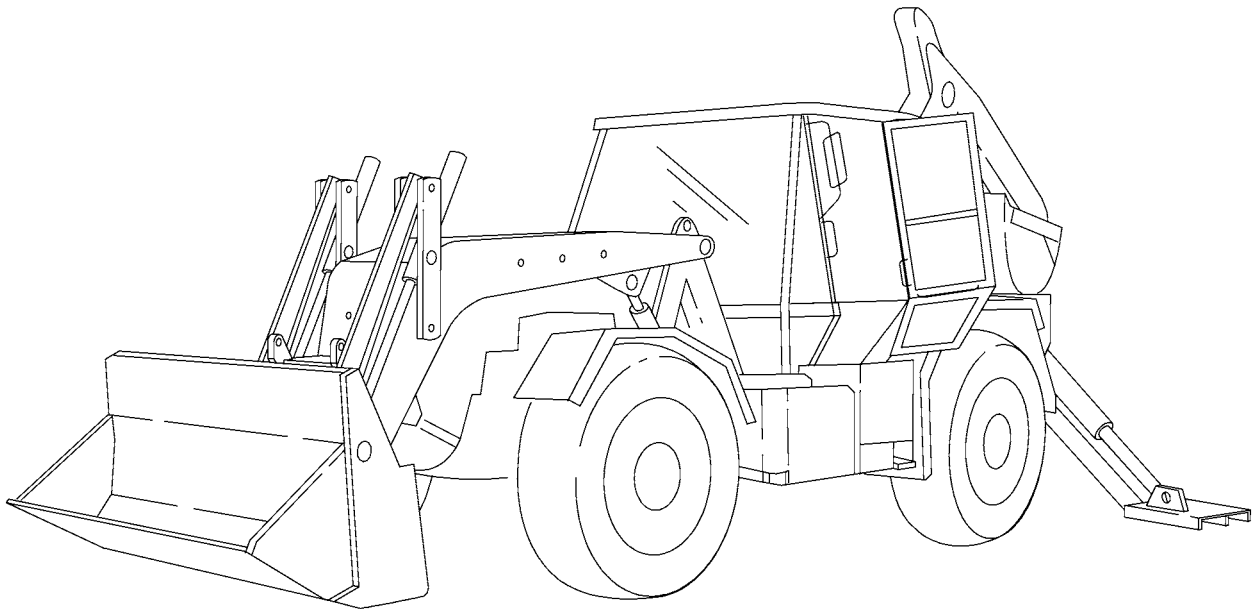


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TECHNICAL MANUAL

**UNIT, DIRECT SUPPORT, AND GENERAL  
SUPPORT MAINTENANCE MANUAL FOR  
INTERIM HIGH-MOBILITY ENGINEER  
EXCAVATOR (IHMEE)**

NSN 2420-66-148-7692



Approved for public release; distribution unlimited.





**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**WARNING**

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

**WARNING**

All fuels, most lubricants, and some coolants are flammable. Do not store flammable fluids in cab. Failure to comply may result in injury or death to personnel.

**WARNING**

Always replace hoses with appropriate parts to prevent hoses from bursting. Failure to comply may result in injury or death to personnel.

**WARNING**

Always securely support vehicle if required to work under it. Failure to comply may result in injury or death to personnel.

**WARNING**

Always use caution if a fitting is removed. Slowly loosen the fitting. If the system is still under pressure, release it slowly in a well-ventilated area.

**WARNING**

APPROVED HEARING PROTECTION MUST BE WORN by operator and any personnel within 22 ft. (7 m) of an IHMEE at high idle or within 12 ft. (4 m) of an IHMEE at low idle. Personnel hearing can be PERMANENTLY DAMAGED if exposed to constant high noise levels of 85 dB (A) or greater. Personnel exposed to high noise levels shall participate in a hearing conservation program in accordance with DA PAM 501. Hearing loss occurs gradually but becomes permanent over time. Failure to comply may cause impairment or loss of hearing.

**WARNING**

Avoid contact with hot oil. Failure to comply may result in serious injury.

**WARNING**

**CARBON MONOXIDE POISONING CAN BE DEADLY**

- CARBON MONOXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS, WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCES SYMPTOMS OF HEADACHE, DIZZINESS, AND LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, OR COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.
- CARBON MONOXIDE OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO ENSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE:
  1. DO NOT operate engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.
  2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in the personnel compartments.
  3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
  4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either is present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm, DO NOT PERMIT EXERCISE; if necessary, administer artificial respiration (see FM 4-25.11).
- THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

**WARNING**

- CARC paint contains isocyanate (HDI) which is highly irritating to skin and respiratory system. High concentrations of HDI can produce symptoms of itching and reddening of skin, a burning sensation in throat and nose and watering of the eyes. In extreme concentrations, HDI can cause cough, shortness of breath, pain during respiration, increased sputum production, and chest tightness. The following precautions must be taken whenever using CARC paint:
- ALWAYS use air line respirators when using CARC paint unless air sampling shows exposure to be below standards. Use chemical cartridge respirator if air sampling is below standards.
- DO NOT let skin or eyes come in contact with CARC paint. Always wear protective equipment (gloves, ventilation mask, safety goggles, etc.).
- DO NOT use CARC paint without adequate ventilation.
- NEVER weld or cut CARC-coated materials.
- DO NOT grind or sand painted equipment without high-efficiency air purifying respirators in use.
- BE AWARE of CARC paint exposure symptoms; symptoms can occur a few days after initial exposure. Seek medical help immediately if symptoms are detected.

**WARNING**

Calls attention to instructions which, if not correctly followed, may result in injury or death to personnel.

**WARNING**

Contact with refrigerant can cause frostbite. Keep hands and face away to prevent personal injury.

**WARNING**

Contents of starting fluid cylinder are under pressure. Store in a cool dry area. Do not incinerate, puncture, or attempt to remove cores from cylinder. Failure to comply may result in injury or death to personnel.

**WARNING**

Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.

**WARNING**

Cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.

**WARNING**

Death or serious injury may result if you attempt to mount or stop a moving vehicle.

**WARNING**

Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.

**WARNING**

Do not attempt to back out screws while wheels are in motion. Failure to comply may result in injury or death to personnel.

**WARNING**

Do not attempt to jump clear of a tipping vehicle; serious or fatal crushing injuries may result. Vehicle tips faster than driver can jump free. Failure to comply may result in injury or death to personnel.

**WARNING**

Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.

**WARNING**

Do not open high side valve on manifold gauge set while charging the A/C system.

**WARNING**

Do not smoke when servicing air conditioners or wherever refrigerant gas may be present. Personal injury or death can result from inhaling refrigerant through a lit cigarette.

**WARNING**

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

**WARNING**

Drive shafts are heavy. Ensure no personnel are under a drive shaft when it is removed. Failure to comply could result in serious injury or death to personnel.

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**WARNING**

Ensure all welds are ground completely smooth. Failure to comply may result in injury to personnel or damage to equipment.

**WARNING**

Ensure starting fluid cylinder is removed prior to working with valve assembly wires. Failure to comply may result in injury or death to personnel and/or damage to equipment.

**WARNING**

Ensure that no personnel are near or around the IHMEE when reversing during operations with vehicle lights set to BO DRIVE or BO MARKER. In this condition, the reverse alarm is not operational. Failure to comply may result in serious injury or death to personnel.

**WARNING**

Ensure that the bucket is directly supported before assembly/disassembly. Failure to comply may result in serious injury or death to personnel.

**WARNING**

Ensure the transmission is adequately supported before loosening transmission mount. Failure to comply may allow the transmission to shift, resulting in injury to personnel and/or damage to equipment.

**WARNING**

Entanglement in moving parts can cause serious injury or death.

**WARNING**

Evaporator assembly is heavy. Use an assistant and follow safe working procedures when removing or installing evaporator assembly. Failure to comply may result in injury to personnel.

**WARNING**

- Failure to comply with the following may result in injury or death to personnel:
- Mount and dismount the IHMEE only where steps and/or handrails are provided. Do not use any controls as handholds.
- Clean shoes and wipe hands before climbing on the vehicle. Use handholds when mounting the IHMEE.
- Inspect, clean, and have any necessary repairs made to steps prior to mounting the IHMEE.
- Always use "three-point contact" with the IHMEE; face the vehicle when entering or leaving the cab. Three-point contact means that three out of four arms and legs are in contact with the vehicle at all times during mount and dismount.
- Never get on or off a moving IHMEE.
- Never jump off the IHMEE.
- Do not attempt to climb on or off the IHMEE while carrying tools or supplies.
- Never jump on or off a moving vehicle. Be careful of slippery conditions on platforms, handholds, and steps when leaving vehicle.
- Do not use the IHMEE as a platform.

**WARNING**

Failure to properly inspect and maintain seat belts can cause serious injury or loss of life.

**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). Ensure FEL arms are directly supported before disassembly. Failure to comply may result in serious injury or death to personnel.

**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). To avoid personal injury, exercise extreme care when manually handling the FEL arms. Failure to comply may result in injury or death to personnel.

**WARNING**

Follow safe working procedures when lifting or moving heavy items. Use an appropriate lifting device whenever part to be moved exceeds 50 lb. (23 kg). Failure to comply may result in injury or death to personnel.

**WARNING**

Forklift tine is heavy. Use an assistant and follow safe working procedures when removing or installing forklift tine. Failure to comply may result in injury to personnel.

**WARNING**

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

**WARNING**

Hitch assembly is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hitch assembly. Failure to comply may result in injury or death to personnel.

**WARNING**

Hose reel weighs 86 lb. (39 kg). Use an assistant and follow safe working procedures when lifting or moving hose reel. Failure to comply may result in injury or death to personnel.

**WARNING**

Hot parts and fluids can burn personnel. If vehicle has been operating, let engine cool before starting work. Avoid contact with hot fluid when removing hoses or fittings. Failure to comply may result in serious injury or death to personnel.

**WARNING**

Hot parts can burn personnel. Let hot parts cool before starting work.

**WARNING**

Hot parts can burn personnel. Let hot parts cool before starting work. Avoid contact with hot oil. Failure to comply may result in serious injury.

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

**WARNING**

Hydraulic cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**WARNING**

If a maintenance procedure must be performed with the engine running, do not leave vehicle unattended. Failure to comply may result in injury or death.



**WARNING**

If hydraulic cylinders are bypassing oil, they may be hot enough to burn you. When checking cylinder temperature, avoid direct contact. Failure to comply may result in injury to personnel.

**WARNING**

If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.

**WARNING**

If the FEL arms are required to be raised for service work, the maintenance arm must be fitted. Do not work under raised FEL arms unless the maintenance arm is fitted. Failure to comply may result in serious injury or death to personnel.

**WARNING**

If the replacement of any part of the seat belt is required, the entire belt assembly must be replaced. Failure to comply may result in injury or death to personnel.

**WARNING**

If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be relieved before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.

**WARNING**

If vehicle has recently been driven, oil may be hot. To avoid personal injury, wear appropriate safety equipment. Failure to comply may result in injury or death to personnel.

**WARNING**

If you experience problems operating any controls, turn off your SINGAR radio unit. Failure to comply may result in death or injury to personnel and/or damage to equipment.

**WARNING**

It is very important that T-section of release bolt fully engages in bottom seat. Failure to comply may result in injury or death to personnel.

**WARNING**

JP-8 fuel oil under pressure can penetrate the skin causing serious injury, blindness, or death. Ensure all pressure is released before disturbing the fuel system. Failure to comply may result in injury or death to personnel.

**WARNING**

Lead-acid battery gases can explode. Do not smoke, have open flames, or make sparks around a battery, especially if caps are off. Battery may give off gas which can explode. Failure to comply may result in injury or death to personnel.

**WARNING**

Loader arm assembly weighs approximately 1,543 lb. (700 kg). To avoid personal injury, exercise extreme care when manually handling the loader arms. Failure to comply may result in injury or death to personnel.

**WARNING**

Make sure personnel are clear of wheels before turning steering wheel. Failure to comply may result in injury or death to personnel.

**WARNING**

Most relays always have electrical current going to them and can cause severe injury to personnel. Care must be exercised when working in PDP box.

**WARNING**

Never lubricate or service vehicle while it is moving. Keep hands, feet, and clothing clear of moving parts. Failure to comply may result in serious injury or death to personnel.

**WARNING**

Never use fuel to clean parts. Fuel is highly flammable. Failure to comply may result in injury or death to personnel.

**WARNING**

Never work under vehicle raised by the FEL. If the vehicle must be raised, place supporting blocks under frame. Failure to comply may result in serious injury or death to personnel.

**WARNING**

No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Failure to comply may result in injury or death to personnel.

**WARNING**

No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.

**WARNING**

Personal injury or death can result from inhaling refrigerant. Only vent refrigerant in a well-ventilated area.

**WARNING**

Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty.

**WARNING**

Quick-hitch assembly is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving quick-hitch assembly. Failure to comply may result in injury or death to personnel.

**WARNING**

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

**WARNING**

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

**WARNING**

Seat belts and protective headgear must always be worn when operating or driving in the vehicle. Failure to comply may result in injury or death to personnel.

**WARNING**

Serious injury or death can result from contact with electric power lines. Never move any part of vehicle or load closer to power lines than 9 ft. (3 m). Failure to comply may result in injury or death to personnel.

**WARNING**

Starting fluid contains ethyl ether and is extremely flammable. Do not smoke when replacing starting fluid cylinder. No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.

**WARNING**

Starting fluid contains ethyl ether and is TOXIC. It can be harmful or fatal if swallowed. Avoid contact with skin or eyes, or breathing fumes. Make sure you are in a well-ventilated area. To prevent possible injury, wear gloves and protective eye equipment when handling starting fluid cylinder. If fluid enters the eyes or if fumes irritate the eyes, they should be washed with large quantities of clean water for 15 minutes. A physician, preferably an eye specialist, must be contacted. If swallowed, DO NOT INDUCE VOMITING. Call a physician immediately. Failure to comply may result in injury or death to personnel.

**WARNING**

The backhoe must be supported when removing or installing any backhoe cylinder. Failure to comply may result in serious injury or death to personnel and damage to equipment.

**WARNING**

The cutting edge is heavy. To avoid personal injury, exercise extreme care when manually handling the cutting edge. Failure to comply may result in injury to personnel.

**WARNING**

The engine and transmission assembly weighs approximately 1 ton (907 kg). To avoid the possibility of personal injury, loss of life, and the destruction of the vehicle, only a qualified person using certified lifting equipment is to carry out slinging operations involving the IHMEE. Failure to comply may result in injury or death to personnel.

**WARNING**

The front axle assembly is heavy. To avoid personal injury, exercise extreme care when manually handling axle. Failure to comply may result in injury or death to personnel.

**WARNING**

The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.

**WARNING**

The IHMEE requires an escort and may not exceed 42 mph (68 km/h) when operating on primary roads. Failure to comply may result in injury to personnel and/or damage to equipment.

**WARNING**

The Operator's seat is heavy. Two soldiers are required to remove the seat from the cab. Failure to comply could result in injury to personnel.

**WARNING**

The rear axle assembly is heavy. Always use lifting device to support axle. To avoid personal injury, exercise extreme care when manually handling axle. Failure to comply may result in injury or death to personnel.

**WARNING**

The ROPS/FOPS is designed only to protect the operator during earth-moving operations. Failure to comply may result in injury or death to personnel.

**WARNING**

The seat belts must always be worn when operating or driving the vehicle. Failure to comply may result in injury or death to personnel.

**WARNING**

The spring motor is under tension when installed. To prevent injury, relieve tension before removing spring motor. Failure to comply may result in injury or death to personnel.

**WARNING**

The stabilizer arms are heavy. To avoid personal injury, exercise extreme care when manually handling the stabilizer arms. Failure to comply may result in injury or death to personnel.

**WARNING**

The sway bar is heavy and it is under tension when installed. To prevent injury, take care when removing and installing sway bar. Failure to comply may result in injury or death to personnel.

**WARNING**

The swing tower assembly is heavy. To avoid personal injury, exercise extreme care when manually handling the swing tower assembly. Failure to comply may result in injury or death to personnel.

**WARNING**

The transmission assembly weighs approximately 992 lb. (450 kg). Ensure suitable lifting device is used. Failure to comply may result in serious injury or death to personnel.

**WARNING**

This procedure is for emergency towing of the vehicle only, and will manually release the vehicle's brakes. Ensure that vehicle is secured by the towing vehicle or wheel chocks before attempting the following procedure. Failure to comply may allow the vehicle to move, resulting in serious injury or death to personnel and/or equipment damage.

**WARNING**

Tilt linkages are heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving tilt linkages. Failure to comply may result in injury or death to personnel.

**WARNING**

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

**WARNING**

To avoid personal injury, prior to removing a bushing, ensure component is adequately supported. Failure to comply may result in injury or death to personnel.

**WARNING**

To avoid personal injury, wear protective equipment when using compressed air. Failure to comply may result in injury or death to personnel.

**WARNING**

To avoid possible fatal injuries, do not under any circumstances attempt to dismantle the spring brake chambers on the vehicle.

**WARNING**

To prevent inadvertent movement of the FEL arms when installing the maintenance arm, CROSS COUNTRY DRIVING must be selected on the driving mode switch. Failure to comply may result in injury or death to personnel.

**WARNING**

To prevent injury from hot, spraying oil, do not remove hydraulic connection hoses until engine is cool.

**WARNING**

To prevent injury, always replace bushings with authorized parts only. Failure to comply may result in injury or death to personnel.

**WARNING**

To prevent injury, isolate air supply prior to working on airbags. Failure to comply may result in injury or death to personnel.

**WARNING**

To prevent personal injury, ensure air is exhausted from primary and secondary pneumatic systems prior to starting work. Failure to comply may result in injury or death to personnel.

**WARNING**

To prevent personal injury, ensure air is exhausted from primary and secondary pneumatic system prior to working on system. Failure to comply may result in injury or death to personnel.

**WARNING**

To prevent personal injury, exercise care when positioning vehicle stands beneath axle housing. Failure to comply may result in injury or death to personnel.

**WARNING**

To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

**WARNING**

Turn ignition switch to OFF to stop engine. Lock ignition switch in OFF position. Death or serious injury may result if the unsupported vehicle moves unexpectedly during maintenance.

**WARNING**

Unsafe welding practices can cause serious injury from fire, explosions, or harmful agents. Allow only authorized personnel to weld or cut metals, and follow safety precautions in TC 9-237. Protective clothing and goggles must be worn, adequate protective equipment used, a suitable fire extinguisher kept nearby, and requirements of TC 9-237 strictly followed.

**WARNING**

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



**WARNING**

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

**WARNING**

Valve block weighs 56 lb. (25 kg). Use an assistant and follow safe working procedures when removing or installing valve block. Failure to comply may result in injury to personnel.

**WARNING**

Valve block weighs 95 lb. (43 kg). Use an appropriate lifting device with an assistant, and follow safe working procedures when removing or installing valve block. Failure to comply may result in injury to personnel.

**WARNING**

Wear dust mask and eye protection when removing dust from brake drum and mechanism. Failure to comply may result in personal injury.

**WARNING**

Wear protective goggles, face shield, and gloves when working with glass. Failure to comply may result in injury or death to personnel.

**WARNING**

You are within the backhoe crush zone when operating the backhoe valves. Ensure backhoe swing pin is in place to prevent backhoe from swinging and causing injury or death to personnel.



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SUPPORT MAINTENANCE MANUAL FOR  
INTERIM HIGH-MOBILITY ENGINEER  
EXCAVATOR (IHMEE)****NSN 2420-66-148-7692****Approved for public release; distribution unlimited.**

TM 5-2420-230-24-1, 01 OCT 2003, is updated as follows:

1. File this sheet in front of the manual for reference.
2. This change is mainly the result of adding new equipment to the IHMEE vehicles, including a hydraulic hose reel and an optional cold weather kit. Other updates have been made to ensure the accuracy and usability of the manual.
3. New or updated text is indicated by a vertical bar in the outer margin of the page.
4. Added or heavily revised illustrations are indicated by a vertical bar adjacent to it. Illustrations with minor changes are indicated by a miniature pointing hand indicating the updated area.
5. Remove old pages and insert new pages as indicated below.

**Remove Pages**

a through l  
A and B (Blank)  
i through iv  
1-1 through 1-4  
1-9 and 1-10  
2-1 through 2-10  
2-15/2-16 (Blank)  
3-1 through 3-10  
3-13 through 3-26  
3-29 and 3-30  
3-37 through 3-42  
3-47 through 3-50  
3-53 and 3-54  
3-55 through 3-60  
3-63 and 3-64  
3-67 through 3-80  
3-83 through 3-98  
3-105 through 3-110 (Blank)  
4-1 through 4-44  
5-1 through 5-40  
6-1 through 6-15/6-16 (Blank)  
7-1 through 7-10  
8-3 through 8-12  
9-3 through 9-14  
10-1 through 10-56

**Insert Pages**

a through q/r (Blank)  
A and B  
i through iv  
1-1 through 1-4  
1-9 through 1-11/1-12 (Blank)  
2-1 through 2-10  
2-15 and 2-16  
3-1 through 3-10  
3-13 through 3-26  
3-29 and 3-30  
3-37 through 3-42  
3-47 through 3-50  
3-53 through 3-54.1/5-54.2 (Blank)  
3-55 through 3-60  
3-63 and 3-64  
3-67 through 3-80  
3-83 through 3-98.1/3-98.2 (Blank)  
3-105 through 3-119/3-120 (Blank)  
4-1 through 4-57/5-58 (Blank)  
5-1 through 5-43/5-44 (Blank)  
6-1 through 6-15/6-16 (Blank)  
7-1 through 7-13/7-14 (Blank)  
8-3 through 8-12  
9-3 through 9-14  
10-1 through 10-88

TM 5-2420-230-24-1

11-3 through 11-4  
12-1 through 12-78  
13-1 through 13-62 (Blank)  
14-1 through 14-14  
15-1 through 15-12  
15-15 through 15-19/15-20 (Blank)  
16-1 through 16-7/16-8 (Blank)  
17-1 and 17-2  
17-7 and 17-8  
17-11 through 17-14  
17-17 and 17-18  
19-1 through 19-4  
19-11 through 19-14  
none  
A-1 and A-2  
B-1 through B-22  
C-1 through C-6  
D-1 through D-12  
F-1 through F-22  
H-1 through H-8  
J-1 through J-16  
K-1 through K-4  
INDEX-1 through INDEX-10

11-3 through 11-4  
12-1 through 12-95/12-96 (Blank)  
13-1 through 13-80  
14-1 through 14-14  
15-1 through 15-12  
15-1 through 15-19/15-20 (Blank)  
16-1 through 16-7/16-8 (Blank)  
17-1 and 17-2  
17-7 and 17-8  
17-11 through 17-14  
17-17 and 17-18  
19-1 through 19-4  
19-11 through 19-22  
20-1 through 20-60  
A-1 and A-2  
B-1 through B-31/B-32 (blank)  
C-1 through C-6  
D-1 through D-14  
F-1 through F-22  
H-1 through H-8.6  
J-1 through J-16  
K-1 through K-4.2  
INDEX-1 through INDEX-12

By Order of the Secretary of the Army:

Official:



SANDRA R. RILEY  
*Administrative Assistant to the  
Secretary of the Army*

0315503

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

**DISTRIBUTION:** To be distributed in accordance with the initial distribution requirements for IDN: 256772, requirements for TM 5-2420-230-24-1.

INSERT LATEST UPDATED PAGES / WORK PACKAGES. DESTROY SUPERSEDED DATA.

**LIST OF EFFECTIVE PAGES / WORK PACKAGES**

NOTE: The portion of text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands.

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

Original... 0..... 01 OCT 2003

Change ... 1..... 22 JUL 2005

**TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 52 AND TOTAL NUMBER OF WORK PACKAGE PAGES IS 1346 CONSISTING OF THE FOLLOWING:**

Page / WP No.	*Change No.	Page / WP No.	*Change No.	Page / WP No.	*Change No.
Front Cover	0	3-14	0	3-79 and 3-80	1
a — r (Blank)	1	3-15 — 3-19	1	3-81 and 3-82	0
A and B	1	3-20	0	3-83 — 3-95	1
i — iii	1	3-21 — 3-26	1	3-96	0
iv	0	3-27 and 3-28	0	3-96.1 — 3-98.2 (Blank)	1
1-1	1	3-29 and 3-30	1	3-99 — 3-105	0
1-2	0	3-31 — 3-37	0	3-106 — 3-107	1
1-3 and 1-4	1	3-38 — 3-41	1	3-108 — 3-109	0
1-5 — 1-8	0	3-32 — 3-47	0	3-110 — 3-120 (Blank)	1
1-9 — 1-12 (Blank)	1	3-48 — 3-50	1	4-1 — 4-58 (Blank)	0
2-1 — 2-3	1	3-51 — 3-52	0	5-1 — 5-20	1
2-4 and 2-5	0	3-53 — 3-60	1	5-21	0
2-6 and 2-7	1	3-61 — 3-63	0	5-22 — 5-44 (Blank)	1
2-8	0	3-64	1	6-1	0
2-9	1	3-65 — 3-66	0	6-2	1
2-10 — 2-15	0	3-67	1	6-3	0
2-16	1	3-68	0	6-4 — 6-16 (Blank)	1
3-1	0	3-69 — 3-73	1	7-1 — 7-14 (Blank)	0
3-2 — 3-4	1	3-74	0	8-1 and 8-2	0
3-5	0	3-75	1	8-3 — 8-7	1
3-6 — 3-10	1	3-76	0	8-8	0
3-11 and 3-12	0	3-77	1	8-9 — 8-12	1
3-13	1	3-78	0	8-13 — 8-14	0

\* Zero in this column indicates an original page or work package.

**TM 5-2420-230-24-1**

Page / WP No.	*Change No.	Page / WP No.	*Change No.	Page / WP No.	*Change No.
9-1 — 9-3	0	17-2	1	H-8 — H-8.6	1
9-4 — 9-12.2 (Blank)	1	17-3 — 17-7	0	H-9 — H-80	0
9-13	0	17-8	1	J-1 — J-16	1
9-14	1	17-9 and 17-10	0	J-17 — J-138	0
10-1 — 10-88	1	17-11 — 17-14	1	K-1 — K-4.2	1
11-1 and 11-2	0	17-15 and 17-16	0	K-5 — K-110	0
11-3 and 11-4	1	17-17 and 17-18	1	Index-1 — Index-12	1
11-5 and 11-6	0	18-1 — 18-4 (Blank)	0		
12-1 — 12-96 (Blank)	1	19-1	1		
13-1 — 13-80	1	19-2	0		
14-1	0	19-3	1		
14-2 — 14-5	1	19-4 — 19-10	0		
14-6	0	19-11 — 19-22	1		
14-7	1	20-1 — 20-60	0		
14-8	0	A-1 and A-2	1		
14-9	1	B-1 — B-32 (Blank)	1		
14-10	0	C-1	0		
14-11	1	C-2 — C-4	1		
14-12	0	C-5	0		
14-13 and 14-14	1	C-6	1		
14-15 and 14-16 (Blank)	0	D-1 — D-14	0		
15-1	0	E-1 — E-12	1		
15-2 — 15-9	1	F-1	0		
15-10 and 15-11	0	F-2 — F-21	1		
15-12	1	F-22 — F-174	0		
15-13 and 15-14	0	G-1 — G-28	0		
15-15 and 15-16	1	H-1 and H-2	1		
15-17	0	H-3	0		
15-18 — 15-20 (Blank)	1	H-4	1		
16-1	0	H-5	0		
16-2 — 16-8 (Blank)	1	H-6	1		
17-1	0	H-7	0		

\* Zero in this column indicates an original page or work package.

# UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL FOR INTERIM HIGH-MOBILITY ENGINEER EXCAVATOR (IHMEE)

NSN 2420-66-148-7692

## REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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## Table of Contents

		Page
CHAPTER 1	Introduction . . . . .	1-1
Section I	General Information. . . . .	1-1
Section II	Equipment Description and Data. . . . .	1-3
Section III	Technical Principles of Operation . . . . .	1-4
CHAPTER 2	Safety Instructions . . . . .	2-1
Section I	General Safety. . . . .	2-2
Section II	Operational Safety. . . . .	2-5
Section III	Maintenance Safety . . . . .	2-9
CHAPTER 3	Scheduled Maintenance and Troubleshooting . . . . .	3-1
Section I	Preventive Maintenance Checks and Services (PMCS). . . . .	3-1
Section II	Lubricating Instructions. . . . .	3-19
Section III	Preparation for Storage or Shipment. . . . .	3-24
Section IV	Troubleshooting. . . . .	3-31

CHAPTER 4	Power Pack . . . . .	4-1
CHAPTER 5	Steering System. . . . .	5-1
CHAPTER 6	Suspension. . . . .	6-1
CHAPTER 7	Fuel System. . . . .	7-1
CHAPTER 8	Braking System. . . . .	8-1
CHAPTER 9	Cooling System. . . . .	9-1
CHAPTER 10	Hydraulic System. . . . .	10-1
CHAPTER 11	Exhaust System. . . . .	11-1
CHAPTER 12	Electrical System. . . . .	12-1
CHAPTER 13	Body, Cab, and Chassis. . . . .	13-1
CHAPTER 14	Drive train and Axles . . . . .	14-1
CHAPTER 15	Pneumatic System . . . . .	15-1
CHAPTER 16	Backhoe. . . . .	16-1
CHAPTER 17	Front-End Loader (FEL) . . . . .	17-1
CHAPTER 18	Forklift Attachment. . . . .	18-1
CHAPTER 19	Air-Conditioning (A/C) System . . . . .	19-1
CHAPTER 20	Cold Weather Kit . . . . .	20-1
APPENDIX A	References . . . . .	A-1
APPENDIX B	Maintenance Allocation Chart . . . . .	B-1
Section I	Introduction. . . . .	B-1
Section II	Maintenance Allocation Chart (MAC). . . . .	B-4
Section III	Tools and Test Equipment. . . . .	B-29
Section IV	Remarks. . . . .	B-31



APPENDIX C	Expendable/Durables List. . . . .	C-1
Section I	Introduction. . . . .	C-1
Section II	Expendable and Durable Items. . . . .	C-2
APPENDIX D	Mandatory Replacement Parts . . . . .	D-1
Section I	Introduction. . . . .	D-1
Section II	Mandatory Replacement Parts. . . . .	D-1
APPENDIX E	Torque Limits . . . . .	E-1
APPENDIX F	Transmission Service Manual. . . . .	F-1
Section I	U.S. Army Supplement to Dana Spicer Clark-Hurth Material. . . . .	F-1
Section II	Vendor Service Manual. . . . .	F-22
APPENDIX G	Electronic Gear Selector (EGS) User Manual . . . . .	G-1
Section I	U.S. Army Supplement to Dana Spicer Clark-Hurth Material. . . . .	G-1
Section II	Vendor Operator Manual. . . . .	G-2
APPENDIX H	Backhoe Service Manual . . . . .	H-1
Section I	U.S. Army Supplement to Case Material. . . . .	H-1
Section II	Vendor Service Manual. . . . .	H-8.6
APPENDIX J	Axle Service Manual . . . . .	J-1
Section I	U.S. Army Supplement to Dana Spicer Material. . . . .	J-1
Section II	Vendor Service Manual. . . . .	J-16
APPENDIX K	Power Steering Service Manual . . . . .	K-1
Section I	U.S. Army Supplement to Sheppard Material. . . . .	K-1
Section II	Vendor Service Manual. . . . .	K-4.2
APPENDIX L	Engine Service and Troubleshooting Manuals . . . . .	L-1
Section I	U.S. Army Supplement to Cummins Material. . . . .	L-2
Section II	Vendor Service Manual. . . . .	L-59
Section III	Vendor Troubleshooting Manual. . . . .	L-536
	Power Distribution Panel Layout . . . . .	FP-1
	Power Distribution Panel Diagram. . . . .	FP-3
	Electric Diagram . . . . .	FP-23
	Hydraulic Diagram . . . . .	FP-37
	Pneumatic Diagram . . . . .	FP-39

## PURPOSE OF MANUAL.

The information in this manual is designed to help maintain the Interim High-Mobility Engineer Excavator (IHMEE) vehicle. It is intended to serve as a guide to assist qualified mechanics in the maintenance of the vehicle. In addition to this manual, refer to TM 5-2420-230-24P for any required parts information.

## HOW TO USE THIS MANUAL.

Listed below are some of the features included in this manual to help locate and use the needed information:

- Each chapter begins with a Table of Contents listing all paragraph headings in the chapter.
- Warning, caution, note, and subject headings and other essential information are printed in bold type, making them easier to see.
- The maintenance tasks describe what must be done to the vehicle before starting the task, and what must be done to return the vehicle to operating condition after the task is finished.
- The appendixes are located at the end of the manual. They contain a reference guide to other manuals, guidelines to reading the Maintenance Allocation Chart (MAC), a list of expendable supplies and materials, towing procedures, and torque values.
- Several vendor manuals have also been included as appendixes. Appendixes in this volume include those for the backhoe, axles, steering pump, and vane pump/motor. Each vendor manual has a supplement showing task boxes relating to each maintenance task.
- Refer to TM 5-2420-230-24-2 for engine vendor manuals and foldout schematics.

The manual is divided into chapters containing Unit, Direct Support, and General Support maintenance procedures. These procedures describe a number of things, such as:

- What will be needed to do the job.
- If any assistance will be needed.
- How long the job will take.
- Important safety precautions.

In addition to the text, there will be illustrations for most procedures. These illustrations are keyed to the text and shows you how to take the part off and put it on. Cleaning and inspection procedures are also included when required.

Follow these guidelines when using this manual:

- Read all WARNINGS and CAUTIONS before performing any procedure.
- Become familiar with the entire maintenance procedure before beginning a maintenance task.

# CHAPTER 1

## INTRODUCTION

<b>Contents</b>	<b>Para</b>	<b>Page</b>
Scope.....	1-1	1-1
Maintenance Forms, Records, and Reports. ....	1-2	1-1
Destruction of Army Material to Prevent Enemy Use. ....	1-3	1-2
Preparation for Storage or Shipment.....	1-4	1-2
Nomenclature Cross-Reference. ....	1-5	1-2
Reporting Equipment Improvement Recommendations (EIRs).....	1-6	1-2
Equipment Improvement Report and Maintenance Digest (EIR MD) and Equipment Improvement Report and Maintenance Summary (EIR MS). ....	1-7	1-3
Warranty Information. ....	1-8	1-3
Metric System. ....	1-9	1-3
Vehicle Description.....	1-10	1-3
Equipment Characteristics, Capabilities, and Features.....	1-11	1-4
Location and Description of Major Components. ....	1-12	1-4
Safety, Care, and Handling. ....	1-13	1-4
Systems Introduction.....	1-14	1-4
Power Train.....	1-15	1-5
Engine System.....	1-16	1-6
Electrical System.....	1-17	1-7
Pneumatic System.....	1-18	1-8
Hydraulic System. ....	1-19	1-9
Steering System.....	1-20	1-9
Heating, Ventilation, and Air-Conditioning (HVAC). ....	1-21	1-10
Wheels and Tires.....	1-22	1-10
Cold Weather Kit.....	1-23	1-11

### Section I. General Information.

**1-1. SCOPE.**

This manual provides the technical information required to maintain the Interim High-Mobility Engineer Excavator (IHMEE). The manual covers the vehicle and all the accessories that may be fitted. This chapter contains a general description of the IHMEE.

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

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by (as applicable) DA PAM 738-750, Functional User’s Manual for The Army Maintenance Management System (TAMMS) or AR 700-138, Army Logistics Readiness and Sustainability.

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

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

**1-4. PREPARATION FOR STORAGE OR SHIPMENT.**

Refer to Para 3-9 and Para 3-10 for instructions on preparing the IHMEE for storage or shipment.

**1-5. NOMENCLATURE CROSS-REFERENCE.**

<b>Common Name</b>	<b>Official Nomenclature</b>
Engine coolant	- Antifreeze, ethylene glycol mixture
Glad hand	- Quick disconnect air coupling
Light bulb	- Incandescent lamp
O-ring	- Preformed packing
Service brake pedal	- Brake pedal
Snap ring	- Retaining ring
Throttle pedal	- Throttle control
U-joint	- Universal joint
Washer fluid	- Windshield cleaning compound

**1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS).**

If any vehicle needs improvement, let us know. Send us an EIR. The user is the only one who can tell us how the equipment might be improved. Let us know what isn't liked about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-automotive Command, ATTN: AMSTA-QRT, Warren, MI 48397-5000. We'll send a reply.

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

The quarterly Equipment Improvement Report and Maintenance Digest, TB 43 0001-39 series, contains valuable field information on the equipment covered in this manual. The information in the TB 43 0001-39 series is compiled from some of the Quality Deficiency Reports that have been prepared on the vehicles covered in this manual. Many of these articles result from comments, suggestions, and improvement recommendations that were submitted to the EIR program. The TB 43-0001-39 series contains information on equipment improvements, minor alterations, proposed Modification Work Orders (MWO's), warranties (if applicable), actions taken on some of the DA Form 2028's (Recommended Changes to Publications), and advance information on proposed changes that may affect this manual.

In addition, the more maintenance-significant articles, including minor alterations, field-fixes, etc., that have a more permanent and continuing need in the field are republished in the Equipment Improvement Report and Maintenance Summary (EIR MS) for TACOM Equipment (TM 43-1043). Refer to both of these publications (TB 43 0001-39 series and TM 43-1043) periodically, especially the TB 43 0001-39 series, for the most current and authoritative information on the equipment. The information will help the user do a better job and will advise of the latest changes to this manual. Also refer to DA PAM 310-1, Consolidated Index of Army Publications and Blank Forms, and Appendix A (References) of this manual.

## **1-8. WARRANTY INFORMATION.**

The IHMEE vehicles are warranted by ADI Limited and various component equipment manufacturers. The warranty starts on the date found in block 23 of DA Form 2408-9 in the logbook. Report all defects in material or workmanship to the supervisor, who will take appropriate action. Refer to TB 5-2420-230-14 for more information on the warranty procedures for the IHMEE vehicles.

## **1-9. METRIC SYSTEM.**

The equipment described herein contains metric components and requires metric, common, and special tools. Therefore, metric units and English units will be used throughout this publication. English values are listed first, with the metric equivalent shown afterward in parentheses. An English-to-metric conversion table is included as the last page of this manual inside the back cover.

## **Section II. Equipment Description and Data.**

### **1-10. VEHICLE DESCRIPTION.**

The IHMEE is a high-speed, all-terrain engineering vehicle. The IHMEE has two-wheel and four-wheel drive, and is can travel at an average highway speed of 42 mph (68 km/h). A cold weather kit can also be fitted to allow better vehicle starting in arctic condiditons. The vehicle has a hydraulic hose reel, Front-End Loader (FEL), and a backhoe. In addition, the FEL can be replaced with a forklift.

**1-11. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.**

Refer to TM 5-2420-230-10 for equipment characteristics, capabilities, and features.

**1-12. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.**

Refer to TM 5-2420-230-10 for location and description of major components.

**1-13. SAFETY, CARE, AND HANDLING.**

Significant hazards and safety recommendations are listed in Table 1-1. Refer to Chapter 2 for more safety information.

**Table 1-1. Significant Hazards and Safety Recommendations.**

<b>Hazard</b>	<b>Safety Recommendation or Precaution</b>	<b>Operating Condition*</b>
Low air pressure for brakes.	Do not drive vehicle while low air pressure warning buzzer is sounding or warning indicator is on.	Abnormal
Vehicle instability with backhoe use.	Ensure stabilizers are down on firm ground, side slope does not exceed 5 degrees, and backhoe is not overloaded.	Abnormal
Connecting towing devices.	Do not go between vehicles unless they are both stopped and brakes are applied.	Normal
Refueling vehicle.	Shut OFF engine and no smoking when filling tank.	Normal
Replacing starting fluid cylinder (if equipped).	Shut OFF engine and no smoking when replacing starting fluid cylinder.	Normal

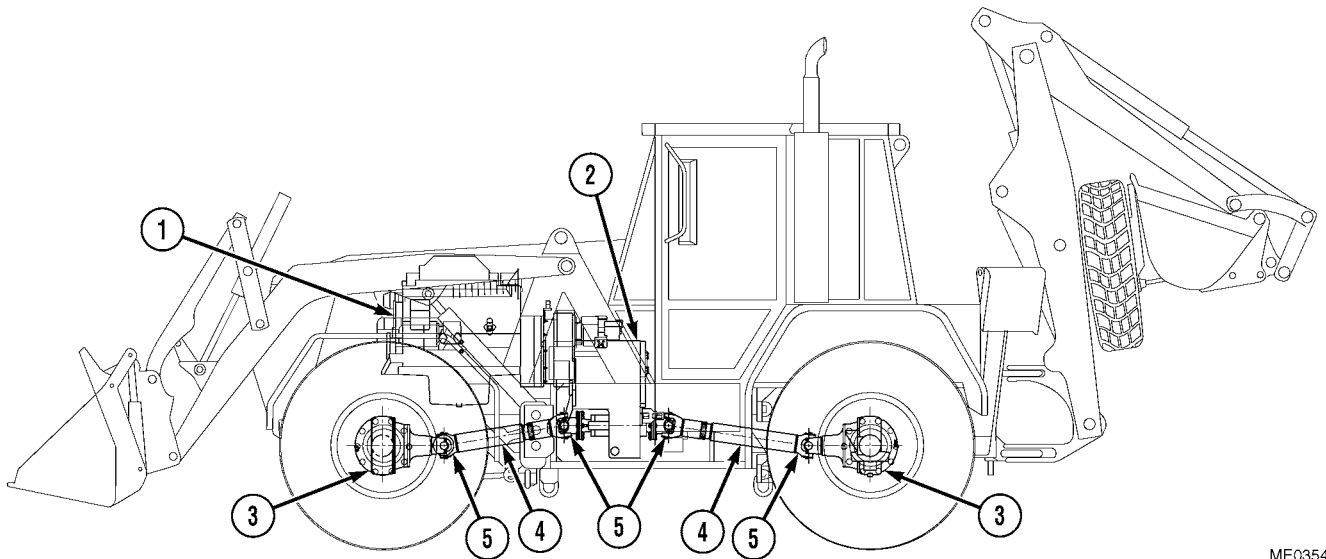
\* Category of hazards as to whether they may be expected under normal or abnormal operating conditions.

**Section III. Technical Principles of Operation.**

**1-14. SYSTEMS INTRODUCTION.**

The IHMEE contains seven functional systems: the power train; engine system; electrical system; pneumatic system; hydraulic system; steering system; and the Heating, Ventilation, and Air-Conditioning (HVAC) system. This section explains the overall operation of the functional systems.

**1-15. POWER TRAIN.**



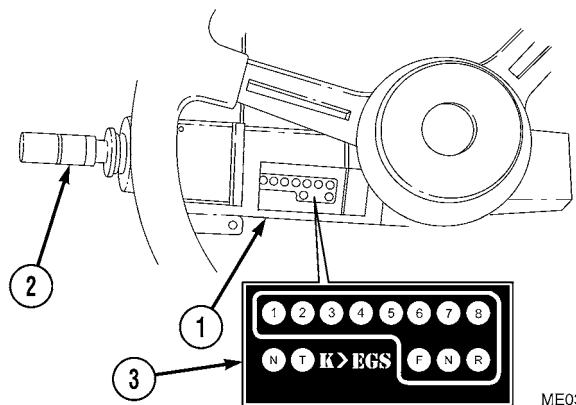
ME0354

Power for the vehicle is provided by a diesel engine (1) which is coupled directly to an automatic transmission (2). Power from the transmission is transferred to the front and rear axles (3) through the front and rear drive shafts (4) and U-joints (5).

**a. Engine.** The engine is a 185-hp, 6-cylinder, 5.88-L diesel engine.

**b. Automatic Transmission.** The transmission provides 12 gears and 8 speeds controlled by the Electronic Gear Selector (EGS): four high-range and four low-range forward gears, and two high-range and two low-range reverse gears.

The EGS (1) is comprised of a mechanical shift lever (2), a microcomputer, and an indicator display (3) integrated into the shift lever housing. The EGS computer system receives information internally from the shift lever (2) and externally from a speed sensor. This information, together with acquired vehicle speed information, is used to shift to the requested gear, or to prevent this while indicating this on the indicator display (3).

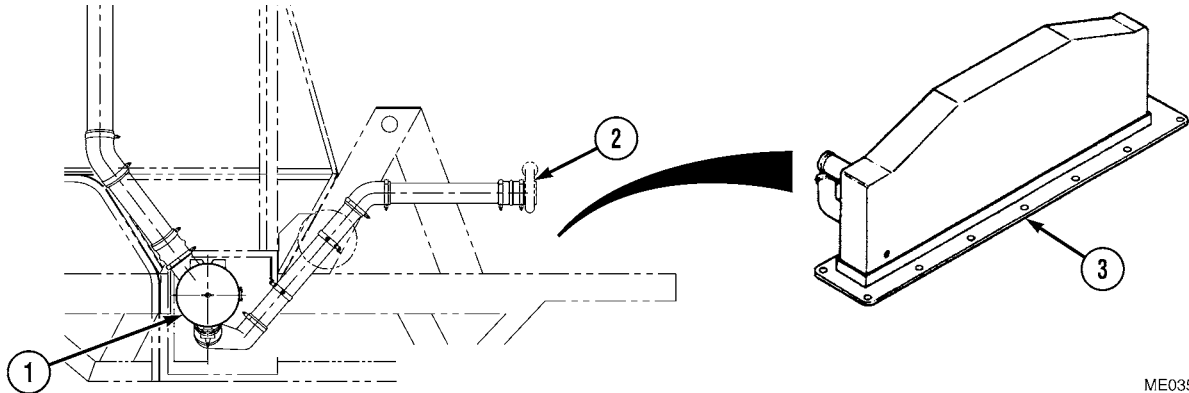


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**c. Axles and Suspension.** The front and rear axles are hub-reduction, full-floating, axle-shaft type. The front axle provides steering. The rear axle is nonsteering. Both the front and rear axles are equipped with wheel differentials. The front and rear suspensions consist of shock absorbers, air bags, and check straps. Check straps are used to limit the separation of the suspension and avoid damage to the air bags.

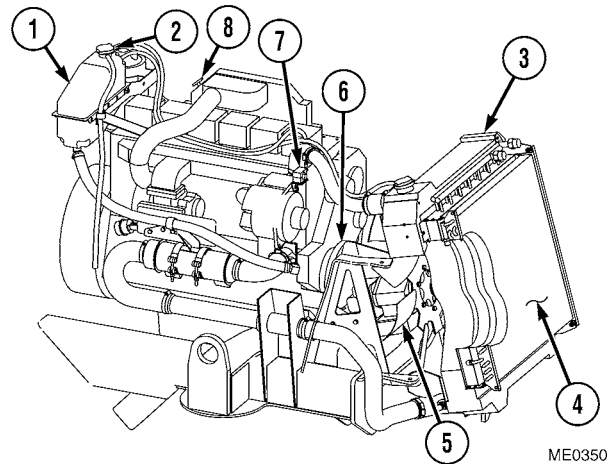
**d. Drive Shafts and U-Joints.** The drive shafts and U-joints transmit engine power to the axles.

**1-16. ENGINE SYSTEM.**



**a. Air Intake.** The air intake system consists of a dry-type air cleaner (1), a turbocharger (2), and an aftercooler (3). Engine exhaust gases flow through the turbocharger (2) driving a turbine wheel. A compressor wheel on the opposite end of the turbine wheel shaft rotates and draws in fresh air through the air cleaner (1). Air from the air cleaner (1) flows through the aftercooler (3) which cools the air before it is delivered to the engine cylinders.

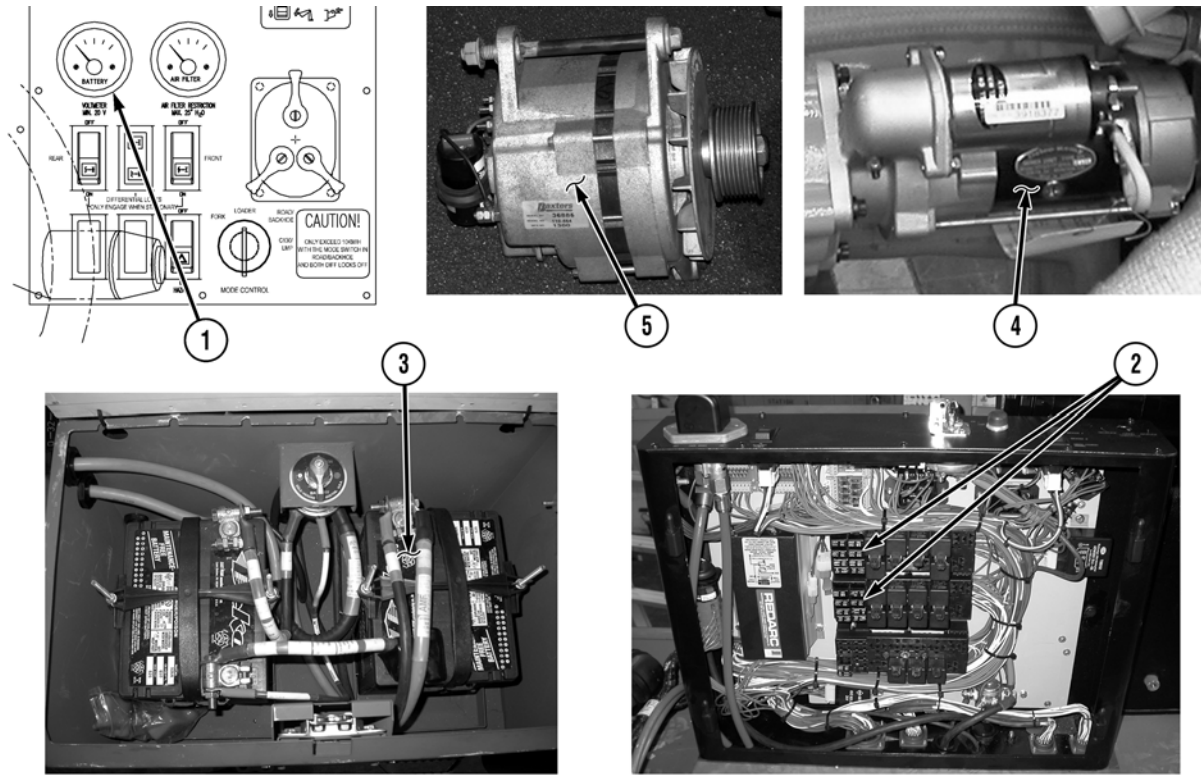
**b. Cooling System.** The pressure-type cooling system protects the engine by removing heat generated during the combustion process. Coolant is added to the coolant overflow tank (1) through the filler cap (2). Pressure within the cooling system is regulated by pressure releases in the filler cap (2) and a relief cap on the radiator. Hot coolant flows from the engine to the top radiator tank (3) and through the radiator core (4) where a stream of air removes heat. This air is drawn through the cores by a hydraulically activated fan (5). A water pump (6) draws the coolant from the bottom of the radiator and pushes it through the engine, repeating the cooling process. Thermostats (7), mounted in each coolant outlet elbow, remain closed until the coolant approaches a predetermined temperature at which time they open. When the coolant temperature drops below the thermostat rating, they close. An air vent line (8), between the radiator (3) and the water pump inlet, removes air trapped in the engine when the cooling system is being filled.



**c. Fuel System.** Fuel is drawn from the fuel tank by the fuel pump. It passes through the supply line to a fuel/water separator (Primary Fuel Filter) and a secondary fuel filter to the engine fuel injector pump. There, fuel is metered and sent to the six fuel injectors via the fuel injector lines. Surplus fuel from injectors is returned to the fuel tank through the return line. The fuel/water separator removes water and large solid particles from the fuel. The finer particles are removed by the secondary filter before they can enter the fuel injector pump.



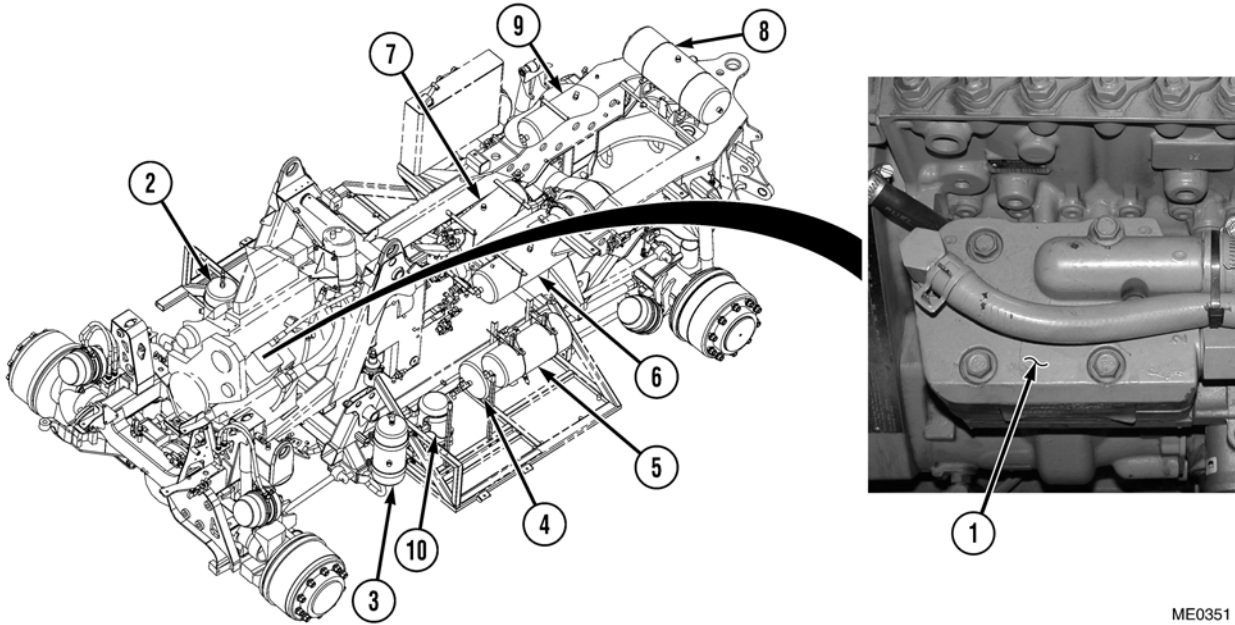
**1-17. ELECTRICAL SYSTEM.**



ME0353

The voltage and current for the electrical system are indicated by a voltmeter (1) located on the dash panel, inside the cab. Circuit breakers (2) located in the cab protect the main circuits. Electrical power is provided by two 12-Vdc series-connected batteries (3). Power is distributed throughout the vehicle by wiring harnesses. The harnesses are interconnected by pin connectors. A heavy-duty starting motor (4) is mounted on the engine flywheel housing and provides the cranking power necessary for starting the engine. The belt-driven alternator (5) maintains a 24-Vdc level for battery charging.

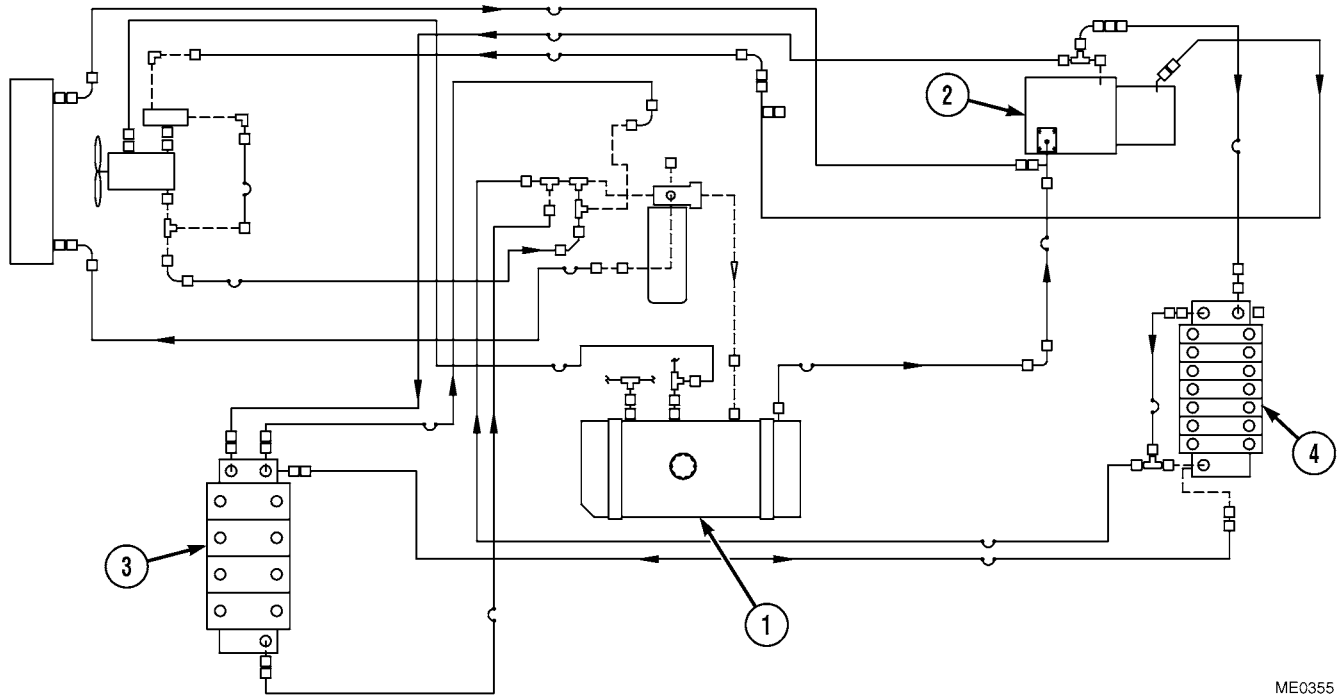
**1-18. PNEUMATIC SYSTEM.**



ME0351

The air system consists of an engine-driven air compressor (1) and eight air reservoirs (2) through (9). Air is drawn from the engine air intake and routed to the air compressor (1). Pressurized air flows from the air compressor through an aftercooler, a coalescing filter, and through an air dryer (10) where the air is cooled and the moisture/oil is removed. Moisture not removed by the air dryer will condense in the air reservoir. System air pressure is 119 psi (820 kPa). The air system includes the necessary valves and air lines to control the vehicles' air-operated devices. The air compressor supplies 15 cfm at 119 psi (3.25 m<sup>3</sup>/min. at 820 kPa). Air pressure in this system is shown by the red needle on the DUAL BRAKE PRESSURE gauge inside the cab.

**1-19. HYDRAULIC SYSTEM.**

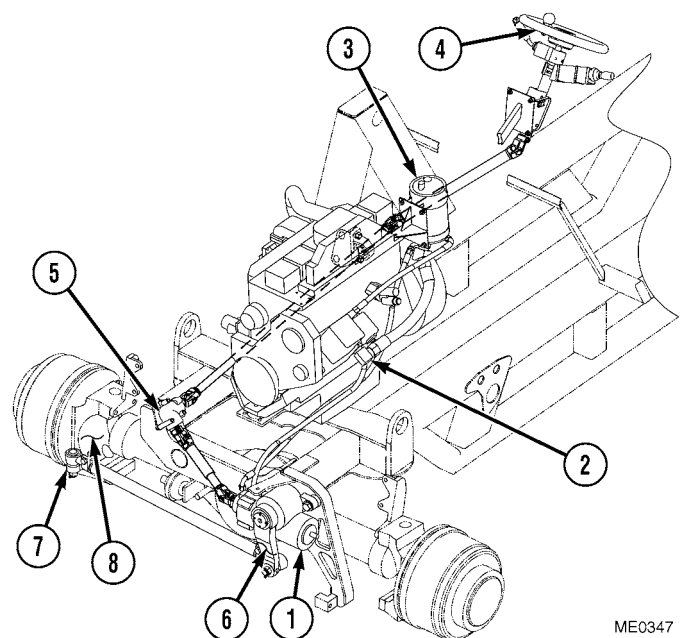


ME0355

Hydraulic reservoir (1) supplies the hydraulic pump (2), which is mounted on the back of the transmission on the left-hand side. Hydraulic pump (2) provides fluid power to the FEL, hose reel, and backhoe through hydraulic lines to the FEL valve block (3) and backhoe valve block (4).

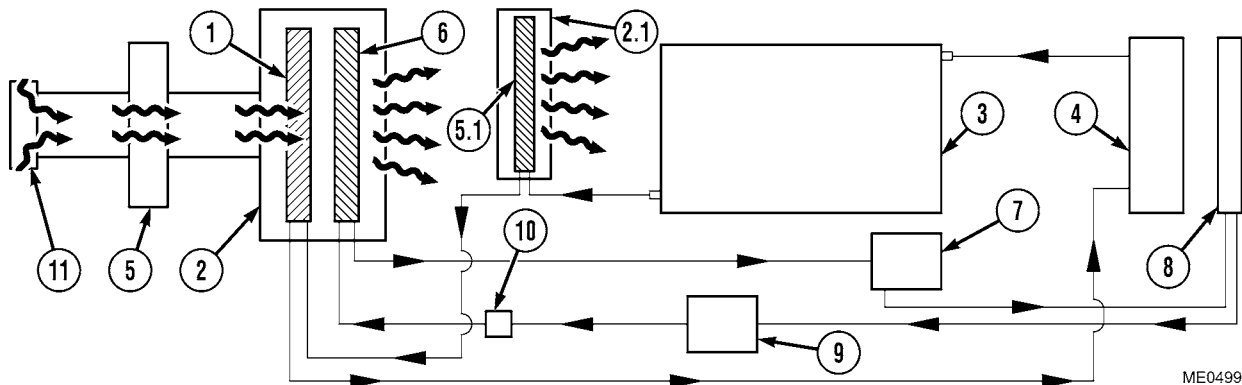
**1-20. STEERING SYSTEM.**

Power is supplied to the main steering gear box (1) by an engine-driven pump (2). The fluid reservoir (3) is separate from the main hydraulic system. The steering wheel (4) is mechanically linked to the steering gear box (1) by steering linkages and a miter box (5). When the steering wheel is rotated, the actuating valve in the steering gear box opens. Pressured oil is applied to one end of the steering gear piston, causing it to move the sector shaft and pitman arm. The pitman arm (6) is mechanically connected to the drag link (7). The drag link moves the steering mechanism on the front axles (8) to the left or right, causing the vehicle to steer in the same direction.



ME0347

**1-21. HEATING, VENTILATION, AND AIR-CONDITIONING (HVAC).**



ME0499

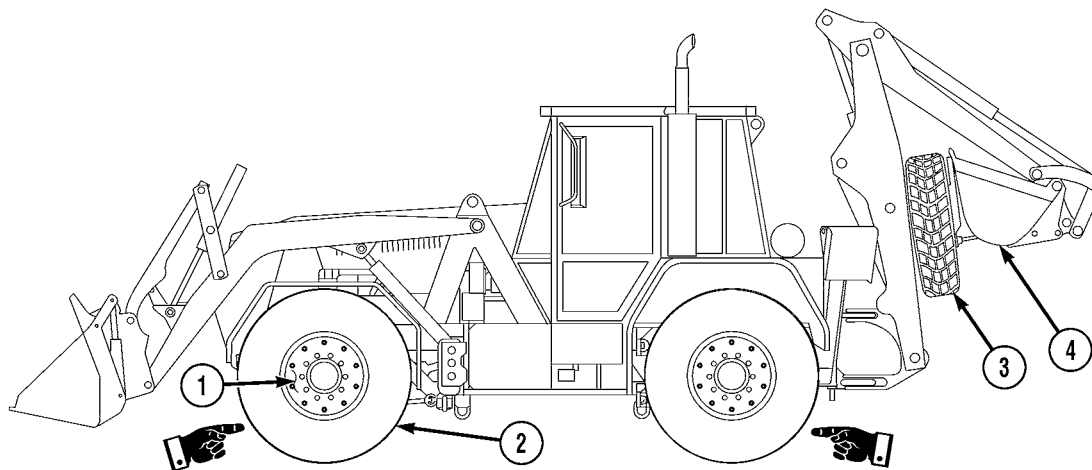
The IHMEE is equipped with an HVAC system that is capable of heating, cooling, and pressurizing the cab.

The cab heating system consists of a heater core (1) inside the cab A/C control unit (2), an auxiliary defroster (2.1), the engine (3), and the radiator (4). Hot coolant from the engine (3) flows to the auxiliary defroster (2.1) and the cab A/C control unit (2) before returning to the radiator (4). The cab air pressurizer (5) blows air through the heater core (1), extracting heat from the coolant to warm the cab. The auxiliary defroster (2.1) blows internal cabin air through its internal heater core (5.1) to defrost the windshield.

The cab cooling system consists of an evaporator (6) inside the cab A/C control unit (2), the A/C compressor (7) mounted on the engine (3), the A/C condenser (8), and the drier (9). R-134a refrigerant is pressurized by the A/C compressor (7) and then converted to a high-pressure liquid state by the A/C condenser (8). Liquid from the A/C condenser (8) passes through the drier (9), then to a thermal expansion valve (10), which meters the refrigerant to the evaporator (6). As expansion takes place within the evaporator (6), heat is absorbed, cooling and dehumidifying the air that the cab air pressurizer (5) blows through the evaporator (6).

In both heating and cooling, the air feeding into the cab A/C control unit (2) enters the cab through the A/C precleaner (11) and the cab air pressurizer (5), which also contains an air filter.

