NOTE

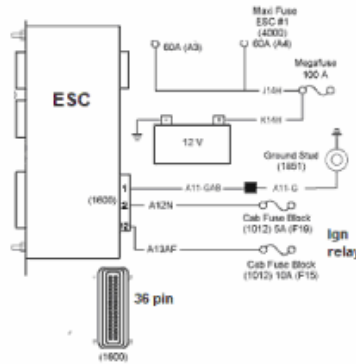
The testing method for troubleshooting the electrical systems portrayed in this manual is a basic voltage test. An alternative method of checking for voltage drops within a given circuit may be a quicker method of identifying an exact problem.

If one of the 60 amp maxi fuses should happen to blow, the ESC will still be able to operate half of the system outputs.

Always check connectors for damage or pushed out terminal ends

Battery voltage is supplied to the ESC through two 60A fuses in the maxi fuse block in the engine compartment power distribution center. The ESC receives power, with the ignition switch in the ignition position from the ignition relay through a 10 amp fuse F15. The ESC receives power on pin 2 of connector (1600), with the ignition switch in the accessory position, from the accessory relay through a 5 amp fuse F19. The ESC ground is to the negative terminal of the batteries via ground stud (1851).

Chapter 4 – MAINTENANCE INSTRUCTIONS

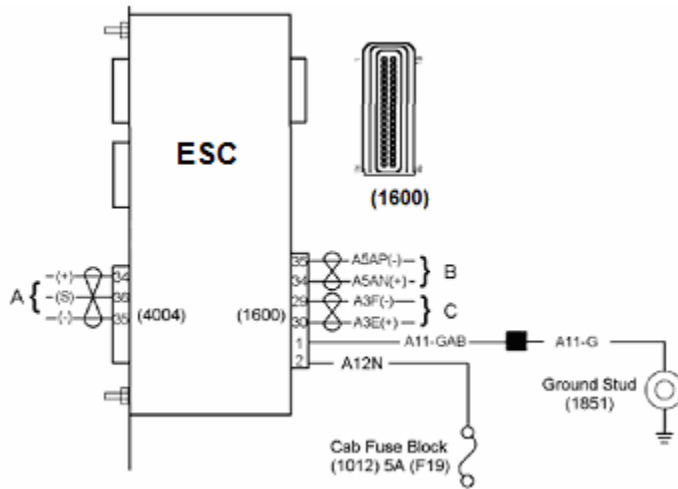


ESC Power and Ground System Circuitry Voltage Check Chart

ESC connector (4009) – Battery Voltage Check – Check with the Ignition Switch OFF and (4009) disconnected.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
(4009) harness pin, circuit J14B, to ground	12± 1.5 volts	If voltage is incorrect, check for blown maxi fuse A3, blown mega fuse or open wiring.
ESC Connector (4010) – Battery Voltage Check - Check with the Ignition Switch OFF and (4010) disconnected.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
(4010) harness cavity, circuit J14A, to ground.	12± 1.5 volts	If voltage is incorrect, check for blown maxi fuse A4, missing voltage from starter solenoid to mega fuse terminal or open wiring.
ESC Power – Ignition Voltage Check (Check with the Ignition Switch ON and (1600) disconnected)		
NOTE		
ESC breakout box ZTSE-4477 should be used to make measurements at ESC connectors.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
Harness connector (1600) cavity 12 to ground.	12± 1.5 volts	If voltage is incorrect, check for blown fuse F15, missing voltage from ignition relay, missing voltage to relay from ignition switch or missing voltage from mega fuse.
Harness connector (1600) cavity 12 to cavity 1.	12± 1.5 volts	If voltage is incorrect, check for open in ground circuit from (1600) to ground stud (1851).

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ESC Power – Accessory Voltage Check (Check with the Ignition Switch ON and (1600) disconnected).		
NOTE		
ESC breakout box ZTSE-4477 should be used to make measurements at ESC connectors.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
Harness connector (1600) cavity 2 to ground.	12± 1.5 volts	If voltage is incorrect, check for blown fuse F19, missing voltage from accessory relay, missing voltage to relay from ignition switch or missing voltage from mega fuse.
Harness connector (1600) cavity 2 to cavity 1.	12± 1.5 volts	If voltage is incorrect, check for open in ground circuit from (1600) to ground stud (1851).



ESC Data Link Circuits Check

ESC Ignition Voltage Check – Check with the Ignition Switch ON and (1600) disconnected.		
NOTE		
ESC breakout box ZTSE-4477 should be used to make measurements at ESC connectors.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
Harness connector (1600) cavity 2 to ground.	12± 1.5 volts	If voltage is incorrect, check for blown fuse F19, missing voltage from ignition relay, missing voltage to relay from ignition switch or missing voltage from mega fuse.
Harness connector (1600) cavity 2 to cavity 1.	12± 1.5 volts	If voltage is incorrect, check for open in ground circuit from (1600) to ground stud (1851).

Chapter 4 – MAINTENANCE INSTRUCTIONS

ESC Switch Data Link Voltage Check – Check with the Ignition Switch ON and (1600) disconnected.		
NOTE		
ESC breakout box ZTSE-4477 should be used to make measurements at ESC connectors.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
Harness connector (1600) cavity 29 to cavity 1.	Approximately 3 volts	If voltage is incorrect, check for open or short in (+) data link circuits or modules.
Harness connector (1600) cavity 30 to cavity 1.	Approximately 2 volts	If voltage is incorrect, check for open or short in (-) data link circuits or modules.
ESC Drivetrain 1939 Data Link Resistance Check – Check with Battery disconnected.		
NOTE		
ESC breakout box ZTSE-4477 should be used to make measurements at ESC connectors.		
NOTE		
Always check connectors for damage and pushed out terminals.		
Test Points	Spec.	Comments
Harness connector (1600) cavity 34 to cavity 35.	Approximately 60 ohms	If resistance is incorrect, check for missing or open terminating resistors in data link, open or shorts in data link, and open or shorted modules.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.3 General Wire Harness Maintenance

GENERAL WIRE HARNESS MAINTENANCE		
This task covers:		
<p>a) Removal</p> <p>d) Follow-On Maintenance</p>	<p>b) Repair</p>	<p>c) Installation</p>
<p>INITIAL SET UP</p> <p><u>Special Tools</u></p> <p>Heat gun or suitable heating device</p> <p>Soldering Iron</p> <p>ZTSE4436 Wiring Repair Kit</p> <p>ZTSE4437 Engine Connector Repair Kit</p> <p>ZTSE4435B Terminal Test Adapter</p> <p><u>Personnel</u></p> <p>One (1) Wheeled Vehicle Mechanic</p> <p><u>Equipment Required</u></p> <p>General Mechanic Tool Kit</p> <p><u>Material Parts</u></p> <p>Heatshrink, Sealed</p> <p>Identification Tags</p> <p>Cable Ties</p> <p>Cushion Clips (if necessary)</p> <p>Rosin Core Solder</p>		<p><u>Equipment Conditions</u></p> <p>Engine OFF</p> <p>Battery Disconnect Switch OFF</p> <p>Batteries disconnected</p> <p>Parking brake set</p> <p>Transmission set in NEUTRAL (N)</p> <p>Wheels chocked</p> <p><u>Reference</u></p> <p>Parts Manual</p> <p>Wiring Schematics</p> <p><u>Follow-On Maintenance</u></p> <p>Reconnect Batteries</p> <p>Battery Disconnect Switch ON</p> <p>Start vehicle</p> <p>Verify circuit repair and operation</p> <p>Shut engine OFF</p> <p>Remove chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Connectors and terminals come in all different styles and sizes. To prevent damage, be sure to use only the exact replacements of the components you are replacing. Do not attempt to modify connector or terminal to fit. Failure to comply may result in damage to equipment.

Do not apply excessive heat to heatshrink tubing. Excessive heat may cause heatshrink tubing to split or melt.

Butt splice connector sizes vary by wire diameter. To ensure secure wire repair, only use the splice connector size specified for the wire being repaired. Do not modify butt splice connector to fit. Failure to comply may result in damage to equipment.

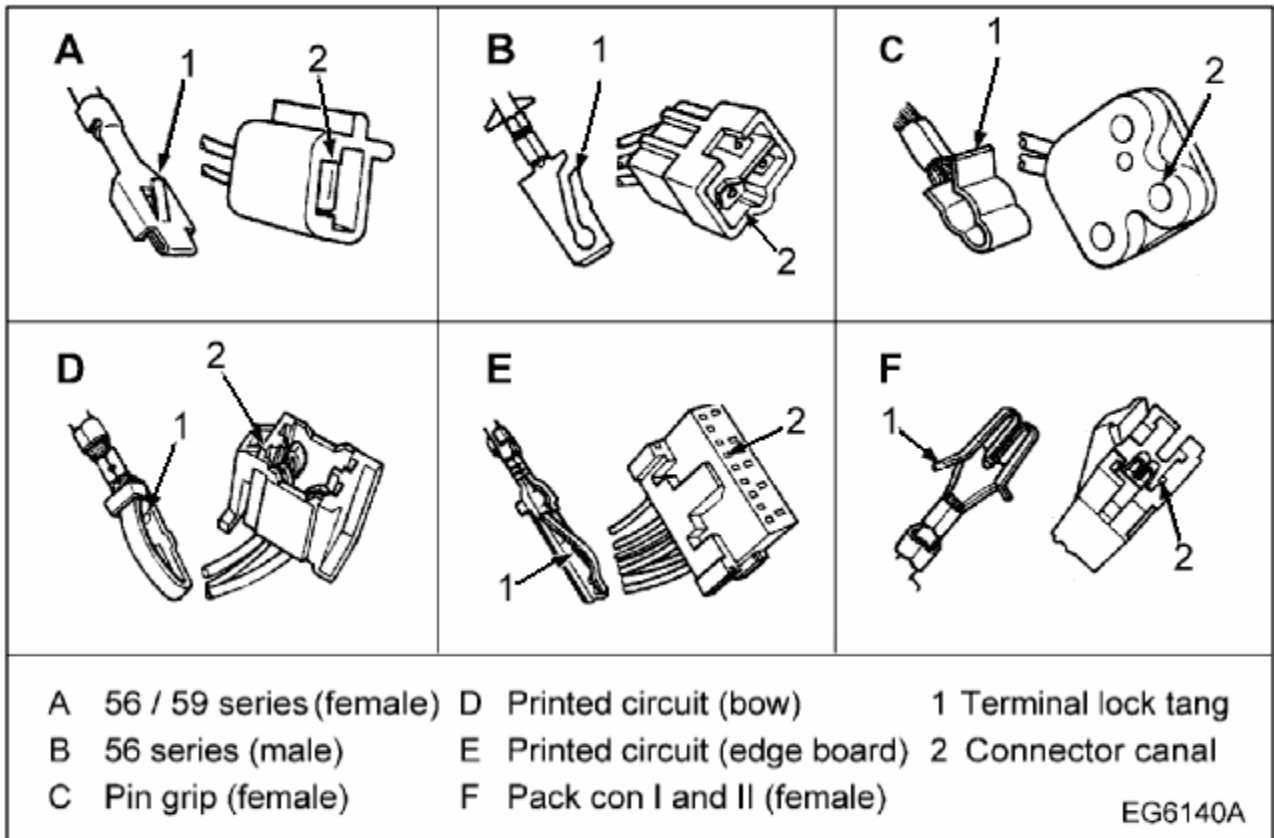
NOTE

There are many different kinds of connectors and all like connectors are repaired the same way. Number of wires in the connection may vary.

1. Repeat procedure as necessary.
2. Tag and mark all wires prior to disassembly to ensure proper assembly.
3. Remove cable ties and cushion clips as required.
4. Arrows in the connector diagrams are pointing to the wire with the terminal end lock tang and the connector canal where the wire goes into the connector.

Chapter 4 – MAINTENANCE INSTRUCTIONS

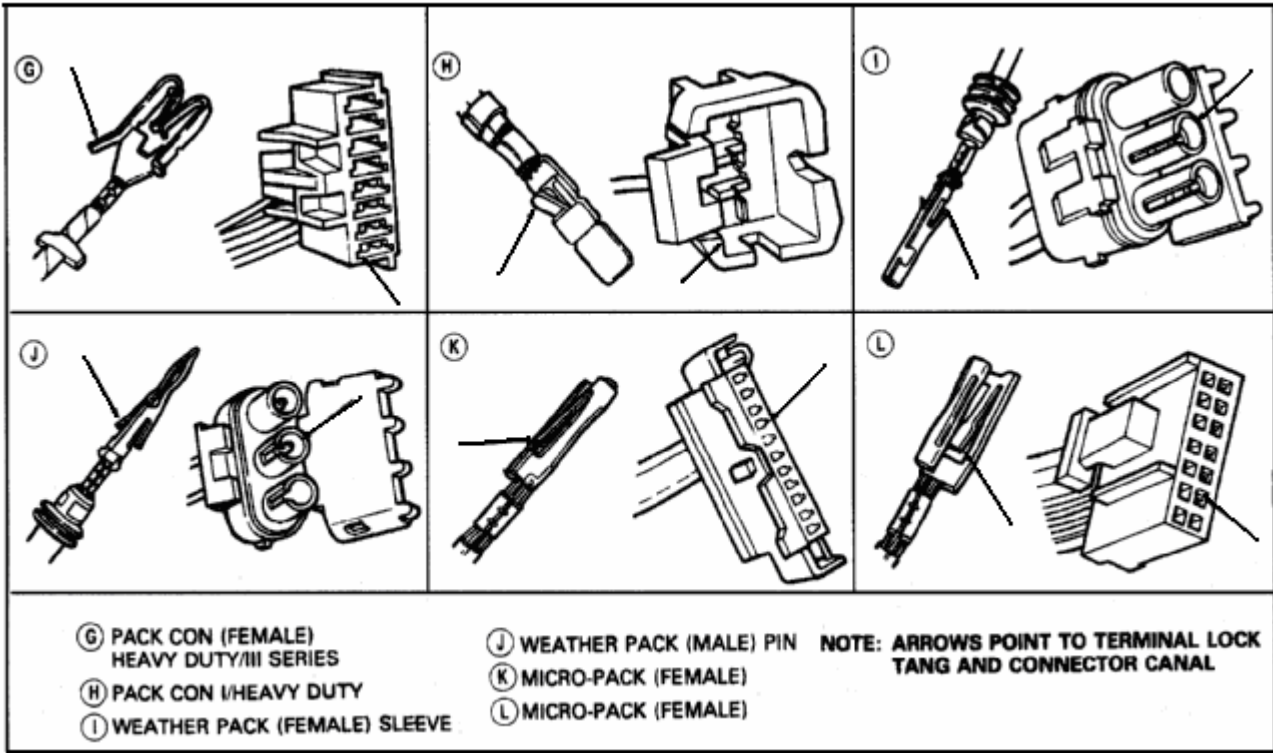
Connectors



1. Locate connectors involved and remove necessary accessories or components to reach them.
2. Disconnect connector.
3. Tag all wires prior to removal from connector to ensure proper assembly.
4. Remove cable ties and cushion clips, as required.
5. Remove lock tabs from connector being replaced.
6. Remove wires from connector.
7. Replace connector.

Chapter 4 – MAINTENANCE INSTRUCTIONS

Terminal End



1. Remove cable ties and cushion clips, as required.
2. Pull back tape insulation from harness enough to be able to pull wire out.
3. Remove lock tab from connector.
4. Label all wires in connector to ensure proper assembly if removing more than one wire.
5. Pull wire out from back side of connector.
6. Cut wire as close to terminal end as possible and discard terminal.
7. With wire strippers, cut about .25 in (0.0635 cm) of insulation.



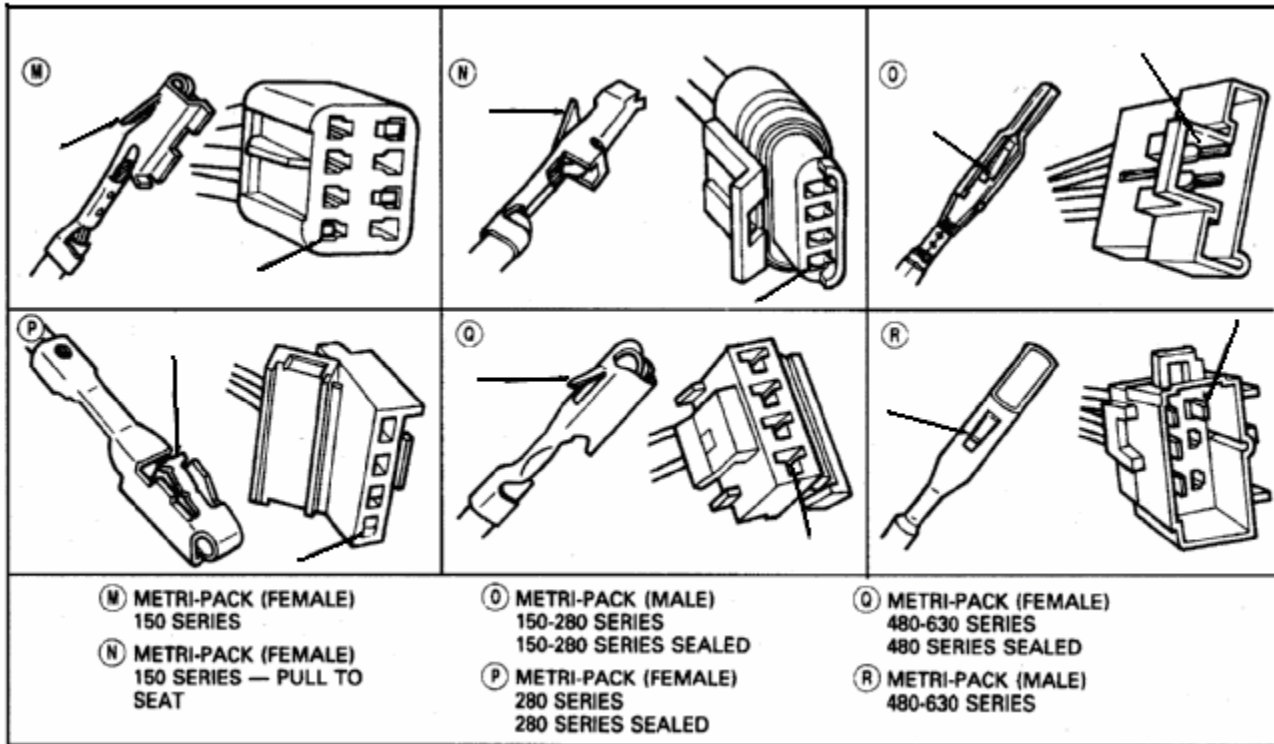
Allow solder to cool before handling. Failure to comply may result in serious injury to personnel.

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

Allow heatshrink tubing to cool before handling. Failure to comply may result in serious injury to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

Wire



1. Remove cable ties and cushion clips, as required.
2. Once you locate bad wire or wires, isolate them from the rest of the harness.
3. Remove harness insulation to work comfortably.
4. Label both ends of the wire or wires being repaired to ensure proper assembly.
5. Cut wire and trim insulation.
6. Cut enough heatshrink to allow slight overlap on each side of butt connect to seal over.
7. Slide heatshrink over one end of wire and allow enough room away from heat of solder.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Repair



Anti-corrosion compound is toxic. Use only in a well vented area. Use approved respirator with dual organic vapor/mist and particulate cartridge. Do not get in eyes; wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention. If swallowed, DO NOT INDUCE VOMITING, contact a physician immediately.



Connectors and terminals come in all different styles and sizes. To prevent damage, be sure to use only the exact replacements of the components you are replacing. Do not attempt to modify connector or terminal to fit. Failure to comply may result in damage to equipment.

Do not apply excessive heat to heatshrink tubing. Excessive heat may cause heatshrink tubing to split or melt.

Butt splice connector sizes vary by wire diameter. To ensure secure wire repair, only use the splice connector size specified for the wire being repaired. Do not modify butt splice connector to fit. Failure to comply may result in damage to equipment.

Wire Repair

1. Prepare wire ends and thread through each end of a correct size butt connector ensuring that the wire ends cross in the center of the butt connector.
2. With butt connector crimping tool, crimp both ends of butt connector and ensure that wire is secure.
3. Heat solder to where it is free flowing through the butt connector and wire end.
4. After solder cools, slide heatshrink over the butt connector and apply heat to allow it to shrink over repair.
5. Repeat, as required, if repairing more than one wire.
6. Repair insulation to harness.
7. Apply anti-corrosion spray to cushion clips that were removed and replaced.

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Installation



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

Connectors

1. Check to make sure all wires and terminal ends are re-installed in proper placement in connector.
2. When inserting wires back into connector, make sure you listen for the click to verify that it is back in place.
3. Once all wires are back in original positions in connector, insert lock tab and listen for the click to verify it is locked into place.
4. Once locked into place, connect to mating connector or components.
5. Apply anti-corrosion spray to cushion clips that were removed and installed.

Terminal Ends

1. Select proper terminal end. Make sure it is exactly the same as one removed.
2. With crimping tool, take terminal end and place on prepared wire end and crimp terminal end to wire using proper setting on tool.
3. Check crimp to make sure it is correct and proceed to next wire if more than one wire is in need of repair.
4. After crimping wires and making sure correct, insert wire back into connector and listen for click to verify it is seated.
5. Verify wire in correct position in connector if more than one wire is repaired.
6. Insert lock tab and verify locked into place by click noise when inserted.
7. Connect with mating connector or component.
8. Apply anti-corrosion spray to cushion clips that were removed and installed.

Chapter 4 – MAINTENANCE INSTRUCTIONS

d) Follow-On Maintenance

1. Reconnect batteries.
2. Battery Disconnect Switch ON.
3. Start vehicle.
4. Verify circuit repair and operation.
5. Shut engine OFF.
6. Battery Disconnect Switch OFF.
7. Remove chocks

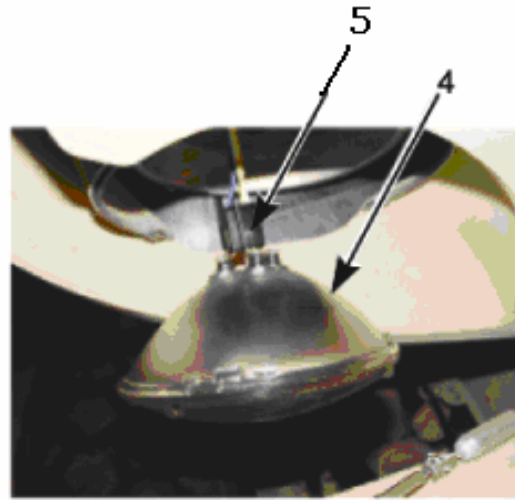
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.4 Headlight Assembly Replacement/Adjustment Procedure

HEADLIGHT ASSEMBLY REPLACEMENT/ADJUSTMENT PROCEDURE		
This task covers:		
a) Removal	b) Installation	c) Test
d) Adjustment	e) Follow-On Maintenance	
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked
<u>Personnel</u>		<u>Reference</u>
One (1) Wheeled Vehicle Mechanic		Parts Manual
<u>Material/Parts</u>		<u>Equipment Required</u>
Headlight (1 or 2) Ties Lockwashers (7 per headlight) Chalk Anti-Corrosion Compound Connector Lubricant		None
		<u>Follow-On Maintenance</u>
		Battery Disconnect Switch ON Start engine Verify all operations of headlights Shut engine OFF Battery Disconnect Switch OFF

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



NOTE

Both headlights are removed the same way. Driver side shown.
Remove cable ties as required.

1. Remove four screws and lockwashers (1) and cover (2) from frame.
2. Remove three adjusting screws and lockwashers (3) from headlight assembly (4).
3. Raise engine hood and secure.
4. Disconnect three-prong connector (5) from backside of headlight assembly (4).
5. Remove headlight assembly (4) from hood. Discard defective headlight.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



Anti-corrosion compound is toxic. Use only in well-ventilated area. Use NIOSH/MSHA-approved respirator with dual organic vapor/mist and particulate cartridge. DO NOT get in easy; wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention. If swallowed, DO NOT INDUCE VOMITING; contact a physician immediately.

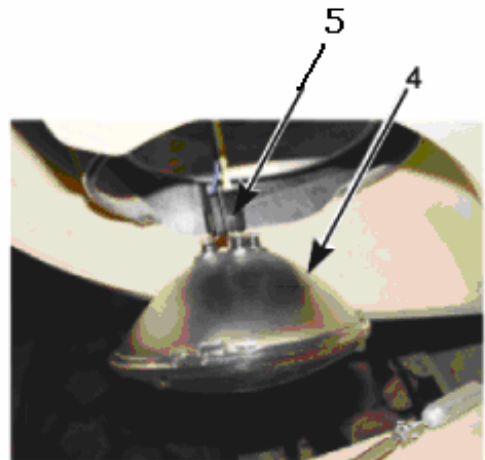
Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.

NOTE

Both headlights are installed the same way. Driver side shown.

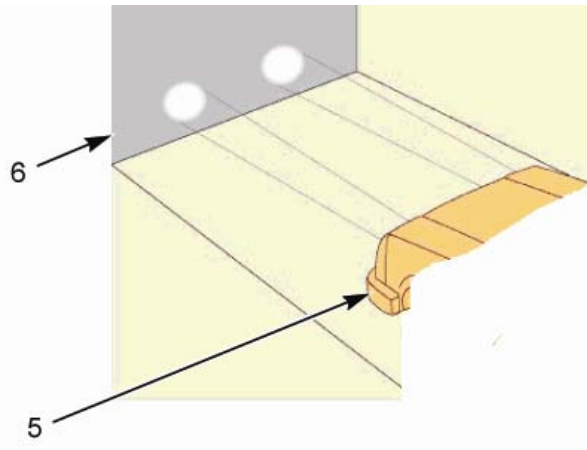
Install cable ties as required.

1. Apply corrosion preventive compound to threads of screws.
2. Apply connector lubricant to three-prong connector (5).
3. Install front ring cover (2) on hood.
4. Install headlight assembly (4) into frame and connect three-prong connector (5) to backside of headlight.
5. Install four mounting screws and lockwashers (1) loosely tighten. Align properly then tighten to specification.
6. Install the three adjusting screws (3) to headlight assembly (4).



Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Test



NOTE

Park vehicle on flat, level surface.
 Vehicle must be unloaded.
 Measurement must be taken from top of front bumper.

1. Position both ends of front bumper (5) 18 inches (46 cm) from flat vertical surface (6) that is approximately 38 inch (97 cm) high.
2. Using chalk, draw a 36 inch (91 cm) vertical chalk line starting at ground on flat vertical surface aligned with each end of front cab.
3. Measure in 4 ¾ inches (12 cm) from each vertical chalk line and draw two 38 inch (97 cm) vertical chalk lines starting from ground.
4. Measure 31-3/8 inches (80 cm) from ground and draw two 8 inch (20 cm) horizontal chalk lines crossing two vertical lines making two crosses.
5. Measure out 4 inches (10 cm) from center of each cross in four directions to make two 8 inch (20 cm) squares.
6. Turn headlight switch ON, and set to low beam.

NOTE

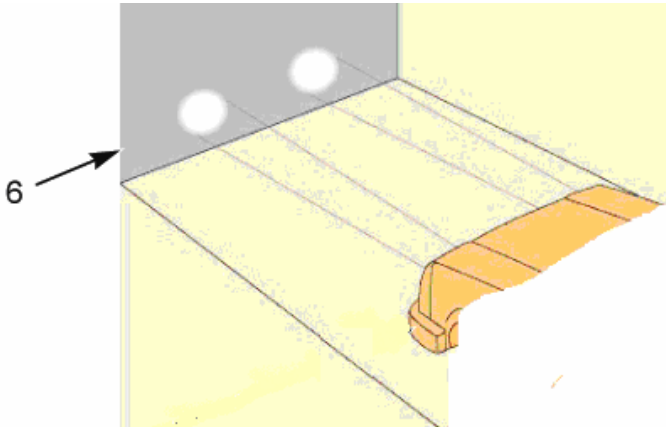
If low headlight beams are within inside of squares, high headlight beams will also be inside of squares and no adjustment is required.

If low headlight beams are not within inside of squares, perform adjustment.

7. Check position of low headlight beams on flat vertical surface (6).

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d) Adjustment



NOTE

Both headlights are adjusted the same way.

Turn adjusting screws (7) clockwise to adjust headlight beam up and down.

1. Adjust screws to move low headlight beams up or down on flat vertical surface (6).

NOTE

When adjusting headlight right or left, two screws (8) at either side of light might need to be loosened and adjusted in combination.

2. Adjust screws to move low headlight beams right or left on flat vertical surface (6).

NOTE

If low headlight beams are within inside of squares, high headlight beams will also be inside of squares and adjustment is completed.

3. Check position of low headlight beams on flat vertical surface (6).
4. Turn headlight switch OFF.

e) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Check all operations of headlights.
4. Shut engine OFF.
5. Battery Disconnect Switch OFF.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.5 Instrument Panel Replacement

INSTRUMENT PANEL REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanics</p> <p><u>Equipment Required</u> Identification Tags Connector Lubricant Sealing Compound</p> <p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Batteries disconnected Wheels chocked Parking brake set Transmission in NEUTRAL (N) Remove Steering Wheel Remove steering column Remove transmission selector Drain air tanks, lines and reservoirs</p>	<p><u>Reference</u> Parts Manual</p> <p><u>Material Parts</u> Instrument Panel</p> <p><u>Follow-On Maintenance</u> Install Steering Column Install Steering Wheel</p> <p>Install Transmission Selector Connect batteries Battery Disconnect Switch ON Verify proper operation of instrument panel and gauges with ignition on Verify vehicle engine will start Re-charge air system Re-check all gauges with engine running Check for any leaks Remove wheel chocks Test drive vehicle Shut engine OFF Ignition switch OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked</p>	

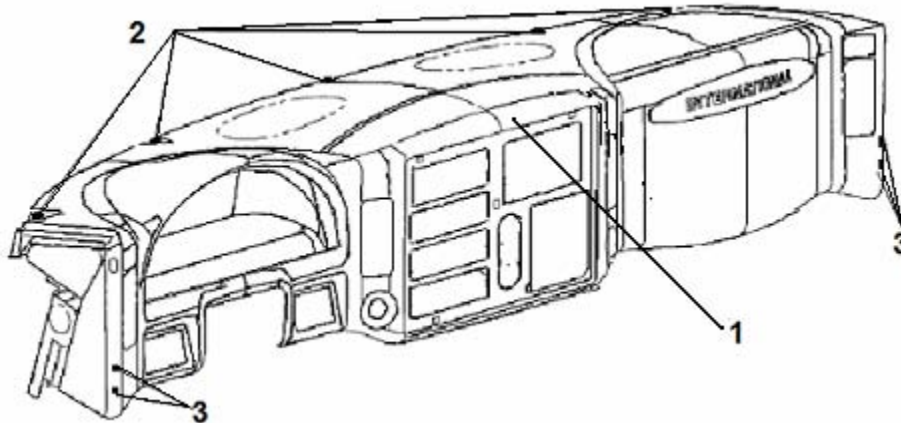
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Before working on any electrical components, ensure that the battery disconnect switch is in the off position and batteries are disconnected. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



1. With driver and passenger doors open, remove A-pillar trim from both driver and passenger doors. Remove lower trim panels (kick panels) from underside of IP to allow access to IP mounting hardware needed in the following steps. Set trim aside to re-install later.
2. Mark and tag both sides of electrical connectors, cables, hoses, and air lines before you disconnect or remove them. This will assist in proper installation later.
3. Disconnect and remove all electrical connectors, cables, hoses, and air lines that you have tagged. There may be connections you cannot get to until you start removing instrument panel (1). Make sure you label/tag them for proper install later.
4. Remove five nuts (2) from mounting brackets at the front edge of the upper instrument panel and cowl panel. (Where the dash and windshield meet). Set nuts aside for re-install later.



Before removing the side A-pillar mounting bolts, you will need assistance with the remainder of the removal. The instrument panel is bulky and heavy. One person can not lift and remove it by themselves. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

5. Remove two bolts (3) from each A-pillar side of dash (total of four). Set bolts aside to re-install later.
6. With aid of an assistant, gentle lift-up over the front mounting bolts and pull the dash (1) out slowly towards front seats. Check to make sure that dash is free of all connections before removing it from vehicle. If connections have not been disconnected, tag connection and disconnect.
7. Remove instrument panel (1) from vehicle cab with assistance on outside of vehicle also.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

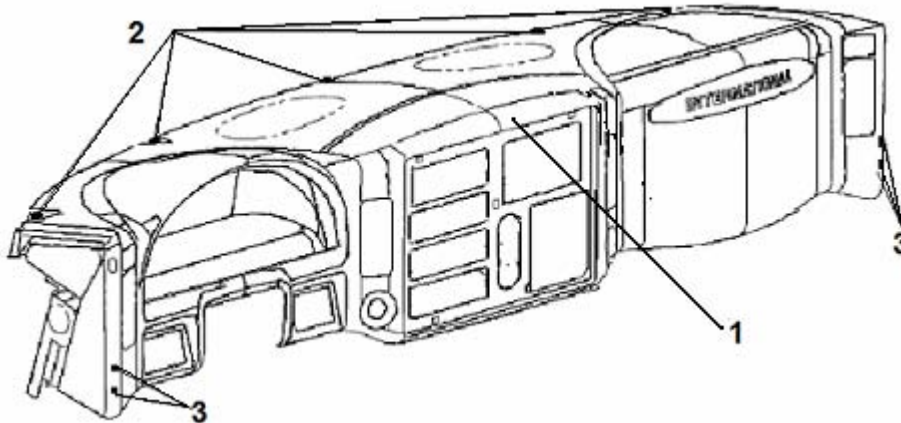


Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin contacted, wash thoroughly with soap and water. Failure to comply may cause serious injury or death to personnel.

1. Apply connector lubricant on all electrical connectors.



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



2. Apply connector lubricant and sealing compound to wires and bolts.
3. With assistance install new instrument panel into vehicle cab.
4. If there were connections removed just before removing instrument panel (1) from vehicle, install them now with mating connector, hose, air line, or cable.
5. Install the instrument panel over the five mounting bolts at windshield cowl and set down.
6. Align the four holes of dash sides with the A-pillar holes and guiding pins and loosely install A-pillar bolts (3).
7. Install five nuts (2) to mounting bolts and tighten them and the four A-pillar bolts (3) to specification.
8. Connect all other connectors, cables, hoses, and air lines with mating ends.
9. Install underside trim panels (kick panels) and A-pillar trim on both driver and passenger sides.

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Install Steering Wheel.
2. Install steering column.
3. Install transmission selector.
4. Connect batteries.
5. Battery Disconnect Switch ON.
6. Verify proper operation of Instrument panel and gauges with IGN ON.
7. Verify vehicle will start.
8. Re-charge air system.
9. Re-check all gauges with engine running.
10. Check for any leaks.
11. Remove wheel chocks.
12. Test drive vehicle.
13. Shut engine OFF.
14. Ignition switch OFF.
15. Battery Disconnect Switch OFF.
16. Parking brake set.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.6 Front Fender Light Assembly and Bulb Replacement

FRONT FENDER LIGHT ASSEMBLY AND BULB REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		<u>Equipment Required</u>
		None
<u>Special Tools</u>		<u>Equipment Conditions</u>
None		Engine OFF
<u>Personnel</u>		Battery Disconnect Switch OFF
One (1) Wheeled Vehicle Mechanic		Parking brake set
		Transmission in NEUTRAL (N)
<u>Material Parts</u>		Wheels chocked
Lockwashers (2 per light)		
Front Fender Light Assembly (1)		
Front Fender Light Bulb (1 per light)		
Anti-Corrosion Compound		<u>Reference</u>
Connector Lubricant		Parts Manual
		<u>Follow-On Maintenance</u>
		Battery Disconnect Switch ON
		Ignition switch ON
		Verify front fender light operation
		Ignition switch OFF
		Battery Disconnect Switch OFF
		Remove wheel chocks

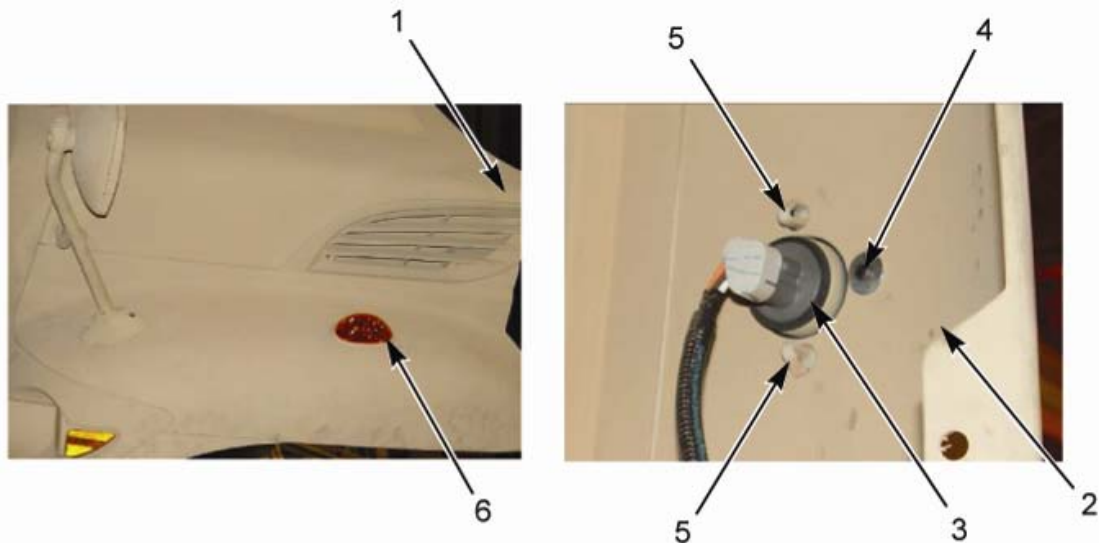
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear protective goggles and work gloves when working on vehicle. Let engine cool before working on or around it. Have assistance when raising engine hood it is extremely heavy. Make sure there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself or an assistant between the hood and any other structure. Failure to comply may result in serious injury or death.

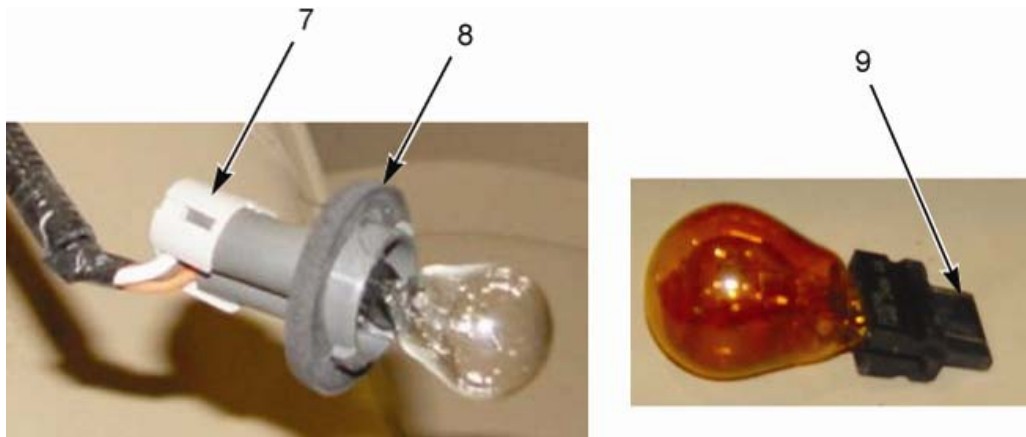
Light Assembly



1. Raise engine hood of vehicle (1) and secure into open position.
2. From underside of fender (2), remove light bulb assembly (3) from fender (2) by twisting assembly counter-clockwise and pull out.
3. From underside of fender, remove two mounting screws and lockwashers (4) and pinch together plastic retainer clips (5) which hold front fender light assembly (6) into place from underside of fender (2).
4. While pushing from the underside of fender (2) also pull on topside of fender light assembly (6) to remove. Discard front fender light assembly and lockwashers.
5. Clean area on underside and top of fender before replacement of front fender light assembly to ensure proper fit of new one.

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Light Bulb



1. Disconnect electrical connection (7) from light bulb assembly (8).
2. Pull light bulb (9) from light socket assembly (8). If you have trouble removing bulb (9), use a pair of pliers carefully pull the fuse type light bulb (9) from light socket assembly (8).
3. Discard burnt out or defective bulb per local regulations.

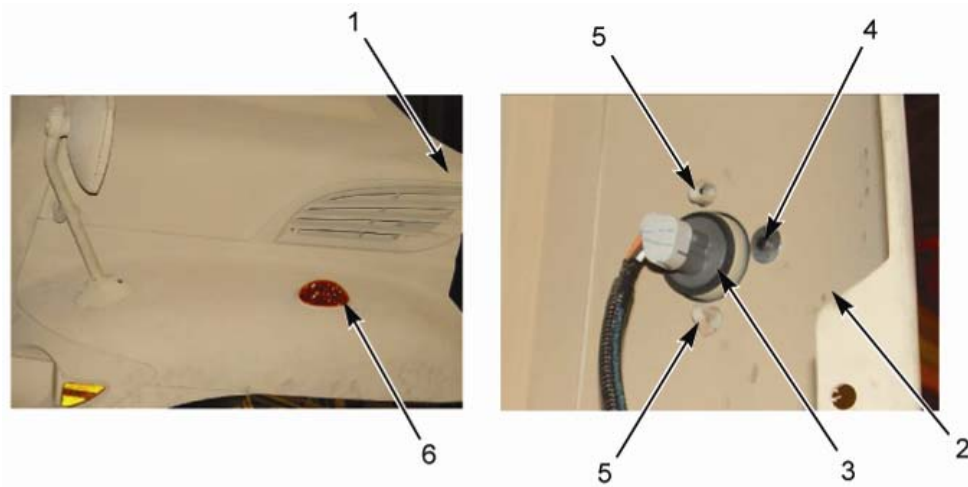
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

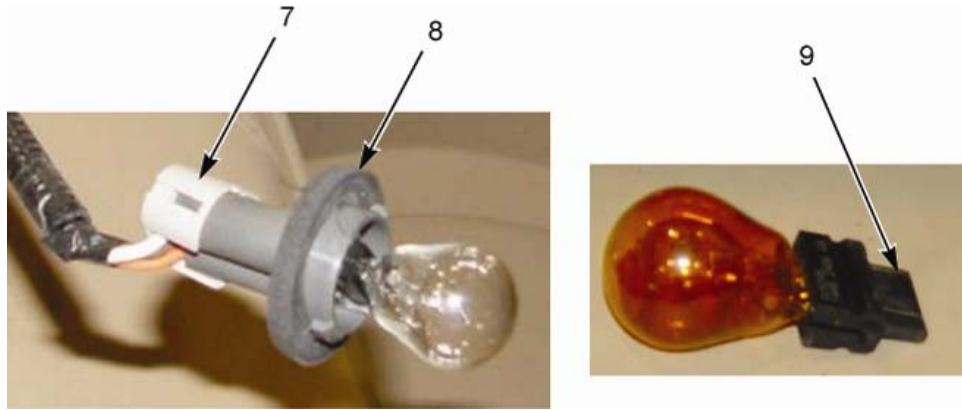
Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may result in serious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

Light Assembly

1. Apply anti-corrosion compound to screws and lockwashers.
2. Install new front fender light assembly (6) by aligning plastic retaining clips (5) and press into place in fender (2).
3. From underside of fender (2) install mounting screws and new lockwashers (4) and tighten to specification.

Chapter 4 – MAINTENANCE INSTRUCTIONS

Light Bulb



1. Apply connector lubricant to front fender light connector (7) and bulb (9).
2. Press new light bulb (9) into light socket assembly (8) until seated.
3. Install light socket assembly (8) into fender by twisting it clock-wise.
4. Plug in electrical connector (7).

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Ignition switch to ON position.
3. Verify front fender light operation.
4. Ignition switch OFF.
5. Battery Disconnect Switch OFF.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.7 Relay Replacement

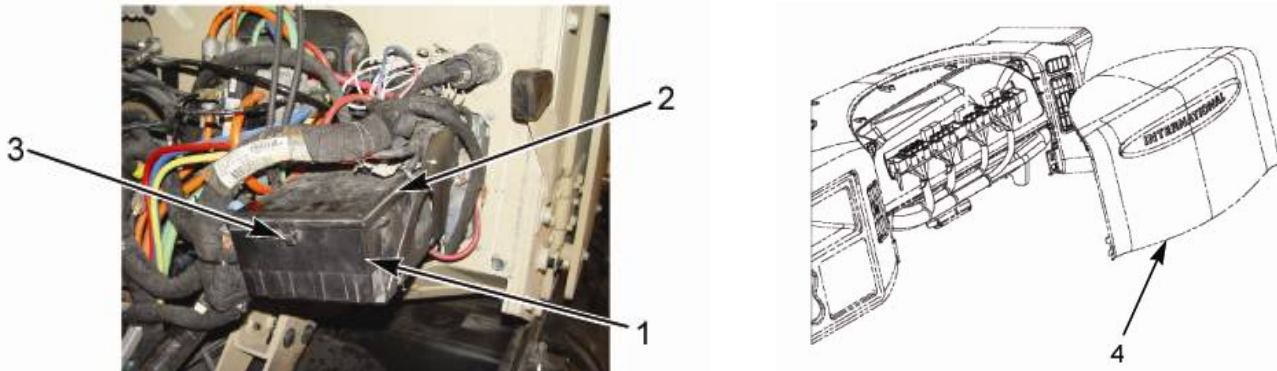
RELAY REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	
<p><u>Special Tools</u> None</p> <p><u>Material/Parts</u> Relay Connector Lubricant</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>	<p><u>Equipment Condition</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission in Neutral (N) Wheels chocked Batteries disconnected Remove IP Access Panels</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Connect batteries Battery Disconnect Switch ON Check operation of relay Battery Disconnect Switch OFF Remove wheel chocks</p>

NOTE

All relays are removed the same way.
Refer to electrical schematics for identification of relays.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove relay box (1) cover (2) by removing clip (3), or access panels (4).
2. Remove relay from relay connector and discard.

b) Installation



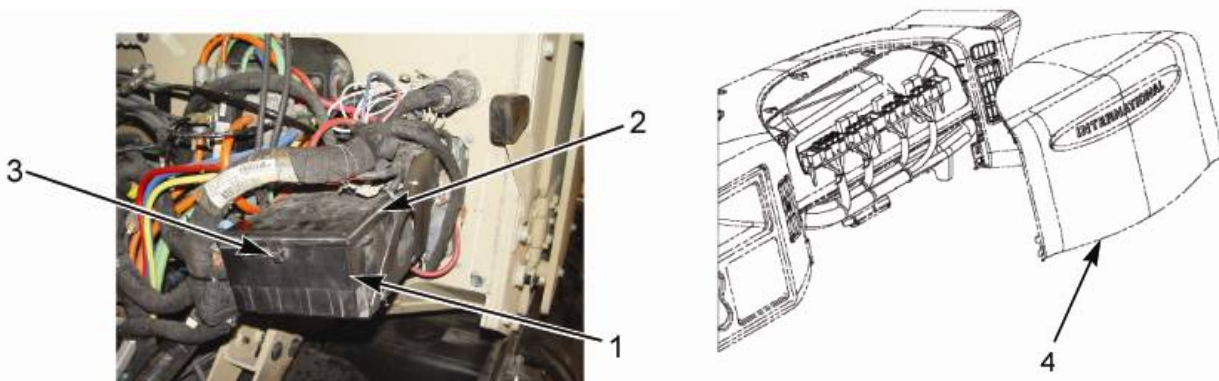
Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water. Failure to comply may cause serious injury or death to personnel.

NOTE

All relays are installed the same way.

Refer to electrical schematics for identification of relays.

1. Apply connector lubricant to relay terminals.
2. Install relay on relay connector in relay box (1).



3. Install relay box cover (2) and clip (3) back into place or re-install access panel (4).

c) Follow-On Maintenance

1. Connect batteries.
2. Check operation of relay.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.8 Battery Disconnect Switch Replacement

BATTERY DISCONNECT SWITCH REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u></p> <p>None</p> <p><u>Personnel</u></p> <p>One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u></p> <p>Battery Disconnect Switch</p> <p>Connector Lubricant</p>	<p><u>Equipment Condition</u></p> <p>Engine OFF</p> <p>Parking brake set</p> <p>Transmission in Neutral (N)</p> <p>Batteries disconnected</p> <p>Wheels chocked</p> <p><u>Reference</u></p> <p>Parts Manual</p> <p><u>Equipment Required</u></p> <p>None</p> <p><u>Follow-On Maintenance</u></p> <p>Connect Batteries</p> <p>Check battery disconnect switch operation</p> <p>Check battery voltage and systems for proper operation</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS



Always remove negative battery terminals first. When reconnecting, always connect negative terminals last to avoid arcing or sparks that could cause an explosion. DO NOT allow tools to contact battery box or other battery terminals when removing or installing terminals. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

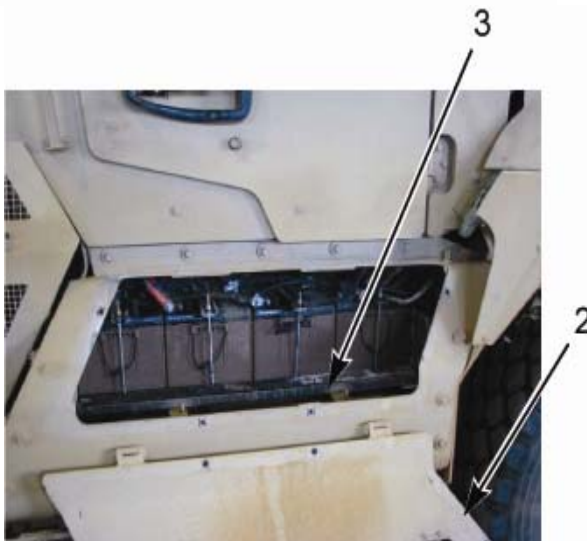
Be careful not to short out battery terminal. DO NOT smoke or use open flame near batteries. Batteries may explode from a spark. Failure to comply may result in serious injury or death to personnel.

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal or positive electrical circuit, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.

To prevent arcing, DO NOT allow tools to contact batteries or other battery terminals. Failure to comply may result in serious injury or death to personnel.

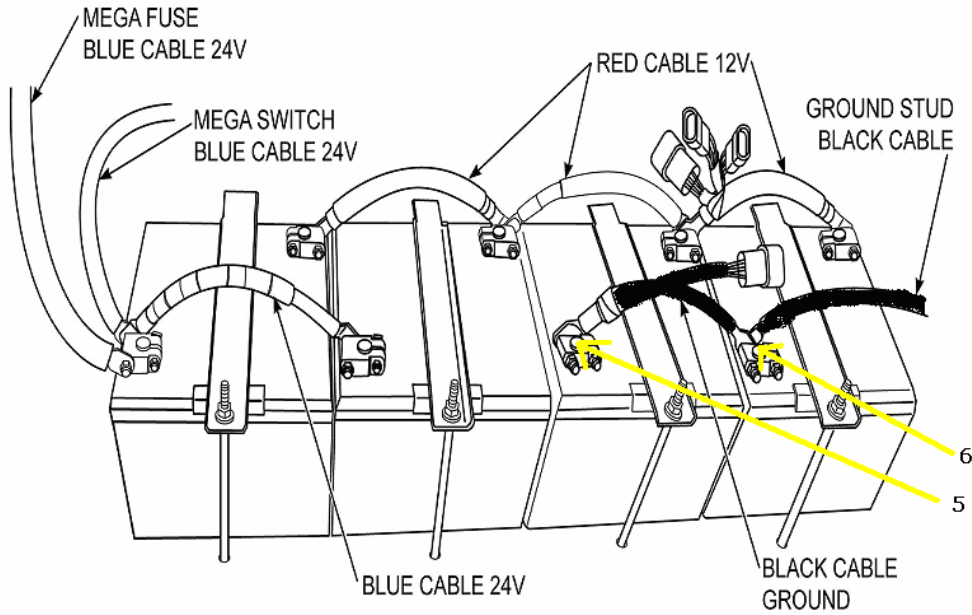
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Turn Battery Disconnect Switch (1) OFF by switching toggle to OFF position.
2. Release battery plate armor cover (2) on battery box (3).

Chapter 4 – MAINTENANCE INSTRUCTIONS



3. Disconnect battery cables.
4. Loosen battery terminal clamp (5) and remove cable from negative battery terminal (6) (will be marked with (-) and should have black cable).
5. Disconnect Battery Disconnect Switch (1) electrical connector and loosen retaining nut holding it into place in dash and remove from dash.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



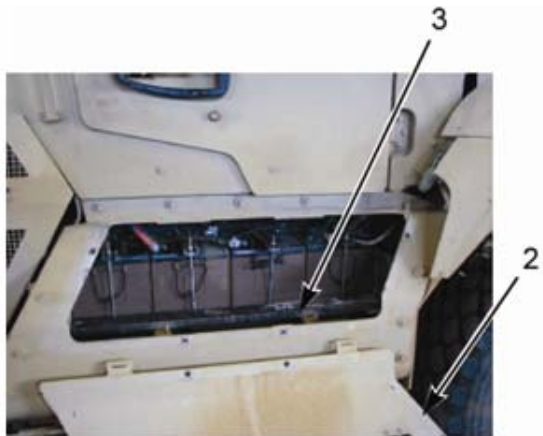
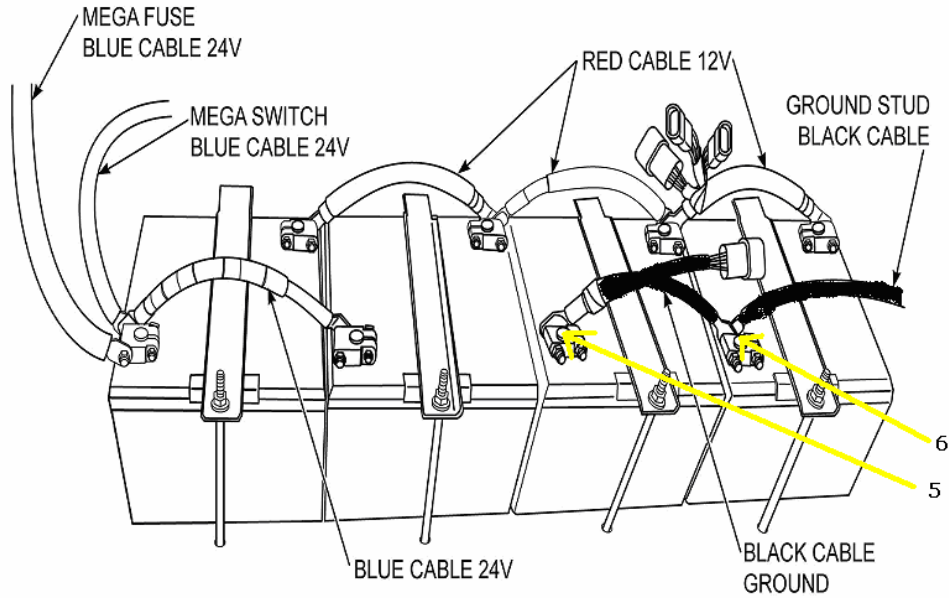
To prevent arcing, **DO NOT** allow tools to contact batteries or other battery terminals. Failure to comply may result in serious injury or death to personnel.

Always remove negative battery terminals first. When reconnecting, always connect negative terminals last to avoid arcing or sparks that could cause an explosion. **DO NOT** allow tools to contact battery box or other battery terminals when removing or installing terminals. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Be careful not to short out battery terminal. **DO NOT** smoke or use open flame near batteries. Batteries may explode from a spark. Failure to comply may result in serious injury or death to personnel.

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

Chapter 4 – MAINTENANCE INSTRUCTIONS



1. Apply connector lubricant to negative battery terminal (6) and clamp (5).
2. Apply connector lubricant to electrical connector for battery disconnect switch (1).
3. Install new battery disconnect switch into dash, tighten retaining nut to secure into place and connect connector.
4. Install clamp (5) on negative battery terminal (6) and securely tighten.
5. Install battery plate armor cover (2) on battery box (3).
6. Secure latch battery plate armor cover (2).
7. Turn Battery Disconnect Switch (1) ON.

c) Follow-On Maintenance

1. Check Battery Disconnect Switch operation.
2. Check battery voltage and systems for proper operation.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.9 Battery Equalizer Replacement

BATTERY EQUALIZER REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	<u>Equipment Condition</u>
<u>Special Tools</u>	Engine OFF
None	Battery Disconnect Switch OFF
<u>Reference</u>	Parking brake set
Parts Manual	Transmission in Neutral (N)
	Wheels chocked
	Remove Battery Armor Plate
	Batteries removed
<u>Personnel</u>	<u>Equipment Required</u>
One (1) Wheeled Vehicle Mechanic	None
<u>Material/Parts</u>	<u>Follow-On Maintenance</u>
Battery Equalizer(s)	Replace batteries
	Run engine
	Check Amp Gauge
	Armor plate installed.

Chapter 4 – MAINTENANCE INSTRUCTIONS

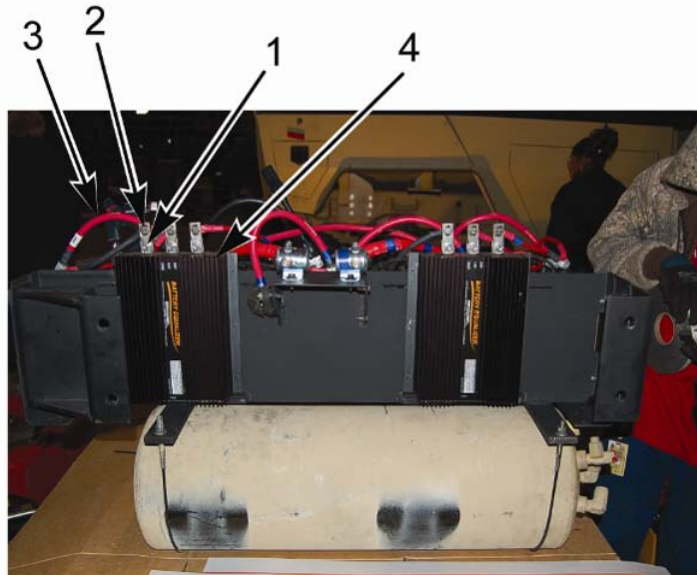
a) Removal



System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

NOTE

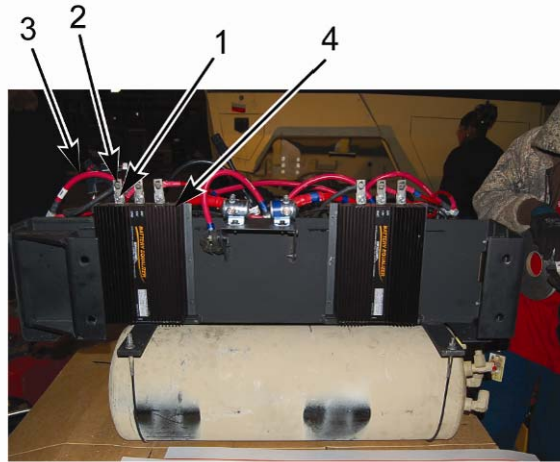
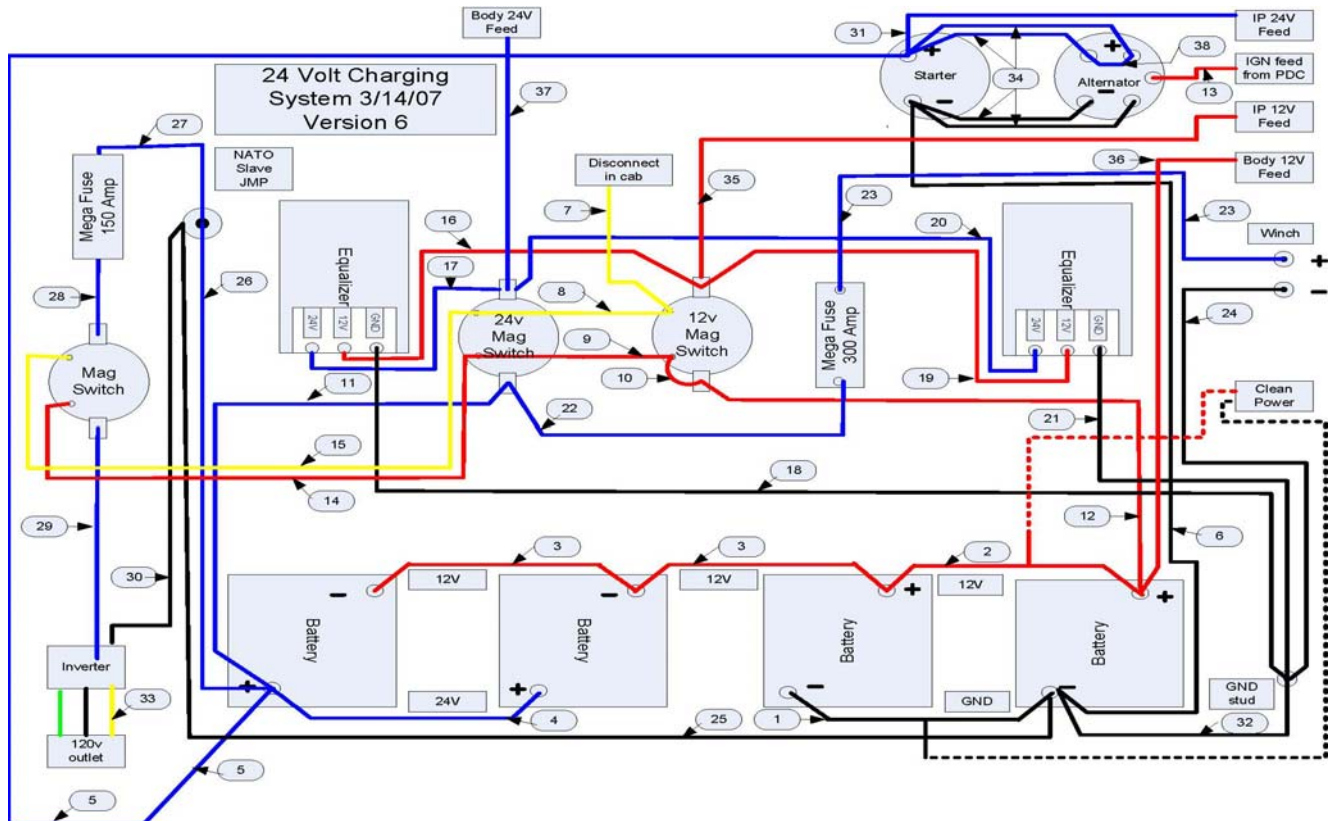
There are two Equalizers; both are removed in same manner. Remove batteries as needed to gain access to equalizer.



1. Remove six nuts (1) from terminal connector blades (2), securing terminal cables (3), place nuts aside for reuse.
2. Place terminal connector cables (3) out of the way.
3. Remove equalizer (4).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Install Equalizer (4).
2. Place terminal connector cables (3), in proper positions on terminal blade studs.
3. Install six nuts (1) to terminal connector blade studs, securing the cable connections.

c) Follow-On Maintenance

1. Replace batteries, armor plate.
2. Start engine; check Amp Gauge for proper charging.

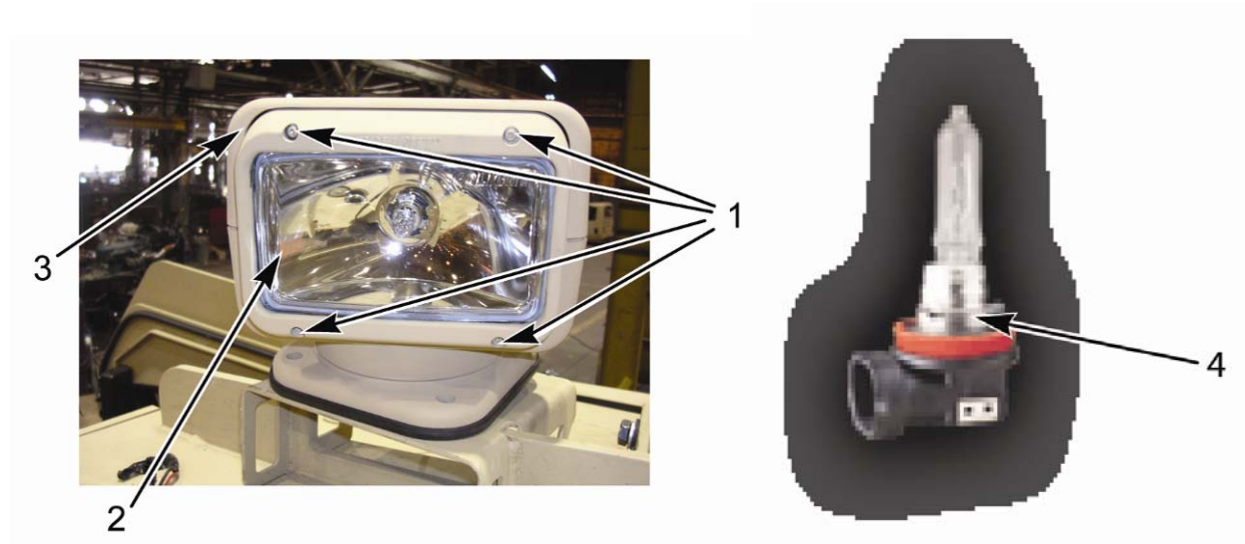
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.10 Spotlight Light Bulb Replacement

SPOTLIGHT LIGHT BULB REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<p><u>Special Tools</u> None</p>	<p><u>Equipment Condition</u> Engine OFF Battery Disconnect Switch OFF Transmission in Neutral (N) Parking brake set Wheels chocked</p>	
<p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>	<p><u>Reference</u> Parts Manual</p>	
<p><u>Material/Parts</u> Light Bulb Model 2049/2067 Corrosion Preventative Compound Connector Lubricant</p>	<p><u>Equipment Required</u> GMTK</p>	<p><u>Follow-On Maintenance</u> Test SPOTLIGHT operation</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove four screws (1) holding lens (2) in place and remove lens from SPOTLIGHT (3).
2. Disconnect connection from light bulb (4) and discard bulb.

b) Installation



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

1. Apply connector lubricant to connector.

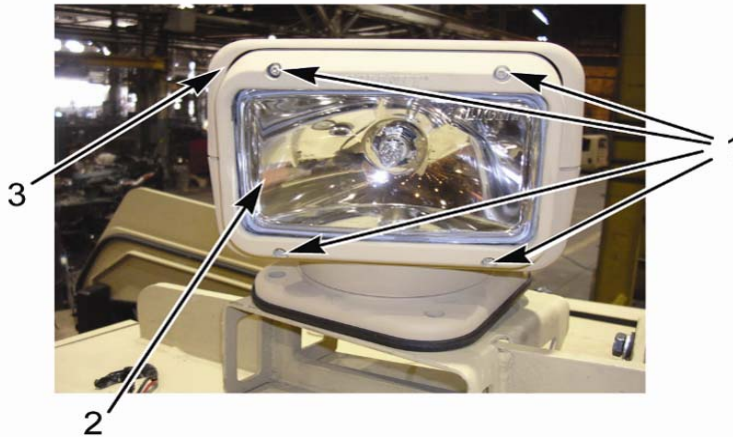


2. Connect connector to light bulb (4).

Chapter 4 – MAINTENANCE INSTRUCTIONS



Anti-corrosion compound is toxic. Use only in well-ventilated area. Use NIOSH/MSHA-approved respirator with dual organic vapor/mist and particulate cartridge. **DO NOT** get in easy; wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention. If swallowed, **DO NOT INDUCE VOMITING**; contact a physician immediately.



3. Apply corrosion preventive compound to four lens screws (1).
4. Install lens (2) into housing (3) and tighten screws (1).

c) Follow-On Maintenance

1. Test SPOTLIGHT operation.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.11 Back-up Light Assembly Replacement

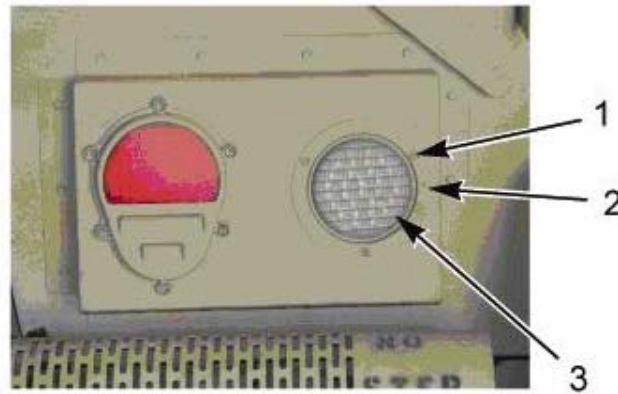
BACK-UP LIGHT ASSEMBLY REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	
<p><u>Special Tools</u> Torx Bit Set (T-25)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Back-up Light Assembly (1)</p>	<p><u>Equipment Condition</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission in Neutral (N) Wheels chocked</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Remove chocks</p>

NOTE

Note location and position of wires prior to removal to ensure proper installation.
Mark and tag all wires to assist in a correct installation of the back-up light assembly.

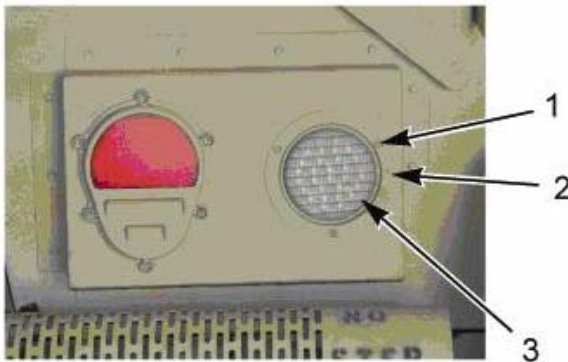
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove three torx screws (1).
2. Remove ring (2).
3. Pull out lens and backup light assembly (3) from truck.
4. Mark and tag wires of the backup light assembly prior to cutting.
5. Disconnect backup light assembly wires.
6. Remove and discard backup light assembly.

b) Installation



1. Install new backup light assembly.
2. Reconnect backup light assembly wires.
3. Place backup light assembly and lens back into truck (3).
4. Install ring (2).
5. Install three torx screws (1).

c) Follow-On Maintenance

1. None.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.12 Blackout Drive Light Assembly Replacement

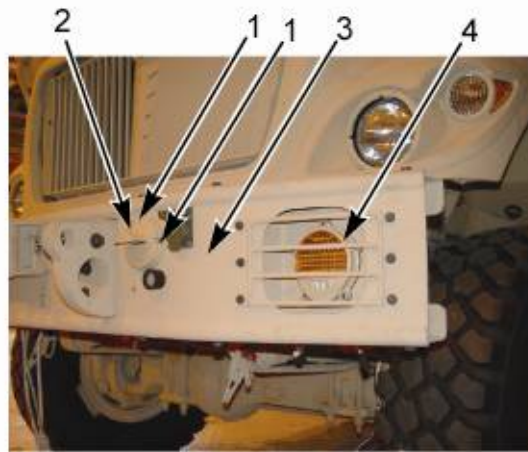
BLACKOUT DRIVE LIGHT ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u> Torx Bit Set (T25)		<u>Equipment Required</u> None
<u>Personnel</u> One (1) Wheeled Vehicle Mechanic		<u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission in NEUTRAL (N) Wheels chocked
<u>Material Parts</u> Blackout Drive Light Assembly (1)		<u>Reference</u> Parts Manual
		<u>Follow-On Maintenance</u> Battery Disconnect Switch ON Ignition switch to ON Verify marker light operation Ignition switch OFF Battery Disconnect Switch OFF Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Remove or disconnect batteries in proper sequence and turn master Master Power switch off prior to performing maintenance in immediate area or working on electrical system. Such disconnects prevent electrical shock to personnel and equipment.



1. Disconnect connector to blackout light assembly from backside of bumper.
2. Remove the three Torx bit screws (1) from the blackout drive light assembly (2) located on the driver side of the front bumper (3) just to the right of the bumper marker light (4).
3. Remove the blackout light assembly from the bumper, may have to pry it a little.

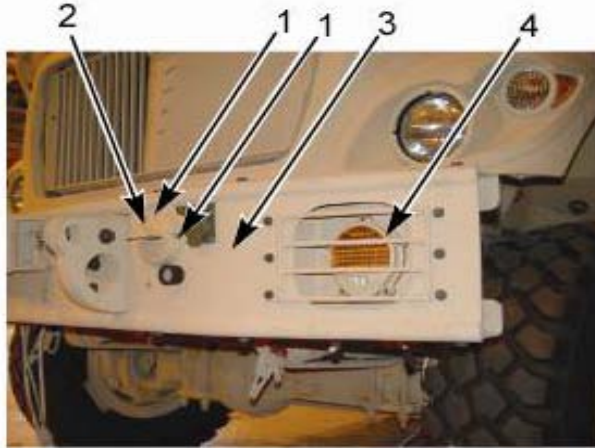
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

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



1. Apply connector lubricant to blackout light.
2. Apply anti-corrosion compound to screws.
3. Clean surface area before installing the new assembly.
4. Install new blackout assembly (2) into bumper (3) next to marker light (4) and install three Torx bit screws (1) and tighten to specification.
5. Connect connector to blackout light.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Ignition switch to ON position.
3. Verify blackout light operation.
4. Ignition switch OFF.
5. Battery Disconnect Switch OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.13 Composite Tail Lamp Assembly Replacement

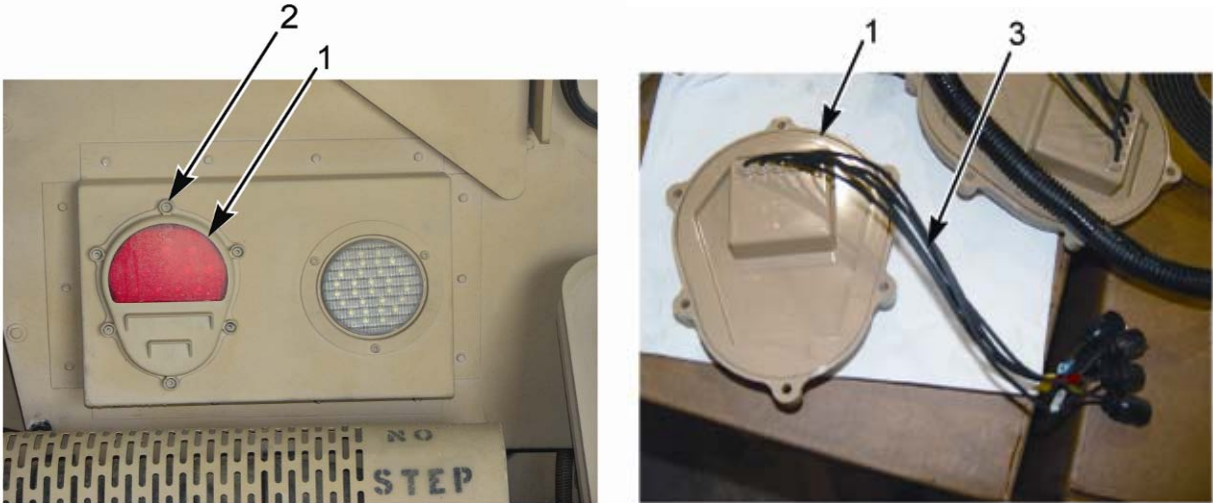
COMPOSITE TAIL LAMP ASSEMBLY REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	
<u>Special Tools</u>	<u>Equipment Condition</u>
None	Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission in Neutral (N) Wheels chocked
<u>Personnel</u>	<u>Reference</u>
One (1) Wheeled Vehicle Mechanic	Parts Manual
<u>Material/Parts</u>	<u>Equipment Required</u>
One (1) Composite Tail Lamp Assembly	None
	<u>Follow-On Maintenance</u>
	Check periodically



To avoid property damage, personal injury or death, park the vehicle on a level surface, set the parking brake, chock the wheels and turn the engine off. System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove six screws (2) that secure the defective composite tail lamp assembly (1).
2. Disconnect the wiring connector (3). Note the color-coding of wires and connectors for installation of new lamp assembly.

b) Installation

1. Connect the rear harness tail lamp connector (3) to tail lamp connector. Note the color-coding of wires and connectors.
2. If the rear lighting is to be entirely body mounted, and a connection to the rear harness tail lamp connector (3) is needed, use connector, terminal and seal specified in the illustrated parts list.
3. Install six screws (2) to secure the new tail lamp assembly (1).

c) Follow-On Maintenance

1. Remove wheel chocks.
2. Battery Disconnect Switch ON.
3. Check periodically.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.14 Turn Signal and Park Light Assembly Replacement

TURN SIGNAL AND PARK LIGHT ASSEMBLY REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SETUP

Special Tools

Multimeter

Equipment Condition

Engine OFF

Battery Disconnect Switch OFF

Parking brake set

Transmission in Neutral (N)

Wheels chocked

Personnel

One (1) Wheeled Vehicle Mechanic

Reference

Parts Manual

Material/Parts

One (1) Turn Signal and Park Light Assembly
(Driver or Passenger Side)

One (1) Tail Lamp Composite Assembly

One (1) Bulb

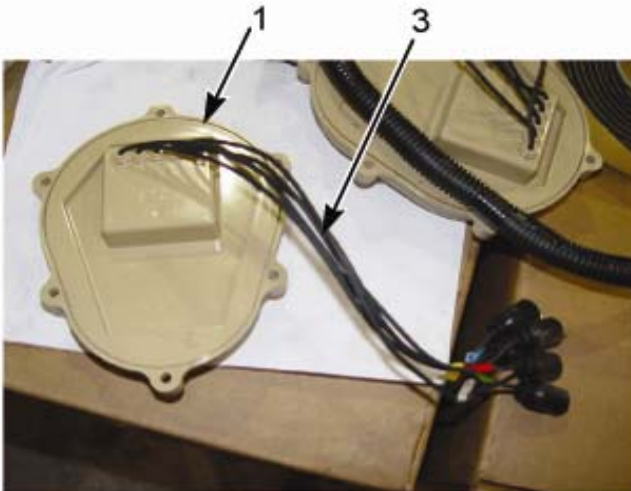
Equipment Required

Follow-On Maintenance

Check periodically

Chapter 4 – MAINTENANCE INSTRUCTIONS

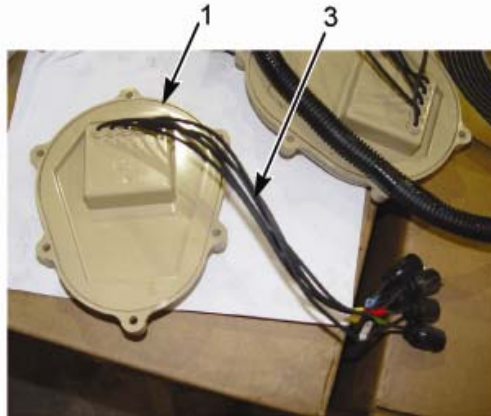
a) Removal



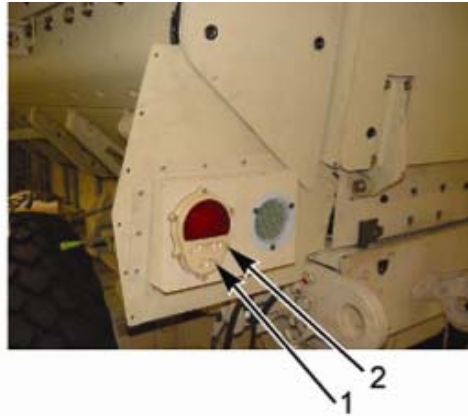
1. Remove six screws that secure the defective Composite Tail Lamp assembly (1).
2. Remove four screws (5) that secure the defective Composite Turn Signal and Parking Light assembly (4) and remove Turn Signal Bulb (6).
3. Disconnect the wiring connector (3).
4. If the rear lighting is to be entirely body mounted, and a connection to the rear harness tail lamp connector (3) is needed, use connector, terminal and seal specified in the illustrated parts list.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Connect the Rear Harness Tail Lamp Connector (3) to Rear Turn Signal Park Light Turn Signal and Park assembly (1).



2. Install six screws (2) to secure the new Tail Lamp assembly (1). Install four screws to secure new Front Turn Signal Park Light assembly (4).
3. Install Side Turn Marker Bulb (6) to the Side Turn Marker Light assembly though opening connection under hood (4).