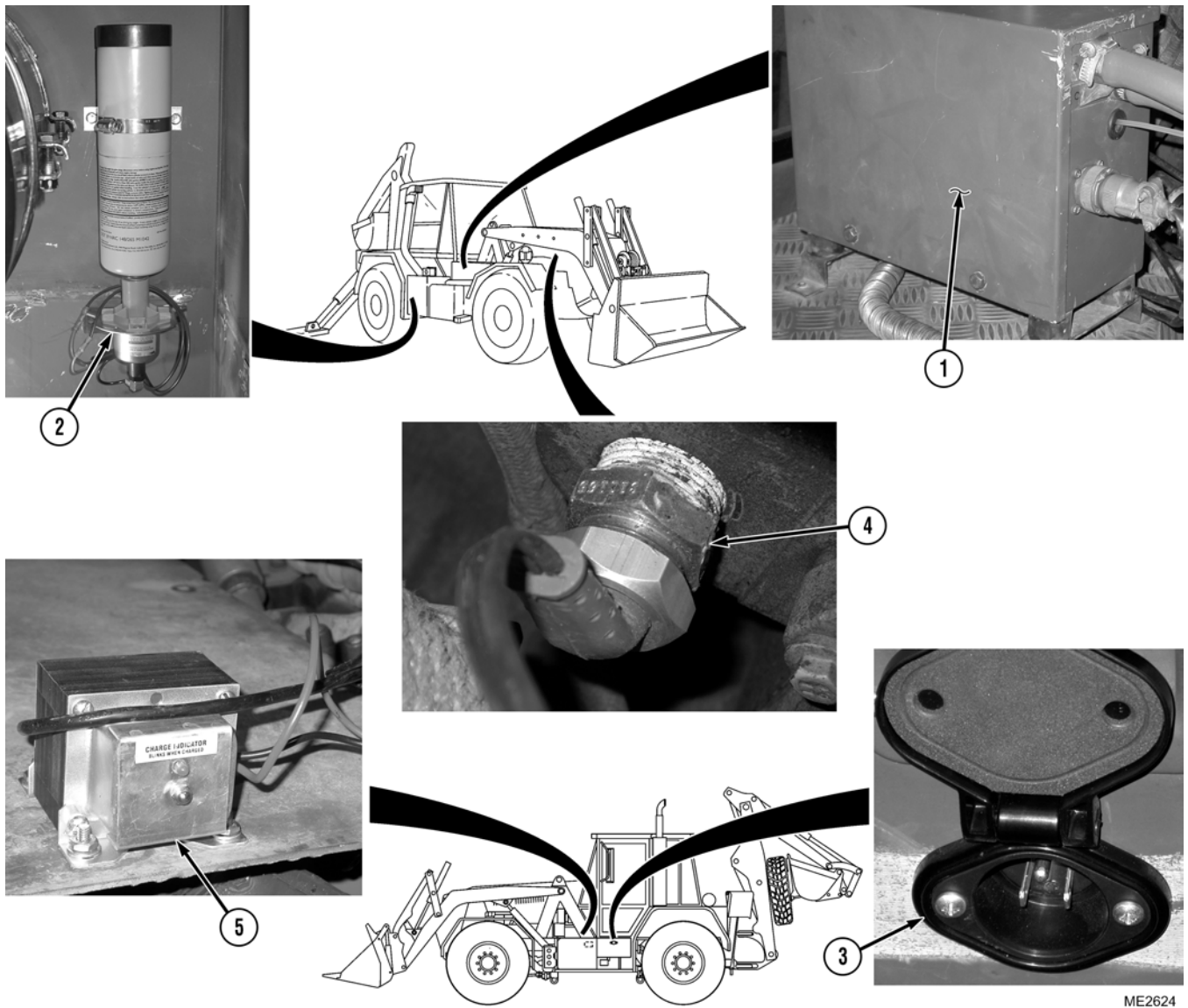
**1-22. WHEELS AND TIRES.**



ME0346

There are two front and two rear steel, two-piece, bolt-together, 24 x 10.00 wheels (1) with 14.00 R24 tubeless, steel radial tires (2). One spare tire (3) can be mounted to the backhoe bucket (4). All five tires have a run-flat insert that allows the IHMEE to be driven a limited distance on one or two flat tires.

**1-23. COLD WEATHER KIT.**



ME2624

In cold weather conditions, the IHMEE may be equipped with a cold weather kit capable of heating the engine block prior to starting the vehicle, assisting the starting procedure, and maintaining the batteries' charge in cold weather conditions.

The arctic heater (1) draws the cold coolant in from the return side of the cooling system and heats the coolant. The arctic heater then pushes the coolant out to the supply side of the cooling system, warming the engine prior to starting the vehicle.

The ether start (2) injects starting fluid into the engine air intake. The starting fluid burns more easily in very cold weather, and assists the starting procedure.

A standard power cord can be plugged into the electrical outlet (3). The electrical outlet allows the block heater (4) and battery trickle charger (5) to be supplied with 110-V power. The block heater allows the coolant to remain warm in cold weather. The battery trickle charger allows a steady current of electricity to be applied to the batteries to maintain their charge.



## CHAPTER 2

### SAFETY INSTRUCTIONS

<b>Contents</b>	<b>Para</b>	<b>Page</b>
Introduction.....	2-1	2-2
Precautions.....	2-2	2-2
Protective Clothing.....	2-3	2-2
Noise Protection.....	2-4	2-3
Vehicle Inspection.....	2-5	2-3
Safety Decals.....	2-6	2-3
Rollover Protection Structure (ROPS)/Falling Object Protection Structure (FOPS).....	2-7	2-3
Handholds and Steps.....	2-8	2-4
Mirrors.....	2-9	2-5
Seat Adjustment.....	2-10	2-5
Seat Belt Use and Maintenance.....	2-11	2-5
Safe Operation.....	2-12	2-5
Rollover.....	2-13	2-6
Passengers.....	2-14	2-6
Power Lines.....	2-15	2-6
Operating on Slopes.....	2-16	2-7
Traveling.....	2-17	2-7
Runaway Accidents.....	2-18	2-8
Transporting.....	2-19	2-9
Safe Servicing and Maintenance.....	2-20	2-9
Jacking and Jack Stand Placement.....	2-21	2-11
Cleanliness.....	2-22	2-11
Pressure Hazards.....	2-23	2-12
Flammable Fluids.....	2-24	2-12
Battery Explosions.....	2-25	2-13
Moving Parts Hazard.....	2-26	2-13
Scald/Burn Hazard.....	2-27	2-13
Manual Handling.....	2-28	2-14
Flying Debris Hazard.....	2-29	2-14
Crush Hazard.....	2-30	2-14
Disposal of Waste.....	2-31	2-15
Electromagnetic Interference.....	2-32	2-15
Carbon Monoxide Hazard.....	2-33	2-16

## Section I. General Safety.

### 2-1. INTRODUCTION.

This chapter contains the safety instructions for the Interim High-Mobility Engineer Excavator (IHMEE). Personnel responsible for the equipment covered in this manual must ensure it is properly and safely operated and maintained. Only appropriately qualified personnel should be employed in these activities.

Statutory and local requirements concerning work practices, safety, and health precautions must be observed. Where appropriate, warnings, cautions, and notes are included in the manual and are defined as follows:

#### **WARNING**

Calls attention to instructions which, if not correctly followed, may result in injury or death to personnel.

#### **CAUTION**

Calls attention to instructions which, if not strictly observed, may result in damage to equipment.

#### **NOTE**

Indicates an operating procedure, maintenance practice, or condition that requires highlighting.

### 2-2. PRECAUTIONS.

Carefully read and follow all safety signs on the vehicle and all safety messages in this manual. If a safety sign is damaged or missing, notify Unit maintenance.

Unauthorized modifications to the vehicle may impair its function or safety, affecting vehicle life. The safety information illustrates basic safety procedures of hydraulic Front-End Loader (FEL)/backhoe vehicles, however, it is impossible for this information to cover every hazardous situation that may be encountered. If in doubt, consult the supervisor before operating and maintaining the vehicle.

### 2-3. PROTECTIVE CLOTHING.

#### **WARNING**

Seat belts and protective headgear must always be worn when operating or driving in the vehicle. Failure to comply may result in injury or death to personnel.

Avoid wearing loose clothing, jewelry, or other items that can catch on control levers or other parts of the vehicle. Wear close-fitting clothing and safety equipment appropriate to the job.

Safety equipment that may be required includes:

- Hard hat
- Safety shoes or boots
- Safety glasses, goggles, or face shield
- Heavy gloves
- Hearing protection
- Reflective clothing
- Respirator or filter mask



## 2-4. NOISE PROTECTION.

### **WARNING**

APPROVED HEARING PROTECTION MUST BE WORN by operator and any personnel within 22 ft. (7 m) of an IHMEE at high idle or within 12 ft. (4 m) of an IHMEE at low idle. Personnel hearing can be PERMANENTLY DAMAGED if exposed to constant high noise levels of 85 dB (A) or greater. Personnel exposed to high noise levels shall participate in a hearing conservation program in accordance with DA PAM 501. Hearing loss occurs gradually but becomes permanent over time. Failure to comply may cause impairment or loss of hearing.

To avoid the risk of hearing damage, approved hearing protection devices must be worn in the situations specified. Personnel exposed to high noise levels shall participate in a hearing conservation program in accordance with DA Pam 40-501. Hearing loss occurs gradually, but becomes permanent over time.

## 2-5. VEHICLE INSPECTION.

To avoid the possibility of personal injury, inspect vehicle carefully each day or shift by walking around it before starting work. For additional details on PMCS and the walk around inspection, refer to TM 5-2420-230-10.

## 2-6. SAFETY DECALS.

Safety decals are fitted to the IHMEE to raise awareness of potential hazards. Refer to TM 5-2420-230-10 for locations of warning and caution stencils, decals, and data plates.

## 2-7. ROLLOVER PROTECTION STRUCTURE (ROPS)/FALLING OBJECT PROTECTION STRUCTURE (FOPS).

The IHMEE is fitted with a ROPS/FOPS which complies with the requirements of OSHA 1926-1001. The ROPS/FOPS is designed to protect the operator only during earth-moving operations.

Protection offered by the ROPS/FOPS will be impaired if it is subjected to structural damage. Any damage to the ROPS/FOPS must be reported to ADI Limited. Repairs may only be undertaken with the prior permission of ADI Limited. The ROPS/FOPS is integral with the chassis, therefore it is not to be modified in any way by welding, bending, drilling, or cutting.

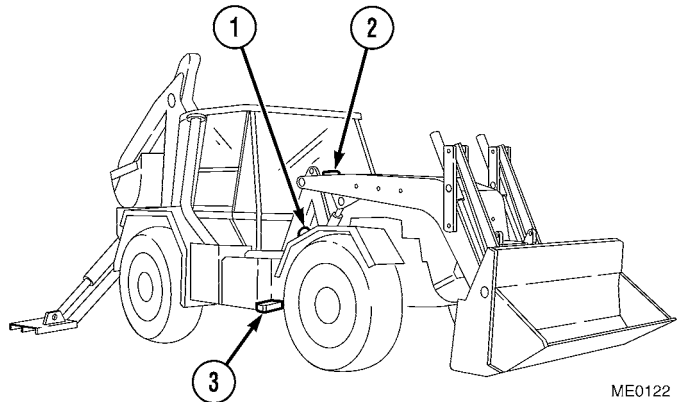
**2-8. HANDHOLDS AND STEPS.**

**WARNING**

- Failure to comply with the following may result in injury or death to personnel:
- Mount and dismount the IHMEE only where steps and/or handrails are provided. Do not use any controls as handholds.
- Clean shoes and wipe hands before climbing on the vehicle. Use handholds when mounting the IHMEE.
- Inspect, clean, and have any necessary repairs made to steps prior to mounting the IHMEE.
- Always use “three-point contact” with the IHMEE; face the vehicle when entering or leaving the cab. Three-point contact means that three out of four arms and legs are in contact with the vehicle at all times during mount and dismount.
- Never get on or off a moving IHMEE.
- Never jump off the IHMEE.
- Do not attempt to climb on or off the IHMEE while carrying tools or supplies.
- Never jump on or off a moving vehicle. Be careful of slippery conditions on platforms, handholds, and steps when leaving vehicle.
- Do not use the IHMEE as a platform.

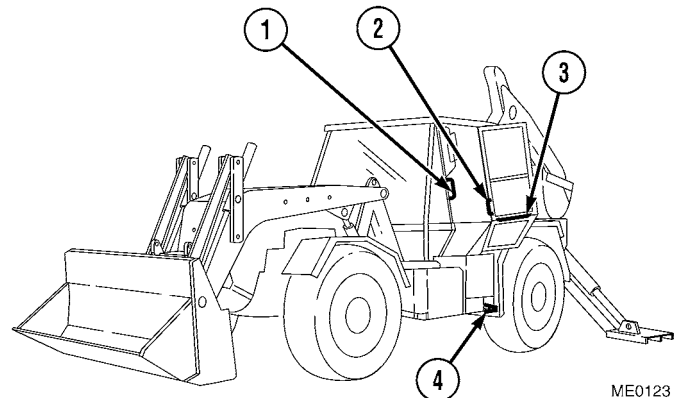
The following list shows the proper handholds and footsteps on the right side of the IHMEE:

- (1) Fender handhold
- (2) FEL handhold
- (3) Fuel tank footstep



The following list shows the proper handholds and footsteps on the left side of the IHMEE:

- (1) Door frame handhold
- (2) Cabin handhold
- (3) Door handhold
- (4) Battery box footstep



## 2-9. MIRRORS.

Each mirror should be adjusted to give a clear and unobstructed view behind the vehicle, with no blind spots.

## 2-10. SEAT ADJUSTMENT.

Ensure seat is adjusted to suit operator. The operator must be able to fully depress pedals when seated. If not, move seat forward and check again.

## 2-11. SEAT BELT USE AND MAINTENANCE.

### **WARNING**

The seat belts must always be worn when operating or driving the vehicle. Failure to comply may result in injury or death to personnel.

The seat belt will help keep the operator safe in the event of a collision or other accident. The seat belt, in conjunction with the ROPS/FOPS, will minimize the chance of injury from a rollover accident.

The seat belts must be maintained in a good condition. Carefully examine buckle, webbing, and fittings. Ensure seat belts operate correctly. Replace seat belt if it does not operate correctly or if it is damaged, worn, or deteriorated.

## Section II. Operational Safety.

## 2-12. SAFE OPERATION.

Check location of underground power cables, gas lines, and water mains before digging. Keep loading area smooth to assist with vehicle stability. Increase power gradually when pulling heavy load or when driving out of ditch or excavation.

Walk around vehicle to clear all personnel from area of operation and vehicle movement. Always check behind vehicle before selecting R (Reverse) gear. Drive carefully in congested areas, over rough ground, near ditches or excavations, and on slopes. Use vehicle lights to warn drivers of other vehicles in low-visibility conditions.

### **WARNING**

Ensure that no personnel are near or around the IHMEE when reversing during operations with vehicle lights set to BO DRIVE or BO MARKER. In this condition, the reverse alarm is not operational. Failure to comply may result in serious injury or death to personnel.

Be aware of the location of other personnel before moving vehicle. Reverse warning alarm must always be audible to warn personnel vehicle is moving in R (Reverse).

## 2-13. ROLLOVER.

### **WARNING**

Do not attempt to jump clear of a tipping vehicle; serious or fatal crushing injuries may result. Vehicle tips faster than driver can jump free. Failure to comply may result in injury or death to personnel.

To avoid rollovers:

- (1) Read and understand all instructions in this manual.
- (2) Carry tools and loads close to ground to aid visibility and lower center of gravity.
- (3) Balance loads so weight is evenly distributed and load is stable.
- (4) Be alert when operating on slopes.
- (5) Reduce speed before turning or swinging load.
- (6) Know capacity of vehicle's FEL and backhoe. Do not overload.
- (7) Be careful when operating at edge of excavation trench.
- (8) Avoid sharp turns.

## 2-14. PASSENGERS.

### **WARNING**

The ROPS/FOPS is designed only to protect the operator during earth-moving operations. Failure to comply may result in injury or death to personnel.

The IHMEE is designed to only safely carry the operator when driving or earth-moving. No other personnel are to ride on the vehicle. Unauthorized riders are subject to personal injury and also obstruct the operator's view, resulting in the vehicle being operated in an unsafe manner.

## 2-15. POWER LINES.

### **WARNING**

Serious injury or death can result from contact with electric power lines. Never move any part of vehicle or load closer to power lines than 9 ft. (3 m). Failure to comply may result in injury or death to personnel.

**2-16. OPERATING ON SLOPES.**

**WARNING**

Do not attempt to jump clear of a tipping vehicle; serious or fatal crushing injuries may result. Vehicle tips faster than driver can jump free. Failure to comply may result in injury or death to personnel.

Always travel straight up and down slopes, never at an angle or perpendicular to slope. Drive up slope in F (Forward) gear, and drive down slope in R (Reverse) gear. Remember: the danger of tipping is always present.

**CAUTION**

When traveling over uneven ground, it is important to keep the FEL active to allow it to be raised or lowered for ground clearance. Failure to comply may result in damage to equipment.

When traveling uphill or downhill with a loaded bucket, keep bucket on uphill side, as low as possible. If vehicle starts to slip or become unstable, lower bucket to ground and stop vehicle immediately.

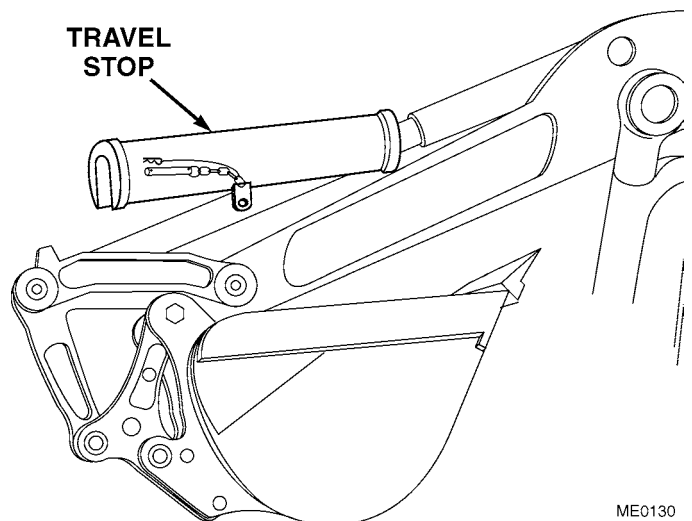
In steep slope conditions, use engine braking to maintain speed control of vehicle; however, do not allow engine to overspeed. Select a low gear speed before starting down slopes and use brakes to control speed of vehicle if necessary.

**2-17. TRAVELING.**

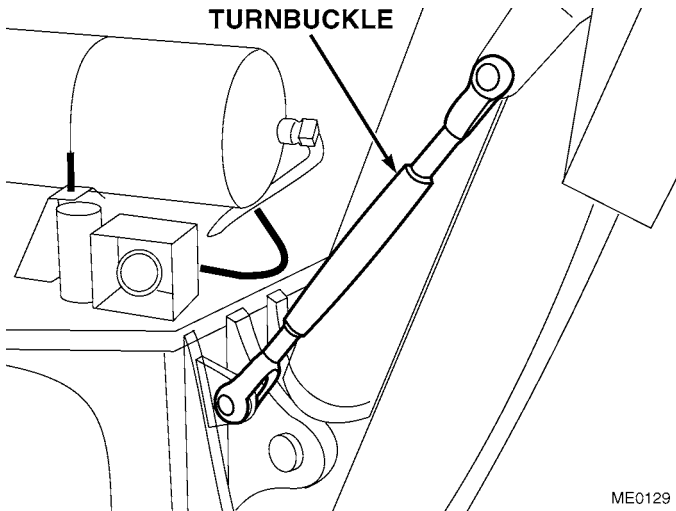
When traveling with a loaded bucket, position bucket as low as possible for better stability and visibility.

When driving the vehicle on a public road, comply with all local laws and regulations. For traveling at speeds in excess of 12 mph (20 km/h), the vehicle must be prepared as follows:

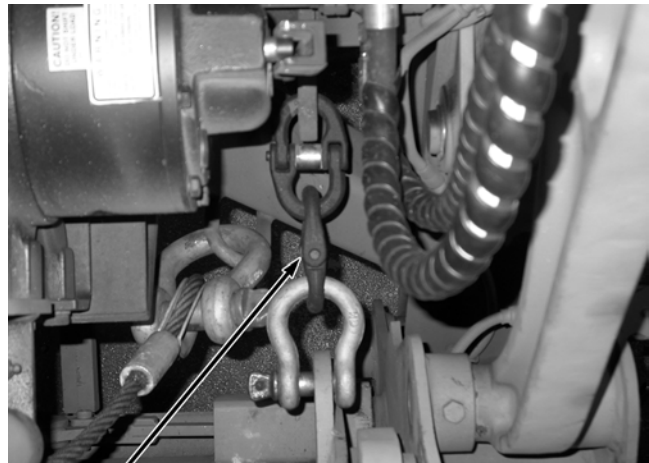
- (1) Set MODE CONTROL switch to ROAD/BACKHOE (TM 5-2420-230-10).
- (1.1) Ensure seat anchor is deployed (TM 5-2420-230-10).
- (2) Fit backhoe travel stop (TM 5-2420-230-10).



ME0130



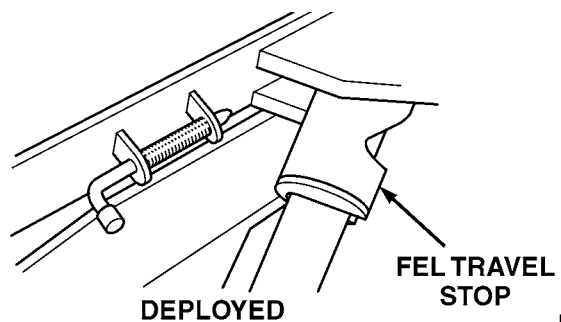
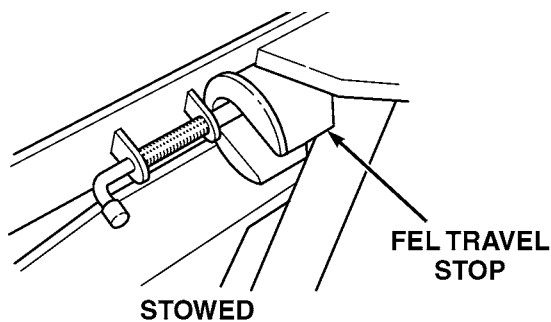
ME0129



LOCKING CLEVIS

ME0682

- (3) Fully raise stabilizer arms and secure turnbuckles (TM 5-2420-230-10).
- (4) Secure FEL locking clevis (TM 5-2420-230-10).



ME0782

- (5) Deploy FEL travel stops (TM 5-2420-230-10).
- (6) Place headlights on FEL bucket (TM 5-2420-230-10).

## 2-18. RUNAWAY ACCIDENTS.

### **WARNING**

Death or serious injury may result if you attempt to mount or stop a moving vehicle.

To avoid runaways:

- (1) Select level ground to park vehicle when possible.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Lower bucket to ground.
- (4) If you must park on a gradient, chock all wheels and lower bucket to ground.

## 2-19. TRANSPORTING.

Observe local laws and regulations when transporting vehicle on public road. Use suitable truck or trailer for transporting vehicle. For specific shipping requirements, refer to TM 5-2420-230-10.

Always load and unload IHMEE on solid, level surfaces, using a loading dock or ramp.

Select a low gear and 4WD mode while driving up or down ramps.

Do not operate any functions other than travel and service brakes when traveling up or down ramps, as this will unbalance vehicle.

When positioned on trailer or flatbed, tie down vehicle using tie-down points:

- (1) Position vehicle and chock all tires.
- (2) With the ignition switch ON, set MODE CONTROL switch to C130/LIMP and wait for suspension to lower.
- (3) Turn each airbag pneumatic control valve off.
- (4) Turn ignition switch OFF.
- (5) Secure vehicle using tie-down points.
- (6) Ensure you know height and weight of IHMEE on trailer.

## Section III. Maintenance Safety

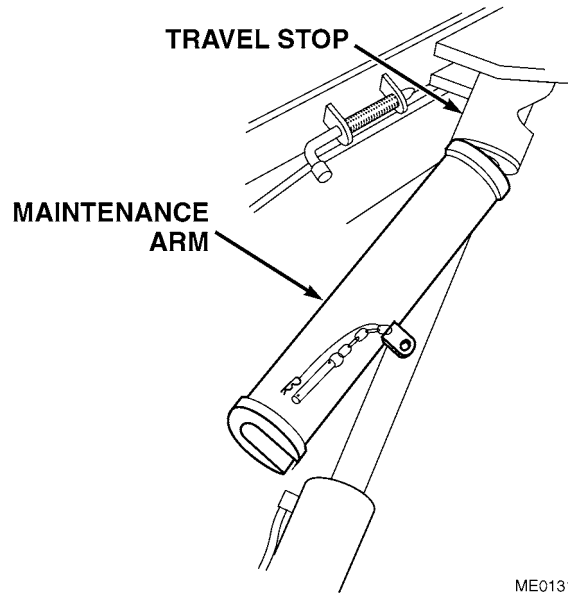
### 2-20. SAFE SERVICING AND MAINTENANCE.

Before performing any work on the IHMEE, prepare and isolate vehicle. It is important to understand all service procedures before undertaking any work.

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Ensure EGS shift lever is in N (Neutral) (TM 5-2420-230-10).
- (3.1) Ensure hose reel is stowed (TM 5-2420-230-10).

**WARNING**

- To prevent inadvertent movement of the FEL arms when installing the maintenance arm, CROSS COUNTRY DRIVING must be selected on the driving mode switch. Failure to comply may result in injury or death to personnel.
- If the FEL arms are required to be raised for service work, the maintenance arm must be fitted. Do not work under raised FEL arms unless the maintenance arm is fitted. Failure to comply may result in serious injury or death to personnel.
- Never work under vehicle raised by the FEL. If the vehicle must be raised, place supporting blocks under frame. Failure to comply may result in serious injury or death to personnel.



ME0131

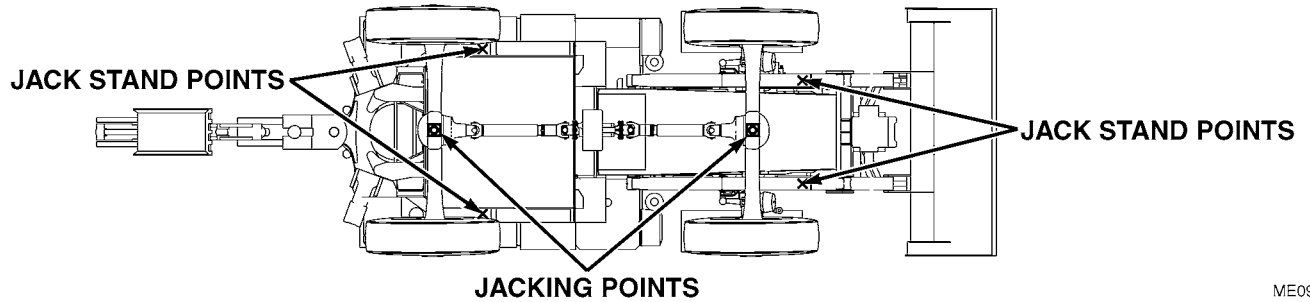
- (4) To secure FEL arms, lower bucket to ground or use travel stops and maintenance arm.
- (5) If engine is hot, run engine at idle speed without load for 2 min. to cool turbo.

**WARNING**

- Turn ignition switch to OFF to stop engine. Lock ignition switch in OFF position. Death or serious injury may result if the unsupported vehicle moves unexpectedly during maintenance.
  - Never lubricate or service vehicle while it is moving. Keep hands, feet, and clothing clear of moving parts. Failure to comply may result in serious injury or death to personnel.
  - If a maintenance procedure must be performed with the engine running, do not leave vehicle unattended. Failure to comply may result in injury or death.
- (6) Unless otherwise specified, shut OFF engine and place electrical master switch in OFF position (TM 5-2420-230-10).
  - (7) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).



**2-21. JACKING AND JACK STAND PLACEMENT.**



ME0951

**WARNING**

- Always securely support vehicle if required to work under it. Failure to comply may result in injury or death to personnel.
- Do not work on any item supported only by lift jacks or hoist. Always use blocks or proper stands to support the item prior to any work. Equipment may fall and cause injury or death to personnel.
- To prevent personal injury, exercise care when positioning vehicle stands beneath axle housing. Failure to comply may result in injury or death to personnel.

Using a 10-Ton jack, use the illustration above for placement of the jack and jack stand points for the IHMEE.

**2-22. CLEANLINESS.**

Keep engine compartment, radiator, batteries, hydraulic lines, fuel tank, lights, windows, BII toolboxes, and operator's station clean. Remove any grease, oil, or debris buildup to avoid possible injury or vehicle damage. Do not spray water or steam inside cab.

**2-23. PRESSURE HAZARDS.**

**WARNING**

- Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.
- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.

Always relieve pressure before disconnecting hydraulic or pneumatic lines. Upon completion of work, tighten all connections before restoring system pressure.

Hydraulic oil under pressure can penetrate skin, causing serious injury, blindness, or death. If a maintenance procedure must be performed on the hydraulic system, hydraulic pressure must be released prior to beginning any work.

Search for hydraulic leaks with a piece of cardboard, taking care to protect hands and body from high-pressure fluids. If an accident occurs, seek medical attention immediately. Any fluid injected into skin must be surgically removed without delay.

**2-24. FLAMMABLE FLUIDS.**

**WARNING**

- All fuels, most lubricants, and some coolants are flammable. Do not store flammable fluids in cab. Failure to comply may result in injury or death to personnel.
- Never use fuel to clean parts. Fuel is highly flammable. Failure to comply may result in injury or death to personnel.
- No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Failure to comply may result in injury or death to personnel.

Handle fuel with care. Do not refuel vehicle while smoking or when near open flame or sparks. Always shut OFF engine before refueling vehicle. Fill fuel tank and fuel cans outdoors.

## 2-25. BATTERY EXPLOSIONS.

### **WARNING**

Lead-acid battery gases can explode. Do not smoke, have open flames, or make sparks around a battery, especially if caps are off. Battery may give off gas which can explode. Failure to comply may result in injury or death to personnel.

Never check battery charge by placing metal object across posts. Do not charge frozen batteries; they may explode. Ensure battery compartment ventilation holes are not obstructed or blocked.

## 2-26. MOVING PARTS HAZARD.

### **WARNING**

Entanglement in moving parts can cause serious injury or death.

To prevent accidents, care should be taken to ensure hands, feet, clothing, jewelry, and hair do not become entangled when working around moving parts.

## 2-27. SCALD/BURN HAZARD.

### **WARNING**

- If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be relieved before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.
- Use a clean, thick waste cloth, rags, or like material to remove the cap. Avoid using gloves. If hot water soaks through gloves, personnel could be burned.
- Hot parts can burn personnel. Let hot parts cool before starting work.

After operation, the engine coolant is hot and is under pressure. Hot fluid and steam may be contained in engine, radiator, and heater lines. When removing radiator cap or coolant reservoir cap, ensure engine is cool and turn cap slowly to pressure-relief stop point. Allow all pressure to release before continuing to remove cap.

Engine oil, gear oil, and hydraulic oil become hot during operation. The engine, hoses, lines, and exhaust system also become hot. Wait for oil and components to cool before starting any maintenance or inspection work.

**2-28. MANUAL HANDLING.**

**WARNING**

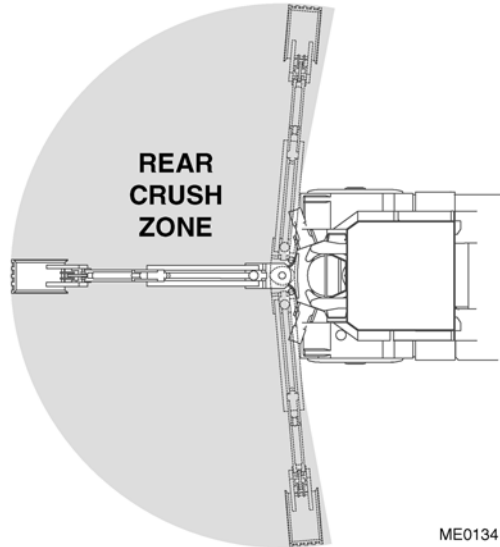
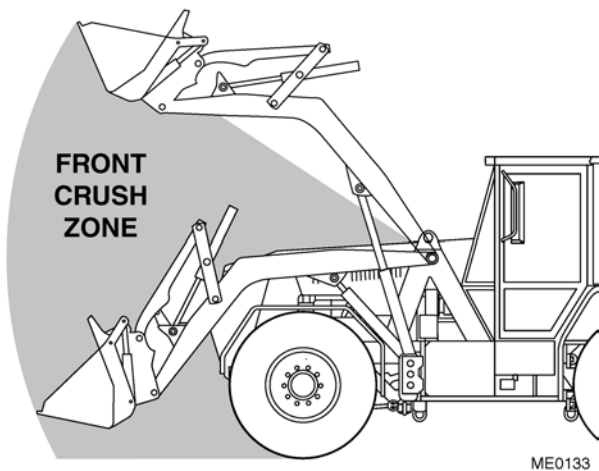
Follow safe working procedures when lifting or moving heavy items. Use an appropriate lifting device whenever part to be moved exceeds 50 lb. (23 kg). Failure to comply may result in injury or death to personnel.

Many of the operating and maintenance procedures require the manual handling of heavy items (e.g., changing a tire). Refer to appropriate manuals and regulations for guidance and follow all safe working procedures.

**2-29. FLYING DEBRIS HAZARD.**

Guard against injury from flying pieces of metal or debris. Wear safety glasses or goggles. Keep personnel away from the working area and take care when striking any object with IHMEE tools in order to avoid personal injury.

**2-30. CRUSH HAZARD.**



**WARNING**

Always securely support vehicle if required to work under it. Failure to comply may result in injury or death to personnel.

The front and rear crush zones are illustrated above.

Always lower attachment or implement to ground before working on vehicle. If you must work on a lifted vehicle or attachment, securely support them.

Do not support vehicle on soft or brittle blocks, hollow tiles, or props that may crumble under continuous load. Do not work under vehicle that is supported solely by a jack.

### **2-31. DISPOSAL OF WASTE.**

Follow appropriate regulations and Unit standard operating procedures on correct ways to recycle or dispose of waste. Potentially harmful waste includes such items as oil, fuel, coolant, brake fluid, filters, and batteries. Improper disposal of waste can threaten the environment and ecology.

Use leak-proof containers when draining fluids. Do not pour waste on ground, down drains, or into any water source.

Air-conditioning refrigerants escaping into the air can damage the atmosphere. Government regulations require a certified service center to recover and recycle used air-conditioning refrigerants.

### **2-32. ELECTROMAGNETIC INTERFERENCE.**

#### **WARNING**

If you experience problems operating any controls, turn off your SINGAR radio unit. Failure to comply may result in death or injury to personnel and/or damage to equipment.

Electronic controls, devices, and systems may be susceptible to electromagnetic interference (EMI) if inadequately shielded or otherwise configured for electromagnetic compatibility. When operating any of the vehicle's controls while the SINGAR radio is on, EMI could occur. If you notice controls not responding correctly, or at all, turn your SINGAR radio off.

Also, use of the hazard warning lights may cause emissions that could cause interference with some radio communications.

**2-33. CARBON MONOXIDE HAZARD.**

**WARNING**

CARBON MONOXIDE POISONING CAN BE DEADLY

- CARBON MONOXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS, WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCES SYMPTOMS OF HEADACHE, DIZZINESS, AND LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, OR COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.
- CARBON MONOXIDE OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO ENSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE:
  1. DO NOT operate engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.
  2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in the personnel compartments.
  3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
  4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either is present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm, DO NOT PERMIT EXERCISE; if necessary, administer artificial respiration (see FM 4-25.11).
- THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

## CHAPTER 3

### SCHEDULED MAINTENANCE AND TROUBLESHOOTING

<b>Contents</b>	<b>Para</b>	<b>Page</b>
PMCS Introduction. . . . .	3-1	3-1
Maintenance Forms and Records. . . . .	3-2	3-1
Preventive Maintenance Checks and Services. . . . .	3-3	3-1
General Maintenance Procedures. . . . .	3-4	3-2
Fluid Leakage. . . . .	3-5	3-3
Preventive Maintenance Checks and Services (PMCS) Table. . . . .	3-6	3-3
Maintaining Lubricant Levels. . . . .	3-7	3-19
General Lubrication Instructions. . . . .	3-8	3-19
General Preparation for Storage or Shipment. . . . .	3-9	3-24
Storage Maintenance Procedures. . . . .	3-10	3-24
Troubleshooting Introduction. . . . .	3-11	3-31
Troubleshooting Procedures. . . . .	3-12	3-31
Hydraulic Controls Error Codes Specification. . . . .	3-13	3-35
Types of Reaction of ECU to Failures Detected. . . . .	3-14	3-36
Auxiliary Hydraulics Backhoe Flow Rates. . . . .	3-15	3-37
Troubleshooting Table. . . . .	3-16	3-38

#### Section I. Preventive Maintenance Checks and Services (PMCS).

**3-1. PMCS INTRODUCTION.**

This section contains Unit PMCS requirements for the IHMEE. The PMCS tables contain checks and services necessary to ensure the vehicle is ready for operation. Using PMCS tables, perform maintenance at specified intervals.

**3-2. MAINTENANCE FORMS AND RECORDS.**

Every mission begins and ends with paperwork. There is not much of it, but it must be kept up. The completed forms and records have several uses. They are a permanent record of services, repairs, and modifications made on the vehicle. They are reports to Unit Maintenance and to your Commander. They are a checklist to know what was wrong with the vehicle after its last use, and whether those faults have been fixed. For information needed on the forms and records, see DA PAM 738-750.

**3-3. PREVENTIVE MAINTENANCE CHECKS AND SERVICES.**

- a.** Do the semiannual (S) PREVENTIVE MAINTENANCE once every 6 months or every 12,000 mi. (20 000 km), whichever comes first. Pay attention to the CAUTIONS and WARNINGS.
  
- b.** Do the annual (A) PREVENTIVE MAINTENANCE once a year or every 24,000 mi. (40 000 km), whichever comes first. Pay attention to the CAUTIONS and WARNINGS.
  
- c.** If something does not work, troubleshoot with instructions in Para 3-16.

- d. Always do PREVENTIVE MAINTENANCE in the same order until it gets to be habit. Once practiced, problems can be spotted quickly.
- e. If something looks wrong and cannot be fixed immediately, write it on DA Form 2404.
- f. When doing PREVENTIVE MAINTENANCE, take along the tools and supplies needed to make all the checks. Always take a clean cloth or two.

### 3-4. GENERAL MAINTENANCE PROCEDURES.

#### WARNING

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
  - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
  - Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- a. **Cleanliness.** Dirt, grease, oil, and debris only get in the way and may cover up a serious problem. Use degreasing solvent (Item 58, Appendix C) on all metal surfaces.
  - b. **Bolts, Nuts, and Screws.** Check bolts, nuts, and screws for obvious looseness, missing, bent, or broken condition. Look for chipped paint, bare metal, or rust around boltheads. If any part seems loose, tighten it, or report it to Unit Maintenance.
  - c. **Welds.** Look for loose or chipped paint, rust, or gaps where parts are welded together. If a bad weld is found, report it to Unit Maintenance.
  - d. **Electric Wires and Connectors.** Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and make sure wires are in good shape. If a bad wire or connector is found, report it to Unit Maintenance.
  - e. **Hydraulic Lines and Fittings.** Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots show leaks, and a stain around a fitting or connector could indicate a leak. If a leak comes from a loose fitting or connector, tighten it. If something is worn out or damaged, report it to Unit Maintenance.
  - f. **Damage to Vehicle.** Damage is defined as any conditions that affect safety or would render the vehicle unserviceable for mission requirements.



**3-5. FLUID LEAKAGE.**

It is necessary to know how fluid leakage affects the status of fuel, oil, coolant, and the hydraulic systems. The following are definitions of the different types/classes of leakage that determine the status of the vehicle. Learn, then be familiar with them, and REMEMBER – WHEN IN DOUBT, NOTIFY THE SUPERVISOR!



Equipment operation is allowable with minor leakage (Class I or II). Consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify the supervisor. When operating with Class I or II leaks, continue to check fluid levels as required in the PMCS. Class III leaks should be reported to the supervisor or to Unit Maintenance. Failure to comply may result in damage to equipment.

- a. **Class I.** Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
- b. **Class II.** Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked/inspected.
- c. **Class III.** Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

**3-6. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) TABLE.**

*Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE.*

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
1	Semiannual	Road Test	<p><b>PRIOR TO ROAD TEST</b></p> <p>Supervise Operator/Crew in performing PMCS listed in TM 5-2420-230-10.</p> <p><b>ROAD TEST</b></p> <p>Maintenance personnel will be with the vehicle's operator to assist in performing PMCS checks and verify preservice checks.</p> <p><b>NOTE</b></p> <p>The following will be performed during the road test. These inspections must be performed before any Unit-level PMCS, regardless of interval. For the road test, the vehicle will be driven at least 5 mi. (8 km) over different ground to give enough time to detect any malfunctions.</p> <p>a. Start engine (TM 5-2420-230-10).</p>	

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
	Semiannual	Road Test — Continued	<p style="text-align: center;"><b>WARNING</b></p> <p>Make sure personnel are clear of wheels before turning steering wheel. Failure to comply may result in injury or death to personnel.</p> <p>b. Notice if starter engages smoothly and turns the engine at normal cranking speed.</p> <p>c. Listen for unusual engine noise at idle, at operating speeds, and under acceleration. Be alert for excessive vibration and the smell of oil, fuel, or exhaust.</p> <p>d. Check for response to shifting and for smoothness of operation in all speed ranges. Be alert for unusual noises or difficulty shifting in any speed range.</p> <p>e. Test for response to accelerator feed. Check for sticking pedal.</p> <p>f. With vehicle speed approximately 5 mph (8 km/h), turn steering wheel left, then right, to detect steering backlash, shimmy, or freeplay of more than 1.5 in. (38 mm) in either direction. Vehicle should respond instantly. With vehicle moving on straight, level terrain, lightly hold steering wheel to check for pull and wandering.</p> <p>g. Apply brake pedal with steady force. The vehicle should slow down and stop without pulling to one side or jerking. Release brake pedal. The brakes should release immediately without difficulty.</p> <p>h. Observe vehicle's response to road shocks. Side sway or continuous bouncing indicates a malfunction.</p>	<p>Starter inoperative or makes excessive grinding sound.</p> <p>Engine knocks, rattles, or smokes excessively.</p> <p>Transmission shifts improperly, does not shift, or makes excessive noises.</p> <p>Pedal sticks or binds.</p> <p>Steering binds, grabs, wanders, or freeplay is more than 1.5 in. (38 mm) in either direction.</p> <p>Brakes chatter, pull to one side, are inoperative, or will not release.</p> <p>Handling is unstable.</p>
1.1	Semiannual	Preservice Checks	<p style="text-align: center;"><b>AFTER ROAD TEST</b></p> <p>a. Ensure vehicle has been cleaned and free of mud, gravel, etc., from underbody, outside, and crew compartment area.</p>	

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
	Semiannual	Preservice Checks — Continued	<div style="text-align: center; border: 2px dashed black; padding: 5px; margin-bottom: 10px;"> <b>CAUTION</b> </div> <p>Do not hold steering wheel at full left or full right for more than 10 sec. Oil overheating or pump damage can occur, resulting in damage to equipment.</p> <p>b. With vehicle stopped and engine running, turn steering wheel to extreme left, then to extreme right to check for hard steering.</p> <p>c. Check engine operation at all speeds. Ensure engine-governed speed (no load) is between 2,175-2,275 RPM.</p> <p>d. Raise FEL and support it with maintenance arm (TM 5-2420-230-10).</p> <p>e. Shut OFF engine (TM 5-2420-230-10).</p> <p>f. Jack vehicle and place on safety stands (Para 2-21).</p> <p>g. Remove belly plates (TM 5-2420-230-10).</p> <p>h. Open hood (TM 5-2420-230-10).</p> <p>i. Remove engine access panel (TM 5-2420-230-10).</p> <p>j. Remove hydraulic reservoir step plate (Para 13-15).</p> <p>k. Remove fuel tank step plate (Para 13-14).</p> <p>l. Remove firewall from inside cab (TM 5-2420-230-10).</p> <p>m. Release parking brake to position all hubs for checking proper oil level and set parking brake (TM 5-2420-230-10).</p>	<p>Hard steering is evident.</p> <p>Engine-governed speed (no load) is below 2,175 RPM or exceeds 2,275 RPM.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

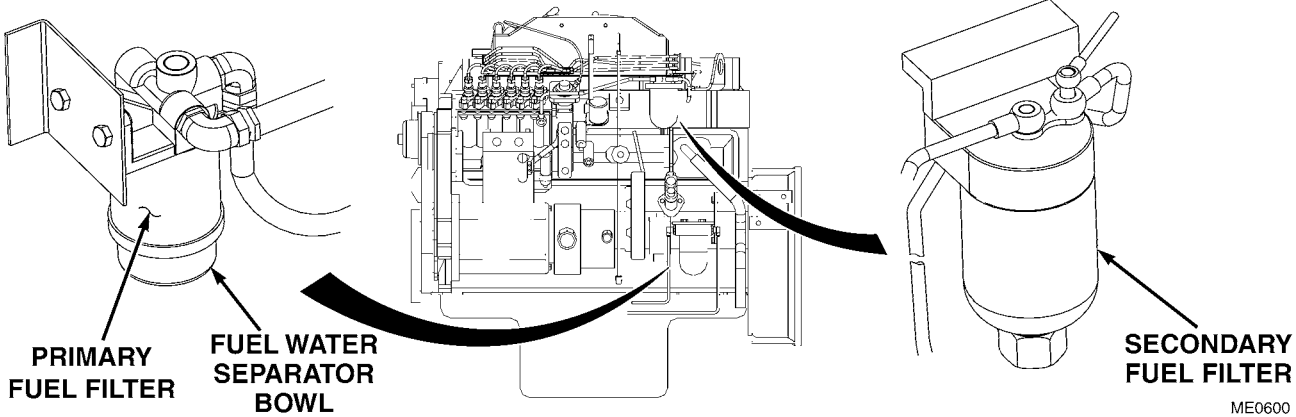
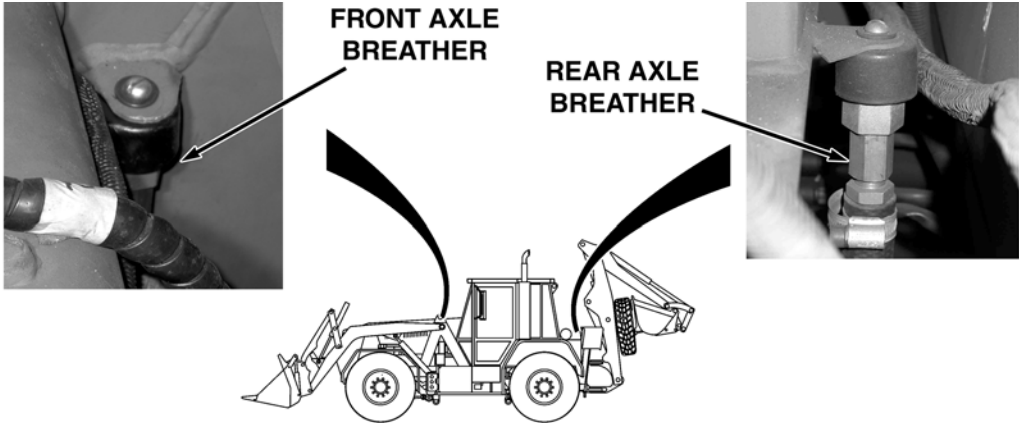
Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
2	Semiannual	Fuel System	 <p style="text-align: center;"><b>NOTE</b></p> <p>Do not discard fuel/water separator bowl.</p> <ol style="list-style-type: none"> <li>a. Replace primary and secondary fuel filter (Para 7-5).</li> <li>b. Inspect fuel/water separator for dents and cracks that could cause leaks.</li> <li>c. Inspect all fuel lines for loose connections, splits, cracks, and kinks that could leak.</li> </ol>	<p>Class III leak evident.</p> <p>Evidence of loose connections, splits, cracks, or kinks that could cause leaks.</p>
3		Axle Breathers	 <p>Clean axle and hub breathers (Para 14-8 and Para 14-9).</p>	<p>Axle or hub breathers are clogged.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

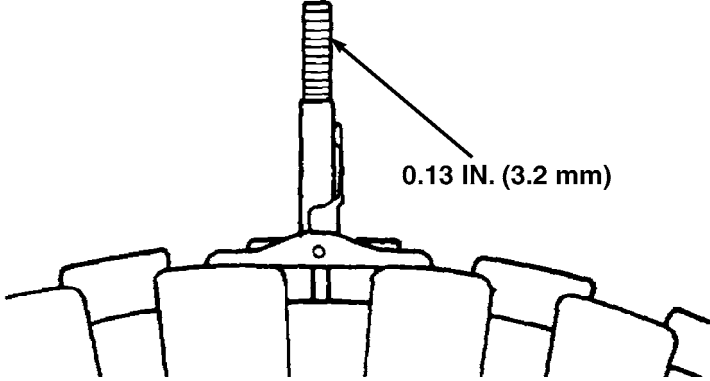
Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
4	Semiannual	Body	Inspect body for loose rivets, cracks, loose or missing bolts, and general damage.	Body has any damage that would hinder vehicle operation.
5	Semiannual	Tires	 <p style="text-align: right; margin-right: 20px;">ME0272</p> <ol style="list-style-type: none"> <li>a. Check wheel for separation, dents, bends, or breaks.</li> <li>b. Check each tire for tread depth, nicks, cuts, and gouges in accordance with TM 9-2610-200-14.</li> <li>c. Ensure each tire is properly inflated. Refer to TM 5-2420-230-10.</li> <li>d. Ensure all wheel lugnuts are tightened to 475-525 lbf/ft (644-712 N•m).</li> <li>e. Ensure all rim nuts are tightened to 294 lbf/ft (399 N•m).</li> </ol>	<p>Separation, dents, bends, or breaks are evident.</p> <p>Tread depth is less than 0.13 in. (3.2 mm). Nicks, cuts, or gouges are present.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
6	Semiannual	Steering	<p>a. Check steering gear box mounting bolts for looseness and leaks. If loose, tighten to 190 lbf/ft (258 N•m).</p> <p>b. Check steering column, U-joints, steering linkages, tie rods, and drag link for looseness, breaks, cracks, rust, and serviceability.</p> <p>c. Visually check tie rod and steering linkages for unusual damage.</p> <p>d. Check tie rod adjustment. Ensure there is 0.08 in. (2 mm) toe-in measurement between both tie rods (Para 5-17).</p> <div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p><b>WARNING</b></p> </div> <p>Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.</p> <p>e. Inspect power steering pump for leaks, cracks, or damage.</p>	<p>Bolts are loose and/or Class III leak evident.</p> <p>Looseness, breaks, or cracks are evident.</p> <p>Damaged tie rod ends are evident.</p> <p>Toe-in measurement is not 0.08 in. (2 mm) between tie rods.</p> <p>Cracks, damage, or Class III leaks are evident.</p>
7	Semiannual	Hydraulic System	<div style="text-align: center; margin-bottom: 10px;"> <p><b>NOTE</b></p> </div> <ul style="list-style-type: none"> <li>• After installing new filter element, fill hydraulic reservoir, operate engine for 5 min., and check hoses for leaks. Shut down engine and recheck fluid level (Para 3-8).</li> <li>• Oil and filter will be changed only when they are known to be contaminated, clogged, or when service is recommended by AOAP laboratory (Para 10-9 and Para 10-10).</li> <li>• If AOAP laboratory support is not available, change oil and oil filter at 6,000 mi. (9600 km) or every 12 months.</li> <li>• Change filter in new or rebuilt hydraulic system within 1,000 mi. (1 609 km) but no sooner than 497 mi. (800 km) (Para 10-10).</li> </ul>	

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
7	Semiannual	Hydraulic System — Continued	a. Follow routing of all hydraulic lines, hoses, and tubes to inspect for loose fittings, rubbing, chafing, cracks, bends, breaks, and leaks. Tighten if loose, and replace or repair hoses or lines that are damaged (Para 10-14).  b. Service FEL and backhoe valve blocks (Para 10-8).	Any loose fittings, excessive wear from rubbing, chafing. Cracks, bends, breaks, and any evidence of leaks.
8	Semiannual	Engine Compartment	<p style="text-align: center;"><b>NOTE</b></p> <ul style="list-style-type: none"> <li>• Small particles in engine oil are common; however, large metal particles indicate possible damage.</li> <li>• Oil and filter will be changed only when they are known to be contaminated, clogged, or when service is recommended by AOAP laboratory (Para 3-8 and Para 4-4).</li> <li>• If AOAP laboratory support is not available, change oil and oil filter at 3,000 mi. (4 800 km) or every 6 months.</li> </ul> a. Check all oil lines and hoses for frays, leaks, cracks, and wear that could leak.  b. Check oil filter housing and oil pan drain plug for looseness. Ensure all oil pan bolts are tight.  c. Check valve cover housing for evidence of leaks.  d. Check all engine compartment wiring harnesses for frays, splits, missing insulation, or poor connections. Replace any worn wiring.  e. Inspect alternator mounting for looseness. Inspect bracket and attaching hardware for cracks, bends, and loose mounting.	Frays, leaks, cracks or wear are evident.  Drain plugs or oil pan bolts are loose.  Class III leaks are evident.  Frays, splits, missing insulation or poor connections are evident.  Cracked, bent, or loose mounting are evident.

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
9	Semiannual	Cooling System	<p style="text-align: center;"><b>WARNING</b></p> <p>If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be relieved before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.</p> <p style="text-align: center;"><b>NOTE</b></p> <p>Coolant level should be visible at inspection glass (TM 5-2420-230-10).</p> <p>a. Check and maintain coolant (Item 3, Appendix C) in accordance with TB 750-651 and Para 3-8.</p> <p>b. Check all hoses and clamps for looseness, splits, wear, or cracks that could cause leaks.</p>	<p>Coolant condition/testing shows draining is required.</p> <p>Class III leakage is evident. Hoses are loose split, worn, or cracked.</p>
10	Semiannual	Battery Electrical System	<p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p style="text-align: center;"><b>NOTE</b></p> <p>Refer to TM 9-6140-200-14 for more specific details on battery maintenance.</p> <p>a. Inspect battery stowage box for corrosion and debris.</p> <p>b. Clean NATO slave receptacle terminals and coat with corrosion preventative compound (Item 15, Appendix C).</p>	<p>Excessive corrosion in battery box.</p> <p>Terminals are corroded.</p>



Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

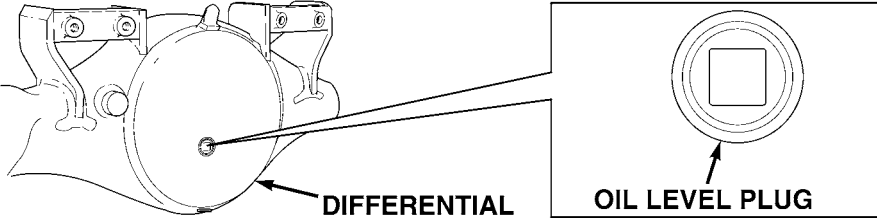

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
11	Semiannual	Air System	<p><b>NOTE</b></p> <p>In areas where it is common for the temperature to vary by approximately 30 °F (17 °C), small amounts of water can accumulate in the air system due to condensation. The presence of small amounts of condensation is normal.</p> <p>a. Drain air tanks (Para 15-4). If any moisture is forced out, inspect air dryer and replace air dryer desiccant (Para 15-12). If moisture is milky, blue, or green, serious internal malfunctions are indicated.</p> <p>b. Inspect eight air tank reservoirs, attaching valves, lines, and connections for loose mountings, bends, dents, and cracks that could cause leaks.</p>	<p>Moisture is milky, blue, or green.</p> <p>Loose mounting, bends, dents, cracks, loose air lines, or air leaks are evident.</p>
12	Semiannual	Differential and Hub Oil		<p>Excessive metal shavings are evident.</p>
13	Semiannual	Axles	<p>Drain and fill front and rear differential oil (Para 14-4) and check for metal shavings.</p> <p>Check upper and lower axle ball joints for excessive grease. Excessive grease indicates worn or damaged seal.</p>	<p>Excessive grease is evident.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
14	Semiannual	Brake System	 <p style="text-align: right; margin-right: 20px;">ME1726</p>	
15	Semiannual	Exhaust System	<p>a. Remove brake drums (Para 8-6).</p> <p>b. Check that brake shoe linings are not worn to less than 0.3 in. (8 mm).</p> <p>c. Inspect brake shoe linings for oil contamination and damage.</p> <p>d. Check brake drums for obvious grooves and uneven wear.</p> <p>e. Clean hub and brake shoe assemblies with degreasing solvent (Para 8-6).</p> <p>f. Install brake drums (Para 8-6).</p> <p>g. Inspect slack adjuster for damage and adjustment (Para 8-6).</p> <div style="text-align: center; margin: 10px 0;"> <div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div> </div> <p>Hot parts can burn personnel. Let hot parts cool before starting work.</p> <p>a. Inspect exhaust manifold, pipes, muffler, and tailpipe for corrosion and carbon deposits which may indicate leaks.</p> <p>b. Inspect exhaust system for damaged or loose pipes or clamps, and leaking gaskets or seals.</p>	<p>Brake shoe linings are less than 0.3 in. (8 mm) thick.</p> <p>Oil contamination or damage is evident.</p> <p>Deep grooves or uneven wear is evident.</p> <p>Slack adjuster is damaged or brake shoes can not be adjusted.</p> <p>Evidence of excessive corrosion or carbon deposits.</p> <p>Pipes or clamps are damaged, clamps are loose, or gaskets or seals are leaking.</p>

**Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued**

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
16	Semiannual	Transmission	<p style="text-align: center;"><b>NOTE</b></p> <ul style="list-style-type: none"> <li>• Oil and filter will be changed only when they are known to be contaminated, clogged, or when service is recommended by AOAP laboratory (Para 3-8 and Para 4-5).</li> <li>• If AOAP laboratory support is not available, change oil and oil filter at 6,000 mi. (9 600 km) or every 12 months.</li> <li>• Change filter in new or rebuilt transmissions in accordance with TB 5-2420-230-14.</li> </ul> <p>a. Check transmission for cracks, loose bolts, leaks, and obvious damage.</p> <p>b. Inspect transmission output shaft seal for damage and leaks.</p> <p>c. Operate vehicle and check for leaks.</p>	<p>Cracks, loose bolts, or obvious damage. Class III leaks are evident.</p> <p>Damage or Class III leaks are evident.</p> <p>Class III leaks are evident.</p>
17	Semiannual	Frame	<p>Check frame for cracks, breaks, bends, and excessive corrosion.</p>	<p>Cracks, bends, breaks, or excessive corrosion are evident.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
18	Semiannual	Propeller Shafts and U-Joints	<p style="text-align: center;"><b>NOTE</b></p> <ul style="list-style-type: none"> <li>• When using a grease gun, apply lubricant to fitting until clean lubricant squeezes out of part being lubricated.</li> <li>• Use proper lubricant to purge all four bearing seals of each U-joint. This flushes abrasive contaminants and ensures all four bearings are filled properly. Pop seals. These seals are made to be popped (Para 3-8 and Para 14-5).</li> <li>• When sure of proper lubrication, run bolts down until bearing plates are flush to yoke races, then back off slightly. Tighten bolts to 62 lbf/ft (84 N•m).</li> <li>• If any seals fail to purge, move driveshaft from side to side while applying grease gun pressure. This allows greater clearance on thrust end of bearing that is not purging. If seals still do not purge, rock vehicle by releasing parking brake. This removes windup in the driveline and allows for greater clearance on the thrust end of the U-joint.</li> <li>• Due to the U-joint seal’s design, there will occasionally be one or more bearing seals of a joint that may not purge. Seal tension then has to be released.</li> <li>• To release seal tension, loosen bolts holding bearing assembly that does not purge. It may be necessary to loosen bearing assembly approximately 0.06 in. (1.5 mm), minimum. If loosening does not result in purging, remove bearing assembly to determine cause of blockage.</li> <li>• When lubricating splines of propeller shafts, apply grease to spline fitting until lubricant appears at pressure relief hole. Cover hole with finger and continue adding grease until it appears at sleeve yoke seal.</li> </ul> <p>a. Inspect all propeller shafts for bends and cracks.</p> <p>b. Inspect U-joints for wear, play, and broken or missing lubrication fittings. There should be no free play at U-joint.</p>	<p>Any evidence of bends or cracks.</p> <p>Broken or missing lubrication fittings. Free play at U-joint.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued



Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
19	Semiannual	Seat belts	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><b>SEAT ANCHOR</b></p> </div> <div style="text-align: center;">  <p><b>OPERATOR SEAT</b></p> </div> <div style="text-align: right;"> <p>ME1725</p> </div> </div> <div style="text-align: center; margin-top: 20px;"> <div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div> <ul style="list-style-type: none"> <li>• Failure to properly inspect and maintain seat belts can cause serious injury or loss of life.</li> <li>• If the replacement of any part of the seat belt is required, the entire belt assembly must be replaced. Failure to comply may result in injury or death to personnel.</li> </ul> <ol style="list-style-type: none"> <li>a. Check for worn webbing at latch and D-loop areas.</li> <li>b. Check D-loop for free rotation, deformation, cracks or damage.</li> <li>c. Check latch and buckle for wear, deformation, damage or broken casing.</li> <li>d. Check that retractor is not locked up and spools out/retracts webbing properly.</li> <li>e. Check all seat belt mounting hardware for looseness and other damage.</li> </ol> </div>	<p>Webbing is cut, frayed, or excessively worn.</p> <p>D-loop does not rotate freely or is deformed, cracked or broken.</p> <p>Molded plastic around buckle/latch is deformed, cracked or broken.</p> <p>Retractor does not operate properly or is cracked or broken.</p> <p>Hardware is loose, missing, rusted, corroded or damaged.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
20	Semiannual	Postservice Checks	<p style="text-align: center;"><b>NOTE</b></p> <ul style="list-style-type: none"> <li>• If performing the next higher service, vehicle conditions must remain the same.</li> <li>• If not performing the next higher service, the following must be performed prior to final road test:                             <ul style="list-style-type: none"> <li>• Operate engine for 5 min., and check housing for leaks. Shut OFF engine, check crankcase oil level, and bring oil level to full mark.</li> </ul> </li> </ul> <ol style="list-style-type: none"> <li>a. Jack vehicle and remove safety stands (Para 2-21).</li> <li>b. Install belly plates (TM 5-2420-230-10).</li> <li>c. Close hood (TM 5-2420-230-10).</li> <li>d. Install engine access panel (TM 5-2420-230-10).</li> <li>e. Install hydraulic reservoir step plate (Para 13-15).</li> <li>f. Install fuel tank step plate (Para 13-14).</li> <li>g. Install firewall cover (TM 5-2420-230-10).</li> </ol>	
20.1	Semiannual	Road Test	<p style="text-align: center;"><b>FINAL ROAD TEST</b></p> <p>After all services and inspections have been completed, take vehicle on short road test to ensure all corrections have been accomplished. Correct any defects or malfunctions that occur during this test.</p> <p>During road test:</p> <ol style="list-style-type: none"> <li>a. Listen for any unusual noises.</li> <li>b. Check steering operation.</li> <li>c. Check operation of brakes.</li> <li>d. Check transmission operation - all ranges.</li> <li>e. Note any loss of power or rough running engine.</li> <li>f. Check driveline operation.</li> </ol>	<p>Unusual noises present.</p> <p>Steering abnormal.</p> <p>Brakes inoperable.</p> <p>Does not shift properly.</p> <p>Loss of power or rough running.</p> <p>Unusual vibration.</p>

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
21	Annual	Air Intake System	a. Inspect air cleaner, hoses, and tubing for proper installation, cracks, breaks, or loose connections that could let unfiltered air get into air system.  b. Replace air filter element (Para 13-27.1).	Improper installation, cracks, breaks, or loose connections are evident.
22	Annual	Power Steering Oil Filter	Replace power steering oil filter (Para 5-5).	
23	Annual	Air System	<p style="text-align: center;"><b>NOTE</b></p> <p>In areas where it is common for the temperature to range by approximately 30 °F (17° C), small amounts of water can accumulate in the air system due to condensation. The presence of small amounts of condensation is normal.</p> a. Check air compressor and air governor for loose mounting.  b. Inspect air drier for dents, cracks, and corrosion that may cause leaks.  c. Inspect air drier desiccant for holes and contamination (Para 15-12).  d. Start engine (TM 5-2420-230-10) and watch DUAL AIR PRESSURE gauge. Needle should move up as pressure builds.  e. After several minutes, gauge should stop between 120-125 psi (827- 862 kPa) as governor cuts out. When governor cuts out, released air from air drier can be heard. If governor does not cut out between 120-125 psi (827-862 kPa), adjust governor (Para 15-9).	Looseness of mounting hardware.  Dents, cracks, excessive corrosion, or leaks are evident.  Holes or contamination are evident.  Needle does not move.  Air pressure below 120-125 psi (827-862 kPa) or governor will not adjust.
23.1	Annual	Arctic Heater (If Equipped)	Remove glow pin (Para 20-10) and check for damage. Replace if necessary.	Glow pin damaged or corroded.

Table 3-1. Unit Level Preventive Maintenance Checks and Services (PMCS) for IHMEE. — Continued

Item No.	Interval	Item to be Checked or Serviced	Procedure	Not Fully Mission Capable If:
24	Annual	Postservice Checks	<p style="text-align: center;"><b>NOTE</b></p> <p>Operate engine for 5 min., and check housing for leaks. Shut OFF engine, check crankcase oil level, and bring to full mark.</p> <p>a. Jack vehicle and remove safety stands (Para 2-21).</p> <p>b. Install belly plates (TM 5-2420-230-10).</p> <p>c. Close hood (TM 5-2420-230-10).</p> <p>d. Install engine access panel (TM 5-2420-230-10).</p> <p>e. Install fuel tank step plate (Para 13-14).</p> <p>f. Install hydraulic reservoir step plate (Para 13-15).</p> <p>g. Install firewall (TM 5-2420-230-10).</p>	
25	Annual	Road Test	<p style="text-align: center;"><b>FINAL ROAD TEST</b></p> <p>After all services and inspections have been completed, take vehicle on short road test to ensure all corrections have been accomplished. Correct any defects or malfunctions that occur during this test.</p> <p>During road test:</p> <p>a. Listen for any unusual noises.</p> <p>b. Check steering operation.</p> <p>c. Check operation of brakes.</p> <p>d. Check transmission operation - all ranges.</p> <p>e. Note any loss of power or rough-running engine.</p> <p>f. Check driveline operation.</p> <p>g. Check for oil leaks.</p>	<p>Unusual noises present.</p> <p>Steering abnormal.</p> <p>Brakes inoperable.</p> <p>Does not shift properly.</p> <p>Loss of power or rough running.</p> <p>Unusual vibration.</p> <p>Class III leak evident.</p>



## Section II. Lubricating Instructions.

### 3-7. MAINTAINING LUBRICANT LEVELS.

Lubricant levels must be checked as specified in the crew level PMCS (TM 5-2420-230-10), the PMCS Table (Para 3-3) and the General Lubrication Instructions (Para 3-8). Steps must be taken to replenish and maintain lubricant levels.