4. Check vehicle light operation.

c) Follow-On Maintenance

1. Check Periodically.

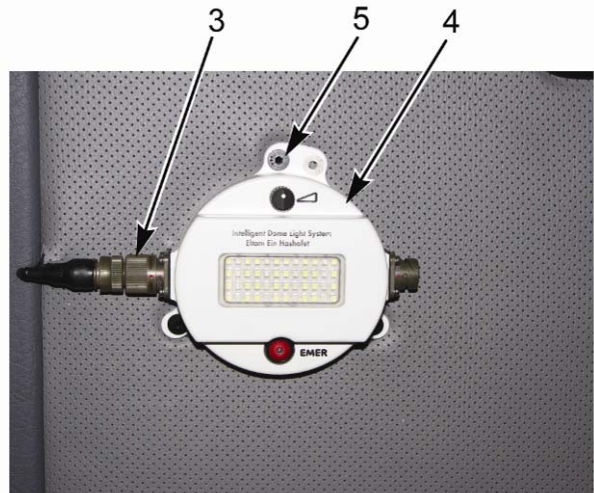
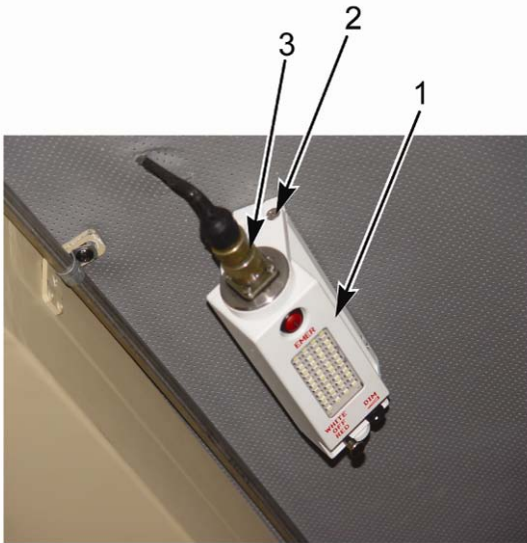
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.15 Cab Interior Light Replacement

CAB INTERIOR LIGHT REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<p><u>Special Tools</u> None</p>		<p><u>Equipment Condition</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF</p>
<p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>		<p><u>Reference</u> Parts Manual</p>
<p><u>Material/Parts</u> Two (2) “Intelligent Dome Light System” Lights</p>		<p><u>Equipment Required</u> None</p>
		<p><u>Follow-On Maintenance</u> Check the dome lights by turning the lights on, then turning the dimmer knob to increase or decrease light intensity. Check the EMERGENCY MODE WHITE or RED by depressing the RED Emergency button.</p>

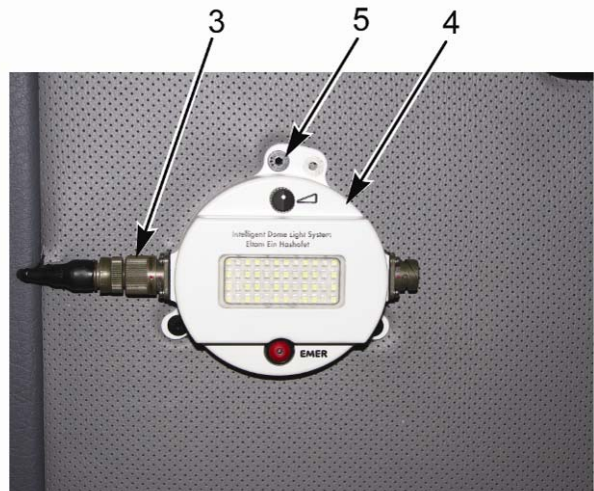
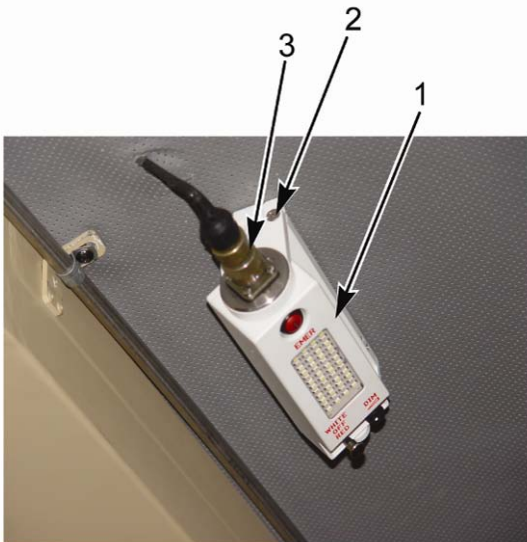
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



The cab interior light replacement consists of two “Intelligent System” dome lights, one located in the foreword ceiling area between the driver and passenger seat. The other Light is ceiling mounted midway above the crew compartment. The foreword “Intelligent System” dome light (1) is removed by unscrewing four screws (2), then unscrewing the electrical wiring cable (3). The “Intelligent System” dome light (4) located on the ceiling in the crew compartment is removed by unscrewing three screws (5), then unscrewing the electrical wiring cable (3).

b) Installation



The foreword “Intelligent System” dome Light (1) is installed by screwing four screws, then screwing the electrical wiring cable (3). The “Intelligent System” dome light (4) located on the ceiling in the crew compartment is installed by screwing three screws (5), then screwing the electrical wiring cable (3).

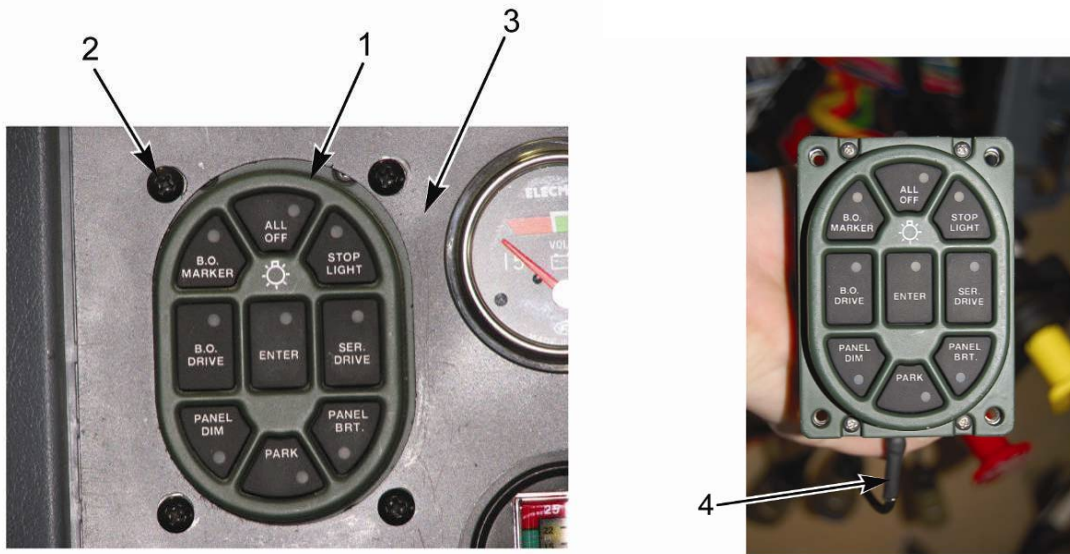
Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Check the dome lights by turning the lights on, then turning the dimmer knob to increase or decrease light intensity.
2. Check the EMERGENCY MODE WHITE or RED by depressing the RED Emergency button.

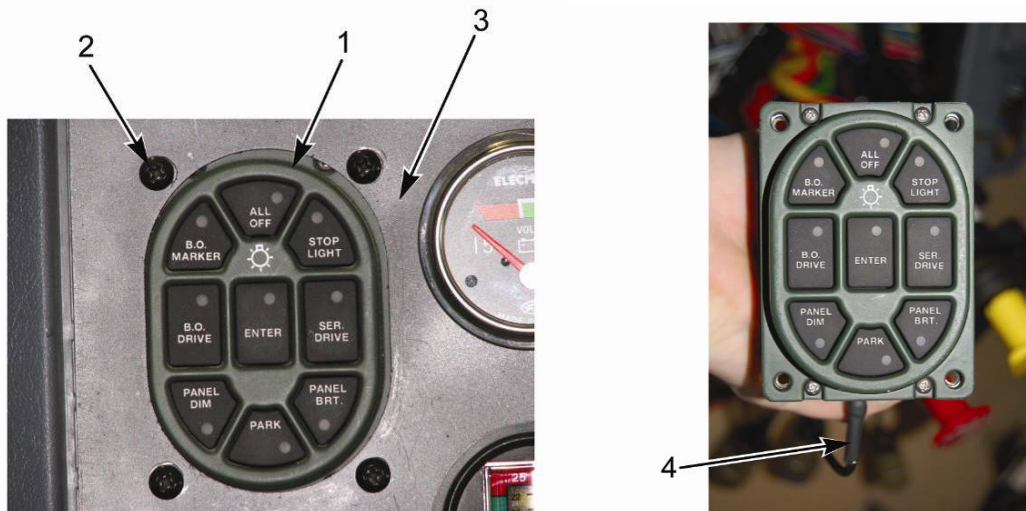
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove the four screws (2) that secure the Marker Light Control Switch (1) to the Instrument Panel Face Plate (3). Disconnect the Electrical Connector (4).

b) Installation



1. Install screwing four screws (2) securing the Marker Light Control Switch (1) to the Instrument Panel Face plate (3). Connect the Electrical Connector (4).

c) Follow-On Maintenance

1. Check Marker Light Control Switch to ensure the Blackout Light is operational before installing Face Plate to Instrument Panel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.17 Hazard Warning Light Switch/Turn Signal Wiper Control Replacement

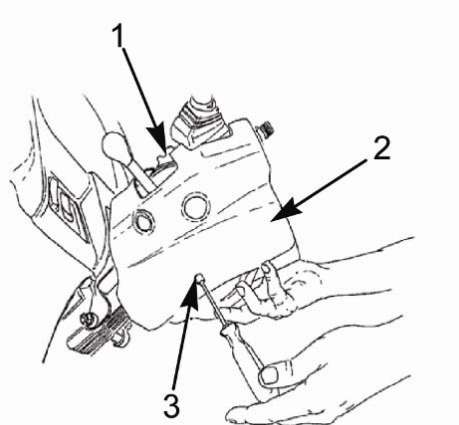
HAZARD WARNING LIGHT SWITCH/TURN SIGNAL WIPER CONTROL REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Wheels chocked Battery Disconnect Switch OFF
<u>Personnel</u>		<u>Reference</u>
One (1) Wheeled Vehicle Mechanic		Parts Manual
<u>Material/Parts</u>		<u>Equipment Required</u>
Hazard Warning Light Switch/Turn Signal Wiper Control (1)		None
		<u>Follow-On Maintenance</u>
		Check Hazard Lights

Chapter 4 – MAINTENANCE INSTRUCTIONS

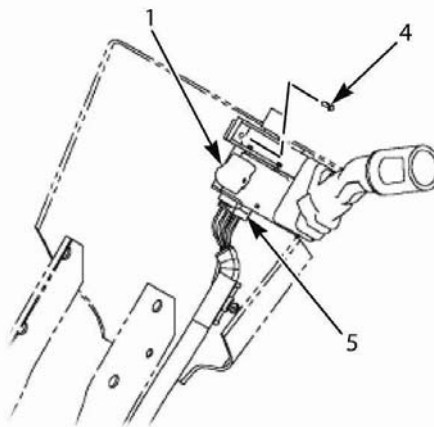
a) Removal



1. The side covers (2) must be removed to replace the Hazard Warning Light Switch/Turn Signal Wiper Control (1).



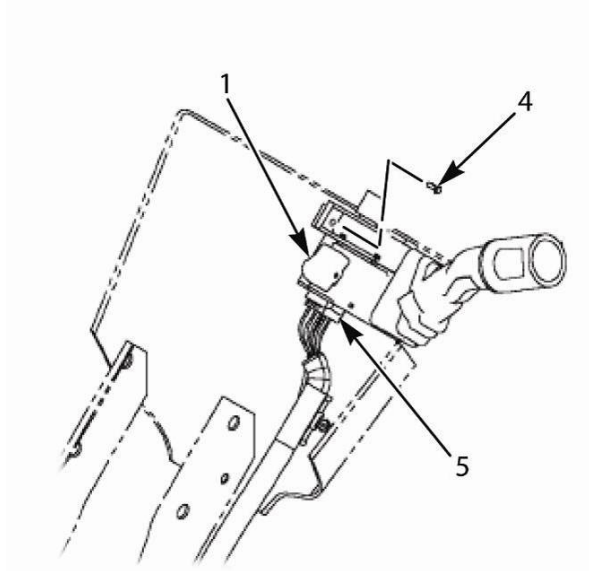
2. Unscrew two screws (3) that hold the side covers in position.



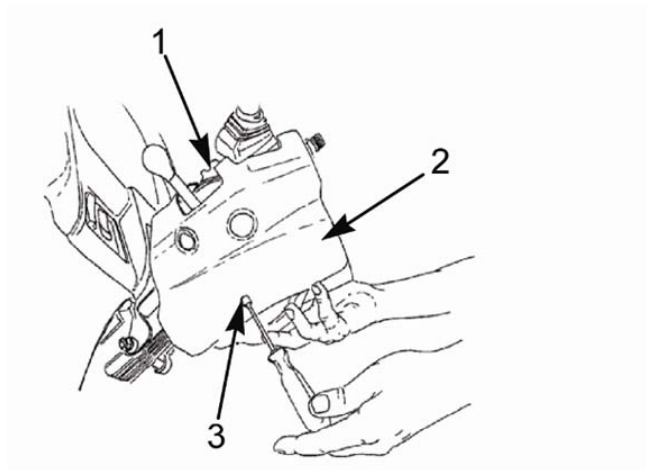
3. With the side covers removed, unscrew the fastener (4) that secures the Hazard Warning Light Switch/Turn Signal Wiper Control.
4. Disconnect the electrical connector (5) connected to the hazard warning light switch.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. To install Hazard Warning Light Switch/Turn Signal Wiper Control (1) connect the electrical connector (5) to the Hazard Warning Light Switch/Turn Signal Wiper Control.
2. Secure the Hazard Warning Light Switch/Turn Signal Wiper Control by screwing in with fastener (4).



3. Place in position side covers (2) and secure with two screws (3).

c) Follow-On Maintenance

1. Check hazard warning light.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.18 Horn Button Assembly Replacement

HORN BUTTON ASSEMBLY REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SETUP

Special Tools

None

Equipment Condition

Engine OFF

Wheels chocked

Battery Disconnect Switch OFF

Personnel

One (1) Wheeled Vehicle Mechanic

Reference

Parts Manual

Equipment Required

None

Material/Parts

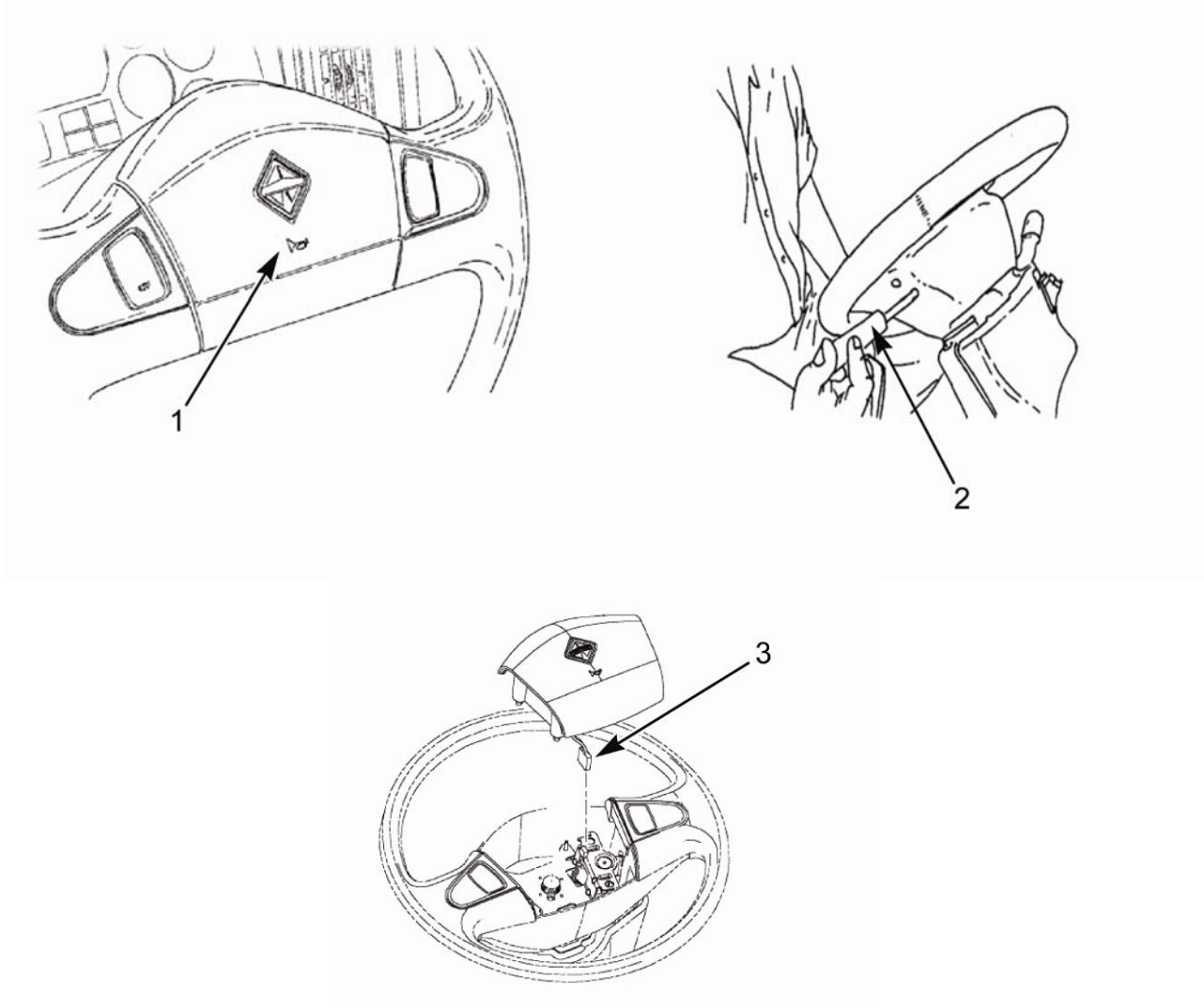
One (1) Horn Button Assembly

Follow-On Maintenance

Test horn

Chapter 4 – MAINTENANCE INSTRUCTIONS

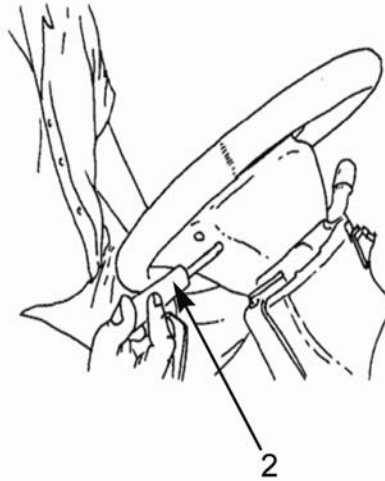
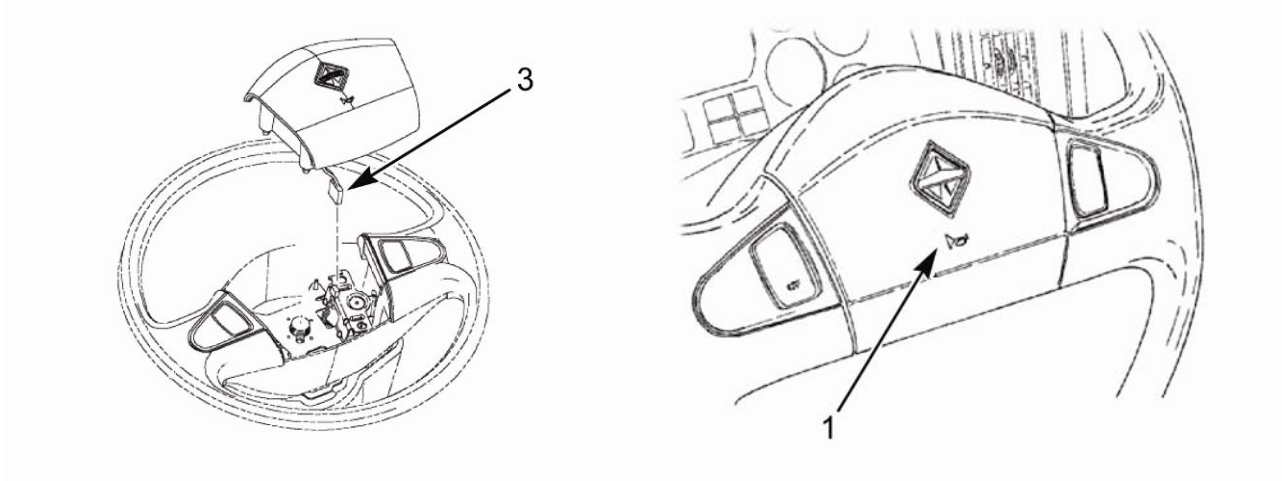
a) Removal



1. Remove front (1) and/or side covers.
2. To release front cover, insert removal tool (2) into the aperture, (Phillips Head Screwdriver may be used).
3. Remove horn cover.
4. Disconnect electrical connector (3) to horn button assembly.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Connect electrical connector (3) to horn button assembly.
2. Install horn cover (1).
3. To secure cover aperture insert tool (2) into aperture and tighten.

c) Follow-On Maintenance

1. Test horn.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.19 Slave Receptacle Replacement

SLAVE RECEPTACLE REPLACEMENT	
This task covers:	
a) Removal	b) Installation
	c) Follow-On Maintenance
INITIAL SETUP	<u>Equipment Condition</u>
	Engine OFF
<u>Special Tools</u>	Wheels chocked
None	Battery disconnected
<u>Personnel</u>	<u>Reference</u>
One (1) Wheeled Vehicle Mechanic	Parts Manual
<u>Material/Parts</u>	<u>Equipment Required</u>
Slave receptacle (1)	None
Identification Tags	<u>Follow-On Maintenance</u>
	Connect Batteries



Electrical shock hazard. Disconnect battery ground cable or power source prior to working on electrical components. Failure to heed warning could cause shock, injury or death. If electrical shock occurs, administer first aid and seek medical assistance immediately.

NOTE

Note location and position of wires prior to removal to ensure proper installation.

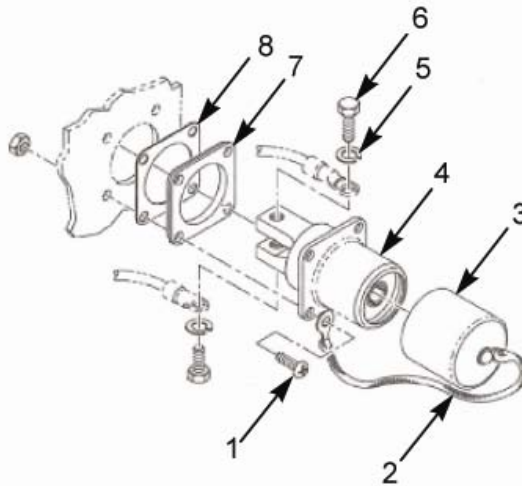
Mark and tag all wires to assist in a correct installation of the slave receptacle.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



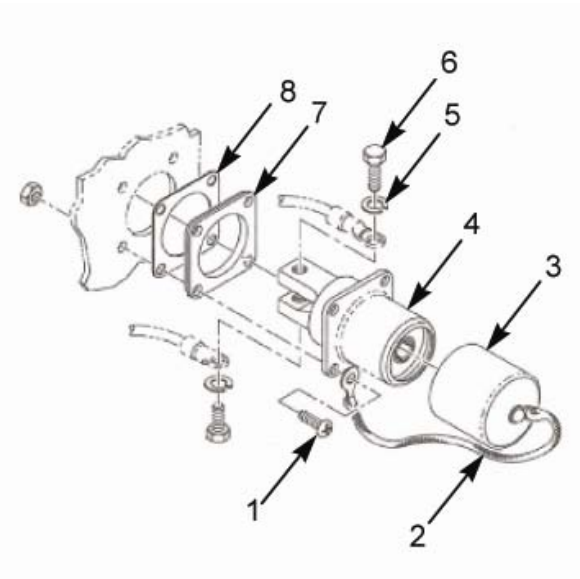
1. Remove 10 bolts from grated side cover (1) and remove cover.



2. Remove four screws (1).
3. Remove slave receptacle cover cord (2).
4. Remove slave receptacle cover (3).
5. Pull out slave receptacle (4).
6. Mark or tag the positive and negative cables before removing.
7. Remove positive and negative cables bolts (6) and lock washers (5).
8. Place positive and negative cables to the side.
9. Remove and discard slave receptacle (4).
10. Remove and inspect slave receptacle gasket. If cracked or damaged, replace slave receptacle gasket (7).
11. Remove and inspect insulator gasket. If damaged, replace insulator gasket (8).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Install insulator gasket (8).
2. Install slave receptacle gasket (7).
3. Reconnect positive and negative cables to the new slave receptacle.
4. Install positive and negative cable lock washers (5) and bolts (6).
5. Install new slave receptacle (4).
6. Install slave receptacle cover (3).
7. Slave receptacle cover cord (2).
8. Install four screws (1).
9. Install 10 bolts into grated side cover and install cover.



c) Follow-On Maintenance

1. Battery Reconnected.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.20 Gauges (Various) Instrument Cluster Replacement

GAUGES (VARIOUS) INSTRUMENT CLUSTER REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		
Torx Bit (T-20) (T-30)		<u>Equipment Required</u>
Utility Knife		None
<u>Personnel</u>		
One (1) Wheeled Vehicle Mechanic		<u>Equipment Conditions</u>
		Engine OFF
		Battery Disconnect Switch OFF
		Parking brake set
		Transmission set in NEUTRAL (N)
		Wheels chocked
<u>Material Parts</u>		
Tach, Speedometer, & Warning Light Assembly (1)		<u>Reference</u>
Air Gauge (2)		Parts Manual
Fuel Gauge (1)		
Water Gauge (1)		<u>Follow-On Maintenance</u>
Transmission Gauge (1)		Re-install steering column to IP
Oil Gauge (1)		Battery Disconnect Switch ON
Volt Gauge (1)		Ignition to ON position
Digital Odometer Display (1)		Check warning lights operation
Four Quadrant Gauge (2)		Start engine
Identification Tags		Re-fill air tanks
Connector Lubricant		Verify gauge operation
		Engine OFF
		Remove chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

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

a) Removal

Steering Column Cover

1. Tilt steering column all the way down, to access plastic cover.
2. Remove 2 ea., T-30, Torx bit screws from bottom of plastic cover on steering column.
3. Remove steering column plastic cover in two pieces and set aside.

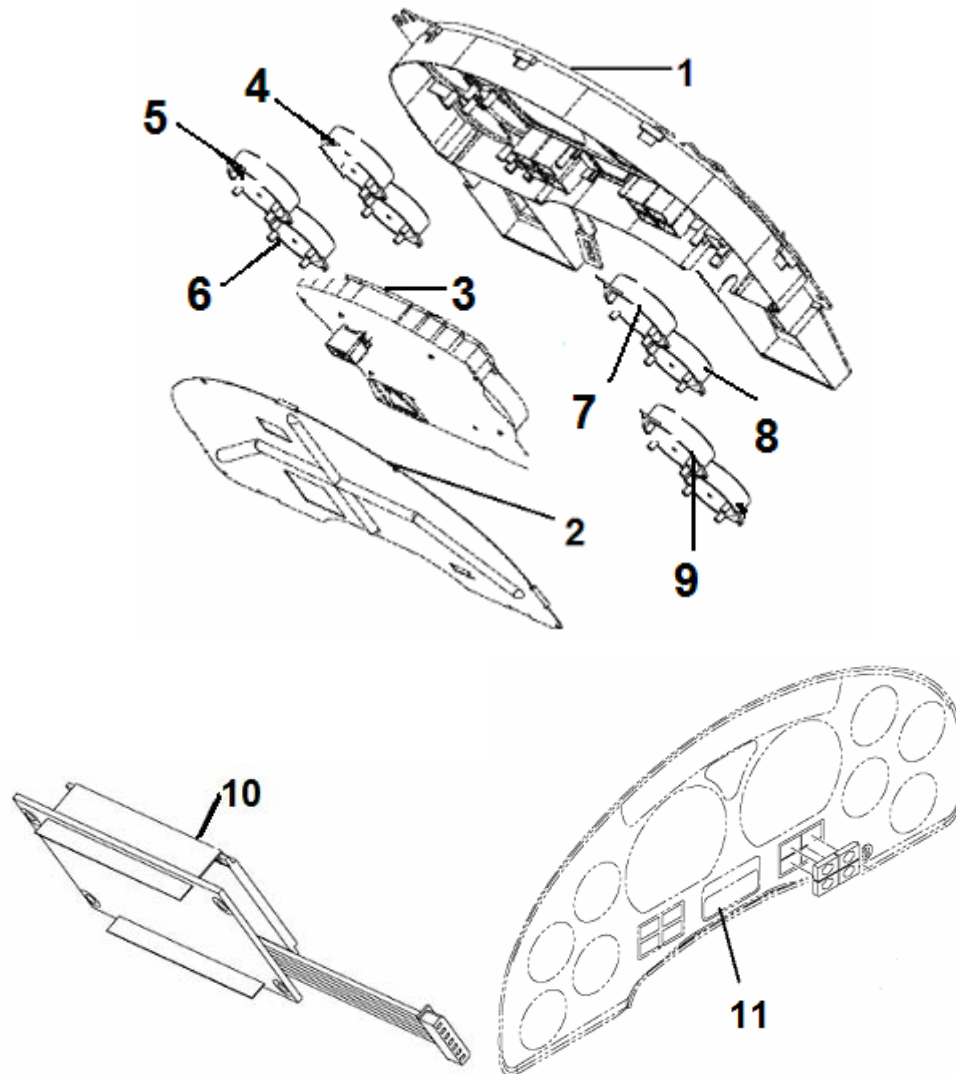


NOTE

All gages are removed in same manner.

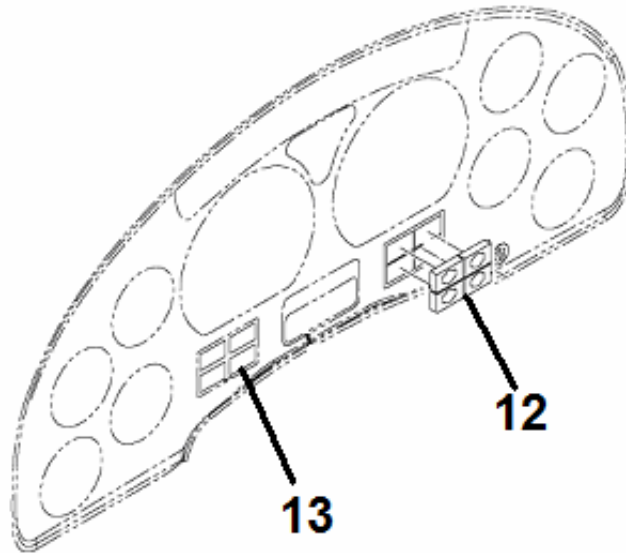
Chapter 4 – MAINTENANCE INSTRUCTIONS

Tach, Speedometer, and Warning Gauges



1. Pull top of instrument panel trim toward steering wheel and carefully remove.
2. Remove screws holding back (2) onto cluster gauge and remove back (2)
3. Remove Torx bit screws (T-20), holding cluster IP (1) in dash.
4. Disconnect all connectors from backside (2) of cluster (1) and label them as to where each goes for easier reinstallation later.
5. Move cluster (1) from instrument panel.
6. Place on a stable and padded surface face down.
7. Remove screws holding back (2) onto cluster gauge and remove back (2).
8. Disconnect connector for display gauge (10).
9. Remove screws holding digital display in place (11).
10. Remove digital display (10).

Four Quadrant Display Gauges



1. Remove Torx bit screws, (T-20), holding cluster IP in dash.
2. Disconnect all connectors from backside of cluster and label them as to where each goes for easier reinstallation later.
3. Remove cluster from instrument panel.
4. Place on a stable and padded surface face down.
5. Remove screws holding back onto cluster gauge and remove back.
6. Disconnect connector for four quadrant gauge display (12) and (13).
7. Remove screws holding display in place.
8. Remove gauge display (12) and (13).

Chapter 4 – MAINTENANCE INSTRUCTIONS

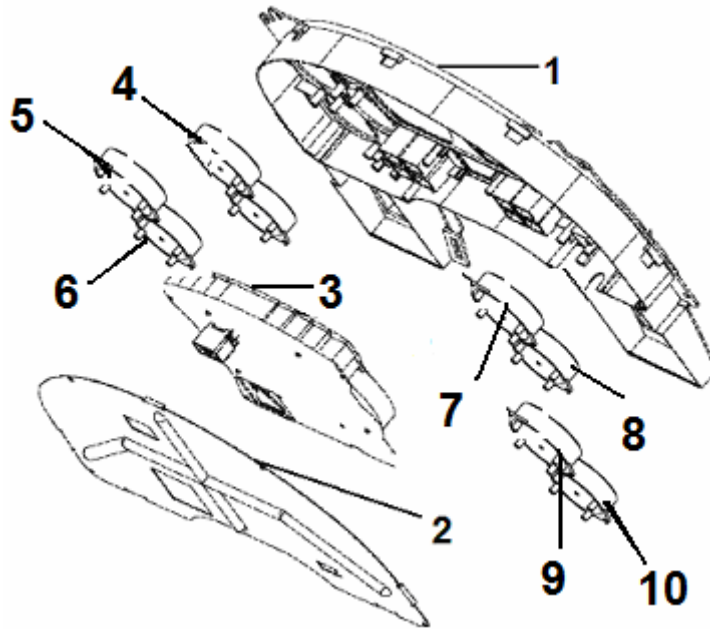
b) Installation



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

NOTE

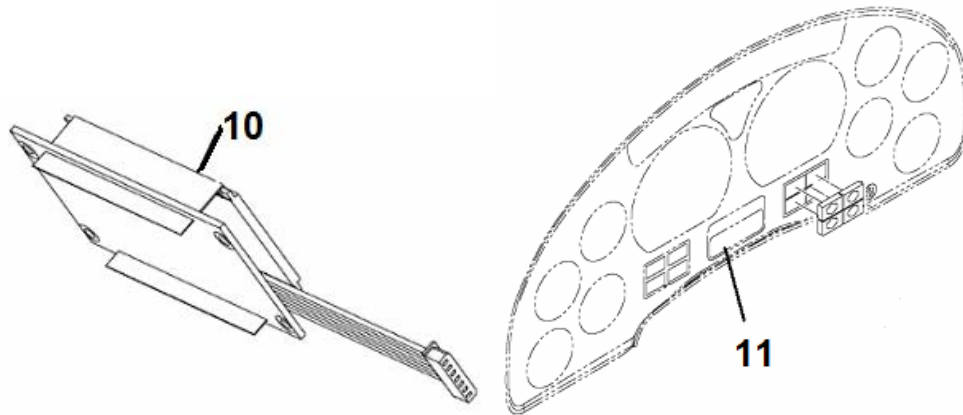
All gauges installed with same procedure.

Tach, Speedometer, and Warning Gauge

1. Apply connector lubricant to all electrical connectors.
2. Install new gauge or gauges (3), (4), (5), (6), (7), (8), (9), or (10) using appropriate jumper to connect the gauge to the connector.
3. Install cluster backing (2) back on to cluster assembly (1).
4. Install cluster back into dash with Torx bit.

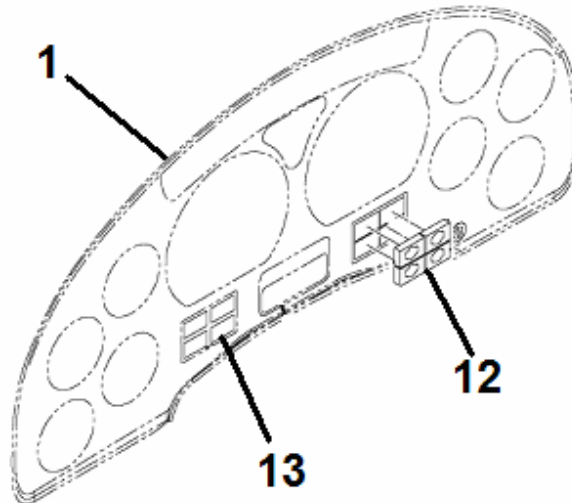
Chapter 4 – MAINTENANCE INSTRUCTIONS

Digital Odometer Display Gauge



1. Apply connector lubricant to connector (10).
2. Install new digital odometer display (10) and connect to the cluster display (11).
3. Install cluster backing back on to cluster assembly.
4. Install IP cluster back into dash with Torx bits and torque to specification.

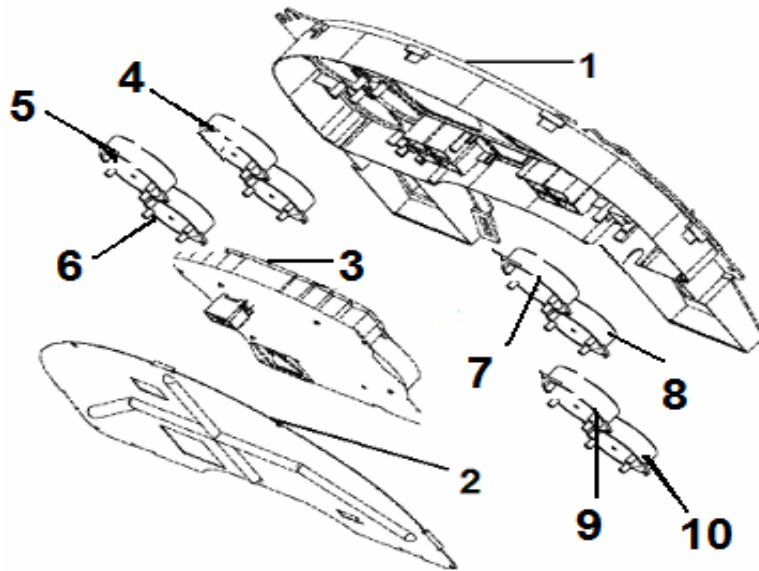
Four Quadrant Display Gauge



1. Apply connector lubricant to connector.
2. Install new four quadrant display gauge (12) and (13) and connect to the cluster display (1).
3. Install cluster backing back on to cluster assembly.
4. Install IP cluster back into dash with Torx bits and torque to specification.

Chapter 4 – MAINTENANCE INSTRUCTIONS

Instrument Panel Trim



1. Align Instrument Panel trim and apply forward pressure until panel clicks into place.
2. Install steering column cover.
3. Install 2 Torx Bit screws into steering column cover.
4. Reposition steering column.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Ignition to ON position.
3. Verify warning lights operation.
4. Start engine.
5. Verify gauge operation.
6. Engine OFF.
7. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.21 24V Gauge Replacement

24V GAUGE REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SET UP

Special Tools

Torx Bit (T-20)

Equipment Required

None

Personnel

One (1) Wheeled Vehicle Mechanic

Equipment Conditions

Engine OFF

Battery Disconnect Switch OFF

Parking brake set

Transmission set in NEUTRAL (N)

Wheels chocked

Instrument Panel center console faceplate removed

Material Parts

24V Gauge

Connector Lubricant

Identification Tags (as required)

Reference

Parts Manual

Follow-On Maintenance

Install Instrument Panel center console faceplate

Battery Disconnect Switch ON

Start engine

Verify gauge operation

Engine OFF

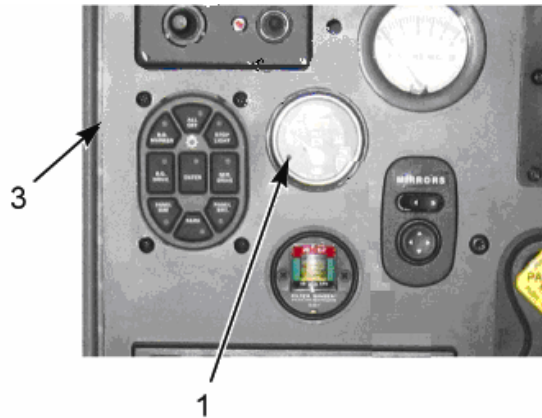
Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

a) Removal



1. Remove two screws holding 24V gauge (1) into place in IP center panel (3).
2. Pull 24V gauge (1) out of center dash panel (3) and disconnect electrical connector.
3. Discard 24V gauge (1).

b) Installation



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

1. Apply connector lubricant to connector.
2. Connect electrical connector.
3. Insert 24V gauge (1) into center dash panel (3).
4. Install two screws to hold into place.

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Install IP center panel faceplate.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Verify operation of gauge.
5. Engine OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.22 Air Restriction Gauge Replacement

AIR RESTRICTION GAUGE REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SET UP

Special Tools

None

Equipment Required

None

Personnel

One (1) Wheeled Vehicle Mechanic

Equipment Conditions

- Engine OFF
- Battery Disconnect Switch OFF
- Parking brake set
- Transmission set in NEUTRAL (N)
- Wheels chocked
- Remove IP center console faceplate

Material Parts

- Air Restriction Gauge (1)
- Connector Lubricant

Reference

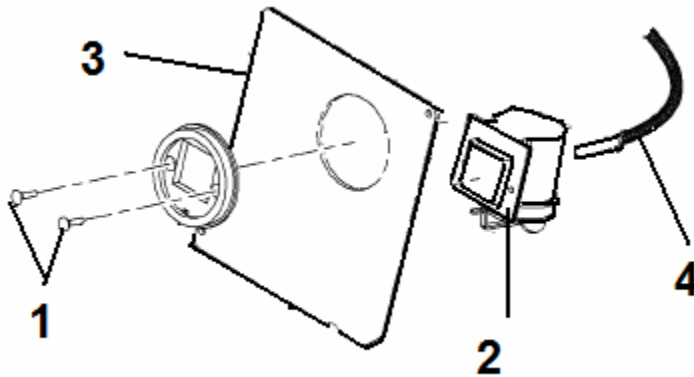
Parts Manual

Follow-On Maintenance

- Install IP center console faceplate
- Battery Disconnect Switch ON
- Start engine
- Verify gauge operation
- Check for air leaks
- Engine OFF
- Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove two screws (1) holding air restriction gauge (2) into place in center IP panel (3).
2. Pull air restriction gauge (2) out of dash panel (3) and disconnect air hose (4).
3. Discard air restriction gauge (2).

b) Installation



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

1. Apply very thin layer of lubricant to tip of air hose (4).
2. Attach air hose to air restriction gauge (2) and clamp into place.
3. Insert air restriction gauge (2) into dash panel.
4. Install two mounting screws (1) to hold into place.

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Re-install IP center console faceplate.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Verify gauge operation.
5. Check for air leaks.
6. Engine OFF.
7. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.23 Rocker Switch Replacement

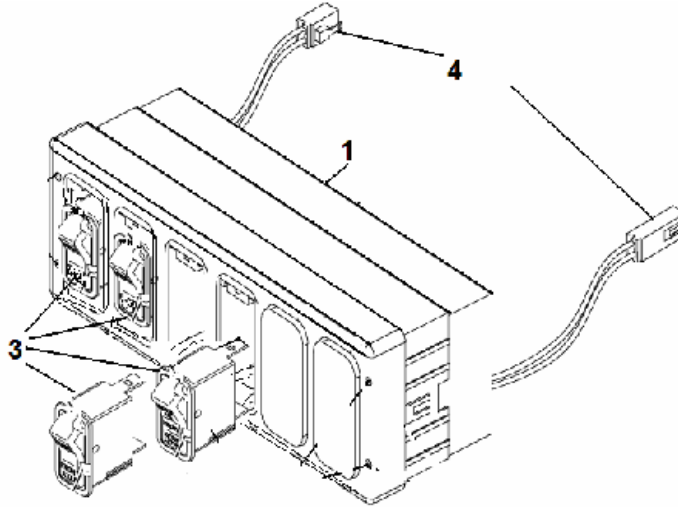
ROCKER SWITCH REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		<u>Equipment Required</u>
DIN removal tools (2)		None
<u>Personnel</u>		<u>Equipment Conditions</u>
One (1) Wheeled Vehicle Mechanic		Engine OFF
		Battery Disconnect Switch OFF
		Parking brake set
<u>Material Parts</u>		Transmission set in NEUTRAL (N)
Rocker Switches (6) if needed		Remove IP center console faceplate
Connector Lubricant		Wheels chocked
Identification tags (if needed)		
		<u>Reference</u>
		Parts Manual
		<u>Follow-On Maintenance</u>
		Re-install IP center console faceplate
		Battery Disconnect Switch ON
		Start engine
		Verify switch operation
		Engine OFF
		Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



1. Remove switch pack rocker switch panel (1) from dash.
2. Once rocker switch panel (1) is removed, disconnect electrical connectors (4).
3. Remove the back panel off rocker switch panel (1) for easier access to rocker switches (3).
4. Remove rocker switches (3) by pressing down on tabs.
5. Discard switches.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

1. Apply connector lubricant to electrical connectors (4).
2. Snap rocker switch (3) into place in rocker switch panel (1).
3. Re-install back panel to rocker switch panel (1).
4. Slide rocker switch panel (1) back into center dash panel until it clicks into place.

c) Follow-On Maintenance

1. Re-install IP center console faceplate.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Verify switch operation.
5. Engine OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.24 110V Plug Replacement

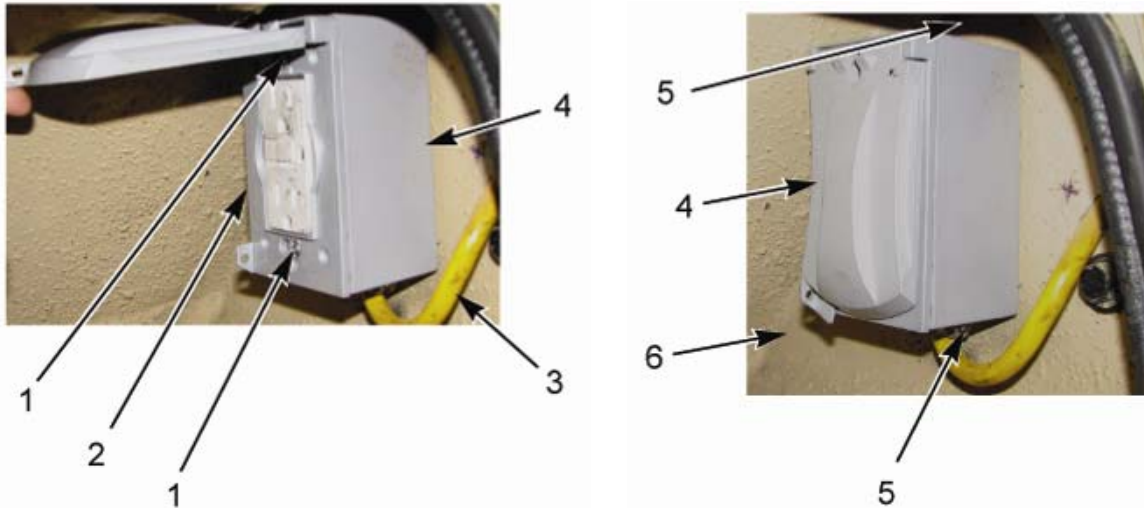
110V PLUG REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		<u>Equipment Required</u>
None		None
<u>Personnel</u>		<u>Equipment Conditions</u>
One (1) Wheeled Vehicle Mechanic		Engine OFF
		Battery Disconnect Switch OFF
		Parking brake set
		Transmission set in NEUTRAL (N)
		Wheels chocked
		Batteries disconnected
<u>Material Parts</u>		<u>Reference</u>
110V Plug Box (1)		Parts Manual
Connector Lubricant		
Anti-Corrosion Compound		
Identification Tags (as needed)		
		<u>Follow-On Maintenance</u>
		Re-connect batteries
		Battery Disconnect Switch ON
		Ignition switch to the ON position
		Verify plug operation
		Ignition switch to the OFF position
		Remove wheel chocks



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove two screws (1) to remove faceplate (2) to get to cable (3) inside 110V plug box (4).
2. Remove clamp from electrical cable (3) and disconnect wire connections inside box after labeling.
3. Remove two bolts (5) holding 110V plug box (4) to sidewall of right rear stowage box (6).
4. Discard 110V plug box.

b) Installation



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

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

1. Apply connector lubricant to electrical cable (3) connections.
2. Apply anti-corrosion compound to bolts (5) and screws (1).
3. Insert electrical cable (3) into clamp inside 100V plug box (4) and tighten clamp to specification.
4. Connect any wires that were disconnected making sure you connect them to the proper connection per label.
5. Install 110V plug box (4) to sidewall of right rear stowage box (6) with two bolts (5).
6. Install 110V plug box faceplate (2) with two screws (1).

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Re-connect batteries.
2. Battery Disconnect Switch ON.
3. Ignition switch to the ON position.
4. Verify plug operation.
5. Ignition switch to the OFF position.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.25 Transfer Case Shift Sensor Replacement

TRANSFER CASE SHIFT SENSOR REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SETUP

Special Tools

None

Personnel

One (1) Wheeled Vehicle Mechanic

Material/Parts

Transfer Case Shift Sensor

Equipment Condition

Engine OFF

Wheels chocked

Battery Disconnect Switch OFF

Reference

Parts Manual

Equipment Required

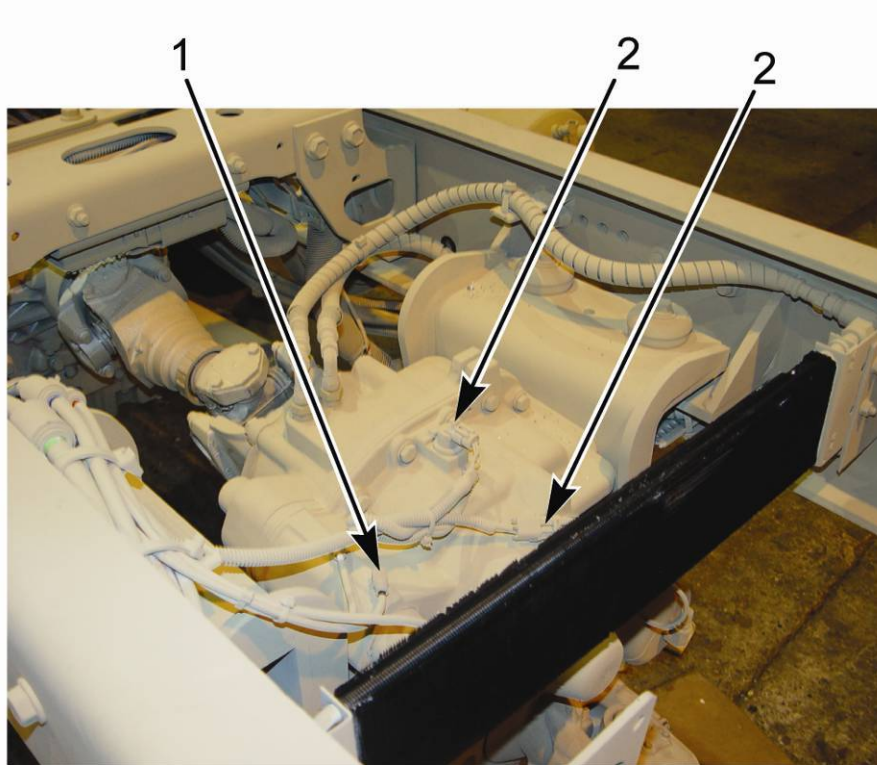
None

Follow-On Maintenance

Test drive vehicle

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



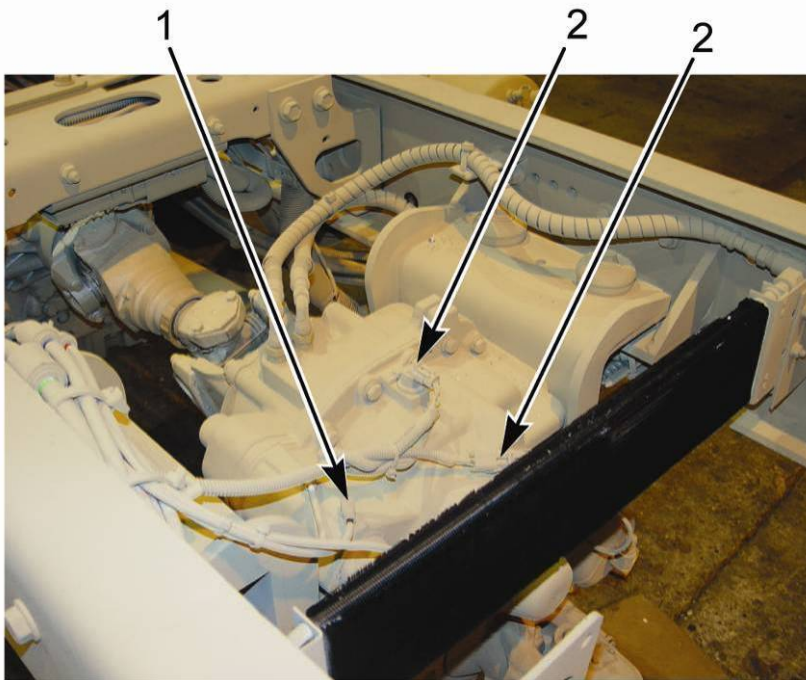
NOTE

Body removed for clarity.

1. Park the vehicle on a level surface.
2. Disconnect the harness (2) for the indicator switch wires.
3. Remove transfer case shift sensor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Install transfer case shift sensor.
2. Connect the harness (2) for the indicator switch wires.
3. Connect the air lines (1) at the shift cylinders of the transfer case.

c) Follow-On Maintenance

1. Test drive vehicle.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.26 Engine Start Switch Replacement

ENGINE START SWITCH REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		<u>Equipment Required</u>
None		1 1/8 in. thin wall socket (1) Socket wrench (1)
<u>Personnel</u>		<u>Equipment Conditions</u>
One (1) Wheeled Vehicle Mechanic		Engine OFF Battery Disconnect Switch OFF Wheels chocked
<u>Material Parts</u>		<u>Reference</u>
Start Switch (1) Start Switch Rubber trim (1) 1 1/8 in. mounting cap nut (1)		Parts Manual
		<u>Follow-On Maintenance</u>
		Battery Disconnect Switch ON Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

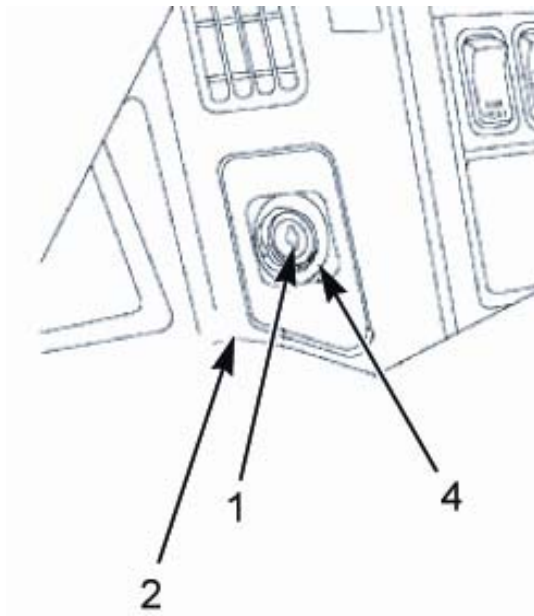
NOTE

The Start switch (1) is located to the right of the driver in the dash panel (2) below instrument panel.

a) Removal

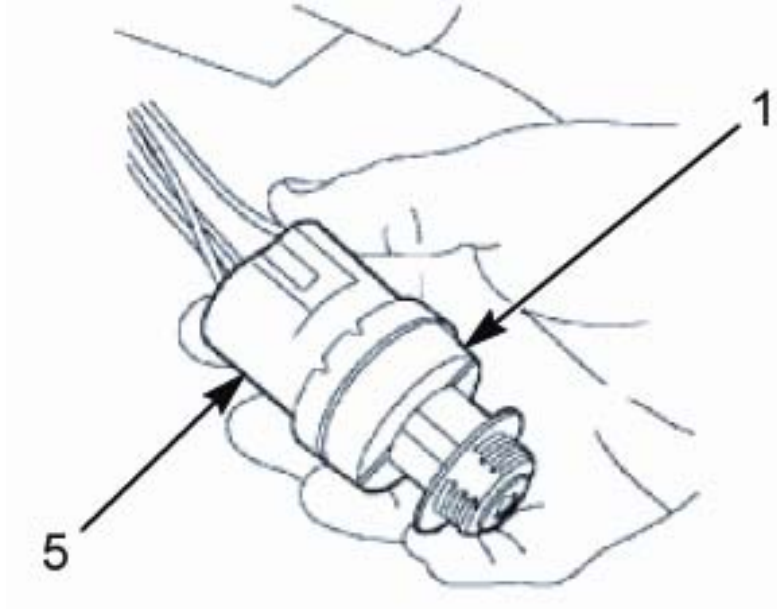


1. Remove rubber trim (3) from around Start switch (1).



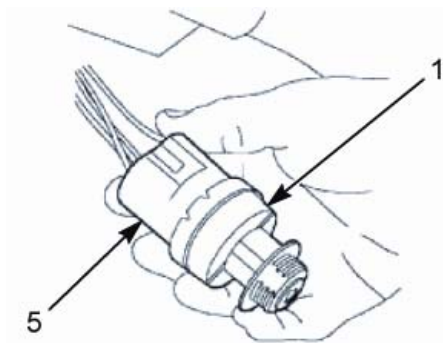
2. Using a 1 1/8 in. thin wall socket, unscrew mounting cap nut (4) and remove it from start switch (1).
3. Reach up behind dash panel (2) and pull start switch (1) out of dash panel and pull it down below dash panel.

Chapter 4 – MAINTENANCE INSTRUCTIONS



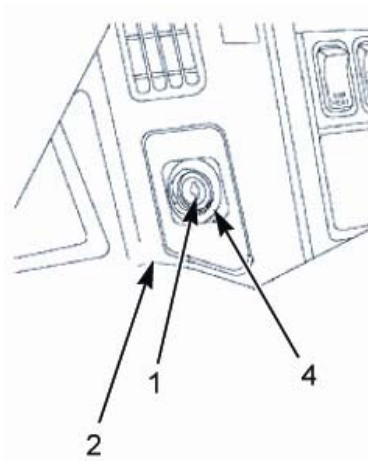
4. Disconnect start switch connector (5) from back of the start switch (1) and remove start switch from vehicle.

b) Installation

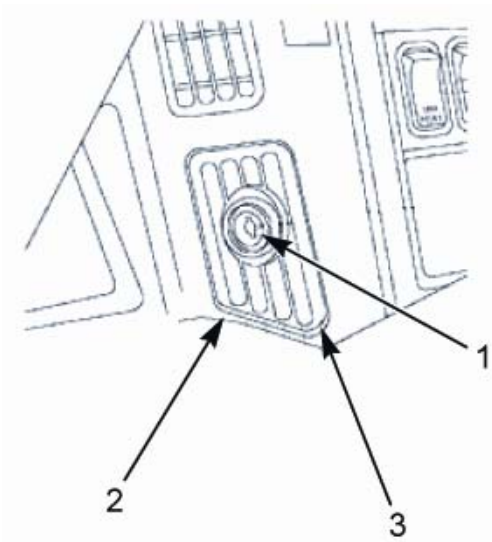


1. Position start switch (1) at dash panel and connect start switch connector (5) to back of start switch.

Chapter 4 – MAINTENANCE INSTRUCTIONS



2. Position start switch (1) up behind dash panel (2) and insert it into dash panel opening.
3. With start switch (1) pushed through dash panel (2) and positioned properly, using a 1 1/8 in. thin wall socket, install mounting cap nut (4) securing it to dash panel. Tighten snugly.



4. Install rubber trim (3) around start switch (1).

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Check out system.
3. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.27 Ether Start Switch Replacement

ETHER START SWITCH REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SET UP

Special Tools

None

Personnel

One (1) Wheeled Vehicle Mechanic

Material Parts

Ether Start Switch (1)

Connector Lubricant

Identification Tags (as needed)

Equipment Required

None

Equipment Conditions

Engine OFF

Battery Disconnect Switch OFF

Parking brake set

Transmission set in NEUTRAL (N)

Wheels chocked

Reference

Parts Manual

Follow-On Maintenance

Battery Disconnect Switch ON

Start engine

Verify switch operation

Engine OFF

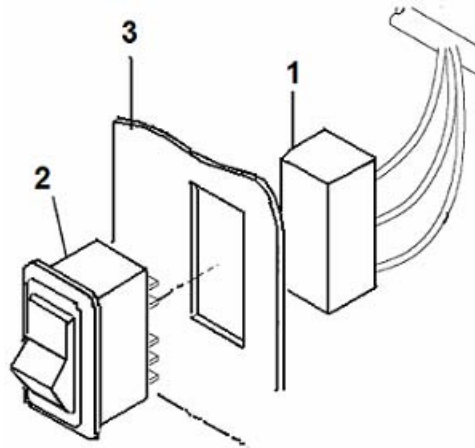
Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



1. Disconnect electrical connection (1) to ether switch (2) in dash (3) next to steering column.
2. Push ether switch (2) out front of dash panel (3).
3. Discard ether switch (2).

b) Installation



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

1. Apply connector lubricant to electrical connector (1).
2. Push new ether switch (2) into dash panel (3).
3. Connect electrical connector (1).

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify ether switch operation.
4. Engine OFF.
5. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

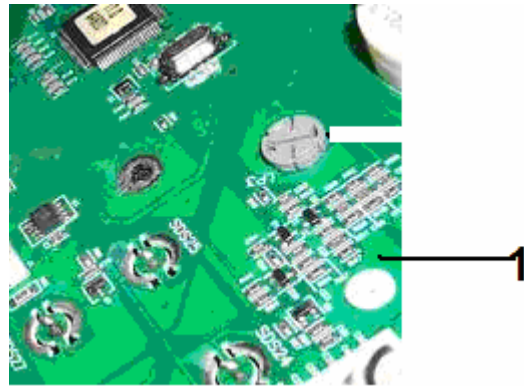
a) Removal



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

NOTE

All the lights for the electronic gauge cluster are replaced the same way and are twist-in lights. Each warning light will have a lamp and each gauge will have one or two depending on its size.



1. Remove the EGC from the instrument panel.
2. Remove six screws holding the back of the EGC in place and remove the back cover.
3. Locate the failed lamp on the back side of the circuit board (1), and remove it by twisting it out of the circuit board.

b) Installation



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

1. Apply a very thin layer of lubricant to electrical connectors.
2. Install lamp into socket and twist clockwise to tighten.

c) Follow-On Maintenance

1. Re-install EGC.
2. Re-install steering column to dash.
3. Battery Disconnect Switch ON.
4. Ignition switch to the ON position.
5. Verify light operation.
6. Ignition switch turned OFF.
7. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.29 Electronic System Controller (ESC) Replacement

ELECTRONIC SYSTEM CONTROLLER (ESC) REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u> Diamond Logic Software		<u>Equipment Required</u> None
<u>Personnel</u> One (1) Wheeled Vehicle Mechanic		<u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Batteries disconnected Parking brake set Transmission in NEUTRAL (N) Wheels chocked Disconnect the batteries
<u>Material Parts</u> Electronic System Control Module Identification Tags Connector Lubricant Anti-Corrosion Compound		<u>Reference</u> Parts Manual
		<u>Follow-On Maintenance</u> Re-connect batteries Battery Disconnect Switch ON Start engine Verify operation Engine OFF Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

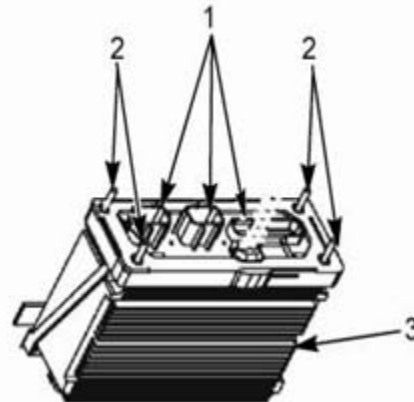


Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Assure batteries are disconnected before removing ESC. Injury to personnel or damage to equipment may result.



When replacing the Electronic System Controller (ESC) make sure that the new replacement unit has been programmed for vehicle, using Diamond Logic Software. Failure to comply may result in damage to equipment.



1. Mark and label electrical connection (1) to ESC (3) inside cab.
2. Remove four nuts from bolts (2) that secure the ESC (3) to the dash panel.
3. Remove the ESC (3) from the inside of the cab.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

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

2. Apply connector lubricant to electrical connectors.
3. Apply anti-corrosion compound to four nuts and bolts (2).
4. Slide new ESC (3) module into place inside cab of vehicle threading bolts (2)
5. Install four nuts on the four bolts (2).
6. Connect all electrical connectors (1).

c) Follow-On Maintenance

1. Re-connect batteries.
2. Battery Disconnect Switch ON.
3. Verify operation.
4. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.30 Circuit Breaker Replacement

CIRCUIT BREAKER REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	
<p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Circuit breaker of proper size and current rating (1)</p>	<p><u>Equipment Condition</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF Access to the fuse panels</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Remove wheels chocks Install access fuse panel covers</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

Circuit breakers for vehicle wiring circuits are generally grouped together in a circuit breaker panel. Most circuit breaker panels provide space for installing additional circuit breakers if needed for installation of accessory circuits.

The 2 fuse/circuit breaker panels are located behind the passenger instrument panel and on the firewall in the engine compartment. Circuit breakers are designed to pass a given amount of current. The current flow limit is indicated by the rating (capacity) of the circuit breaker (10 ampere, 14 ampere, etc.). Do not replace a circuit breaker with one of a higher capacity.

Circuit breakers are designed to open the circuit any time current demand exceeds the capacity of the breaker. In the event of short or overload, the circuit breaker will open due to excessive heat developed by the higher amperage passing through it. When the heat dissipates, the breaker will close allowing the current to flow again.

If the cause of the short or overload has not been removed, the circuit breaker will open again to protect the circuit. The current flow limit is indicated by the rating (capacity) of the circuit breaker (15 amperes, 20 amperes, etc.) Do not replace a circuit breaker with one of a higher capacity.

Vehicles may have additional secondary or accessory circuits not routed through the fuse or circuit breaker panel. Such circuits are protected by in-line fuses or remote mounted circuit breakers in the current feed wiring. Refer to vehicle circuit diagrams for remote fuse locations.



1. Determine which circuit breaker needs to be replaced.
2. Remove faulty CB.
3. Note orientation and rating (capacity) of the CB for replacement purposes.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

1. Obtain circuit breaker of the same rating of faulty CB.
2. Install new circuit breaker noting the CB orientation.
3. Turn Battery Disconnect Switch ON.
4. Check system for operation.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Check out system.
3. Remove wheels chocks.
4. Install access fuse panels.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.31 Fuse Replacement

FUSE REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<p><u>Special Tools</u> Digital Multimeter (DMM) Fuse Puller</p>	<p><u>Equipment Condition</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF Access to the fuse panels</p>	
<p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>	<p><u>Reference</u> Parts Manual</p>	
<p><u>Material/Parts</u> Fuse of proper size and current rating (1)</p>	<p><u>Equipment Required</u> None</p>	
	<p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Remove wheels chocks Install access fuse panel covers Check circuits</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

Fuses for most vehicle wiring circuits are grouped together in a fuse panel. Some fuse panels have removable fuse terminals which can be replaced if damaged. Most fuse panels provide space to install additional fuse terminals if needed for installation of accessory circuits.



The main power distribution panel is located on the left driver side of the engine compartment adjacent to the cowl. The second fuse panel is located behind the passenger instrument panel. Fuses are designed to pass a given amount of current. The current flow limit is indicated by the rating or “Size” of the fuse (10 ampere, 15 ampere, etc.). Exceeding this limit will cause the fuse to “blow”, opening the circuit.

After the cause of the overload is determined and corrected, a new fuse must be installed in the circuit. Do not replace a “blown” fuse with a fuse of higher capacity. To do so may result in damage to electrical components or wiring.

Vehicles may have additional secondary or accessory circuits not routed through the fuse or circuit breaker panel. Such circuits are protected by “in line” fuses or remote mounted circuit breakers in the current feed wiring. Refer to vehicle circuit diagrams for remote fuse locations.

1. Determine which fuse needs to be replaced.
2. Use fuse puller to remove blown fuse.
3. Check fuse with DMM to determine continuity.
4. If fuse is bad, discard. If fuse is good, install in original location and continue troubleshooting.

b) Installation

1. Obtain fuse the same size and ratings of blown fuse.
2. Using fuse puller, install new fuse in terminals.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Check out system.
3. Remove wheels chocks.
4. Install access fuse panels.

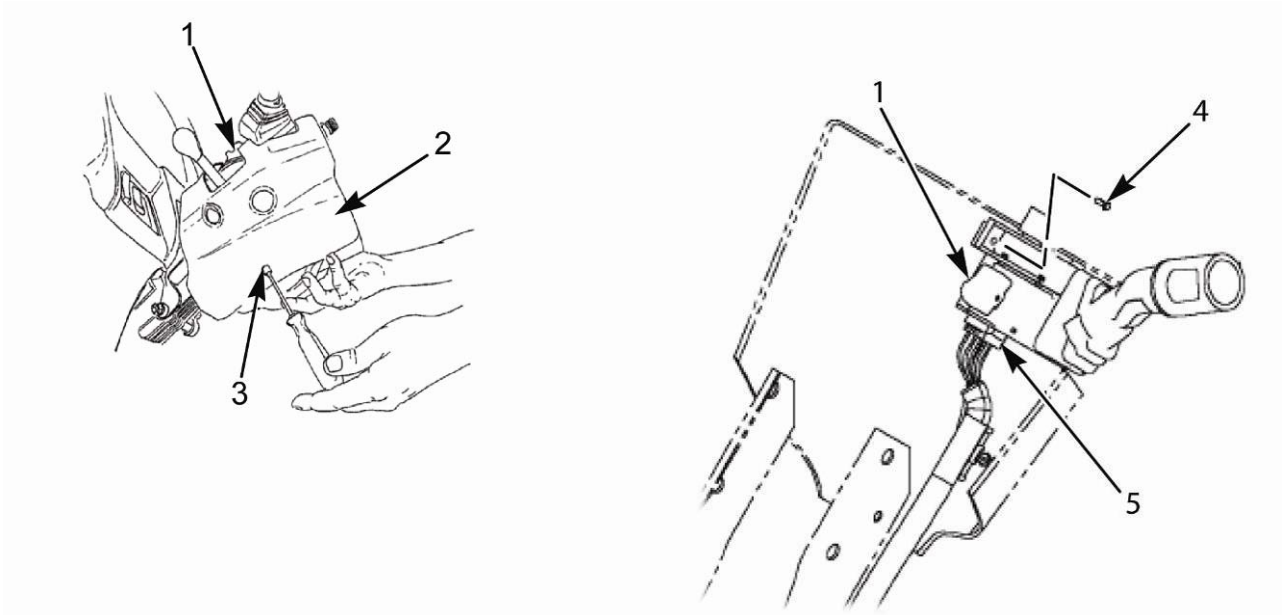
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.32 Turn Signal/Wiper Control Assembly Replacement

TURN SIGNAL/WIPER CONTROL ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Wheels chocked Battery Disconnect Switch OFF
<u>Personnel</u>		<u>Reference</u>
One (1) Wheeled Vehicle Mechanic		Parts Manual
		<u>Equipment Required</u>
		None
<u>Material/Parts</u>		<u>Follow-on Maintenance</u>
One (1) Turn Signal/Wiper Control Assembly		Cycle Washer/Wiper Control Check for proper operation of system

Chapter 4 – MAINTENANCE INSTRUCTIONS

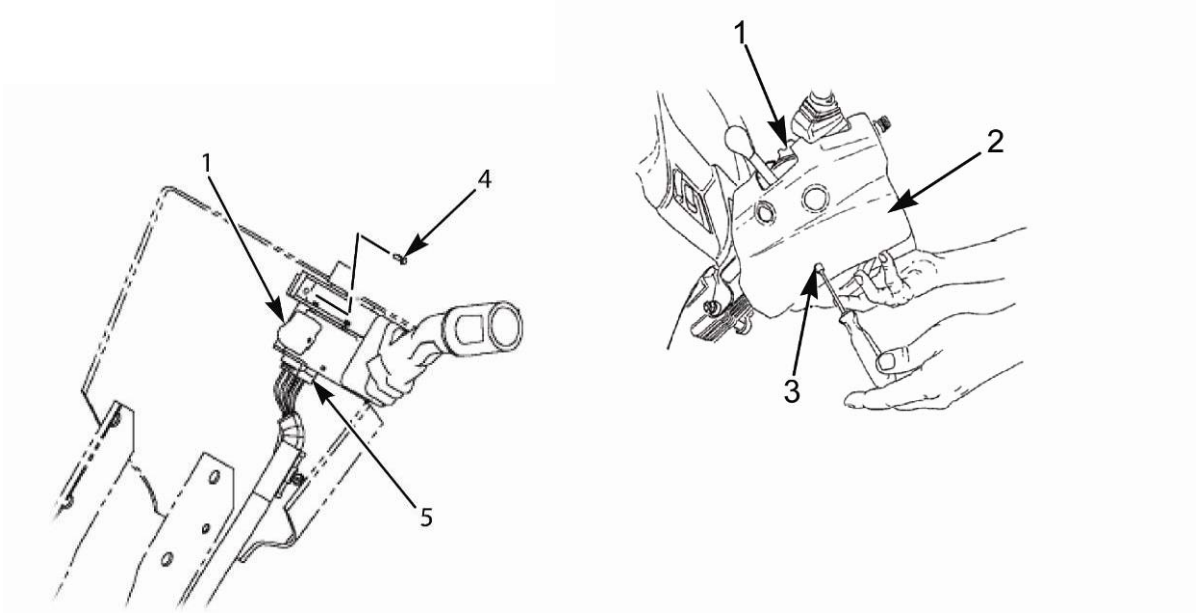
a) Removal



1. To replace Turn Signal/Wiper Control assembly (1), the side covers (2) must be removed.
2. Unscrew two screws (3) that hold the side covers in position.
3. With the side covers removed, unscrew the fastener (4) that secures the Turn Signal/Wiper Control assembly.
4. Disconnect the electrical connector (5) connected to the Turn Signal/Wiper Control assembly.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. To install the Turn Signal/Wiper Control assembly (1) connect the electrical connector (5) to the Turn Signal/Wiper Control assembly.
2. Secure Turn Signal/Wiper Control assembly (1) by screwing in with Fastener (4).
3. Place in position Side Covers (2) and secure with two screws (3).

c) Follow-On Maintenance

1. Cycle Washer/Wiper Control.
2. Check for proper operation of system.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.33 FSS Control Switches and Lights Assembly Replacement

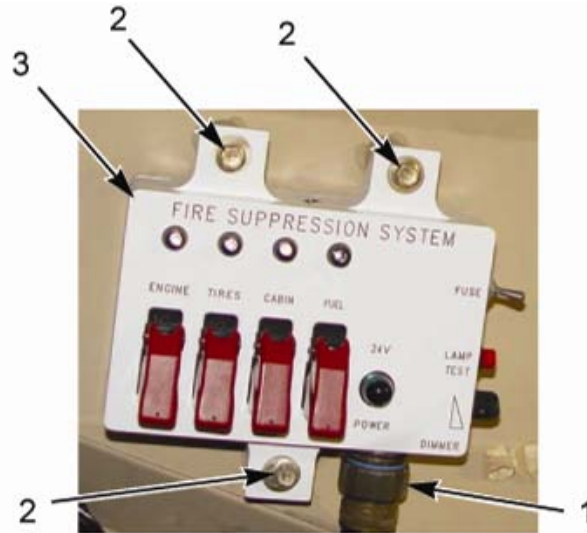
FSS CONTROL SWITCHES AND LIGHTS ASSEMBLY REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>	<u>Equipment Required</u>	
None	None	
<u>Personnel</u>	<u>Equipment Conditions</u>	
One (1) Wheeled Vehicle Mechanic	Engine OFF	
<u>Material Parts</u>	Battery Disconnect Switch OFF	
Fire Extinguisher Discharge Switch	Parking brake set	
Dielectric Compound	Transmission set in NEUTRAL (N)	
	Wheels chocked	
	<u>Reference</u>	
	Parts Manual	
	<u>Follow-On Maintenance</u>	
	Battery Disconnect Switch ON	
	Ignition switch to the ON position	
	Verify switch operation	
	Ignition switch turned OFF	
	Remove wheel chocks	

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



1. Remove electrical connection (1) from fire extinguisher switch control box (3).
2. Remove three bolts (2) from switch control box (3).
3. Discard fire extinguisher switch control box (3).

b) Installation



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

1. Apply thin layer of lubricant to electrical connector.
2. Install new fire extinguisher control switch box (3) with three bolts (2).
3. Connect electrical connector (1).

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Ignition switch to the ON position.
3. Verify circuit operation.
4. Ignition switch turned OFF.
5. Battery Disconnect Switch OFF.
6. Remove wheel chocks.

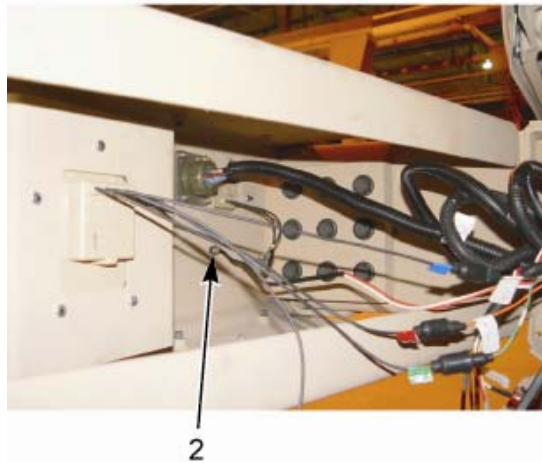
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.34 I.R. Light Replacement

I. R. LIGHT REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<p><u>Special Tools</u> Torx Bit (T-25)</p>		<p><u>Equipment Condition</u> Transmission set in (N) Parking Brake Set Engine OFF Wheels chocked Battery Disconnect Switch OFF</p>
<p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>		<p><u>Reference</u> Parts Manual</p>
		<p><u>Equipment Required</u> None</p>
<p><u>Material/Parts</u> One (1) I. R. Light</p>		<p><u>Follow-On Maintenance</u> Check I. R. Light operation</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Replace the I.R. Light (1) which is located on the driver's side front bumper, press fitted to the inside of the bumper, positioned as to allow the sensor to operate through its dedicated opening. Remove the I.R. Light with a firm pull on the Light.