### 3-8. GENERAL LUBRICATION INSTRUCTIONS.

#### WARNING

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
  - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
  - Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- a. **Cleaning Fittings Before Lubrication.** Clean parts with Degreasing Solvent MIL-PRF-680 (Item 58, Appendix C) or equivalent. Dry before lubricating. Dotted arrow points indicate lubrication on both sides of the equipment or in multiple locations.
  - b. **Lubrication After Forging.** If forging operation occurs, lubricate all fittings below forging depth, and check axles for contamination.
  - c. **Lubrication After High-Pressure Washing.** After a thorough washing, lubricate all grease fittings and oilcan points outside and underneath vehicle.
  - d. **Localized Views.** A reference to the appropriate localized view is given after most lubrication entries. Localized views begin on page F-23.
  - e. **Notes.**
    - (1) **COLD TEMPERATURE OPERATION.** For operating of equipment in expected continuous temperatures below 0 °F (-18 °C), remove lubricants prescribed in Table 3-2 for temperatures above 0 °F (-18 °C). Relubricate with lubricants specified in Table 3-2 for temperatures 0 °F to -50 °F (-18 °C to -46 °C). After changing to OEA, drain one pint of oil from oil sampling valve.
    - (2) **ENGINE, TRANSMISSION, HYDRAULIC SYSTEM.**
      - (a) **Transmissions.** Operate engine 1 minute at 1,500 RPM, then idle until transmission reaches normal operating temperature. With engine idling, check transmission dipstick. If oil level is on or below LOW line, add oil. Approximately 1 qt. (0.9 L) of oil is required to bring oil level from bottom of LOW band to desired level between LOW and FULL band. See Para 3-6.

- (b) **Crankcase.** Check oil level with vehicle parked on level ground and the engine off and cool. Do not overfill.
- (c) **Army Oil Analysis Program (AOAP).** Refer to TB 43-0211 for sampling requirements. Refer to TM 5-2420-230-10 for additional information regarding the AOAP for the IHMEE.

After expiration of warranty, active Army units will send an engine oil sample to an AOAP laboratory for analysis every 100 hours of operation or 90 days, whichever occurs first. Reserve and National Guard units will send an oil sample to an AOAP laboratory for analysis every 100 hours of operation or 180 days, whichever occurs first.

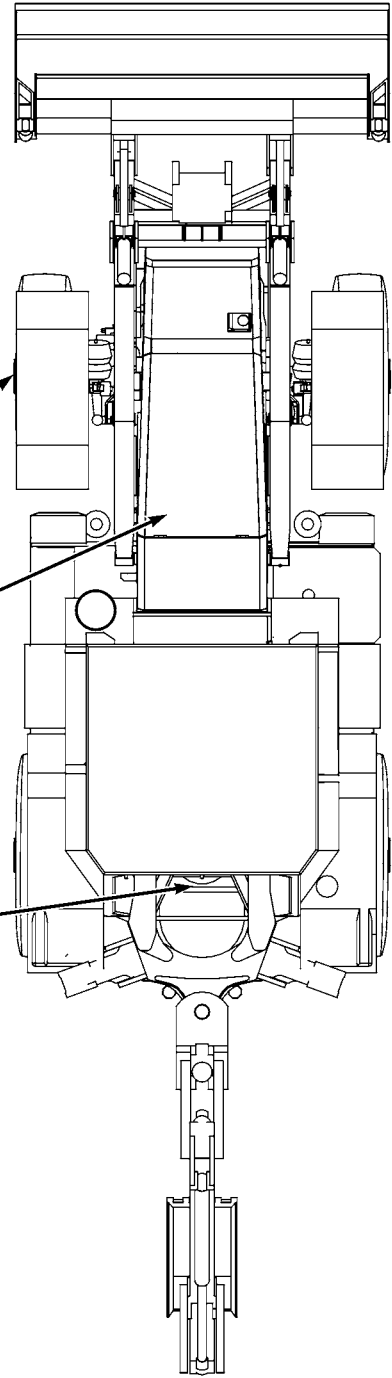
Intervals for sampling as well as draining and refilling lubricants may be changed by an AOAP laboratory.

If AOAP laboratory support is not available, drain and refill crankcase oil every 3,000 mi. (4 800 km) or every 6 months, whichever comes first, and drain and refill transmission oil every 6,000 mi. (9 600 km) or annually, whichever comes first. Drain and refill hydraulic reservoir every 6,000 mi. (9 600 km) or annually, whichever comes first.

- 1 After the engine's initial warranty period, crankcase oil will be changed only when directed by an oil analysis laboratory. When AOAP laboratory support is not available, change oil and filter element(s) at prescribed hardtime intervals, 3,000 mi. (4 800 km) or 6 months, whichever occurs first.
- 2 After the transmission's initial warranty period, transmission oil will be sampled every six months, 500 hours of operation or 1,000 mi. (1 600 km), whichever occurs first. Reserve and National Guard units will sample every 180 days or 1,000 mi. (1 600 km), whichever occurs first. Transmission oil will be changed only when directed by an oil analysis laboratory. When AOAP laboratory support is not available, change oil each 6,000 mi. (9 600 km) or 12 months, whichever occurs first.
- 3 Hydraulic reservoir oil will be sampled every 12 months. Oil will be changed only when directed by an oil analysis laboratory. When AOAP laboratory support is not available, change oil every 6,000 mi. (9 600 km) or 12 months, whichever occurs first.

**Table 3-2. Lubricants by Temperature Range.**

LUBRICANTS		EXPECTED TEMPERATURES				DESERT CONDITIONS
		CAPACITIES	Above +15 °F (Above -9 °C)	+40 to -15 °F (+4 to -26 °C)	+40 to -50 °F (+4 to -46 °C)	
OE/HDO- (MIL-PRF-2104)	Lubricating Oil Ice, Tactical	17.3 qt. (16.4 L)	OE/HDO-15/40	OE/HDO-15/40  or OEA	OE/HDO-15/40  or OEA	OE/HDO-40
	Lubricating Oil Ice, Arctic					
	Engine w/Filter Transmission					
Dexron III OE/HDO- (MIL-PRF-46167)	Hydraulic Reservoir w/Filter	160.6 qt. (152 L)	Dexron III	Dexron III	OEA	For arctic operation, refer to FM 9-207.
Dexron III OE/HDO- (MIL-PRF-46167)	Power Steering Reservoir w/Filter	1.1 gal. (4 L)	Dexron III	Dexron III	OEA	
GO- (MIL-PRF-2105)	Differential, Front Differential, Rear	9 qt. (8.5 L) 10.3 qt. (9.7 L)	GO-85/140	GO-85W/140 or GO-80W/90 See note c.	GO-80W/90 or GO-75 See note d.	
GO- (MIL-PRF-2105)	Axle Hub, Front Axle Hub, Rear	1.6 qt. (1.5 L) 1.22 qt. (1.15 L)				
Oilcan Points		As required.	OE/HDO-30	OE/HDO-10	OEA	
GO- (MIL-PRF-2105)	Oil, Lubricating, Gear, Multipurpose, Oil-Lubed Wheel Bearings		GO-85/140	GO-85/140 or GO-80/90 See note c.	GO-80/90 or GO-75 See note d.	
Antifreeze (Ethylene Glycol) (A-A-52624)	Type I (Standard)	31.7 qt. (30 L)	Use above -50 °F (-46 °C)			
	Type IP (Arctic)	31.7 qt. (30 L)	Use in extended periods of -40 °F (-40 °C) and below.			
Grease, Automotive and Artillery (GAA) (MIL-PRF-10924)		As required.	GAA all temperatures			
<b>KEY NOTES:</b>						
<p>a. OEA must be used when temperatures are consistently below 0 °F (-18 °C).</p> <p>b. OE/HDO-15/40 must be used when temperatures are consistently above 0 °F (-18 °C).</p> <p>c. GO-85/140 must be used when temperatures are consistently above 30 °F (-1 °C).</p> <p>d. GO-80/90 must be used when temperatures are consistently above -15 °F (-26 °C).</p> <p>e. After changing to OEA, drain 1 pint of oil from oil sampling valve.</p> <p>f. Refer to Appendix C for lubricant National Stock Number information.</p>						
<b>INTERVALS:</b>						
<p>S (Semiannually) - 500 Hours/6 Months</p> <p>A (Annually) 1,000 Hours/12 Months</p>						



**Hub**  
Drain and Refill Four Hubs.  
(See Views 1 and 2)

**Power Steering**  
Drain.  
(See View 3)  
Fill.  
(See View 4)  
Replace Oil Filter.  
(See View 4)

**Axle**  
Drain and Refill.  
(See View 5)

 **Interval**  
S/500 hours

Annual

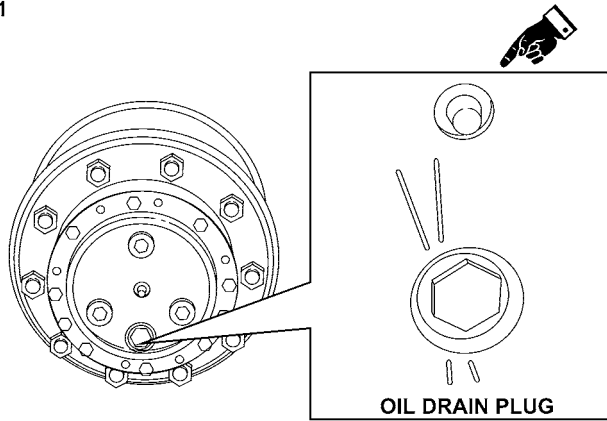
Annual

Annual

S/500 hours

**TOP VIEW**

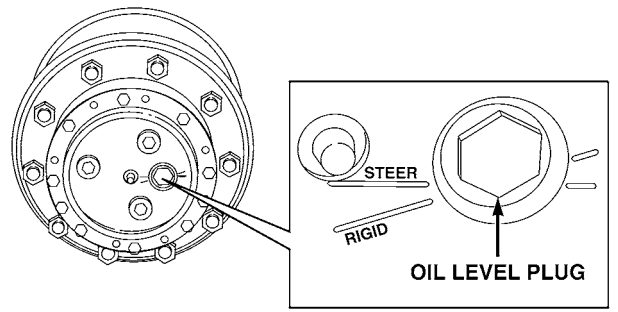
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ME0816

AXLE HUB

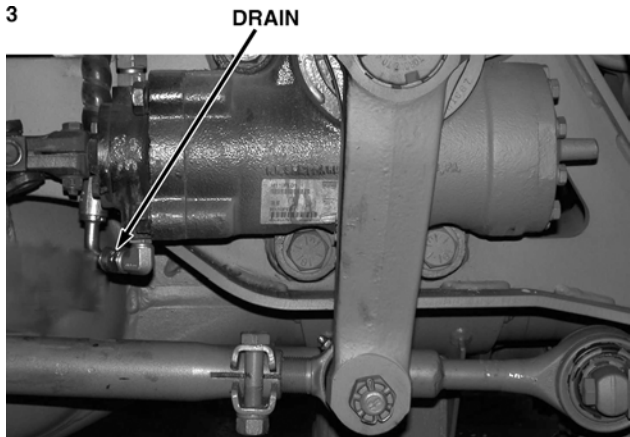
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ME0815

AXLE HUB

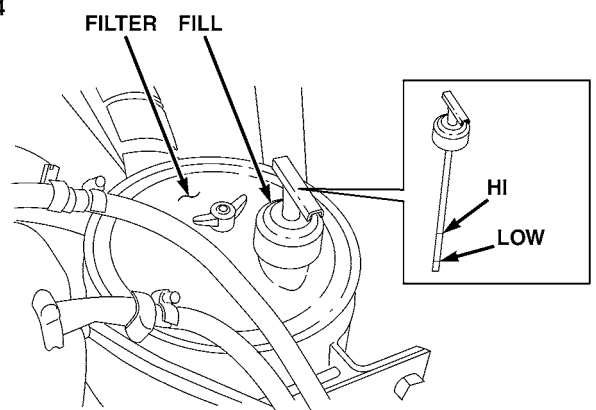
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ME0813

MITER BOX

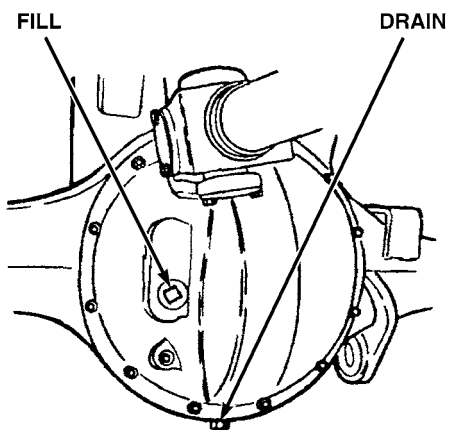
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ME0812

POWER STEERING RESERVOIR

5



ME0833

AXLE

### Section III. Preparation for Storage or Shipment.

#### 3-9. GENERAL PREPARATION FOR STORAGE OR SHIPMENT.

Instructions in this section apply to the vehicle to make it available for use upon receipt after shipment. The storage instructions apply to vehicles being taken out of service for a period up to 1 year without exercise. If vehicles are inactive for more than 1 year, they will use extended storage procedures.

- a.* Instructions pertaining to administrative storage are covered in AR 750-1.
- b.* Instructions pertaining to security procedures are covered in TB 9-2300-422-20.
- c.* Instructions pertaining to storage and maintenance of propositioned materiel configured to unit sets are covered in TM 38-450.
- d.* Instructions for overseas shipment are covered in TB 9-2300-281-35.
- e.* Perform all Unit Preventive Maintenance Checks and Services (PMCS).
- f.* Correct all deficiencies noted during inspection if facilities are available. If repairs required are beyond the scope of Unit Maintenance, refer the deficiencies to Direct or General Support Maintenance.
- g.* Refer to TB 9-2300-281-35 for Basic Issue Items (BII) and Components of End Items (COEI) packing instructions. Information pertaining to BII and COEI storage locations are covered in Appendix B of TM 5-2420-230-10.
- h.* Remove rust and corrosion, and scrape any flaked and peeling paint. Dry all surfaces to be painted and coated with preservatives. Refer to TM 9-247: Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Material and Related Materials Including Chemicals.
- i.* Repaint surface, as required, to prevent against deterioration. Refer to TM 43-0209: Painting Instructions for Field Use, Color, Marking, and Camouflage Painting of Military Vehicles.

#### 3-10. STORAGE MAINTENANCE PROCEDURES.

- a.* Before placing vehicle in storage, perform the following tasks:
  - (1) Clean exterior and interior of cab, engine, and undercarriage. Wash any oil, grease, or mud from tires.
  - (2) Conduct visual inspection of vehicle. Check lubricant levels and tire pressures. Correct any discrepancies.
  - (3) Completely lubricate chassis and all ancillary equipment in accordance with TM 5-2420-230-10.
  - (4) Check condition of engine air cleaner. Service if necessary (Para 13-27.1).
  - (5) Coat all exposed unpainted surfaces, such as hydraulic cylinders, axle ball sockets, drive shafts, and shift cables with grease (Item 30, Appendix C).
  - (6) Clean batteries and battery cables with sodium bicarbonate solution (Item 57, Appendix C) and rinse with fresh water.
  - (7) Protect all tires from direct sunlight.

- (8) If possible, store vehicles close together, out of direct sunlight, and away from electrical or generating equipment.



Ensure tires are not resting on surface containing grease or oil. Failure to comply may result in tire damage.

- (9) Park vehicle to allow access for inspection, maintenance, and exercising.

**b. Short-Term Storage Preparation.**

**NOTE**

- If the vehicle is to be placed into short-term storage, park it inside a building when possible and a place on suitable safety stands to prevent tire sidewall damage. If a building is not available, park vehicle in a dry area on suitable planks and cover with a sealed waterproof covering.
  - To prevent seals and gaskets in the power train and hydraulic systems from failing it is recommended that every 6 months the vehicle are taken out of storage and started up and driven until the engines and transmissions reach normal operating temperature and both hydraulic systems are exercised.
- (1) If possible, elevate vehicle on suitable safety stands with tires free turning to prevent sidewall damage.
  - (2) Prepare suspension as per tie-down procedures by turning MODE CONTROL switch to C130/LIMP position. After all air is expelled from air bags, turn off isolator valve at each air bag.
  - (3) Touch up any paint areas where the paint has exposed bare metal (TM 43-0209).
  - (4) Drain fuel tank (Para 7-7). Add approximately 2 gal. (8 L) of diesel flushing oil (Item 41, Appendix C) to fuel tank and run engine until exhaust smoke is blue-white in color. Drain remaining diesel flushing oil from tank.
  - (5) Drain cooling system and leave drain valve open. Loosen radiator cap (Para 9-4).

**NOTE**

Steps (6) through (9) only need to be performed if the vehicle has been in service for over 100 hours. New vehicles will not require draining.

- (6) Drain and refill engine with new oil and replace oil filter (Para 4-4).
- (7) Drain and refill transmission with new oil and replace transmission filters (Para 4-5).
- (8) Drain and refill hydraulic reservoir and replace filter (Para 10-9).
- (9) Drain and refill power steering system and replace filter (Para 5-5).
- (10) Relieve hydraulic pressure from hydraulic system (Para 10-5).
- (11) Place "Do Not Operate" tag on the ignition switch (TM 5-2420-230-10).
- (12) Remove batteries from vehicle (Para 12-6) and keep fully charged (TM 9-6140-200-14).
- (13) Drain all air tanks (Para 15-4).

**c.** While vehicle is in storage, perform the following tasks monthly:

- (1) Install batteries (Para 12-6).
- (2) If engine is run every 30 days or less, use lubricating oil OE/HDO (Item 44, Appendix C). If engine is not run every 30 days or less, use preservative lubricating oil (Item 46, Appendix C) and change oil filter (Para 4-4) or warranty will not be maintained (refer to TM 5-2420-230-14).
- (3) Conduct visual inspection of vehicle. Check for oil leaks, lubricant levels, coolant level, and tire pressures. Correct any discrepancies.
- (4) Inspect oilcan points. Lubricate if necessary (TM 5-2420-230-10).
- (5) Ensure parking brake is ON, shift transmission to N (Neutral), start engine, and idle for 10 minutes. After 10 minutes of engine idle, operate engine for 5 min. at 1,500 rpm or until engine coolant temperature reaches 180 °F (82 °C). Shift transmission slowly through all gear selector positions. Return transmission to N (Neutral).
- (6) Move vehicle 30 ft. (9 m) in F (Forward) and R (Reverse).
- (7) Idle engine 10 min. before shutdown.
- (8) Check grease coating on all chromium-plated and unpainted surfaces. If grease was wiped from chromium-plated or unpainted surfaces when vehicle was moved, recoat these surfaces with grease (Item 30, Appendix C).
- (9) Remove batteries from vehicle (Para 12-6) and keep fully charged (TM 9-6140-200-14).

**d.** While vehicle is in storage, perform the following tasks quarterly:

- (1) Perform all monthly tasks.
- (2) Exercise all ancillary equipment (TM 5-2420-230-10).
- (3) Drive vehicle at least a quarter mile (0.5 km). While driving, shift transmission through all gear ranges.

**e.** While vehicle is in storage, perform the following tasks yearly:

- (1) Perform all quarterly tasks.
- (2) Clean exterior and interior of cab, engine, and undercarriage. Wash any oil and grease from tires.
- (3) Clean batteries and battery cables with sodium bicarbonate solution (Item 57, Appendix C) and rinse with fresh water. Keep batteries fully charged and clean (TM 9-6140-200-14).
- (4) Completely lubricate chassis and all ancillary equipment in accordance with TM 5-2420-230-10.





The only coolant authorized for use in the IHMEE is Ethylene-Glycol. To avoid possible internal damage to the engine cooling system, use only Ethylene-Glycol coolant.

### NOTE

Ethylene-Glycol is supplied ready to use at the correct concentration and therefore there is no need to mix it prior to filling the cooling system. Approximately 32 qt. (30 L) of Ethylene-Glycol coolant is required to totally fill the cooling system.

- (5) Check coolant level. Test coolant to ensure that cooling system is protected against corrosion and temperatures down to -30 °F (-34 °C). Add Ethylene-Glycol coolant (Item 3, Appendix C) if cooling system is not adequately protected (TB 750-651).
- (6) Change engine oil and oil filter (Para 4-4). Change fuel filters (Para 7-5).

**f.** Extended Storage Procedures (Vehicle Inactive).



When vehicle is to remain inactive for more than 6 months, long-term storage procedures must be performed to prevent damage due to rust, corrosion, or organic growth in the fluids.

### NOTE

- When vehicle is to remain inactive for more than 6 months, long-term storage procedures must be performed to maintain the vehicle warranty.
  - To prevent seals and gaskets in the power train and hydraulic systems from failing it is recommended that every 6 months the vehicle are taken out of storage and started up and driven until the engines and transmissions reach normal operating temperature and both hydraulic systems are exercised.
- (1) Elevate on suitable safety stands with tires free turning to prevent sidewall damage. Deflate tires and re-inflate with nitrogen (Item 39, Appendix C) to prevent corrosion.
  - (2) Prepare suspension as per tie-down procedures by turning MODE CONTROL switch to C130/LIMP position. After all air is expelled from air bags, turn off isolator valve at each air bag (TM 5-2420-230-10).
  - (3) Completely lubricate chassis and all ancillary equipment in accordance with (TM 5-2420-230-10).
  - (4) Main hydraulic and steering hydraulic systems long-term storage:



To avoid overfilling, drain an amount of oil equal to amount being added before installing additive, or damage to equipment may result.

- (a) Drain amount of oil from main hydraulic reservoir equal to quantity of additive being added (Para 10-9).
  - (b) Add 6 qt. (5.7 L) vapor corrosion inhibitor (Item 16, Appendix C) or equivalent to main hydraulic reservoir.
  - (c) Operate all hydraulic equipment.
  - (d) Turn steering wheel to full right turn and then full left turn. Repeat this cycle three times.
  - (e) If additional storage time is required, repeat steps (a) and (b) at yearly intervals.
  - (f) Relieve hydraulic pressure from hydraulic systems (Para 10-5).
- (5) Drain and refill power steering system, replace oil filter (Para 5-5).
- (6) Axle long-term storage:



To avoid overfilling, drain an amount of oil equal to amount being added before installing additive, or damage to equipment may result.

#### NOTE

If storage exceeds 12 months, axles must be resealed by regional service dealer.

- (a) Drain amount of oil from axle equal to quantity of additive being added.
  - (b) Add 17.0 fl. oz. (0.50 L) of vapor corrosion inhibitor (Item 16, Appendix C) or equivalent to front axle.
  - (c) Add 18.5 fl. oz. (0.55 L) of vapor corrosion inhibitor (Item 16, Appendix C) or equivalent to rear axle.
  - (d) Drive vehicle approximately 1 mi. (1.6 km) to mix additive.
  - (e) If additional storage time is required, repeat steps (a) and (b) at yearly intervals.
- (7) Back off slack adjusters on all four wheels.
- (8) Transmission long-term storage:

#### NOTE

If storage exceeds 12 months, transmission must be resealed by regional service dealer.

- (a) Drain oil (Para 4-4).
- (b) Add 2 qt. (1.9 L) of vapor corrosion inhibitor (Item 16, Appendix C) or equivalent and then fill transmission to operating level with transmission fluid.
- (c) Run engine for approximately 5 min. at 1,500 RPM with the transmission in N (Neutral).
- (d) Drive vehicle, making sure transmission shifts through all ranges.
- (e) Continue running engine at 1,500 RPM with transmission in N (Neutral) until normal operating temperature is reached.



Do not allow transmission oil temperature to exceed 225 °F (107 °C), or transmission may be damaged.

- (f) If normal operating temperature is less than 225 °F (107 °C), shift transmission to F (Forward) and stall converter. Do not exceed 225 °F (107 °C). Idle engine about 5 min. with transmission in N (Neutral).



Hot parts can burn personnel. Let hot parts cool before starting work.

- (g) As soon as transmission is cool enough to touch, seal all openings and breather with moisture-proof tape (Item 64, Appendix C).
  - (h) Coat all exposed, unpainted surfaces with preservative grease such as petrolatum (Item 50, Appendix C).
  - (i) If additional storage time is required, repeat steps (b) through (h) at yearly intervals; except it is not necessary to drain transmission each year. Just add vapor corrosion inhibitor (Item 16, Appendix C).
- (9) Fuel system long-term storage:
- (a) Drain fuel tank (Para 7-7).
  - (b) Change all fuel filters (Para 7-5).
  - (c) Disconnect fuel lines from engine fuel filter and the injector pump return line.
  - (d) Fill one 2 gal. (4 L) container with fuel (Item 69, Appendix C) and another with preservative oil using flushing oil (Item 41, Appendix C). Place both fuel lines in the fuel container and start engine. With engine running smoothly transfer the fuel lines to the preservative container, operate the engine until preservative oil flows out of the injector return line.
  - (e) When storing vehicle in freezing conditions, adding 3 oz. (89 ml) of isopropyl alcohol (Item 2, Appendix C) to 20 gal. (76 L) of JP-8 will help prevent fuel line freeze-up.
  - (f) Run engine 5 min. to circulate clean, treated fuel throughout fuel system.
  - (g) Drain fuel tank (Para 7-7).

- (h) Add 2 teaspoons of Shell VPI crystals (Item 37, Appendix C) in the fuel tank.
- (10) Engine long-term storage:
  - (a) Change oil and filter (Para 4-4). Add preservative lubricating oil (Item 46, Appendix C).
  - (b) Remove intake and exhaust manifolds and spray preservative oil (Item 41, Appendix C) into intake and exhaust ports in cylinder head and manifold.
  - (c) Remove rocker covers and spray rocker levers, valve stems, springs valve guides, crossheads and pushrods with preservative oil (Item 41, Appendix C) and replace rocker covers.
  - (d) Seal off turbocharger inlet and outlet connections and all other openings with moisture-resistant tape (Item 64, Appendix C) to prevent dirt and/or moisture from entering engine.
  - (e) Place warning tags on ignition and electrical master switches that clearly state:
    - Engine has been treated with preservative.
    - Do not bar crankshaft.
    - Coolant has been removed.
    - Date of treatment.
- (11) Drain coolant (Para 9-4).
- (12) Battery long-term storage (more than 30 days with no charging): Remove batteries from vehicle (Para 12-6) and keep fully charged (TM 9-6140-200-14).

**g. When removing vehicle from storage, perform the following tasks:**

- (1) Conduct a visual inspection of vehicle and remove moisture-proof tape from engine, transmission, and fuel system. Check lubricant levels and tire pressures. Correct any discrepancies.
- (2) Lubricate chassis, ancillary equipment, and oilcan points (TM 5-2420-230-10).
- (3) Flush entire fuel system with clean JP-8 (Item 69, Appendix C), replace fuel filters, refill fuel tank, prime and bleed system (Para 7-4).
- (4) Install batteries (Para 12-6).
- (5) Fill cooling system (Para 9-4) and free spin cooling fan.
- (6) Start engine, allow air pressure to build up before raising RPM to 1200 gradually, run until normal operating temperature is reached.
- (7) Perform hydraulic function test (TM 5-2420-230-10).
- (8) Check transmission oil while engine is at normal operating temperature (TM 5-2420-230-10).
- (9) Perform electrical function test, including air conditioner function test.
- (10) Place suspension to road mode.

- (11) Remove from safety stands and road test.

## Section IV. Troubleshooting.

### 3-11. TROUBLESHOOTING INTRODUCTION.

This section contains step-by-step procedures for identifying, locating, isolating, and repairing equipment malfunctions. Troubleshooting is presented in a series of steps until the fault is fixed. In most cases, the step asks a question. It is followed by what to do if the condition is not met. If the condition is met, proceed to the next step.

### 3-12. TROUBLESHOOTING PROCEDURES.

#### *a. General.*

The Fault Symptom Index (Table 3-5) lists common malfunctions by vehicle system followed by tests, inspections, and corrective actions.

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

Before using troubleshooting tables, be sure all applicable Preventive Maintenance Checks and Services (PMCS) have been performed. Perform tests, inspections, and corrective actions in the order listed. Try to return the vehicle or component to operation after each test, inspection, and corrective action has been performed.

While doing troubleshooting, refer to any figures, foldouts, and publications mentioned in the text. These figures, foldouts, and additional publications will help isolate and locate troubles and get the vehicle back in service as quickly as possible. Foldout schematics are found in the second volume of this manual.

#### *b. Measurements Required for Troubleshooting.*

#### **WARNING**

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

#### **CAUTION**

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

- (1) Resistance measurements.
  - (a) Connect red test lead to Volt-Ohm input connector and black lead to COM input connector on meter.
  - (b) Set function/range switch to desired Ohm position. If the magnitude of the resistance is not known, set the switch to the highest range, then reduce until satisfactory reading is obtained.

- (c) If the resistance being measured is connected to a circuit, turn electrical master switch to OFF position (TM 5-2420-230-10).



When measuring high resistance, be careful not to contact adjacent points, even if they are insulated, to prevent damage to equipment.

- (d) Connect test leads to circuit being measured. Some insulators have a relatively low insulation resistance, which can affect the resulting measurement.
  - (e) Read resistance value on digital display.
- (2) Continuity checks.
- (a) Place the function/range switch in any Ohm range.

### NOTE

Some meters show "1+m" (or simply "1") when function/range switch is in any Ohm position.

- (b) Connect red test lead to Volt-Ohm connector and black lead to COM input connector on meter. When the test leads are separated or measuring an out-of-range resistance, the digital display will indicate OL (Over Limit).
  - (c) Put one test probe at one end of wire or circuit to be tested. Use other test lead to trace circuit. When continuity is established, an Ohm symbol will appear in the upper-left corner of the digital display. If contact in the wire is maintained long enough (about a 0.25 second), the OL will disappear and the resistance value of the wire or circuit will appear next to the symbol.
  - (d) If your multimeter does not work in this manner, learn how it operates before performing troubleshooting.
- (3) Voltage measurements. The IHMEE is equipped with 24-Vdc circuits. Troubleshooting procedures will reference 24-Vdc measurement, however, the value can vary. When the batteries are fully charged, 25.2-Vdc can be measured on an open 24-Vdc circuit and 29-Vdc can be measured when the engine is running at 1,000 RPM.
- (a) Connect red test lead to Volt-Ohm input connector and black lead to COM input on meter. If a DC-AC switch is present, ensure it is set to DC position.
  - (b) Set function/range switch to desired volts position. If the magnitude of the voltage is not known, set the switch to a range which will be able to read most voltages seen on vehicle (typically, a 200-Vdc range will do). Then, reduce the range until a satisfactory reading is obtained.

**c. General Wire Test Procedures.** IHMEE troubleshooting isolates problems down to the components that could cause a specific failure. When all of the components in a circuit are tested without isolating a fault, the wires are the only other components that could be suspected of being damaged. Each wire that must be tested may pass through two or more connectors. The following procedures provide general instructions for testing electrical wires. These procedures will either attempt to measure a voltage at the working end of a circuit or continuity from the power end of a specific wire to the working end. Before either of these tests are performed, all connectors in the circuit must be checked for looseness.

**WARNING**

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

**CAUTION**

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

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

**NOTE**

IHMEE is equipped with 24-Vdc circuits. The troubleshooting fault that referenced these general wire tests will provide voltage information for testing wires.

- (d) Check for required voltage at working end of wire.
  - 1 If the required voltage is not measured at the working end of the wire, go to Step (e).
  - 2 If the required voltage is measured at the working end of the wire, the fault has not been isolated. Continue with fault isolation tests or notify supervisor.
- (e) Disconnect first connector in line from working end of wire to power source.
- (f) Check for required voltage at working end of wire.
  - 1 If the required voltage is not measured at the working end of the wire, go to Step (g).
  - 2 If the required voltage is measured at the working end of the wire, a fault is in the section of wire most recently disconnected. Repair wire and perform voltage test again.
- (g) Repeat Steps (d) and (e) until all sections of suspect wire are tested.

**WARNING**

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

**CAUTION**

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

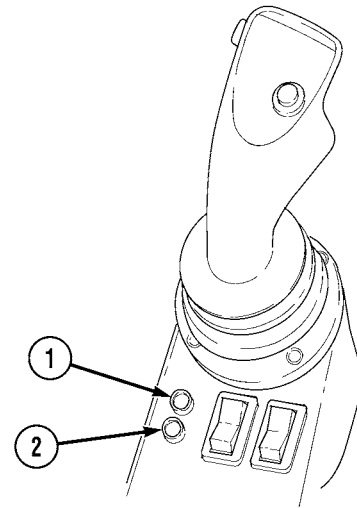
- (2) Wire continuity test.
  - (a) Disconnect wire from component (e.g., light, relay, motor, etc.) at working end of circuit and from power end.
  - (b) Set up vehicle conditions that will create desired circuit.
  - (c) Check continuity from power end of wire to working end of wire.
    - 1 If continuity is not measured, go to Step (d).
    - 2 If continuity is measured, the fault has not been isolated. Continue with fault isolation tests or notify supervisor.
  - (d) Disconnect first connector from working end of wire in line to power source.
  - (e) Check continuity.
    - 1 If continuity is not measured, go to Step (f).
    - 2 If continuity is measured, a fault is in the section of the wire most recently disconnected. Repair wire and perform continuity test again.
  - (f) Repeat Steps (d) and (e) until all sections of the suspect wire are tested.
- (3) Wire harness shorting wires test.
  - (a) Disconnect wire harness connector with wire suspected of damage.
  - (b) Set multimeter select switch to Ohm.
  - (c) Connect positive (+) multimeter lead to harness connector terminal of suspect wire.
  - (d) Connect negative (-) multimeter lead to each of other terminals in harness connector.
    - 1 If there is continuity, the suspect wire and the wire where continuity is measured are shorting together; repair wire.
    - 2 If there is no continuity, all wires are OK.
- (4) Wire repair. Refer to FM 11-60 and FM 11-61 for detailed instructions concerning electrical wiring repairs. Wire harness repair is limited to splicing and taping of wires at Unit Maintenance.



**3-13. HYDRAULIC CONTROLS ERROR CODES SPECIFICATION.**

In the event of a malfunction, the electronic system performs a self-test and then provides a visual indication of likely faults to assist with fault diagnosis and rectification. The self-test checks the condition of all wiring, detectors, and internal, electronic logic in the control box.

A visual indication of error codes is given on the left-hand joystick control by a coded flashing of the loader indicator lamp (1) and the backhoe indicator lamp (2). The loader indicator lamp flashes to show the first digit of the two-digit error code, and the backhoe indicator lamp flashes to show the second digit. For example, if error code 48 is being displayed, both lamps flash four times to indicate first digit is “4,” then the backhoe indicator lamp flashes another four times to indicate the second digit is “8.”



ME0197

The hydraulic error codes are given in Table 3-3. For correction of all error codes, refer to TS table (Para 3-16) or appropriate maintenance task as indicated by the “LIKELY FAULT” column.

**Table 3-3. Hydraulic Error Codes.**

DEVICE	LIKELY FAULT	CODE	TYPE
System voltage	Voltage too low	48	1
	Voltage too high		1
Controller	Internal fault, diagnostic circuits	91	1
Right joystick wiring	4-in-1 potentiometer shorted to ground	32	2
	4-in-1 potentiometer shorted to ground	33	2
	Bucket potentiometer shorted to ground	34	2
	Bucket potentiometer shorted to ground	35	2
	Arms' potentiometer shorted to ground	36	2
	Arms' potentiometer shorted to ground	37	2
Left joystick wiring	Swing potentiometer shorted to ground	42	2
	Swing potentiometer shorted to ground	43	2
	Dipper potentiometer shorted to ground	44	2
	Dipper potentiometer shorted to ground	45	2
Load-holding valve solenoid	No connected load	51	2
Float valve section B	No connected load	52	2
Float valve section A	No connected load	53	2
Boom sensor wiring	Signal shorted to ground	12	3
	Signal shorted to power	13	3

**Table 3-3. Hydraulic Error Codes. — Continued**

DEVICE	LIKELY FAULT	CODE	TYPE
Bucket sensor wiring	Signal shorted to ground	22	3
	Signal shorted to power	23	3
RPM	No RPM	25	3
	Bad frequency	26	3
Controller	Internal fault, sensor reading circuits	92	3
	Boom not calibrated	94	3
	Loader bucket not calibrated	95	3
	Internal fault, other	93	4
Load-holding valve solenoid	Overload or power output fault	55	4
Float valve section B	Overload or power output fault	56	4
Valve control wiring	Loader arm signal shorted to ground	71	4
	Backhoe boom signal shorted to ground	72	4
	Loader bucket signal shorted to ground	73	4
	Backhoe bucket signal shorted to ground	74	4
	Dipper signal shorted to ground	76	4
	Auxiliary signal shorted to ground	77	4
	Swing signal shorted to ground	78	4
	4-in-1 signal shorted to ground	79	4
	Loader arm signal shorted to power	81	4
	Backhoe boom signal shorted to power	82	4
	Loader bucket signal shorted to power	83	4
	Backhoe bucket signal shorted to power	84	4
	Dipper signal shorted to power	86	4
	Auxiliary signal shorted to power	87	4
	Swing signal shorted to power	88	4
4-in-1 signal shorted to power	89	4	
Float valve section A		57	4
Stabilizer valve	Power output shorted to ground	59	4

**3-14. TYPES OF REACTION OF ECU TO FAILURES DETECTED.**

- a. Type 1.** The operation of the electronic control box continues as before, except FAILURE is displayed. If the supply voltage overall is not correct, the equipment supply switch turns OFF the electronic control box. If DIAGNOSTIC FAILURE (91) is activated, regulation inputs are ignored.
- b. Type 2.** Operation continues as before, except defective inputs are ignored (inactive state) and DEFECT is displayed until the electronic control box is switched OFF by the operator. If the error displayed involves a control lever, defective outputs from the control lever are ignored.

c. **Type 3.** The loader arms and bucket operation stops. This occurs when the loader arm potentiometer or the bucket potentiometer indicates one of the following conditions:

- Part is defective.
- Cables become grounded.
- Cables are connected to supply voltage.
- System is not calibrated.

This type of failure is also caused by a speed value which is outside the limits or by a wrong internal reference voltage which deactivates loader detector measurement but leaves the electronic control box in an operative condition. Switching to BACKHOE can interrupt error codes, but error flags are not erased. To move, the loader must be turned off, then restarted in C130 LIMP mode.

d. **Type 4.** The electronic control box is inactive. It only shows this error code. This happens when one of the following occurs:

- An internal failure is detected.
- A supply output terminal is overloaded.
- A control valve output is grounded.
- A control valve output is connected to the supply voltage, which deactivates either the electronic control box or the control valve control circuits.

**3-15. AUXILIARY HYDRAULICS BACKHOE FLOW RATES.**

**Table 3-4. Flow vs. RPM — Flow in Gallons (Liters) per Minute.**

RPM	Flow Mode #1	Flow Mode #2	Flow Mode #3
Idle	5 gal. (19 L)	10 gal. (38 L)	10 gal. (38 L)
1,000	5 gal. (19 L)	13 gal. (50 L)	13 gal. (50 L)
1,100	5 gal. (19 L)	14 gal. (53 L)	14 gal. (53 L)
1,200	5 gal. (19 L)	15 gal. (57 L)	15 gal. (57 L)
1,300	5 gal. (19 L)	16 gal. (61 L)	16 gal. (61 L)
1,400	5 gal. (19 L)	18 gal. (68 L)	18 gal. (68 L)
1,500	5 gal. (19 L)	19 gal. (72 L)	19 gal. (72 L)
1,600	5 gal. (19 L)	20 gal. (76 L)	20 gal. (76 L)
1,700	5 gal. (19 L)	21 gal. (80 L)	21 gal. (80 L)
1,800	5 gal. (19 L)	22 gal. (83 L)	22 gal. (83 L)
1,900	5 gal. (19 L)	23 gal. (87 L)	23 gal. (87 L)
2,000	5 gal. (19 L)	24 gal. (91 L)	24 gal. (91 L)
2,100	5 gal. (19 L)	24 gal. (91 L)	24 gal. (91 L)
2,200	5 gal. (19 L)	25 gal. (95 L)	25 gal. (95 L)
2,300	5 gal. (19 L)	26 gal. (98 L)	26 gal. (98 L)
2,400	5 gal. (19 L)	26 gal. (98 L)	26 gal. (98 L)
2,500	5 gal. (19 L)	26 gal. (98 L)	26 gal. (98 L)

**3-16. TROUBLESHOOTING TABLE.**

*Table 3-5. Fault Symptom Index.*

<b>TROUBLESHOOTING PROCEDURE</b>	<b>PAGE</b>
<b>Engine</b>	
1. Engine Cranks but Will Not Start. . . . .	3-40
2. Excessive Exhaust Noise or Rattling.. . . .	3-42
3. Engine Misses. . . . .	3-43
4. Engine Does Not Develop Full Power, Slow Acceleration, or Detonation.. . . .	3-44
5. Engine Emits Excessive Black, Blue, or White Exhaust Smoke. . . . .	3-46
6. Abnormal Engine Noise. . . . .	3-47
7. High or Low Oil Pressure. . . . .	3-48
8. Engine Overheats.. . . .	3-49
9. Oil in Coolant or Coolant in Oil. . . . .	3-51
10. Excessive Fuel Consumption. . . . .	3-52
11. Turbocharger Excessively Noisy or Vibrates or Oil Dripping From Turbocharger Adapter. . . . .	3-53
<b>Transmission</b>	
12. Transmission Fails To Shift or Shifts Erratically.. . . . .	3-54.1
13. Transmission Will Not Shift Into High/Low Range. . . . .	3-57
14. Transmission Will Not Shift Into 2WD/4WD.. . . . .	3-59
15. Transmission Overheating. . . . .	3-61
16. Transmission Stall Test. . . . .	3-62
<b>Steering</b>	
17. Steering System Has Uneven Feel or Vibration, Vehicle Wanders, or Tires Show Uneven Wear. . . . .	3-63
18. Hard to Steer. . . . .	3-64
<b>Suspension</b>	
19. Vehicle Leans to One Side or Rides Too Hard. . . . .	3-64
20. Excessive Movement in Suspension. . . . .	3-65
21. Ride Level Valve (RLV) out of Adjustment. . . . .	3-66
<b>Fuel System</b>	
22. Fuel Gauge Reads Incorrectly. . . . .	3-67
23. Low Fuel Pressure or No Fuel Delivery. . . . .	3-68
<b>Cooling System</b>	
24. Low Coolant Level. . . . .	3-69
25. Noisy Hydraulic Cooling Fan. . . . .	3-70.1
<b>Hydraulic System</b>	
26. Hydraulic Oil Overheating. . . . .	3-71
27. Noisy Hydraulic Pump or Hydraulic Oil Foams. . . . .	3-72
27.1 Hydraulic Hose Reel Does Not Operate or Low Hydraulic Power on Hand Tool Attachment. . . . .	3-72.1
27.2 No or Low Hydraulic Power on Individual Function. . . . .	3-72.2
28. No or Low Hydraulic Power For Complete Hydraulic System. . . . .	3-73
29. Right Joystick Inoperable. . . . .	3-74
30. Left Joystick Inoperable. . . . .	3-76

Table 3-5. Fault Symptom Index. — Continued

TROUBLESHOOTING PROCEDURE	PAGE
<b>Electrical System</b>	
31. No System Voltage. . . . .	3-78
32. No Power at Ignition Switch. . . . .	3-79
33. Starter Will Not Crank. . . . .	3-80
34. Starter Motor Turns, but Engine Will Not Crank. . . . .	3-81
35. Starter Motor Continues to Run After Engine Starts. . . . .	3-82
36. Low Battery Output. . . . .	3-83
37. Noisy Alternator. . . . .	3-84
38. Charging Indicator Light Remains Illuminated or Does Not Charge. . . . .	3-85
39. Hourmeter Does Not Work. . . . .	3-86
40. Transmission Oil Temperature Gauge Does Not Work. . . . .	3-87
41. Horn Does Not Work. . . . .	3-88
42. Reverse Alarm Does Not Work. . . . .	3-89
43. Front or Rear Wipers Do Not Work. . . . .	3-90
44. Headlight Does Not Work. . . . .	3-91
45. Turn Signal Does Not Work. . . . .	3-92
46. Brake Light Does Not Work. . . . .	3-93
47. No Power At Hydraulics. . . . .	3-94
48. EGS Has No Power or Is Not Working. . . . .	3-95
49. Electronic Control Unit (ECU) Indicates Fault. . . . .	3-96
49.1 Auxiliary Defroster Does Not Work. . . . .	3-96.1
<b>Body, Cabin, and Chassis</b>	
49.2 No Heat from Auxiliary Defroster and Cabin Heater. . . . .	3-96.2
50. Windshield Washers Do Not Work. . . . .	3-97
51. Air-Conditioner (A/C) Will Not Operate or Cool. . . . .	3-98.1
<b>Drivetrain, Axles, and Wheels</b>	
52. Hub Hot or Brakes Locked and Will Not Disengage. . . . .	3-99
53. Noisy Differential or Driveshaft. . . . .	3-101
54. Driveline Vibration. . . . .	3-101
<b>Pneumatic System</b>	
55. No Air/Low Air in System. . . . .	3-102
56. Excessive Moisture in System. . . . .	3-103
57. Air Drier Constantly Cycling or Purging. . . . .	3-104
58. Air Drier Safety Valve Exhausting Air. . . . .	3-105
59. Differential Lock Will Not Engage. . . . .	3-106
<b>Backhoe and Front-End Loader (FEL)</b>	
60. Backhoe or FEL Noisy in Operation. . . . .	3-108
<b>Brake System</b>	
61. Slack Adjusters Out of Adjustment. . . . .	3-109
<b>Cold Weather Kit</b>	
62. Arctic Heater 7-Day Timer Will Not Operate. . . . .	3-110
63. Arctic Heater 7-Day Timer Does Not Display Error Code, But Arctic Heater Will Not Operate. . . . .	3-111
64. Arctic Heater 7-Day Timer Displays Error Code. . . . .	3-112
65. Ether Start Will Not Work. . . . .	3-116
66. Engine Block Heater Will Not Work. . . . .	3-118
67. Battery Trickle Charger Will Not Operate. . . . .	3-119

Table 3-6. Unit Troubleshooting Table.

Malfunction	Test or Inspection	Corrective Action
1. ENGINE CRANKS BUT WILL NOT START.		<p>FUEL TANK STEP PLATE SHOWN REMOVED FOR CLARITY</p>
<b>NOTE</b>		
<p>If vehicle has a cold weather kit, and ambient temperature is below 60 °F (15 °C), refer also to Fault 65.</p>		
Step 1.	Check air intake to turbocharger for restriction.	Clear restriction if necessary.
<b>WARNING</b>		
<ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul>		
Step 2.	Check fuel tank (1) for water in fuel or incorrect grade of fuel.	If water is in fuel or fuel is incorrect grade, drain fuel tank (1) and flush supply lines (Para 7-7).
Step 3.	Check fuel line (2) for cracks, leaks, blockage, or damage.	If fuel line (2) is blocked, replace fuel line (2) (Para 7-7).
Step 4.	Visually check for debris and water in fuel/water separator (3).	Replace filter in fuel/water separator (3) if excessive debris or water is found (Para 7-5).
Step 5.	Remove and check secondary fuel filter (4) for blockage (Para 7-5).	If secondary fuel filter (3) is blocked, replace secondary fuel filter (Para 7-5).

Table 3-6. Unit Troubleshooting Table. — Continued

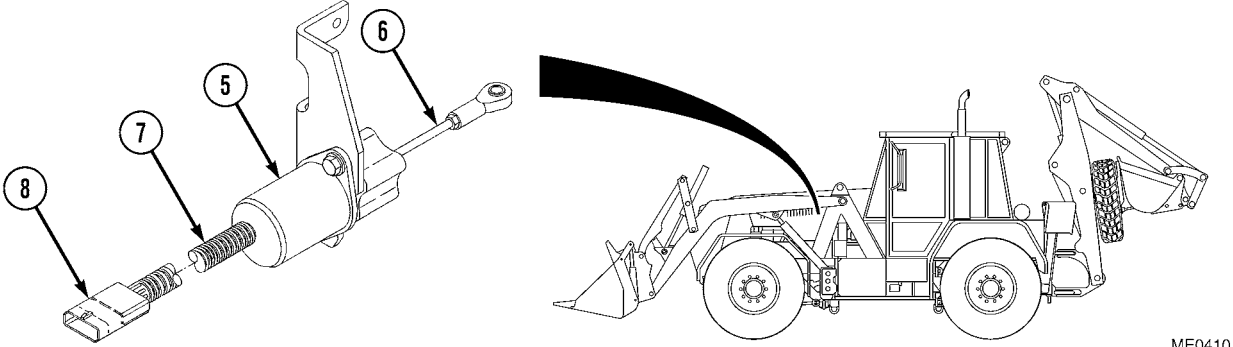
Malfunction	Test or Inspection	Corrective Action
<b>ENGINE CRANKS BUT WILL NOT START. — CONTINUED</b>		
		
<b>WARNING</b>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 6.	Check fuel shut-off solenoid (5) to ensure it is functioning properly.	If fuel shut-off solenoid arm (6) moves, notify Direct Support maintenance (Appendix L).
Step 7.	Check wiring harness (7) for continuity and connector (8) for damage or short.	If wiring harness (7) does not have continuity, replace wiring harness (Para 12-27). If connector (8) has damage or a short, replace connector (Para 12-28).
Step 8.	Check wiring harness from fuel shut-off solenoid to power source for continuity.	If wiring harness does not have continuity, replace wiring harness (Para 12-27). If fault continues, notify Direct Support maintenance (Para L-26).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction
Test or Inspection
Corrective Action
<p>2. EXCESSIVE EXHAUST NOISE OR RATTLING.</p>
<p><b>WARNING</b></p>
<p>Hot parts can burn personnel. Let hot parts cool before starting work.</p>
<p>Step 1. Check muffler (1) and exhaust system (2) for damage and obstructions.</p>
<p>If muffler (1) is damaged, replace muffler (Para 11-5).</p>
<p>If muffler (1) or exhaust system (2) has obstructions, clear obstructions.</p>
<p>Step 2. Check exhaust system (2) for exhaust gas leaks.</p>
<p>Repair or replace any leaking exhaust components found (Chapter 11).</p>



Table 3-6. Unit Troubleshooting Table. — Continued

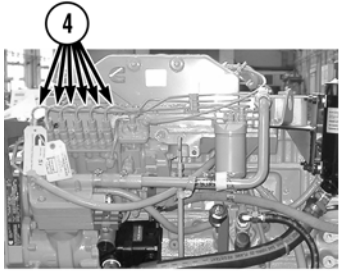
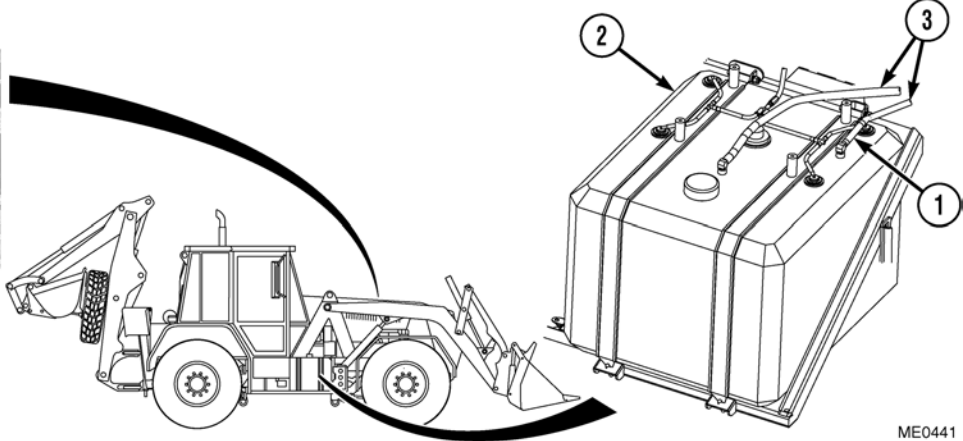
Malfunction	Test or Inspection	Corrective Action
<b>3. ENGINE MISSES.</b>		 <p style="text-align: right;">ME0441</p>
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul>		
Step 1.	Check for air in fuel system.	
Step 2.	Disconnect return line (1) from fuel tank (2).	
Step 3.	Crank engine and check for air in fuel at return line (1).	
Step 4.	<p>Tighten connections and visually check fuel lines (1), (3), and (4) for damage.</p> <p style="padding-left: 40px;">If fuel tank lines (1) or (3) are damaged, replace fuel tank lines (Para 7-7).</p> <p style="padding-left: 40px;">If engine fuel lines (4) are damaged, replace engine fuel lines (Para L-14).</p>	
Step 5.	<p>Check fuel tank (2) for incorrect grade of fuel.</p> <p style="padding-left: 40px;">If fuel is incorrect grade, drain fuel tank (2) (Para 7-7).</p>	
Step 6.	<p>Start engine (TM 5-2420-230-10) and check slow idle speed to ensure it is not below 900 RPM.</p> <p style="padding-left: 40px;">Adjust slow idle speed to correct speed of 900 RPM if necessary (Para L-49).</p> <p style="padding-left: 40px;">If fault continues, notify Direct Support maintenance (Para L-26).</p>	

Table 3-6. Unit Troubleshooting Table. — Continued

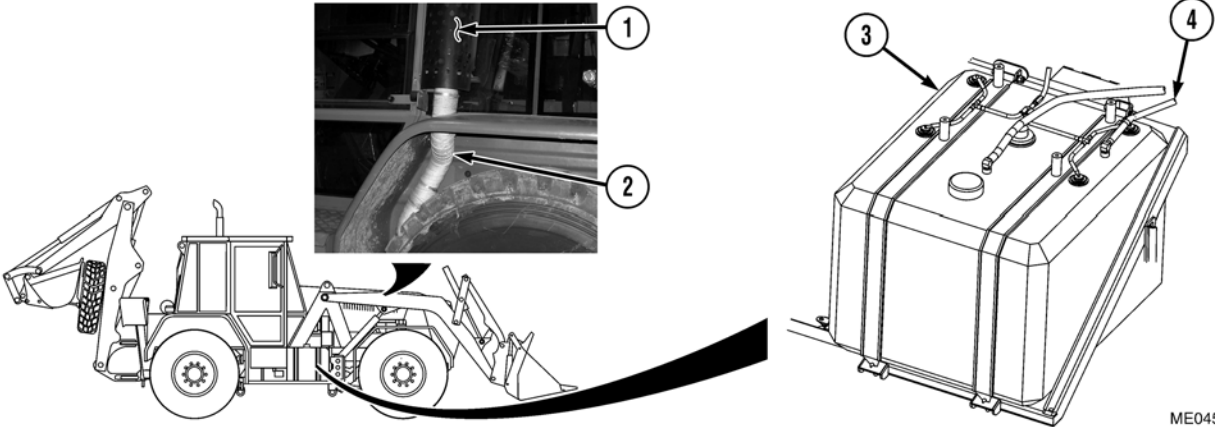
Malfunction	Test or Inspection	Corrective Action
<p>4. ENGINE DOES NOT DEVELOP FULL POWER, SLOW ACCELERATION, OR DETONATION.</p>		<p>ME0452</p>
<p><b>WARNING</b></p>		
<p>Hot parts can burn personnel. Let hot parts cool before starting work.</p>		
<p>Step 1. Check muffler (1) and exhaust system (2) for damage and obstructions.</p>	<p>If muffler (1) or exhaust system (2) has obstructions, clear the obstructions.</p>	
<p><b>WARNING</b></p>		
<ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul>		
<p>Step 2. Check fuel tank (3) for incorrect grade of fuel.</p>	<p>If fuel is incorrect grade, drain fuel tank (3) (Para 7-7).</p>	
<p>Step 3. Check fuel return line (4) for pinches, kinks, or damage.</p>	<p>If fuel return line (4) is pinched, kinked, or damaged, remove two hose clamps and fuel return line. Install new fuel return line with two hose clamps.</p>	
<p>Step 4. Check fuel filters for blockage.</p>	<p>If fuel filter(s) have blockage, replace fuel filter(s) (Para 7-5).</p>	

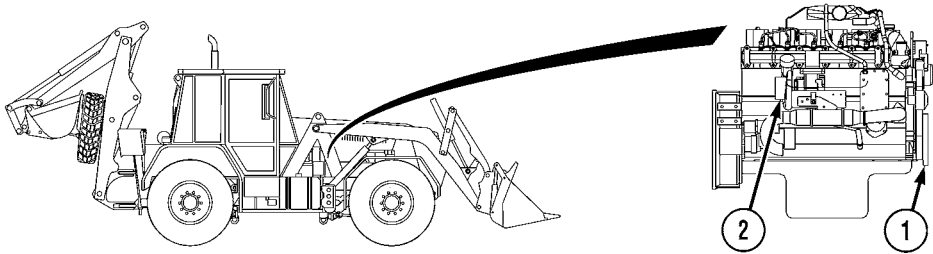
Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>ENGINE DOES NOT DEVELOP FULL POWER, SLOW ACCELERATION, OR DETONATION. — CONTINUED</b>		
Step 5.	Check fuel shut-off solenoid lever (5) to ensure it is not against stop on injection pump.	Adjust fuel shut-off solenoid as necessary.
Step 6.	Check fast idle speed to ensure it is not too low.	Adjust fast idle speed to 2,600 RPM (Para L-49).
<b>WARNING</b>		
<ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul>		
Step 7.	Check fuel injection lines for leaks, kinks, and pinches.	Replace fuel lines as needed (Para L-14).
Step 8.	Check air intake system for leaks.	If air intake system has air leaks, notify Direct Support maintenance.
Step 9.	Inspect turbocharger (6) for proper operation (Para L-12).	If turbocharger (6) is damaged, notify Direct Support maintenance (Para L-12). If fault continues, notify Direct Support maintenance (Para L-26).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
5. ENGINE EMITS EXCESSIVE BLACK, BLUE, OR WHITE EXHAUST SMOKE.		<p style="text-align: center;"><b>WARNING</b></p> <ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul> <p>Step 1. Check fuel tank (1) for incorrect grade of fuel.</p> <p style="padding-left: 40px;">If fuel is incorrect grade, drain fuel tank (1) (Para 7-7).</p> <p>Step 2. Check fuel lines (2) for damage (Para L-14).</p> <p style="padding-left: 40px;">If fuel lines (2) are damaged, replace fuel lines (Para L-14).</p> <p>Step 3. Check turbocharger (3) for proper operation (Para L-12).</p> <p style="padding-left: 40px;">If turbocharger (3) is damaged or does not function properly, replace turbocharger (Para L-12).</p> <p>Step 4. Check fuel injection nozzle (4) for proper operation.</p> <p style="padding-left: 40px;">If fuel injection nozzles (4) do not function properly, replace fuel injection nozzles and notify Direct Support maintenance (Para L-18).</p> <p style="padding-left: 40px;">If fault continues, notify Direct Support maintenance (Para L-26).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<p>6. ABNORMAL ENGINE NOISE.</p>		<p>Step 1. Check for loose engine components. Tighten loose components as necessary.</p> <p>Step 2. Check for loose or worn vibration damper (1). If loose or worn, replace vibration damper (1).</p> <p>Step 3. Check turbocharger (2) for correct operation (Para L-12). If turbocharger (2) is damaged or does not function correctly, replace turbocharger (Para L-12). If fault continues, notify Direct Support maintenance (Appendix L).</p>

ME0459

Table 3-6. Unit Troubleshooting Table. — Continued

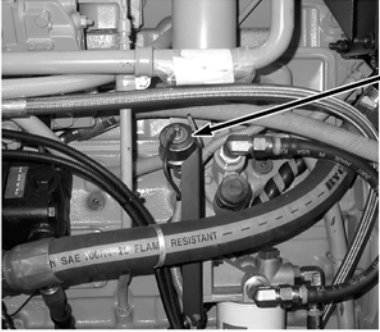
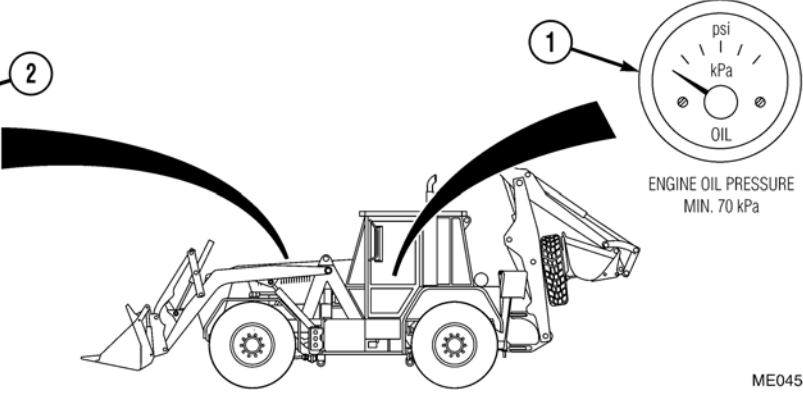

Malfunction	Test or Inspection	Corrective Action
7. HIGH OR LOW OIL PRESSURE.		 <p>   ENGINE OIL PRESSURE MIN. 70 kPa         </p>
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 1.	<p>Check ENGINE OIL PRESSURE gauge (1) and oil pressure sensor (2) to ensure both are functioning correctly.</p>	<p>Remove wire at sending unit and ground to vehicle chassis. Have an assistant watch gauge to identify its movement. If no movement is noticed, check continuity of wire. Replace wire as necessary (Para 12-27).</p> <p>If wire has continuity, replace gauge (Para 12-23).</p>
Step 2.	<p>Check oil pressure regulating valve for correct reading of 30-90 psi (207-621 kPa) at 900 RPM. Clean valve (Para L-36).</p>	<p>If oil pressure regulating valve is not functioning correctly, replace oil pressure regulating valve (Para L-36).</p> <p>If fault continues, notify Direct Support maintenance (Appendix L).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

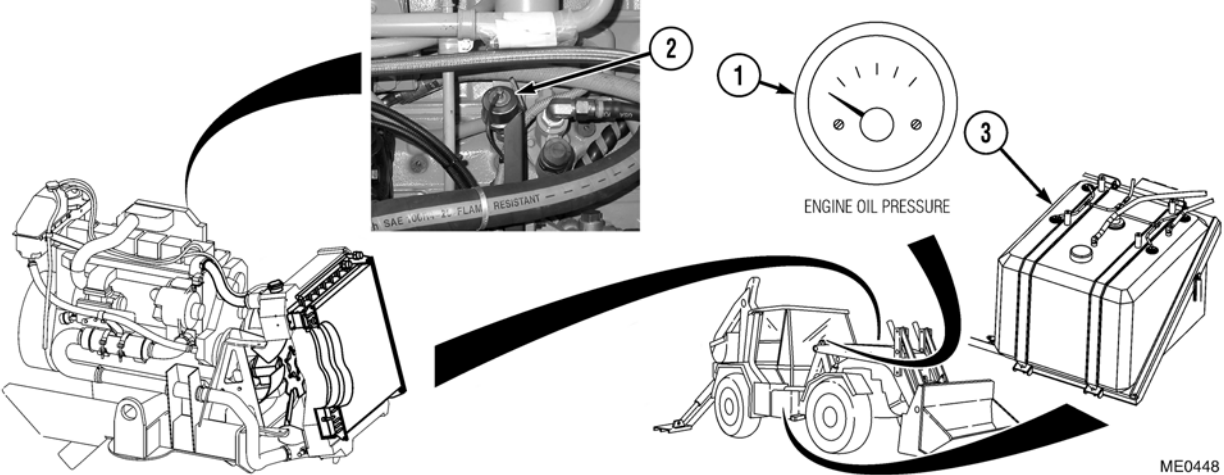
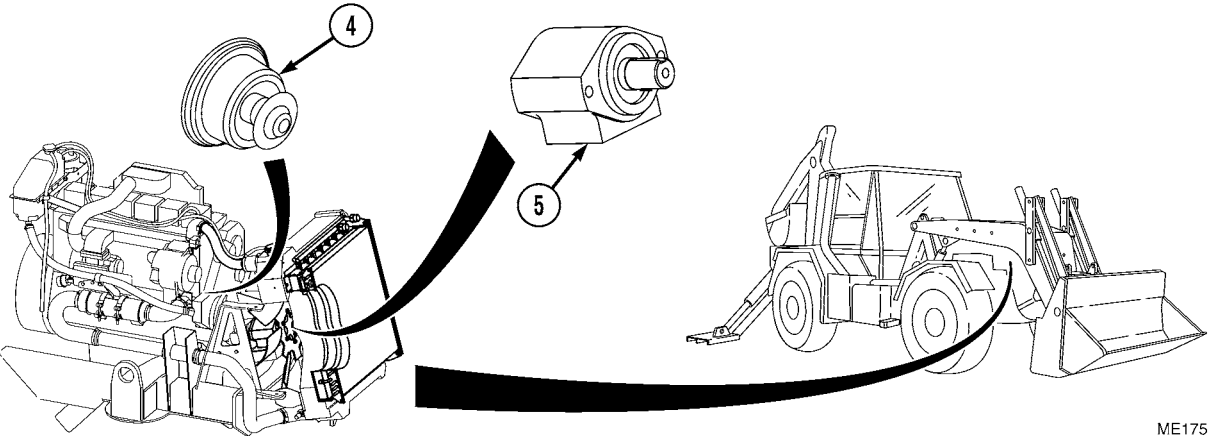
Malfunction
Test or Inspection
Corrective Action
<p><b>8. ENGINE OVERHEATS.</b></p>  <p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 1. Check ENGINE OIL PRESSURE gauge (1) and oil pressure sensor (2) to ensure both are functioning correctly.</p> <p>Remove wire at sending unit and ground to vehicle chassis. Have an assistant watch gauge to identify its movement. If no movement is noticed, check continuity of wire. Replace wire as necessary (Para 12-27).</p> <p>If wire has continuity, replace gauge (Para 12-23).</p> <p>Step 2. Check serviceability of belt (TM 5-2420-230-10).</p> <p>If belt is unserviceable, replace belt (Para 4-6).</p> <p style="text-align: center;"><b>WARNING</b></p> <ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul> <p>Step 3. Check fuel tank (3) for incorrect grade of fuel.</p> <p>If fuel is incorrect grade, drain fuel tank (3) (Para 7-7).</p> <p style="text-align: right;">ME0448</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>ENGINE OVERHEATS. — CONTINUED</b>		
		
Step 4.	Check thermostat (4) to ensure it is functioning correctly (Para L-11).	If thermostat (4) is missing or not functioning correctly, replace thermostat (Para L-11).
Step 5.	With engine stopped, check hydraulic fan motor (5) to ensure it is functioning properly by rotating fan blade. Blades should move freely.	If hydraulic fan motor (5) is not operating or blades do not move freely, perform hydraulic pressure test (Para 10-6).
		If hydraulic oil pressure is low, notify Direct Support maintenance.
		If oil pressure is in correct range, replace hydraulic fan motor (5) (Para 9-6).