2. Disconnect the electrical connector (2).

b) Installation

1. Connect the electrical connector (2) to the I.R. Light (1).
2. Press fit the I.R. Light into the front bumper, from the rear towards the front through the dedicated opening for the I.R. Light.

c) Follow-On Maintenance

1. Check I.R. Light operation.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.35 I.R. Light Switch Replacement

I.R. LIGHT SWITCH REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		<u>Equipment Required</u>
None		None
<u>Personnel</u>		<u>Equipment Conditions</u>
One (1) Wheeled Vehicle Mechanic		Engine OFF
		Battery Disconnect Switch OFF
		Parking brake set
		Transmission set in NEUTRAL (N)
		Wheels chocked
		IP center panel faceplate removed
<u>Material Parts</u>		<u>Reference</u>
I.R. Light Switch Assembly (1)		Parts Manual
Identification Tags (as needed)		
Dielectric Grease		
		<u>Follow-On Maintenance</u>
		Re-install IP center panel faceplate
		Battery Disconnect Switch ON
		Start switch to ON position
		Verify switch operation
		Start switch to OFF
		Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



I.R. Control Panel



1. Remove four retaining screws (1) from I.R. control panel (5).
2. Remove I.R. control panel (5) from dash.
3. Disconnect electrical connections on back of panel.
4. Remove nut (2) from toggle switch (3) and remove through back-side.
5. Remove low, high knob (4) by pulling on it slightly. Remove rest of switch from back-side.
6. Discard both switches being replaced.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

1. Install new toggle switch (3) from back-side and secure with nut (2).
2. Install new low, high switch from back-side and secure into place. Install knob (4) by lining it up and pushing it on.
3. Apply connector lubricant to electrical connectors.
4. Connect electrical harness.
5. Install I.R. light switch panel (5) back into dash with four retaining screws (1).



c) Follow-On Maintenance

1. Re-install IP center panel faceplate.
2. Battery Disconnect Switch ON.
3. Start switch to the ON position.
4. Verify switch operation.
5. Start switch to OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.36 Inverter 110V Replacement

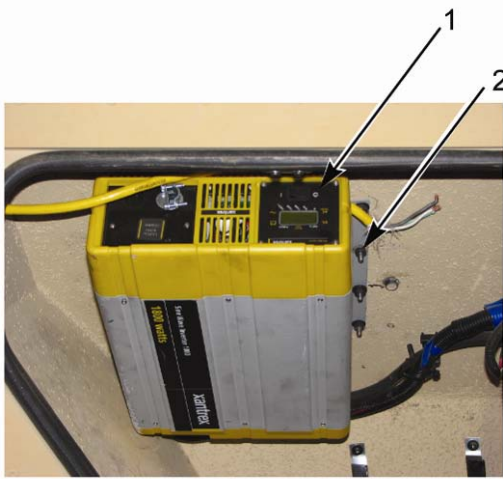
110V INVERTER REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		
None		
<u>Personnel</u>		
One (1) Wheeled Vehicle Mechanic		
<u>Material/Parts</u>		
One (1) 1800 Inverter 110V		
<u>Equipment Condition</u>		
Transmission set to (N)		
Parking Brake set		
Engine OFF		
Wheels chocked		
Battery Disconnect Switch OFF		
Batteries Disconnected		
<u>Reference</u>		
Parts Manual		
<u>Equipment Required</u>		
None		
<u>Follow-On Maintenance</u>		
Test inverter		
Connect Batteries		



System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

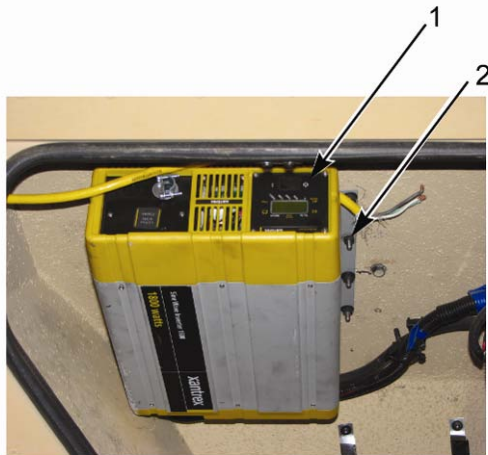
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Disconnect the electrical connections (3). Note the location and positioning of wiring connections for reassembly and tag to identify for installation of new inverter.
2. To remove the 110V Inverter (1), unscrew the eight screws (2) that secure the inverter to the vehicle.

b) Installation



1. Secure the 110V Inverter (1) to the vehicle with eight screws (2).
2. Connect all electrical connections to the 110V Inverter (1).

c) Follow-On Maintenance

1. Test inverter.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.37 Instrument Panel Dim Module Replacement

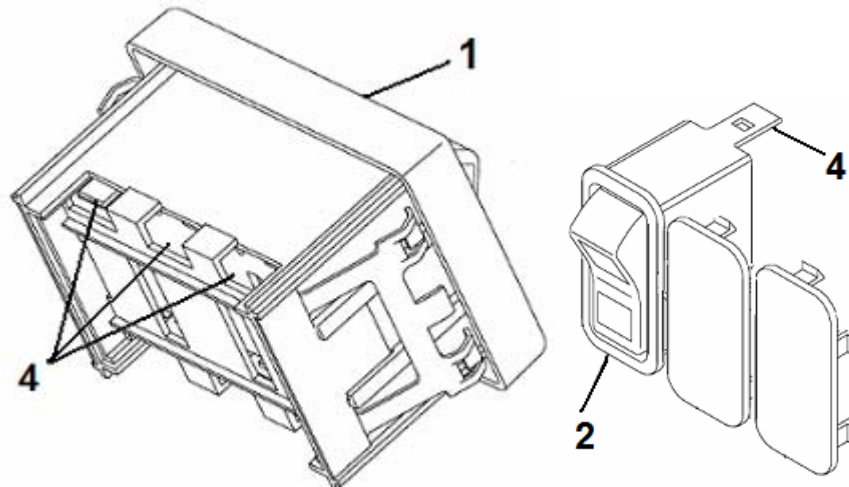
INSTRUMENT PANEL DIM MODULE REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<p><u>Special Tools</u> DIN Removal Tools (2)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Panel Dim Module (1) Connector Lubricant Identification Tags (if needed)</p>	<p><u>Equipment Required</u> None</p> <p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission set in NEUTRAL (N) Wheels chocked</p> <p><u>Reference</u> Parts Manual</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Ignition switch ON Verify module operation Ignition switch OFF Remove wheel chocks</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



1. Pull instrument panel switch box (1) from dash.
2. Disconnect electrical connection from instrument panel dim switch.
3. Push in tabs (4) to release instrument panel dim switch (2) from instrument panel switch box (1).
4. Discard instrument panel dim switch (2).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

1. Apply connector lubricant to electrical connector.
2. Install new instrument panel dim switch (2) into instrument panel switch box (1) until you hear it click into place.
3. Connect electrical connector to instrument panel dim switch (2).
4. Install instrument panel switch box (1) into dash panel until your hear it click into place on both sides.

c) **Follow-On Maintenance**

1. Battery Disconnect Switch ON.
2. Ignition switch to the ON.
3. Verify switch operation.
4. Ignition switch to OFF.
5. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.38 Fusible Link Inspection and Replacement

FUSIBLE LINK INSPECTION AND REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Soldering Iron</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Fusible link of proper rating Rosin Core Solder (1) Splices (2)</p>	<p><u>Equipment Condition</u> Engine OFF Wheels chocked Battery Disconnect Switch OFF Batteries disconnected</p> <p><u>Reference</u> Parts Manual Electrical Schematic</p> <p><u>Equipment Required</u> None</p>	<p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Remove wheels chocks Check circuit Batteries connected</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

NOTE

Fusible links are used to protect the wiring harness in the event of a short, in a non-fused circuit.

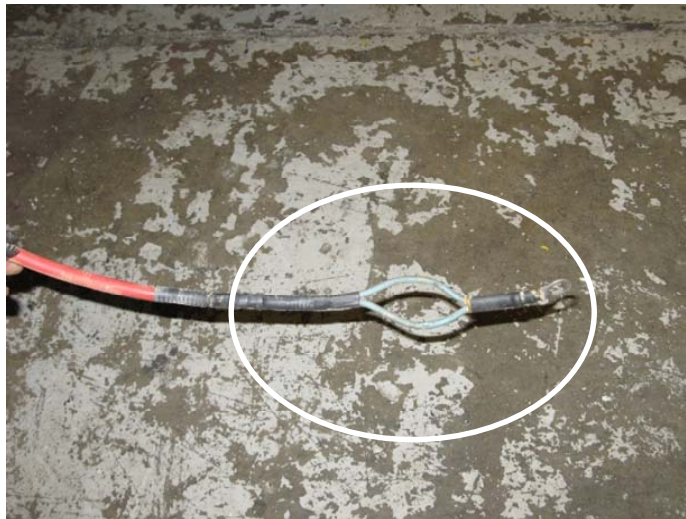
The fusible link consists of a length of special light gauge wire. In case of a short or overload, the fusible link opens (“burns out”) to protect the rest of the circuit. Repair consists of splicing a new fusible link into the circuit.

Locations of fusible links, where used, are shown on the wiring circuit diagram covering the vehicle involved.

a) Removal

1. Locate fusible link in circuit.
2. Cut or un-solder the connection.
3. Note the fusible link rating for installation purposes.

FUSABLE LINK



b) Installation

1. Locate fusible link in circuit.
2. Install fusible link in circuit.
3. Solder or splice fusible link in circuit.
4. Check wiring.
5. Check circuit.

c) Follow-On Maintenance

1. Check circuit.
2. Connect batteries.
3. Battery Disconnect Switch ON.
4. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.39 Accelerator Pedal Sensor (APS) Test and Replacement

ACCELERATOR PEDAL SENSOR (APS) TEST AND REPLACEMENT		
This task covers:		
a) Test	b) Removal	c) Installation
d) Follow-On Maintenance		
INITIAL SET UP		
<u>Special Tools</u>		<u>Equipment Required</u>
DVOM – Digital Volt Ohm Meter		None
MSD – Break Out Tec		
		<u>Equipment Conditions</u>
		Battery Disconnect Switch ON
		Engine OFF
		Parking brake set
		Transmission set in NEUTRAL (N)
		Wheels chocked
<u>Personnel</u>		
One (1) Wheeled Vehicle Mechanic		
<u>Material Parts</u>		<u>Follow-On Maintenance</u>
Throttle Pedal Sensor (1)		Battery Disconnect Switch ON
Connector Lubricant		Start engine
Anti-Corrosion Compound		Verify throttle pedal sensor operation
		Engine OFF
		Remove wheel chocks
<u>Reference</u>		
Parts Manual		



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



Testing should be preformed before Battery Disconnect Switch is turned off to get accurate readings. Failure to comply may result in false readings and inaccurate testing which can lead to damage to equipment.

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a) Test

Before Test

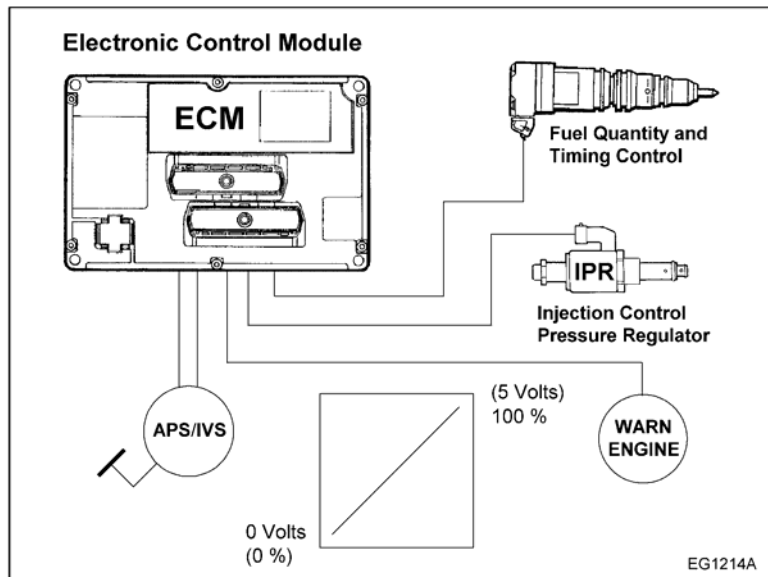
Before troubleshooting, make sure that the batteries are fully charged! Check battery cables and grounds for clean, tight connections free of damage. Many of the voltage tests will give misleading readings if batteries are not fully charged.

Before troubleshooting a particular circuit, inspect connectors for pushed back, loose or damaged (spread or bent) terminals, or wires with cuts strands etc. The wires and connections must be free of damage or corrosion. When some connectors corrode, a light white residue will be present that must be removed.

Before troubleshooting, inspect the suspect circuit grounds for clean, tight connections free of damage.

Circuit Function and Diagnostics

Accelerator Position Sensor and Idle Validation Switch (APS/IVS)



Signal Function Diagram for APS/IVS

The Accelerator Position Sensor (APS) is a potentiometer sensor. When the APS receives a 5V reference signal and a ground from the Electronic Control Module (ECM), a linear analog voltage signal will indicate a demand for power.

The Idle Validation Switch (IVS) provides 0 or 12 Volts to the ECM as a redundant signal to verify the pedal idle position.

Fuel Quantity and Timing Control - The APS signal calculates desired injector timing and fuel quantity.

Injection Control Pressure - The accelerator pedal position determines desired injection control pressure.

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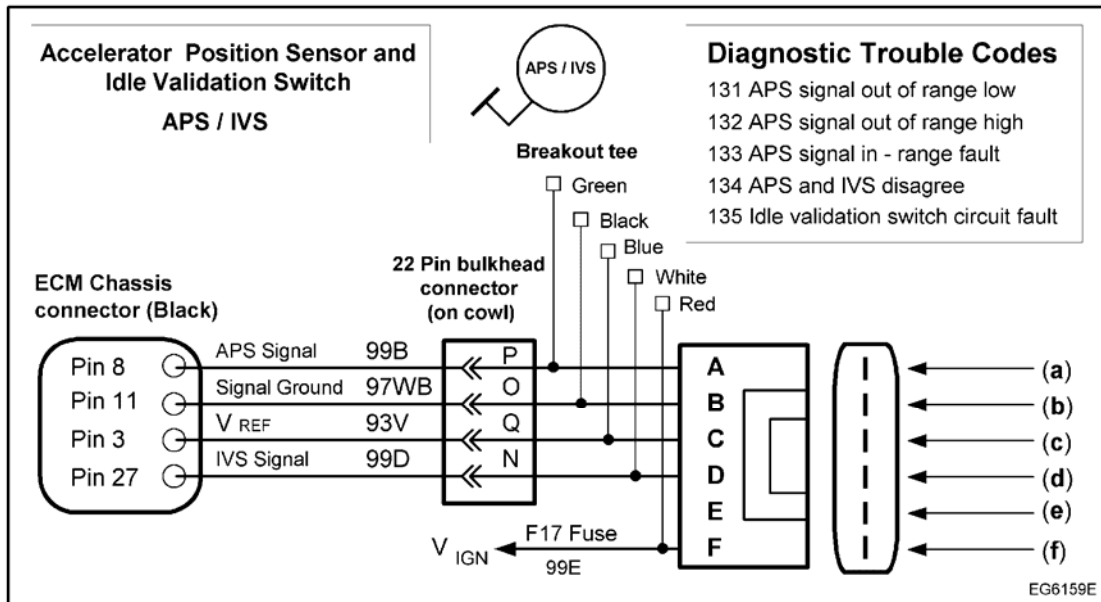
Fault Detection and Management

Detected malfunctions of the APS or IVS sensor circuit will illuminate the WARN ENGINE lamp.

If the ECM detects an APS signal Out of Range High or Out of Range Low, the engine will ignore the APS signal and operate at low idle.

When differences between IVS and APS are detected, the ECM sets an IVS Diagnostic Trouble Code and limits the APS command to 50%.

If differences between the IVS and APS are detected, but the ECM cannot discern an APS or IVS Diagnostic Trouble Code, the engine will operate at low idle only.



Chapter 4 – MAINTENANCE INSTRUCTIONS

APS / IVS Circuit Diagram

**Sensor Circuit Diagnostics Using an EST
APS/IVS Sensor Tests Using Master Diagnostics**

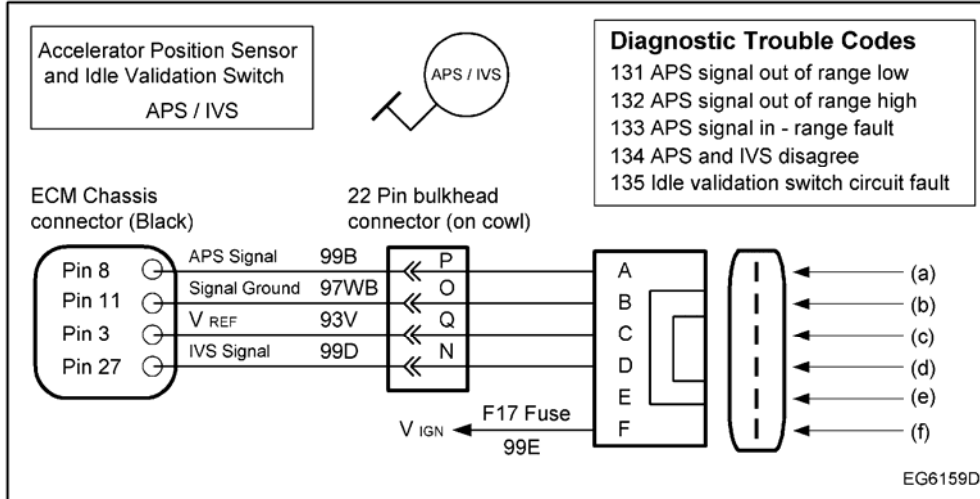
Accelerator Position Sensor (APS) Sensor Voltage Checks.					
Use Sensor Circuit Specifications to verify IVS Signal. (Check with key-ON engine-OFF.)					
Install the 5 wire breakout tee between the APS/IVS sensor and harness connector.					
View APS/IVS VOLTAGE using the Continuous Monitor session and the Continuous Monitor test found under the diagnostics menu in MASTER DIAGNOSTICS.					
If the circuit has an active fault according to the voltage level (Code 131 <0.146V, Code 132 >4.55V), complete the following steps.					
Test Condition	Expected Voltage		Comments		
Sensor Disconnected	0V		Voltage >0.146V, inspect the signal circuit for short to VREF or B+.		
Measure voltage from PIN C to and using a DMM.	5V 0.5		If voltage is >5.5V, check VREF for short to B+. If voltage <4.5V, check VREF circuit for open or short to and. Remove the positive battery cable. Measure resistance from PIN C to PIN 3 (spec <5) and from PIN C to and (spec >1k) using a breakout box to determine if the short to and or open is in the harness.		
0.5 k jumper installed between the GREEN and BLUE pins of the breakout tee.	5V		If voltage is <4.55V, check signal circuit for open or short to ground. Remove the positive battery cable. Measure resistance from PIN C to Ground (spec >1 k) and from PIN A to PIN 8 (spec <5) using a breakout box to determine if short to ground or open is in the harness.		
Standard Jumper installed between the BLUE, GREEN, and BLACK pins of the breakout tee.	0V		If voltage is >0.039V, check ground circuit for resistance >5. Measure resistance between PIN B and PIN 11 (spec <5) using a breakout box to determine if resistance is in the harness.		
Replace the sensor if the code is active and the expected results are obtained with all the sensor tests. The sensor is not at fault if one or more of the sensor tests does not produce the expected results.					
See APS/IVS Sensor Troubleshooting Flowchart following this table.					
OPERATIONAL VOLTAGE CHECKS					
(Check with breakout tee installed and APS/IVS sensor connected.)					
	APS test points: (+) 8 to (-) 11		IVS test points: (+) 27 to (-) 11		
Position	Voltage	% APS	Voltage	% APS	Comments
Low Idle	0.64 0.66V	0%	0V	0%	IVS toggles just off idle
High Idle	3.84 3.86V	98 - 102%	12 1.5V	98 - 102%	
Diagnostic Trouble Code Description					
131 APS signal voltage was < 0.146 volts for more than 0.5 sec*					
132 APS signal voltage was more than 4.55 volts for more than 0.5 sec*					
133 APS signal in-range fault*					
134 APS and IVS disagree*					
135 Idle validation switch circuit fault - 50% APS only					
*If diagnostic trouble code is set, engine operation will default to run at low idle speed only					

Chapter 4 – MAINTENANCE INSTRUCTIONS

Alternate Testing Procedure

NOTE

Use this procedure if no EST is available.



Circuit diagram for APS / IVS

CONNECTOR VOLTAGE CHECKS (Check with sensor disconnected from harness and key on)					
Test Points		Spec.		Comments	
A to And		0V		Voltage > 0.146V, signal is shorted to Vref or B+	
B to And		0V		Ground circuit, no voltage expected	
C to And		5 + 0.5V		Voltage > spec, wire shorted to B+	
D to And		0 - 0.25V		Voltage > 0.25, IVS signal wire shorted to Vref or B+	
F to And		12 + 1.5V		Voltage < 10.5V check circuit for open or resistance	
CONNECTOR CHECKS TO CHASSIS GROUND (Check with sensor connector disconnected, positive battery cable disconnected, and key off.)					
Test Points		Spec.		Comments	
A to And		> 1000		If < 1000, check for short to ground.	
B to And		< 5		If > 5, check for open.	
C to And		> 500		If < 0.5k, check for short to ground.	
D to And		> 1000		If < 1k, check for short to ground.	
F to And		> 1000		If < 1k with fuse removed, check for short to ground.	
OPERATIONAL VOLTAGE CHECKS					
	APS test points		IVS test points		
Position	Voltage +8 to 11	% APS	Voltage +2711	% APS	Comments
Low Idle	0.25 to 0.8V	0%	0V	0%	IVS toggles just off idle
High Idle	3 to 4.4V	98-102%	12+ 1.5V	98-102%	

Continued on next page

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HARNES RESISTANCE CHECKS (Check with breakout box installed on chassis side only).		
Test Points	Spec.	Comments
8 to A	<5	APS signal wire open
11 to B	<5	Signal ground open
3 to C	<5	Vref wire open
27 to D	<5	IVS wire open
Fuse 17 to F	<5	IVS power wire open (Remove fuse.)
FAULT CODE DESCRIPTIONS		
131 = APS signal was < 0.146V for more than 0.5 seconds*		
132 = APS signal was > 4.55V for more than 0.5 seconds*		
133 = APS signal in-range Diagnostic Trouble Code*		
134 = APS and IVS disagree*		
135 = Idle validation switch circuit diagnostic trouble code - 50% APS only		
* If a diagnostic trouble code is set, engine operation will default to run at low idle speed only.		

Extended Description

International electronic engines use an electronic accelerator pedal assembly that includes an Accelerator Position Sensor (APS) and an Idle Validation Switch (IVS). The APS and IVS are integrated into one component mounted on the accelerator pedal. The accelerator pedal assembly is serviceable to the extent that the APS/IVS switch can be replaced without replacing the complete assembly.

The Electronic Control Module (ECM) determines the accelerator pedal position by processing input signals from the Accelerator Position Sensor (APS) and the Idle Validation Switch (IVS).

Accelerator Position Sensor (APS)

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

APS Auto-Calibration

The ECM determines the lowest and highest pedal positions by reading and storing the minimum and maximum voltage levels from the APS. In this manner the ECM auto-calibrates the system for maximum pedal sensitivity. The ECM auto-calibrates when the key is ON, but when the key is OFF, these values are lost. When the key is ON again, this process starts over. When the pedal is disconnected (or new one installed), the pedal does not need calibration, since calibration happens when the key is ON.

Idle Validation Switch (IVS)

The ECM expects to receive one of two signals through the ECM black chassis connector (terminal 27) from APS/IVS connector terminal D:

- (a) 0V when the pedal is in the idle position.
- (b) 12V when the pedal is depressed.

The Idle Validation Switch receives 12V voltage from the ignition fuse. When the pedal is not in the idle position (throttle applied), the IVS supplies a 12V signal to the ECM.

The ECM compares APS/IVS inputs at terminals 8 and 27 to verify that the pedal is in the idle position. If the APS signal at terminal 8 indicates throttle is being applied, the ECM expects to see 12V at IVS terminal 27. If the APS signal at terminal 8 indicates idle, the ECM expects to see 0V at the IVS terminal 27.

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NOTE

The timing process is critical between the APS and the IVS sensors; therefore, the correct operation of the APS/IVS assembly is difficult to measure, using a volt ohmmeter.

ECM Diagnostics

When the ignition is ON, the ECM continuously monitors the APS/IVS circuits for expected voltages. The ECM also compares the APS and IVS signals for differences. If the signals are not what the ECM expects to see, the ECM sets Diagnostic Trouble Codes.

Diagnostic Trouble Code 131**ATA Code PID 91 FMI 4****APS Out of Range Low**

Diagnostic Trouble Code 131 is set if the ECM detects voltage lower than 0.146V at terminal 8. Possible causes include a short to ground or an open in circuit 99B. Diagnostic Trouble Code 131 is displayed by the EST or the Engine Warn Light.

When Diagnostic Trouble Code 131 is active, the ECM restricts engine speed to idle and turns the Engine Warning Light ON. If the condition causing Diagnostic Trouble Code 131 is intermittent or corrected, code 131 will become inactive and normal engine operation will resume.

Diagnostic Trouble Code 132**ATA Code PID 91 FMI 3****APS Out of Range High**

Diagnostic Trouble Code 132 is set if the ECM detects a voltage greater than 4.55V at terminal 8. Possible cause: Short to VREF or 12V in circuit 99B. Code 132 is displayed by the EST or the Engine Warn Light

When Diagnostic Trouble Code 132 is active, the ECM restricts engine speed to idle and turns the Engine Warn Light ON. If the condition causing Diagnostic Trouble Code 131 is intermittent or corrected, code 132 will become inactive and normal engine operation will resume.

Diagnostic Trouble Codes 133, 134 and 135**APS In-Range Fault**

The ECM checks the voltage output of the APS by comparing the APS signal with the IVS signal. APS and IVS signals can disagree in two cases:

- (c) The APS signal indicates the pedal is pressed down to accelerate, but the IVS signal indicates idle position.
- (d) The APS signal indicates the pedal has been released to allow the engine to return to idle, but the IVS signal indicates off-idle position of the pedal.

If the ECM detects either condition above, the ECM isolates the source of conflict and sets the correct Diagnostic Trouble Code.

Diagnostic Trouble Code 133**ATA Code PID 91 FMI 2****APS In Range Fault**

If the IVS signal is changing, but the APS signal is constant, the ECM assumes APS is the conflict source and sets Diagnostic Trouble Code 133. Engine rpm is restricted to idle and the Engine Warn Light is turned ON.

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Diagnostic Trouble Code 134
ATA Code PID 91 FMI 7
APS/IVS Disagree

If neither the APS or IVS is changing, or both are changing, or the ECM cannot determine the Diagnostic Trouble Code in specified time, Diagnostic Trouble Code 134 is set, engine rpm is restricted to idle, and the Engine Warn Light is turned ON.

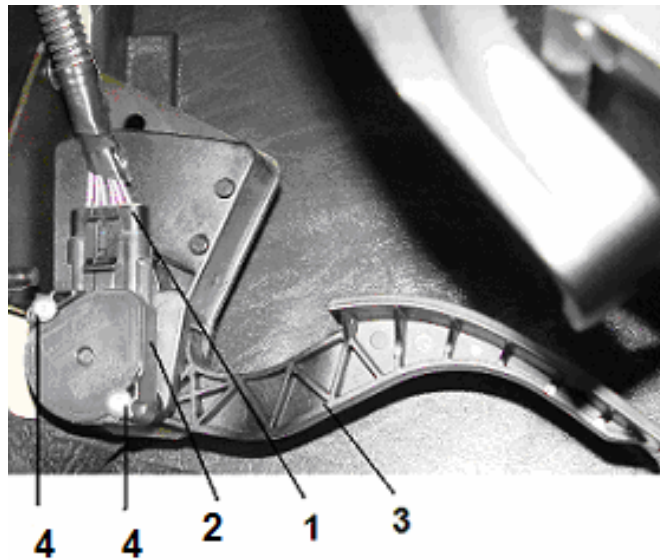
Diagnostic Trouble Code 135
ATA Code SID 230 FMI 11
IVS Circuit Fault

If the APS is changing but IVS is constant, the ECM assumes the IVS is the conflict source and sets Diagnostic Trouble Code 135, APS is limited +050%. The Engine Warn Light is not turned ON.

Codes 133, 134, and 135 are caused by intermittent conditions; these Diagnostic Trouble Codes remain active until the vehicle has been shutdown and restarted. They do not recover without cycling the key switch.

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b) Removal



1. Battery Disconnect Switch OFF.
2. Disconnect electrical connector (1) to Throttle Position Sensor (2) on pedal (3).
3. Remove two mounting screws (4).
4. Remove throttle position sensor and discard.

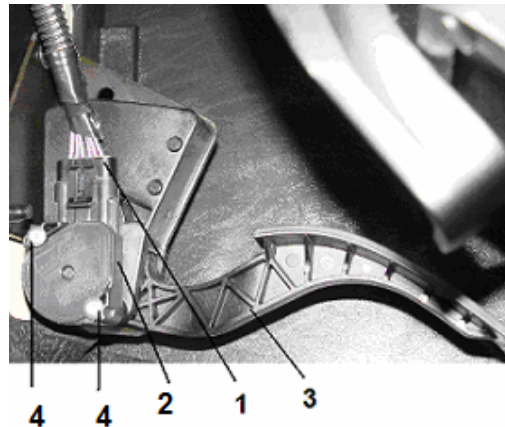
Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Installation



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

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



1. Apply thin layer connector lubricant to electrical connector.
2. Apply thin layer anti-corrosion compound to two mounting screws.
3. Install new throttle position sensor (2) onto pedal (3) with two mount screws (4).
4. Connect electrical connector (1).

d) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify TPS operation.
4. Engine OFF.
5. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.40 Barometric Pressure Sensor Test and Replacement

BAROMETRIC PRESSURE SENSOR TEST AND REPLACEMENT

This task covers:

- | | | |
|--------------------------|------------|-----------------|
| a) Test | b) Removal | c) Installation |
| d) Follow-On Maintenance | | |

INITIAL SET UP

Special Tools

Breakout Tee

Equipment Required

None

Personnel

One (1) Wheeled Vehicle Mechanic

Equipment Conditions

- Engine OFF
- Battery Disconnect Switch OFF (after testing)
- Parking brake set
- Transmission set in NEUTRAL (N)
- Wheels chocked

Material Parts

Barometric Pressure Sensor (1)

Reference

Parts Manual

Follow-On Maintenance

- Battery Disconnect Switch ON
- Start engine
- Verify operation
- Engine OFF
- Remove wheel chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS



Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.



Testing needs to be performed before Battery Disconnect Switch is turned off to get accurate readings. Failure to comply may result in false readings and inaccurate testing which can lead to damage to equipment.

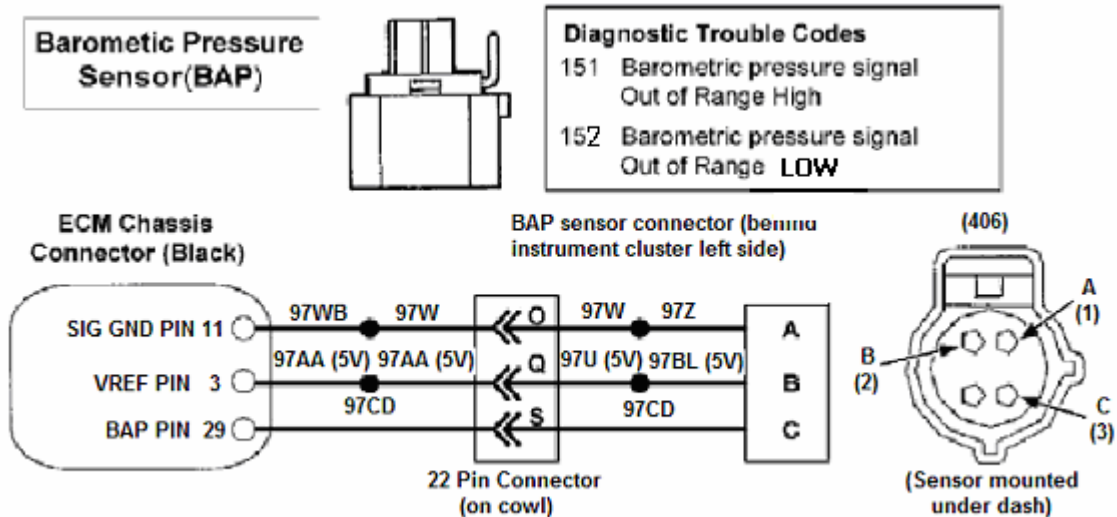
a) Test

Before Test

Before troubleshooting, make sure that the batteries are fully charged! Check battery cables and grounds for clean, tight connections free of damage. Many of the voltage tests will give misleading readings if batteries are not fully charged.

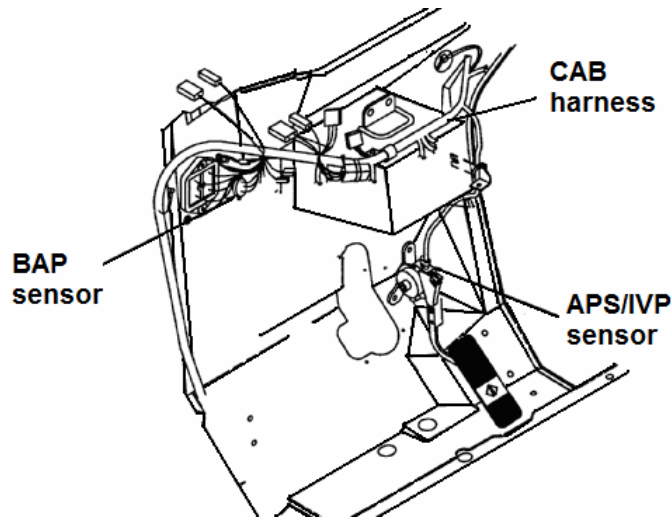
Before troubleshooting a particular circuit, inspect connectors for pushed back, loose or damaged (spread or bent) terminals, or wires with cuts strands etc. The wires and connections must be free of damage or corrosion. When some connectors corrode, a light white residue will be present that must be removed.

Before troubleshooting, inspect the suspect circuit grounds for clean, tight connections free of damage.



Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Removal



1. Locate sensor under dash left side of cluster and disconnect electrical connector.
2. Remove mounting screws from sensor. Discard sensor.

c) Installation



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

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

1. Apply connector lubricant to electrical connector.
2. Apply thin layer of anti-corrosion compound to mounting screws.
3. Install mounting screws into sensor and mount to bracket/dash frame and tighten.

d) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify operation.
4. Shut engine OFF.
5. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.41 Intake Air Temperature Sensor (IAT) Replacement

INTAKE AIR TEMPERATURE SENSOR (IAT) REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u> None		<u>Equipment Condition</u> Transmission set to (N) Parking Brake set Engine OFF Wheels chocked
<u>Personnel</u> One (1) Wheeled Vehicle Mechanic		<u>Reference</u> Parts Manual
<u>Material/Parts</u> Intake Air Temperature Sensor (IAT) (1) Identification Tags (as needed)		<u>Equipment Required</u> None
		<u>Follow-On Maintenance</u> None

NOTE

Note location and position of wires prior to removal to ensure proper installation.

Mark and tag all wires to assist in a correct installation of the Intake Air Temperature (IAT) sensor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

INTAKE AIR TEMP. SENSOR REPLACEMENT



1. Disconnect the electrical connector to the Intake Air Temperature (IAT) sensor (2).
2. Remove old IAT sensor and discard (1).



b) Installation

1. Install new IAT sensor (1).
2. Reconnect the electrical connector to the new IAT sensor (2).

c) Follow-On Maintenance

1. None.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.42 Mirror Remote Control Unit Replacement

MIRROR REMOTE CONTROL UNIT REPLACEMENT

This task covers:

a) Removal

b) Installation

c) Follow-On Maintenance

INITIAL SETUP

Special Tools

None

Personnel

One (1) Wheeled Vehicle Mechanic

Material/Parts

Electric Mirror Switch (1)

Equipment Condition

Engine OFF

Battery Disconnect Switch OFF

Wheels chocked

Remove center instrument panel

Reference

Parts Manual

Equipment Required

None

Follow-On Maintenance

Install instrument panel

Battery Disconnect Switch ON

Remove chocks

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove electric mirror switch by carefully sliding a flat blade screwdriver under the edge of the electric mirror switch and gently pry it out of the IP.
2. Once the electric mirror switch is lifted out of the IP, disconnect wiring harness connector from the backside of the electric mirror switch.
3. Lay switch out of the way and save for installation, unless damaged and being replaced.

b) Installation

1. Connect wiring harness connector to the backside electric mirror switch.
2. Once the wiring harness connector is connected to the electric mirror switch, push wiring harness into opening in IP.
3. With the wiring harness properly positioned inside the IP, position electric mirror switch into the opening of the IP push it down until the retaining tabs secure it in place.

c) Follow-On Maintenance

1. Install instrument panel.
2. Battery Disconnect Switch ON.
3. Check out system.
4. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.43 Mirror Remote Control Wire Harness Replacement

MIRROR REMOTE CONTROL WIRE HARNESS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Mirror Remote Control Wire Harness</p>	<p><u>Equipment Condition</u> Engine OFF Battery Disconnect Switch OFF Wheels chocked Remove mirror remote control unit Remove mirror harness disconnect on each door Remove IP Center Cluster</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Install I.P. Center Cluster Connect mirror remote control unit Connect mirror harness disconnect on each door Battery Disconnect Switch ON Remove chocks</p>	

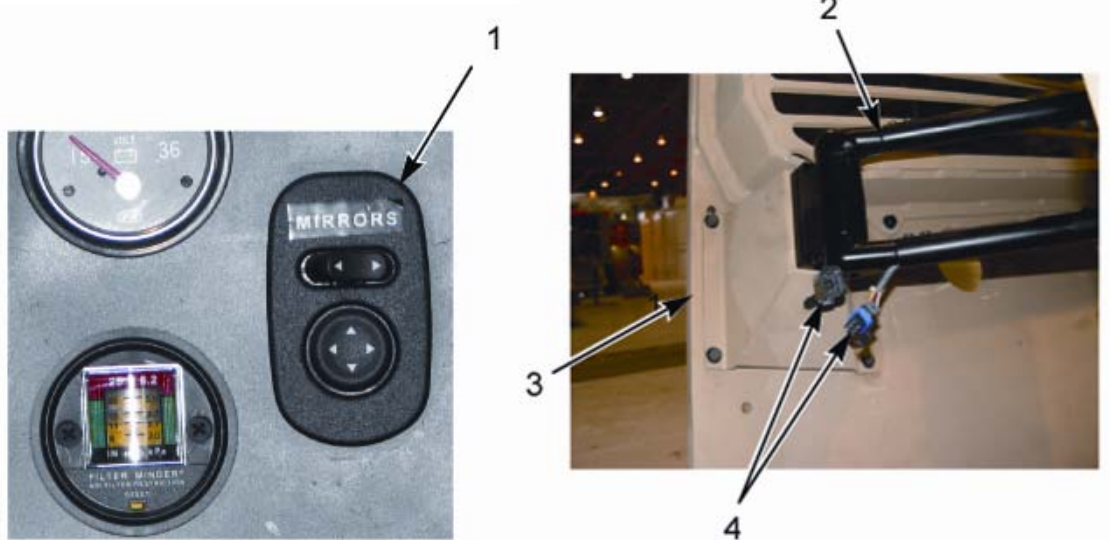
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

NOTE

Removal of wiring harness for driver and passenger mirror is identical except where noted.

1. Turn Battery Disconnect Switch OFF.



2. Remove electric mirror remote control switch (1) by carefully sliding a flat blade screwdriver under the edge of the electric mirror switch and gently pry it out of the instrument panel (IP).
3. Once the electric mirror switch is lifted out of the IP, disconnect wiring harness connector from the back side of the electric mirror switch (1).
4. Lay switch (1) out of the way and save for installation, unless damaged and being replaced.
5. Grasp the driver mirror assembly bracket (2), and carefully remove the bolts securing the mirror adjustment housing (3).
6. Disconnect remote control harness connector (4) on bracket (2).

Chapter 4 – MAINTENANCE INSTRUCTIONS

7. Note wire harness connection used on the driver side door.
8. Repeat steps 5 through 7 on the passenger side door.
9. Remove instrument panel (5) for access on the back side.
10. Note any connectors and harness clamps used for installation purposes.
11. Remove any wiring harness clamps holding wiring harness (6) to IP.
12. Remove mirror wire harness (6) from driver's door to control switch connector (1).
13. Repeat process for passenger side harness (6).
14. Carefully lift the entire mirror wiring harness off the IP.
15. Discard harness.