ME1759



Table 3-6. Unit Troubleshooting Table. — Continued

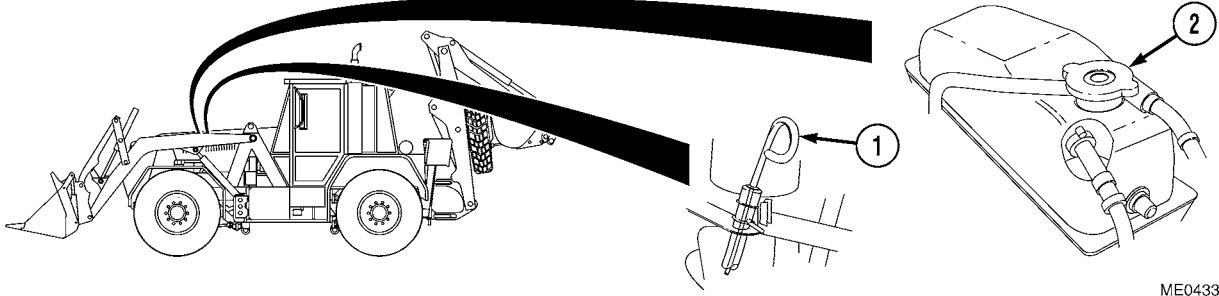
Malfunction
Test or Inspection
Corrective Action
<p>9. OIL IN COOLANT OR COOLANT IN OIL.</p>  <p style="text-align: right; font-size: small;">ME0433</p> <p>Step 1. Check for water in engine oil (1).</p> <p style="padding-left: 40px;">If engine oil appears a milky color, notify Direct Support maintenance (Appendix L). Collect and submit an AOAP sample of engine oil, and wait for further direction from AOAP lab.</p> <div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 10px auto;"><b>WARNING</b></div> <p style="padding-left: 40px;">If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be relieved before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.</p> <p>Step 2. Check coolant (2) for contamination.</p> <p style="padding-left: 40px;">If contaminated, notify Direct Support maintenance (Appendix L).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
10. EXCESSIVE FUEL CONSUMPTION.	<p>The diagram shows a fuel tank (1) with fuel lines (3) leading to the engine. The engine has fuel lines (2) and a turbocharger (4). A photograph shows the turbocharger (4) in detail. A cross-section of the engine shows the fuel system components.</p>	ME0434
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul>		
Step 1.	Check fuel tank (1) for incorrect grade of fuel.	<p>If fuel is incorrect grade, drain fuel tank (1) (Para 7-7).</p> <p>If engine fuel lines (2) are damaged, replace engine fuel lines (Para L-14).</p> <p>If fuel tank lines (3) are damaged, replace fuel tank lines (Para 7-7).</p>
Step 2.	Check turbocharger (4) for correct operation (Para L-12).	If turbocharger (4) is damaged, replace turbocharger (Para L-12).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<p>11. TURBOCHARGER EXCESSIVELY NOISY OR VIBRATES OR OIL DRIPPING FROM TURBOCHARGER ADAPTER.</p>	<p>The diagram consists of three parts: a close-up photograph of the turbocharger assembly with callouts 1, 2, and 3; a side-view line drawing of a loader with a curved arrow pointing to the turbocharger location; and a detailed engine view with a curved arrow pointing to the aftercooler (1). The engine view is labeled ME0435.</p>	<p>Step 1. Check aftercooler (1) and exhaust manifold (2) for air leaks.</p> <p style="padding-left: 40px;">If aftercooler (1) has air leaks, replace aftercooler (Para L-16).</p> <p style="padding-left: 40px;">If exhaust manifold (2) has air leaks, replace exhaust manifold (Para L-13).</p> <p>Step 2. Check turbocharger mounting bolts (3) and hardware for looseness.</p> <p style="padding-left: 40px;">Tighten mounting bolts (3) if necessary.</p>

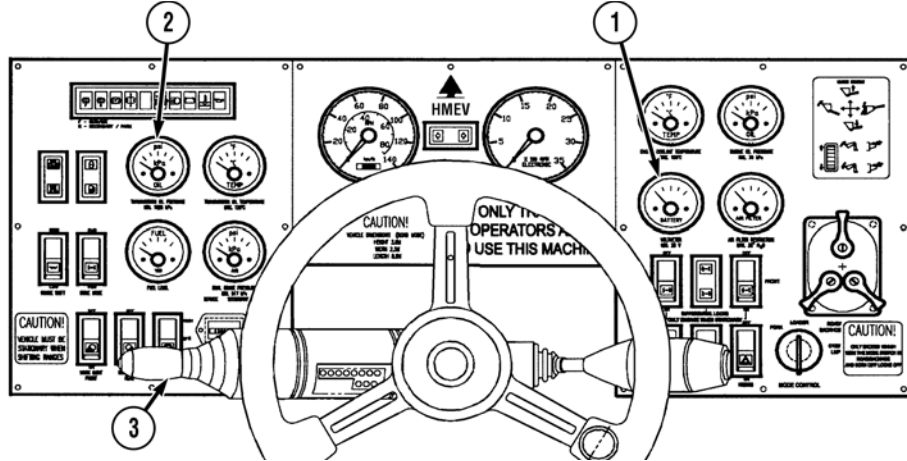
Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>TURBOCHARGER EXCESSIVELY NOISY OR VIBRATES OR OIL DRIPPING FROM TURBOCHARGER ADAPTER. — CONTINUED</b>		
<b>WARNING</b>		
<ul style="list-style-type: none"> <li>• Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.</li> <li>• If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.</li> <li>• Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.</li> </ul>		
Step 3.	Check air intake (4) on turbocharger (5) for clogging.	<p>If air intake (4) is clogged, clean using degreasing solvent (Item 58, Appendix C) and a clean cloth (Item 10, Appendix C).</p>
Step 4.	Check oil return line (6) on turbocharger (5) for carbon buildup.	<p>If oil return line (6) has carbon buildup, remove and clean using degreasing solvent and a clean cloth.</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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12. TRANSMISSION FAILS TO SHIFT OR SHIFTS ERRATICALLY.



ME1763

Step 1. Check VOLTMETER gauge (1).

If gauge (1) reads less than 20 Vdc, Go to Fault 36.

Step 2. Check TRANSMISSION OIL PRESSURE gauge (2).

If gauge (2) reads less than 235 psi (1 620 kPa), check gauge for proper operation. Replace if necessary (Para 12-23).

Step 3. Check circuit breaker CB-18 in the Power Distribution Panel (PDP) (refer to FO-1).

If circuit breaker CB-18 is tripped, reset circuit breaker.

**WARNING**

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

Step 4. Check for continuity on wire 360 from circuit breaker CB-18 to Electronic Gear Shift (EGS) (3) (refer to FO-3).

If there is not continuity, replace wire harness (Para 12-27).



Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>TRANSMISSION FAILS TO SHIFT OR SHIFTS ERRATICALLY. — CONTINUED</b>		
Step 5.	Perform self-test on EGS (3) (Para G-3).	<p>If 'N' LED (4) is ON, and 'T' LED (5) is blinking, replace EGS (3) (Para 12-25).</p> <p>If 'N' LED (4) is ON, and 'T' LED (5) is ON, proceed to Step 6.</p> <p>If 'N' LED (4) is ON, 'T' LED (5) is ON, and '1' LED (6) is RED, proceed to Step 9.</p> <p>If 'N' LED (4) is ON, 'T' LED (5) is ON, and '2' LED (7) is RED, proceed to Step 10.</p> <p>If 'N' LED (4) is ON, 'T' LED (5) is ON, and '3' LED (8) is RED, proceed to Step 11.</p> <p>If 'N' LED (4) is ON, 'T' LED (5) is ON, and '4' LED (9) is RED, proceed to Step 12.</p> <p>If 'N' LED (4) is ON, 'T' LED (5) is ON, and 'R' LED (10) is RED, proceed to Step 13.</p>
Step 6.	Perform input test on EGS (3) (Para G-3).	<p>If a fault is detected, replace EGS (Para 12-25).</p> <p>If no fault is detected, proceed to Step 7.</p>
Step 7.	Perform output test on EGS (3) (Para G-3).	<p>If a fault is detected, replace EGS (Para 12-25).</p> <p>If no fault is detected, proceed to Step 8.</p>
Step 8.	Perform speed sensor test on EGS (3) (Para G-3).	<p>If a lamp test fault is detected, replace EGS (Para 12-25).</p> <p>If a speed display fault is detected, replace speed sensor (Para 12-34.3).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

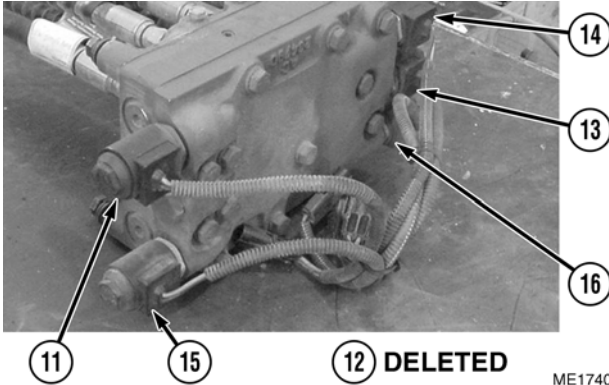
Malfunction	Test or Inspection	Corrective Action
<b>TRANSMISSION FAILS TO SHIFT OR SHIFTS ERRATICALLY. — CONTINUED.</b>		
		
<b>WARNING</b>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 9.	<p>Check solenoid coil '1' (11) for continuity.                      If solenoid coil '1' (11) has between 36-38 Ohms, go to Step 14.                      If solenoid coil '1' (11) does not have between 36-38 Ohms, replace solenoid coil (Para 12-34.2).</p>	
Step 10.	<p>Check solenoid coil '2' (13) for continuity.                      If solenoid coil '2' (13) has between 36-38 Ohms, go to Step 14.                      If solenoid coil '2' (13) does not have between 36-38 Ohms, replace solenoid coil (Para 12-34.2).</p>	
Step 11.	<p>Check solenoid coil '3' (14) for continuity.                      If solenoid coil '3' (14) has between 36-38 Ohms, go to Step 14.                      If solenoid coil '3' (14) does not have between 36-38 Ohms, replace solenoid coil (Para 12-34.2).</p>	
Step 12.	<p>Check solenoid coil 'F' (15) for continuity.                      If solenoid coil 'F' (15) has between 36-38 Ohms, go to Step 14.                      If solenoid coil 'F' (15) does not have between 36-38 Ohms, replace solenoid coil (Para 12-34.2).</p>	
Step 13.	<p>Check solenoid coil 'R' (16) for continuity.                      If solenoid coil 'R' (16) has between 36-38 Ohms, go to Step 14.                      If solenoid coil 'R' (16) does not have between 36-38 Ohms, replace solenoid coil (Para 12-34.2).</p>	
Step 14.	<p>Check solenoid coil wire harness for continuity.                      If continuity is not present, replace wire harness (Para 12-27).                      If continuity is present, replace remote shift valve (Para 4-14).                      If trouble persists, notify Direct Support maintenance (page F-103).</p>	



Table 3-6. Unit Troubleshooting Table. — Continued

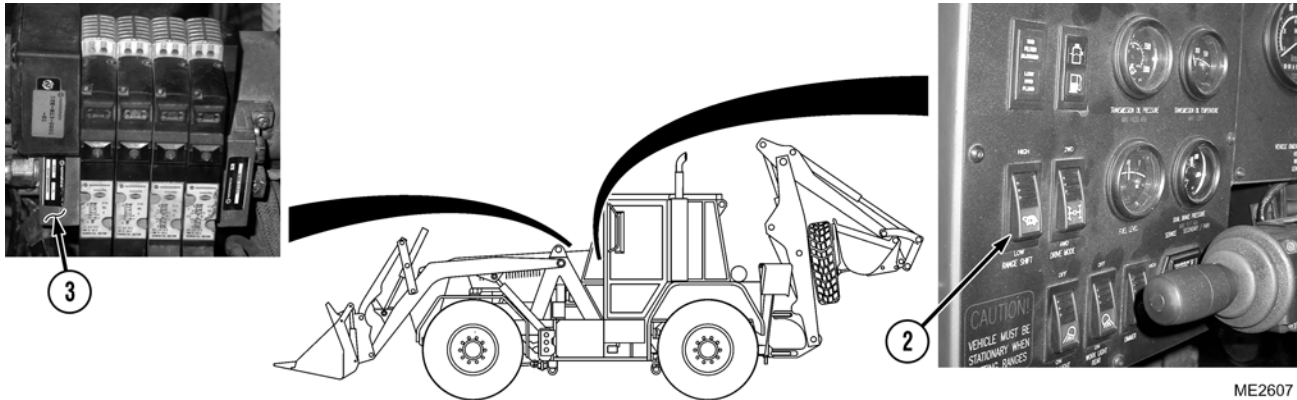
Malfunction	Test or Inspection	Corrective Action
13. TRANSMISSION WILL NOT SHIFT INTO HIGH/LOW RANGE.		<p><b>NOTE</b></p> <p>To perform this troubleshooting, the ignition switch must be in the IGN position, the EGS must be in the N (Neutral) position, and the air system must be fully pressurized.</p> <p>Step 1. Check high/low shift cylinder (1) for bent control rod.</p> <p>If control rod on high/low shift cylinder (1) is bent, replace control rod (Para 4-18).</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 2. Check high-range relay in PDP box for proper operation (refer to FO-1).</p> <p>If high-range relay is not operating properly, replace relay (Para 12-15).</p> <p>Step 3. Remove engine access panel (TM 5-2420-230-10).</p> <p>Step 4. Check RANGE SHIFT switch (2) for proper operation and ensure LED indicator (2.1) illuminates.</p> <p>If RANGE SHIFT switch (2) is not operating properly, replace RANGE SHIFT switch (Para 12-14).</p> <p>If LED indicator (2.1) does not illuminate, replace valve island (Para 12-34.1).</p>

ME2606

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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**TRANSMISSION WILL NOT SHIFT INTO HIGH/LOW RANGE. — CONTINUED**



**WARNING**

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

- Step 5. Check for 24 Vdc at terminal C of pneumatic valve assembly (3) (refer to FO-3).
  - If 24 Vdc is not present at terminal C, go to Step 6.
  - If 24 Vdc is present at terminal C, go to Step 7.
- Step 6. Check for continuity on wire 393 between RANGE SHIFT switch (2) and pneumatic valve assembly (3) (refer to FO-3).
  - If continuity is not present, replace wire harness (Para 12-27).

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

- Step 7. Check for air pressure at port 1 on pneumatic valve assembly (3) (refer to FO-5).
  - If air pressure is present at port 1, replace pneumatic valve assembly (3) (Para 12-34).
  - If air pressure is not present at port 1, go to Fault 55.
- Step 8. Install engine access panel (TM 5-2420-230-10).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
14. TRANSMISSION WILL NOT SHIFT INTO 2WD/4WD.		ME2605
<b>NOTE</b>		
<p>To perform this troubleshooting, the ignition switch must be in the IGN position, the EGS must be in the N (Neutral) position, and the air system must be fully pressurized.</p>		
Step 1.	Check 2WD/4WD shift cylinder (1) for bent control rod.	<p>If control rod on 2WD/4WD shift cylinder (1) is bent, replace control rod (Para 4-17).</p>
<b>WARNING</b>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 2.	Remove engine access panel (TM 5-2420-230-10).	
Step 3.	Check DRIVE MODE switch (2) for proper operation and ensure LED indicator (2.1) illuminates.	<p>If DRIVE MODE switch (2) is not operating properly, replace DRIVE MODE switch (Para 12-14).                      If LED indicator (2.1) does not illuminate, replace valve island (Para 12-34.1).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

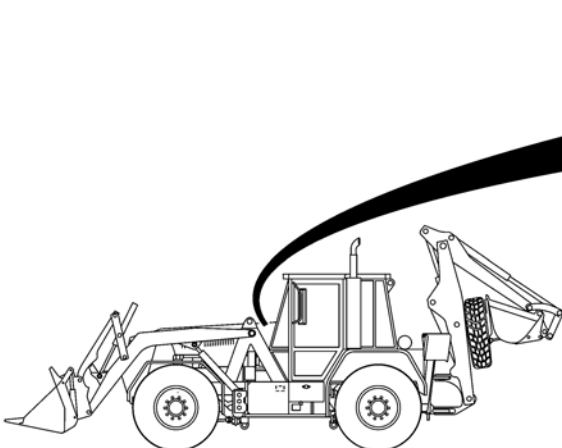
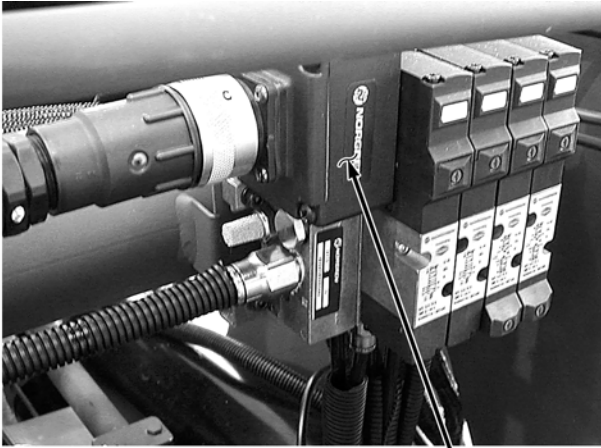
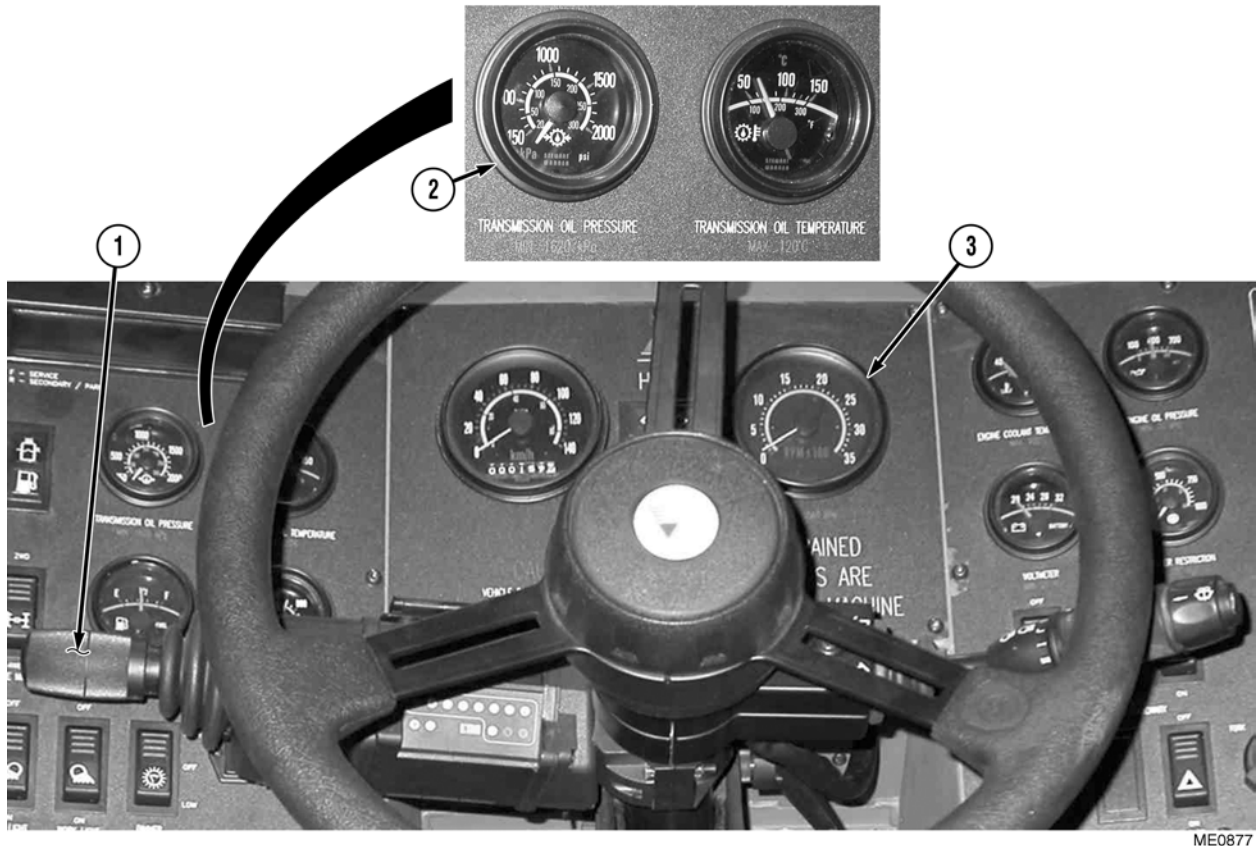
Malfunction	Test or Inspection	Corrective Action
<b>TRANSMISSION WILL NOT SHIFT INTO 2WD/4WD. — CONTINUED</b>		
		<p style="text-align: center;">3</p> <p>ME222</p>
<b>WARNING</b>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.</p>		
Step 4.	Check for 24 Vdc at terminal A of pneumatic valve assembly (3) (refer to FO-3).	<p>If 24 Vdc is not present at terminal A, go to Step 5.</p> <p>If 24 Vdc is present at terminal A, go to Step 6.</p>
Step 5.	Check for continuity on wire 151 from pneumatic valve assembly (3) (refer to FO-3).	<p>If continuity is not present, replace wire harness (Para 12-27).</p>
<b>WARNING</b>		
<p>Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.</p>		
Step 6.	Check for air pressure at port 1 on pneumatic valve assembly (3) (refer to FO-5).	<p>If air pressure is present at port 1, replace pneumatic valve assembly (3) (Para 12-34).</p> <p>If air pressure is not present at port 1, go to Fault 55.</p>
Step 7.	Install engine access panel (TM 5-2420-230-10).	

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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15. TRANSMISSION OVERHEATING.



- Step 1. Check for contaminated oil in transmission.  
If transmission oil is contaminated, change oil and filters (Para 4-5).
- Step 2. Ensure TRANSMISSION OIL PRESSURE gauge (2) reads a minimum of 235 psi (1 620 kPa).  
If correct reading is not obtained notify Direct Support maintenance (page F-103).
- Step 3. Check EGS (1) for proper shifting.  
If vehicle will not shift properly, go to Fault 12.
- Step 4. Check engine idle RPM on tachometer (3).  
If engine RPM reads less than 900 RPM, adjust low idle (Para L-49).

Table 3-6. Unit Troubleshooting Table. — Continued

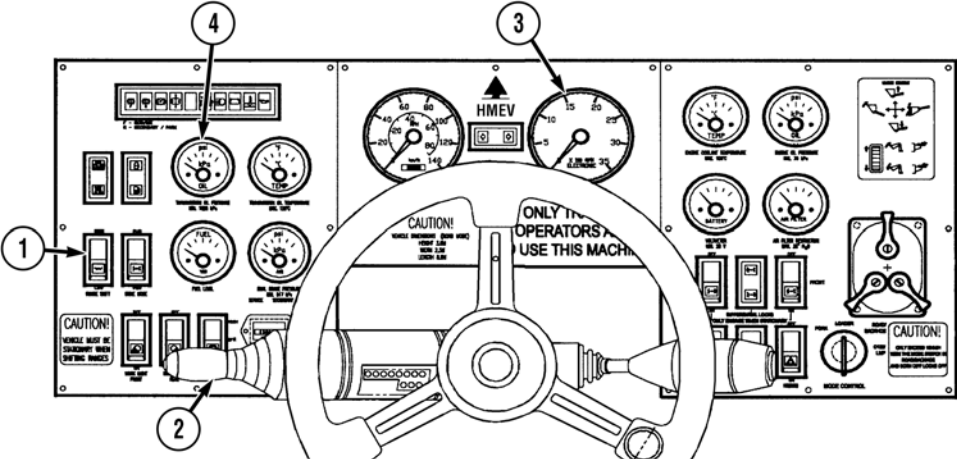
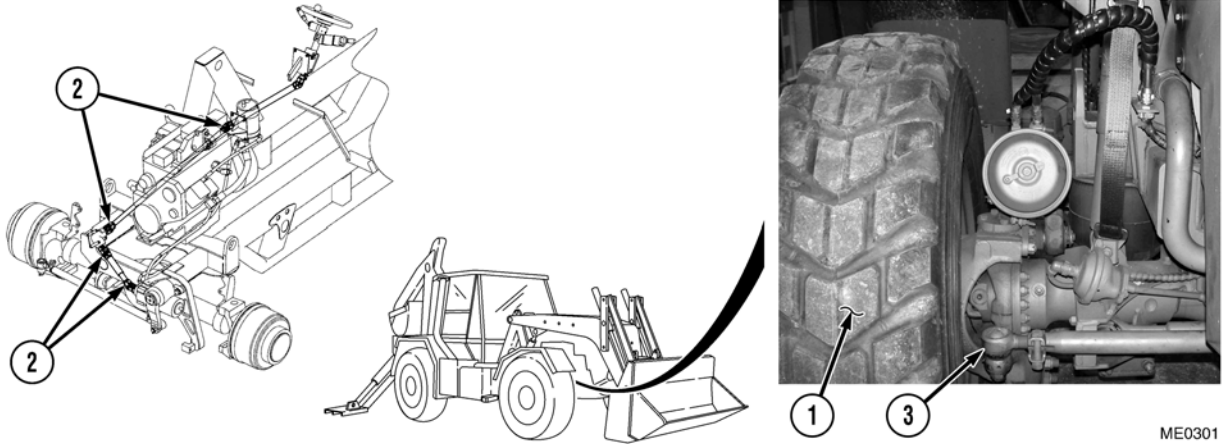
Malfunction	Test or Inspection	Corrective Action
16.	<b>TRANSMISSION STALL TEST.</b>	 <p>ME1200</p> <p>Step 1. Start engine (TM 5-2420-230-10).</p> <p>Step 2. Apply parking brake (TM 5-2420-230-10).</p> <p>Step 3. Set RANGE SHIFT switch (1) to HIGH (TM 5-2420-230-10).</p> <p>Step 4. With foot brake applied, set EGS (2) to first gear (TM 5-2420-230-10).</p> <p>Step 5. With foot brake applied, use throttle to accelerate engine speed until tachometer (3) reads 2,100 RPM.</p> <p>Step 6. Check TRANSMISSION OIL PRESSURE gauge (4) for a reading of 290 psi (2 000 kPa).</p> <p>If 290 psi (2 000 kPa) is not indicated, replace transmission charge pump (Para 4-11).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<p>17. STEERING SYSTEM HAS UNEVEN FEEL OR VIBRATION, VEHICLE WANDERS, OR TIRES SHOW UNEVEN WEAR.</p>		<p>Step 1. Check wheels (1) for proper alignment (Para 5-17).</p> <p style="padding-left: 40px;">If wheels (1) are out of alignment, realign wheels (Para 5-17).</p> <p>Step 2. Check steering U-joints (2) for excessive wear and proper alignment (Para 5-14).</p> <p style="padding-left: 40px;">If steering U-joints (2) are worn, replace steering U-joints (Para 5-14).</p> <p style="padding-left: 40px;">If steering U-joints (2) are out of alignment, realign steering U-joints (Para 5-14).</p> <p>Step 3. Check condition of tie rods (3) (Para 5-13).</p> <p style="padding-left: 40px;">If tie rods (3) are worn, replace tie rods (Para 5-13).</p>

ME0301

Table 3-6. Unit Troubleshooting Table. — Continued

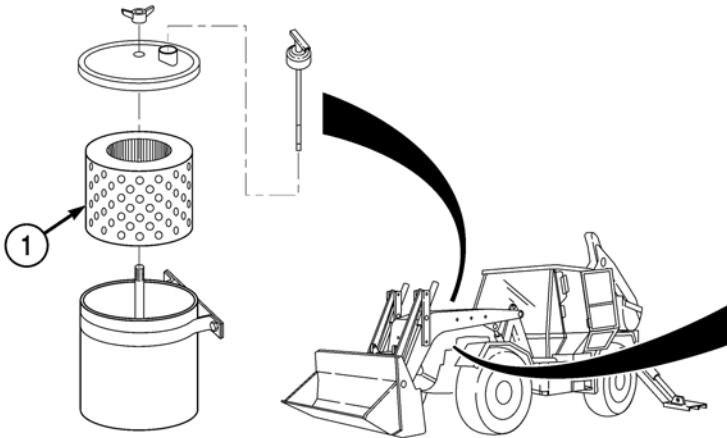
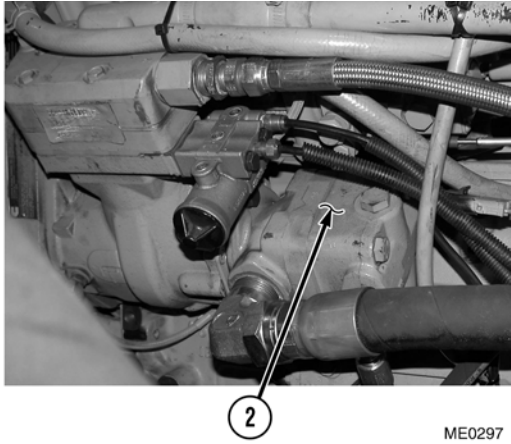
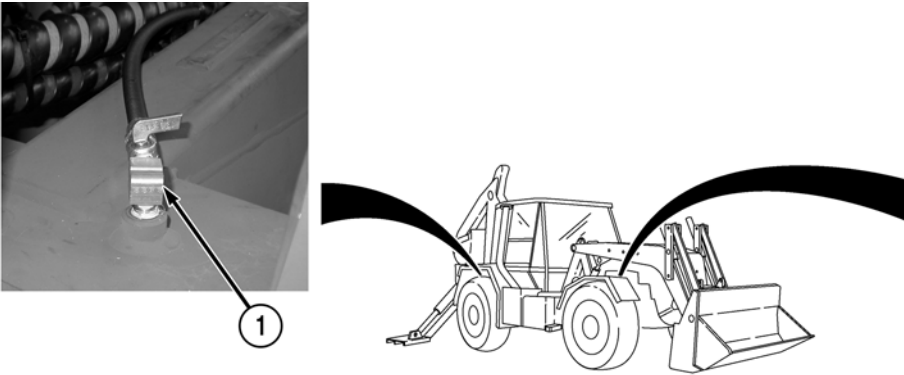
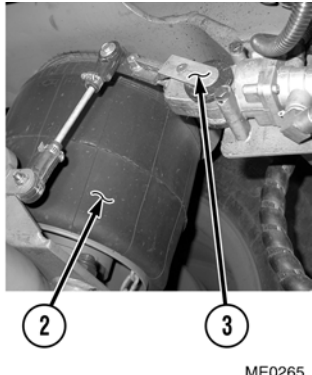
Malfunction	Test or Inspection	Corrective Action
<b>18. HARD TO STEER.</b>		 <p style="text-align: right;">ME0297</p>
	<p>Step 1. Check power steering oil filter (1) and visually inspect oil condition (Para 5-5). If power steering oil filter (1) is clogged, replace with new filter (Para 5-5).</p> <p>Step 2. Check power steering pump (2) by performing hydraulic flow test (Para K-7). If power steering pump (2) is not functioning, replace power steering pump (Para 5-8).</p>	
<b>19. VEHICLE LEANS TO ONE SIDE OR RIDES TOO HARD.</b>		 <p style="text-align: right;">ME0265</p>
	<p>Step 1. Check airbag isolation valves (1) to ensure they are open. If airbag isolation valves (1) are not open, open airbag isolation valves (TM 5-2420-230-10).</p> <p>Step 2. Check airbags (2) to ensure proper inflation. If airbags (2) are damaged, replace airbags (Para 6-5).</p> <p>Step 3. Check ride level valves (3) for proper operation or movement. Adjust ride level valves (3) (Para 6-7). If no movement, replace defective ride level valves (3) (Para 6-7).</p>	



Table 3-6. Unit Troubleshooting Table. — Continued

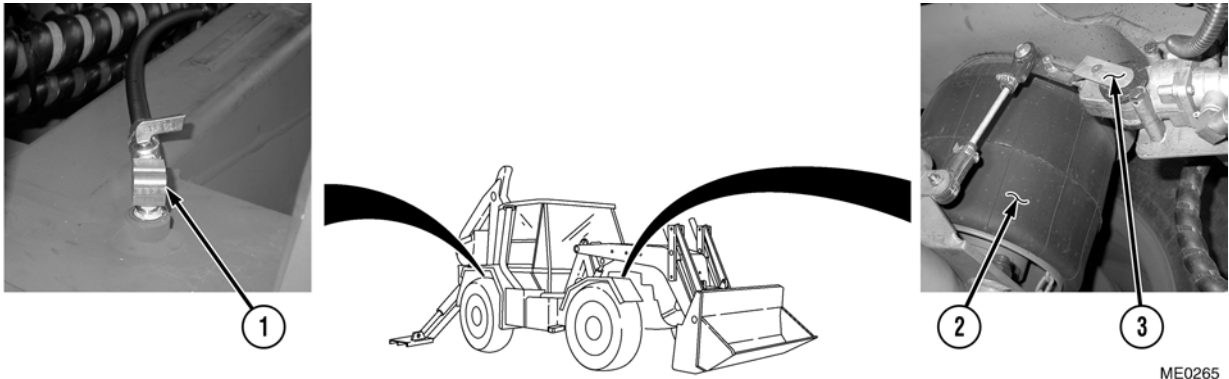
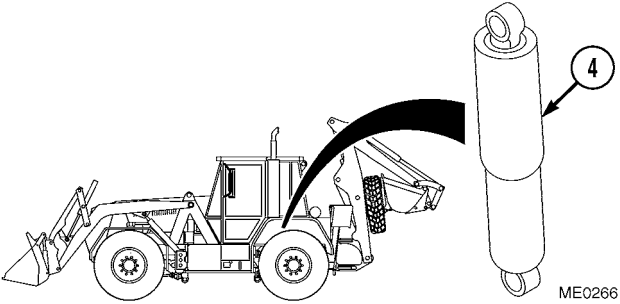
Malfunction	Test or Inspection	Corrective Action
<b>20. EXCESSIVE MOVEMENT IN SUSPENSION.</b>		<p>Step 1. Check air system for leaks in air lines and fittings. If a leak is present, tighten loose connection, or replace defective air fittings or lines (Para 15-5 or Para 15-8).</p> <p>Step 2. Check airbag isolation valve (1) to ensure it is open. If airbag isolation valve (1) is closed, open airbag isolation valve (TM 5-2420-230-10).</p> <p>Step 3. Check airbags (2) to ensure proper inflation. If airbags (2) are damaged, replace airbags (Para 6-5).</p> <p>Step 4. Check ride level valve (3) for proper operation or movement. Adjust ride level valves (3) (Para 6-7). If no movement, replace defective ride level valve (3) (Para 6-7).</p>
		<p>Step 5. Check shock absorbers (4) for damage. If shock absorbers (4) are damaged replace shock absorbers (Para 6-8).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

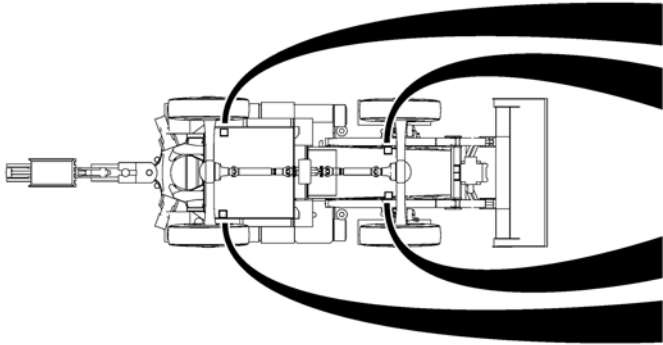
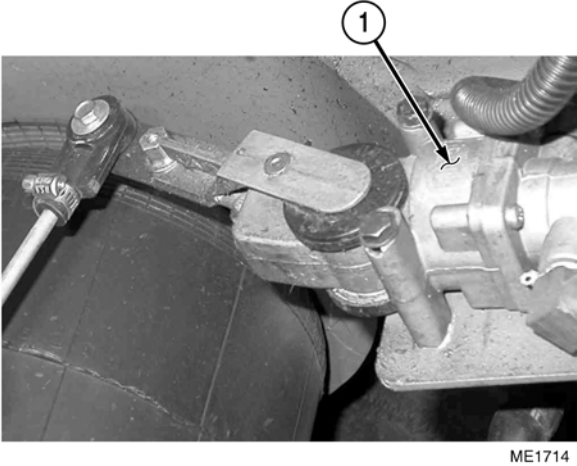
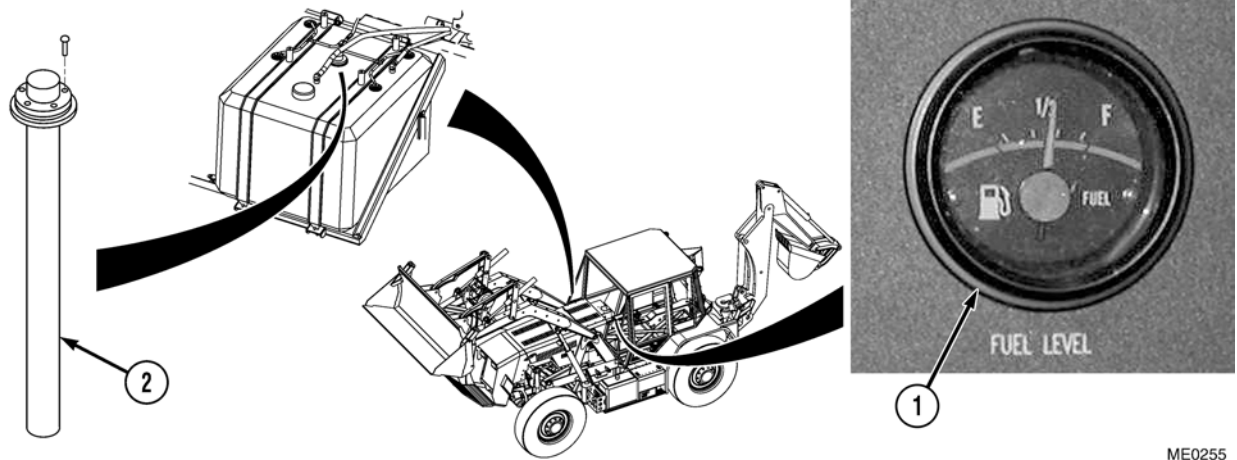
Malfunction	Test or Inspection	Corrective Action
21. RIDE LEVEL VALVE (RLV) OUT OF ADJUSTMENT.		 <p style="text-align: right;">ME1714</p>
	<p>Step 1. Check air system for leaks in air lines and fittings.</p>	<p>If a leak is present, tighten loose connection, or replace defective air fittings or lines (Para 15-5 or Para 15-8).</p>
	<p>Step 2. Check RLV (1).</p>	<p>Adjust RLV (1) (Para 6-7). If RLV (1) cannot be adjusted, replace defective RLV (Para 6-7).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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22. FUEL GAUGE READS INCORRECTLY.



ME0255

**WARNING**

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

Step 1. Check fuel gauge (1) for proper operation.

Remove wire at sending unit and ground to vehicle chassis. Have an assistant watch gauge to identify its movement. If no movement is noticed, check continuity of wire. Replace wire if necessary (Para 12-27).

If wire has continuity, replace fuel gauge (Para 12-23).

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

Step 2. Check fuel gauge sending unit (2) for proper operation.

Remove sending unit and raise and lower float. Have an assistant watch gauge to identify its movement. If no movement is noticed, replace fuel gauge sending unit (2) (Para 12-37).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
23. LOW FUEL PRESSURE OR NO FUEL DELIVERY.		<p style="text-align: center;"><b>WARNING</b></p> <ul style="list-style-type: none"> <li>• No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.</li> <li>• Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.</li> <li>• To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.</li> </ul> <p>Step 1. Check fuel tank (1) to ensure correct grade of fuel is in tank. If fuel is incorrect grade, drain fuel tank (1) and flush supply lines (Para 7-7).</p> <p>Step 2. Check fuel breather (2) for blockage. If fuel breather (2) has blockage, remove blockage and clean breather (Para 7-6). If blockage is severe or fuel breather (2) is damaged, replace fuel breather (Para 7-6).</p> <p>Step 3. Check fuel supply hose (3) for blockage. Clean or replace fuel supply hose (3) as necessary (Para 7-7).</p> <p>Step 4. Check output side of primary fuel filter (4) for blockage. Replace primary fuel filter (4) as necessary (Para 7-5).</p> <p>Step 5. Check output side of secondary fuel filter (5) for blockage. Replace secondary fuel filter (5) as necessary (Para 7-5). If fault continues, notify Direct Support Maintenance (Appendix L).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
24. LOW COOLANT LEVEL.		<p style="text-align: right;">ME0260</p> <div style="text-align: center; border: 2px solid black; padding: 5px; margin: 10px 0;"><b>WARNING</b></div> <ul style="list-style-type: none"> <li>• If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be relieved before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.</li> <li>• Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.</li> </ul> <p>Step 1. Check radiator cap gasket (1) for serviceability.</p> <p style="padding-left: 40px;">If radiator cap gasket is unserviceable, replace radiator cap.</p> <p>Step 2. Check upper and lower radiator hoses (2) for damage.</p> <p style="padding-left: 40px;">If radiator hose(s) are damaged, replace radiator hose(s) (Para 9-5) and top off coolant level (TM 5-2420-230-10).</p> <p style="text-align: center;"><b>NOTE</b></p> <p style="padding-left: 40px;">Step 2.1 applies only to vehicles equipped with a cold weather kit.</p> <p>Step 2.1 Check arctic heater coolant hoses (2.1) for damage.</p> <p style="padding-left: 40px;">If arctic heater hose(s) are damaged, replace arctic heater hose(s) (Para 20-5), and top off coolant level (TM 5-2420-230-10).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>LOW COOLANT LEVEL. — CONTINUED</b>		
<p>The diagram illustrates the inspection process for a low coolant level. On the left, a line drawing of an engine is shown with a callout arrow pointing to the water pump (3). In the center, a detailed view of the water pump (3) is shown with a callout arrow pointing to its weep hole (4). On the right, two panels show the weep hole (4) being inspected. The top panel shows a hand using a tool to inspect the weep hole (4) with a 'no oil' symbol (a circle with a diagonal line and 'OK') above it. The bottom panel shows a hand inspecting the weep hole (4) with a callout arrow pointing to the weep hole (4) and another callout arrow pointing to the water pump (3). Below the engine and water pump diagrams is a line drawing of a wheel loader with a callout arrow pointing to the engine compartment. The diagram is labeled ME2598 in the bottom right corner.</p>		
Step 3.	Remove belt (Para 4-6) and inspect the water pump (3) weep hole (4) for an indication of a coolant leak.	If water pump (3) weep hole (4) is leaking, replace water pump (Para L-23).
Step 4.	If coolant level is still low, remove and visually check water pump (3) seal and impeller for cracks and damage (Para L-23).	If seal and impeller have cracks and/or is damaged, replace water pump (3) (Para L-23).
	If coolant level continues to be low, notify Direct Support Maintenance (Appendix L).	

Table 3-6. Unit Troubleshooting Table. — Continued

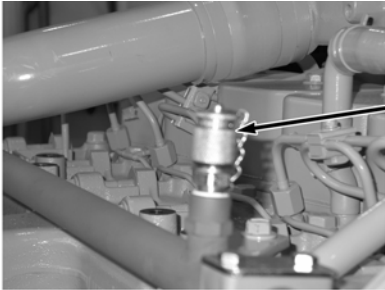
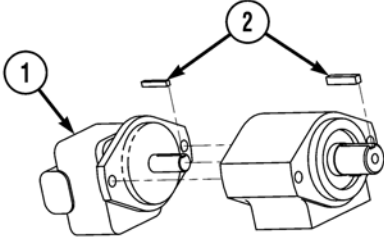
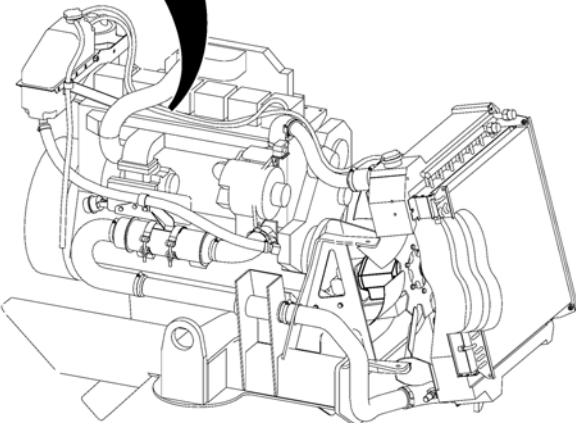
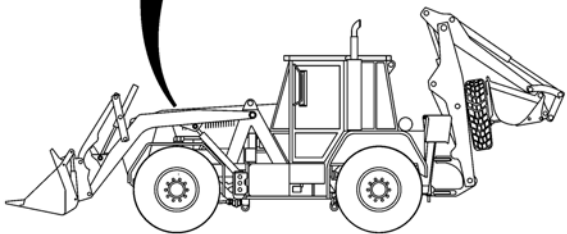
Malfunction	Test or Inspection	Corrective Action
25. NOISY HYDRAULIC COOLING FAN.		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p style="text-align: right; margin-right: 50px;">ME0439</p> <p>Step 1. With engine stopped, check hydraulic fan motor (1) to ensure it is functioning properly by rotating fan blade. After initial resistance, blades should move freely.</p> <p style="padding-left: 40px;">If no initial resistance is felt, replace damaged woodruff key(s) (2) (Para 9-6).</p> <p>Step 2. Check hydraulic fan motor (1) for 3,200 psi (22 063 kPa) at high idle at hydraulic fan motor test port (3) with a pressure gauge capable of measuring 0 to 3,500 psi (0 kPa to 24 132 kPa).</p> <p style="padding-left: 40px;">If pressure at hydraulic fan motor test port (3) is less than 2,900 psi (19 995 kPa) at high idle, replace hydraulic fan motor (Para 9-6).</p>





Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
26. HYDRAULIC OIL OVERHEATING.		<p>Step 1. Check for warning light on gauge indicating return filter blockage.</p> <p style="padding-left: 40px;">If return filter is blocked, replace return filter (Para 10-10).</p> <p>Step 2. Check hydraulic oil cooler (1) for blockage or buildup.</p> <p style="padding-left: 40px;">If hydraulic oil cooler (1) is blocked or dirty, clean or replace hydraulic oil cooler (Para 9-8).</p> <div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 10px auto;"><b>WARNING</b></div> <ul style="list-style-type: none"> <li>• Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.</li> <li>• Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.</li> </ul> <p>Step 3. Check supply line (2) for clogging, collapsing, or leaking.</p> <p style="padding-left: 40px;">If supply line (2) is clogged, collapsed, or leaking, replace supply line (Para 10-14).</p> <p>Step 4. Ensure hydraulic fan motor is operating properly.</p> <p style="padding-left: 40px;">If hydraulic fan motor is not operating properly, replace hydraulic fan motor (Para 9-6).</p>

ME0440

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>27. NOISY HYDRAULIC PUMP OR HYDRAULIC OIL FOAMS.</b>	<p>③ DELETED</p> <p>④ DELETED</p>	<p>Step 1. Check for clogged or pinched supply line (1).</p> <p>If supply line (1) is clogged or pinched, clean or replace supply line as necessary (Para 10-14).</p> <p>Step 2. Check for air in hydraulic oil by looking for foamy hydraulic oil in hydraulic reservoir (2).</p> <p>If air is in hydraulic oil, check and tighten supply line (1) connections.</p> <p>Step 3. Deleted.</p> <p>Step 4. Deleted.</p> <p>Step 5. Check hydraulic pump (5) with flow meter (Para 10-7).</p> <p>If flow rate is less than 24 gpm (91 L/min), replace hydraulic pump (Para 10-13).</p> <p style="text-align: right;">ME0443</p>

Table 3-6. Unit Troubleshooting Table. — Continued

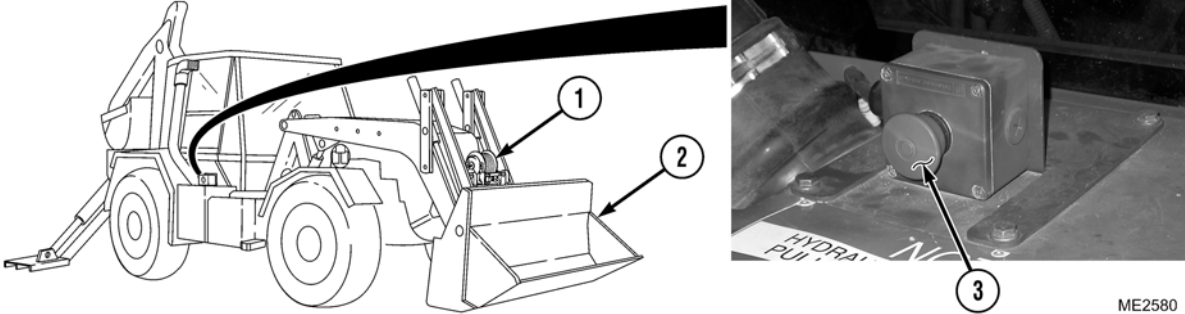
Malfunction	Test or Inspection	Corrective Action
<p><b>27.1 HYDRAULIC HOSE REEL DOES NOT OPERATE OR LOW HYDRAULIC POWER ON HAND TOOL ATTACHMENT.</b></p>		<p style="text-align: center;"><b>WARNING</b></p> <p>Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.</p> <p>Step 1. Check for damaged hoses and connectors on hose reel (1). If hoses and connectors are damaged, replace hoses and connectors (Para 10-29).</p> <p>Step 2. Connect and operate 4-in-1 bucket (2) (TM 5-2420-230-10). If 4-in-1 bucket (2) operates, go to Step 3.</p> <p>Step 3. Operate another hydraulic function (TM 5-2420-230-10). If only 4-in-1 bucket (2) does not operate, go to Fault 27.2. If no other hydraulic functions operate, go to Fault 28.</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 4. Check wire harness on hose reel switch (3) for continuity (refer to FO-3). If continuity is present, replace hose reel valve assembly (Para 10-33). If continuity is not present, replace hose reel switch (Para 10-32).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>27.2 NO OR LOW HYDRAULIC POWER ON INDIVIDUAL FUNCTION.</b>		
<p>The diagram illustrates the hydraulic system components of a backhoe loader. On the left is the FEL Valve Block, and on the right is the Backhoe Valve Block. In the center is the backhoe loader with arrows pointing to the FEL Cylinders (at the front loader) and Backhoe Cylinders (at the rear backhoe). Curved arrows connect the valve blocks to their respective cylinder groups.</p>		
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<ul style="list-style-type: none"> <li>• Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.</li> <li>• Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.</li> </ul>		
Step 1.	Check hydraulic cylinder(s) and valve block on problem hydraulic circuit for visible damage or leaks.	
	If valve block is damaged or leaking, replace or repair valve block (Para 10-15 or 10-16).	
	If hydraulic cylinder is damaged, replace cylinder (Chapter 10).	
	If hydraulic cylinder is leaking, repair cylinder (Chapter 10 or Appendix H).	
<b>NOTE</b>		
	Step 2 only applies to the tilt, lift, 4-in-1 bucket cylinders.	
Step 2.	Observe operation of tandem hydraulic cylinders on problem hydraulic circuit.	
	If one side has no power or moves extremely slow, replace or repair damaged cylinder (Chapter 10).	

ME2567

Table 3-6. Unit Troubleshooting Table. — Continued

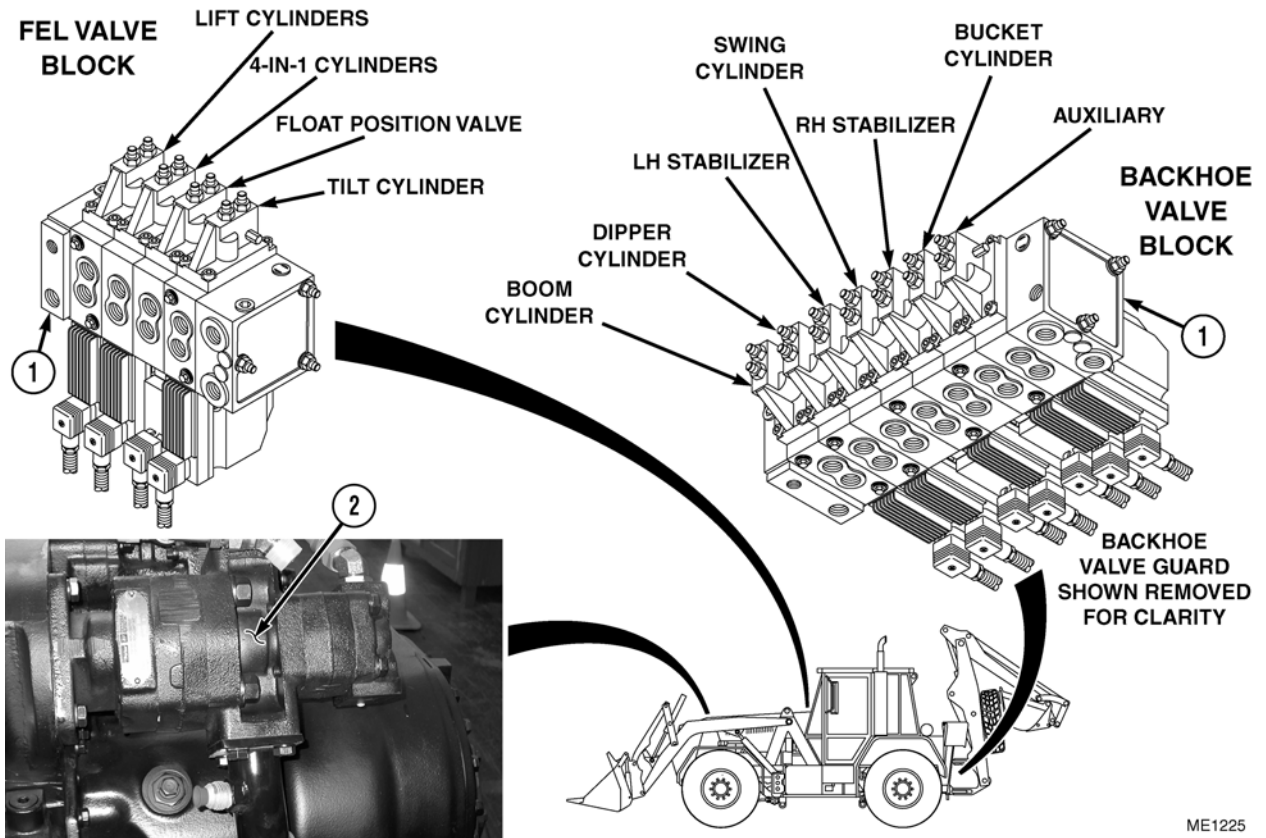
Malfunction	Test or Inspection	Corrective Action
<b>NO OR LOW HYDRAULIC POWER ON INDIVIDUAL FUNCTION. — CONTINUED</b>		
<p>The diagram illustrates the hydraulic system components for a loader. On the left is the FEL Valve Block, and on the right is the Backhoe Valve Block. In the center is the loader with arrows pointing to the FEL Cylinders and Backhoe Cylinders. Callout 1 points to a solenoid on the FEL Valve Block and a solenoid on the Backhoe Valve Block. Callout 2 points to a solenoid plug on the FEL Valve Block and a solenoid plug on the Backhoe Valve Block. The diagram is labeled ME2568.</p>		
<b>WARNING</b>		
<p>If hydraulic cylinders are bypassing oil, they may be hot enough to burn you. When checking cylinder temperature, avoid direct contact. Failure to comply may result in injury to personnel.</p>		
Step 3.	Check hydraulic cylinder(s) and hoses on problem hydraulic circuit for excessive heat.	<p>If hydraulic cylinder and hoses are excessively hot, replace or repair damaged cylinder (Chapter 10 or Appendix H).</p>
Step 4.	Manually operate valve on problem hydraulic circuit (Para 10-8).	<p>If valve will not manually operate, repair valve block (Para 10-15 or 10-16).</p>
<b>NOTE</b>		
<p>The FEL float, LH stabilizer, and RH stabilizer solenoids do not have LEDs.</p>		
Step 5.	With engine running, check for a green LED on solenoid (1) for problem hydraulic circuit.	<p>If LED is red, replace solenoid (1) (Para 12-33).</p>
Step 6.	Check voltage at solenoid plug (2) (refer to FO-3).	<p>If solenoid plug (2) has low voltage, replace corresponding wire harness (Para 12-27).                      If solenoid plug (2) voltage is correct, replace solenoid (Para 12-33).</p>



Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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28. NO OR LOW HYDRAULIC POWER FOR COMPLETE HYDRAULIC SYSTEM.



**WARNING**

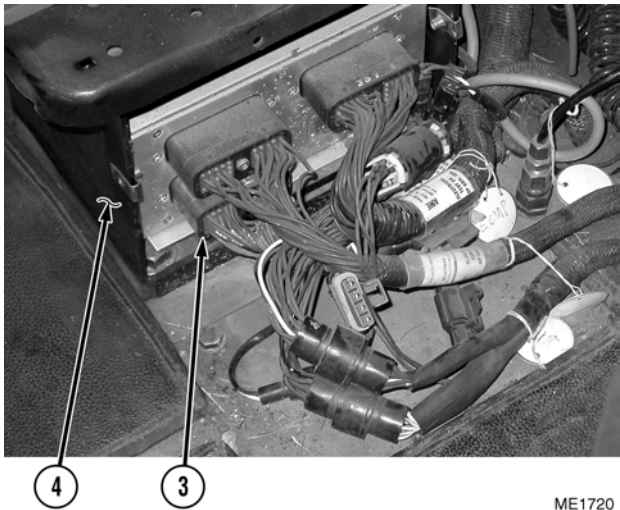
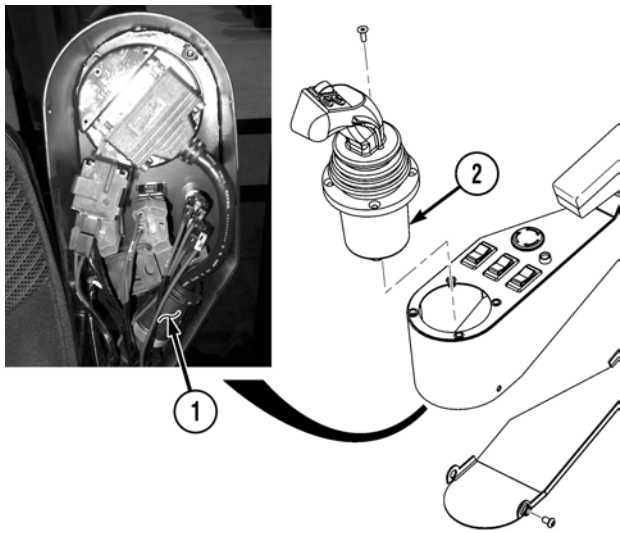
Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.

- Step 1. Check relief valves on backhoe and FEL valve blocks (1) for leaks, and to ensure neither is set too low.
- If either relief valve is set too low, reset relief valve (Para 10-6).
  - If either relief valve is leaking, repair or replace valve block as necessary (Para 10-15 or Para 10-16).
- Step 2. Check hydraulic pump (2) with flow meter (Para 10-7).
- If flow rate is less than 24 gpm (91 L/min), replace hydraulic pump (2) (Para 10-13).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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**29. RIGHT JOYSTICK INOPERABLE.**



ME1719

ME1720

**WARNING**

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

- Step 1. Disconnect electrical connector HX10 (1) from right joystick (2) (refer to FO-3).
- Step 2. Disconnect electrical connector HJ1 (3) from ECU (4) (refer to FO-3).
- Step 3. Turn ignition switch to IGN position (TM 5-2420-230-10).
- Step 4. Check for 12 Vdc on pin 1 of electrical connector HJ1 (3) (refer to FO-3).

If 12 Vdc is not present, set ignition switch to OFF and replace ECU (4) (Para 12-32).

If 12 Vdc is present, set ignition switch to OFF and proceed to Step 5.



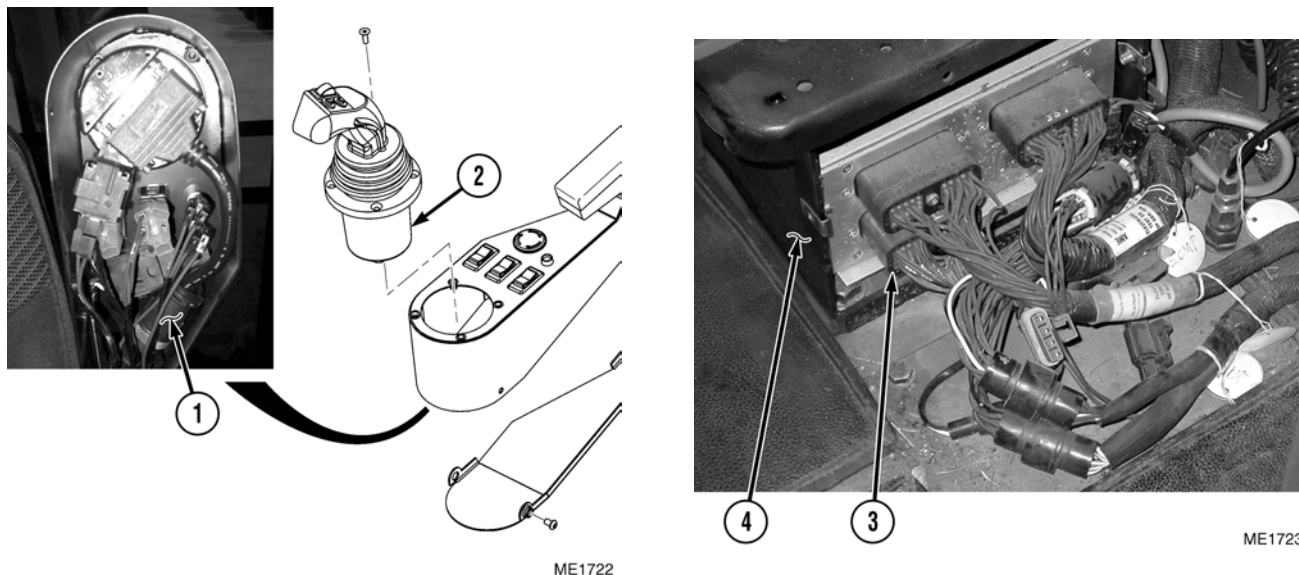
Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction			
Test or Inspection		Corrective Action	
<b>RIGHT JOYSTICK INOPERABLE. — CONTINUED</b>			
<b>WARNING</b>			
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.			
Step 5. Check for continuity between the following pins of electrical connector HX10 (1) and electrical connector HJ1 (3) (refer to FO-3):			
RH JOYSTICK ELECTRICAL CONNECTOR HX10		ECU ELECTRICAL CONNECTOR HJ1	SIGNAL PATH NAME
Pin U	to	Pin 1	Right joystick voltage (through SP-H3)
Pin T	to	Pin 25	Right center joystick input
Pin N	to	Pin 1	Right joystick voltage (through SP-H3)
Pin M	to	Pin 35	Right joystick ground
Pin J	to	Pin 6	Arm boom potentiometer signal
Pin G	to	Pin 5	Bucket potentiometer signal
Pin F	to	Pin 29	Return-to-dig button signal
Pin E	to	Pin 37	Return-to-position button signal
Pin D	to	Pin 4	4-in-1 potentiometer signal
Pin A	to	Pin 12	Transmission cutout signal
If there is continuity, replace right joystick (2) (Para 12-24).			
If there is not continuity, replace wire harness (Para 12-27).			

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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30. LEFT JOYSTICK INOPERABLE.



**WARNING**

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

- Step 1. Disconnect electrical connector HX11 (1) from left joystick (2) (refer to FO-3).
- Step 2. Disconnect electrical connector HJ1 (3) from ECU (4) (refer to FO-3).
- Step 3. Set ignition switch to IGN position (TM 5-2420-230-10).
- Step 4. Check for 12 Vdc on pin 11 of electrical connector HJ1 (3) (refer to FO-3).

If 12 Vdc is not present, set ignition switch to OFF and replace ECU (4) (Para 12-32).

If 12 Vdc is present, set ignition switch to OFF and proceed to Step 5.

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction		Test or Inspection	Corrective Action
<b>LEFT JOYSTICK INOPERABLE. — CONTINUED</b>			
<b>WARNING</b>			
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short may result in instant heating of tools, damage to equipment, and injury or death to personnel.			
Step 5. Check for continuity between the following pins of electrical connector HX11 (1) and electrical connector HJ1 (3) (refer to FO-3):			
LH JOYSTICK ELECTRICAL CONNECTOR HX11		ECU ELECTRICAL CONNECTOR HJ1	SIGNAL PATH NAME
Pin A	to	Pin 10	Work selection button
Pin G	to	Pin 7	Swing potentiometer signal
Pin J	to	Pin 8	Dipper potentiometer signal
Pin K	to	Pin 9	Bucket shake signal
Pin M	to	Pin 34	Left joystick ground
Pin N	to	Pin 11	Left joystick voltage (through SP-H2)
Pin T	to	Pin 24	Left center joystick input
Pin U	to	Pin 11	Left joystick voltage (through SP-H2)
If there is continuity, replace left joystick (2) (Para 12-24).			
If there is not continuity, replace wire harness (Para 12-27).			

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
31. NO SYSTEM VOLTAGE.	<p>The diagram illustrates the electrical system components for troubleshooting. On the left, a battery box is shown with a master switch labeled '1'. In the center, a skid steer loader is shown with two batteries labeled '3'. On the right, the ignition switch is shown with positions for 'OFF', 'IGN', and 'START', labeled '2'. A circular 'PUSH' button is also shown next to the ignition switch. A curved arrow points from the battery box area towards the ignition switch area.</p>	<p>Step 1. Ensure electrical master switch (1) in battery box is in the ON position and ignition switch (2) is in the IGN position (TM 5-2420-230-10).</p> <p>If there is still no system voltage, go to Step 2.</p>
<p><b>WARNING</b></p>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 2.	Check voltage on both batteries (3).	<p>If voltage is low, charge batteries (3) (TM 9-6140-200-14).</p> <p>If batteries do not hold charge, replace batteries (3) (Para 12-6).</p>

ME0424

Table 3-6. Unit Troubleshooting Table. — Continued

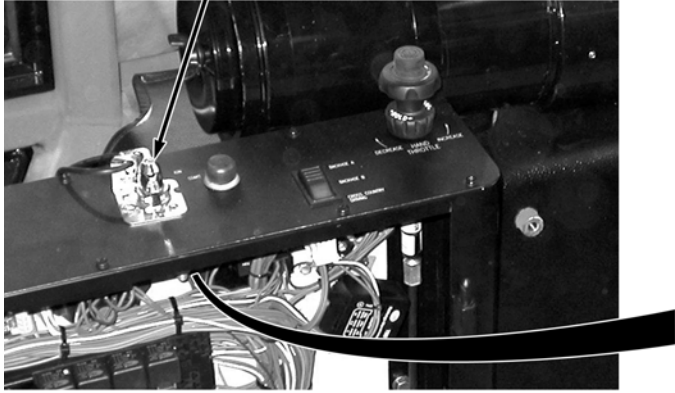
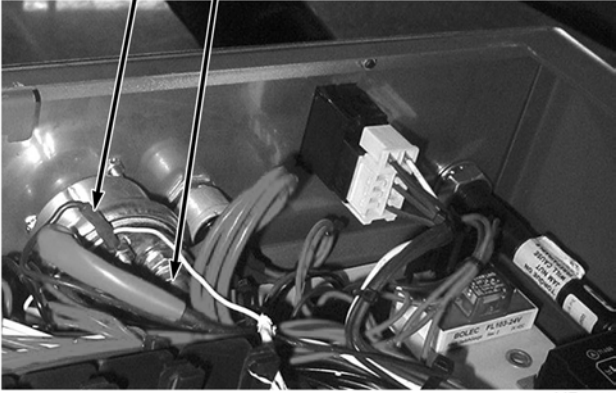
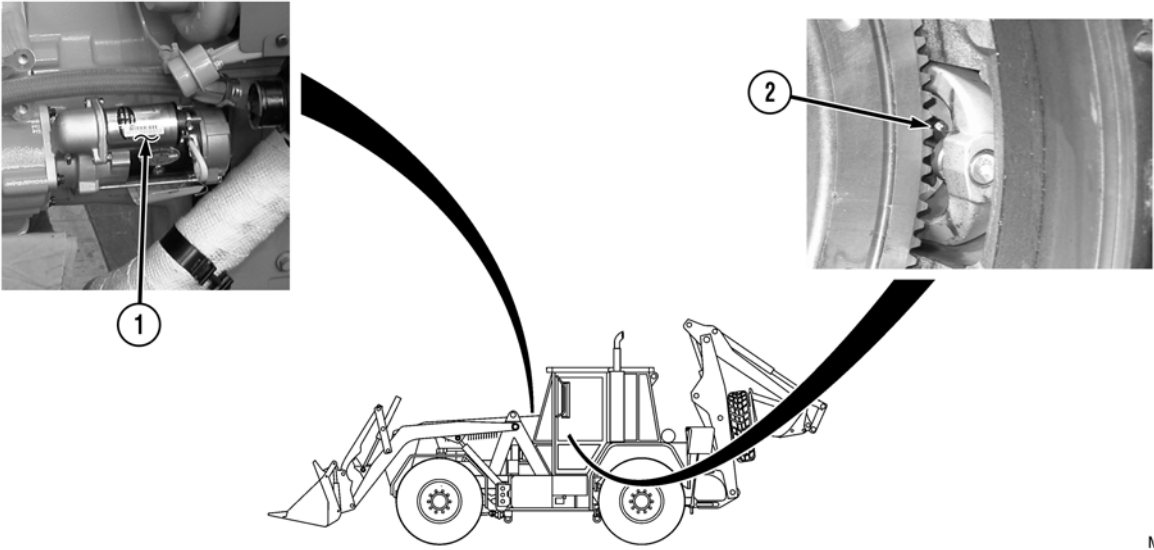
Malfunction	Test or Inspection	Corrective Action
32. NO POWER AT IGNITION SWITCH.		
<p><b>WARNING</b></p>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 1.	Check for 24 Vdc on wire 24 (1) at ignition switch (2) (refer to FO-3).	<p>If 24 Vdc is not present on wire 24 (1), check wire for continuity. Replace wire as necessary (Para 12-27).</p>
Step 2.	With ignition switch in IGN position, check for 24 Vdc on wire 7 (3) at ignition switch (2) (refer to FO-3).	<p>If 24 Vdc is not present on wire 7 (3), replace ignition switch (Para 12-18).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
33. STARTER WILL NOT CRANK.		<p><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>
		<p>Step 1. Check for 24 Vdc at terminal B on starter solenoid (1) (refer to FO-3).</p> <p style="padding-left: 40px;">If 24 Vdc is present at terminal B and starter motor (2) does not crank, replace starter motor (Para 12-11).</p> <p>Step 2. With ignition switch in IGN position (TM 5-2420-230-10), check for 24 Vdc at wire 26 on starter button (3) (refer to FO-3).</p> <p style="padding-left: 40px;">If 24Vdc is not present at wire 26, check wire for continuity. Replace wire harness as necessary (Para 12-27).</p> <p>Step 3. Check for 24 Vdc at wire 28 on starter button (3) (refer to FO-3).</p> <p style="padding-left: 40px;">If 24 Vdc is not present at wire 28, replace starter button (Para 12-22).</p> <p>Step 4. Check starter solenoid (4) to ensure it is functioning correctly.</p> <p style="padding-left: 40px;">If starter solenoid (4) does not function correctly, replace starter solenoid (Para 12-16).</p> <p>Step 5. Check starter motor pinion to ensure it is not jammed in flywheel gear.</p> <p style="padding-left: 40px;">If starter motor pinion is jammed in flywheel gear, replace starter motor (Para 12-11).</p> <p>Step 6. Check engine (5) to ensure it is not seized.</p> <p style="padding-left: 40px;">If engine (5) is seized, notify Direct Support maintenance (Appendix L).</p>

ME0659

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<p>34. STARTER MOTOR TURNS, BUT ENGINE WILL NOT CRANK.</p>		<p>Step 1. Remove starter (1) (Para 12-11) and check starter pinion and flywheel ring gear (2) for broken or excessively worn teeth.</p> <p>If starter pinion has broken or excessively worn teeth, replace starter motor (Para 12-11).</p> <p>If flywheel ring gear is damaged, notify Direct Support maintenance (Para L-24).</p>

ME0456

Table 3-6. Unit Troubleshooting Table. — Continued

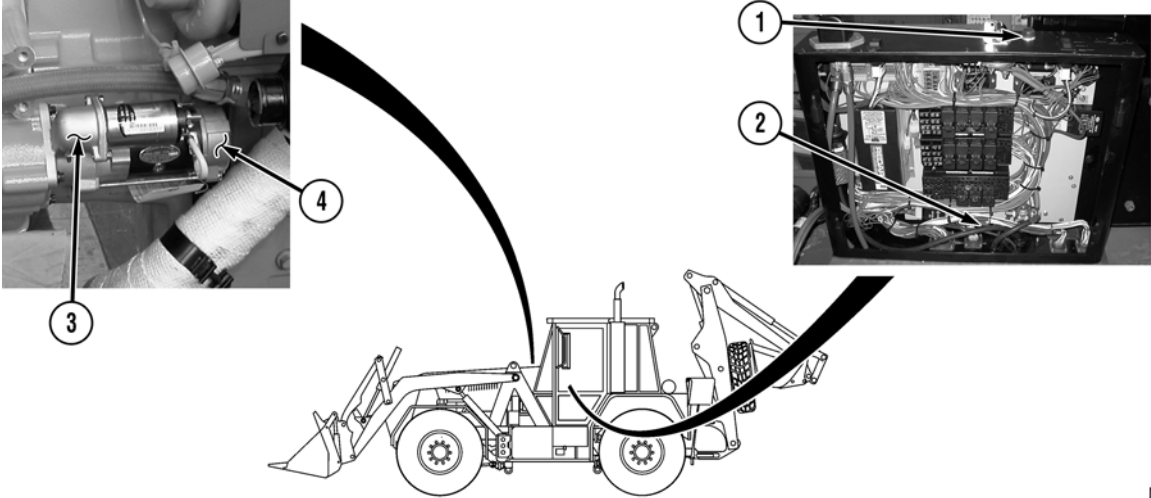
Malfunction	Test or Inspection	Corrective Action
35. STARTER MOTOR CONTINUES TO RUN AFTER ENGINE STARTS.	 <p>The diagram shows a side view of a wheel loader. Callout 1 points to the starter button on the operator's console. Callout 2 points to the starter solenoid located near the engine. Callout 3 points to the starter solenoid on the front of the engine. Callout 4 points to the starter motor on the front of the engine. Two inset photographs provide close-up views: the left inset shows the starter motor (4) and its solenoid (3), while the right inset shows the starter solenoid (2) and the starter button (1).</p>	ME0659
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 1.	Check for 24 Vdc at wire 28 on starter button (1) (refer to FO-3).	If 24 Vdc is present at wire 28, replace starter button (Para 12-22).
Step 2.	Check starter solenoid (2) to ensure it is functioning correctly.	If starter solenoid (2) does not function correctly, replace starter solenoid (Para 12-16).
Step 3.	Check starter solenoid (3) to ensure starter motor (4) is disengaging.	If starter motor (4) is not disengaging properly, replace starter motor (Para 12-11).



Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
36. LOW BATTERY OUTPUT.		<div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 0 auto;"><b>WARNING</b></div> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 1. Check batteries (1) for broken posts and ensure they are fully charged (TM 9-6140-200-14).</p> <p style="padding-left: 40px;">If battery posts are broken, or if batteries (1) will not charge, replace batteries (Para 12-6).</p> <p>Step 2. With engine running, check for 26 to 28 Vdc at terminal B on alternator (2) (refer to FO-3).</p> <p style="padding-left: 40px;">If output of alternator (2) is below 26 Vdc, replace alternator (Para 12-10).</p> <p>Step 3. Check for 24 Vdc at wire 31 on charge equalizer (3) (refer to FO-3).</p> <p style="padding-left: 40px;">If 24 Vdc is not present at wire 31, replace charge equalizer (Para 12-20).</p> <p style="padding-left: 40px;">If vehicle is equipped with cold weather kit, and problem persists, go to Fault 67.</p>

Table 3-6. Unit Troubleshooting Table. — Continued

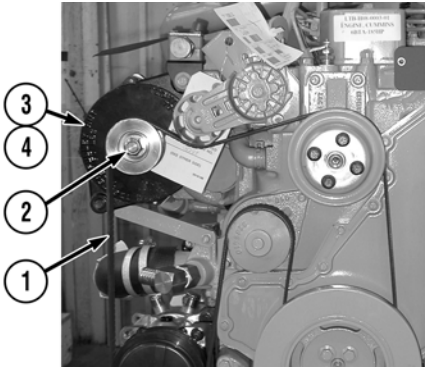
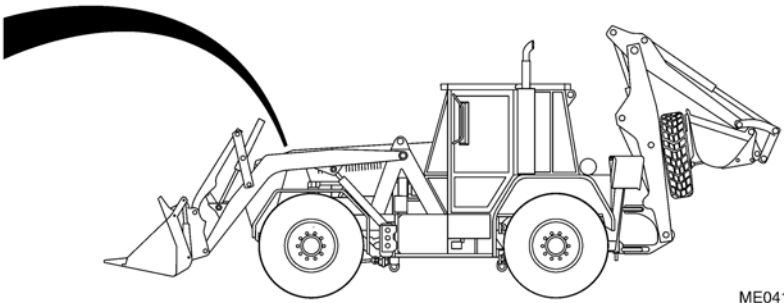
Malfunction	Test or Inspection	Corrective Action
37. NOISY ALTERNATOR.		 <p style="text-align: right;">ME0417</p>
	<p>Step 1. Check drive belt (1) for excessive wear (TM 5-2420-230-10).</p> <p style="padding-left: 40px;">If drive belt (1) is worn, replace drive belt (Para 4-6).</p> <p>Step 2. Remove drive belt (1) (Para 4-6).</p> <p>Step 3. Inspect alignment of alternator pulley (2).</p> <p>Step 4. Ensure alternator (3) and alternator bearing (4) are functioning correctly.</p> <p>Step 5. Spin alternator shaft to ensure it is not noisy.</p> <p style="padding-left: 40px;">If alternator pulley (2) is out of alignment, alternator (3) or alternator bearing (4) is not functioning correctly, or alternator shaft is noisy, replace alternator (3) (Para 12-10).</p> <p>Step 6. Install drive belt (1) (Para 4-6).</p>	

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>38. CHARGING INDICATOR LIGHT REMAINS ILLUMINATED OR DOES NOT CHARGE.</b>		<p>Step 1. Check drive belt (1) and alternator pulley (2) for excessive wear or damage (TM 5-2420-230-10).</p> <p>If drive belt (1) is loose, inspect self tensioner (3) and replace if necessary (Para L-9).</p> <p>If drive belt (1) is worn or damaged, replace drive belt (Para 4-6).</p> <p>If alternator pulley (2) is worn or damaged, replace alternator pulley (Para 12-10).</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 2. Check alternator exciter relay (4) (signal wire) to ensure it is functioning correctly (refer to FO-1).</p> <p>If exciter relay (4) is not functioning correctly, replace relay (Para 12-15).</p> <p>Step 3. With engine running, check for 26 to 28 Vdc at terminal B on alternator (5) (refer to FO-3).</p> <p>If alternator (5) is not charging 26-28 Vdc, replace alternator (Para 12-10).</p> <p>Step 4. Check wiring harness (6) for continuity.</p> <p>If continuity is not present, replace wiring harness (6) (Para 12-27).</p>

ME0411

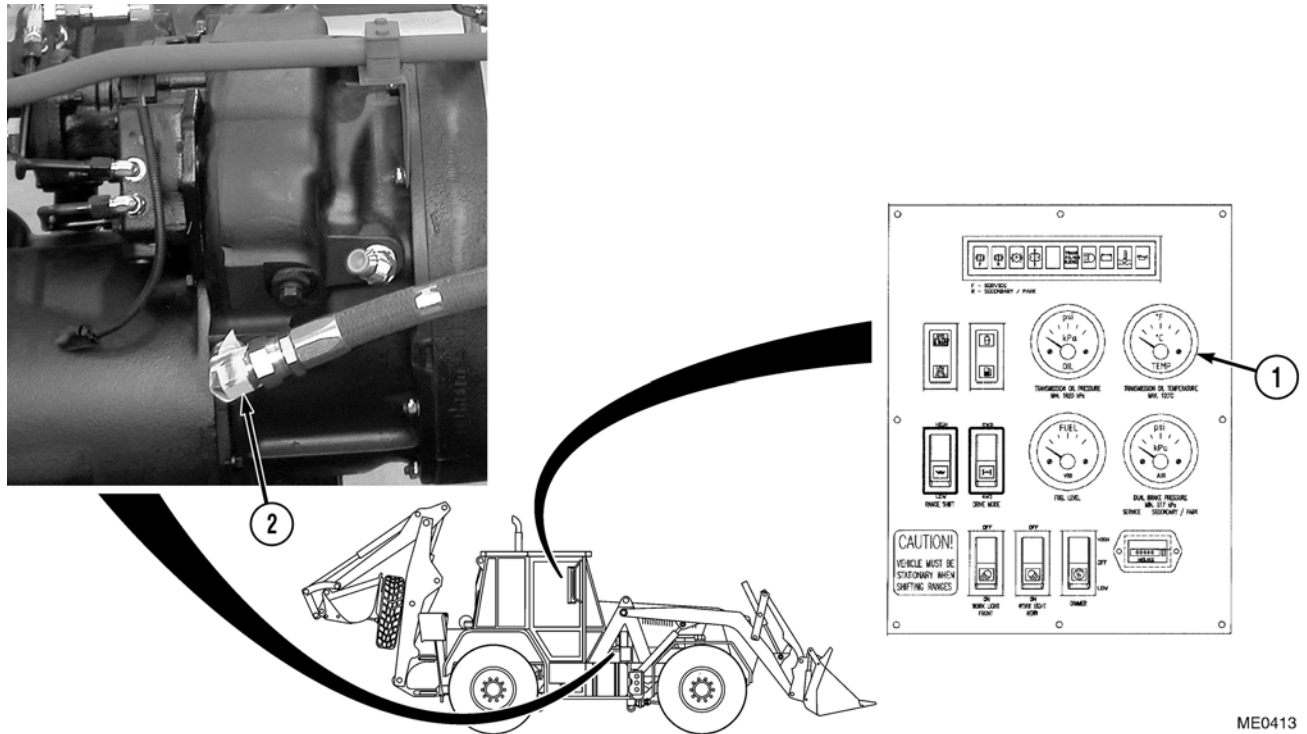
Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>39. HOURMETER DOES NOT WORK.</b>		<p><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>
Step 1.	Check for 24 Vdc at wire 322 on hourmeter (1) (refer to FO-3).	<p>If 24 Vdc is present at wire 322, replace hourmeter (1) (Para 12-23).</p> <p>If 24 Vdc is not present at wire 322, check wire for continuity. Replace dash harness as necessary (Para 12-39).</p>
Step 2.	Check alternator exciter relay (2) (signal wire) to ensure it is functioning correctly (refer to FO-1).	<p>If exciter relay (2) is not functioning correctly, replace relay (Para 12-15).</p>
Step 3.	Check for a good ground at hourmeter (1).	<p>If a good ground is not present, replace dash harness (Para 12-39).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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40. TRANSMISSION OIL TEMPERATURE GAUGE DOES NOT WORK.



ME0413

**WARNING**

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

Step 1. Check TRANSMISSION OIL TEMPERATURE gauge (1) and sending unit (2) for proper operation and good connections.

If sending unit (2) does not function correctly, replace sending unit (Para 4-7).

If connections at sending unit (2) are loose or broken, tighten or repair connections as necessary.

Step 2. Remove wire 271 at sending unit (2) and ground to vehicle chassis. Have an assistant watch TRANSMISSION OIL TEMPERATURE gauge (1) to verify its operation (refer to FO-3).

If no movement is noticed, check continuity of wire 271. Replace wire harness if necessary (Para 12-27 or Para 12-39).

If wire 271 has continuity, replace TRANSMISSION OIL TEMPERATURE gauge (1) (Para 12-23).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction
Test or Inspection
Corrective Action
<p>41. HORN DOES NOT WORK.</p>
<p style="text-align: right;">ME0414</p>
<p><b>WARNING</b></p>
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>
<p>Step 1. Check for 24 Vdc on wire 180 at horn (1) when switch (2) is pressed (refer to FO-3).</p>
<p style="padding-left: 40px;">If 24 Vdc is present on wire 180, replace horn (1) (Para 19-7).</p>
<p style="padding-left: 40px;">If 24 Vdc is not present, check wire 180 for continuity. Replace wire harness as necessary (Para 12-27).</p>
<p>Step 2. Check for 12 Vdc on wire 190 at switch (2) (refer to FO-3).</p>
<p style="padding-left: 40px;">If 12 Vdc is present on wire 190, replace indicator arm (3) (Para 12-26).</p>
<p style="padding-left: 40px;">If 12 Vdc is not present, check wire 190 for continuity. Replace wire harness as necessary (Para 12-27).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

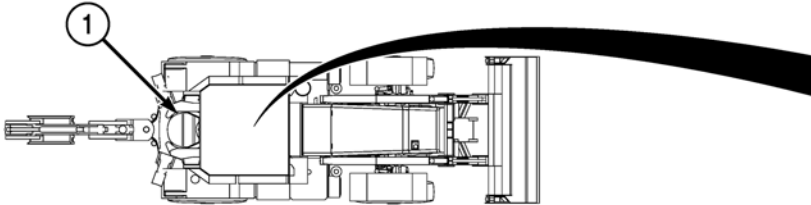
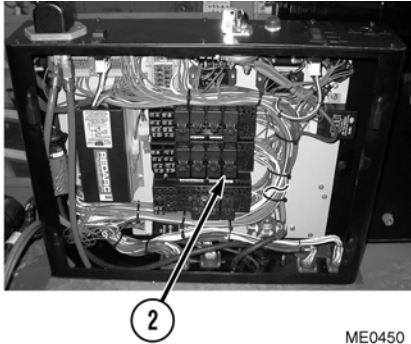
Malfunction	Test or Inspection	Corrective Action
42. REVERSE ALARM DOES NOT WORK.		 <p style="text-align: right;">ME0450</p>
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
<p><b>NOTE</b></p>		
<p>Blackout mode disables reverse alarm.</p>		
Step 1.	<p>Check for 24 Vdc at wire 378 on reverse alarm (1) (refer to FO-3).</p>	<p>If 24 Vdc is present at wire 378, replace reverse alarm (1) (Para 12-38).</p> <p>If 24 Vdc is not present at reverse alarm (1), check wire 378 for continuity. Replace wire harness as necessary (Para 12-27).</p>
Step 2.	<p>Check reverse alarm relay (2) for proper operation and good connections (refer to FO-1).</p>	<p>If reverse alarm relay (2) does not function correctly, replace reverse alarm relay (Para 12-15).</p> <p>If connections at reverse alarm relay (2) are loose or broken, tighten or repair connections as necessary.</p>

Table 3-6. Unit Troubleshooting Table. — Continued

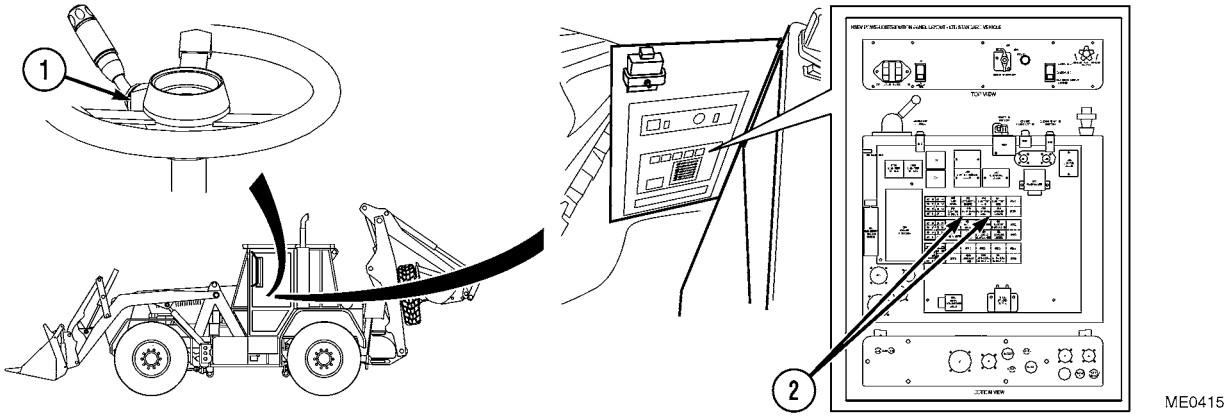
Malfunction	Test or Inspection	Corrective Action
43. FRONT OR REAR WIPERS DO NOT WORK.		<p><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 1. Check for 24 Vdc at terminal 23 of wiper switch (1).</p> <p>If 24 Vdc is present at terminal 23, replace wiper switch (1) (Para 12-29 or Para 12-30).</p> <p>If 24 Vdc is not present at terminal 23, check wiring harness on wiper switch (1) for continuity. Replace wiring harness as necessary (Para 12-27).</p> <p><b>NOTE</b></p> <p>Step 2 only applies to the front wiper motor.</p> <p>Step 2. Check front wiper relays (2) to ensure they function correctly (refer to FO-1).</p> <p>If front wiper relay(s) (2) do not function correctly, replace wiper relay(s) (Para 12-15).</p>



Table 3-6. Unit Troubleshooting Table. — Continued

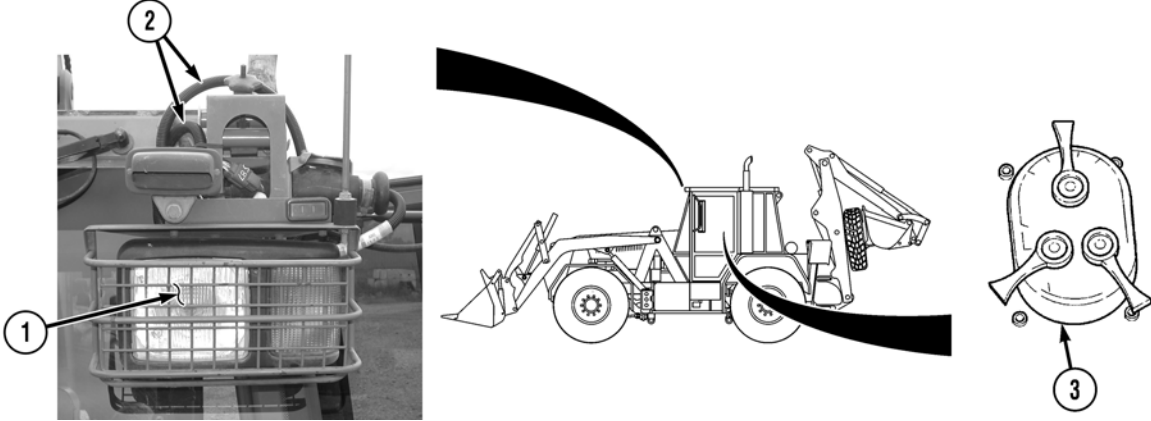
Malfunction	Test or Inspection	Corrective Action
44. HEADLIGHT DOES NOT WORK.		<p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 1. Ensure master light switch is set correctly (TM 5-2420-230-10).</p> <p>Step 2. Check circuit breaker CB-24 in the Power Distribution Panel (PDP) (refer to FO-1).</p> <p style="padding-left: 40px;">If circuit breaker CB-24 is tripped, reset circuit breaker.</p> <p>Step 3. Ensure headlight is plugged in correctly (TM 5-2420-230-10).</p> <p>Step 4. Check for voltage at headlight bulb (1).</p> <p style="padding-left: 40px;">If voltage is present, replace headlight bulb (1) (Para 12-45).</p> <p>Step 5. Check wiring harness (2) for continuity.</p> <p style="padding-left: 40px;">If continuity is not present, replace wiring harness (2) (Para 12-27).</p> <p>Step 6. Check master light switch (3) to ensure it functions correctly.</p> <p style="padding-left: 40px;">If master light switch (3) does not function correctly, replace master light switch (Para 12-12).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
45. TURN SIGNAL DOES NOT WORK.		<p>Step 1. Ensure master light switch is set correctly (TM 5-2420-230-10).</p>
<p><b>WARNING</b></p>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 2.	Check circuit breaker CB-24 in the Power Distribution Panel (PDP) (refer to FO-1).	If circuit breaker CB-24 is tripped, reset circuit breaker.
Step 3.	Check for voltage at bulb (1).	If voltage is present at bulb (1), replace bulb (1) (Para 12-45).
		If connections at bulb (1) are loose or broken, tighten or repair connections as necessary.
Step 4.	Check turn signal switch (2) to ensure it functions correctly.	If turn signal switch (2) does not function correctly, replace turn signal switch (Para 12-26).
Step 5.	Check wiring harness (3) for continuity.	If continuity is not present, replace wiring harness (3) (Para 12-27).
Step 6.	Check master light switch (4) to ensure it functions correctly.	If master light switch (4) does not function correctly, replace master light switch (Para 12-12).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
46. BRAKE LIGHT DOES NOT WORK.		<p>Step 1. Ensure master light switch is set correctly (TM 5-2420-230-10).</p>
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 2.	Check circuit breaker CB-23 in the Power Distribution Panel (PDP) (refer to FO-1).	If circuit breaker CB-23 is tripped, reset circuit breaker.
Step 3.	Ensure air system is pressurized to 75-100 psi (517-689 kPa).	
Step 4.	Check brake light and bulb (1) to ensure they function correctly.	If brake light and bulb (1) do not function correctly, replace brake light or bulb as required (Para 12-45).
Step 5.	Check foot treadle valve switch (2) to ensure it functions correctly.	If foot treadle valve switch (2) does not function correctly, replace foot treadle valve (Para 8-9).
Step 6.	Check brake valve for proper function at brake switch port.	
Step 7.	Check wiring harness (3) for continuity.	If continuity is not present, replace wiring harness (3) (Para 12-27).
Step 8.	Check master light switch (4) to ensure it functions correctly.	If master light switch (4) does not function correctly, replace master light switch (Para 12-12).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
47. NO POWER AT HYDRAULICS.	<p>The diagram illustrates the inspection points for 'NO POWER AT HYDRAULICS'. It features a central line drawing of a skid-steer loader. Three callout boxes with arrows point to specific components: (1) points to a charge equalizer inside the electrical compartment; (2) points to the wiring harness; and (3) points to the hydraulic master switch located on the operator's arm rest. An inset photograph on the left shows the interior of the electrical compartment with the charge equalizer (1) clearly visible.</p>	ME0461
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 1.	Check charge equalizer (1) for voltage of 12 Vdc and check 12 Vdc fuse to ensure it functions correctly.	
	<p>If charge equalizer (1) does not read 12 Vdc or functions incorrectly, replace charge equalizer (Para 12-20) or fuse.</p>	
Step 2.	Check wiring harness (2) for continuity.	
	<p>If continuity is not present, replace wiring harness (2) (Para 12-27).</p>	
Step 3.	Check hydraulic master switch (3) on arm rest to ensure it functions correctly.	
	<p>If hydraulic master switch (3) does not function correctly, replace hydraulic master switch (Para 12-21).</p>	

Table 3-6. Unit Troubleshooting Table. — Continued

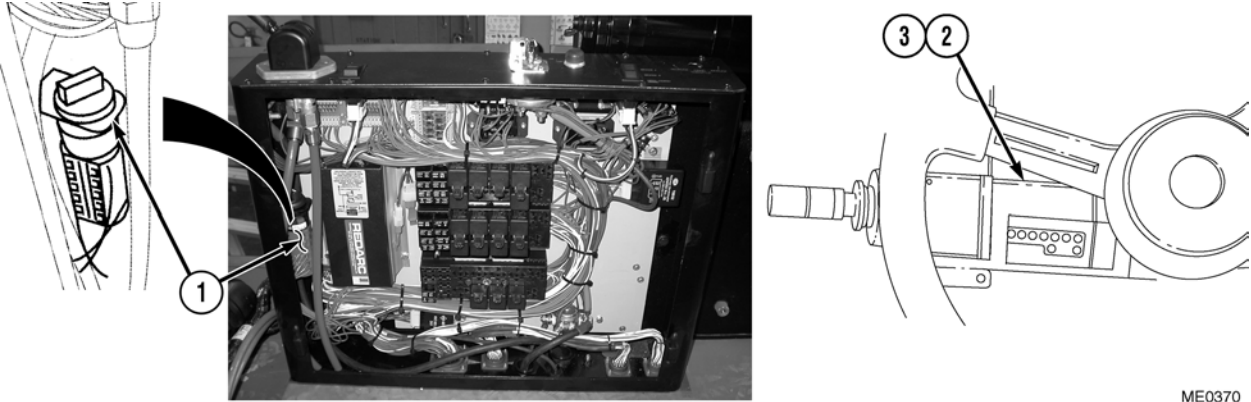
Malfunction	Test or Inspection	Corrective Action
48. EGS HAS NO POWER OR IS NOT WORKING.		<p>Step 1. Ensure emergency gearshift switch (1) in PDP box is in off position.</p> <p>Step 2. Check connector (2) at EGS unit (3) for secure connection.</p> <p style="padding-left: 40px;">If connector (2) at EGS unit (3) connection is loose or broken, tighten or repair connection (Para 12-28) as necessary.</p> <p>Step 3. Check circuit breaker CB-18 in the Power Distribution Panel (PDP) (refer to FO-1).</p> <p style="padding-left: 40px;">If circuit breaker CB-18 is tripped, reset circuit breaker.</p>
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p style="text-align: center;">Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 4.	Check for continuity on wire 360 from circuit breaker CB-18 to EGS (3) (refer to FO-3).	<p style="padding-left: 40px;">If there is not continuity, replace wire harness (Para 12-27).</p> <p style="padding-left: 40px;">If there is continuity, go to Fault 12.</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
49.	<b>ELECTRONIC CONTROL UNIT (ECU) INDICATES FAULT.</b>	<div> <p>The diagram shows a control lever assembly. Two indicator lamps are shown on the left side of the lever's base. Lamp 1 is the upper lamp, and lamp 2 is the lower lamp. Arrows point from the circled numbers 1 and 2 to their respective lamps. To the right of the lever are two rectangular switches. The reference code ME1226 is located to the right of the diagram.</p> </div> <p>Step 1. Start engine (TM 5-2420-230-10).</p> <p>Step 2. Turn on hydraulic master switch (TM 5-2420-230-10).</p> <p>Step 3. Check loader indicator lamp (1) and backhoe indicator lamp (2).</p> <p>If chair is facing loader, loader indicator lamp (1) should flash once and remain illuminated.</p> <p>If chair is facing backhoe, backhoe indicator lamp (2) should flash once and remain illuminated.</p> <p>If loader indicator lamp (1) or backhoe indicator lamp (2) continue to flash on and off, a fault is indicated (Para 3-13 and Para 3-14).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>49.1 AUXILIARY DEFROSTER DOES NOT WORK.</b>		
		<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>
	<p>Step 1. Check auxiliary defroster fan (1) for dirt, debris, and jams.</p>	<p>If auxiliary defroster fan (1) is jammed due to dirt and debris, clear jam.</p>
	<p>Step 2. Check continuity of auxiliary defroster fan (1).</p>	<p>If auxiliary defroster fan (1) does not have continuity, replace auxiliary defroster fan (Para 13-36).</p>
	<p>Step 3. Check continuity of auxiliary defroster switch (2).</p>	<p>If auxiliary defroster switch (2) does not have continuity, replace auxiliary defroster switch (Para 12-16.1).</p>
	<p>Step 4. Check continuity of auxiliary defroster (3) wire harness (refer to FO-3).</p>	<p>If auxiliary defroster (3) wire harness does not have continuity, replace wire harness (Para 12-27)</p>

**WARNING**

Table 3-6. Unit Troubleshooting Table. — Continued

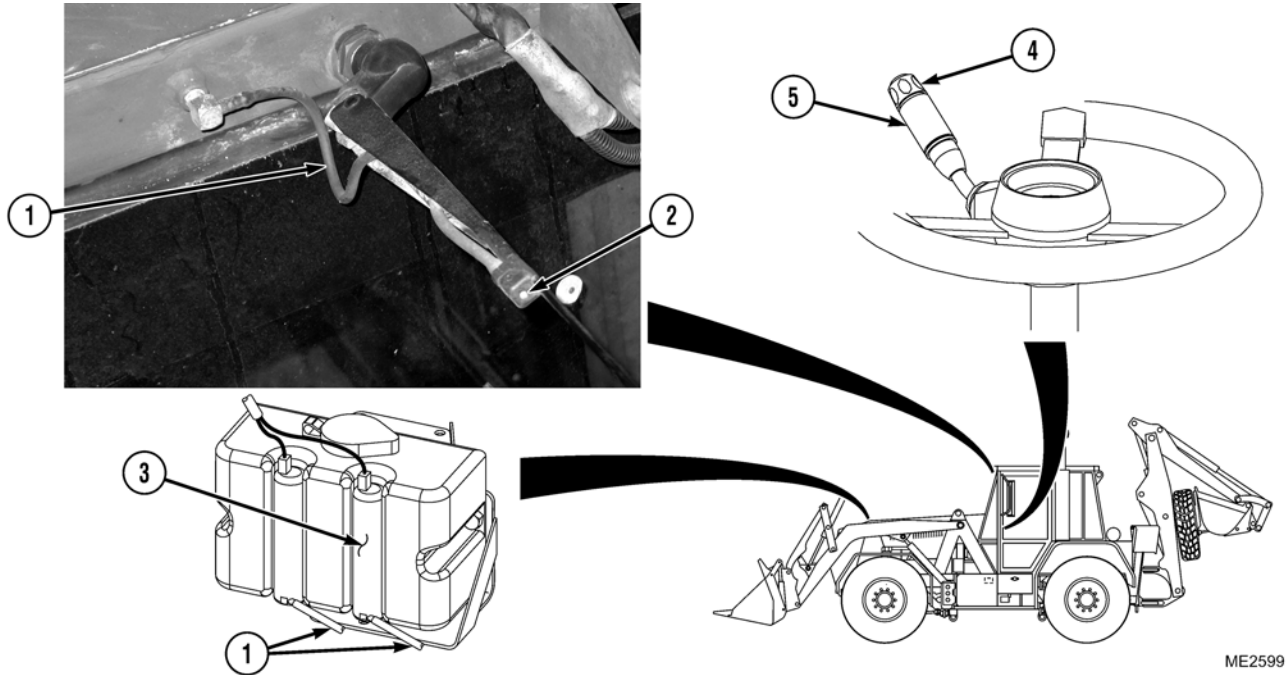
Malfunction	Test or Inspection	Corrective Action
<b>49.2 NO HEAT FROM AUXILIARY DEFROSTER AND CABIN HEATER.</b>		
<p>CAB ROOF SHOWN REMOVED FOR CLARITY</p> <p>ME2612</p> <div style="border: 2px solid black; padding: 5px; text-align: center; font-weight: bold;"> <b>WARNING</b> </div>		
	<ul style="list-style-type: none"> <li>• Hot parts and fluids can burn personnel. If vehicle has been operating, let engine cool before starting work. Avoid contact with hot fluid when removing hoses or fittings. Failure to comply may result in serious injury or death to personnel.</li> <li>• Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.</li> </ul>	
Step 1.	Check thermostat (1) to ensure it is functioning correctly (Para L-11).	If thermostat (1) is missing or not functioning correctly, replace thermostat (Para L-11).
Step 2.	Check auxiliary defrost coolant hoses (2) and evaporator coolant hoses (3) for clogging, collapsing, or leaking.	If coolant hoses (2) and (3) are clogged, collapsed, or leaking, replace hoses (Para 13-36 and Para 19-10).
Step 3.	Check auxiliary defroster heater core (4) for damage, blockage, or leaking (Para 13-36).	If auxiliary defroster heater core (4) is damaged, blocked, or leaking, replace heater core (Para 13-36).
		If auxiliary defroster heater core (4) is not damaged, blocked, or leaking, replace evaporator (Para 19-10).



Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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50. WINDSHIELD WASHERS DO NOT WORK.



ME2599

Step 1. Check for blocked, damaged, or leaking windshield washer hoses (1) and nozzles (2).

If windshield washer hoses (1) or nozzles (2) are blocked, clear blockage.

If windshield washer hoses (1) or nozzles (2) are damaged or leaking, replace hoses and/or nozzles (Para 13-22).

**WARNING**

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

Step 2. Check for 24 Vdc on wire 181 at windshield washer pump (3) when front washer switch (4) is pressed (refer to FO-3).

If 24 Vdc is present on wire 181, replace windshield washer pump (3) (Para 12-31).

If 24 Vdc is not present, check wire 181 for continuity, replace wire as necessary (Para 12-27).

Step 3. Check for 24 Vdc on wire 190 at front washer switch (4) (refer to FO-3).

If 24 Vdc is present on wire 190, replace indicator arm (5) (Para 12-26).

If 24 Vdc is not present, check wire 190 for continuity, replace wire as necessary (Para 12-27).

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>WINDSHIELD WASHERS DO NOT WORK. — CONTINUED</b>		
Step 4.	Check for 24 Vdc on wire 186 at windshield washer pump (6) when rear wiper/washer switch (7) is pressed (refer to FO-3).	<p>If 24 Vdc is present on wire 186, replace windshield washer pump (6) (Para 12-31).</p> <p>If 24 Vdc is not present, check wire 186 for continuity, replace wire as necessary (Para 12-27).</p>
Step 5.	Check for 24 Vdc on wire 190 at rear wiper/washer switch (7) (refer to FO-3).	<p>If 24 Vdc is present on wire 190, replace rear wiper/washer switch (7) (Para 12-30).</p> <p>If 24 Vdc is not present, check wire 190 for continuity, replace wire as necessary (Para 12-27).</p>

ME2600

Table 3-6. Unit Troubleshooting Table. — Continued

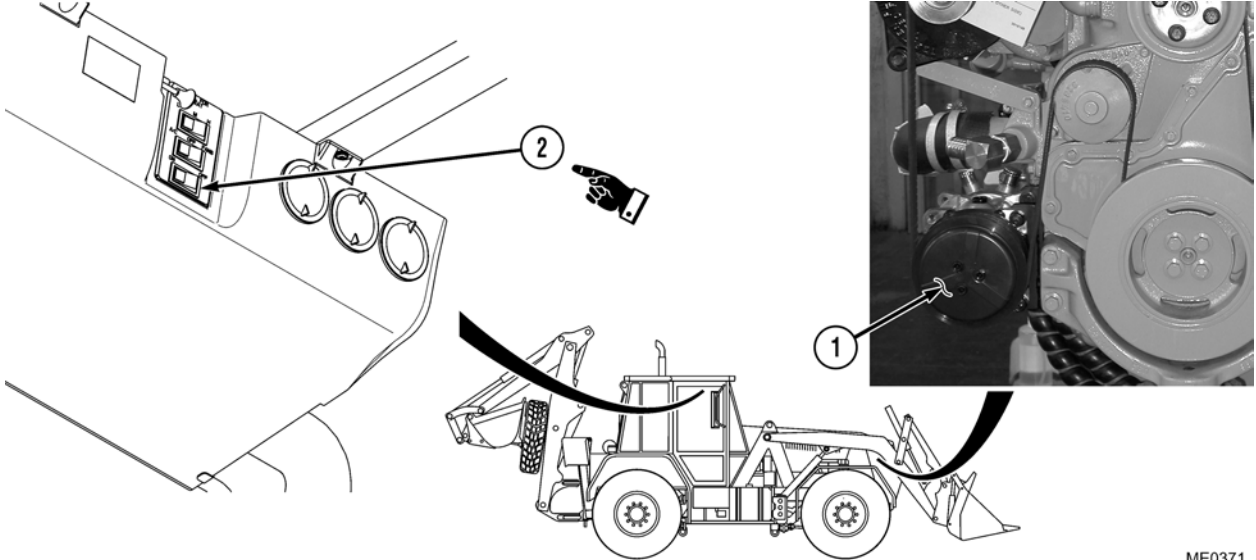
Malfunction
Test or Inspection
Corrective Action
<p>51. AIR-CONDITIONER (A/C) WILL NOT OPERATE OR COOL.</p>  <p style="text-align: right;">ME0371</p>
<p><b>WARNING</b></p>
<p>Entanglement in moving parts can cause serious injury or death.</p>
<p>Step 0.1 Ensure A/C system is properly charged and has no leaks (Para 19-4).</p>
<p>Step 1. Check to make sure A/C clutch (1) on A/C compressor is engaging when A/C is turned on (TM 5-2420-230-10).</p>
<p>If A/C clutch (1) does not engage, replace A/C compressor (Para 19-8).</p>
<p><b>WARNING</b></p>
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>
<p>Step 2. Check A/C selector switch (2) in cabin for voltage (refer to FO-3).</p>
<p>If voltage is not present at A/C selector switch (2), replace evaporator fan switch (Para 19-10).</p>
<p>If A/C clutch (1) stays engaged, notify Direct Support maintenance to check refrigerant level (Para 19-4).</p>



Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction
Test or Inspection
Corrective Action
<p>52. HUB HOT OR BRAKES LOCKED AND WILL NOT DISENGAGE.</p>
<p><b>WARNING</b></p>
<p>Hot parts can burn personnel. Let hot parts cool before starting work.</p>
<p>Step 1. Check hub (1) oil level.</p>
<p>If hub (1) oil level is low, drain and refill (Para 14-4).</p>
<p>Step 2. Check brakes (2) for dragging.</p>
<p>If brakes (2) are dragging, adjust or replace as necessary (Para 8-6).</p>
<p>If brakes (2) can not be adjusted, replace slack adjusters (Para 8-5).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

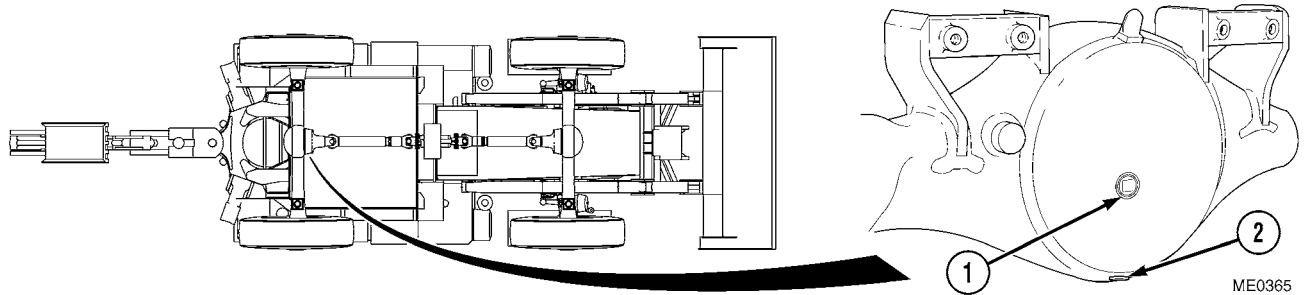
Malfunction	Test or Inspection	Corrective Action
<b>HUB HOT OR BRAKES LOCKED AND WILL NOT DISENGAGE. — CONTINUED</b>		
Step 3.	Ensure that brake pedal (3) is not sticking in depressed position.	If foot brake pedal (3) is sticking, replace foot treadle valve (4) (Para 8-9).
Step 4.	Check air lines for leakage or damage. Use a soap solution (Item 56, Appendix C) to check for leakage at connections (watch for bubbles).	Replace all damaged lines (Para 15-8) and tighten any loose connections.
Step 5.	Using a soap solution (Item 56, Appendix C), check the air line between front and rear axle quick release valves for damage or leaks.	Replace damaged air lines (Para 15-8) and tighten loose connections.
Step 6.	Check air system for proper operation.	If faulty treadle valve (4) is found, replace foot treadle valve (Para 8-9).
Step 7.	Check S-cam (5) for sticking and/or proper operation.	Replace faulty S-cam (5) (Para J-4 or Para J-11).

ME1177

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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**53. NOISY DIFFERENTIAL OR DRIVESHAFT.**



**NOTE**

Rear axle shares oil with rear hub; front axle cannot share oil with front hub.

Step 1. Check axle oil level (1) for contamination (TM 5-2420-230-10) and drain plug (2) for metal shavings.

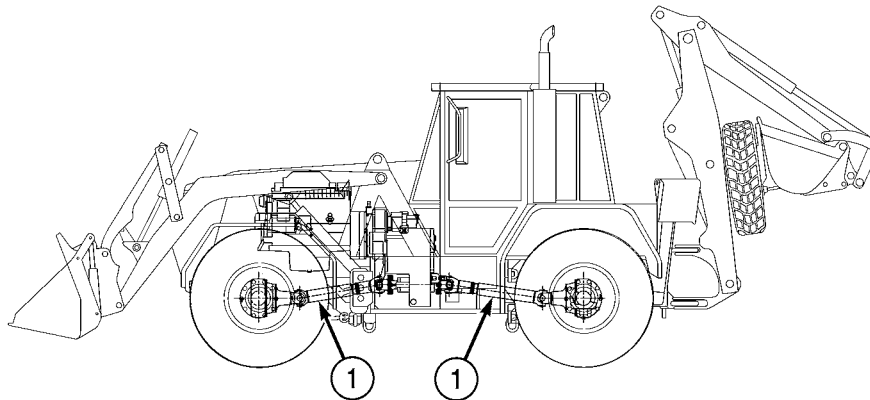
If metal shavings are present, notify Direct Support maintenance (Para J-8 or Para J-14).

If axle oil level (1) is low or contaminated, drain and fill (Para 14-4).

Step 2. Check U-joints for excessive lateral movement.

If unserviceable, replace U-joints (Para 14-5).

**54. DRIVELINE VIBRATION.**



Step 1. Inspect driveline: drive shafts (1) and U-joints for excessive play.

If drive shafts (1) or U-joints are damaged or having dents or missing weights, replace if necessary (Para 14-5).

Table 3-6. Unit Troubleshooting Table. — Continued

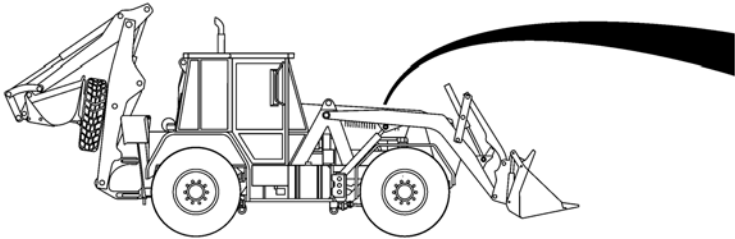
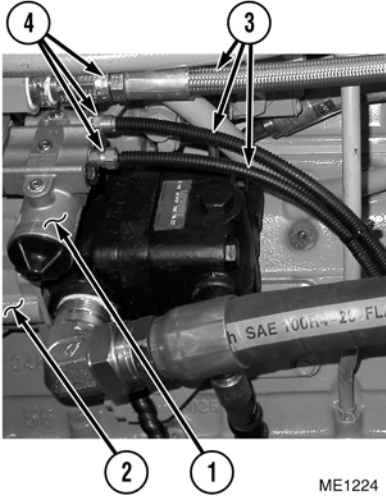
Malfunction	Test or Inspection	Corrective Action
55.	<b>NO AIR/LOW AIR IN SYSTEM.</b>	<div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: right; margin-right: 100px;">ME1224</p> <div style="text-align: center; margin: 10px 0;"> <div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div> </div> <p>Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.</p> <p>Step 1. Check governor (1) for leaks and to ensure governor has correct cut-in and cut-out pressures of 120-125 psi (827-862 kPa).</p> <p style="padding-left: 40px;">If governor (1) has leaks, tighten connections.</p> <p style="padding-left: 40px;">If governor (1) cut-in and cut-out pressures are incorrect, adjust to correct specification of 120-125 psi (827-862 kPa) (Para 15-9).</p> <p style="padding-left: 40px;">If governor (1) is defective or will not adjust, replace governor (Para 15-9).</p> <p>Step 2. Check air compressor (2) to ensure it functions properly.</p> <p style="padding-left: 40px;">Listen for dump valve for air displacement.</p> <p style="padding-left: 40px;">If air compressor (2) continuously displaces air from drier, replace air drier (Para 15-11).</p> <p>Step 3. Connect slave air line to service coupling on left front of vehicle and check air system for leaks in air compressor supply lines (3) and fittings (4) (refer to FO-5).</p> <p style="padding-left: 40px;">If a leak is present, tighten loose connection, or replace defective lines (3) or fittings (4) (Para 15-8).</p> <p>Step 4. Check primary brake system for air leaks.</p> <p style="padding-left: 40px;">Repair air leaks by tightening connections or replacing bad components as necessary (Para 15-8).</p>



Table 3-6. Unit Troubleshooting Table. — Continued

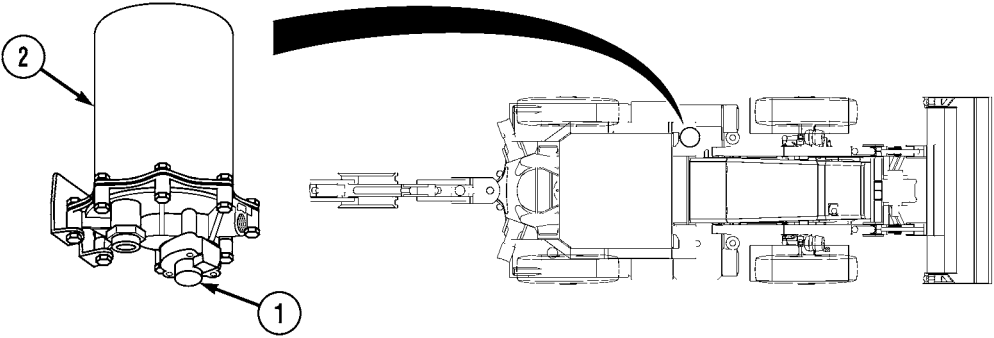
Malfunction	Test or Inspection	Corrective Action
56.	<b>EXCESSIVE MOISTURE IN SYSTEM.</b>	 <p>ME0376</p> <div style="border: 2px solid black; padding: 5px; text-align: center; font-weight: bold; font-size: 1.2em;">WARNING</div> <p>Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.</p> <p>Step 1. Check for signs of excessive moisture at unloader valve (1) on air drier (2).</p> <p>If unloader valve (1) has excessive moisture, replace desiccant (Para 15-12).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

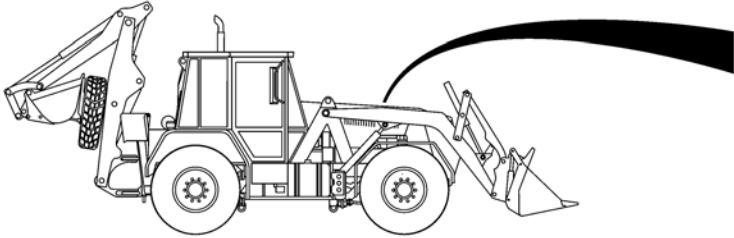

Malfunction	Test or Inspection	Corrective Action
57. AIR DRIER CONSTANTLY CYCLING OR PURGING.		 <p style="text-align: right; font-size: small;">ME0367</p>
<div style="border: 2px solid black; padding: 5px; display: inline-block;"><b>WARNING</b></div>		
<p>Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.</p>		
Step 1.	Check air system for leaks in lines (1) and fittings (2).	<p>If a leak is present, tighten loose connection, or replace defective fittings (2) or lines (1) (Para 15-5 or Para 15-8).</p>
Step 2.	Check governor (3) for leaks and ensure governor has correct cut-in/cut-out pressures of 120-125 psi (827-862 kPa).	<p>If governor (3) cut-in and cut-out pressures are incorrect, adjust to correct specification of 120-125 psi (827-862 kPa) (Para 15-9).</p> <p>If governor (3) is defective or will not adjust, replace governor (Para 15-9).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>58. AIR DRIER SAFETY VALVE EXHAUSTING AIR.</b>		<p>Step 1. Disassemble air drier and check desiccant cartridge (1) for blockage (Para 15-12).</p> <p>Dark color in desiccant cartridge (1) is an indication of blockage. Replace desiccant cartridge (Para 15-12).</p> <p>Step 2. Check discharge valve (2) for proper operation.</p> <p>If discharge valve (2) is not operating properly, remove, clean with soapy water, and install.</p> <p>If discharge valve (2) is operating properly, replace air drier (Para 15-11).</p>

ME0377

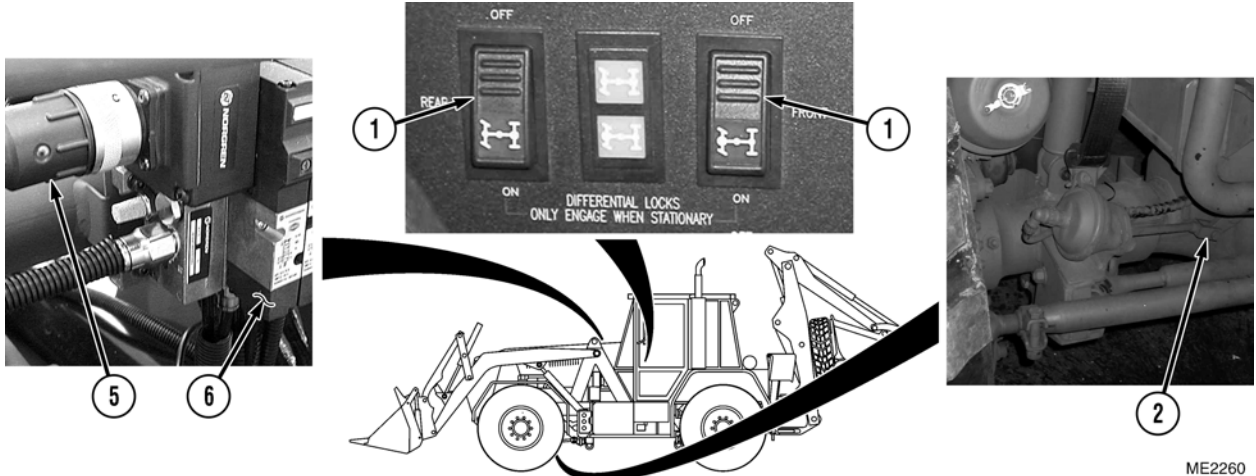
Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
59. DIFFERENTIAL LOCK WILL NOT ENGAGE.		<p><b>NOTE</b></p> <p>The front and rear axles have differential lock actuators. The troubleshooting procedures are the same for both front and rear. The front axle differential lock actuator is shown.</p> <p>Step 1. Have an assistant put DIFFERENTIAL LOCKS switches (1) in ON position and observe differential lock actuator clevis (2) for movement or engagement.</p> <p>If movement is noticed, notify Direct Support maintenance (Para J-8 or Para J-14).</p> <div style="text-align: center; border: 2px solid black; padding: 5px; width: fit-content; margin: 10px auto;"><b>WARNING</b></div> <p>Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.</p> <p>Step 2. Drain air system (Para 15-4) and remove air line (3) at differential lock actuator (4). Start engine and allow air pressure to build (TM 5-2420-230-10). Observe for air after an assistant puts DIFFERENTIAL LOCKS switches (1) in ON position.</p> <p>If air is present, replace differential lock actuator (3) (Para J-8 or Para J-14).</p> <p>Step 2.1 With DIFFERENTIAL LOCKS switches (1) in ON position, ensure both LED indicators (4.1) illuminate.</p> <p>If LED indicators do not illuminate, replace valve island (Para 12-34.1).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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**DIFFERENTIAL LOCK WILL NOT ENGAGE. — CONTINUED**



**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

Step 3. Drain air system (Para 15-4) and remove air lines (5) at solenoid block (6). Start engine and allow air pressure to build (TM 5-2420-230-10). Observe for air after an assistant put DIFFERENTIAL LOCKS switches (1) in ON position.

If air is present, replace solenoid (Para 12-34).

**WARNING**

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

Step 4. With DIFFERENTIAL LOCKS switches (1) in ON position, remove wires PJ38-Y and PJ38-Z at solenoid block (6), and ground to vehicle chassis (refer to FO-3). Have an assistant observe differential lock actuator clevis (2) for movement or engagement.

If differential lock actuator clevis (2) moves, replace wire harness (Para 12-27).

Step 5. With DIFFERENTIAL LOCKS switches (1) in ON position, check for 18 to 24 Vdc at wires 291 and 292 on solenoid block (6) (refer to FO-3).

If proper voltage is present, notify Direct Support maintenance (Para J-8 or Para J-14).

If proper voltage is not present, replace faulty DIFFERENTIAL LOCKS switch(s) (1) (Para 12-14).

Table 3-6. Unit Troubleshooting Table. — Continued

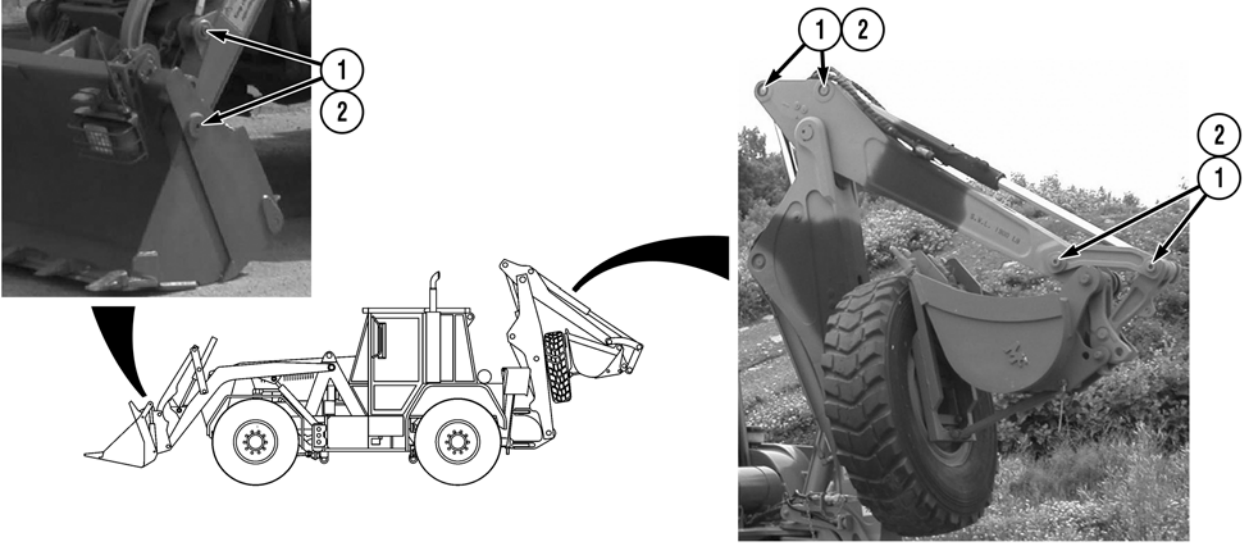
Malfunction	Test or Inspection	Corrective Action
60. BACKHOE OR FEL NOISY IN OPERATION.		<p>Step 1. Check for seized pins (1) on FEL or backhoe.</p> <p>If pins (1) are seized, lubricate and replace pins (refer to appropriate paragraph in Chapter 16 or Chapter 17).</p> <p>Step 2. Check bushing(s) (2) on FEL or backhoe for damage.</p> <p>If bushing(s) (2) is damaged, lubricate and install a new bushing (Para 17-6).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

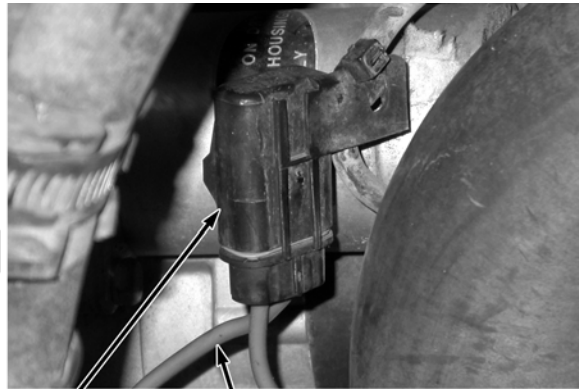
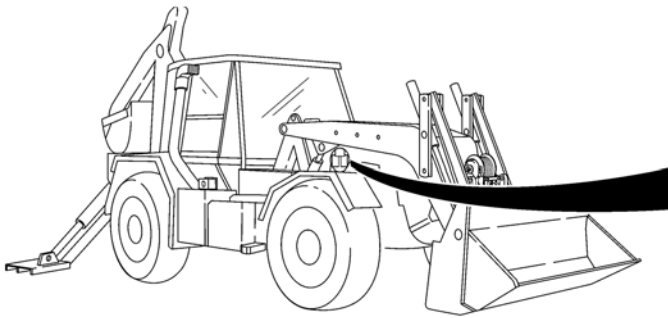
Malfunction	Test or Inspection	Corrective Action
61. SLACK ADJUSTERS OUT OF ADJUSTMENT.	<p>The diagram illustrates the location of slack adjusters on a wheel loader. Callout 1 points to a slack adjuster on the rear axle, and callout 2 points to a slack adjuster on the front axle. A central illustration shows the loader with curved arrows indicating the movement of the front and rear axles during operation.</p>	<p>Step 1. Apply brakes several times to check slack adjuster function.</p> <p style="padding-left: 40px;">If slack adjusters do not function, replace slack adjuster (Para 8-5).</p> <p>Step 2. When brakes are applied, observe adjusting screw (2) for clockwise movement on the return stroke.</p> <p style="padding-left: 40px;">If adjusting screw (2) does not rotate, adjust per procedures detailed in Para 8-5.</p> <p style="padding-left: 40px;">If slack adjusters will not adjust, replace slack adjuster (Para 8-5).</p>

ME1183

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
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62. ARCTIC HEATER 7-DAY TIMER WILL NOT OPERATE.



1 2

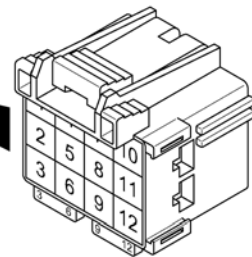
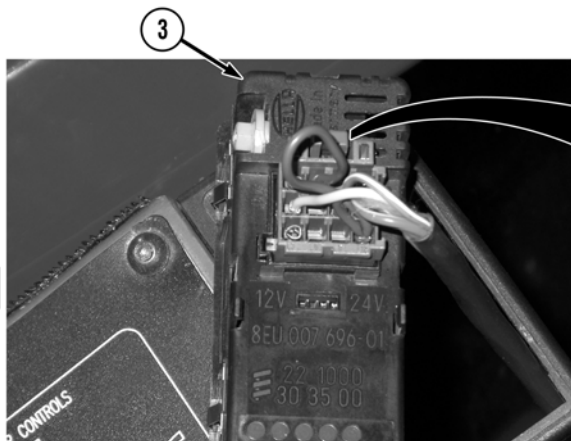
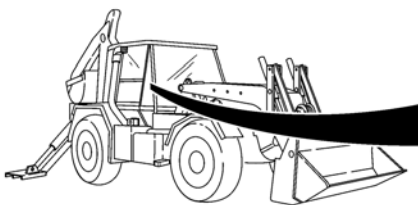
ME2595

**WARNING**

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

Step 1. Check fuse (1) on red wire (2).

If fuse (1) is broken, replace fuse.



ME2596

Step 2. Check for 24 Vdc between terminal 4 and terminal 11 on 7-day timer (3).

If 24 Vdc is present between terminal 4 and terminal 11, replace 7-day timer (3) (Para 20-4).

If 24 Vdc is not present between terminal 4 and terminal 11, check wire harness on 7-day timer (3) for continuity. Replace wire harness if necessary (Para 12-27).