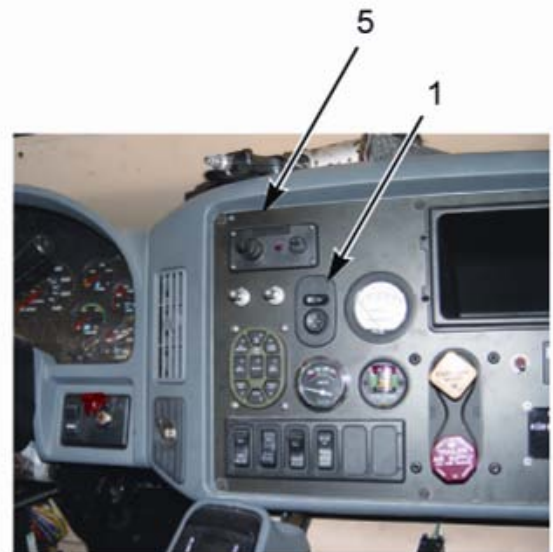
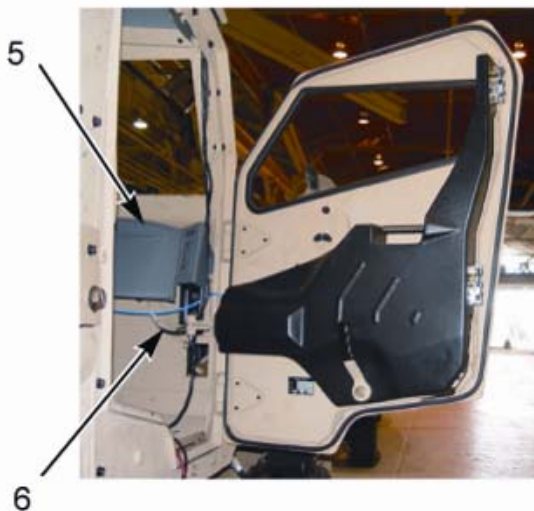
To avoid wire harness or IP damage, if there is any resistance, do not tug on wiring harness to free it. Find source of resistance and free connector or clip, then remove wiring harness from IP.

b) Installation

NOTE

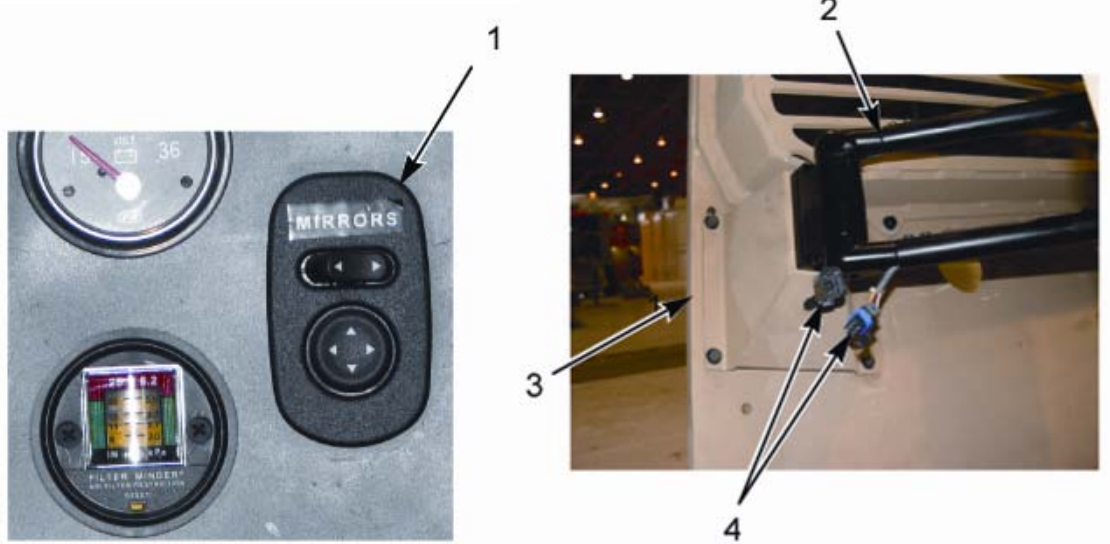
Installation of mirror wiring harness for driver and passenger is identical except where noted.

Make sure each connector has its ribbed seal in place before connecting to sensor. In some cases, during disassembly, a ribbed seal may pull out of its connector and remain on the mating socket of a sensor or actuator. A connector assembled without appropriate ribbed seal can become contaminated with moisture and terminals may corrode. This can result in poor electrical connections.



1. Connect wire harness (6) to connector on mirror control switch (1).
2. Install mirror control switch (1) in IP.

Chapter 4 – MAINTENANCE INSTRUCTIONS



3. Separate and run harness to driver's mirror (2). Use wire harness labeling performed in the removal steps.
4. Run harness through door panel to mirror adjustment housing (3) and out to mirror (2).
5. Connect harness to mirror.
6. Secure harness with clamps and cables to IP as noted in the removal process.
7. Perform steps 2 through 6 for the passenger mirror.
8. Carefully inspect each connector. Make sure each connector has its ribbed seal in place. Replace connectors with ribbed seal if missing.
9. Connect batteries.

c) Follow-On Maintenance

1. Install IP Center Cluster.
2. Battery Disconnect Switch ON.
3. Check out system.
4. Remove wheels chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

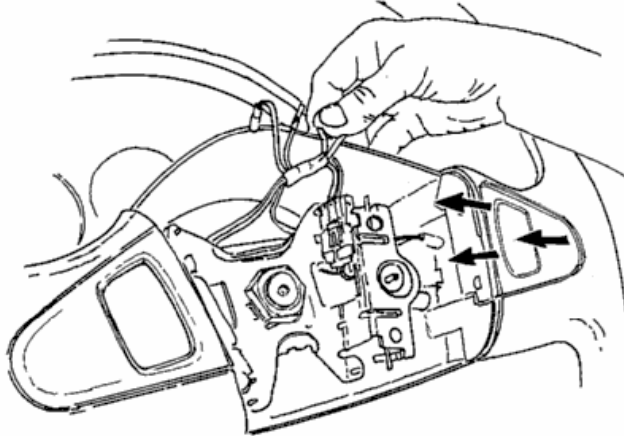
4-5.44 Cruise Control Switch Module Replacement

CRUISE CONTROL SWITCH MODULE REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Set/Cruise Resume/Accel Switch (1) Cruise/Throttle On/Off Switch (1)</p>	<p><u>Equipment Condition</u> Transmission in (N) Parking Brake set Horn switch removed Engine OFF Battery Disconnect Switch OFF Wheels chocked Remove steering wheel front and side covers</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Remove chocks Install steering wheel front and side covers</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. Remove steering wheel front and side covers
2. Disconnect switch wiring harness.
3. Remove the switch modules by sliding them toward the center (direction of arrows).



b) Installation

1. Slide new switch assembly from center of hub toward the outside (opposite of arrow direction).
2. Connect switch wire harness.
3. Install front and side covers.
4. Connect batteries.

c) Follow-On Maintenance

1. Install steering wheel front and side covers.
2. Battery Disconnect Switch ON.
3. Check out system.
4. Remove wheels chocks.

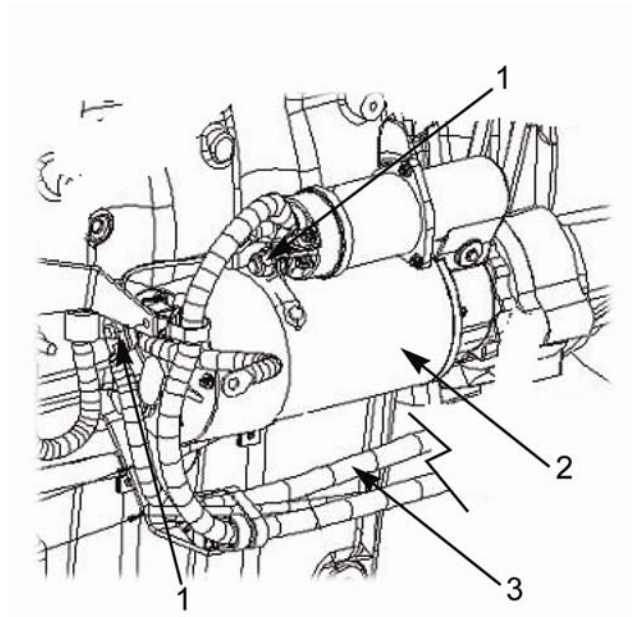
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.45 Starter Harness Replacement

STARTER HARNESS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Wheels chocked Battery Disconnect Switch OFF Batteries disconnected Belly armor removed
<u>Personnel</u>		<u>Reference</u>
One (1) Wheeled Vehicle Mechanic		Parts Manual
		<u>Equipment Required</u>
		None
<u>Material/Parts</u>		<u>Follow-On Maintenance</u>
One (1) Starter Harness Identification Tags (if needed)		Connect batteries Start engine Install Belly Armor

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



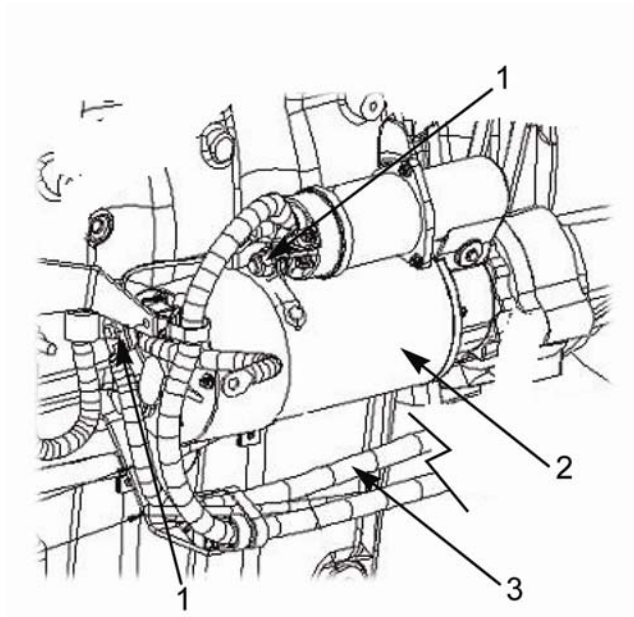
1. Disconnect all electrical connections (1) to the Starter (2). (Tag wiring connections for reassembly.)
2. Disconnect the Starter Wiring Harness (3) from the I/P Wiring Harness.
3. Remove Starter Wiring Harness.



System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Connect the Starter Wiring Harness to the IP Wiring Harness.
2. Connect all electrical connections to the starter as they were removed.

c) Follow-On Maintenance

1. Reconnect Batteries.
2. Start engine.
3. Install Belly Armor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.46 Engine Sensor Harness Replacement

ENGINE SENSOR HARNESS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		
None		<u>Equipment Conditions</u>
		Engine OFF
		Battery Disconnect Switch OFF
		Batteries disconnected
		Parking brake set
		Transmission set in NEUTRAL (N)
		Wheels chocked
<u>Personnel</u>		
One (1) Wheeled Vehicle Mechanic		
<u>Material Parts</u>		
Engine Sensor Harness (1)		
Identification Tags (if needed)		
Dielectric Grease		
Push Pin Connector Loops (as needed)		
		<u>Follow-On Maintenance</u>
		Batteries connected
		Battery Disconnect Switch ON
		Start engine
		Verify operation of sensors
		Shut engine OFF
		Remove wheel chocks
<u>Equipment Required</u>		
None		
<u>Reference</u>		
Parts Manual		



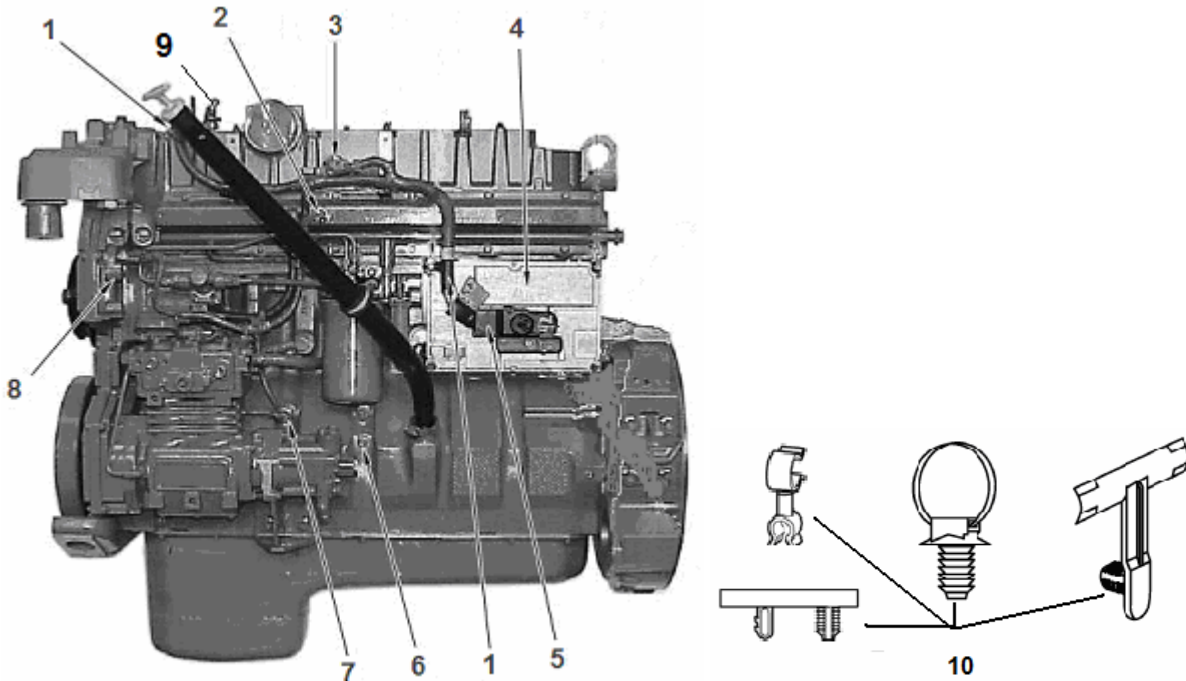
Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

Before opening the hood, make sure that there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself or an assistant between the hood and any other structure. Failure to comply may result in serious injury or death.

Engine components become extremely hot during normal operation. Always allow engine to cool completely prior to performing any task or procedures on it. Working in close quarters in engine compartment can be difficult moving around. Wear proper safety equipment; safety goggles, work gloves, long sleeves or shop coat. Failure to comply may result in serious burns, cuts, or injury or death to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



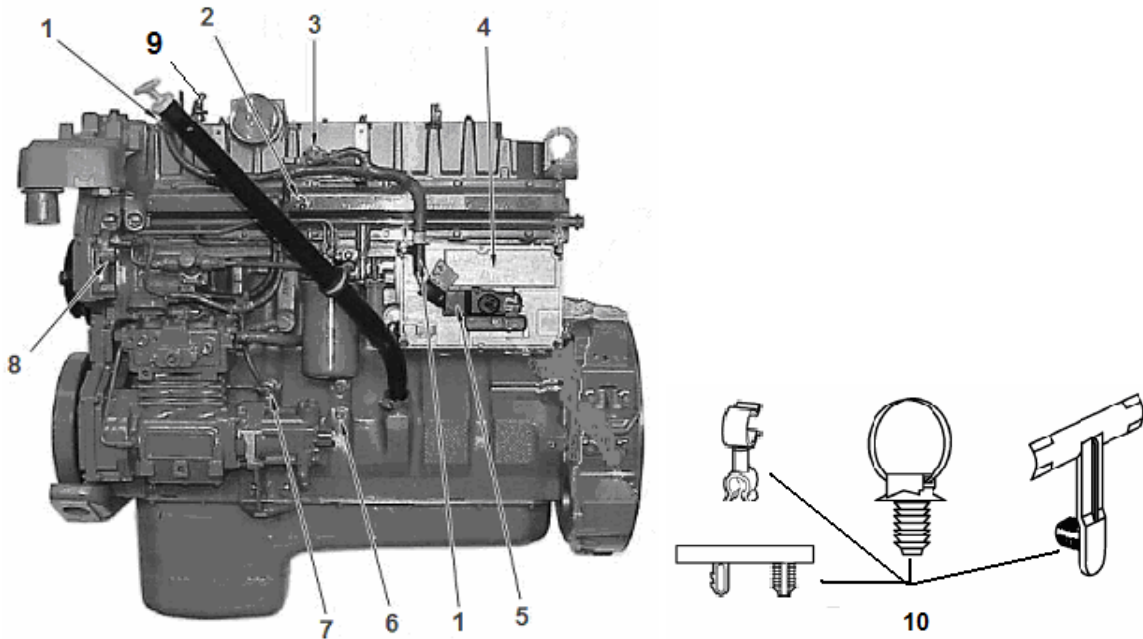
1. After making sure engine is cool enough to work on, mark and label all electrical connections and all sensors from engine wire harness (1) for proper installation of new harness. Mark both sensor and connector on harness to match up with new harness if need too.
2. When disconnecting the ECM (4) apply a thin layer of approved dielectric grease to ECM connection (5) for protection.
3. Separate the main engine harness (1) from the vehicle body harness.
4. Disconnect valve cover wiring harness connector (3).
5. Disconnect injection control pressure (ICP) sensor (2) connector.
6. Disconnect engine oil pressure (EOP) sensor (7) connector.
7. Disconnect engine oil temperature (EOT) sensor (8) connector.
8. Disconnect manifold absolute pressure (MAP) sensor (9) connector.
9. Disconnect camshaft position (CMP) sensor located above the water pump pulley.
10. Disconnect engine coolant temperature (ECT) sensor located on right front of cylinder head, below the thermostat.
11. Disconnect injection pressure regulator (IPR) located on the left side of the high-pressure pump.
12. Unbolt any ground bolt connections (6).
13. Separate engine wire harness (1) from any wire harness brackets. Use a push pin removal tool and flathead screwdriver.
14. Carefully lift the entire main engine wiring harness (1) off engine. Remember the routing of harness to ensure proper routing of new harness when installed.
15. Check all connector pins on sensors, if bent or corroded replace the sensor.
16. Check all connectors on sensors, if cracked, chipped, or broken replace sensor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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



1. Apply connector lubricant to all electrical connections on new main wiring harness (1).
2. If any sensor needed to be replaced, make sure that Loctite was applied to the threads of the sensor before installing it into engine block.
3. If need too, label connectors according to old harness removed.
4. Carefully lay main engine harness across engine (1) as the old one was taken off.
5. Install any ground bolts (6) connections.
6. Connect injector pressure regulator (IPR) sensor connector located on the left side of the high-pressure pump.
7. Connect the camshaft position (CMP) sensor located above the water pump pulley.
8. Connect the manifold absolute pressure (MAP sensor (9) connector.
9. Connect the engine oil temperature (EOT) sensor (8) connector.
10. Connect the engine oil pressure (EOP) sensor (7) connector.
11. Connect the injection control pressure (ICP) sensor (2) connector.
12. Connect the valve cover wiring harness connector (3) connector.
13. Connect the ECM (4) with the ECM connector (5) and tighten bolt.
14. Connect any other sensor connector that was removed and connect main engine harness (1) to vehicle body harness.
15. Make sure that harness is secure in place with push pin holders and clip and hoop holders (10).

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Connect batteries.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Verify operation of all sensors.
5. Shut engine OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.47 Camshaft Sensor Replacement

CAMSHAFT SENSOR REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<p><u>Special Tools</u> Sensor Gauge Z7SE Torque Wrench</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Wiring Harness Clamps Wiring Harness Routing Clips CMP Sensor (1) CMP O-Ring (1) Mounting Bolt CMP Sensor (1) Shim Pack</p>	<p><u>Equipment Required</u> Rags</p> <p><u>Equipment Conditions</u> Transmission set in (N) Parking Brake set Engine OFF Battery Disconnect Switch OFF Wheels chocked</p> <p><u>Reference</u> Parts Manual</p> <p><u>Follow-On Maintenance</u> Battery Disconnect Switch ON Remove chocks</p>	

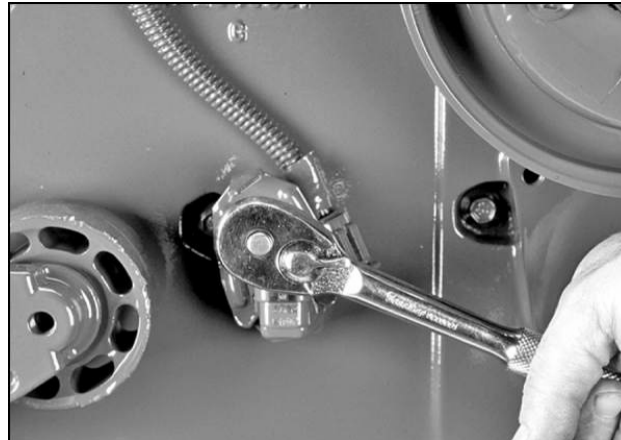
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Avoid engine damage, if there is any resistance; do not tug on wiring harness to free it. Find source of resistance and free connector or clip, then remove wiring harness from engine.

1. If necessary, remove wiring harness clamp holding wiring harness to engine.



2. Unlatch and separate CMP sensor. Remove mounting bolt and CMP sensor from front cover.



Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation

1. If required, measure CMP sensor clearance, as described in “Measure CMP Sensor Clearance” section.
2. Place new O-ring on CMP sensor; lubricate O-ring with clean engine oil.
3. Install CMP sensor in front cover with mounting bolt.
4. Tighten CMP sensor mounting bolt to 13 lb-ft (17 N•m).
5. Connect engine wiring harness to CMP.
6. Install wiring harness routing clips.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Check out system.
3. Remove wheels chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.48 Measure Camshaft (CMP) Sensor Clearance Procedure

MEASURE CAMSHAFT (CMP) SENSOR CLEARANCE PROCEDURE		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
Camshaft Sensor Air Gap Tool ZTSE4414		Transmission set in (N)
Depth Gauge Micrometer OEM1013		Parking Brake set
Depth Micrometer or Precision Caliper (Obtain locally)		Engine OFF
		Wheels chocked
		Battery Disconnect Switch OFF
		Wheels chocked
<u>Material/Parts</u>		<u>Reference</u>
Shim pack (1) (if needed)		Parts Manual
		<u>Equipment Required</u>
		GMTK
<u>Personnel</u>		<u>Follow-On Maintenance</u>
One (1) Wheeled Vehicle Mechanic		Battery Disconnect Switch ON
		Check system
		Remove wheels chocks

NOTE

Use worksheet to complete CMP sensor air gap analysis to obtain correct CMP sensor clearance.

Use proper combination of shims to achieve the desired air gap of 0.025 to 0.030 in. (0.635 to 0.762 mm).

Ensure that the camshaft sensor has been removed according to “Camshaft Sensor Replacement” procedures before performing this procedure.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Determine CMP Sensor Clearance

Method One

Instructions for measuring CMP sensor air gap on Navistar T 444E and I-6E Engines.

1. Remove serpentine drive belt.
2. Remove CMP sensor and note part number on connector end of sensor (black) or side of CMP sensor (blue). Compare part number suffix from sensor removed (or new sensor being installed) to chart below to calibrate the measurement tool:

SENSOR I.D.	Length / Cal. Cup
—C96	1.152 / Red
—C97	1.152 / Red
—C98	1.142 / Blue
—C91	1.152 / Red
—C92	1.142 / Blue

3. Insert measurement tool in calibration cup of selected color, hold firm downward pressure on tool and adjust indicator dial to zero. Tighten lock tab on dial ring. See Figure 1 on reverse side. The tool is now calibrated for the length of CMP sensor to be installed in the engine.
4. Install measurement tool in engine front cover and tighten clamp screw to about 10 in.-lb.
5. Crank the engine with starter, or bar engine over by hand, for at least two complete revolutions of the crankshaft.

Observe needle sweep on the dial indicator. The range of sweep is an indication of timing wheel run-out which should be less than .008".

Crank engine long enough to get an average reading of the dial indicator. Note this measurement. Figure 2 indicates an **air gap** of .025" as an example. (The needle is .025" counterclockwise from zero). Figure 3 illustrates an **interference** condition of .005" between the CMP sensor and the timing disc. (The needle is .005" clockwise from zero). If an interference condition (Fig. 3) is observed during cranking the CMP sensor may have been damaged and must be replaced.

6. Determine shim thickness required to achieve an air gap of .025" to .030". Select appropriate shim(s) from #1826583 C91 shim kit and place on CMP sensor using grease to hold in place. Install CMP sensor with shim(s) and a new #1824948 C1 O-ring.
7. Re-install serpentine drive belt and start engine to confirm successful installation of sensor and belt.
8. Clear all diagnostic codes.



Figure 1

Figure 1 illustrates calibration procedure for measurement tool. Set dial to zero with selected calibration cup.

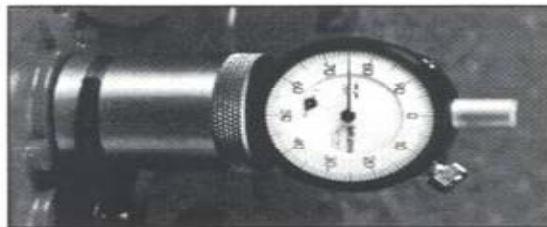


Figure 2

Figure 2 shows an example indicator reading of .025" **air gap** between CMP sensor tip and the trigger wheel.

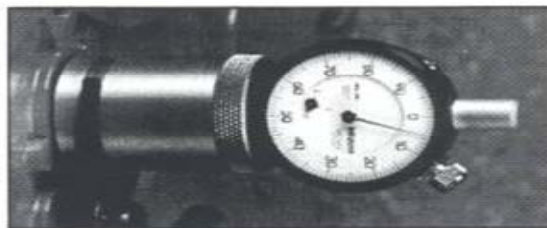


Figure 3

Figure 3 shows an example indicator reading of .005" **interference** between CMP sensor tip and the trigger wheel.

SPX Corporation

SPX Corporation
655 Eisenhower Drive
Owatonna, MN 55060-0995
1-800-328-6657

Chapter 4 – MAINTENANCE INSTRUCTIONS

CMP Air Gap Analysis Worksheet		
STEP	OPERATION	MEASUREMENT
1	Record initial measured distance from CMP sensor mounting surface to trigger wheel tooth.	
2	Record measured distance after crankshaft rotation.	
3	Record measured distance after crankshaft rotation.	
4	Record measured distance after crankshaft rotation.	
5 & 6	Record average dimension.	
7	Record CMP sensor length.	
8	Record actual air gap.	
9	Record CMP air gap interference between actual and desired air gap.	
10	Enter measured shim pack thickness.	

Method Two

- Carefully measure the CMP sensor from tip to mounting flange with a [Depth Micrometer](#) or [Precision Caliper](#). Record dimension in appropriate box on work sheet.



Measure with depth micrometer

- Perform math as directed on work sheet. Then select appropriate combination of shims from [Shim Kit](#), if required.
- Install CMP sensor with required shims. Make sure shims are centered on CMP sensor flange. Use small amount of grease to hold them, if necessary.
- Connect sensor wiring harness and test engine.

b) Follow-On Maintenance

- Battery Disconnect Switch ON.
- Check out system.
- Remove wheels chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-5.49 Fuel Injector Wiring Harness Replacement

FUEL INJECTOR WIRING HARNESS REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<p><u>Special Tools</u> Cylinder Head Magnetic Intake Shield (PS94-831-1) (1)</p> <p><u>Material/Parts</u> Relay Fuel Injection Wiring Harness</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>	<p><u>Equipment Condition</u> Transmission set in (N) Parking Brake set Engine OFF Battery Disconnect Switch OFF Wheels chocked Remove valve cover Air Intake tube removed A/C Compressor Hoses Removed CAC tube and hoses removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Install removed components Battery Disconnect Switch ON Remove wheels chocks Install Intake tube Install A/C Compressor Hoses Install CAC tube and hoses</p>	

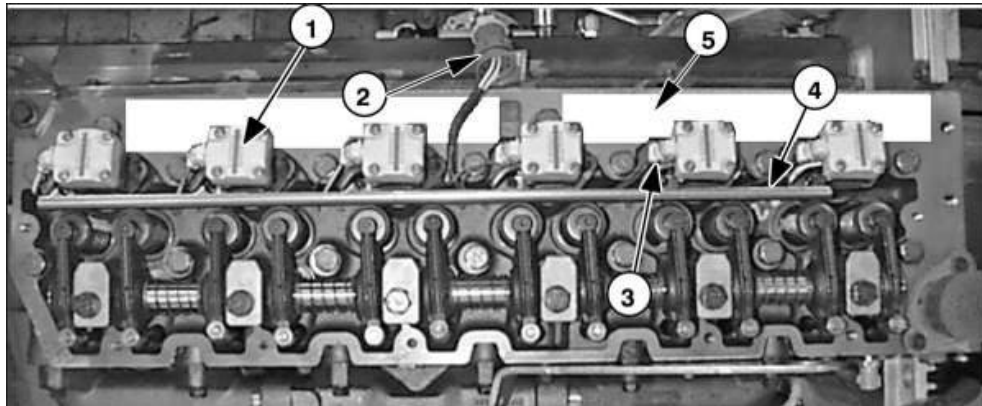
Chapter 4 – MAINTENANCE INSTRUCTIONS



To avoid serious personal injury, possible death, or damage to the engine or vehicle, read all safety instructions in the "Safety Information" section of this manual.

To avoid serious personal injury, possible death, or damage to the engine or vehicle, make sure the transmission is in neutral, parking brake is set, and wheels are blocked before doing diagnostic or service procedures on engine or vehicle.

a) Removal



Fuel Injector and Cylinder Head Magnetic Intake Shield

- | | |
|-----|---|
| (1) | Fuel Injector |
| (2) | Main Wiring Harness Connector |
| (3) | Fuel Injector Solenoid Connector |
| (4) | Wiring Harness Channel |
| (5) | Cylinder Head Magnetic Intake Shield (PS94-831-1) |

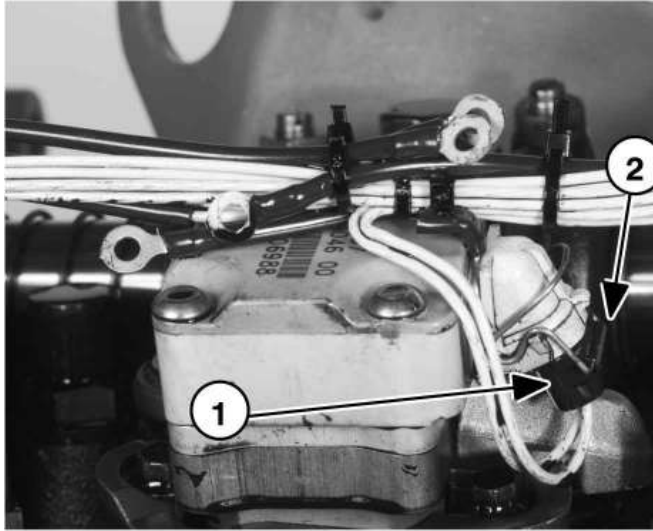


To avoid possible damage to the engine or vehicle, do not pull on wires.

NOTE

Once valve cover and intake manifold and gasket have been removed, identify fuel injectors and solenoid connectors. Place Cylinder Head Magnetic Intake Shield (5) over intake ports of cylinder head to prevent any small loose parts, dirt or debris from falling in power cylinder.

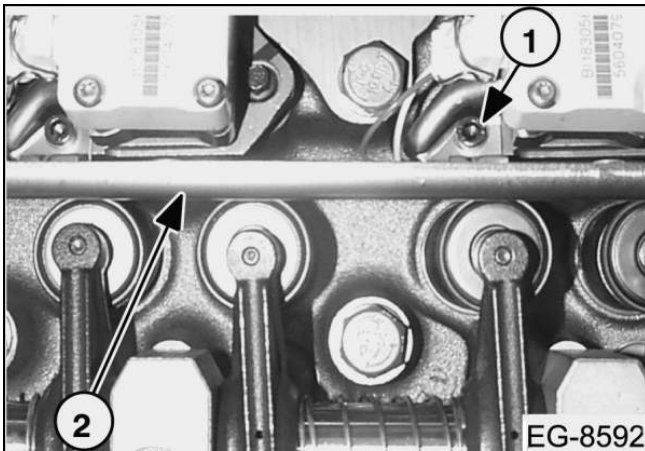
Chapter 4 – MAINTENANCE INSTRUCTIONS



- (1) Fuel Injector Solenoid Connector
- (2) Wire Bail

Solenoid Connector

1. Locate solenoid wire bail connector (2) at each fuel injector (1). Pull back on each connector wire bail (2).
2. Pull down on connectors to disconnect wiring harness from fuel injectors.

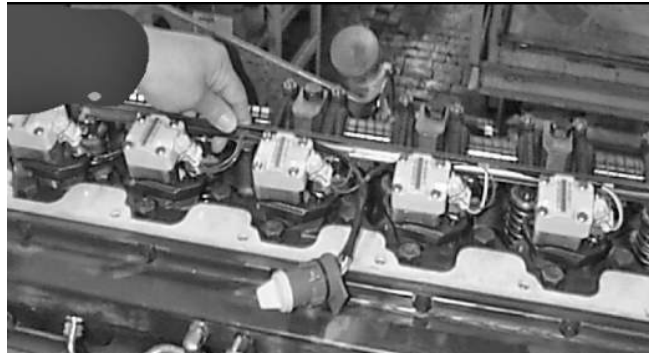


- (1) Hold Down Bolts (1 Per Injector)
- (2) Wiring Harness and Oil Deflector Assembly

Remove Hold Down Bolts

3. Remove wiring harness and oil deflector assembly (2) hold down bolts (1).

Chapter 4 – MAINTENANCE INSTRUCTIONS



Remove Wiring Harness and Oil Deflector Assembly

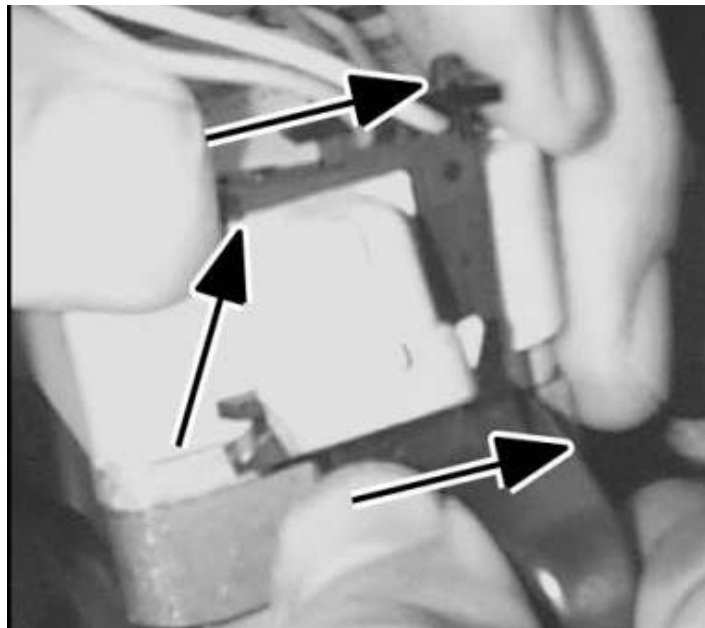
4. Remove wiring harness and oil deflector assembly.



To avoid engine damage, if there is any resistance, do not tug on wiring harness to free it. Find source of resistance and free connector or clip, then remove wiring harness from engine.

Alternate Procedure

1. Release wire bail on injector harness connector and remove connector.

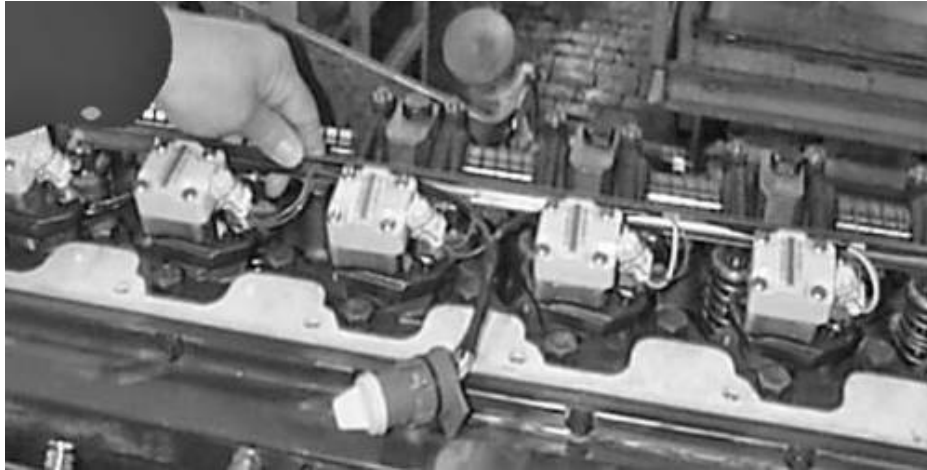


Remove Harness Clip

2. Release top snap of fuel injector harness clip by applying a slight force in each directions indicated by arrows. Once top snap is free, release bottom snap by pushing against side of oil deflector in direction shown.
3. Slide harness clip away from fuel injector toward cam side of engine.

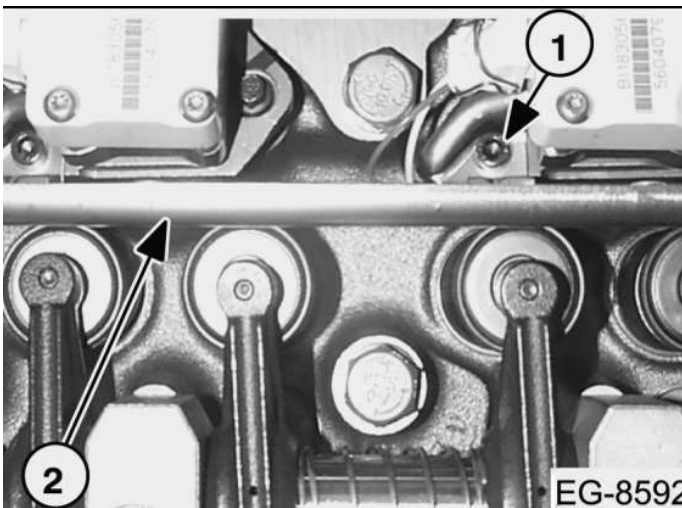
Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



Install Wiring Channel and Oil Deflector Assembly

1. Install wiring harness and oil deflector assembly.

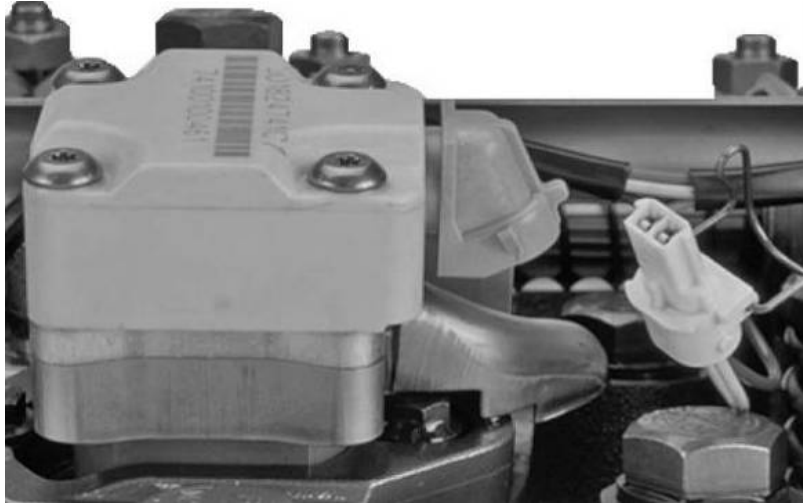


- | |
|---|
| (1) Channel Hold Down Bolt (1 Per Injector) |
| (2) Channel |

Fasten Wiring Channel and Oil Deflector Assembly

2. Install wiring harness and oil deflector assembly bolts (1) to fuel injector and tighten.
3. Push wiring harness connector in fuel injector solenoid connector.
4. Lock six wiring harness connectors on fuel injector solenoid connectors using wire bails.