Table 3-6. Unit Troubleshooting Table. — Continued

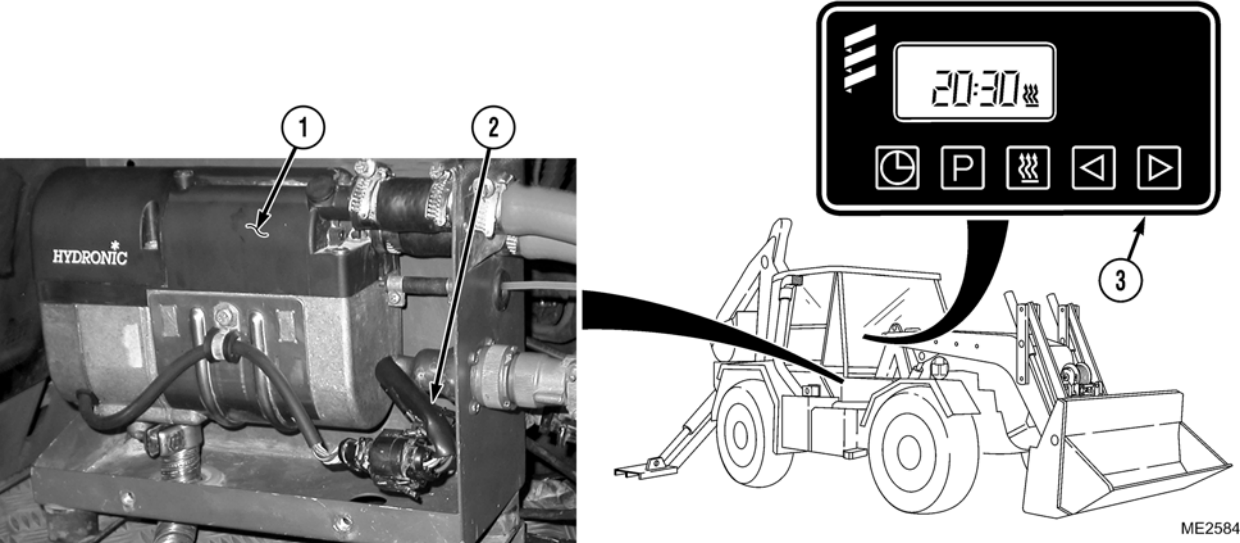
Malfunction	Test or Inspection	Corrective Action
63.	<p><b>ARCTIC HEATER 7-DAY TIMER DOES NOT DISPLAY ERROR CODE, BUT ARCTIC HEATER WILL NOT OPERATE.</b></p>	 <p>The diagram illustrates the electrical components for the arctic heater system. On the left, a photograph shows a 'HYDRONIC' arctic heater with a circled '1' pointing to its top. A circled '2' points to a connector on the heater's side. On the right, a line drawing of a skid steer loader shows a circled '3' pointing to the 7-day timer located in the operator's compartment. An inset shows a close-up of the timer's digital display, which reads '20:30' and has a flame icon to its right. Below the display are five buttons: a power button, a 'P' button, a flame icon button, a left arrow button, and a right arrow button. Arrows connect the circled numbers to their respective components.</p>
<p><b>WARNING</b></p>		
<p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p>		
Step 1.	<p>Check wire harness between arctic heater (1) and connector (2) for continuity.</p>	<p>If continuity is not present, replace wire harness (Para 12-27).</p>
Step 2.	<p>Check wire harness between connector (2) and 7-day timer (3) for continuity.</p>	<p>If continuity is not present, replace wire harness (Para 12-27).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

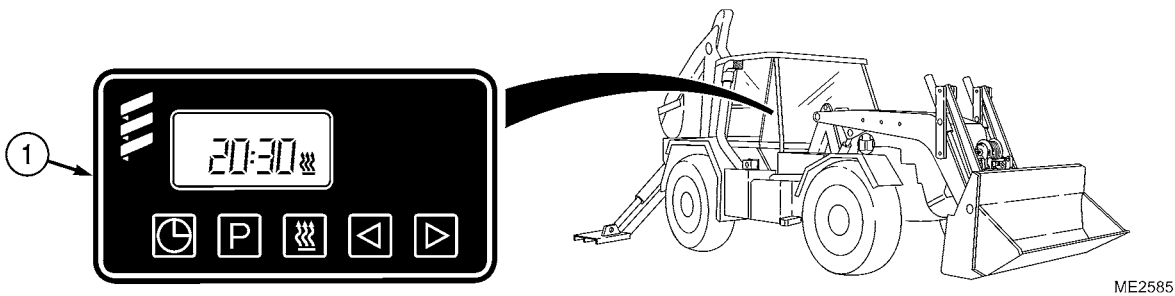
Malfunction	Test or Inspection	Corrective Action
64.	ARCTIC HEATER 7-DAY TIMER DISPLAYS ERROR CODE.	 <p style="text-align: center;"><b>WARNING</b></p> <p>Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.</p> <p>Step 1. Obtain error code from 7-day timer display (1).</p> <ul style="list-style-type: none"> <li>If 7-day timer displays F10 or F11, go to Step 2.</li> <li>If 7-day timer displays F12, F14, F17, F60, F61, F71, or F72, replace overheat and temperature sensors (Para 20-11).</li> <li>If 7-day timer displays F20 or F21, replace glow pin (Para 20-10).</li> <li>If 7-day timer displays F30, go to Step 4.</li> <li>If 7-day timer displays F31 or F32, replace combustion air blower (Para 20-6).</li> <li>If 7-day timer displays F41 or F42, replace water pump (Para 20-12).</li> <li>If 7-day timer displays F47 or F48, go to Step 5.</li> <li>If 7-day timer displays F51, F52, F53, F54, or F56, go to Step 6.</li> <li>If 7-day timer displays F64 or F65, replace flame sensor (Para 20-8).</li> <li>If 7-day timer displays F90, F92, F93, or F97, replace control unit (Para 20-7).</li> </ul>

Table 3-6. Unit Troubleshooting Table. — Continued

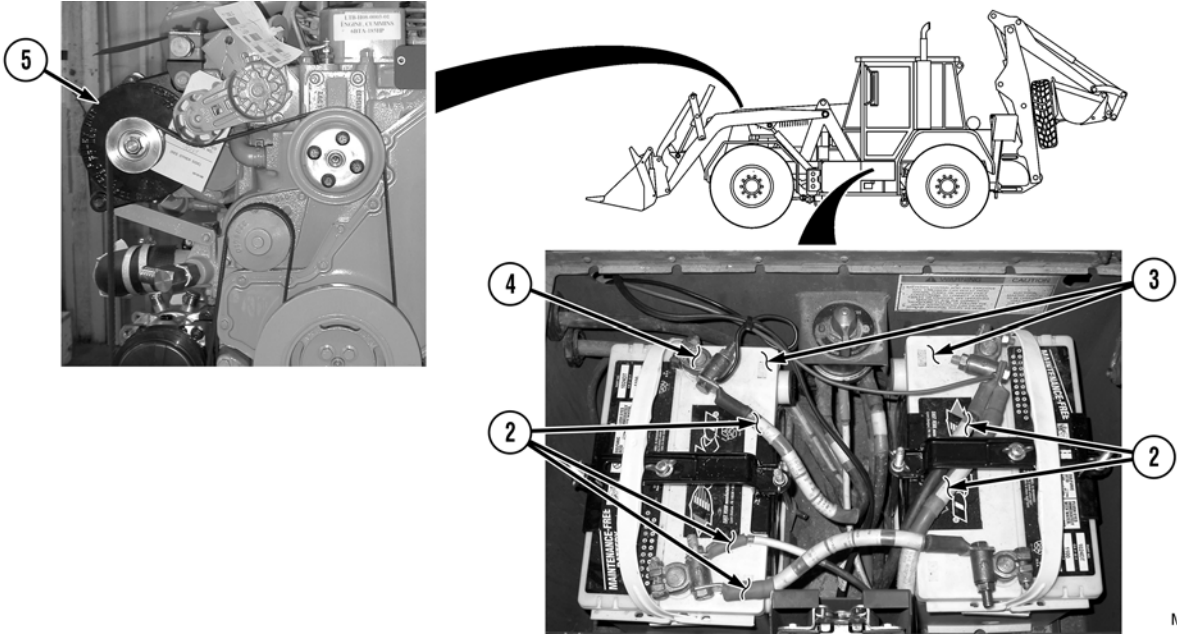
Malfunction	Test or Inspection	Corrective Action
<b>ARCTIC HEATER 7-DAY TIMER DISPLAYS ERROR CODE. — CONTINUED</b>		
		
Step 2.	Check battery cables (2) and batteries (3) for damage, and ensure they are fully charged (TM 9-6140-200-14).	<p>If battery posts (4) are broken, or if batteries (3) will not charge, replace batteries (Para 12-6).</p> <p>If battery cables (2) are broken or damaged, replace battery cables (Para 12-7).</p>
Step 3.	With engine running, check for 26 to 28 Vdc at terminal B on alternator (5) (refer to FO-3).	<p>If output of alternator (5) is less than 26 Vdc or greater than 28 Vdc, replace alternator (Para 12-10).</p> <p>If alternator (5) is reading the correct voltage and problem persists, notify supervisor.</p>

Table 3-6. Unit Troubleshooting Table. — Continued

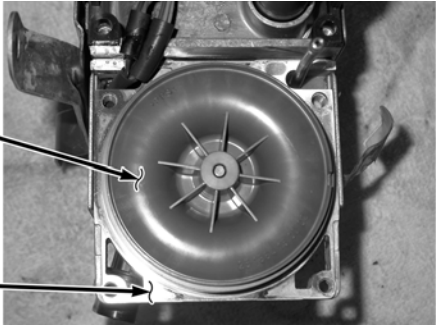
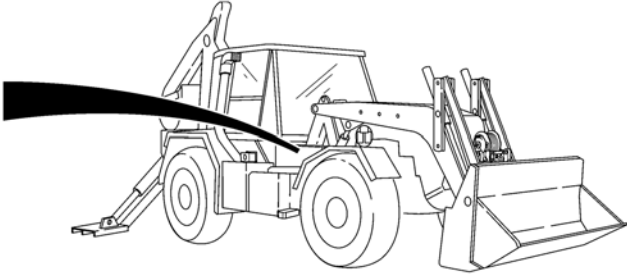

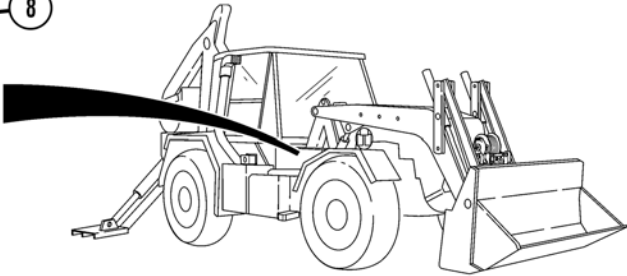
Malfunction	Test or Inspection	Corrective Action
<b>ARCTIC HEATER 7-DAY TIMER DISPLAYS ERROR CODE. — CONTINUED</b>		
		ME2587
Step 4.	Remove combustion air blower (6) and check it for dirt, debris, and jams (Para 20-6).	<p>If combustion air blower impeller (7) is jammed due to dirt and debris, clear jam.</p> <p>If combustion air blower impeller (7) is not jammed due to dirt and debris, replace combustion air blower (Para 20-6).</p>
		ME2588
Step 5.	Check wire harness on fuel metering pump (8) for continuity.	<p>If continuity is present, replace fuel metering pump (Para 20-9).</p> <p>If continuity is not present, replace wire harness (Para 12-27).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>ARCTIC HEATER 7-DAY TIMER DISPLAYS ERROR CODE. — CONTINUED</b>		
Step 6.	Check arctic heater air intake (9) and exhaust pipe (10) for damage or blockage.	<p>If air intake (9) or exhaust pipe (10) is blocked, remove blockage.</p> <p>If exhaust pipe (10) is damaged, replace exhaust pipe (Para 20-5).</p>
Step 7.	Test fuel metering pump (8) (Para 20-9).	<p>If fuel metering pump (8) fails test, replace fuel metering pump (Para 20-9).</p> <p>If fuel metering pump (8) passes, replace flame sensor (Para 20-8).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

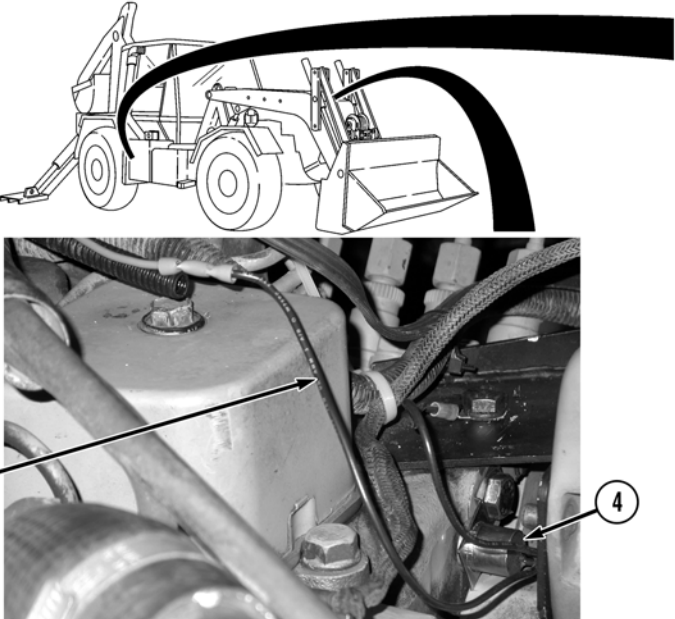
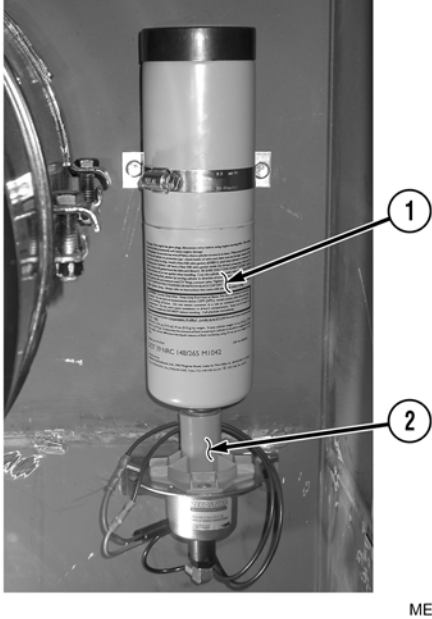
Malfunction	Test or Inspection	Corrective Action
65. ETHER START WILL NOT WORK.	 <p>The diagram shows a backhoe loader with a thick black line indicating the ether start system. Below it, a close-up of the engine compartment shows a white starting fluid cylinder (callout 3) and a valve assembly (callout 4).</p>	 <p>A close-up photograph of the starting fluid cylinder (callout 1) and the valve assembly (callout 2). The cylinder is white with a black top and a label. The valve assembly is a metal component with a spring and a wire attached.</p>
<b>NOTE</b>		
<ul style="list-style-type: none"> <li>• Ether start will only function if engine block temperature is 60 °F (16 °C) or below.</li> <li>• While performing troubleshooting checks, ensure all wires and tube are properly connected.</li> </ul>		
Step 1.	Test starting fluid cylinder (1) (Para 20-15).	<p>If starting fluid cylinder (1) is empty, replace starting fluid cylinder (Para 20-15).                      If starting fluid cylinder (1) is not empty, install same starting fluid cylinder (1) (Para 20-15).</p>
Step 2.	Check continuity of valve assembly (2).	<p>If valve assembly (2) does not have continuity, replace valve assembly (Para 20-13).</p>
Step 3.	Check continuity of wire (3) between thermostat (4) and ether valve (2).	<p>If wire (3) does not have continuity, replace wire (Para 20-16).</p>
<b>NOTE</b>		
<p>Thermostat will only have continuity if block temperature is 60 °F (16 °C) or below.</p>		
Step 4.	Check continuity of thermostat (4).	<p>If thermostat (4) does not have continuity, replace thermostat (Para 20-16).</p>

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>ETHER START WILL NOT WORK. — CONTINUED</b>		
Step 5.	<p>Check continuity of jumper wire (5) between starter button (6) and ether pushbutton (7).</p> <p>If jumper wire (5) does not have continuity, replace jumper wire (Para 20-14).</p>	
Step 6.	<p>Check continuity of ether pushbutton (7).</p> <p>If ether pushbutton (7) does not have continuity, replace ether pushbutton (Para 20-14).</p>	
Step 7.	<p>Check continuity of wire (8) between ether pushbutton (7) and valve assembly (2).</p> <p>If wire (8) does not have continuity, replace wire (Para 20-13).</p>	
Step 8.	<p>Check tube (9) between valve assembly (2) and atomizer (10).</p> <p>If tube (9) is crimped or damaged, replace tube (Para 20-13).</p>	
Step 9.	<p>Check atomizer (10) for blockage or damage.</p> <p>If atomizer (10) is blocked, clear blockage.</p> <p>If atomizer (10) is damaged, replace atomizer (Para 20-13).</p>	

Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
66. ENGINE BLOCK HEATER WILL NOT WORK.		<p>Step 1. Check engine block heater (1) for continuity.</p> <p>If engine block heater (1) does not have continuity, replace engine block heater (Para-20-17).</p> <p>Step 2. Check plug wires (2), (3), and (4) for continuity.</p> <p>If plug wires (2), (3), and (4) do not have continuity, replace block heater (1) (Para-20-17).</p> <p>Step 3. Check bulk wires (5), (6), and (7) for continuity.</p> <p>If bulk wires (5), (6), or (7) do not have continuity, replace wire(s) as necessary (Para-20-17).</p> <p>Step 4. Check electrical outlet wires (8), (9), and (10) for continuity.</p> <p>If electrical outlet wires (8), (9), and (10) do not have continuity, replace electrical outlet (Para 20-17).</p>

ME2592



Table 3-6. Unit Troubleshooting Table. — Continued

Malfunction	Test or Inspection	Corrective Action
<b>67. BATTERY TRICKLE CHARGER WILL NOT OPERATE.</b>		<p>Step 1. Remove hydraulic reservoir step plate (Para 13-15).</p> <p>Step 2. Check continuity of fuse (1).</p> <p style="padding-left: 40px;">If fuse (1) does not have continuity, replace fuse.</p> <p>Step 3. Connect power source to electrical outlet (2).</p> <p>Step 4. Check battery trickle charger LED indicator (3).</p> <p style="padding-left: 40px;">If LED indicator (3) is not lit, replace battery trickle charger (Para 20-18).</p> <p style="padding-left: 40px;">If LED indicator (3) is lit, check wires and connections. Replace battery trickle charger as necessary (Para 20-18).</p> <p>Step 5. Unplug electrical outlet (2) if ambient conditions do not warrant its use.</p> <p>Step 6. Install hydraulic reservoir step plate (Para 13-15).</p>

ME2603



## CHAPTER 4 POWER PACK

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	4-1	4-1
Vehicle Preparation and Isolation. . . . .	4-2	4-1
Restore IHMEE to Operational Readiness. . . . .	4-3	4-2
Engine Oil Service and Filter Replacement. . . . .	4-4	4-2
Transmission Oil Service and Filters Replacement. . . . .	4-5	4-4
Drive Belt Replacement. . . . .	4-6	4-6
Power Pack Replacement. . . . .	4-7	4-8
Engine Component Replacement. . . . .	4-8	4-22
Transmission Component Replacement. . . . .	4-9	4-30
Separate Engine From Transmission. . . . .	4-10	4-34
Charging Pump Replacement. . . . .	4-11	4-38
Engine Oil Sampling Valve Assembly Replacement. . . . .	4-12	4-42
Transmission Oil Sampling Valve Assembly Replacement. . . . .	4-13	4-43
Remote Shift Valve Replacement. . . . .	4-14	4-45
Engine Mount Replacement. . . . .	4-15	4-48
Transmission Mount Replacement. . . . .	4-16	4-49
Transmission 2/4WD Control Cylinder Replacement. . . . .	4-17	4-52
Transmission High/Low Control Cylinder Replacement. . . . .	4-18	4-54

**4-1. GENERAL.**

This chapter contains procedures required for removal, replacement, installation, and maintenance of the engine and transmission. This chapter should be read in conjunction with Appendix L and Appendix F.

**4-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance procedures on the Interim High-Mobility Engineer Excavator (IHMEE), complete the following steps:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**4-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness by doing the following:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Ensure hydraulics are set to CROSS COUNTRY DRIVING mode (TM 5-2420-230-10).
- (6) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position, as required (TM 5-2420-230-10).

**4-4. ENGINE OIL SERVICE AND FILTER REPLACEMENT.**

This Task Covers:

- |                          |                |            |
|--------------------------|----------------|------------|
| a. Draining              | b. Replacement | c. Filling |
| d. Follow-On Maintenance |                |            |

**INITIAL SETUP**

<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Pan, drain, Item 29, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, common no. 2, Item 36, Appendix B	TM 5-2420-230-10	Engine shut OFF.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Electrical master switch OFF.
	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Materials/Parts</i>		
Cloth, lint-free, Item 10, Appendix C	TM 5-2420-230-10	Engine hood opened.
Oil, lubricating, Item 44, Appendix C		
Filter, element, fluid, Item 48, Appendix D		
	<i>Drawings Required</i>	
<i>Personnel Required</i>	TM 5-2420-230-24P	Figure 15
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P	Figure 21
<i>References</i>	<i>Estimated Time to Complete</i>	
None	Refer to MAC in Appendix B	

**a. Draining.**



Serious damage to engine can occur by operating engine with incorrect quantity of oil in sump. Failure to comply may result in damage to equipment.

- (1) Ensure engine has reached normal operating temperature.

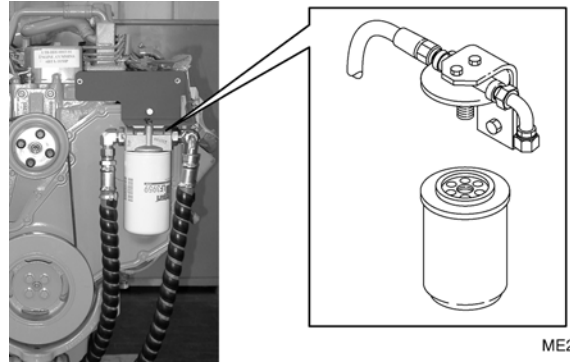
**WARNING**

Avoid contact with hot oil. Failure to comply may result in serious injury.

- (2) Position funnel beneath sump plug, remove oil drain plug and washer. Allow oil to drain completely.

**b. Replacement.**

- (1) Remove oil filter. Discard oil filter.
- (2) Using a clean cloth, ensure oil filter gasket surface on mounting head is clean.
- (3) Fill new oil filter with clean lubricating oil and spread oil on sealing gasket.
- (4) Install oil filter on mounting head and tighten in accordance with filter manufacturer's instructions.



**c. Filling.**

- (1) Inspect condition of sump plug washer. Replace if necessary.

**CAUTION**

To prevent possible damage to oil sump plug and filter element thread, do not exceed specified torque (Appendix E). Failure to comply may result in damage to equipment.

- (2) Using a clean cloth, ensure mating surfaces are clean and install sump plug and washer. Tighten to 59 lbf/ft (80 N·m).
- (3) Add oil to engine until oil reaches FULL mark on dipstick (TM 5-2420-230-10).

**d. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Note oil pressure by checking oil pressure gauge and warning lamp. Lamp should go off after a few seconds. If oil pressure is not evident after 10 seconds, shut OFF engine and investigate.
- (3) Check oil filter and drain plug for signs of oil leakage.
- (4) Shut OFF engine, wait 5 min., then check oil level with dipstick. Add oil as necessary (TM 5-2420-230-10).
- (5) Close hood (TM 5-2420-230-10).
- (6) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**4-5. TRANSMISSION OIL SERVICE AND FILTERS REPLACEMENT.**

This Task Covers:

- a. Draining
- b. Replacement
- c. Filling
- d. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C Compound, sealing, pipe thread, Item 23, Appendix C Oil, lubricating, Item 44, Appendix C Filter, element, Item 47, Appendix D (2) Gasket, Item 86, Appendix D</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 77 TM 5-2420-230-24P Figure 107</p> <p><i>Estimated Time to Complete</i> Refer to MAC in Appendix B</p>	<p><i>Condition Description</i> Electrical master switch OFF. Center belly plate removed. Left hand front belly plate removed.</p>
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To prevent possible transmission damage, do not operate vehicle when transmission oil level is low. Failure to comply may result in damage to equipment.

**a. Draining.**

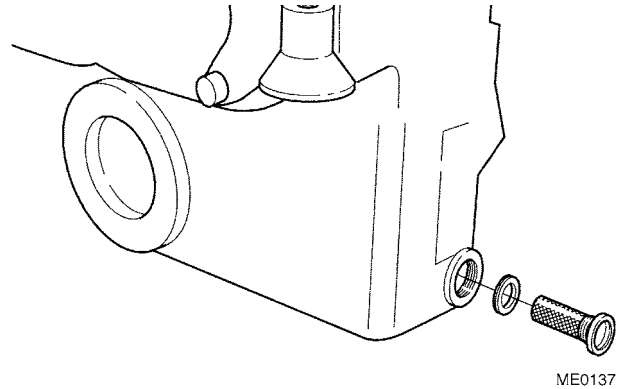
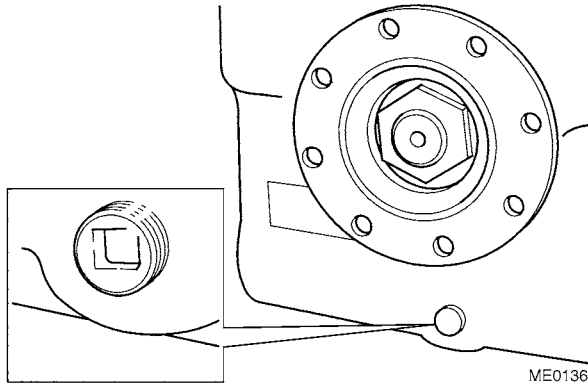


- Avoid contact with hot oil. Failure to comply may result in serious injury.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.



When draining transmission oil, ensure oil temperature is at least 180 to 200 °F (82 to 93 °C). Failure to comply may result in damage to equipment.

- (1) Ensure transmission has reached normal operating temperature.
- (2) Place large waste oil container beneath transmission.



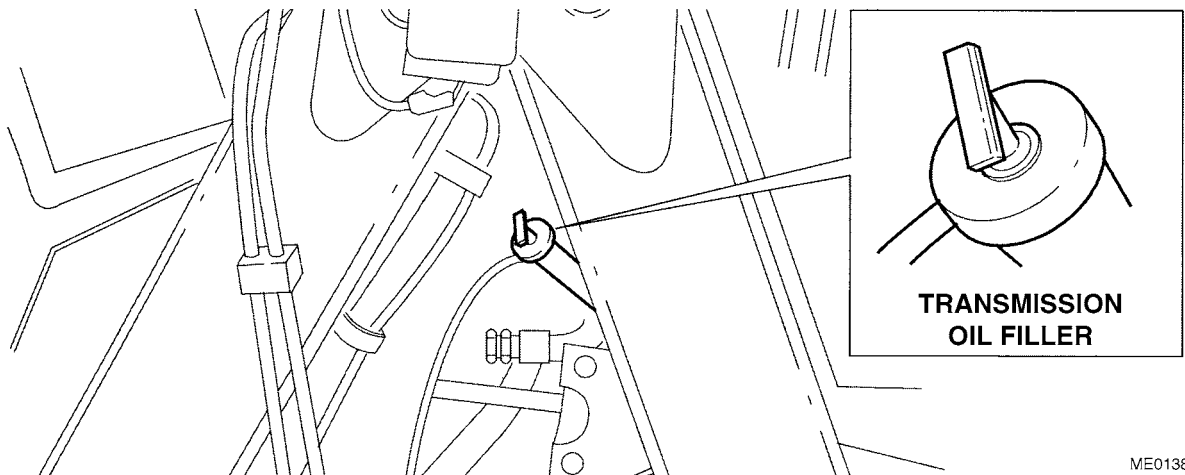
- (3) Remove drain plug and allow transmission oil to completely drain. Inspect drain plug and thoroughly clean with cloth. If metallic particles are found, notify Direct Support maintenance.
- (4) Remove screen and gasket from side of transmission. Discard gasket.
- (5) Using a clean cloth, inspect and thoroughly clean, and install screen using new gasket. If metallic particles are found, notify Direct Support maintenance.

**b. Replacement.**

- (1) Remove and discard transmission oil filters.
- (2) Ensure oil filter gasket surfaces on mounting heads are clean and free from old gasket material.
- (3) Lubricate new filter sealing gasket surfaces with light coat of oil, prefill oil filters with clean oil, and install oil filters on mounting heads. Tighten in accordance with filter manufacturer's instructions.

**c. Filling.**

- (1) Using clean cloth, clean threads on oil drain plug and apply sealing compound.
- (2) Install and tighten oil drain plug.



- (3) Fill transmission with oil and check level.

**d. Follow-On Maintenance.**

- (1) Start engine and check for leaks (TM 5-2420-230-10).
- (2) Shut OFF engine, wait 5 min., then check oil level with dipstick. Add oil as necessary (TM 5-2420-230-10).
- (3) Install belly plates (TM 5-2420-230-10).

**END OF TASK**

<b>4-6. DRIVE BELT REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Inspection	c. Installation
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.
Cloth, lint-free, Item 10, Appendix C	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i>	TM 5-2420-230-10	Hood raised.
MOS 62B, Construction Equipment Repairer		
<i>References</i>	<i>Drawings Required</i>	
None	TM 5-2420-230-24P	Figure 7
	TM 5-2420-230-24P	Figure 8
	TM 5-2420-230-24P	Figure 9
	<i>Estimated Time to Complete</i>	
	Refer to MAC in Appendix B	



**a. Removal.**

- (1) Rotate tensioner clockwise.
- (2) Remove belt and slowly release tensioner.

**b. Inspection.**

Using clean cloth, ensure all belt grooves in pulleys are clean and free from small particles of rubber belting.

**c. Installation.**

- (1) Rotate tensioner clockwise.

**NOTE**

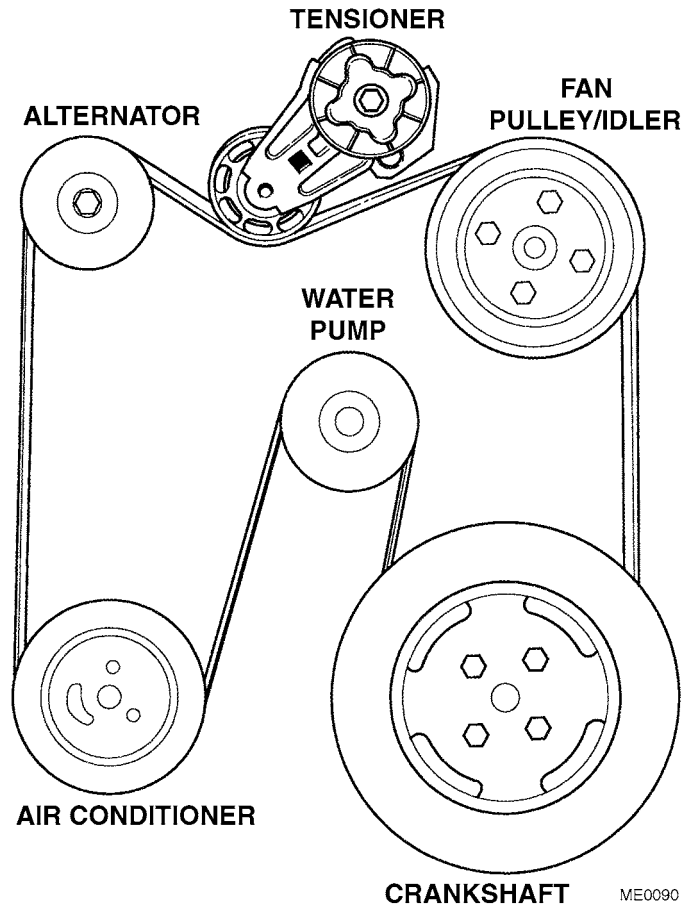
The drive belt and pulleys are 8 groove, except for the air conditioner compressor pump pulley which has 10 grooves. When installing the drive belt, ensure that 1 groove on this pulley is visible on both sides of the drive belt.

- (2) Install drive belt around pulleys and slowly release tensioner.

**d. Follow-On Maintenance.**

- (1) Start engine and inspect drive belt to ensure belt is running in correct alignment (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Close hood (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**4-7. POWER PACK REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Field, maintenance, basic, Item 23, Appendix B Pan, drain, Item 29, Appendix B Stand, power pack, rebuild, Item 34, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B Equipment, suitable lifting</p> <p><i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Cardboard, Item 5, Appendix C Cloth, lint-free, Item 10, Appendix C Nut, self-locking, Item 103, Appendix D (22) Nut, self-locking, Item 106, Appendix D (2) Nut, self-locking, Item 107, Appendix D (4) Nut, self-locking, Item 111, Appendix D (4) Nut, self-locking, Item 112, Appendix D (4) Nut, self-locking, Item 126, Appendix D (16) O-ring, Item 139, Appendix D Tags, Item 63, Appendix C Ties, cable Item 68, Appendix C Washer, fluid, Item 14, Appendix C Washer, lock, Item 282, Appendix D (4) Washer, lock, Item 285, Appendix D (4)</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (3)</p> <p><i>References</i> None</p> <p><i>Equipment Conditions</i> <i>TM or Para</i>      <i>Condition Description</i> TM 5-2420-230-10      Firewall cover removed. TM 5-2420-230-10      Belly plates removed. Para 15-4      Air system drained. Para 4-4      Engine oil drained. Para 4-5      Transmission oil drained.</p>	<p><i>Equipment Conditions (Cont.)</i> <i>TM or Para</i>      <i>Condition Description</i> Para 13-15      Hydraulic reservoir step plate removed. Para 13-14      Fuel tank step plate removed. Para 17-4      FEL arms removed. Para 13-18      Nose cone removed. Para 12-10      Alternator removed. Para 9-7      Transmission oil cooler removed. Para 9-9      Coolant reservoir removed. Para 5-14      Steering shafts removed. Para 5-16      Miter box removed. Para 12-31      Washer bottle assembly and bracket removed. Para 20-13      Ether start atomizer removed (if equipped). Para 20-16      Ether start thermostat removed (if equipped). Para 20-17      Engine block heater removed (if equipped).</p> <p><i>Drawings Required</i> TM 5-2420-230-24P      Figure 1 TM 5-2420-230-24P      Figure 23 TM 5-2420-230-24P      Figure 25 TM 5-2420-230-24P      Figure 27 TM 5-2420-230-24P      Figure 75 TM 5-2420-230-24P      Figure 96 TM 5-2420-230-24P      Figure 97 TM 5-2420-230-24P      Figure 121 TM 5-2420-230-24P      Figure 144 TM 5-2420-230-24P      Figure 156 TM 5-2420-230-24P      Figure 192</p> <p><i>Estimated Time to Complete</i> Refer to MAC in Appendix B</p>
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**a. Removal.**

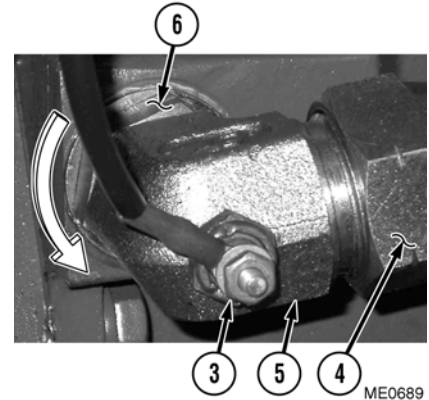
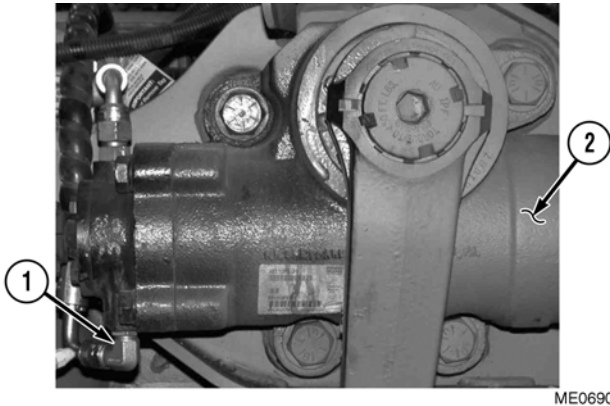
**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.
- Ensure all hoses, wires, and tubes are disconnected and clear before removal.

**WARNING**

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

- (1) Remove engine ground wire located on right side of chassis.
- (2) Remove starter motor wires.
- (3) Remove six bolts, washers, and crossmember located between hood and windshield.



**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

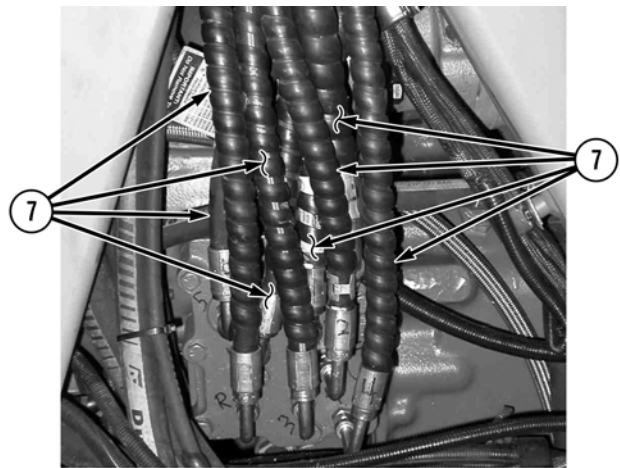
- (4) Disconnect hydraulic line (1) located at bottom of steering gear box (2). Drain power steering reservoir into suitable container.
- (5) Disconnect transmission oil sending unit (3).
- (6) Remove transmission oil cooler line (4) from elbow (5).
- (7) Loosen locknut (6) and remove elbow (5) from transmission block by rotating counterclockwise.
- (8) Remove four self-locking nuts, bolts, and eight washers securing Air-Conditioner (A/C) condenser. Discard self-locking nuts.
- (9) Protect A/C condenser core with cardboard, and place it on right wheel.
- (10) Secure A/C condenser core to fender arm with cable ties.
- (11) Disconnect two hydraulic hoses to hydraulic oil cooler.
- (12) Remove four self-locking nuts, bolts, and eight washers securing hydraulic oil cooler. Discard self-locking nuts.
- (13) Protect cooler core with cardboard and remove hydraulic oil cooler.
- (14) Disconnect coolant reservoir hose.
- (15) Remove four clamps and upper and lower radiator hoses from radiator.
- (16) Remove four self-locking nuts, eight washers, four bolts and radiator from radiator mount bracket. Discard self-locking nuts.

- (17) Remove 6 bolts, 12 washers, 6 self-locking nuts and fan blade. Discard self-locking nuts.
- (18) Disconnect three hydraulic hoses to fan hydraulic motor.
- (19) Remove 8 bolts, 16 washers, and 8 self-locking nuts securing fan motor support to chassis. Discard self-locking nuts.
- (20) Remove fan hydraulic motor and fan motor support from engine bay.
- (21) Remove drive belt (Para 4-6).
- (22) Remove four self-locking nuts, eight washers, four bolts, and A/C compressor. Secure A/C compressor on fender mount with cable ties. Discard self-locking nuts.
- (23) Loosen clamp, remove A/C receiver drier, and secure with cable ties.
- (24) Unscrew transmission filler neck and remove it.
- (25) Deleted.
- (26) Remove eight lines (7) from modulator valve on transmission.

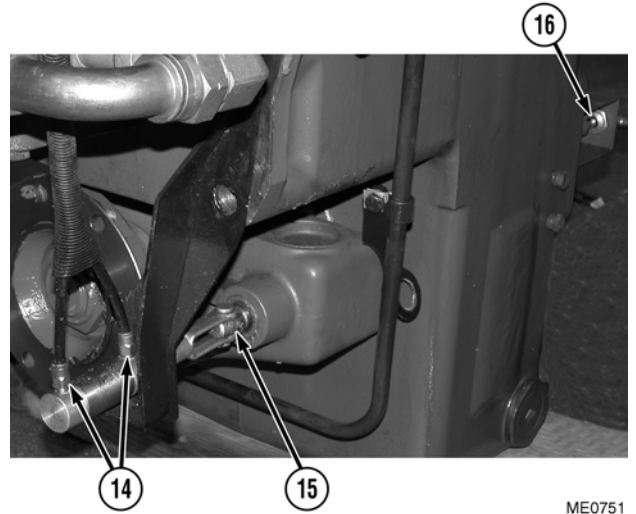
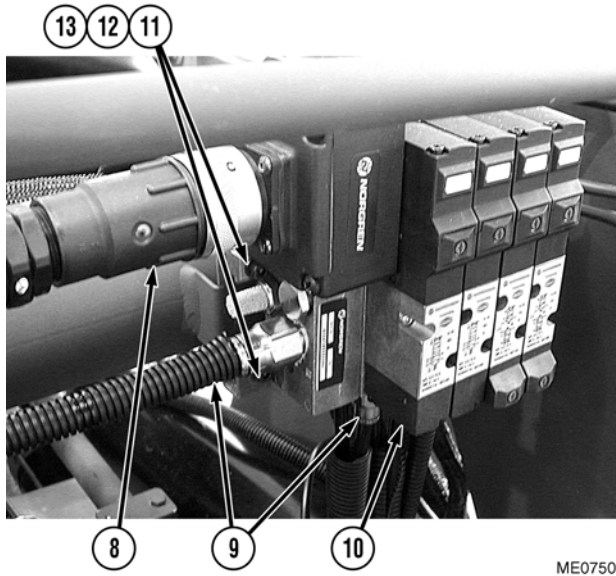
**NOTE**

Remove remote shift valve and hoses as one assembly.

- (27) Remove remote shift valve and bracket (Para 4-14).
- (28) Deleted.

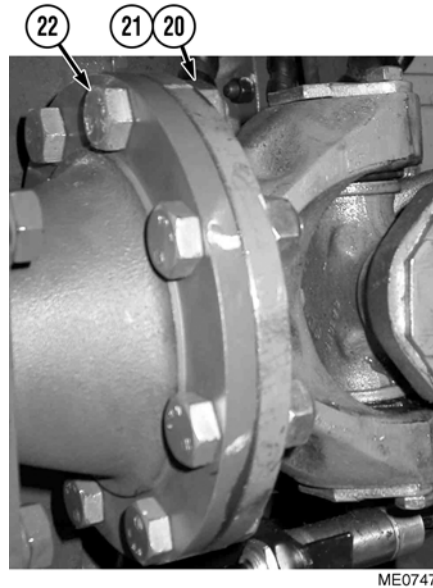
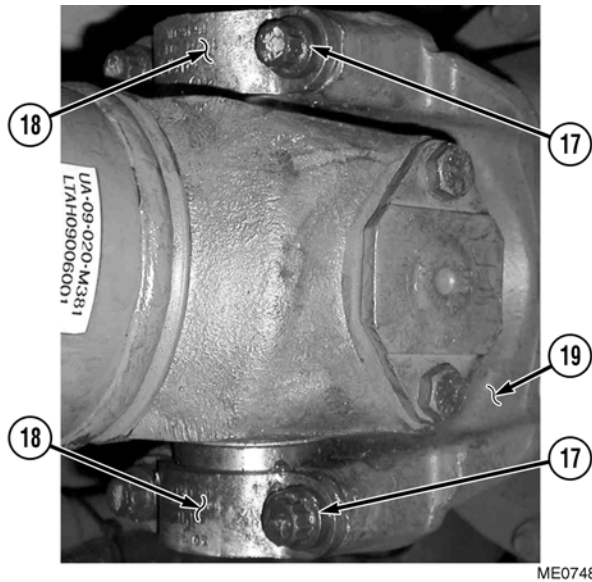


ME0749



- (29) Remove connector (8) and nine air lines (9) from pneumatic valve assembly (10).
- (30) Remove four self-locking nuts (11), screws (12), washers (13), and pneumatic valve assembly (10). Discard self-locking nuts.
- (31) Deleted.
- (32) Remove two HIGH/LOW range transmission air lines (14) from control cylinder (15) located on transmission adjacent to rear drive shaft flange.
- (33) Remove 2WD/4WD control cylinder (16) located on front of transmission adjacent to front drive shaft flange.

- (34) Jack vehicle on one rear side, install jack stand (Para 2-21), and cage brake chamber (Para 8-8).



- (35) Remove four bolts (17) and two retaining straps (18) securing front drive shaft (19) to differential yoke and remove front drive shaft (19).

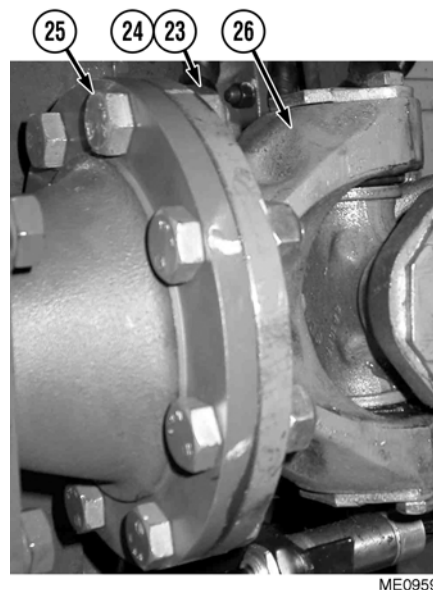
**WARNING**

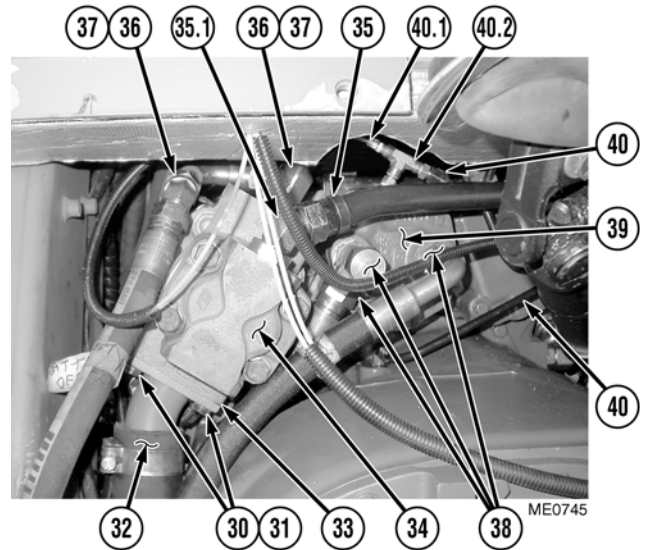
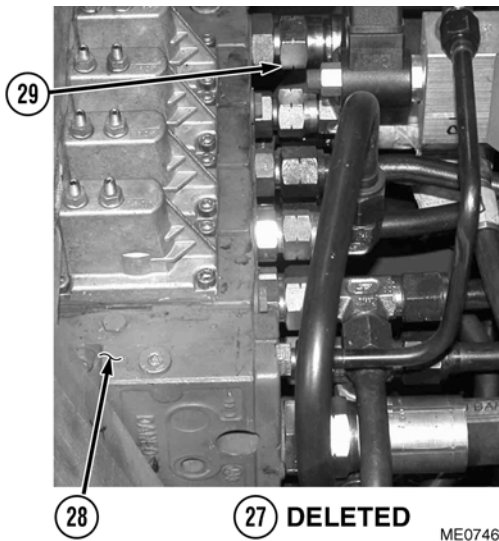
Drive shafts are heavy. Ensure no personnel are under a drive shaft when it is removed. Failure to comply could result in serious injury or death to personnel.

- (36) Scribe aligning mark and remove eight self-locking nuts (20), washers (21), and bolts (22) securing rear end of front drive shaft (19). Discard self-locking nuts.

- (37) Scribe aligning mark and remove eight self-locking nuts (23), washers (24), and bolts (25) from front end of rear drive shaft (26). Set rear drive shaft aside. Discard self-locking nuts.

- (38) Jack vehicle, remove jack stands, and lower vehicle (Para 2-21).

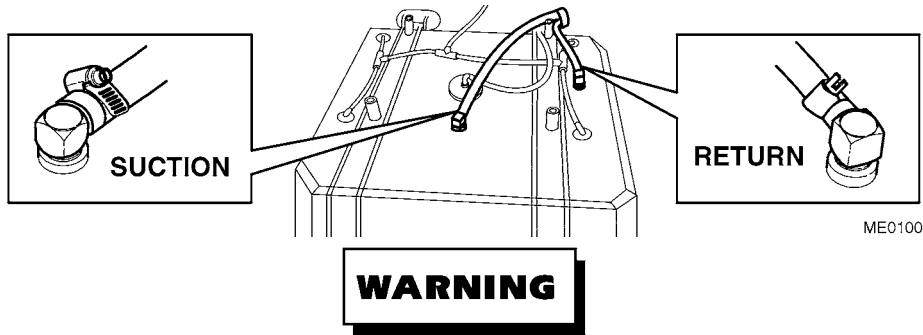




**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

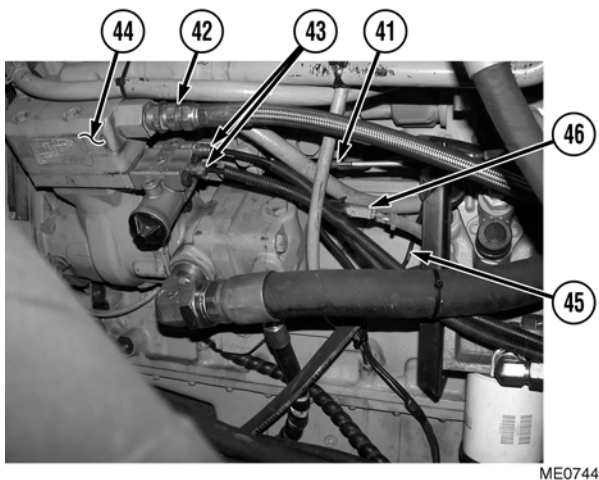
- (39) Deleted.
- (40) Remove hydraulic return line (29) located on FEL valve block (28).
- (41) Remove four bolts (30), lockwashers (31) hydraulic supply line (32), and O-ring (33) from hydraulic pump (34). Discard O-ring and lockwashers.
- (42) Remove hydraulic fan motor supply tube (35) and fitting (35.1).
- (43) Loosen clamps and remove turbo air intake tube.
- (44) Remove hydraulic hoses (36) and fittings (37) from rear of hydraulic pump (34).
- (45) Remove three fittings (38) from rear of transmission charge pump (39).
- (46) Remove two torque converter lockup tubes (40).
- (46.1) Remove capillary tube (40.1) from T-fitting (40.2).
- (46.2) Remove T-fitting (40.2) from transmission charge pump (39).
- (47) Remove hose connecting air cooler to turbocharger, and seal openings with clean cloths.



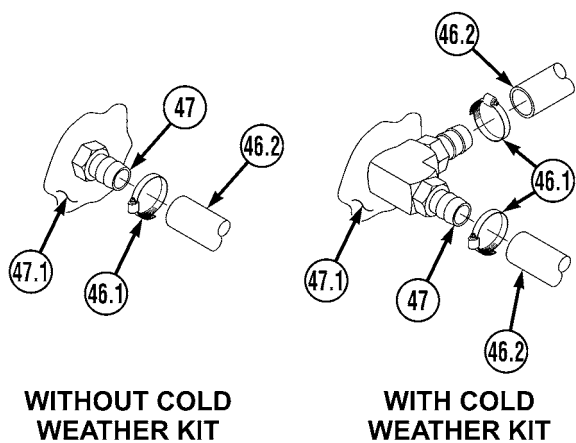
**WARNING**

- JP-8 fuel oil under pressure can penetrate the skin causing serious injury, blindness, or death. Ensure all pressure is released before disturbing the fuel system. Failure to comply may result in injury or death to personnel.
- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

- (48) Loosen clamps and disconnect fuel supply and return lines from top of fuel tank.
- (49) Remove flex pipe from exhaust pipe and muffler.
- (50) Remove exhaust pipe and seal turbine side of turbocharger using a clean cloth.



ME0744



WITHOUT COLD WEATHER KIT

WITH COLD WEATHER KIT

ME0759

- (51) Remove air inlet duct at turbocharger inlet, remove air intake pipe, and seal impeller side of turbocharger with a clean cloth. Disconnect throttle cable (41) where it meets fuel metering unit.
- (52) Remove air compressor supply line (42) and two governor lines (43) at air compressor (44).
- (53) Disconnect engine oil pressure sensor wire (45).
- (54) Disconnect wiring harness (46) at fuel shutoff.

**NOTE**

If vehicle has cold weather kit, remove two clamps and hoses in Step (55).

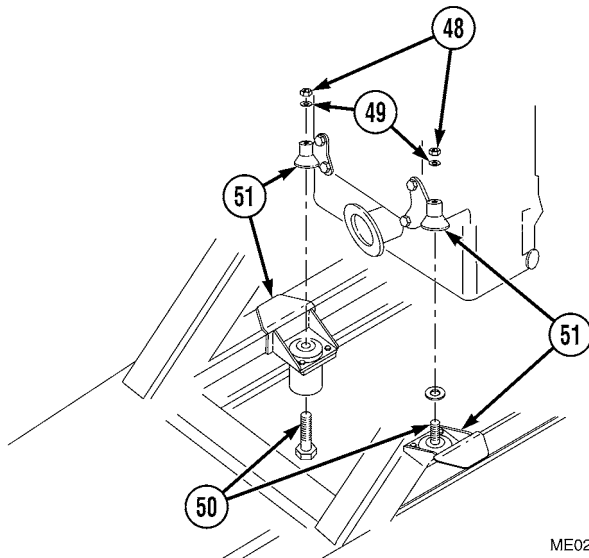
- (55) Loosen clamp (46.1), and remove heater pressure hose (46.2) and clamp from fitting (47) located on rear of engine block (47.1).



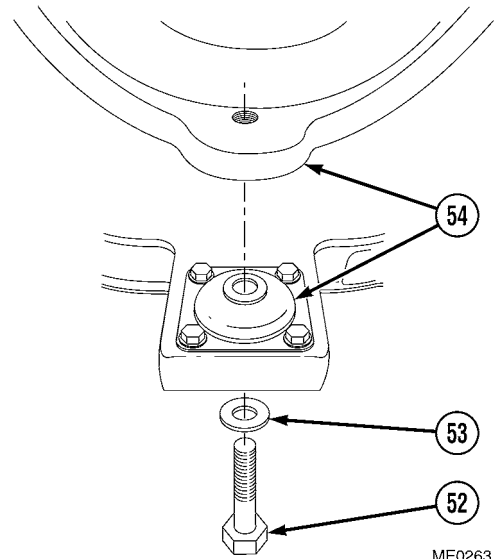
**WARNING**

The engine and transmission assembly weighs approximately 1 ton (907 kg). To avoid the possibility of personal injury, loss of life, and the destruction of the vehicle, only a qualified person using certified lifting equipment is to carry out slinging operations involving the IHMEE. Failure to comply may result in injury or death to personnel.

- (56) Install lifting eye on transmission.
- (57) Attach adjustable sling with capacity suitable for combined weight of engine and transmission to engine and transmission lifting eyes.
- (58) Use lifting device and adjustable sling, remove weight from engine and transmission mounts.
- (59) Remove elbow and hose in front of left transmission mount.



ME0262



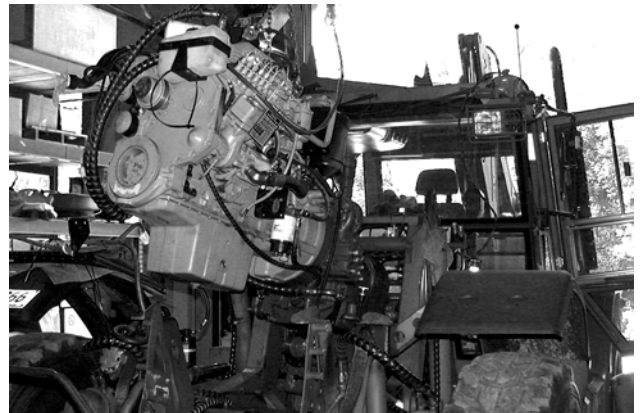
ME0263

- (60) Remove two self-locking nuts (48), washers (49), and bolts (50) from transmission mounts (51). Discard self-locking nuts.
- (61) Remove four bolts, lockwashers, and two mounts from transmission. Discard lockwashers.
- (62) Remove bolt (52) and washer (53) from engine mount (54).

**CAUTION**

Carefully maneuvering without causing further damage to equipment.

- (63) Carefully lift engine and transmission assembly out of engine bay.



ME1710

- (64) Place power pack assembly on power pack stand.
- (65) Remove adjustable sling and lifting device.

**b. Inspection.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Ensure engine bay of IHMEE is prepared to accept engine and transmission.
  - (2) Ensure all electrical cables and connections are routed clear of where engine and transmission assembly will sit.
  - (3) Ensure no loose items are in engine bay.
  - (4) Inspect engine and transmission mounts on chassis for wear, damage, and contamination. Replace any unserviceable mounts.

**c. Installation.**

**WARNING**

The engine and transmission assembly weighs approximately 1 ton (907 kg). To avoid the possibility of personal injury, loss of life, and the destruction of the vehicle, only a qualified person using certified lifting equipment is to carry out slinging operations involving the IHMEE. Failure to comply may result in injury or death to personnel.

- (1) Attach adjustable sling and lifting device to power pack lifting eyes with a capacity for combined weight of engine and transmission.
- (2) Use lifting device to remove power pack assembly from engine stand.

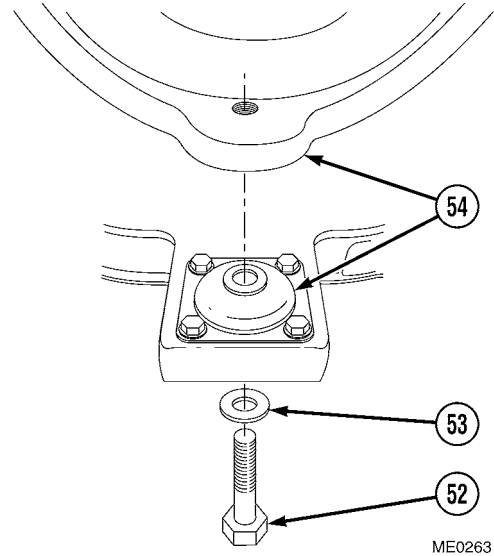
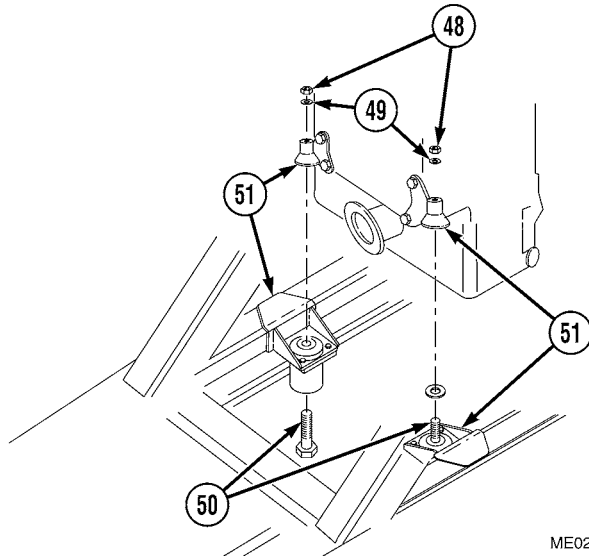


ME1710

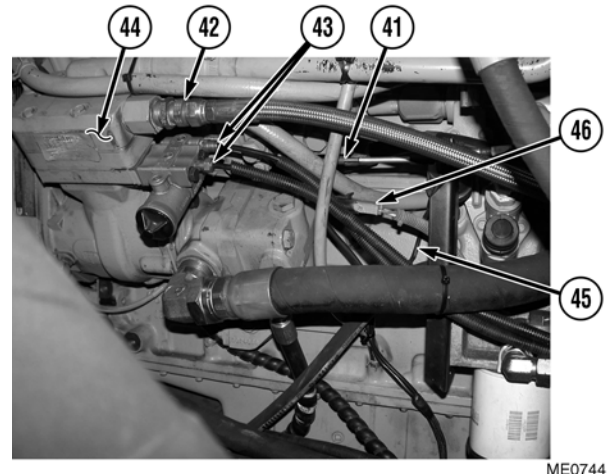
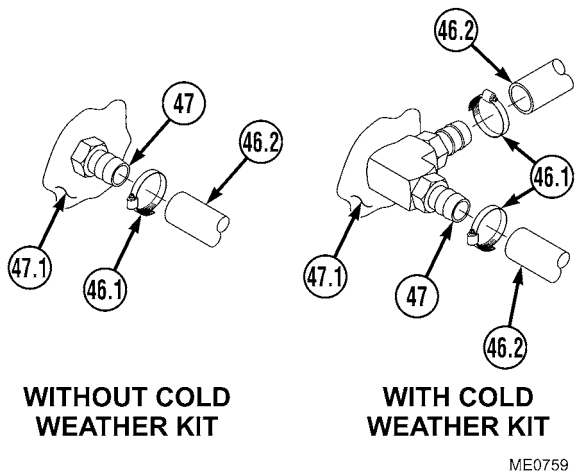
**NOTE**

Do not lower engine and transmission fully onto mounts.

- (3) Carefully maneuver power pack assembly into engine bay so mounting holes align with engine and transmission mounts.
- (4) Install four bolts, new lockwashers, and two mounts on transmission.



- (5) Install washer (53) and bolt (52) into engine mount (54). Hand-tighten bolt.
- (6) Install two bolts (50), washers (49), and new self-locking nuts (48) into transmission mounts (51). Hand-tighten bolts.
- (7) Install elbow and hose in front of left transmission mount.
- (8) Lower weight of engine and transmission onto mounts. Torque bolts (50) and (52) to 258 lbf/ft (350 N•m).
- (9) Remove adjustable sling and lifting device.
- (10) Remove lifting eye from transmission.

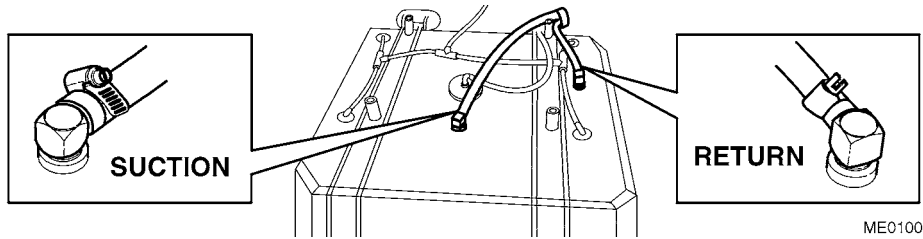


**NOTE**

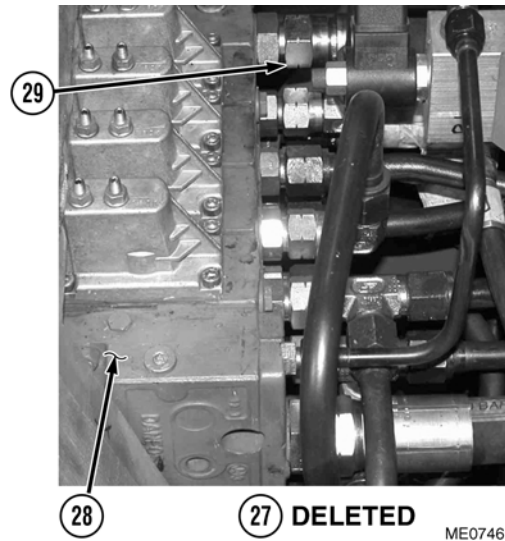
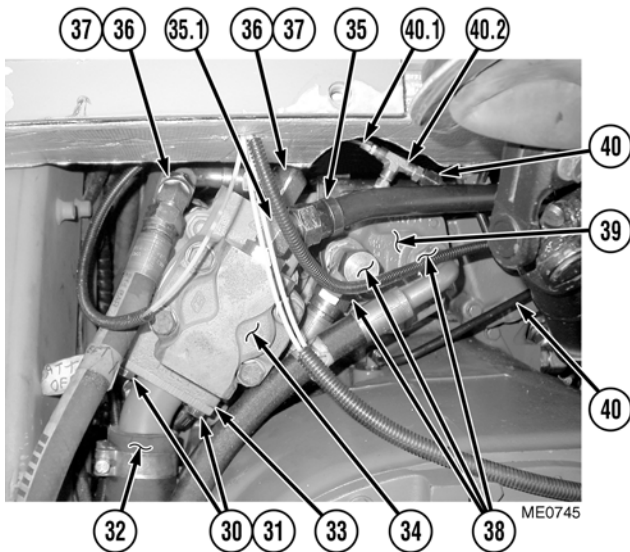
If vehicle has cold weather kit, install two clamps and hoses in Step (11).

- (11) Install heater pressure hose (46.2) and clamp (46.1) on fitting (47) located on rear of engine block (47.1).
- (12) Connect wiring harness (46) at fuel shutoff.
- (13) Connect engine oil pressure sensor wire (45).
- (14) Install air compressor supply line (42) and two governor lines (43) at air compressor (44).
- (15) Connect throttle cable (41) where it meets fuel metering unit.

- (16) Remove cloth from turbine side of turbocharger.
- (17) Install exhaust pipe at turbocharger.
- (18) Install flex pipe to exhaust pipe and muffler.
- (19) Remove cable ties securing A/C compressor and A/C receiver-drier.
- (19.1) Install A/C receiver-drier and tighten clamp.
- (19.2) Install A/C compressor with four bolts, eight washers, and four new self-locking nuts.



- (20) Connect fuel supply and return lines on top of fuel tank and tighten clamps.

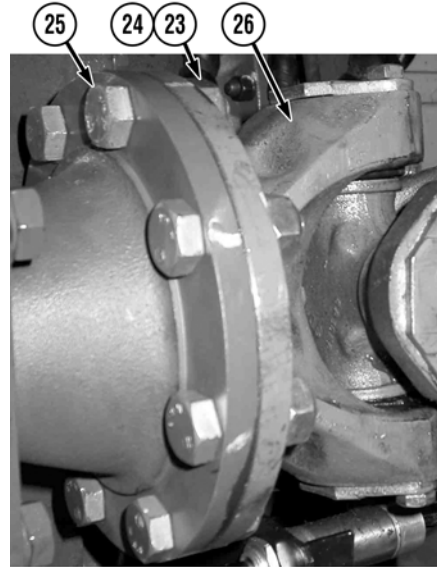


- (21) Install two torque converter lockup tubes (40).
- (22) Install T-fitting (40.2) and capillary tube (40.1) on transmission charge pump (39).
- (23) Install three hydraulic fittings (38) on rear of transmission charge pump (39).
- (24) Install hydraulic fittings (37) and hoses (36) on hydraulic pump (34).
- (25) Install fitting (35.1) and hydraulic fan motor supply tube (35).
- (26) Install new O-ring (33) and hydraulic supply line (32) on hydraulic pump (34) with four new lockwashers (31) and bolts (30).
- (27) Install hydraulic return line (29) located on FEL valve block (28).
- (28) Deleted.
- (29) Remove cloth and install hose connecting air cooler to turbocharger.
- (30) Jack vehicle and place jack stands (Para 2-21) at position with brake chamber caged (Para 8-8).

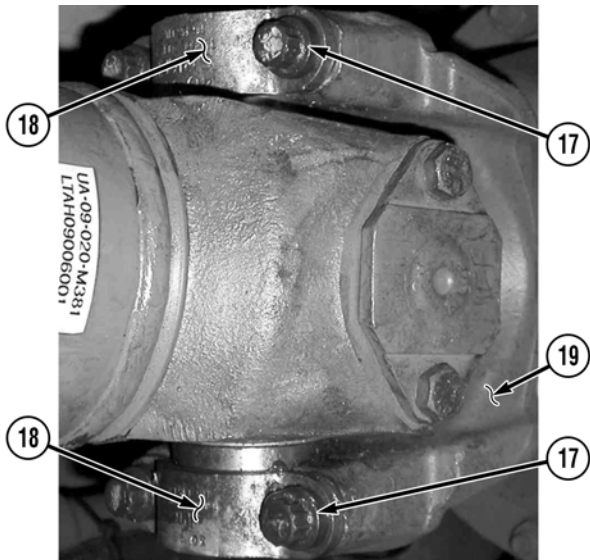
**WARNING**

Drive shafts are heavy. Ensure no personnel are under a drive shaft when it is removed. Failure to comply could result in serious injury or death to personnel.

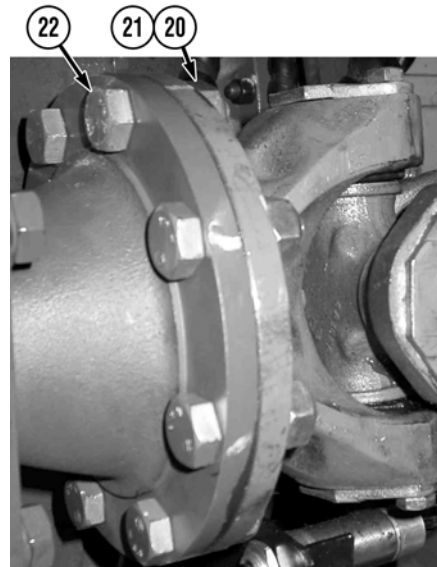
- (31) Position rear drive shaft (26), align scribe marks, and install eight bolts (25), washers (24), and new self-locking nuts (23). Tighten nuts to 38-48 lbf/ft (52-65 N•m).
- (32) Uncage brake chamber (Para 8-8).
- (33) Jack vehicle and remove jack stands.
- (34) Lower vehicle.