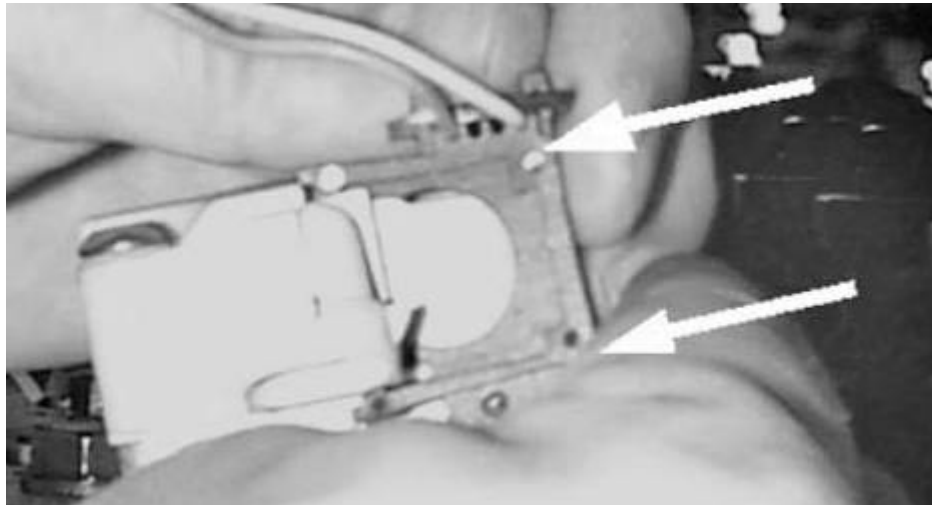
Chapter 4 – MAINTENANCE INSTRUCTIONS



Install Wiring Harness

Alternate Method: For Wiring Harness with Plastic Oil Deflectors

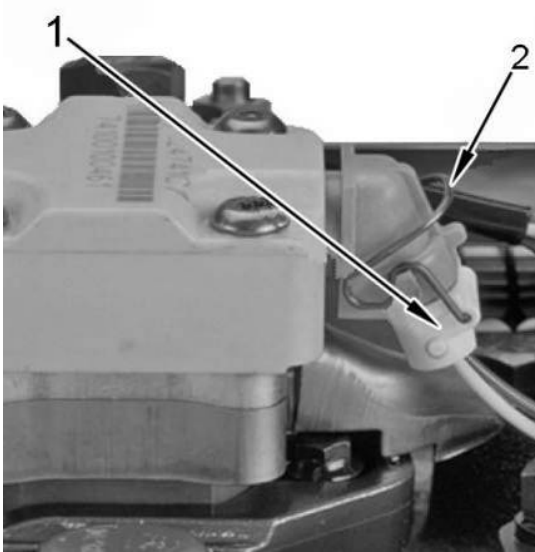
1. Place wiring harness on top of injectors so pass through connector is directly over injector 3.



Snap Wire Bail over Tab

2. Beginning at either cylinder 1 or 6, position upper and lower harness clips inline with injector connector slots. Using both hands, apply a slight force in direction of each arrow until harness clip "snaps" in place as shown.

Chapter 4 – MAINTENANCE INSTRUCTIONS



- | |
|---|
| (1) Fuel Injector Solenoid Connector |
| (2) Fuel Injector Solenoid Connector Clip |

Lock Solenoid Connector

3. Slide harness connector (1) in each injector and snap wire bail (2) over tab to lock harness in place.

c) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Check out system.
3. Remove wheels chocks.

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4-5.50 Trailer 24V Hook-up Replacement

TRAILER 24V HOOK-UP REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SET UP		
<u>Special Tools</u>		<u>Equipment Required</u>
Torx Bit (T-30)		None
<u>Personnel</u>		<u>Equipment Conditions</u>
One (1) Wheeled Vehicle Mechanic		Engine OFF
<u>Material Parts</u>		Battery Disconnect Switch OFF
24V Hook-up rear connector (1)		Batteries disconnected
24V Hook-up front connector (1)		Parking brake set
Connector Lubricant		Transmission set in NEUTRAL (N)
Anti-Corrosion Compound		Wheels chocked
Identification Tags (as needed)		
		<u>Reference</u>
		Parts Manual
		<u>Follow-On Maintenance</u>
		Re-connect batteries
		Battery Disconnect Switch ON
		Start engine
		Verify 24V hook-up operation
		Shut engine OFF
		Remove wheel chocks

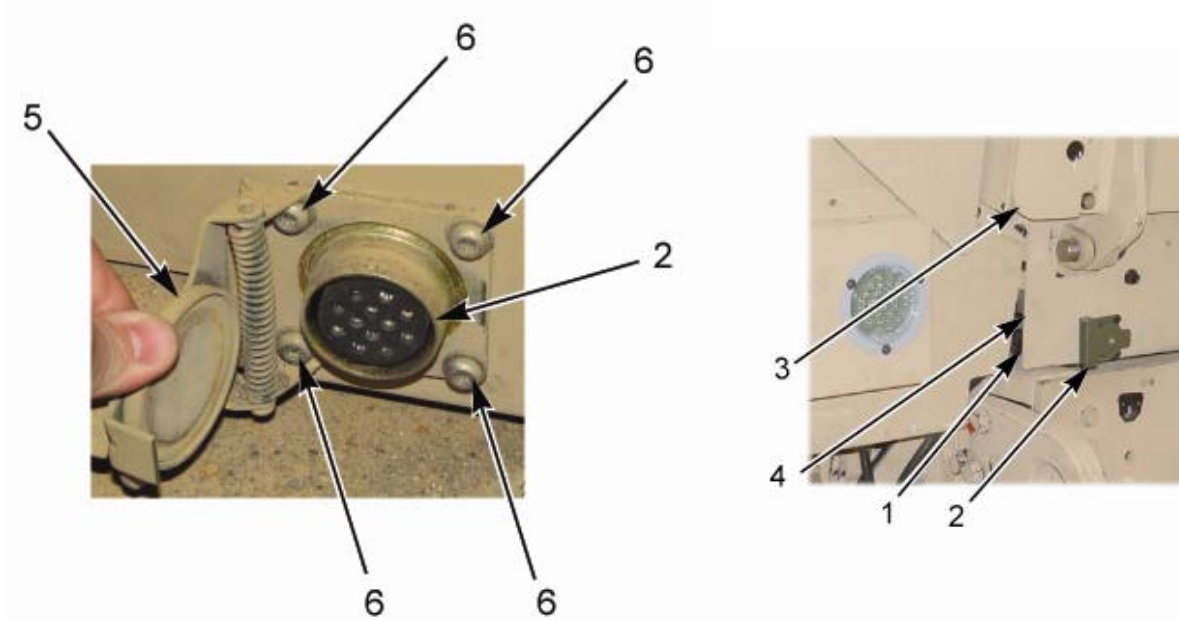


Wear safety goggles and work gloves while working on vehicle. Mark and label all connections and reference areas before removal of parts. Failure to comply may result in damage to equipment and or serious injury or death to personnel.

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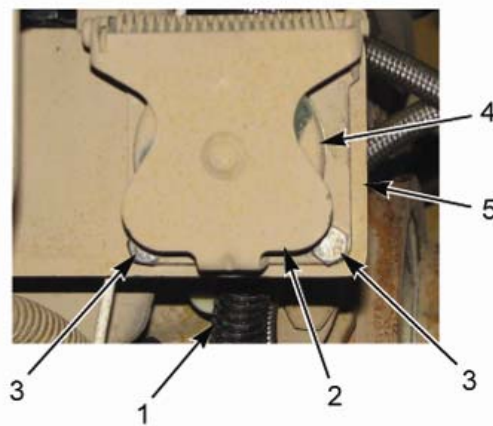
a) Removal

Rear Hook-up



1. Disconnect electrical connection and harness (1) from trailer 24V hook-up connector (2) on the backside rear panel (3) just below hydraulic door (4) and label connectors.
2. Open face covering (5) and remove four Torx bit screws (6) from front side of connector assembly (2).
3. Remove trailer 24V hook-up and discard.

Front Hook-up



1. Disconnect electrical wire harness (1) and connection from backside of connector and label.
2. Open face cover (2) and remove four bolts (3) holding front trailer 24V hook-up (4) to mounting bracket (5) just above the gladhand under vehicle on driver left front.
3. Remove trailer 24V hook-up and discard.

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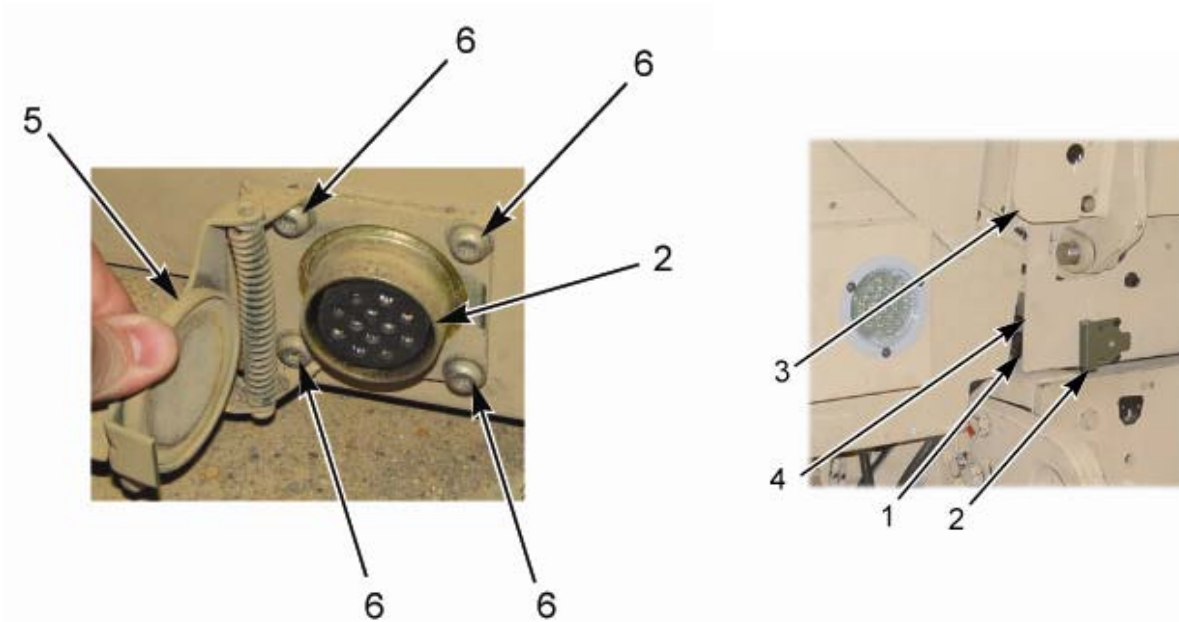
b) Installation



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

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

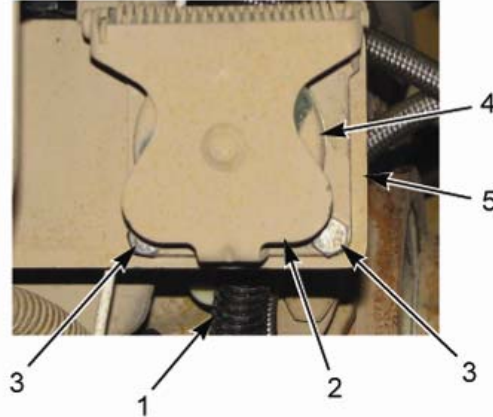
Rear Hook-up



1. Apply connector lubricant to electrical connections.
2. Apply anti-corrosion compound to screws.
3. Install new trailer 24V hook-up (4) into rear panel (3) just below hydraulic door (4).
4. Install the four Torx bit screws (6) and tighten.
5. Connect electrical connector and harness (1) to connector assembly (2) backside.

Chapter 4 – MAINTENANCE INSTRUCTIONS

Front Hook-up



1. Apply connector lubricant to electrical connections.
2. Apply anti-corrosion compound to bolts.
3. Install new trailer 24V hook-up (4) into mounting bracket (5).
4. Install four mounting bolts (3) under face cover (2) and tighten.
5. Connect electrical connector and harness (1) to backside of 24V hook-up connector (4).

c) Follow-On Maintenance

1. Re-connect batteries.
2. Battery Disconnect Switch ON.
3. Start engine.
4. Verify trailer 24V hook-up operation.
5. Shut engine OFF.
6. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6 Transmissions

4-6.1 Transmission Breather Replacement

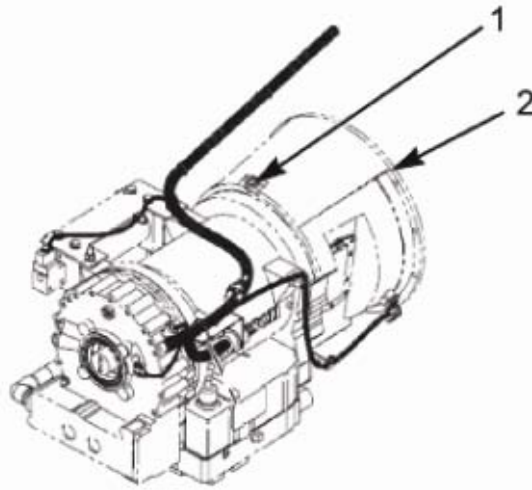
TRANSMISSION BREATHER REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Material/Parts</u> Breather</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p>		<p><u>Equipment Condition</u> Transmission set in (N) Parking Brake set Engine OFF Wheels chocked Belly Armor Removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Belly Armor Installed Remove wheel chocks</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Pliers or a pipe wrench can crush or damage the stem and produce metal chips which could enter the transmission. Always use a properly sized wrench to remove or replace the breather.



Breather Installed on Transmission Converter Housing

1. Use wrench to grasp breather (1) that is located on the top of transmission converter housing (2).
2. Carefully twist breather (1) in a counter-clockwise direction.
3. When breather is loose, grasp and pull up it gently and out. Discard.

b) Installation

1. Place the new breather (1) into the top of the transmission converter housing (2).
2. Hand-twist breather (1) in a clockwise direction.
3. Tighten breather (1) with wrench.

c) Follow-On Maintenance

1. Belly Armor Installed.
2. Remove wheel chocks.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.2 Transmission Recalibration Procedure

TRANSMISSION RECALIBRATION PROCEDURE		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
INITIAL SETUP		
<u>Special Tools</u>		<u>Equipment Condition</u>
None		Engine OFF Wheels chocked Battery Disconnect Switch OFF
<u>Personnel</u>		<u>Reference</u>
One (1) Wheeled Vehicle Mechanic		Parts Manual
		<u>Equipment Required</u>
		Allison DOC™ for PC
<u>Material/Parts</u>		<u>Follow-On Maintenance</u>
One (1) T C M Modul		Confirm DTCs have not returned



To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

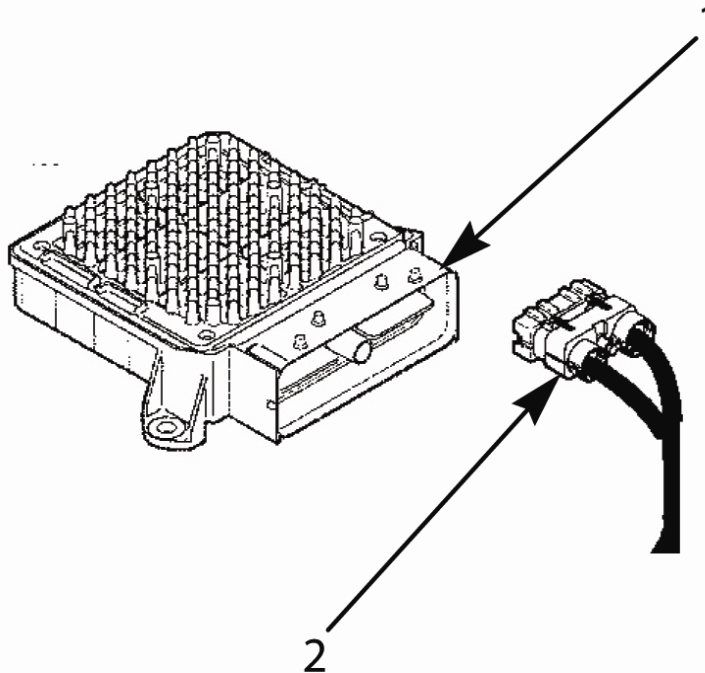
Use a brass or synthetic mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off. Serious personal injury and damage to components can result.

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal

1. If a diagnostic code is found in the TCM memory, record all available code information and clear the active indicator.
2. Test drive the vehicle to confirm a diagnostic code or performance complaint.
3. If the code reappears, refer to the Diagnostic Code section and the appropriate code chart.
4. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.
5. If the code does not reappear, it may be an intermittent problem. Refer to the Allison DOC™ for PC–Service Tool and the code display procedure described in service manual. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for the possible cause(s) of the problem.
6. Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.
7. If difficulties arise, you have unanswered questions, or if you are unable to quickly identify the root cause during troubleshooting, please consult maintenance manual.
8. Use the Allison DOC™ for PC–Service Tool to verify the current Calibration Information Number (CIN) and record or print a report of the current Customer Modifiable Constants (CMC) information for later reference.



9. Remove the 80-way connector from the suspect TCM (1); inspect the connector (2) for damaged or Replace the TCM (1) with a known, good TCM from a similar vehicle.

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NOTE

If using a TCM from another vehicle is unavoidable, the TCM MUST BE set to factory values and the vehicle MUST BE driven carefully to adapt the shifts to the test vehicle. Refer to SIL 16-WT-96 for the correct procedure. Be sure to reset the Adaptive Shift parameters and Autodetect information when it is installed in the original vehicle.

10. If the replacement TCM corrects the original complaint, reinstall the original TCM to verify that the complaint returns. If the complaint is confirmed, install a new TCM.
11. If the complaint does not return, leave the original TCM installed. Disconnecting and reconnecting the TCM can often correct faulty wiring harness connections that may have been present.
12. Clear any diagnostic codes that may be present and test drive the vehicle to confirm the repair.

NOTE

All Allison 4 Generation Controls TCMs are designed to be isolated from the vehicle chassis ground. Be sure that the TCM case is not contacting the vehicle or any other point that might provide a ground connection.

13. Shift Energy Management (SEM) Autoselect feature may be used on certain transmissions. Autoselect is deactivated following the first 20 engine starts where engine and transmission communication are present. If during the first 20 starts the TCM recognizes an engine to be on its list of certified engines, it will lock to the SEM active state. If the engine is not supported, the TCM will lock to a non-SEM state.

NOTE

Most engine upgrades are same type/rating; under normal circumstances there should be no reason to reset the TCM Autoselect.

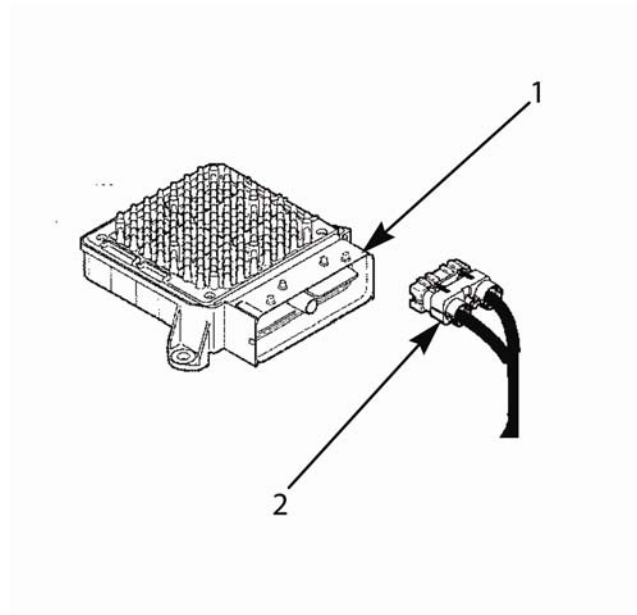
14. However, there may be a small chance that transmission performance, shift quality, or codes may result from the use of different models within the same engine family or when a recalibration of engine software has taken place. If a vehicle receives upgraded engine hardware or software it may become necessary to reactivate the Autoselect feature to redetect the engine current SEM status.

NOTE

Once TCM Autoselect locks, the only way to reactivate is to perform a reset procedure (Refer to service manual).

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b) Installation



1. Install new TCM (1).
2. Connect electrical connector (2).
3. RESET TCM AUTOSELECT.
4. Verify a new engine rating by checking the engine data tag. The engine must be compatible with the transmission rating. If engine rating is not compatible, the vehicle must be returned to the OEM for engine recalibration. If the rating is correct for the transmission, perform the following steps.
5. Allison DOC™ for PC–Service Tool is used to reset Autoselect function as follows:
 - a. Display the Action Request menu.
 - b. On the drop down menu, select Reset SEM Autodetect.
 - c. Click on the O K button.
 - d. The TCM is now reset to Autoselect and will start looking for supporting engine software. Drive the vehicle.

c) Follow On Maintenance

1. Confirm DTCs have not returned.

NOTE

Transmission shifts will now be in the un-adaptive (base) state, so it will be necessary to drive the vehicle to allow shift to converge.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.3 Transmission Fluid and Filter Replacement Procedure

TRANSMISSION FLUID AND FILTER REPLACEMENT PROCEDURE		
This task covers:		
a) Drain	b) Replace	c) Refill
d) Follow-On Maintenance		
INITIAL SETUP		<u>Reference</u>
		Parts Manual
<u>Special Tools</u>		<u>Equipment Condition</u>
Torque Wrench (0-80 ft-lb) (0-59 N•m)		Transmission set in (N)
		Parking Brake set
<u>Personnel</u>		Engine OFF
One (1) Wheeled Vehicle Mechanic		Wheels chocked
		Belly Armor removed
<u>Material/Parts</u>		<u>Equipment Required</u>
Belly Armor Bolts		Drain Pan
Filter		Funnel
O-rings		Rags
Transmission Fluid		
Plug		
Gasket		
		<u>Follow-On Maintenance</u>
		Install belly armor plate
		Test drive vehicle

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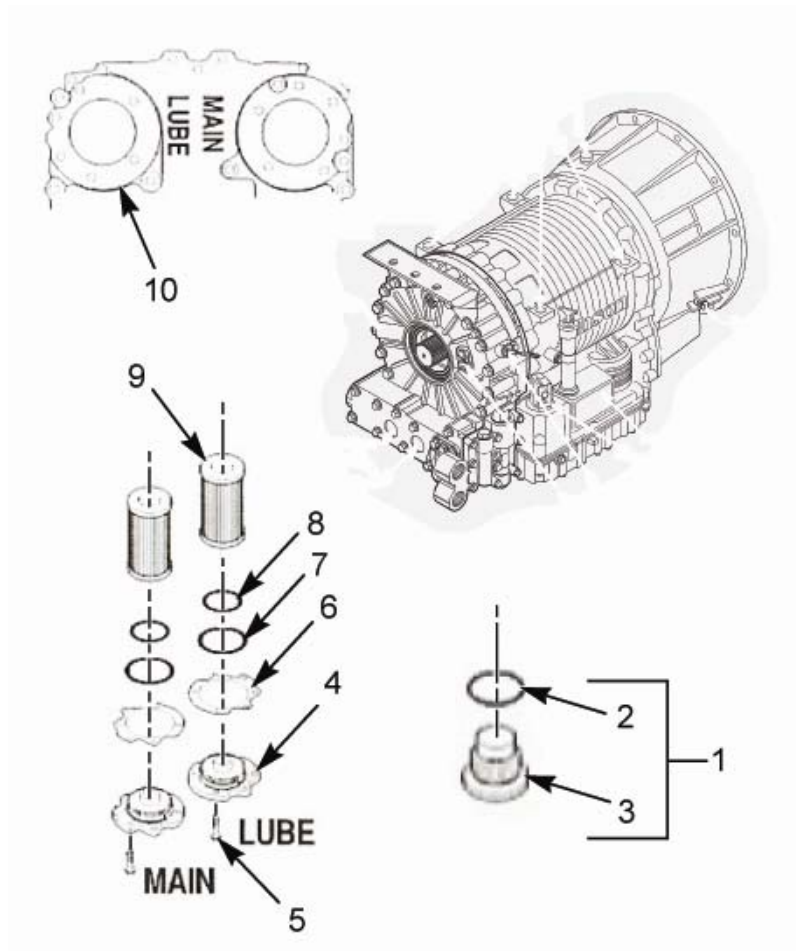
a) Drain



Avoid contact with the hot fluid or the sump when draining transmission fluid. Direct contact with the hot fluid or the hot sump may result in bodily injury.

NOTE

It is recommended that you change the transmission fluid and the filter together.



NOTE

If metallic particles larger than those normally found in filters are present on plugs, notify your supervisor. If this condition exists, the transfer case must be disassembled to find and repair the source of the contamination.

1. Remove drain plug assembly (1) from the control module, and allow the fluid to drain into a suitable container.
2. Examine the fluid for metallic particles larger than those normally found. If fluid contains an abnormal level of particulate, notify your supervisor.

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a) Replace Filters



DO NOT interchange the deep and shallow sump filters. Installation of the wrong filter can cause damage to the transmission.

NOTE

Refer to illustration on page 599.

1. Remove twelve bolts (5), two filter covers (4), two gaskets (6), two O-rings (7), two O-rings (8), and two filters (9) from the bottom of the control module. Discard O-rings.
2. Lubricate and install new O-rings (7) and (8) on each cover (4). Lubricate O-ring inside filter (9). Install new gasket (6) on each filter cover (4) and align holes in gasket (6) with holes in cover (4).



DO NOT use the bolts to draw filter covers to the sump, as this can damage the covers, seals, or sump.

3. Install filter and cover assemblies into the filter compartment (10). Align each filter/cover assembly with the holes in the channel plate/sump. Push the filter/cover assemblies in by hand to seat the seals.
4. Install six bolts (5) into each cover (4) and tighten the bolts to 38–45 lb-ft (51–61 N•m).

a) Refill Transmission

1. Inspect drain plug assembly (1) and replace O-ring (2) or plug (3) as required.
2. Tighten drain plugs to 18–24 lb-ft (25–32 N•m).
3. Refill fluid, and check fluid level. Refer to the Fluid Fill Quantities Table for fluid fill quantities.

		Initial Fill *		Refill *	
Transmission	Sump	Quarts	Liters	Quarts	Liters
3000 Product Family	4 inch	29	27	19	18
	2 inch	26	25	17	16
4000 Product Family	4 inch †	48	45	39	37
	2 inch †	40	38	31	30

* Approximate quantities do not include external lines and cooler hose.

† Add 3 qt (2.8 L) for transmissions with PTO.

c) Follow-On Maintenance

1. Test drive the vehicle, and check for proper fill level when fluid is at operating temperature.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.4 Transmission Cooler Hose Replacement

TRANSMISSION COOLER HOSE REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None Transmission Jack Dolly</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Hoses/Lines (2 ea) O-rings (3 ea) Belly Pan Bolts Loctite</p>		<p><u>Reference</u> Parts Manual</p> <p><u>Equipment Condition</u> Transmission set in (N) Parking Brake set Engine OFF Wheels chocked Battery Disconnect Switch OFF</p> <p><u>Equipment Required</u> Drain Pans (2) Rags</p> <p><u>Follow-On Maintenance</u> Start vehicle and check transmission, hose/lines and cooler for leaks</p>

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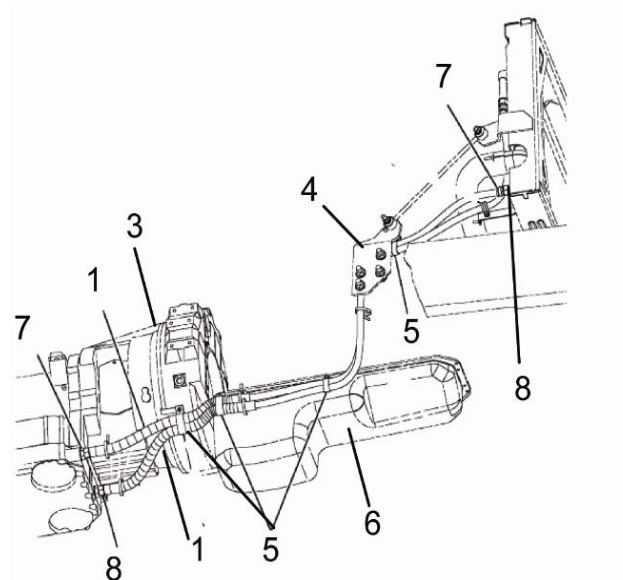
a) Removal



Take care when removing lines and hoses that you do not damage them in the removal process.

Take care if working on vehicle that is still warm to the touch, fluids may be hotter than the surface you are touching. Use caution when pulling lines and hoses off for hot coolant or transmission oil. Failure to comply may result in serious injury to personnel.

1. Place drain pan under transmission and cooler where you are working.
2. Inspect lines/hoses (1) for any signs of contamination, clean and flush away as necessary before removal of lines/hoses (1).



3. Inspect for deterioration, corrosion, rust around all connections at cooler (2) and transmission (3) bracket (4) off radiator, and clips (5) along oil pan (6).
4. Inspect for faulty connectors (8) or kinks.
5. Remove O-rings (7) from hose/line ends and discard.

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b) Installation

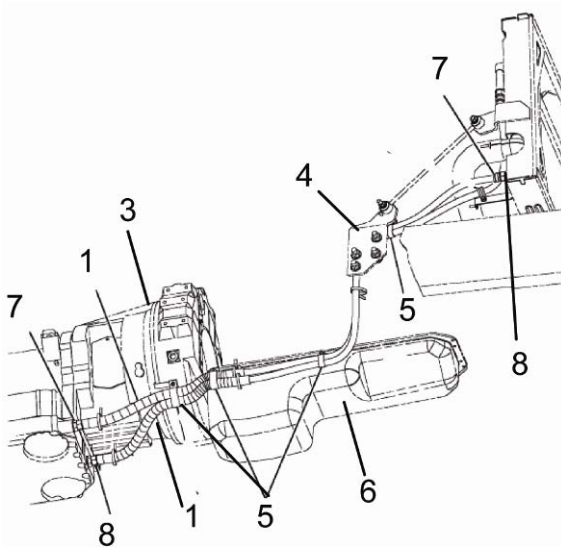


Anti-corrosion compound is toxic. Use only in a well vented area. Use NOSH/MSHA-approved respirator with dual organic vapor/mist and particulate cartridge. Do not get in eyes: wear chemical safety goggles and full face shield when using. Avoid contact with skin and wear rubber or plastic, solvent-resistant gloves. In case of contact, remove contaminated clothing and immediately wash area with soap and water. If eyes are contacted, flush eyes with large amounts of water for at least 15 minutes and get immediate medical attention. If swallowed, **DO NOT INDUCE VOMITING**, contact a physician immediately. Failure to comply may result in serious injury or death to personnel.

Connector lubricant is harmful to skin. Prolonged or repeated contact with skin or contact with eyes may cause irritation. If eyes are contacted, rinse thoroughly and contact physician if irritation persists. If skin is contacted, wash thoroughly with soap and water.



Use caution when threading lines back into transmission and cooler. If threads get crossed this will cause lines not to seal and the lines to leak. Failure to comply will cause damage to equipment.



1. Apply lubricant to O-rings (7) and install on new hose/line (1).
2. When replacing both lines, install one line at a time as not to cross the lines at each end.
3. Make sure when you install hose/lines (1) back into transmission (3) that you do not cross thread connections (8). This will lead to leak and unit not cooling transmission (3) which will damage it.

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4. Route hose/lines (1) the same way the old lines were routed ensuring that all line clips (5) are used to secure them back into place.
5. Repeat procedure for other line.
6. Secure Radiator bracket (4) support and tighten.
7. Do not over tighten connections (8) at cooler (2) or transmission (3). This can strip the thread and cause the connections (8) to leak and more damage.
8. Wipe any excess oil drippings from transmission (3), cooler (2), bracket (4), oil pan (6), and hose/lines (1).

c) Follow-On Maintenance

1. Start vehicle and check transmission, hose/lines and cooler for leaks.

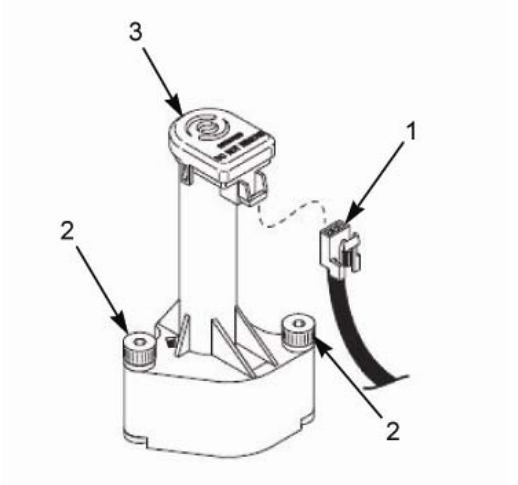
Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.5 Transmission Oil Level Sensor (OLS) Replacement

TRANSMISSION OIL LEVEL SENSOR (OLS) REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> None</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Transmission oil level sensor (1)</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Condition</u> Transmission set in (N) Engine OFF Wheels chocked Belly Armor Plate Removed Transmission pan removed Control valve module removed</p> <p><u>Equipment Required</u> None</p> <p><u>Follow-On Maintenance</u> Control Valve installed Transmission pan installed Belly Armor Plate reinstalled Wheel Chocks removed</p>	

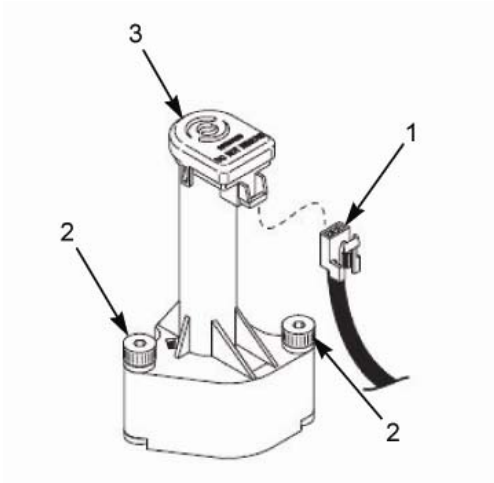
Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Disconnect wire connection to the Transmission Oil Level Sensor (OLS) (1).
2. Remove two bolts (2).
3. Remove and discard old (OLS) (3).

b) Installation



1. Install new (OLS) (3).
2. Install two bolts (2).
3. Reconnect wire connection to the new (OLS) (1).

c) Follow-On Maintenance

1. Control Valve installed.
2. Transmission pan installed.
3. Belly Armor Plate reinstalled.
4. Wheel Chocks removed

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.6 Transmission Assembly Replacement

TRANSMISSION ASSEMBLY REPLACEMENT	
This task covers:	
a) Removal	b) Installation
	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench</p> <p><u>Personnel</u> Two (2) Wheeled Vehicle Mechanics</p> <p><u>Material/Parts</u> Transmission (1) Molybdenum Disulfide Grease (Moly-Cote G or equivalent)</p>	<p><u>Equipment Condition</u> Parking Brake set Battery Disconnect Switch OFF Engine OFF Wheels chocked Drain transmission fluid Disconnect all hydraulic hoses Remove transmission fill tube Disconnect or completely remove controls Plug all openings to keep dirt from entering the hydraulic system.</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Suitable lifting device Suitable sling Rated jack stand</p> <p><u>Follow-On Maintenance</u> Install transmission fill tube Fill transmission with fluid Reconnect and install controls Remove plugs from all openings to the hydraulic system and reconnect hoses.</p>

Chapter 4 – MAINTENANCE INSTRUCTIONS



Avoid contact with the hot fluid or the sump when draining transmission fluid. Direct contact with the hot fluid or the sump may result in bodily damage.

Transmission dry weights are as follows:

Base Transmission	535 lb (243kg)
With Retarder	615 lb (279kg)
With PTO provision	575 lb (261kg)
With Retarder and PTO provision	655 lb (297kg)
With PTO, Retarder and Integral Sump Cooler	740 lb (336.5kg)
3700 SP	1170 lb (530kg)

Use proper tools and lifting equipment when installing or removing a transmission from the repair stand.



Whenever a transmission is overhauled, exchanged, or has undergone repairs, the Transmission Control Module (TCM) must be “RESET TO UNADAPTED SHIFTS”. This will cause the TCM to erase previous adaptive information and begin to adapt in Fast Adaptive Mode from the base calibration. Use the Allison DOC™ for PC-Service Tool (refer to the Allison DOC™ User Guide GN3433EN for instructions) to “RESET TO UNADAPTED SHIFTS”.

The entire converter housing circumference must be flush against the engine flywheel housing before tightening any bolts. DO NOT use the bolts to seat the housing.

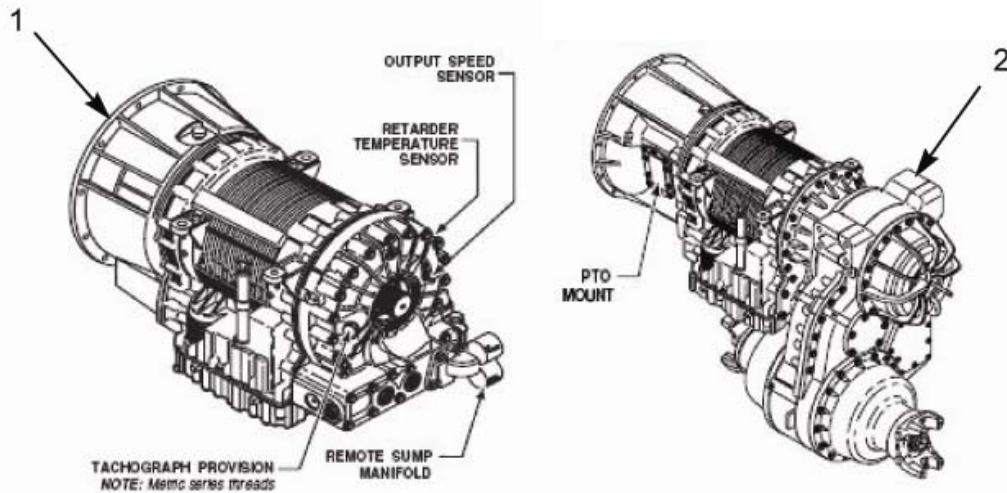
NOTE

A significant amount of fluid may drain from a hydraulic hose when it is disconnected from the transmission.

DO NOT tighten any flexplate-to-flexplate adapter bolts until all of the bolts have been installed and tightened finger tight.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Drain the transmission fluid into a suitable container before removing the transmission from the vehicle. The transmission should be warm and the fluid allowed to drain overnight.
2. Remove the drain plug from the control module. Examine the drained fluid and magnetic drain plug for evidence of contamination.
3. Install the drain plug when fluid draining is completed.
4. If an integral cooler is used, drain coolant from the cooler and disconnect coolant hoses. Remove the hoses from the vehicle if they interfere with transmission removal.
5. Plug all openings to keep dirt from entering the cooling system.
6. For non-retarder models, disconnect the transmission external harness from the feed through harness connector, the input speed sensor, the output speed sensor, and the PTO connector, if present (1). Disconnect tachograph drive, if used.
7. For transfer case models, disconnect the transmission external harness from the feed through harness connector, the input speed sensor, the transfer case connector, and the PTO connector, if present (2). Cover the harness connectors to keep out dirt.
8. Disconnect the vehicle drive shaft from the transmission output flange or yoke. Position the disconnected shaft to avoid interference with removing the transmission.
9. Remove inspector plate from engine bell housing.
10. Rotate torque converter flywheel until bolts are aligned. Remove 6 bolts.
11. Disconnect oil level sensor.
12. Disconnect Varille Speed Sensor (VSS) and rest of wiring harness.
13. Remove 12 bolts from bell housing.

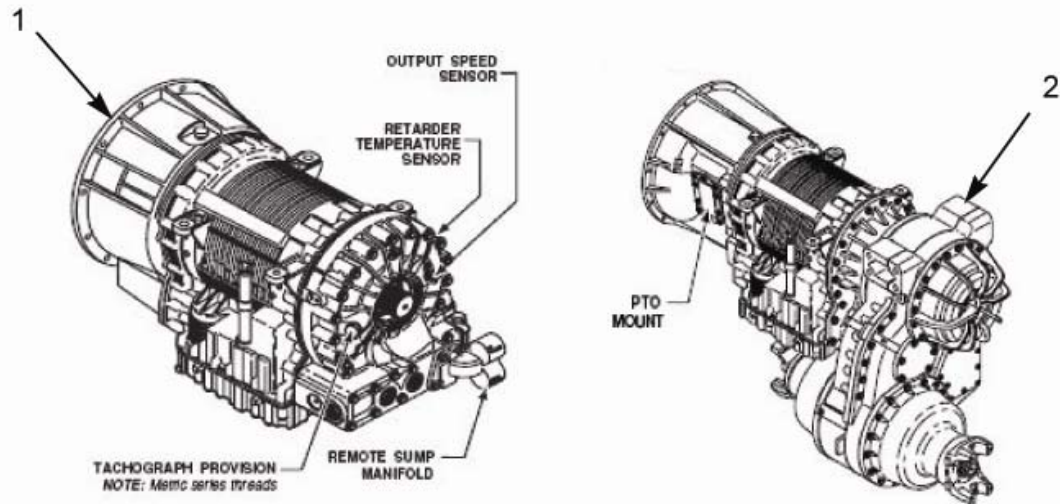
NOTE

Note location of all bolts and brackets for later assembly.

14. Move the transmission away from the engine approximately 4.33 inches (110cm) until it is completely clear of the engine. Remove the adapter ring (if used).
15. Raise or lower the transmission as necessary to remove it from the vehicle.
16. If replacing the transmission, you may need to transfer the output flange or yoke to the replacement transmission.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Handle the transmission carefully to prevent damage to components in the installation path.
2. Use a hoist or transmission jack that allows precise control of transmission movements during installation.
3. Align one of the flexplate's bolt holes with the access opening in the engine flywheel housing.
4. Lubricate the center pilot boss with molybdenum disulfide grease (Molycote G and or equivalent).
5. Install a headless guide bolt into one of the flexplate bolt holes in the flexplate adapter or torque converter mounting lug. Align the guide bolt with the flexplate hole at the access opening.
6. Push the transmission toward the engine while guiding the pilot boss on the torque converter into the flexplate hub adapter and guide the bolt into the hole on the flexplate.
7. Seat the transmission squarely against the engine flywheel housing-**NO FORCE IS REQUIRED**. If interference is encountered, move the transmission away from the engine and investigate the cause.
8. Align the bolt holes in the converter housing with those in the engine flywheel housing.
9. Install all transmission-to-engine bolts finger tight.
10. Tighten four bolts at equally-spaced intervals around the converter housing bolt circle. Use the torque specified by the engine or vehicle manufacturer-usually M10 x 1.5-6H bolts tighten to 38-45 lb-ft (51-61 N•m) or 7/16-14 bolts tighten to 54-65 lb-ft (73-88 N•m) or 3/8-16 bolts tighten to 36-43 lb-ft (49-58 N•m).
11. Rotate the engine crankshaft to install the remaining self-locking bolts into the flexplate adapter. After all bolts have been installed finger tight, tighten M8 bolts to 25-29 lb-ft (33-39 N•m) and M10 bolts to 46-54 lb-ft (63-73 N•m).
12. Install the flywheel housing access cover, if used.
13. If an integral cooler is used, drain coolant from the cooler and disconnect coolant hoses. Remove the hoses from the vehicle if they interfere with transmission removal.
14. Reconnect the vehicle drive shaft from the transmission output flange or yoke. Position the reconnected shaft to the transmission.

Chapter 4 – MAINTENANCE INSTRUCTIONS

15. For transfer case models, disconnect the transmission external harness from the feed through harness connector, the input speed sensor, the transfer case connector, and the PTO connector, if present (2). Cover the harness connectors to keep out dirt.
16. For non-retarder models, disconnect the transmission external harness from the feed through harness connector, the input speed sensor, the output speed sensor, and the PTO connector, if present (1). Disconnect tachograph drive, if used.
17. Remove all plugs to the cooling system and reconnect all hoses.

c) Follow-On Maintenance

1. Remove plugs from all openings to the hydraulic system and reconnect hoses.
2. Reconnect and install all controls.
3. Install transmission fill tube.
4. Fill transmission with fluid.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.7 Transmission Output Yoke and Seal Replacement

TRANSMISSION OUTPUT YOKE AND SEAL REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SET UP</p> <p><u>Special Tools</u> Oil Seal Remover J24171 Seal Installer J39928 Drive Seal Installer J35921-1 Torque Wrench 0-6" Calipers or 4" OD Micrometer</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material Parts</u> Transmission Yoke (1) Oil Seal (1) Retaining Plug O-ring Bolt O-ring</p> <p><u>Reference</u> Parts Manual</p>	<p><u>Equipment Required</u> Drip Pan Suitable sling Rags</p> <p><u>Equipment Conditions</u> Engine OFF Battery Disconnect Switch OFF Parking brake set Transmission in NEUTRAL (N) Wheels chocked Remove belly plate armor Remove transfer to transmission drive shaft</p> <p><u>Follow-On Maintenance</u> Install transmission to transfer drive shaft Install belly plate armor Remove wheel chocks Engine ON Battery Disconnect Switch ON Parking brake OFF Test drive vehicle Verify transmission operation Engine OFF Battery Disconnect Switch OFF Transmission in NEUTRAL (N) Parking brake set Wheels chocked</p>	

Chapter 4 – MAINTENANCE INSTRUCTIONS



International® Mine Protected Vehicle (I-MPV) armor parts are heavy. Use care when removing or installing. DO NOT attempt to lift without the aid of an assistant and a suitable lifting device. Failure to comply may result in serious injury or death to personnel.

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

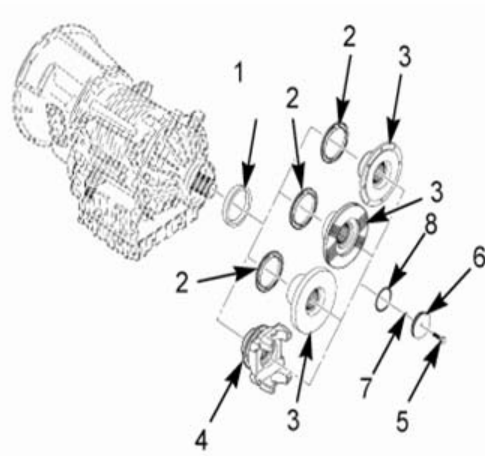
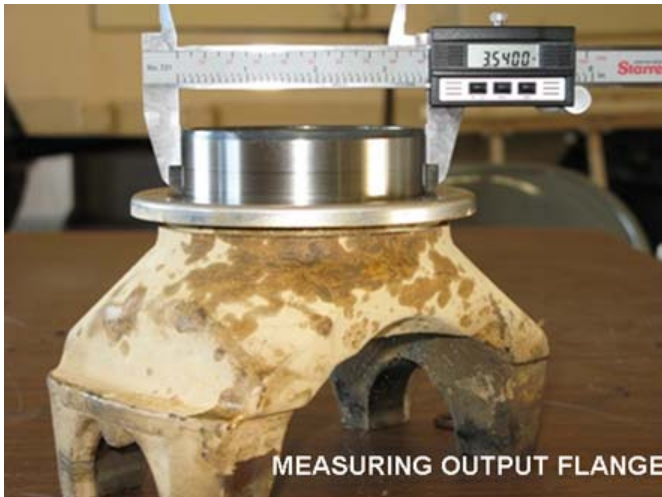
Hydraulic jacks are intended only for lifting the vehicle and not for supporting the vehicle while performing maintenance. DO NOT get under vehicle after vehicle is raised, unless it is properly supported with blocks or jack stands. Failure to comply may result in injury or death to personnel.

Engine components become extremely hot during normal operation. Always allow engine to cool completely prior to performing any task or procedures on it. Working in close quarters in engine compartment can be difficult moving around. Wear proper safety equipment; safety goggles, work gloves, long sleeves or shop coat. Failure to comply may result in serious burns, cuts, or injury or death to personnel.

Use care when working with hot transmission and fluid during maintenance procedures. Wear protective goggles, work gloves and long sleeves to avoid injury. Use caution when working under vehicle, make sure someone knows where you are located. Failure to comply may result to serious injury or death to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. Remove one bolt (5) and O-ring (7), retaining plug (6) and retaining plug O-ring (8). Discard O-rings.

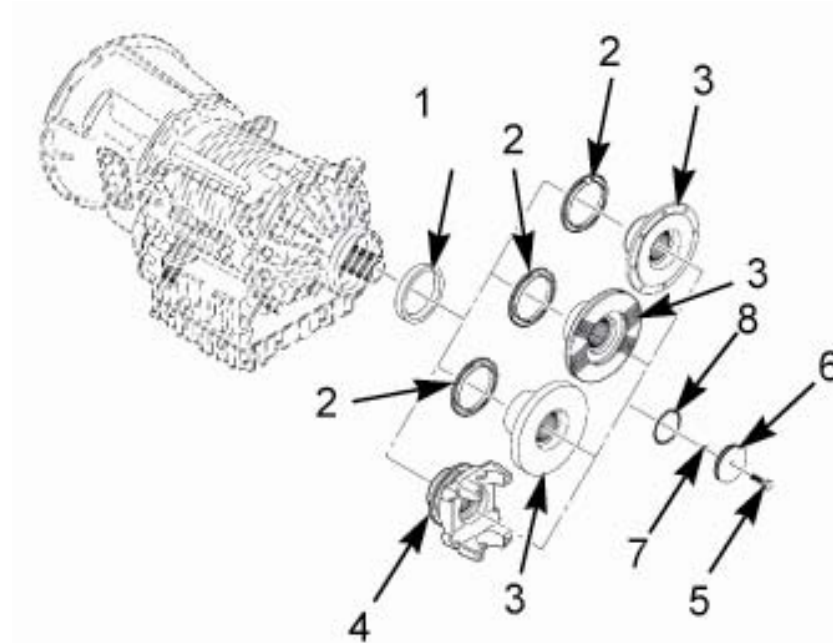
NOTE

When flange or yoke is removed, oil will leak out of transmission tail housing. Use drain pan or rags.

2. Remove flange (3) or yoke (4). Discard yoke.
3. Inspect the journal sealing area. Minimum allowable diameter is 3.535 in. (89.78 cm). Inspect slinger (2) and replace, if necessary.
4. Remove oil seal (1) using oil seal removing tool J24171 or equivalent. Discard oil seal.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Install the new output seal (1) using installer J39928 and drive sleeve J35921-1.
2. Place the new oil seal (1) on the installer tool so that the seal P/N will face outward after the seal is installed. Drive the seal into its bore until the installer tool bottoms out squarely against its locating surface.
3. Install slinger (2).
4. Install flange (3) and new yoke (4).
5. Install new O-ring (8) onto retainer plug (3). Lubricate the O-ring (8).
6. Install an O-ring (8) over bolt (5) so that the O-ring seats against the retainer plug.
7. Insert bolt (5) with O-ring (7) through retainer plug (6).
8. Install retainer plug (8) into yoke (4) or flange (3). Tighten bolt (5) to 52-59 lb-ft (70-80 N•m).

Chapter 4 – MAINTENANCE INSTRUCTIONS

c) Follow-On Maintenance

1. Check transmission oil.
2. Install transfer to transmission drive shaft.
3. Install belly plate armor.
4. Remove wheel chocks.
5. Engine ON.
6. Battery Disconnect Switch ON.
7. Parking brake OFF.
8. Test drive vehicle.
9. Verify transmission operation.
10. Engine OFF.
11. Battery Disconnect Switch OFF.
12. Transmission in NEUTRAL (N).
13. Parking brake set.
14. Wheels chocked.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.8 Transmission Dipstick Replacement

TRANSMISSION DIPSTICK REPLACEMENT	
This task covers:	
a) Removal	b) Installation c) Follow-On Maintenance
INITIAL SETUP	
<u>Special Tools</u>	<u>Equipment Condition</u>
None	Engine OFF Wheels chocked
<u>Personnel</u>	<u>Reference</u>
One (1) Wheeled Vehicle Mechanic	Parts Manual
<u>Material/Parts</u>	<u>Equipment Required</u>
Transmission Dipstick (1)	None
	<u>Follow-On Maintenance</u>
	None

NOTE

To determine the correct replacement dipstick, remove the old dipstick and note the part number stamped on the shaft.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



Transmission
Dipstick

1. Remove old dipstick and discard.

b) Installation

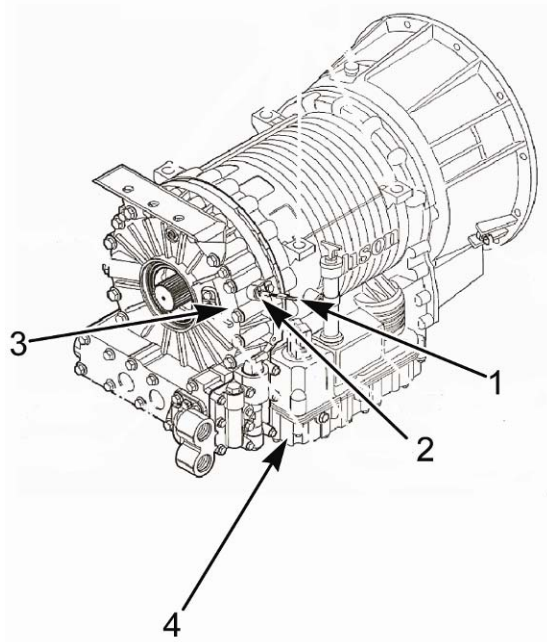
1. Install the new dipstick until the collar below the handle is resting on the filter tube and check the transmission fluid level. Adjust fluid level if necessary.
2. Install the new dipstick until the collar below the handle is resting on the filter tube. Rotate the handle to the locked position as illustrated in the above figure.

c) Follow-On Maintenance

1. None.

Chapter 4 – MAINTENANCE INSTRUCTIONS

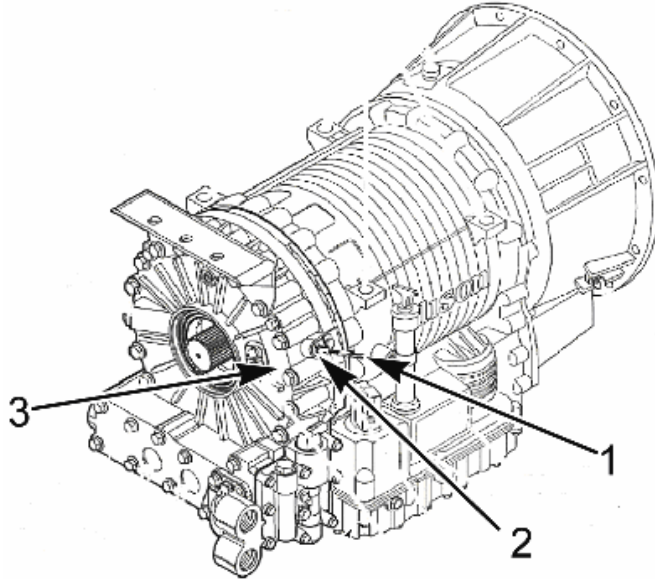
a) Removal



1. Remove wire connection (1) from sending unit (2).
2. Position suitable drain pan under transmission (3) for leaking fluid.
3. Remove sending unit (2) from transmission housing (4).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



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

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

1. Apply sealing compound to threads of sending unit (2).
2. Apply connector lubricant to connector (1).
3. Install sending unit (2) on transmission housing (3) and tighten.
4. Install connector (1) on sending unit (2).

c) Follow-On Maintenance

1. Check operation of Transmission Oil Temperature Sending Unit. Dash light for transmission will go off and stay off after sensor replacement.
2. Install Belly Armor Plate.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.10 Torque Converter Replacement

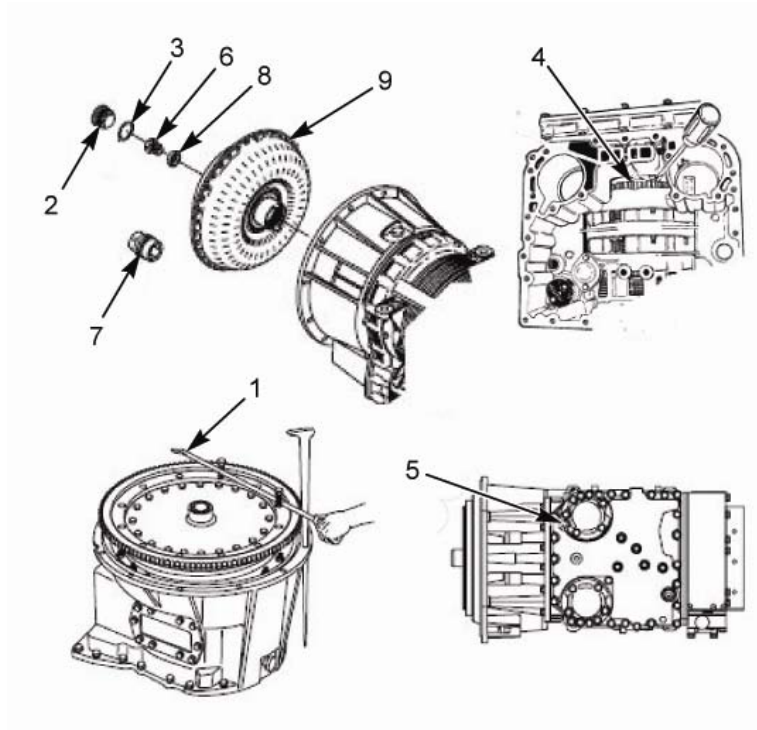
TORQUE CONVERTER REPLACEMENT	
This task covers:	
a) Removal	b) Installation
	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Converter Bolt Tool, J38564 Converter End-play Gauge J38548 Torque Wrench Flat Tip Screwdriver (16-18") 3/4 " Allen Socket Converter Shipping Brackets (2) (if required)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Torque Converter (1) Shim Pack (as required)</p>	<p><u>Equipment Condition</u> Parking Brake set Battery Disconnect Switch OFF Engine OFF Wheels chocked Belly Armor Plate Removed Transmission Removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Suitable lifting device Lifting chains</p> <p><u>Follow-On Maintenance</u> Install Transmission Install Belly Armor Plate</p>

NOTE

Dimension C shown in the Torque Converter Selective Shims Table includes a correction due to internal deflection caused by the 20-25 lb-ft (27-34 N•m) bolt torque applied to gauge J38548. Accurate torque value is critical to selection of the correct shim.

Chapter 4 – MAINTENANCE INSTRUCTIONS

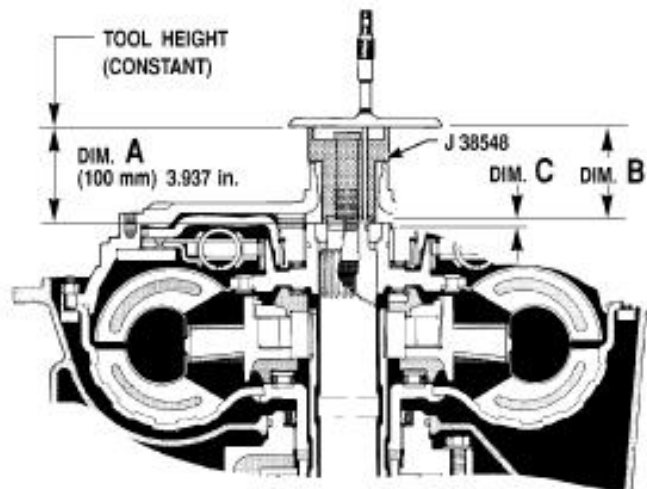
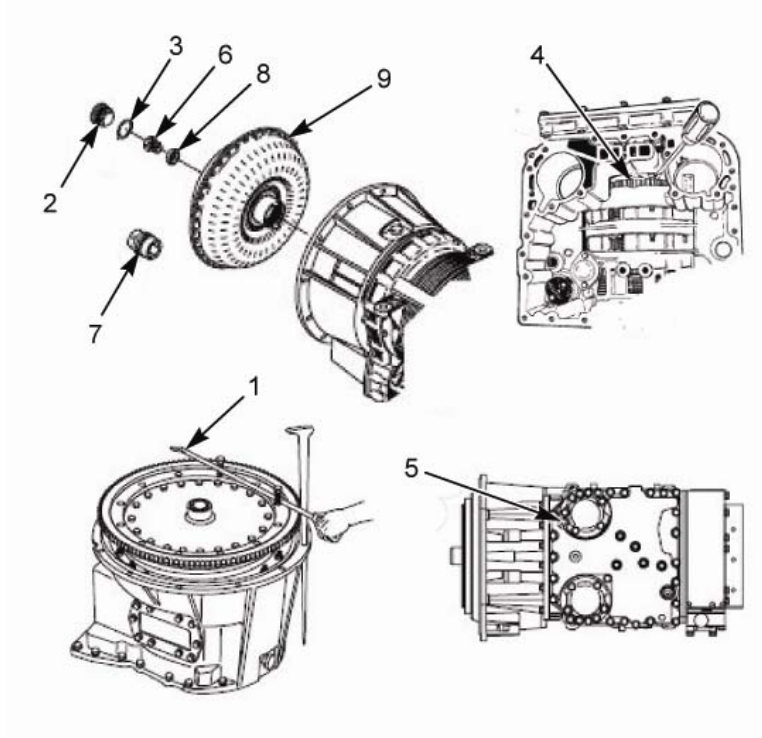
a) Removal



1. Remove converter shipping brackets or equivalent installed to prevent torque converter movement.
2. Keep the torque converter cover from turning by using a heel bar, two bolts and a screwdriver (1).
3. Remove threaded plug (2) and O-ring (3) using a 3/4 inch Allen wrench.
4. Hold the turbine and turbine shaft stationary by using one of the methods listed below:
 - a) Insert a screwdriver into the vanes on the rotating clutch module (4).
 - b) If the control module is in place, remove the plug(s), if present, from the fill tube hole or from the cooler ports before applying lockup air pressure. Apply air pressure through the lockup pressure tap (5) and use a heel bar, screwdriver and bolts. Insert the heel bar into a torque converter housing bolt hole. Insert two bolts into the flexplate adapter bolt holes. Then place a screwdriver at an angle to prevent converter rotation (1)
5. Remove bolt (6) using converter bolt tool J38564 (7).
6. Remove shim (8) located under bolt (6).
7. Attach a sling to the flexplate adapter by positioning the adapter connections an equal distance from each other. Using a chain hoist, carefully lift torque converter module (9) out of the converter housing.
8. Remove old torque converter module and discard.

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



Chapter 4 – MAINTENANCE INSTRUCTIONS

Torque Converter Selective Shims Table

Dimension "C"	Use P/N	Shim Step Dimension
0.0161–0.0260 in. (0.4093–0.6597 mm)	29505688	0.0000 in. (0.000 mm); NO STEP
0.0261–0.0330 in. (0.6598–0.8377 mm)	29505681	0.007–0.009 in. (0.178–0.228 mm)
0.0331–0.0400 in. (0.8378–1.0157 mm)	29505682	0.014–0.016 in. (0.356–0.406 mm)
0.0401–0.0470 in. (1.0158–1.1937 mm)	29505683	0.021–0.023 in. (0.534–0.584 mm)
0.0471–0.0540 in. (1.1938–1.3707 mm)	29505684	0.028–0.030 in. (0.711–0.761 mm)
0.0541–0.0610 in. (1.3708–1.5487 mm)	29505685	0.035–0.037 in. (0.889–0.939 mm)
0.0611–0.0662 in. (1.5488–1.6823 mm)	29505686	0.042–0.044 in. (1.067–1.117 mm)

NOTE

Refer to illustration on Page 629.

1. The torque converter is installed over the turbine shaft which rotates inside the stator shaft of ground sleeve. The splines on the ground sleeve engage the converter stator race. The splines on the turbine shaft engage the converter turbine. The end of the turbine shaft is threaded and machined to accept the converter retaining bolt and lockup sealing.
2. The splines of the ground sleeve and turbine shaft must engage with their respective splines in the torque converter module. The tangs on the converter pump hub must engage the charging pump tangs or the PTO oil pump drive hub.
3. Using a suitable lifting device and lifting chains, install torque converter module into the converter housing module.
4. Make sure the torque converter is properly seated. If PTO equipped, rotate the PTO gear to engage the pump hub with the charging pump.
5. Hold the turbine and turbine shaft stationary by using one of the methods listed below:
 - a) Insert a screwdriver into the vanes on the rotating clutch module (4)
 - b) If the control module is in place, remove the plug(s), if present, from the fill tube hole or from cooler ports before applying lockup air pressure. Apply air pressure through the lockup pressure tab (5) and use a heel bar, screwdriver, and bolts. Insert the heel bar into a torque converter housing bolt hole. Insert two bolts into the flexplate adaptor bolt holes. Then place a screwdriver at an angle to prevent converter rotation (1).
6. Install converter end-play gauge J38548 and tighten the attaching bolt to 20-25 lb-ft (27-34 N•m).
7. Measure from top of tool J38548 to face of turbine shaft and record it as dimension **B**. Subtract dimension **B** from dimension **A**. Dimension **A** is the height of the tool J38548, 3.937 inches (100,000 mm) to determine dimension **C**.
8. Use dimension **C** and Torque Converter Selective Shims Table to determine proper selective shim part number. Remove tool J38548 and continue with installation of the torque converter.
9. Install selective shims (8) with the shim step side toward the turbine shaft. Install bolt (6) and converter bolt tightening tool J38564 (7).

Chapter 4 – MAINTENANCE INSTRUCTIONS

10. Prevent turbine shaft rotation as in Step 5. Tighten bolt to 74-89 lb-ft (100-120 N•m).
11. Remove tool J38564. Install O-ring (3) on threaded converter end plug (2). Use a 3/4 inch Allen socket to install end plug (2) and tighten end plug (2) to 37-44 lb-ft (50-60 N•m).
12. Install converter shipping brackets or equivalent to retain the torque converter to the transmission. Tighten the shipping brackets to 38-45 lb-ft (51-61 N•m).

c) Follow-On Maintenance

1. Install Transmission.
2. Install Belly Plate Armor.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.11 Converter Housing Module (Bell Housing) Replacement

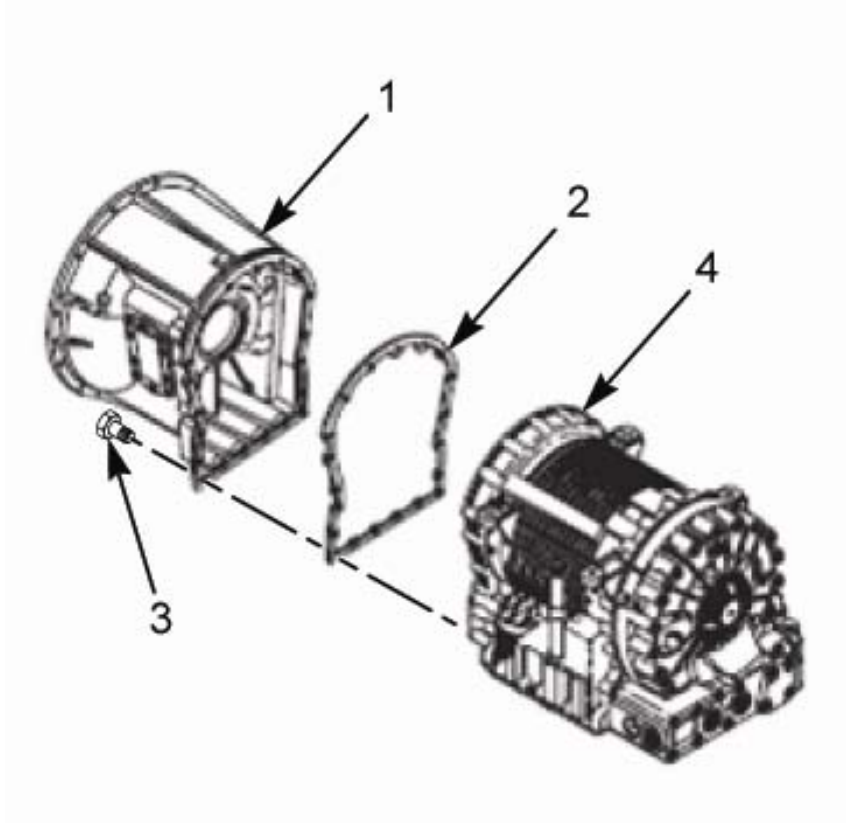
CONVERTER HOUSING MODULE (BELL HOUSING) REPLACEMENT		
This task covers:		
a) Removal	b) Installation	c) Follow-On Maintenance
<p>INITIAL SETUP</p> <p><u>Special Tools</u> Torque Wrench (0-100 ft-lb)</p> <p><u>Personnel</u> One (1) Wheeled Vehicle Mechanic</p> <p><u>Material/Parts</u> Converter Housing Module Main Housing Gasket</p>	<p><u>Equipment Condition</u> Parking Brake Set Engine OFF Wheels chocked Battery Disconnect Switch OFF Transmission removed Belly Armor Removed</p> <p><u>Reference</u> Parts Manual</p> <p><u>Equipment Required</u> Suitable Sling</p> <p><u>Follow-On Maintenance</u> Install Transmission Install Belly Armor Test drive vehicle</p>	



System components become extremely hot during normal operation. Use extreme care when working around hot components. Failure to comply may result in injury to personnel.

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



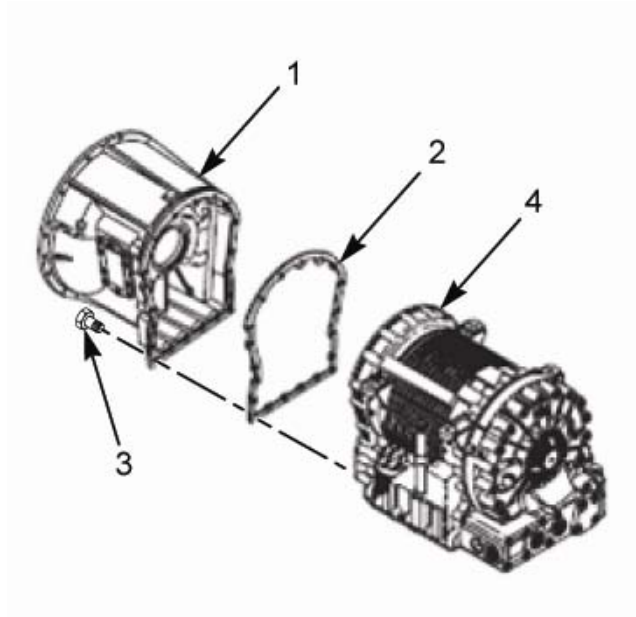
NOTE

Three converter housing retaining bolts (3) are removed from inside the converter housing (1). After loosening the bolts, use mechanical fingers or a similar tool to remove these bolts.

1. Remove twenty bolts (3) that retain converter housing (1), or from Main Housing Module (4).
2. Lift straight up on the Converter Housing Module (1), or remove it using the same sling used for removing the Converter Module.
3. Remove Main Housing Gasket (2) from Converter Housing (1) or from Main Housing Module (4).

Chapter 4 – MAINTENANCE INSTRUCTIONS

b) Installation



1. Install Main Housing Gasket (2) to The Converter Housing (1) or Main Housing Module (4).
2. Using the Sling in assisting in align the Converter Housing Module (1) to the Main Housing Module (4).
3. Install twenty bolts (3) that secure the converter housing (1) to the Main Housing Module (4).
4. Torque bolts to 38-45 ft-lb (58 - 61 N•m).

c) Follow-On Maintenance

1. After assembly, install transmission.
2. Test drive vehicle.

Chapter 4 – MAINTENANCE INSTRUCTIONS

4-6.12 Transmission Control Module Replacement

TRANSMISSION CONTROL MODULE REPLACEMENT

This task covers:

- | | | |
|-----------------|--------------------------|-------------|
| a) Removal | b) Disassembly | c) Assembly |
| d) Installation | e) Follow-On Maintenance | |

INITIAL SET UP

Special Tools

Torx Bit (T-15)

Personnel

One (1) Wheeled Vehicle Mechanic

Material Parts

Automatic Transmission Main
Pushbutton Control (1)

Anti-corrosion Compound

Equipment Required

None

Equipment Conditions

Engine OFF

Battery Disconnect Switch OFF

Parking brake set

Transmission set in NEUTRAL (N)

Wheels chocked

Reference

Parts Manual

Follow-On Maintenance

Battery Disconnect Switch ON

Start engine

Verify operation of shift selector

Remove wheel chocks

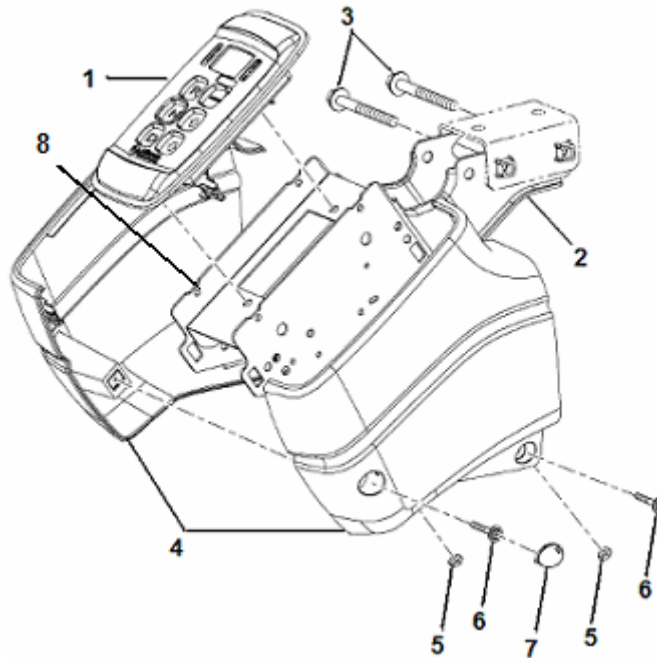
Test drive vehicle for proper
operation.

Shut engine OFF

Set parking brake

Chapter 4 – MAINTENANCE INSTRUCTIONS

a) Removal



1. From driver side of cab on the underside of the center dash panel, remove the two mounting bolts (3) from the mounting bracket (2).
2. Remove the shift selector (1) from its mounting position under dash.
3. Disconnect all connections and take shift controller (1) to a workbench.

b) Disassembly

1. With shift control unit (4) on workbench, remove button fastener (7) to uncover self-tapping screws (6) and nuts (5).
2. Remove two self-tapping screws (6) and nuts (5), with Torx Bit (T-15) from housing (4) of shift controller (1).
3. Separate the two halves of the housing (4) to uncover inside mounting bracket (8) for shift controller module (1).
4. With push pin removal tool or flathead screw driver, with care not to bent bracket out of shape, pry shift control module (1) from bracket. Discard old shift module per local regulations.

c) Assembly

1. Install new shift module (1) into internal mounting bracket (8) carefully as not to damage any of the buttons on the display.
2. Align the two halves of the housing (4) and insert the two screws (6) and nuts (5). Make sure both halves of the housing (4) line up exactly in the front and rear.

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d) Installation



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

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

1. Apply connector lubrication to electrical connectors.
2. Apply anti-corrosion compound to mounting bolts.
3. Connect all electrical connectors and/or cables.
4. Align mounting bracket (2) to dash frame hole and insert mounting bolts (3). Tighten bolts.

e) Follow-On Maintenance

1. Battery Disconnect Switch ON.
2. Start engine.
3. Verify operation of shift selector.
4. Remove wheel chocks.
5. Test drive vehicle for proper operation.
6. Shut engine OFF.
7. Set parking brake.

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS <small>For use of this form, see AF 25-32; the proponent agency is DARSA</small>						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: <i>(Forward to proponent of publication or form) (Include ZIP Code)</i> PM-MRAP, AMSTA-LC-GMM, 6501 E. 11 Mile Road, Warren, MI 48397-5000						FROM: <i>(Activity and location) (Include ZIP Code)</i>	
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
PUBLICATION/FORM NUMBER TM 9-2355-106-23-2						DATE	TITLE Maintenance Manual COTS for International Mine Resistant Vehicle Category 1 2355-01-553-4634 Category II 2355-01-553-4636
ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON	
<small>* Reference to line numbers within the paragraph or subparagraph.</small>							
TYPED NAME, GRADE OR TITLE						TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: <i>(Forward direct to addressee listed in publication)</i>			FROM: <i>(Activity and location) (Include ZIP Code)</i>				DATE	
PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS								
PUBLICATION NUMBER				DATE		TITLE		
PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
PART III - REMARKS <i>(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)</i>								
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			SIGNATURE	

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:



JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0726007

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 990003,
requirements for TM 9-2355-106-23-2.

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meter = 0.3937 Inch
 1 Decimeter = 10 Centimeters = 3.94 Inches
 1 Meter = 10 Decimeters = 100 Centimeters
 = 1000 Millimeters = 39.37 Inches
 1 Dekameter = 10 Meters = 32.8 Feet
 1 Hectometer = 10 Dekameters = 328.08 Feet
 1 Kilometer = 10 Hectometers = 1000 Meters
 = 0.621 Mile = 3,280.8 Feet
 Millimeters = Inches times 25.4
 Inches = Millimeters divided by 25.4

WEIGHTS

1 Centigram = 10 Milligrams = 0.154 Grain
 1 Decigram = 10 Centigrams = 1.543 Grains
 1 Gram = 0.001 Kilogram = 10 Decigrams
 = 1000 Milligrams = 0.035 Ounce
 1 Dekagram = 10 Grams = 0.353 Ounce
 1 Hectogram = 10 Dekagrams = 3.527 Ounces
 1 Kilogram = 10 Hectograms = 1000 Grams
 = 2.205 Pounds
 1 Quintal = 100 Kilograms = 220.46 Pounds
 1 Metric Ton = 10 Quintals = 1000 Kilograms
 = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liter = 0.034 Fluid Ounce
 1 Centiliter = 10 Milliliters = 0.34 Fluid Ounce
 1 Deciliter = 10 Centiliters = 3.38 Fluid Ounces
 1 Liter = 10 Deciliters = 1000 Milliliters
 = 33.82 Fluid Ounces
 1 Dekaliter = 10 Liters = 2.64 Gallons
 1 Hectoliter = 10 Dekaliters = 26.42 Gallons
 1 Kiloliter = 10 Hectoliters = 264.18 Gallons

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inch
 1 Sq Decimeter = 100 Sq Centimeters = 15.5 Sq Inches
 1 Sq Meter (Centare) = 10 Sq Decimeters
 = 10,000 Sq Centimeters = 10.764 Sq Feet
 1 Sq Dekameter (Are) = 100 Sq Meters = 1,076.4 Sq Feet
 1 Sq Hectometer (Hectare) = 100 Sq Dekameters
 = 2.471 Acres
 1 Sq Kilometer = 100 Sq Hectometers
 = 1,000,000 Sq Meters = 0.386 Sq Mile

CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.061 Cu Inch
 1 Cu Decimeter = 1000 Cu Centimeters = 61.02 Cu Inches
 1 Cu Meter = 1000 Cu Decimeters
 = 1,000,000 Cu Centimeters = 35.31 Cu Feet

TEMPERATURE

$5/9 (°F - 32°) = °C$
 $(9/5 x °C) + 32° = °F$
 -35° Fahrenheit is equivalent to -37° Celsius
 0° Fahrenheit is equivalent to -18° Celsius
 32° Fahrenheit is equivalent to 0° Celsius
 90° Fahrenheit is equivalent to 32.2° Celsius
 100° Fahrenheit is equivalent to 38° Celsius
 212° Fahrenheit is equivalent to 100° Celsius

APPROXIMATE CONVERSION FACTORS

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>	<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Inches	Centimeters	2.540	Centimeters	Inches	0.394
Feet	Meters	0.305	Meters	Feet	3.280
Yards	Meters	0.914	Meters	Yards	1.094
Miles	Kilometers	1.609	Kilometers	Miles	0.621
Square Inches	Square Centimeters	6.451	Square Centimeters ...	Square Inches	0.155
Square Feet	Square Meters	0.093	Square Meters	Square Feet	10.764
Square Yards	Square Meters	0.836	Square Meters	Square Yards	1.196
Square Miles	Square Kilometers	2.590	Square Kilometers	Square Miles	0.386
Acres	Square Hectometers	0.405	Square Hectometers ...	Acres	2.471
Cubic Feet	Cubic Meters	0.028	Cubic Meters	Cubic Feet	35.315
Cubic Yards	Cubic Meters	0.765	Cubic Meters	Cubic Yards	1.308
Fluid Ounces	Milliliters	29.573	Milliliters	Fluid Ounces	0.034
Pints	Liters	0.473	Liters	Pints	2.113
Quarts	Liters	0.946	Liters	Quarts	1.057
Gallons	Liters	3.785	Liters	Gallons	0.264
Ounces	Grams	28.349	Grams	Ounces	0.035
Pounds	Kilograms	0.454	Kilograms	Pounds	2.205
Short Tons	Metric Tons	0.907	Metric Tons	Short Tons	1.102
Pound-Feet	Newton-Meters	1.356	Newton-Meters	Pound-Feet	0.738
Pounds-Inches	Newton-Meters	0.11375	Kilopascals	Pounds per Square Inch	0.145
Pounds per Square Inch ..	Kilopascals	6.895	Kilometers per Liter ...	Miles per Gallon	2.354
Ounce-Inches	Newton-Meters	0.007062	Kilometers per Hour ...	Miles per Hour	0.621
Miles per Gallon	Kilometers per Liter	0.425	°Fahrenheit	°Celsius	$°C = (°F - 32) \times 5/9$
Miles per Hour	Kilometers per Hour	1.609	°Celsius	°Fahrenheit	$°F = (9/5 \times °C) + 32$

PIN: 084303-000