ME0959

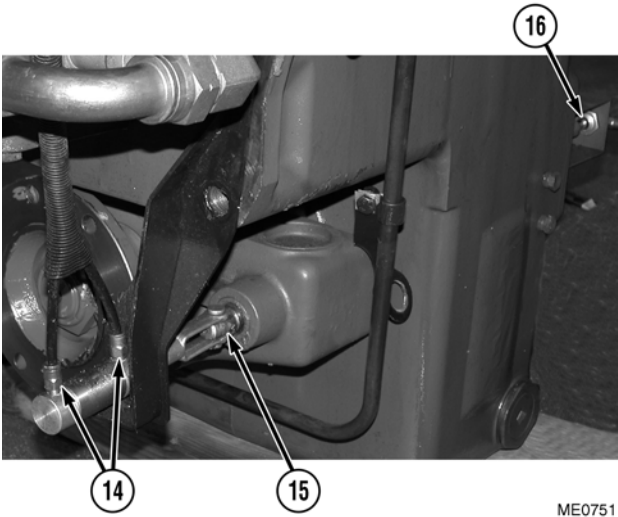


ME0748

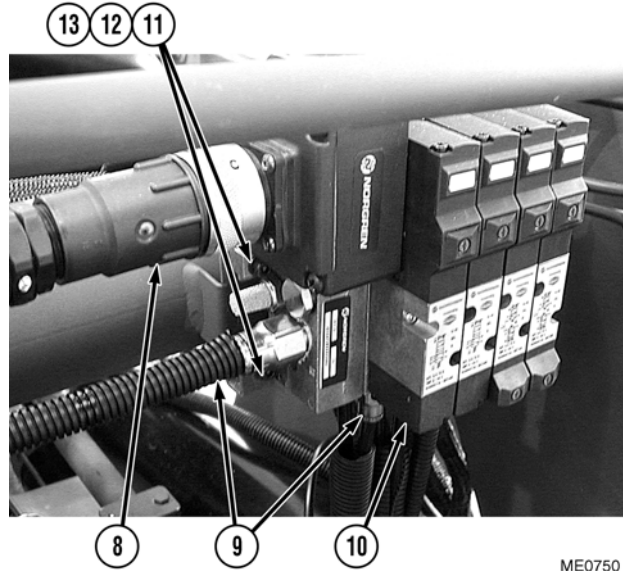


ME0747

- (35) Position front drive shaft, align scribe marks, and install two retaining straps (18) and four bolts (17) securing drive shaft to yoke (19).
- (36) Install eight bolts (22), washers (21), and new self-locking nuts (20). Tighten nuts to 38-48 lbf/ft (52-65 N•m).



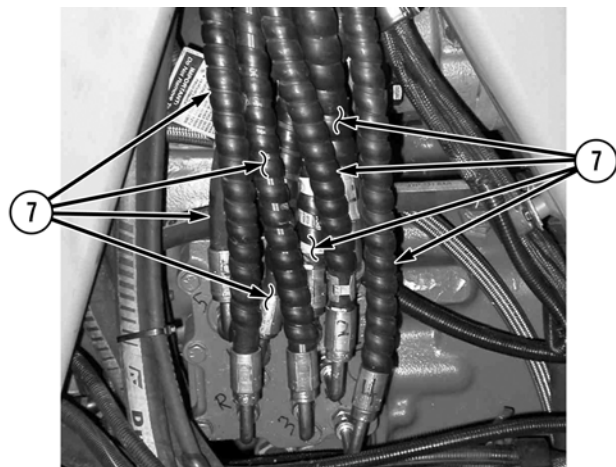
ME0751



ME0750

- (37) Install 2WD/4WD transmission control cylinder (16) located adjacent to front drive shaft flange on front of transmission.
- (38) Install two HIGH/LOW range transmission air lines (14) to control cylinder (15) located adjacent to rear drive shaft flange on transmission.
- (39) Install pneumatic valve assembly (10) with four washers (13), screws (12), and new self-locking nuts (11).
- (40) Install connector (8) and nine air lines (9) on pneumatic valve assembly (10).
- (41) Position transmission hydraulic manifold and hoses on vehicle and route transmission manifold lines through chassis.
- (42) Install four bolts securing transmission hydraulic manifold to transmission.
- (43) Connect five electrical connections at transmission hydraulic manifold.
- (44) Remove cloth from impeller side of turbocharger.
- (45) Install air inlet duct and clamps at turbocharger inlet and air intake pipe. Tighten clamps.

- (46) Install eight lines (7) on remote shift on transmission.
- (47) Install transmission filler neck by screwing into place.
- (48) Position fan hydraulic motor and fan motor support in engine bay.
- (49) Connect three hydraulic hoses to fan hydraulic motor.



ME0749

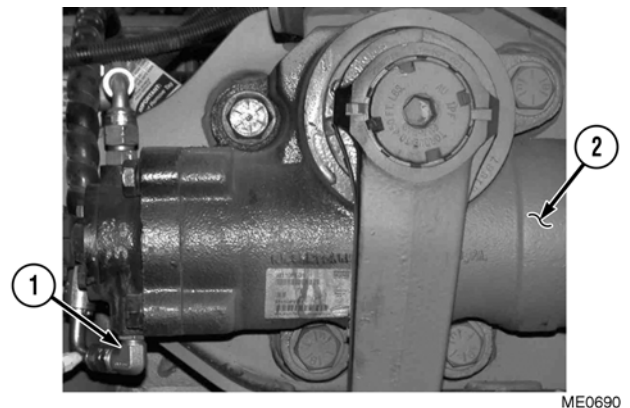
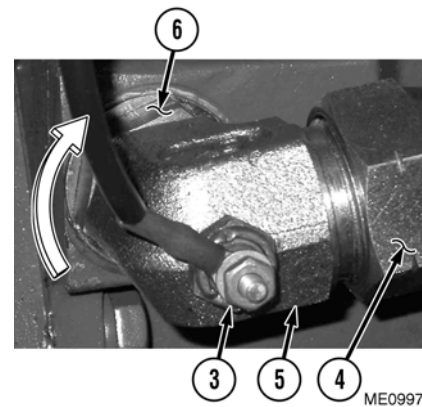
- (50) Install fan motor support to chassis with 8 bolts, 16 washers, and 8 new self-locking nuts. Tighten bolts.
- (51) Install fan blade with 6 bolts, 12 washers, and 6 new self-locking nuts. Tighten nuts to 11 lbf/ft (15 N•m).

- (52) Install radiator on radiator mount bracket with four bolts, eight washers, and four new self-locking nuts. Torque bolts to 40 lbf/ft (54 N•m).

**NOTE**

Hose clamps must be retorqued after vehicle has been run at normal operating temperature.

- (53) Install four clamps and upper and lower radiator hoses on radiator. Torque clamps to 50-70 lbf/in (5.6-7.9 N•m).
- (54) Install coolant reservoir hoses.
- (55) Remove cardboard and install hydraulic cooler with four bolts, new self-locking nuts and eight washers. Torque bolts to 11 lbf/ft (15 N•m).
- (56) Install and tighten two hydraulic hoses to hydraulic oil cooler.
- (57) Remove cable ties securing A/C condenser core.
- (58) Remove cardboard and install A/C condenser with four bolts, new self-locking nuts and eight washers. Torque bolts to 11 lbf/ft (15 N•m).
- (59) Deleted.
- (60) Rotate elbow (5) clockwise on transmission and tighten locknut (6).
- (61) Install transmission oil cooler line (4) and elbow on transmission. Torque clamps to 50-70 lbf/in (5.6-7.9 N•m).
- (62) Connect transmission oil sending unit (3).
- (63) Install hydraulic line (1) located at bottom side of steering gear box (2).
- (64) Install crossmember located between hood and windshield with six bolts and washers.
- (65) Install starter motor wires.
- (66) Install engine ground wire on right side of chassis.



**d. Follow-On Maintenance.**

- (0.1) Install washer bottle assembly and bracket (Para 12-31).
- (1) Install miter box (Para 5-16).
- (2) Install steering shafts and U-joints (Para 5-14).
- (3) Install coolant reservoir (Para 9-9).
- (4) Install transmission oil cooler (Para 9-7).
- (5) Install alternator (Para 12-10).
- (5.1) Install ether start atomizer (if equipped) (Para 20-13).
- (5.2) Install ether start thermostat (if equipped) (Para 20-16).
- (5.3) Install engine block heater (if equipped) (Para 20-17).

- (6) Deleted.
- (7) Fill power steering reservoir (TM 5-2420-230-10).
- (8) Fill transmission oil (Para 4-5).
- (9) Fill engine oil (Para 4-4).
- (10) Check hydraulic oil level (TM 5-2420-230-10).
- (11) Start engine and check for any leaks or unusual noise in or around engine bay (TM 5-2420-230-10).
- (12) Shut OFF engine (TM 5-2420-230-10).
- (13) Install nose cone (Para 13-18).
- (14) Install FEL arms (Para 17-4).
- (15) Install fuel tank step plate (Para 13-14).
- (16) Install hydraulic reservoir step plate (Para 13-15).
- (17) Install belly plates (TM 5-2420-230-10).
- (18) Install firewall cover (TM 5-2420-230-10).

**END OF TASK**

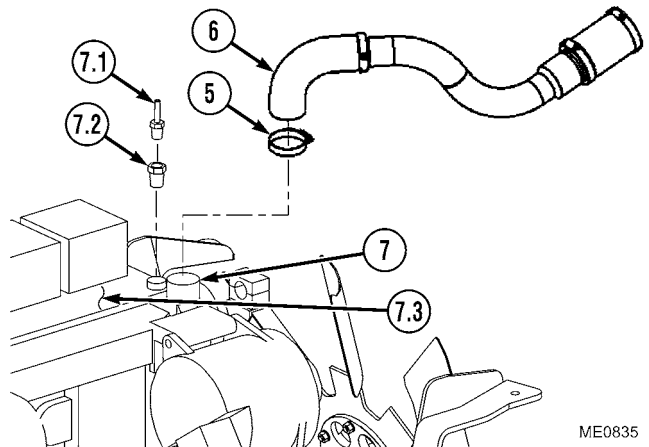
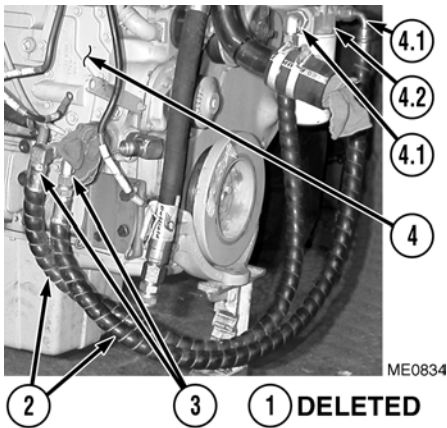
<b>4-8. ENGINE COMPONENT REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	Para 4-7	Power pack removed.
<i>Tools and Special Tools</i>	<i>Drawings Required</i>	
Tool kit, common no. 2, Item 36, Appendix B	TM 5-2420-230-24P	Figure 15
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-24P	Figure 25
	TM 5-2420-230-24P	Figure 26
	TM 5-2420-230-24P	Figure 28
	TM 5-2420-230-24P	Figure 30
	TM 5-2420-230-24P	Figure 31
	TM 5-2420-230-24P	Figure 34
	TM 5-2420-230-24P	Figure 35
	TM 5-2420-230-24P	Figure 40
	TM 5-2420-230-24P	Figure 43
	TM 5-2420-230-24P	Figure 51
	TM 5-2420-230-24P	Figure 67
	TM 5-2420-230-24P	Figure 110
	TM 5-2420-230-24P	Figure 111
<i>Materials/Parts</i>	<i>Estimated Time to Complete</i>	
Cap and plug set, Item 4, Appendix C	Part of Engine Replacement in MAC, Appendix B	
Gasket, Item 76, Appendix D		
Nut, self-locking, Item 100, Appendix D		
Nut, self-locking, Item 110, Appendix D (2)		
O-ring, Item 131, Appendix D		
O-ring, Item 132, Appendix D (2)		
Tags, identification, Item 63, Appendix C		
Ties, cable, Item 68, Appendix C		
Washer, lock, Item 280, Appendix D		
Washer, lock, Item 281, Appendix D (3)		
Washer, lock, Item 282, Appendix D (7)		
<i>Personnel Required</i>		
MOS 62B, Construction Equipment Repairer (2)		
<i>References</i>		
None		



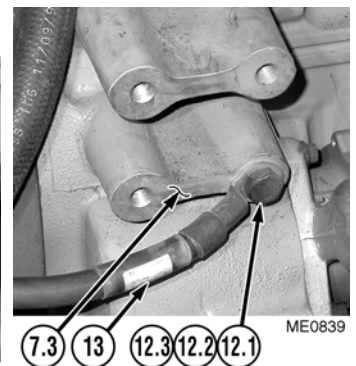
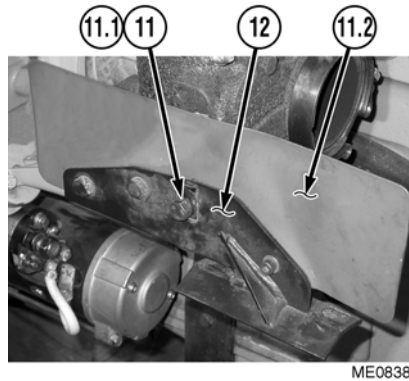
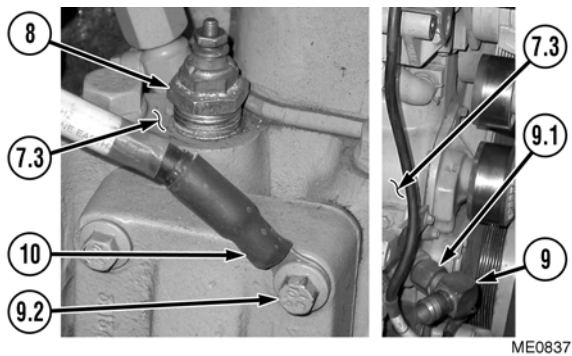
**a. Removal.**

**NOTE**

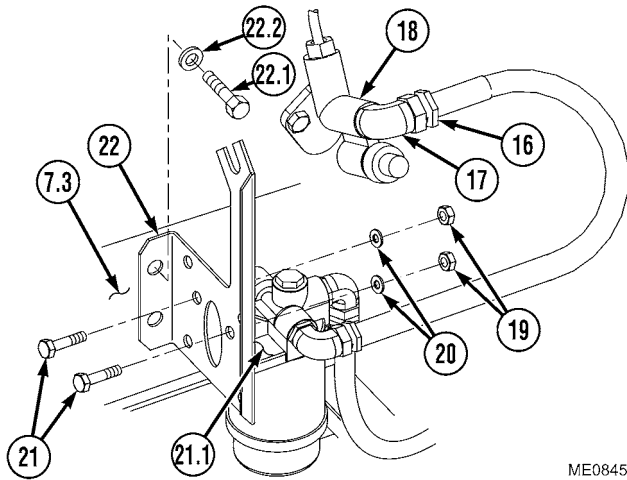
- Tag all hoses, wires, and tubes and note their positions before removal.
- Remove cable ties as necessary.
- Ensure all hoses, wires, and tubes are disconnected and clear before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.



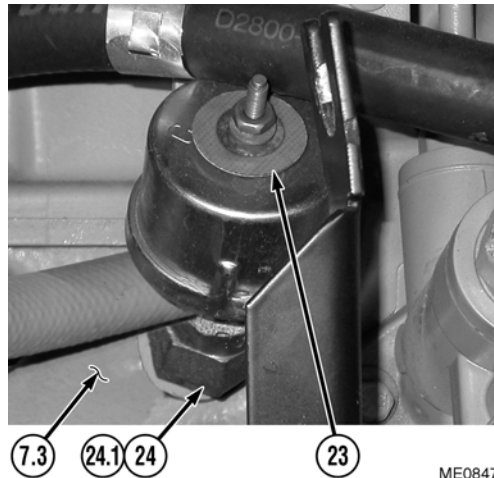
- (1) Deleted.
- (2) Remove two hoses (2) and fittings (3) from oil cooler housing (4).
- (2.1) Remove two hoses (2) and fittings (4.1) from oil filter head (4.2).
- (3) Loosen clamp (5) and remove upper engine coolant hose (6) from water outlet (7).
- (3.1) Remove straight adapter (7.1) and bushing (7.2) from engine block (7.3).



- (4) Remove coolant temperature sending unit (8) from engine block (7.3).
- (5) Remove elbow (9) and adapter (9.1) from engine block (7.3).
- (6) Remove bolt (9.2) and ground wire (10) from engine block (7.3).
- (7) Remove three bolts (11) and washers (11.1) securing heat shield (11.2) and transmission oil cooler bracket (12).
- (8) Remove bolt (12.1), lockwasher (12.2), and washer (12.3) securing negative ground wire (13) to engine block (7.3). Discard lockwasher.



ME0845

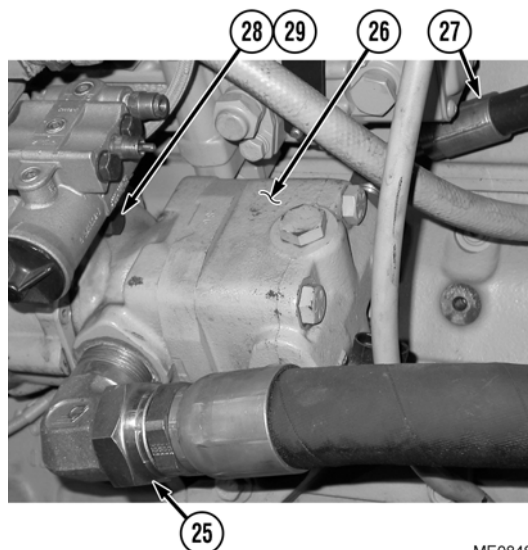


ME0847

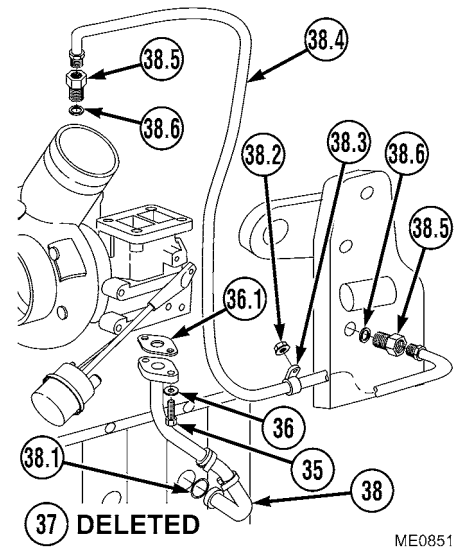
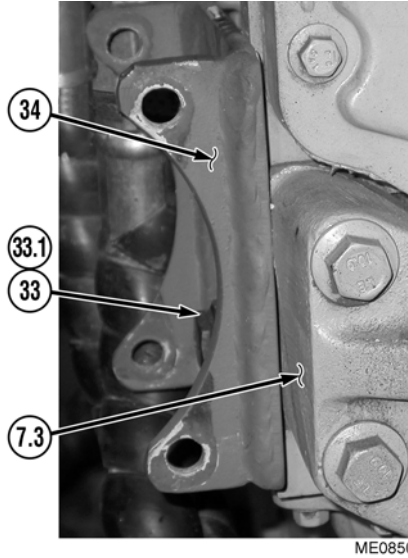
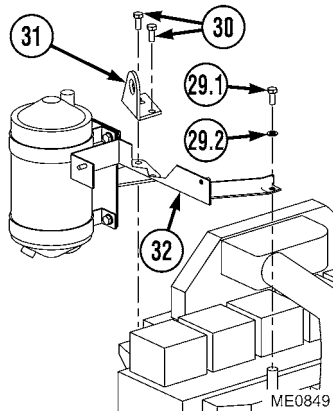
## WARNING

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

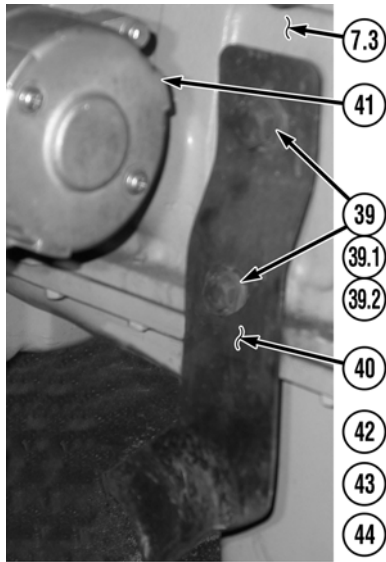
- (9) Disconnect fuel line (16), and remove elbow (17) leading to fuel primer (18).
- (10) Remove two self-locking nuts (19), washers (20), bolts (21), and filter head (21.1) from mounting bracket (22). Discard self-locking nuts.
- (11) Remove two bolts (22.1), lockwashers (22.2), and mounting bracket (22) from engine block (7.3). Discard lockwashers.
- (12) Remove engine oil temperature sending unit (23), elbow (24), and nipple (24.1) from engine block (7.3).
- (13) Disconnect supply line (25) from power steering pump (26).
- (14) Disconnect return line (27) from power steering pump (26).
- (15) Remove two bolts (28) and lockwashers (29) from flange mounting power steering pump (26) to air compressor. Discard lockwashers.
- (16) Remove power steering pump (26).



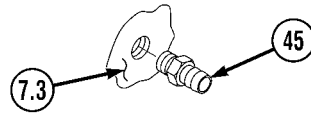
ME0848



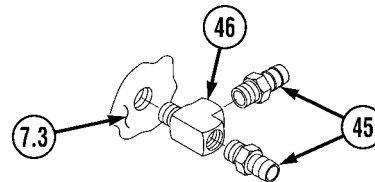
- (16.1) Remove bolt (29.1) and lockwasher (29.2). Discard lockwasher.
- (17) With the aid of an assistant, remove two bolts (30), lifting eye (31), and bracket assembly (32) from engine block (7.3).
- (18) Reinstall lifting eye (31) using two bolts (30).
- (19) Remove three bolts (33), lockwashers (33.1), and A/C bracket (34) from engine block (7.3).
- (20) Remove two bolts (35), washers (36), gasket (36.1), oil return line (38), and O-ring (38.1). Discard gasket and O-ring.
- (21) Remove self-locking nut (38.2), clamp (38.3), and oil supply line (38.4). Discard self-locking nut.
- (21.1) Remove two adapters (38.5) and O-rings (38.6). Discard O-rings.



ME0852



WITHOUT COLD WEATHER KIT



WITH COLD WEATHER KIT

ME0855

(22) Remove two bolts (39), washers (39.1), lockwashers (39.2), and bracket (40) from engine block (7.3) in front of starter (41). Discard lockwashers.

(23) Deleted.

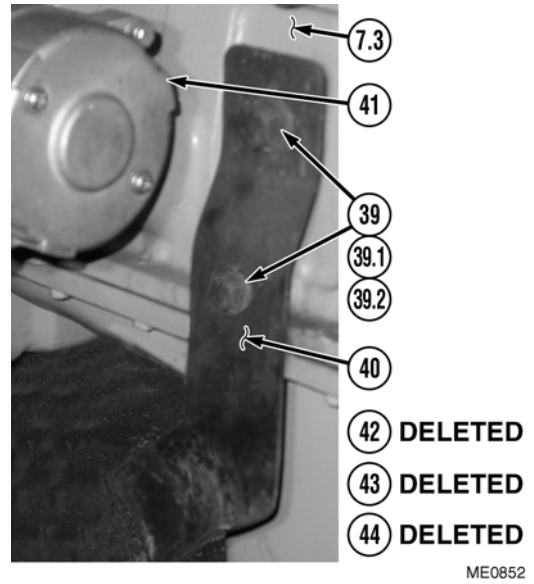
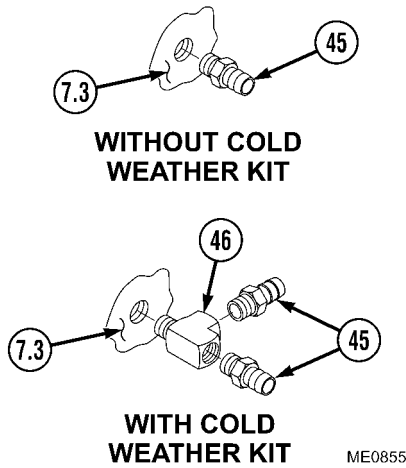
**NOTE**

If vehicle does not have cold weather kit, perform Step (24). If vehicle has cold weather kit, perform Step (24.1).

(24) Remove fitting (45) from rear of engine block (7.3).

(24.1) Remove two fittings (45) and T-fitting (46) from rear of engine block (7.3).

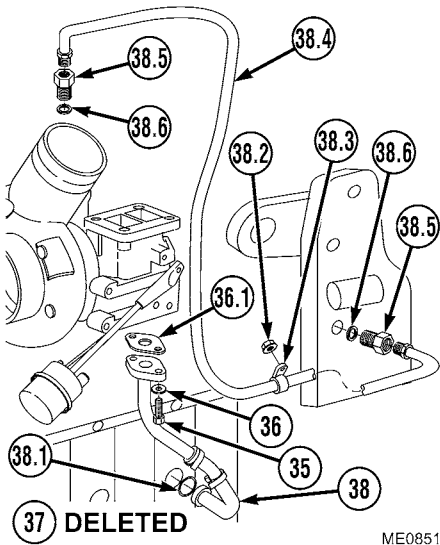
**b. Installation.**



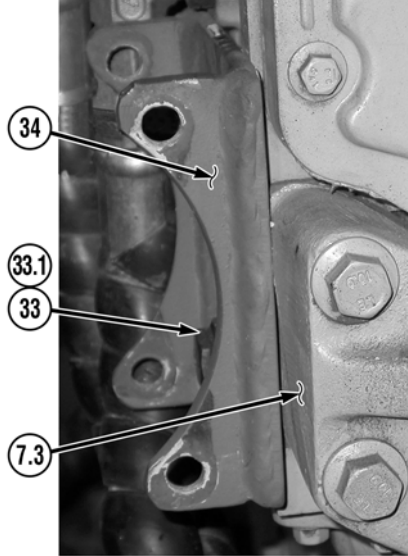
**NOTE**

If vehicle does not have cold weather kit, perform Step (1). If vehicle has cold weather kit, perform Step (1.1).

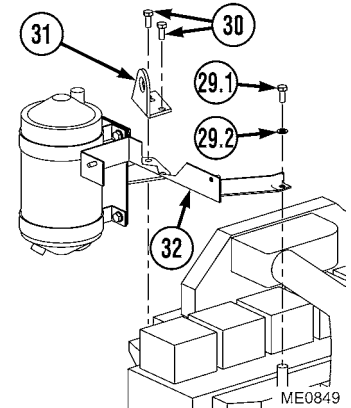
- (1) Install fitting (45) in rear of engine block (7.3). Go to Step (3).
- (1.1) Install T-fitting (46) and two fittings (45) in rear of engine block (7.3).
- (2) Deleted.
- (3) Install bracket (40) on engine block (7.3) in front of starter (41) with two washers (39.1), new lockwashers (39.2), and bolts (39).



ME0851

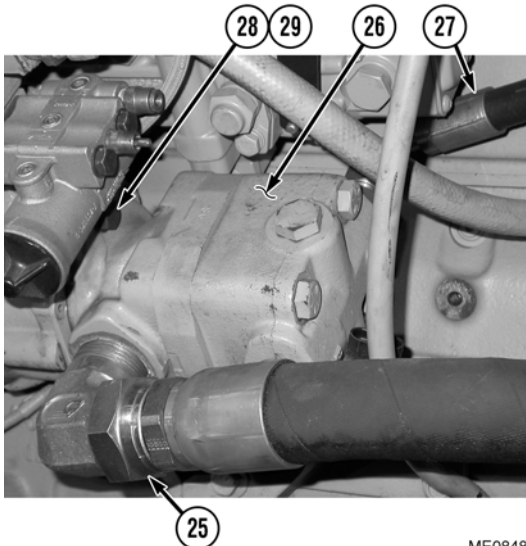


ME0850

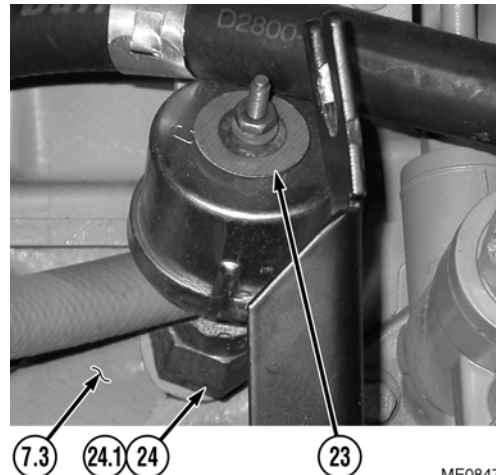


ME0849

- (3.1) Install two new O-rings (38.6) and adapters (38.5).
- (4) Install oil supply line (38.4), clamp (38.3), and new self-locking nut (38.2).
- (5) Install return line (38) with new O-ring (38.1), new gasket (36.1), two washers (36), and bolts (35).
- (6) Deleted.
- (7) Install A/C bracket (34) on engine block (7.3) with four new lockwashers (33.1) and bolts (33).
- (8) Remove two bolts (30) and lifting eye (31).
- (9) With the aid of an assistant, install bracket assembly (32) and lifting eye (31) on engine block (7.3) using two bolts (30).
- (9.1) Install new lockwasher (29.2) and bolt (29.1).



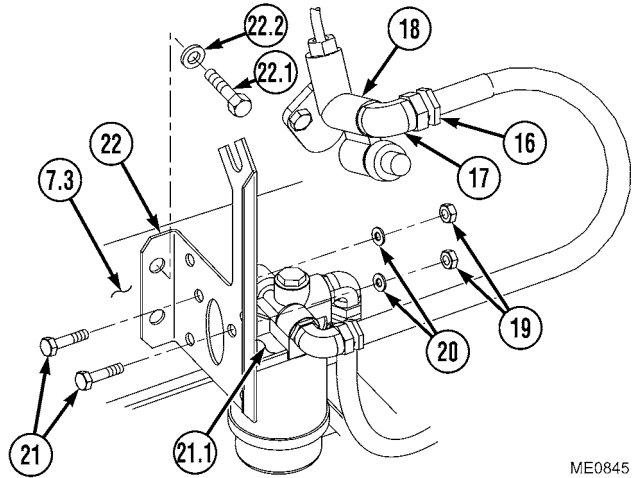
ME0848



ME0847

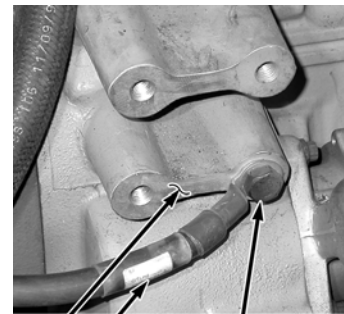
- (10) Install power steering pump (26) with two new lockwashers (28) and bolts (29).
- (11) Connect return line (27) to power steering pump (26).
- (12) Connect supply line (25) to power steering pump (26).
- (13) Install nipple (24.1), elbow (24), and engine oil temperature sending unit (23) on engine block (7.3).

- (13.1) Install mounting bracket (22) on engine block (7.3) with two new lockwashers (22.2) and bolts (22.1).
- (14) Install filter head (21.1) on mounting bracket (22) with two bolts (21), washers (20), and new self-locking nuts (19).
- (15) Install elbow (17) above fuel primer (18), and connect fuel line (16) to elbow.



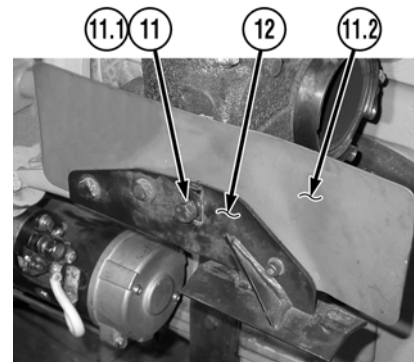
ME0845

- (16) Install negative ground wire (13) on engine block (7.3) with washer (12.3), new lockwasher (12.2), and bolt (12.1).



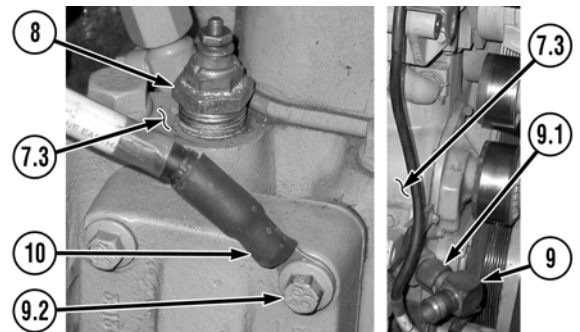
ME0839

- (17) Install transmission oil cooler bracket (12) and heat shield (11.2) with three washers (11.1) and bolts (11).

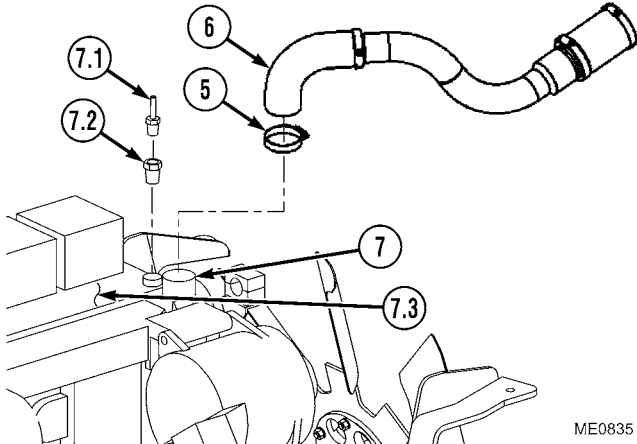


ME0838

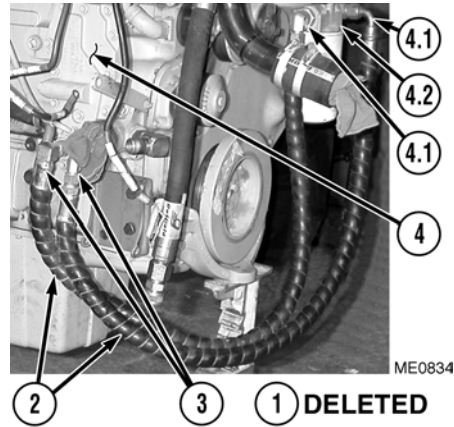
- (18) Remove bolt (9.2) from new engine block (7.3), and install ground wire (10) on engine block with bolt. Torque bolt to 24 lbf/ft (33 N•m).
- (19) Install adapter (9.1) and elbow (9) in engine block (7.3).
- (20) Install coolant temperature sending unit (8) in engine block (7.3).



ME0837



ME0835



ME0834

**NOTE**

Hose clamps must be retorqued after vehicle has been run at normal operating temperature.

- (21) Install upper engine coolant hose (6) and clamp (5) on water outlet (7). Torque clamp to 50-70 lbf/in (5.6-7.9 N•m).
- (21.1) Install two fittings (4.1) and hoses (2) on oil filter head (4.2).
- (22) Install two fittings (3) and hoses (2) on oil cooler housing (4).
- (23) Deleted.

**c. Follow-On Maintenance.**

Install power pack (Para 4-7).

**END OF TASK**

**4-9. TRANSMISSION COMPONENT REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Gasket, Item 87.1, Appendix D
- Gasket, Item 87.2, Appendix D
- Gasket, Item 87.3, Appendix D
- Gasket, Item 88, Appendix D
- Pin, cotter, Item 173.2, Appendix D
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C
- Washer, lock, Item 273, Appendix D (6)
- Washer, lock, Item 281, Appendix D (4)
- Washer, lock, Item 282, Appendix D (4)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

TM or Para  
Para 4-7      Condition Description  
Power pack removed.

*Drawings Required*

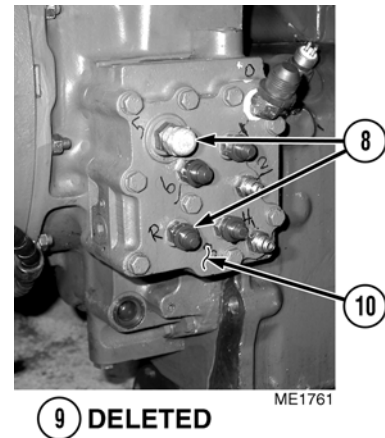
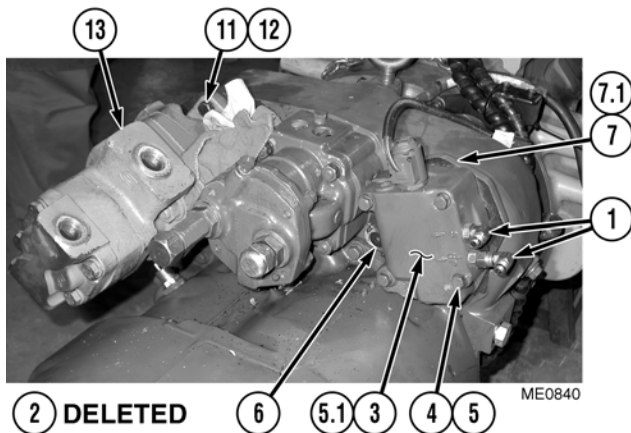
- TM 5-2420-230-24P Figure 88
- TM 5-2420-230-24P Figure 91
- TM 5-2420-230-24P Figure 92
- TM 5-2420-230-24P Figure 93
- TM 5-2420-230-24P Figure 94
- TM 5-2420-230-24P Figure 95
- TM 5-2420-230-24P Figure 96
- TM 5-2420-230-24P Figure 97
- TM 5-2420-230-24P Figure 149

*Estimated Time to Complete*

Part of Transmission Replacement in MAC, Appendix B



a. Removal.

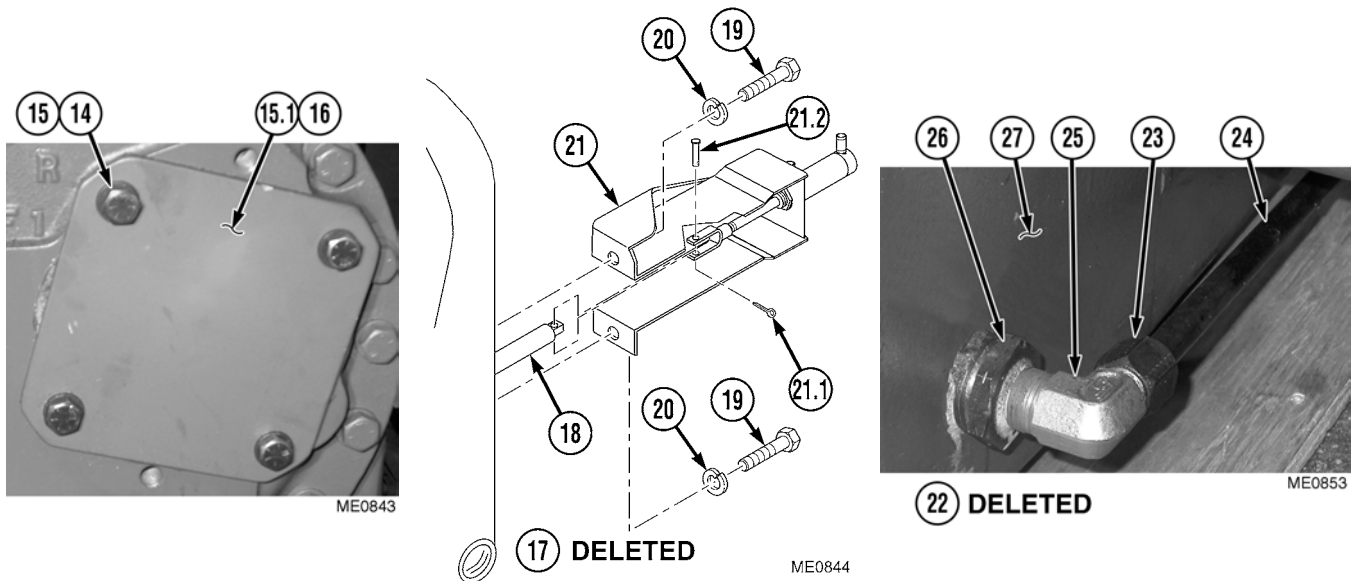


**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

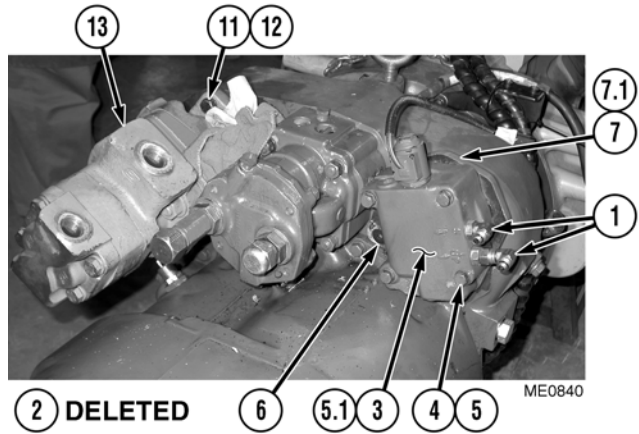
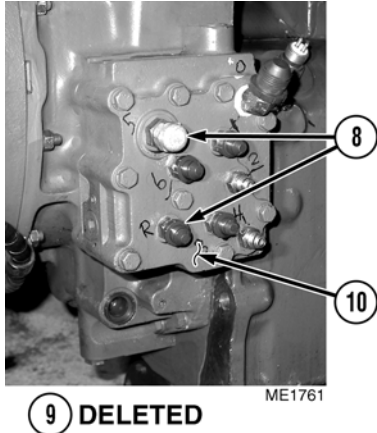
- Tag all hoses, wires, and tubes and note their positions before removal. Remove cable ties as necessary.
  - Ensure all hoses, wires, and tubes are disconnected and clear before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Remove two elbows (1) from lock-up modulator valve (3) located on right rear of transmission.
  - (2) Remove four bolts (4), lockwashers (5), lock-up modulator valve (3), and gasket (5.1). Discard lockwashers and gasket.
  - (3) Remove four bolts (6), spacer (7), and gasket (7.1).
  - (4) Remove eight fittings (8) from modulator valve (10).
  - (5) Remove four bolts (11), lockwashers (12), and hydraulic pump (13). Discard lockwashers.



- (6) Remove four bolts (14), lockwashers (15), gasket (15.1), and cover plate (16) located at top, right rear of transmission. Discard lockwashers and gasket.
- (7) Remove two bolts (19) and lockwashers (20) from control cylinder assembly (21). Discard lockwashers.
- (7.1) Remove cotter pin (21.1), pin (21.2), and control cylinder assembly (21) from straight shaft (18). Discard cotter pin.
- (8) Deleted.
- (9) Loosen collar nut (23) and remove transmission oil dipstick tube (24).
- (10) Remove elbow (25) from reducer (26).
- (11) Remove reducer (26) from transmission housing (27).
- (12) Deleted.
- (13) Deleted.

**b. Installation.**

- (1) Deleted.
- (2) Install reducer (26) in transmission housing (27).
- (3) Install elbow (25) in reducer (26).
- (4) Install transmission oil dipstick tube (24) by tightening collar nut (23) onto elbow (25).
- (5) Deleted.
- (6) Install control cylinder assembly (21) on straight shaft (18) with pin (21.2) and new cotter pin (21.1).
- (6.1) Install control cylinder assembly (21) with two new lockwashers (20) and bolts (19).
- (7) Deleted.
- (8) Install gasket (15.1) and cover plate (16) with four new lockwashers (15) and bolts (14).



- (9) Install hydraulic pump (13) with four new lockwashers (12) and bolts (11).
- (10) Install eight fittings (8) on modulator valve (10).
- (11) Install new gasket (7.1) and spacer (7) with four bolts (6).
- (12) Install new gasket (5.1) and lock-up modulator valve (3) with four new lockwashers (5) and bolts (4).
- (13) Install two elbows (1) on lock-up modulator valve (3).

**c. Follow-On Maintenance.**

Install power pack (Para 4-7).

**END OF TASK**

**4-10. SEPARATE ENGINE FROM TRANSMISSION.**

This Task Covers:

- a. Disassembly
- b. Assembly
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*

- Barring over tool, Item 2, Appendix B
- Dunnage, suitable
- Equipment, suitable lifting
- Field, maintenance, basic, Item 23, Appendix B
- Stand, power pack rebuild, Item 34, Appendix B
- Stand, suitable transmission
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-7	Power pack removed.
Para 4-8	Engine components removed as applicable.
Para 4-9	Transmission components removed as applicable.

*Materials/Parts*

- Packing, preformed, Item 165, Appendix D
- Washer, lock, Item 281, Appendix D (12)
- Washer, lock, Item 286.1, Appendix (8)

*Drawings Required*

TM 5-2420-230-24P	Figure 1
TM 5-2420-230-24P	Figure 4
TM 5-2420-230-24P	Figure 75
TM 5-2420-230-24P	Figure 81

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete*

Part of Power Pack Repair in MAC, Appendix B

**a. Disassembly.**

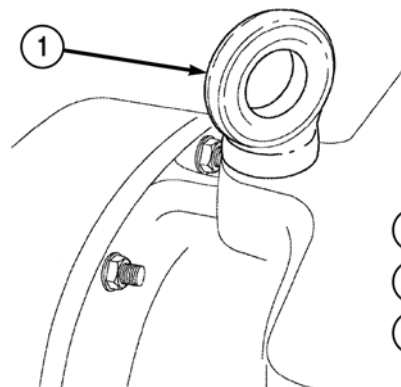
- (1) Deleted.

**WARNING**

The transmission assembly weighs approximately 992 lb. (450 kg). Ensure suitable lifting device is used. Failure to comply may result in serious injury or death to personnel.

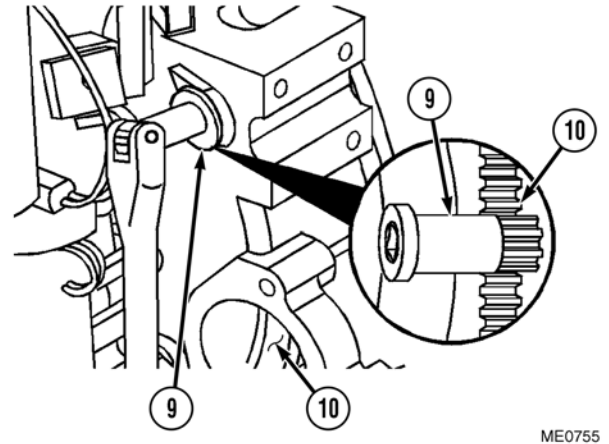
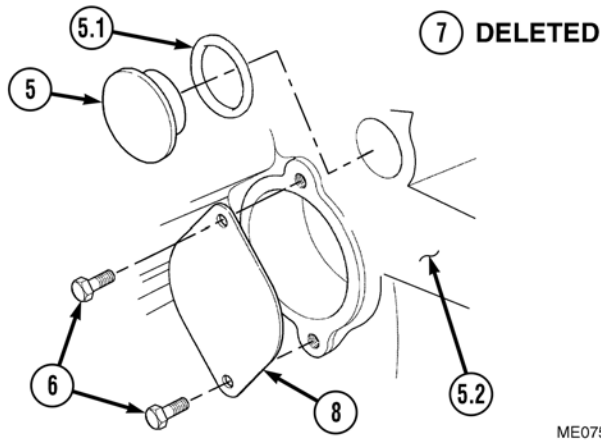
- (2) With engine and transmission assembly securely mounted in stand, attach adjustable sling and lifting device suitable for weight of transmission to lifting eye (1).

- (3) Deleted.

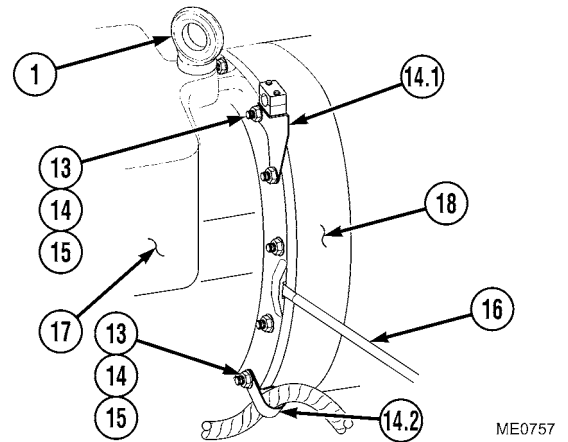
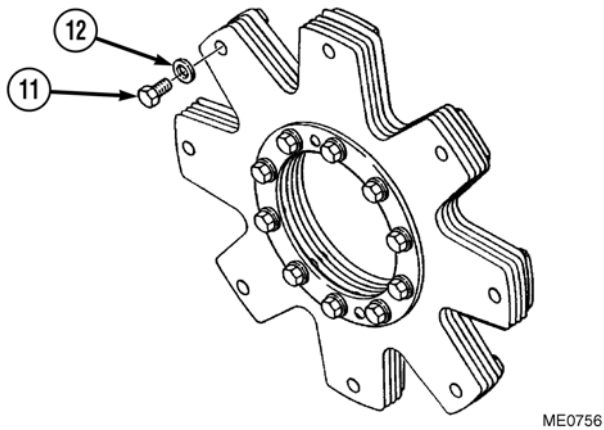


- (2) DELETED
- (3) DELETED
- (4) DELETED

ME0753

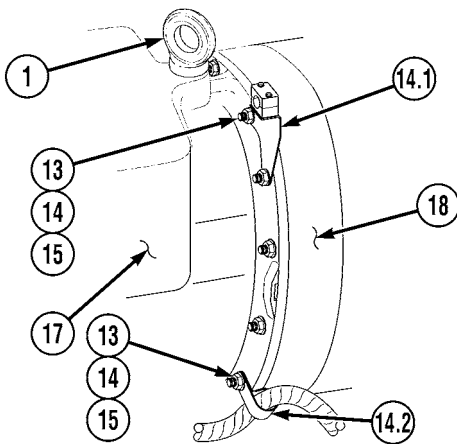


- (4) Remove engine barring cover plate (5) and preformed packing (5.1) from engine bell housing (5.2). Discard preformed packing.
- (5) Remove two bolts (6) and cover plate (8) from engine bell housing (5.2).
- (6) Attach engine barring tool (9) to engine drive plate/ring gear (10).

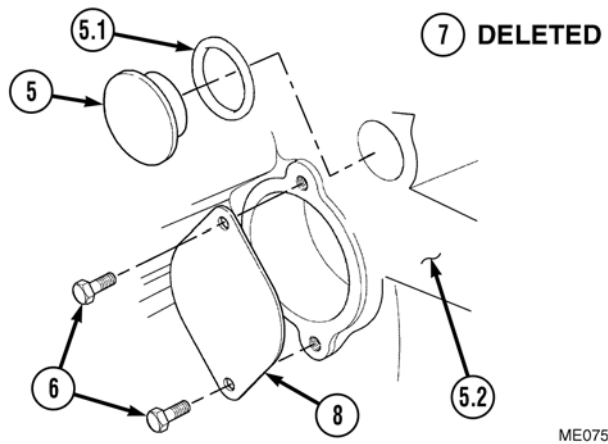


- (7) Rotate engine barring over tool (9) clockwise to remove eight flex plate retaining bolts (11) and lockwashers (12) through access hole on engine bell housing (5.2). Discard lockwashers.
- (8) Remove 12 nuts (13), lockwashers (14), bracket (14.1), and two cushion clips (14.2) from engine block mounting studs (15). Discard lockwashers.
- (9) Using a pry bar (16), carefully separate transmission (17) from engine (18).
- (10) Place transmission (17) on suitable stand.
- (11) Remove lifting equipment and adjustable sling from lifting eye (1).
- (12) Remove lifting eye (1) from transmission (17).

**b. Assembly.**



ME2614

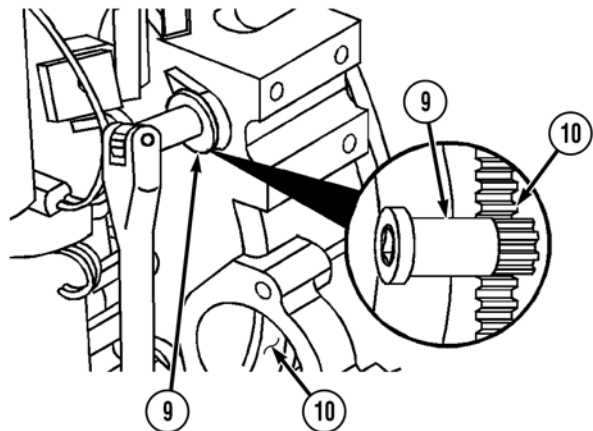


ME0754

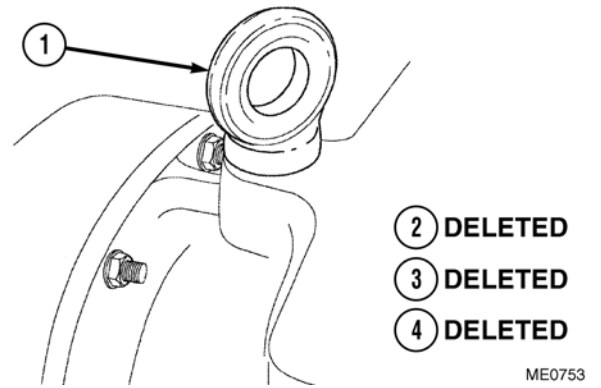
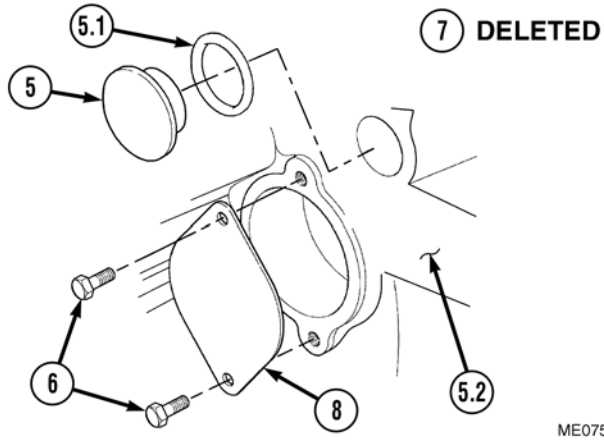
**WARNING**

The transmission assembly weighs approximately 992 lb. (450 kg). Ensure suitable lifting device is used. Failure to comply may result in serious injury or death to personnel.

- (1) Install lifting eye (1) to transmission (17).
- (2) Ensure all mating surfaces of engine block and transmission casing are clean, dry, and free from burrs.
- (3) Attach adjustable sling and lifting device suitable for weight of transmission to lifting eye (1).
- (4) Assemble engine to transmission assembly, ensuring splines of input shaft engage in torque converter.
- (5) Install two cushion clips (14.2), bracket (14.1), 12 new lockwashers (14), and nuts (13) to engine block mounting studs (15).
- (6) If required, remove engine barring cover plate (5) and preformed packing (5.1) from engine bell housing (5.2). Discard preformed packing.
- (7) If required, remove two bolts (6) and cover plate (8) from engine bell housing (5.2).
- (8) Attach engine barring tool (9) to engine drive plate/ring gear (10).
- (9) Rotate engine barring tool (9) clockwise to install eight flex plate retaining bolts (11) and new lockwashers (12). Tighten bolts to 31 lbf/ft (42 N•m).
- (10) Remove engine barring tool (9) from engine drive plate/ring gear (10).



ME0755



ME0754

ME0753

- (11) Install new preformed packing (5.1) and engine barring cover plate (5) to engine bell housing (5.2).
- (12) Install two bolts (6) and cover plate (8) on engine bell housing (5.2). Tighten bolts.
- (13) Deleted.
- (14) Deleted.

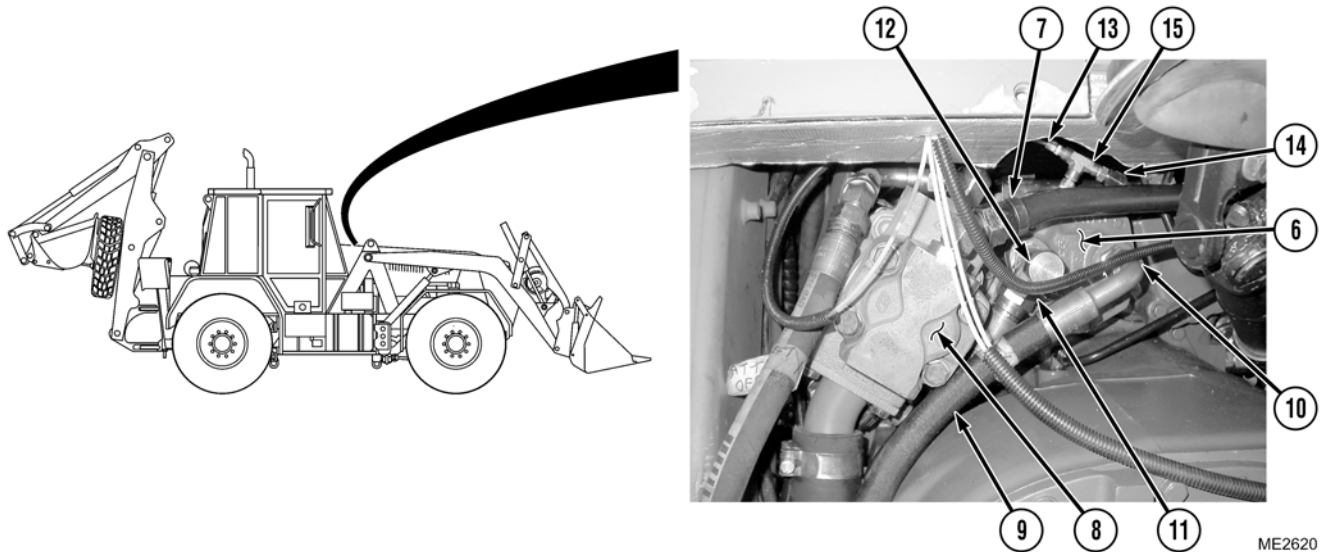
**c. Follow-On Maintenance.**

- (1) Install engine and transmission components as applicable (Para 4-9).
  - (1.1) Install engine components as applicable (Para 4-8).
  - (2) Install power pack (Para 4-7).

**END OF TASK**







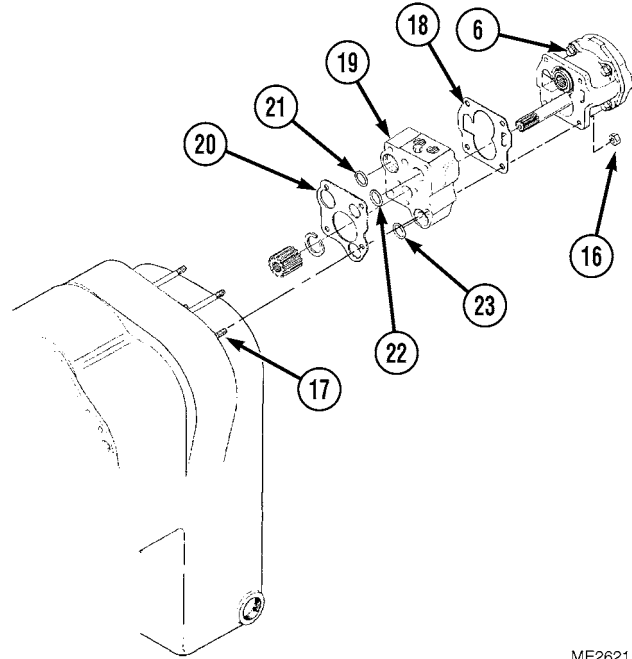
## WARNING

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

## NOTE

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal. Note positions of T-fittings prior to removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (3) Place drain pan under charging pump (6).
  - (4) Disconnect fan motor supply tube (7) from hydraulic pump (8).
  - (5) Disconnect hose (9) from fitting (10).
  - (6) Disconnect hose (11) from T-fitting (12).
  - (7) Disconnect two lines (13) and (14) from T-fitting (15).
  - (8) Remove fitting (10), T-fitting (12), and T-fitting (15) from charging pump (6).

- (9) Remove two nuts (16) from two studs (17).
- (10) Remove charging pump (6) and gasket (18) from four studs (17) and valve assembly (19). Discard gasket.
- (11) Remove valve assembly (19) and gasket (20) from four studs (17) and transmission. Discard gasket.
- (12) Remove two O-rings (21) and (22) and seal (23) from valve assembly (19). Discard O-rings and seal.
- (13) Remove four studs (17) from transmission.



ME2621

**b. Installation.**

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (1) Apply sealing compound, Loctite 243, to threads of four studs (17).
- (2) Install four studs (17) on transmission.

**CAUTION**

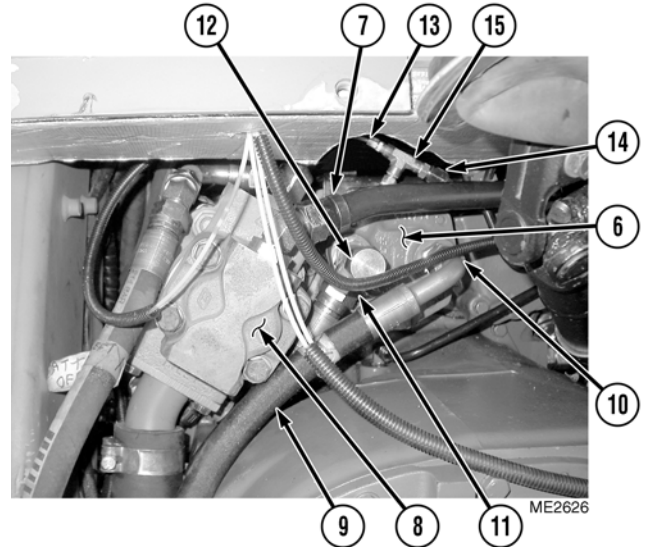
Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

- (3) Install new seal (23) and two new O-rings (22) and (21) on valve assembly (19).
- (4) Install new gasket (20) and valve assembly (19) on four studs (17) and transmission.
- (5) Install new gasket (18) and charging pump (6) on four studs (17) and valve assembly (19) with two nuts (16). Torque nuts to 74 lbf/ft (100 N•m).

**NOTE**

- Ensure T-fittings, lines, and hoses are installed to position noted prior to removal.
- Install cable ties as necessary.

- (6) Install T-fitting (15), T-fitting (12), and fitting (10) on charging pump (6).
- (7) Connect two lines (14) and (13) to T-fitting (15).
- (8) Connect hose (11) to T-fitting (12).
- (9) Connect hose (9) to fitting (10).
- (10) Connect fan motor supply tube (7) to hydraulic pump (8).

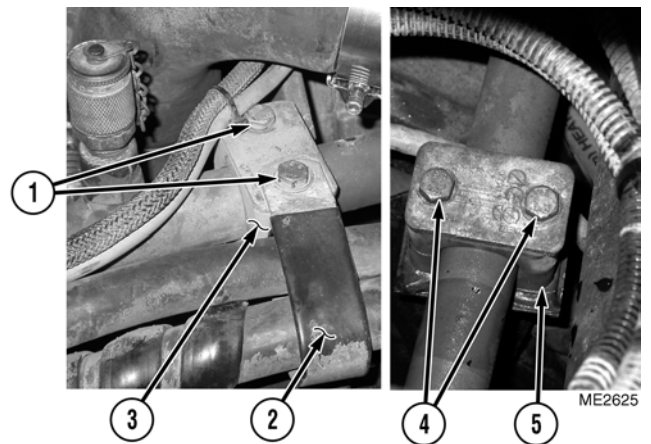


- (11) Install clamp (5) with two bolts (4).
- (12) Install clamp (3) and cushion clip (2) with two bolts (1).

**c. Follow-On Maintenance.**

Install remote shift valve and bracket (Para 4-14).

**END OF TASK**



**4-12. ENGINE OIL SAMPLING VALVE ASSEMBLY REPLACEMENT.**

This Task Covers:

- a. Removal b. Installation c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para* *Condition Description*  
Para 4-4 Engine oil drained.

*Materials/Parts*  
Compound, sealing, pipe thread, Item 23, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 157

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Removal.**

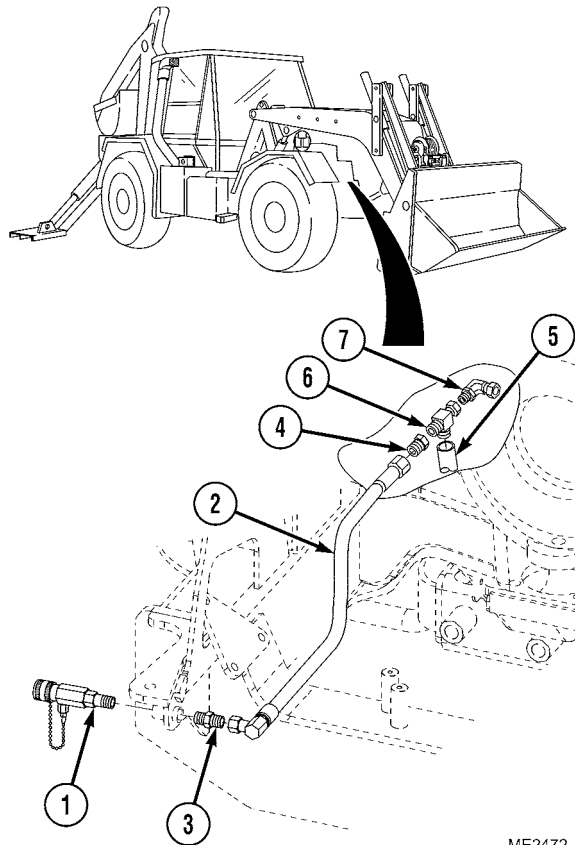


Hot parts can burn personnel. Let hot parts cool before starting work. Avoid contact with hot oil. Failure to comply may result in serious injury.

**NOTE**

Remove cable ties as necessary.

- (1) Place drain pan beneath oil sampling valve (1).
- (2) Remove oil sampling valve (1) from vehicle.
- (3) If required, remove hose (2) from adaptor (3) and reducer (4).
- (4) If required, remove adaptor (3), reducer (4), hose (5) T-fitting (6), and elbow (7) from vehicle.



ME2472

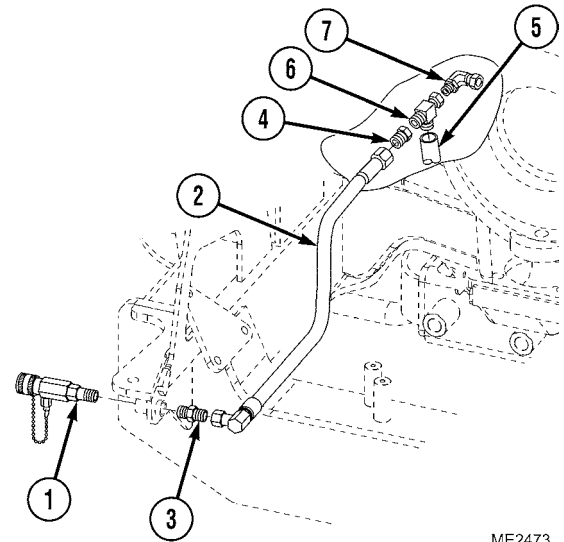
**b. Installation.**

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**NOTE**

- Install cable ties as necessary.
  - Orient the T-fitting (6) toward the rear of the machine.
- (1) If removed, apply sealing compound and install elbow (7), T-fitting (6), reducer (4), hose (5), and adaptor (3) on vehicle.
  - (2) If removed, install hose (2) on reducer (4) and adaptor (3).
  - (3) Apply sealing compound and install oil sampling valve (1) on vehicle.



ME2473

**c. Follow-On Maintenance.**

Fill engine oil and check for leaks (Para 4-4).

**END OF TASK**

<b>4-13. TRANSMISSION OIL SAMPLING VALVE ASSEMBLY REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> TM or Para Para 4-5 <i>Condition Description</i> Transmission oil drained.	
<i>Materials/Parts</i> Compound, sealing, pipe thread, Item 23, Appendix C Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 157	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B	

**a. Removal.**

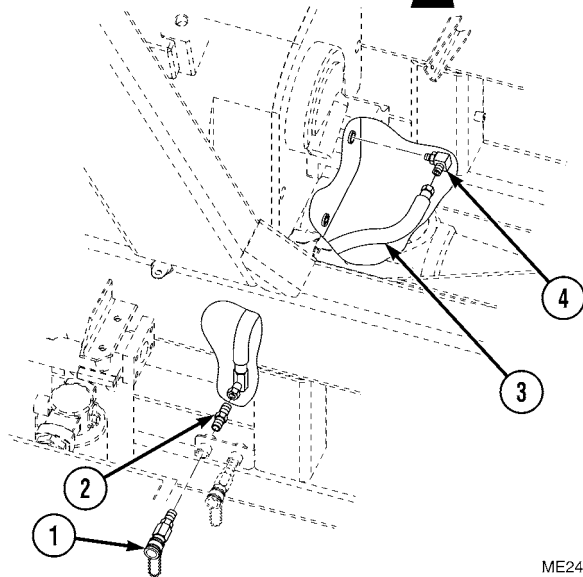
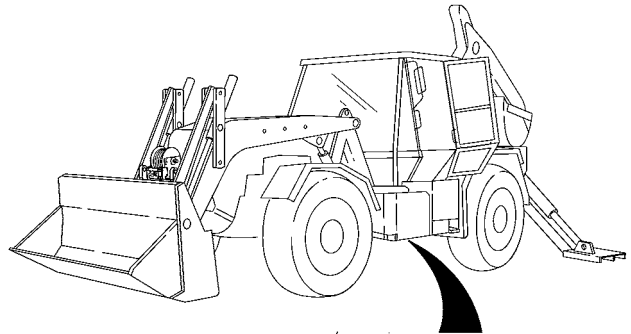
**WARNING**

- Hot parts can burn personnel. Let hot parts cool before starting work. Avoid contact with hot oil. Failure to comply may result in serious injury.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

Remove cable ties as necessary.

- (1) Place drain pan beneath transmission sampling valve (1).
- (2) Remove transmission sampling valve (1) from vehicle.
- (3) If required, disconnect hose (3) from adaptor (2) and elbow (4).
- (4) If required, remove adaptor (2) and elbow (4) from vehicle.



ME2470

**b. Installation.**

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**NOTE**

Install cable ties as necessary.

- (1) If removed, apply sealing compound and install elbow (4) and adaptor (2) on vehicle.
- (2) If removed, apply sealing compound and install hose (3) on elbow (4) and adaptor (2).
- (3) Apply sealing compound and install valve (1) on vehicle.

**c. Follow-On Maintenance.**

Fill transmission oil and check for leaks (Para 4-5).

**END OF TASK**

**4-14. REMOTE SHIFT VALVE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Engine access panel removed.
TM 5-2420-230-10	Fire wall cover removed.
TM 5-2420-230-10	Hood raised.
Para 10-5	Hydraulic pressure relieved.

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 281, Appendix D (4)  
Washer, lock, Item 285, Appendix D

*Drawings Required*  
TM 5-2420-230-24P Figure 89  
TM 5-2420-230-24P Figure 93

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete*  
Refer to MAC in Appendix B

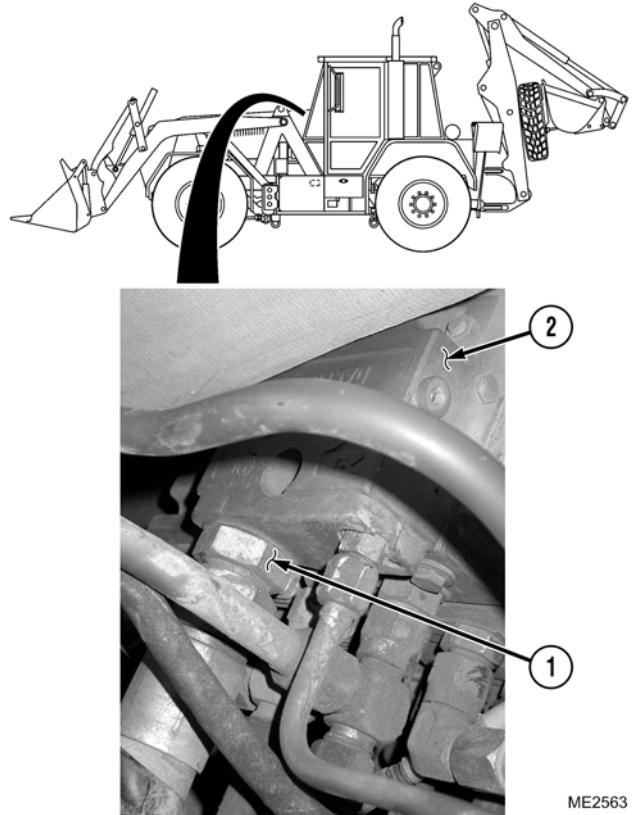
**a. Removal.**

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Tag all hoses and wires, and note their positions before removal.
  - Remove cable ties as necessary.
  - Cap and plug all tubes, hoses and fittings upon removal.
- (1) Position drain beneath inlet line (1), and remove inlet line from FEL valve block (2).



ME2563

(2) Remove nut (3) and washer (4) from coolant reservoir (5) and bracket (6).

(3) Loosen bolt (7) and remove bracket (6) from remote mount (8).

(4) Unplug wiring harness (9) from five solenoids (10).

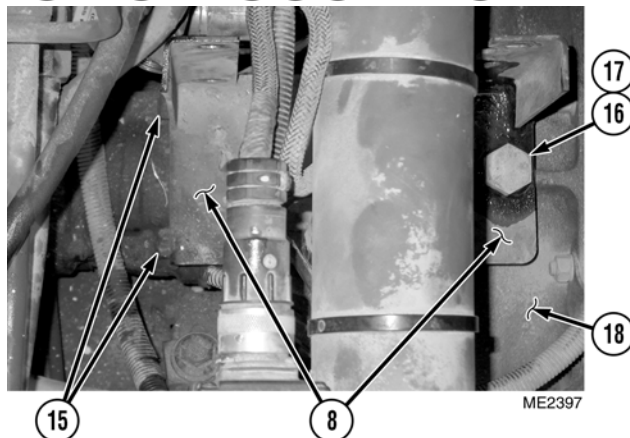
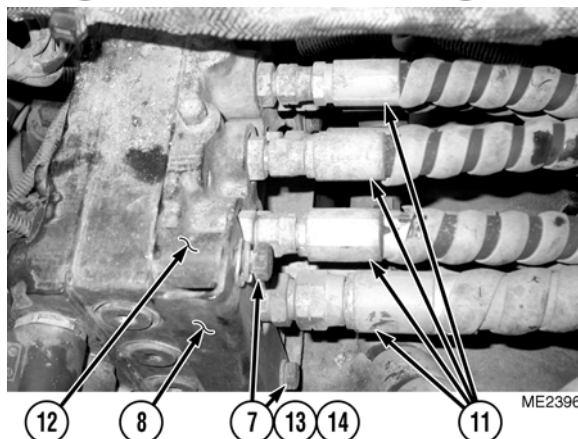
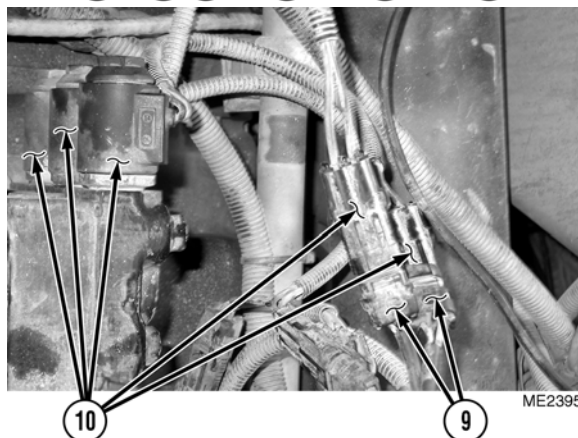
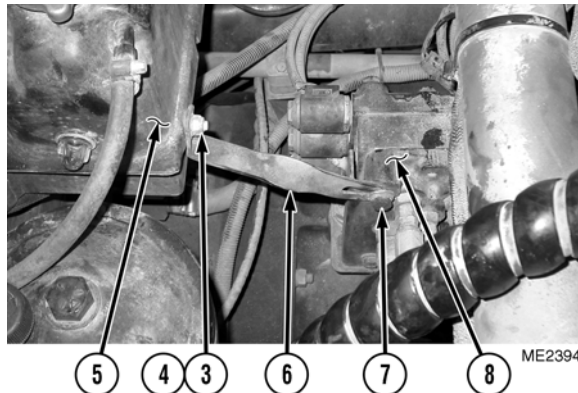
(5) Remove eight hoses (11) from valve assembly (12).

(6) Remove four bolts (7), lockwashers (13), and washers (14) from remote mount (8) and valve assembly (12). Discard lockwashers.

(7) Remove valve assembly (12) from remote mount (8).

(8) Remove two nuts (15), bolt (16), and lockwasher (17) from remote mount (8). Discard lockwasher.

(9) Remove remote mount (8) from transmission (18).



**b. Installation.**

**NOTE**

- Ensure all hoses and wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

(1) Install new lockwasher (17), bolt (16), two nuts (15), and remote mount (8) to transmission (18). Tighten nuts to 74 lbf/ft (100 N•m).

(2) Align valve assembly (12) with remote mount (8) and install with four washers (14), new lockwashers (13), and bolts (7).

(3) Install eight hoses (11) on valve assembly (12).

(4) Connect wire harness (9) to five solenoids (10).

(5) Loosen bolt (7) and install bracket (6) on remote mount (8) and coolant reservoir (5).

(6) Install washer (4) and nut (3) on bracket (6) and coolant reservoir (5).

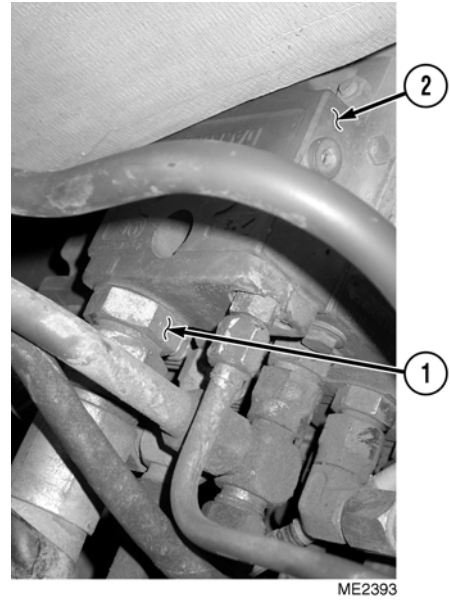
(7) Tighten bolt (7) on remote mount (8).



- (8) Install inlet line (1) on FEL valve block (2).

**c. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Check function of FEL hydraulics (TM 5-2420-230-10).
- (3) Check to ensure transmission shifts properly (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Lower hood (TM 5-2420-230-10).
- (6) Install engine access panel (TM 5-2420-230-10).
- (7) Install firewall cover (TM 5-2420-230-10).



**END OF TASK**

**4-15. ENGINE MOUNT REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 13-18      Nose cone removed.

*Materials/Parts*  
Nut, self-locking, Item 112, Appendix D (4)  
Dunnage, suitable

*Drawings Required*  
TM 5-2420-230-24P    Figure 23

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

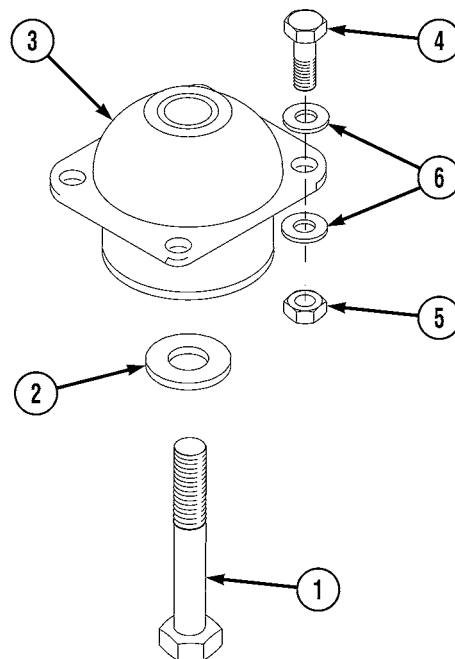
**a. Removal.**

- (1) Remove bolt (1) and washer (2).



Not placing dunnage between floor jack and oil pan could result in damage to the vehicle.

- (2) Place dunnage between floor jack and oil pan and raise engine enough to remove engine mount (3).
- (3) Remove four bolts (4), self-locking nuts (5), eight washers (6), and engine mount (3). Discard self-locking nuts.



**b. Installation.**

- (1) Install engine mount (3) with four bolts (4), new self-locking nuts (5), and eight washers (6). Tighten bolts to 40 lbf/ft (54 N•m).
- (2) Lower engine on engine mount (3).
- (3) Install bolt (1) and washer (2). Tighten bolts to 139 lbf/ft (189 N•m).

ME1237

**c. Follow-On Maintenance.**

Replace nose cone (Para 13-18).

**END OF TASK**

**4-16. TRANSMISSION MOUNT REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None.

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i> Para 4-17	<i>Condition Description</i> Transmission 2/4WD control cylinder removed (left side only). Center belly plate removed. Firewall removed.
--------------------------------	---

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Dunnage, suitable  
Nut, self-locking, Item 106, Appendix D (2)  
Nut, self-locking, Item 112, Appendix D (8)  
Washer, lock, Item 283, Appendix D  
Washer, lock, Item 285, Appendix D (2)

*Drawings Required*  
TM 5-2420-230-24P Figure 96  
TM 5-2420-230-24P Figure 97

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



Failure to place dunnage between floor jack and transmission could result in damage to the vehicle.

**NOTE**

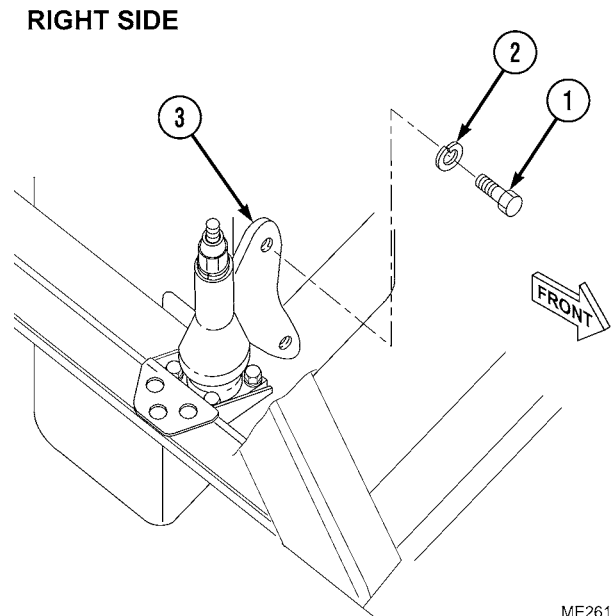
Left and right side transmission mounts are removed in the similar manner. Procedure shown for one mount only.

- (1) Place dunnage between floor jack and transmission and support transmission.

**NOTE**

Step (2) is only applicable if the right side transmission mount is being removed.

- (2) Remove two bolts (1) and lockwashers (2) from transmission mount bracket (3) and transmission. Discard lockwashers.



ME2615

- (3) Remove weather cap (4) from transmission mount (5).

**NOTE**

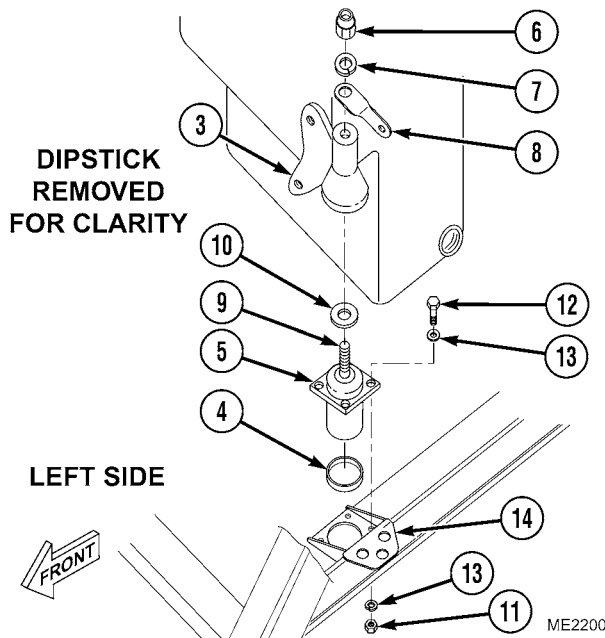
- Dipstick bracket is only on left side transmission mount.
- Note position of dipstick bracket prior to removal.

- (4) Remove self-locking nut (6), lockwasher (7), dipstick bracket (8) (left side only), bolt (9), transmission mount bracket (3) and spacer (10) from transmission mount (5). Discard self-locking nut and lockwasher.

- (5) Remove four self-locking nuts (11), bolts (12), and washers (13) from transmission mount (5) and frame (14). Discard self-locking nuts.

- (6) Jack transmission up enough to remove transmission mount (5).

- (7) Remove transmission mount (5) from frame (14).



**b. Installation.**

- (1) Install transmission mount (5) onto frame (14) with four washers (13), bolts (12), and new self-locking nuts (11). Torque bolts to 40 lbf/ft (54 N•m).

**NOTE**

- Dipstick bracket is only on left side transmission mount.
- Install dipstick bracket as noted prior to removal.

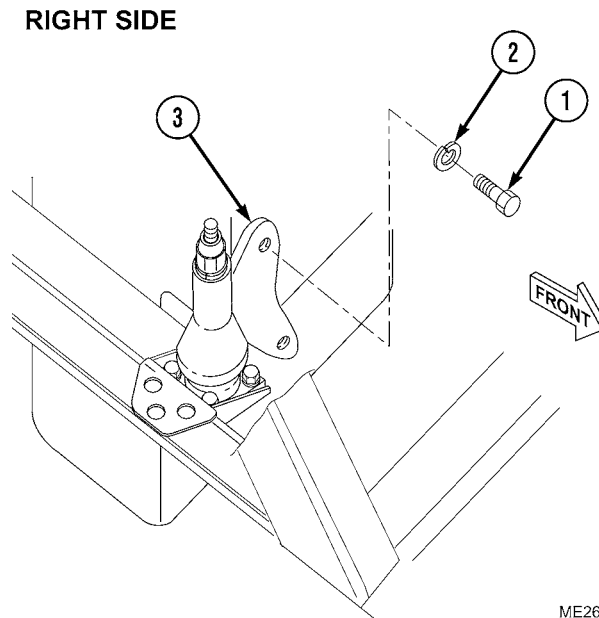
- (2) Install spacer (10) and transmission mount bracket (3) onto transmission mount (5) with bolt (9), dipstick bracket (8) (left side only), new lockwasher (7), and new self-locking nut (6). Torque bolt to 258 lbf/ft (350 N•m).

- (3) Install weather cap (4) on transmission mount (5).

**NOTE**

Step (5) is only applicable if the right side transmission mount is being installed.

- (4) Lower transmission to align transmission mount bracket (3) with holes in transmission.
- (5) Install transmission mount bracket (3) on transmission with two new lockwashers (2) and bolts (1). Torque bolts to 119 lbf/ft (161 N•m).
- (6) Remove dunnage and floor jack from under transmission.



ME2615

**c. Follow-On Maintenance.**

- (1) Install center belly plate (TM 5-2420-230-10).
- (2) Install firewall (TM 5-2420-230-10).
- (3) Install transmission 2/4WD control cylinder (left side only) (Para 4-17).

**END OF TASK**

**4-17. TRANSMISSION 2/4WD CONTROL CYLINDER REPLACEMENT.**

This Task Covers:

- a. Removal                                  b. Installation                                  c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 15-4	Air system drained.
TM 5-2420-230-10	Center belly plate removed.

*Materials/Parts*  
Compound sealing, Loctite 567, Item 22, Appendix C  
Pin, cotter, Item 173.1, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 273, Appendix D (2)

*Drawings Required*

TM 5-2420-230-24P	Figure 92
TM 5-2420-230-24P	Figure 97
TM 5-2420-230-24P	Figure 121

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

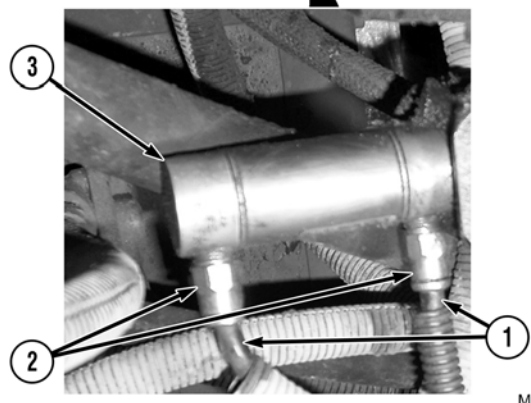
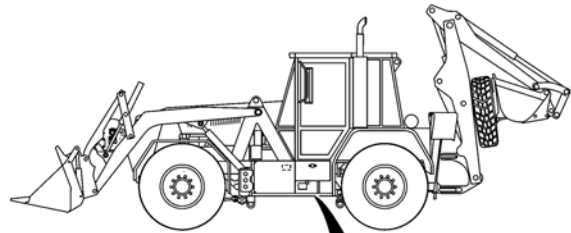
**a. Removal.**

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**NOTE**

- Tag all hoses and tubes, and note their positions before removal.
- Remove cable ties as necessary.
- 2/4WD control cylinder is mounted on front side of transmission.



ME2633

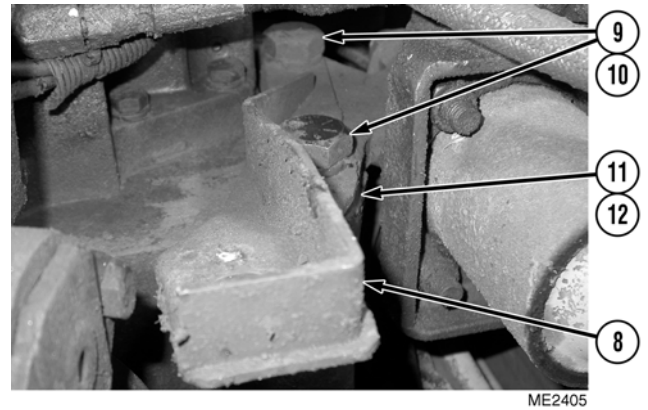
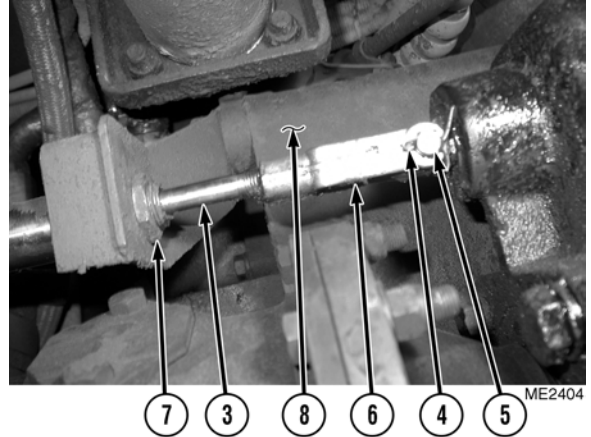
- (1) Remove two air lines (1) from fittings (2).
- (2) Remove two fittings (2) from control cylinder (3).

- (3) Remove cotter pin (4) and pin (5) from clevis (6). Discard cotter pin.
- (4) Remove clevis (6) from control cylinder (3).
- (5) Remove nut (7) from bracket (8) and control cylinder (3).
- (6) Remove control cylinder (3) from bracket (8).

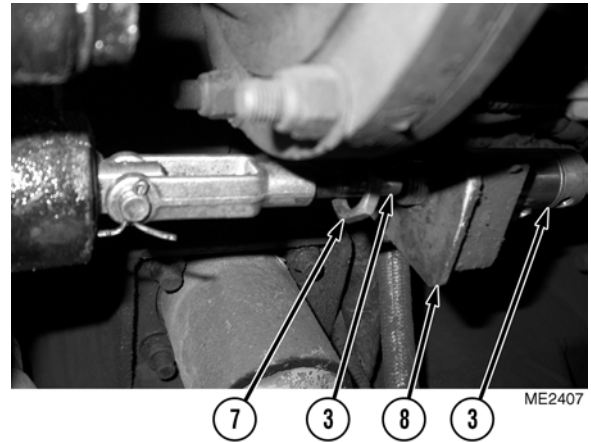
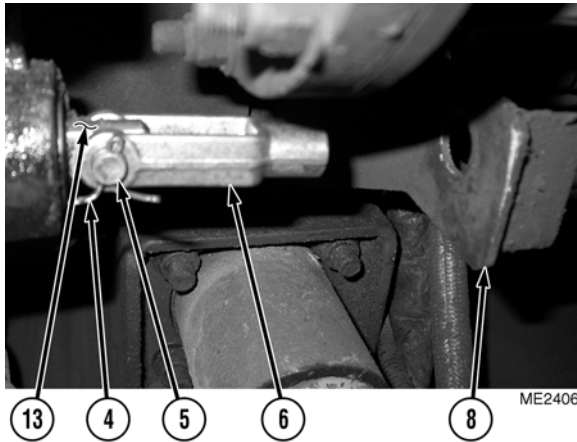
**WARNING**

Ensure the transmission is adequately supported before loosening transmission mount. Failure to comply may allow the transmission to shift, resulting in injury to personnel and/or damage to equipment.

- (7) If required, remove two bolts (9), lockwashers (10), and bracket (8) from transmission (11) and mount (12). Discard lockwasher.

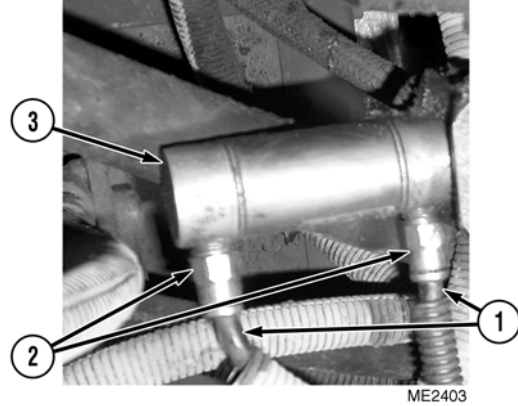
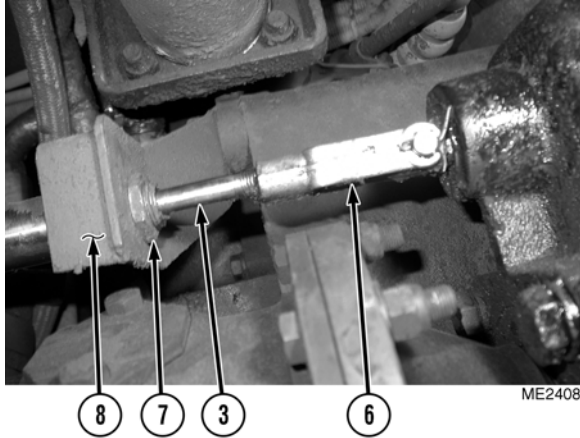


**b. Installation.**



**NOTE**

- Ensure hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) If removed, install bracket (8) on transmission (11) and mount (12) with two new lockwashers (10) and bolts (9).
  - (2) Align clevis (6) with shift rail (13), and install pin (5) and new cotter pin (4).
  - (3) Position control cylinder (3) thru bracket (8) and place nut (7) on shaft of control cylinder (3). Do not install nut.



- (4) Install control cylinder (3) by threading into clevis (6) until flush with back of bracket (8).
- (5) Install nut (7) on control cylinder (3), securing it to bracket (8).

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (6) Apply sealing compound, Loctite 567, to fittings (2).
- (7) Install two fittings (2) on cylinder (3).
- (8) Install two air lines (1) on fittings (2).

**c. Follow-On Maintenance.**

- (1) Start engine and ensure that vehicle properly switches between 2WD and 4WD modes (TM 5-2420-230-10).
- (2) Check for air leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Install center belly plate (TM 5-2420-230-10).

**END OF TASK**

**4-18. TRANSMISSION HIGH/LOW CONTROL CYLINDER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 15-4	Air system drained.
TM 5-2420-230-10	Center belly plate removed.

*Materials/Parts*  
Compound sealing Loctite 567, Item 22, Appendix C  
Pin, cotter, Item 173.1, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 273, Appendix D (2)

*Drawings Required*

TM 5-2420-230-24P	Figure 91
TM 5-2420-230-24P	Figure 92
TM 5-2420-230-24P	Figure 121

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B



a. Removal.

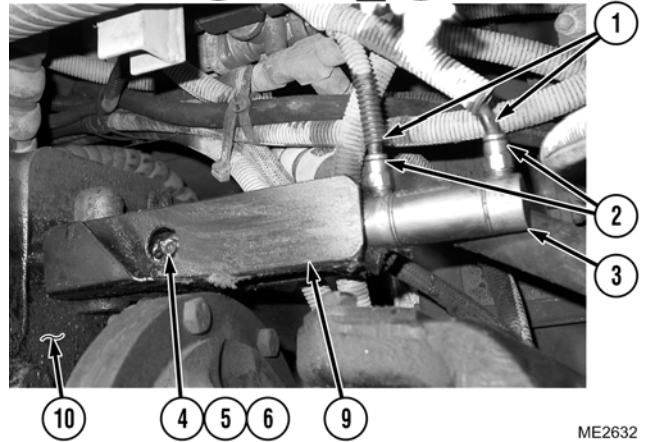
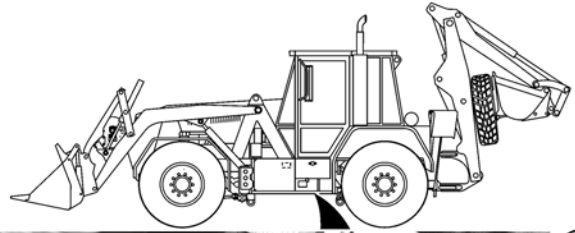
**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

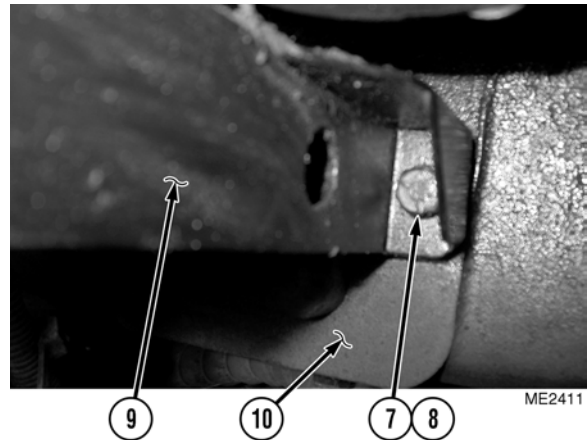
**NOTE**

- Tag all hoses and tubes, and note their positions before removal.
- Remove cable ties as necessary.
- High/low control cylinder is mounted on backside of transmission.

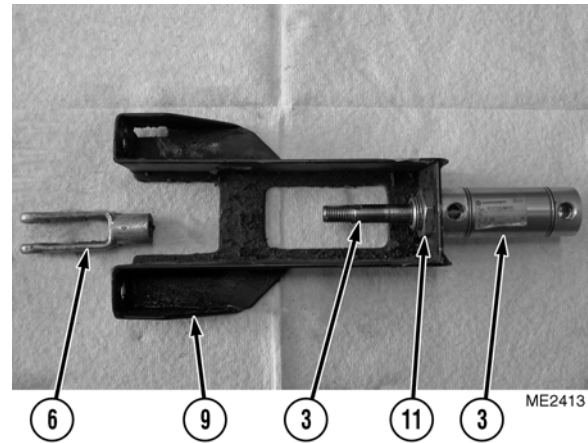
- (1) Remove two air lines (1) from fittings (2).
- (2) Remove two fittings (2) from control cylinder (3).
- (3) Remove cotter pin (4) and pin (5) from clevis (6). Discard cotter pin.
- (4) Remove two bolts (7), lockwashers (8), bracket (9), and control cylinder (3) from transmission (10). Discard lockwashers.
- (5) Remove clevis (6) and nut (11) from control cylinder (3).
- (6) Remove control cylinder (3) from bracket (9).



ME2632

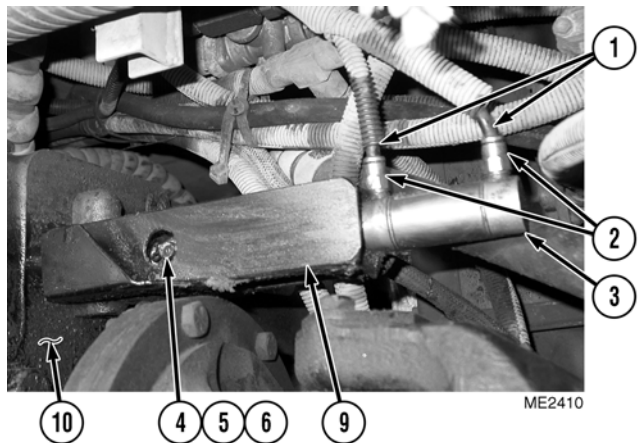
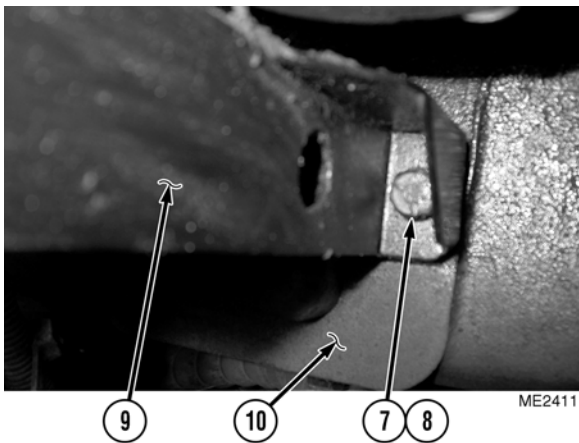
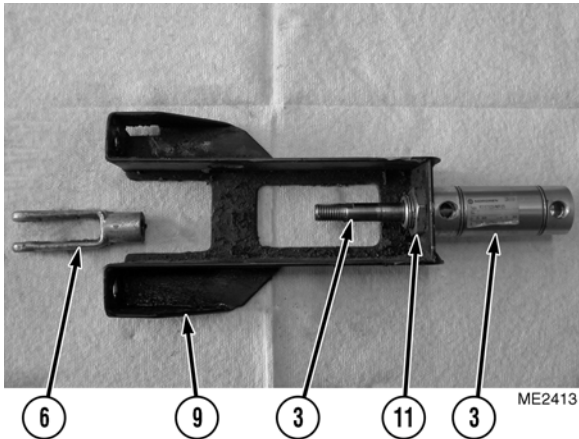


ME2411



ME2413

**b. Installation.**



**NOTE**

- Ensure hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as needed.

- (1) Insert control cylinder (3) through bracket (9) and secure with nut (11).
- (2) Install clevis (6) on control cylinder (3).
- (3) Position bracket (9) and control cylinder (3) on transmission (10).
- (4) Align clevis (6) and straight shaft (12), and install pin (5) and new cotter pin (4).
- (5) Install bracket (9) on transmission (10) with two new lockwashers (8) and bolts (7).

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (6) Apply Loctite 567 to fittings (2).
- (7) Install two fittings (2) on control cylinder (3).
- (8) Install two air lines (1) on control cylinder (2).

**c. Follow-On Maintenance.**

- (1) Start engine and ensure that vehicle properly switches between high and low ranges (TM 5-2420-230-10).
- (2) Check for air leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Install center belly plate (TM 5-2420-230-10).

**END OF TASK**



## CHAPTER 5

### STEERING SYSTEM

Contents	Para	Page
General. . . . .	5-1	5-1
System Operation. . . . .	5-2	5-2
Vehicle Preparation and Isolation. . . . .	5-3	5-3
Restore IHMEE to Operational Readiness. . . . .	5-4	5-3
Power Steering Oil Service and Filter Replacement. . . . .	5-5	5-4
Steering Lines and Hoses Replacement. . . . .	5-6	5-6
Power Steering Reservoir Replacement. . . . .	5-7	5-11
Power Steering Pump Replacement. . . . .	5-8	5-13
Power Steering Gear Box Replacement. . . . .	5-9	5-16
Steering Wheel Replacement. . . . .	5-10	5-21
Steering Column Replacement. . . . .	5-11	5-22
Panhard Rod Replacement. . . . .	5-12	5-23
Tie-Rod End Replacement. . . . .	5-13	5-25
Steering Shaft Maintenance. . . . .	5-14	5-26
Drag Link Replacement. . . . .	5-15	5-34
Steering Miter Box Replacement. . . . .	5-16	5-35
Front Wheel Alignment. . . . .	5-17	5-37
Steering Damper Replacement. . . . .	5-18	5-42

**5-1. GENERAL.**

Components covered within this section include:

**NOTE**

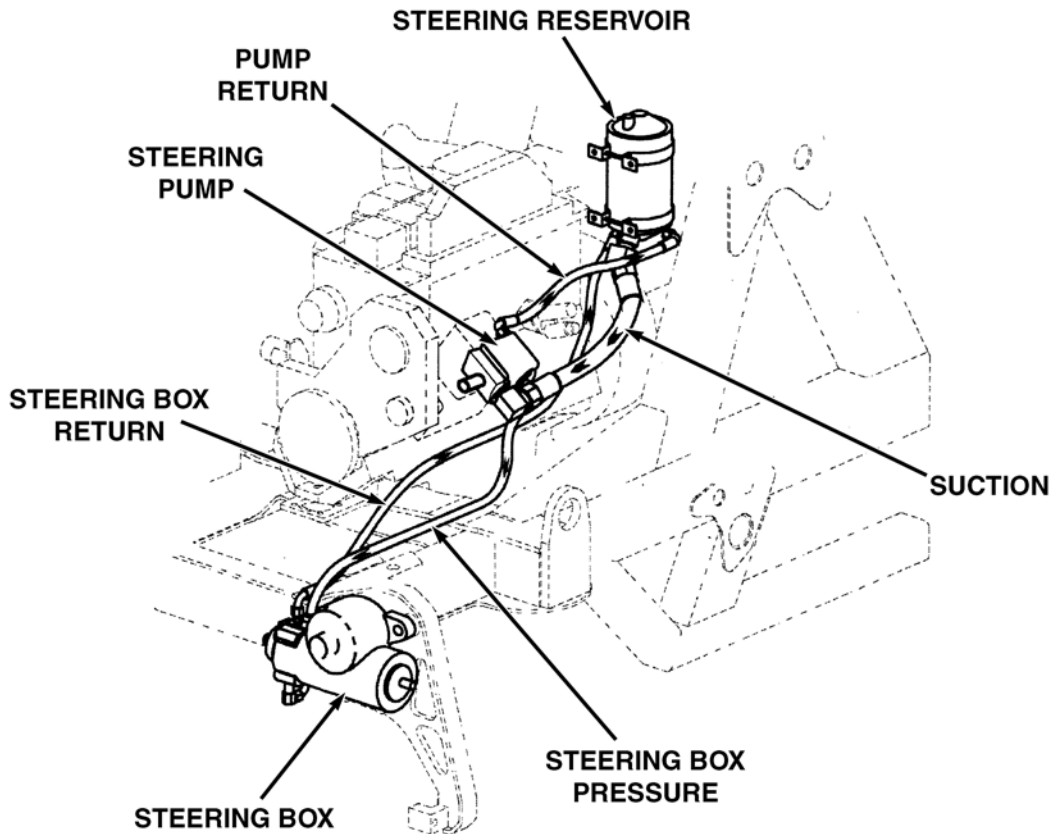
Maintenance for the steering system includes periodic checking of the power steering oil level, changing of oil and filter, inspection of oil hoses, lines, steering box, miter box, U-joints, and steering linkages for signs of damage and/or deterioration, oil leakage, and loose mountings.

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Power steering oil</li> <li>• Hoses and lines</li> <li>• Shaft carrier bearing</li> <li>• Power steering box</li> <li>• Steering damper</li> <li>• Tie rod ends</li> <li>• Steering shafts and U-joints</li> </ul> | <ul style="list-style-type: none"> <li>• Power steering oil filter</li> <li>• Power steering pump</li> <li>• Miter box</li> <li>• Drag link</li> <li>• Pitman arm</li> <li>• Steering linkages</li> </ul> |
|---|---|

## 5-2. SYSTEM OPERATION.

The system includes the following components:

- Steering reservoir
- Steering pump
- Power steering box



ME0151

The power steering system provides full-time hydraulic steering. When the engine is running, there is constant low-pressure oil flowing through the steering box. This constant oil flow provides an instant response and absorbs road shock to help eliminate steering wheel kick.

The steering wheel, column, and linkages are mechanically connected to the power steering box. Rotary movement of the steering wheel turns the steering shafts which move an actuating valve in the power steering box, which directs high-pressure fluid to build up on one side of a piston within the steering box. This high pressure causes the piston to move, which in turn moves the Pitman arm and drag link. When the steering shaft rotation stops, the actuating valve returns to its N (Neutral) position. Internal relief valves unload the hydraulic system if the wheels reach full lock.

### **5-3. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE), perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

### **5-4. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position, as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**5-5. POWER STEERING OIL SERVICE AND FILTER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Cleaning
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*

- Pan, drain, Item 29, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
TM 5-2420-230-10	Hood opened.

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Cloth, lint-free, Item 10, Appendix C
- Dexron III, Item 27, Appendix C
- Filter, Item 47.1, Appendix D
- Solvent, degreasing, Item 58, Appendix C
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 111

*Estimated Time to Complete*

Refer to MAC in Appendix B

*Personnel Required*

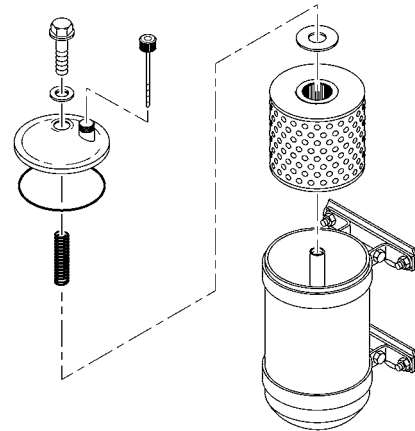
MOS 62B, Construction Equipment Repairer

**a. Removal.**

**NOTE**

- Tag all hoses and tubes and note their positions before removal. Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove and install cable ties as necessary.

- (1) Raise front wheels approximately 1 in. (25 mm) above ground (Para 2-21).
- (2) Place vehicle safety stands beneath front axle housing (Para 2-21) and lower vehicle onto stands.
- (3) Position drain pan beneath steering gear box.



ME0158

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (4) Disconnect pressure and return lines at bottom of steering gear box to allow oil to drain.



- (5) While hoses are disconnected, slowly turn steering wheel from full left to full right three or more times to purge oil from steering gear box.
- (6) Connect supply and return lines to steering gear box and tighten.
- (7) Thoroughly wipe off area around reservoir cap with clean cloth. Remove bolt and cover from top of reservoir.



Only discard filter element, as the remaining parts may be used to retain the filter in the reservoir assembly. Failure to comply may result in damage to equipment.

- (8) Remove oil filter. Discard oil filter.

**b. Cleaning.**



- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Thoroughly clean out reservoir using degreasing solvent and clean cloth.

**c. Installation.**

- (1) Install new oil filter into reservoir.
- (2) Fill power steering reservoir with oil to approximately 1 in. (25 mm) of top of reservoir canister. Install and secure reservoir cover.
- (3) Raise vehicle, remove safety stands, and lower vehicle to ground (Para 2-21).

**d. Follow-On Maintenance.**

- (0.1) Bleed power steering system (Para K-3).
- (1) Start engine and allow engine to idle (TM 5-2420-230-10).



Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.

- (2) Visually check all fittings and hoses for external leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Close hood (TM 5-2420-230-10).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**5-6. STEERING LINES AND HOSES REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p>	<p><i>References</i> None</p>														
<p><i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B</p>	<p><i>Equipment Conditions</i></p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left; width: 40%;"><i>TM or Para</i></th> <th style="text-align: left;"><i>Condition Description</i></th> </tr> </thead> <tbody> <tr> <td>TM 5-2420-230-10</td> <td>Vehicle positioned on level ground.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Parking brake applied.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Engine shut OFF.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Electrical master switch OFF.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>“Do Not Operate” tag attached to ignition switch.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Hood opened.</td> </tr> </tbody> </table>	<i>TM or Para</i>	<i>Condition Description</i>	TM 5-2420-230-10	Vehicle positioned on level ground.	TM 5-2420-230-10	Parking brake applied.	TM 5-2420-230-10	Engine shut OFF.	TM 5-2420-230-10	Electrical master switch OFF.	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.	TM 5-2420-230-10	Hood opened.
<i>TM or Para</i>	<i>Condition Description</i>														
TM 5-2420-230-10	Vehicle positioned on level ground.														
TM 5-2420-230-10	Parking brake applied.														
TM 5-2420-230-10	Engine shut OFF.														
TM 5-2420-230-10	Electrical master switch OFF.														
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.														
TM 5-2420-230-10	Hood opened.														
<p><i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Cloth, lint-free, Item 10, Appendix C Compound, sealing, Loctite 567, Item 22, Appendix C Dexron III, Item 27, Appendix C Solvent, degreasing, Item 58, Appendix C Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C</p>	<p><i>Drawings Required</i> TM 5-2420-230-24P Figure 111</p>														
<p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p>	<p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>														

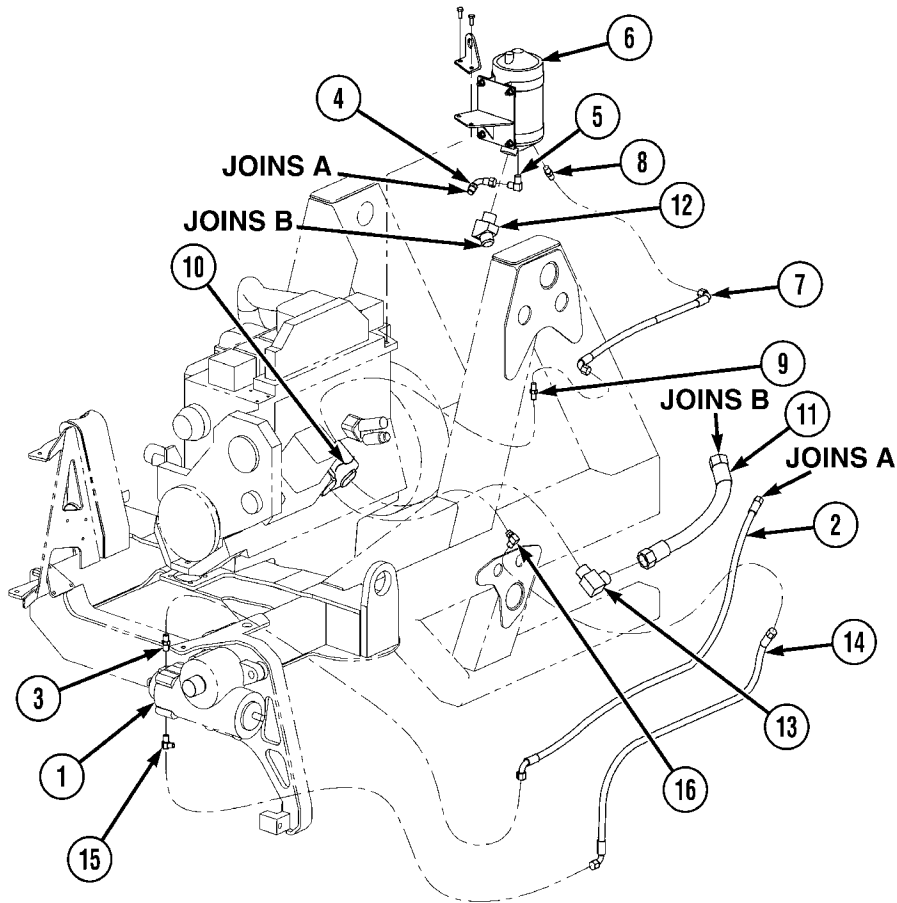
**a. Removal.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

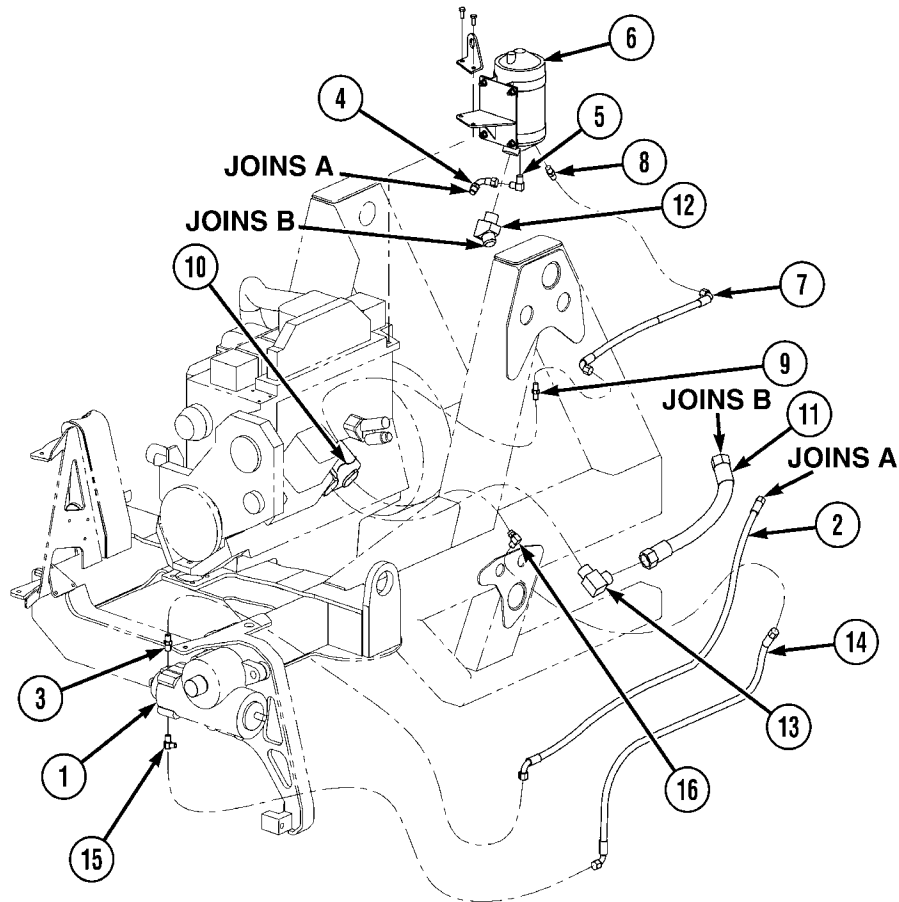
- Ensure all hoses and tubes are disconnected and clean before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes, and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - All lines and hoses are removed and installed the same way.
- (1) Clean power steering lines, hoses, and fluid reservoir with degreasing solvent and a clean cloth.



ME0857

- (2) Place drain pan under power steering gear box (1).
- (3) Remove hose assembly (2) from nipple (3). Allow oil to empty into drain pan.
- (4) Remove hose assembly (2) from adapter union (4).
- (5) Remove nipple (3) from power steering box (1).
- (6) Remove adapter union (4) from 90-degree elbow (5).
- (7) Remove 90-degree elbow (5) from power steering fluid reservoir (6).
- (8) Remove hose assembly (7) from nipples (8) and (9).
- (9) Remove nipple (8) from power steering fluid reservoir (6).
- (10) Remove nipple (9) from power steering pump (10).
- (11) Remove hose assembly (11) from 45-degree elbow (12) and 90-degree elbow (13).
- (12) Remove 45-degree elbow (12) from power steering fluid reservoir (6).
- (13) Remove 90-degree elbow (13) from power steering pump (10).
- (14) Remove hose assembly (14) from 90-degree elbow (15). Allow oil to empty into drain pan.
- (15) Remove hose assembly (14) from 90-degree elbow (16).
- (16) Remove 90-degree elbow (16) from power steering pump (10).
- (17) Remove 90-degree elbow (15) from power steering box (1).

**b. Installation.**



ME0857

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**CAUTION**

All adapter connections must be coated with Loctite 567 prior to installation. Do not coat hose to adapter connections. Damage to hoses could result.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- All lines and hoses are removed and installed the same way.

- (1) Install 90-degree elbow (16) on power steering pump (10).
- (2) Install 90-degree elbow (15) on power steering box (1).
- (3) Install hose assembly (14) on 90-degree elbow (16).
- (4) Install hose assembly (14) on 90-degree elbow (15).
- (5) Install 90-degree elbow (13) on power steering pump (10).
- (6) Install 45-degree elbow (12) on power steering fluid reservoir (6)
- (7) Install hose assembly (11) on 90-degree elbow (13).
- (8) Install hose assembly (11) on 45-degree elbow (12)
- (9) Install nipple (9) on power steering pump (10).
- (10) Install nipple (8) on power steering fluid reservoir (6).
- (11) Install hose assembly (7) on nipple (9).
- (12) Install hose assembly (7) on nipple (8).
- (13) Install elbow (5) on power steering fluid reservoir (6).
- (14) Install adapter union (4) on 90-degree elbow (5).
- (15) Install nipple (3) on power steering box (1).
- (16) Install hose assembly (2) on adapter union (4).
- (17) Install hose assembly (2) on nipple (3).
- (18) Ensure power steering fluid reservoir (6) is filled with clean oil.

**c. Follow-On Maintenance.**

- (1) Bleed power steering system (Para K-3).
- (2) Start engine (TM 5-2420-230-10).

**WARNING**

Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.

- (3) Visually check all fittings and hoses for external leaks.
- (4) Shut OFF engine (TM 5-2420-230-10).
- (4.1) Close hood (TM 5-2420-230-10).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**5-7. POWER STEERING RESERVOIR REPLACEMENT.**

This Task Covers:

- a. Inspection
- b. Removal
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Nut, self-locking, Item 104, Appendix D (4)

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*  
*TM or Para*  
Para 5-5  
Para 5-6

*Condition Description*  
Filter removed.  
Hoses and fittings removed from bottom of steering reservoir.

*Drawings Required*  
TM 5-2420-230-24P Figure 111

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Inspection.**

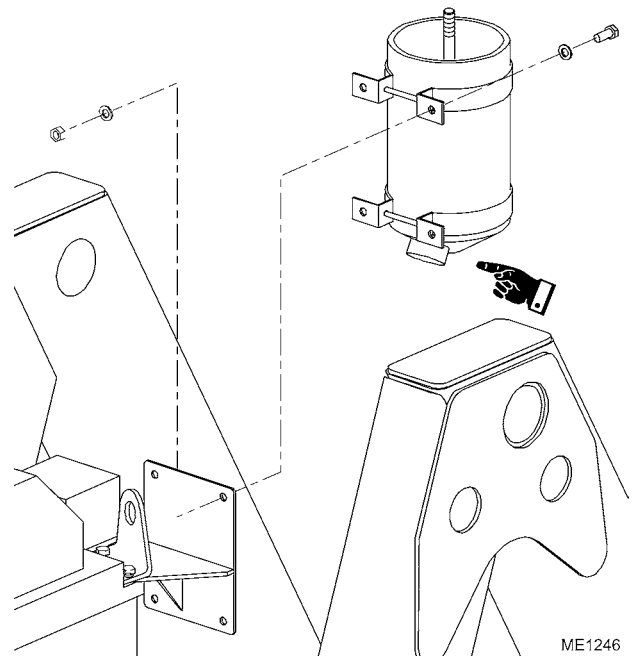
**NOTE**

The steering reservoir has an integral filter and dipstick for checking the quantity of fluid.

Inspect power steering reservoir for corrosion, cracking, and damage.

**b. Removal.**

- (1) Remove four bolts, washers, and self-locking nuts from power steering reservoir. Discard self-locking nuts.
- (2) Remove reservoir.
- (3) Deleted.
- (4) Deleted.



**c. Installation.**

Replacement of power steering reservoir is a reversal of the removal procedure with attention given to the following:

- (1) Deleted.
- (2) Deleted.
- (3) Ensure clamp bolts are tightened.

**d. Follow-On Maintenance.**

- (1) Replace filter (Para 5-5).
- (2) Install hoses and fittings on bottom of steering reservoir (Para 5-6).
- (3) Deleted.
- (4) Deleted.
- (5) Deleted.
- (6) Deleted.

**END OF TASK**





**NOTE**

- Ensure all hoses, wires, and tubes are disconnected and clean before removal.
- Remove cable ties as necessary.
- Tag all hoses, wires, and tubes, and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.

(1) Clean power steering lines, hoses, and fluid reservoir with degreasing solvent and clean cloths.

(2) Place drain pan under power steering box (1).

(3) Remove hose assembly (2) from nipple (3). Allow oil to empty into drain pan.

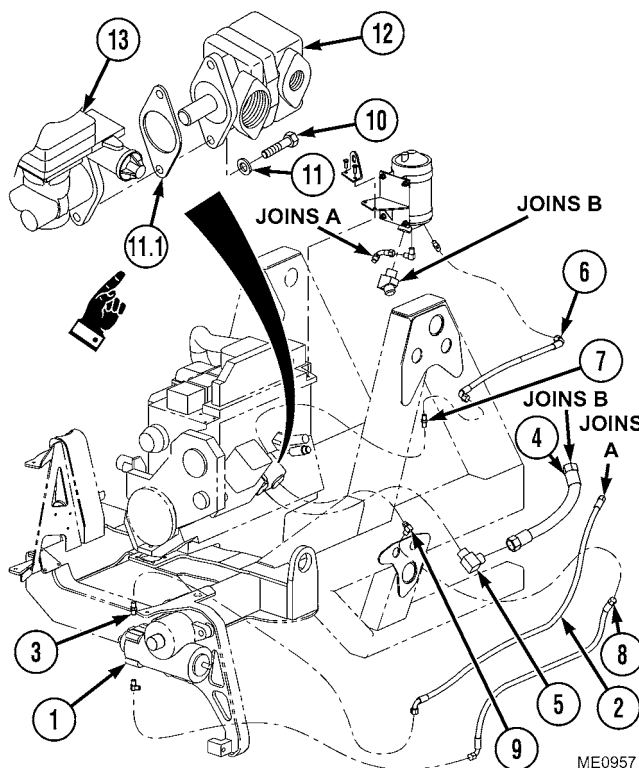
(4) Remove hose assembly (4) from 90-degree elbow (5).

(5) Remove hose assembly (6) from nipple (7).

(6) Remove hose assembly (8) from 90-degree elbow (9).

(7) Remove two bolts (10), lockwashers (11), gasket (11.1), and power steering pump (12) from air compressor (13). Discard lockwashers and gasket.

(8) Remove 90-degree elbow (5) and nipple (7) from power steering pump (12).



**b. Installation.**

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**CAUTION**

All adaptor connections must be coated with Loctite 567 prior to installation. Do not coat hose to adaptor connections. Damage to hoses could result.

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Ensure steering lines and hoses are clean and contain no foreign matter.

(0.1) Apply Loctite 567 to 90-degree elbow (5) and nipple (7).

(1) Install 90-degree elbow (5) and nipple (7) on power steering pump (12).

(2) Install bolts (10), new lockwashers (11), new gasket (11.1), and power steering pump (12) on air compressor (13). Torque bolts to 23 lbf/ft (31 N•m).

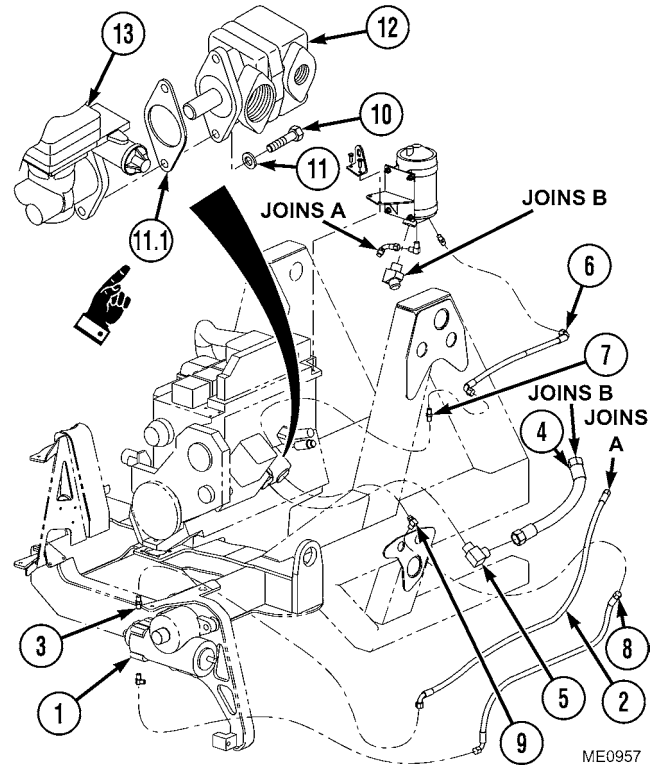
(2.1) Apply Loctite 567 to hose assemblies (4), (6), and (8).

(3) Install hose assembly (8) on 90-degree elbow (9).

(4) Install hose assembly (6) on nipple (7).

(5) Install hose assembly (4) on 90-degree elbow (5).

(6) Install hose assembly (2) on nipple (3).



**c. Follow-On Maintenance.**

- (1) Ensure power steering fluid reservoir is filled with clean oil (Para 5-5).
- (2) Bleed power steering system (Para K-3).

**WARNING**

Do not check for leaks by hand; oil under hydraulic pressure can penetrate the skin and cause severe injury. Failure to comply may result in injury or death to personnel.

- (3) Start engine and check for leaks (TM 5-2420-230-10).
- (4) Functionally test power steering pump (TM 5-2420-230-10).
- (5) Lower hood (TM 5-2420-230-10).
- (6) Shut OFF engine (TM 5-2420-230-10).
- (7) Remove maintenance arm and lower FEL (TM 5-2420-230-10).
- (8) Install left fender (Para 13-16).

**END OF TASK**

**5-9. POWER STEERING GEAR BOX REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Adjustment
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*References*  
None

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Solvent, degreasing, Item 58, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Nut, self-locking, Item 104, Appendix D  
Nut, self-locking, Item 121, Appendix D (4)

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para K-5	Pitman arm removed.
Para 9-5	Radiator removed.

*Drawings Required*

TM 5-2420-230-24P	Figure 109
TM 5-2420-230-24P	Figure 111
TM 5-2420-230-24P	Figure 112

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

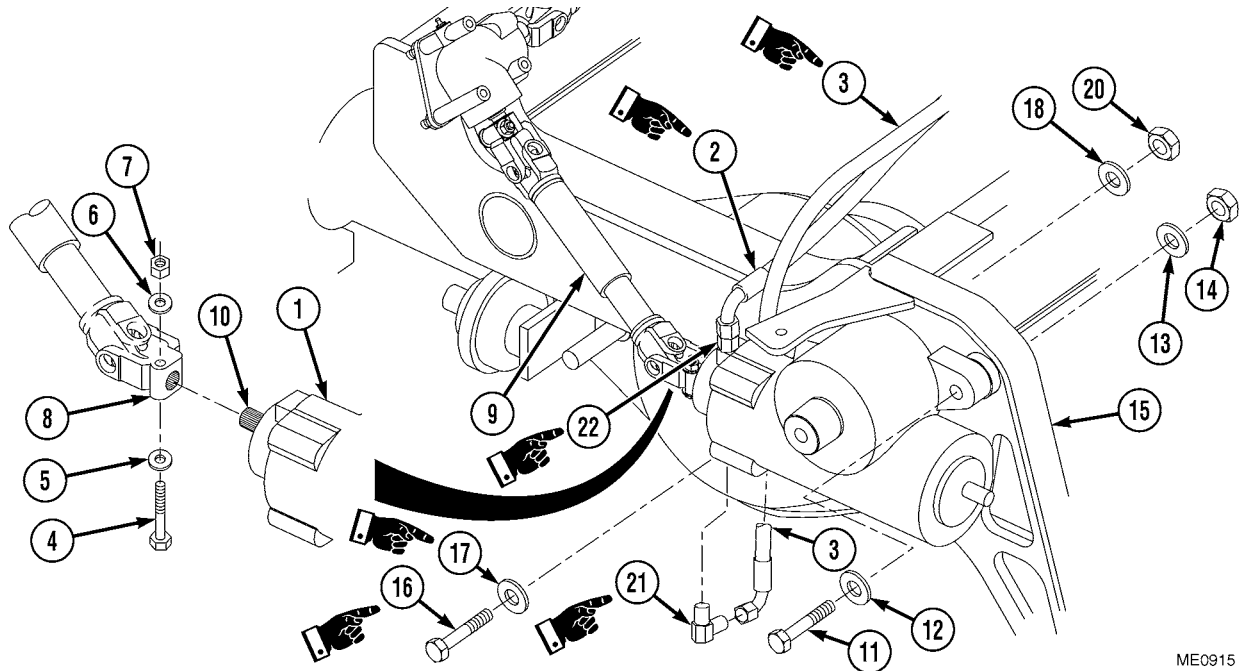
**a. Removal.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**NOTE**

- Remove cable ties as necessary.
  - Tag all hoses, wires, and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Clean power steering lines and hoses with degreasing solvent and a clean cloth.



ME0915

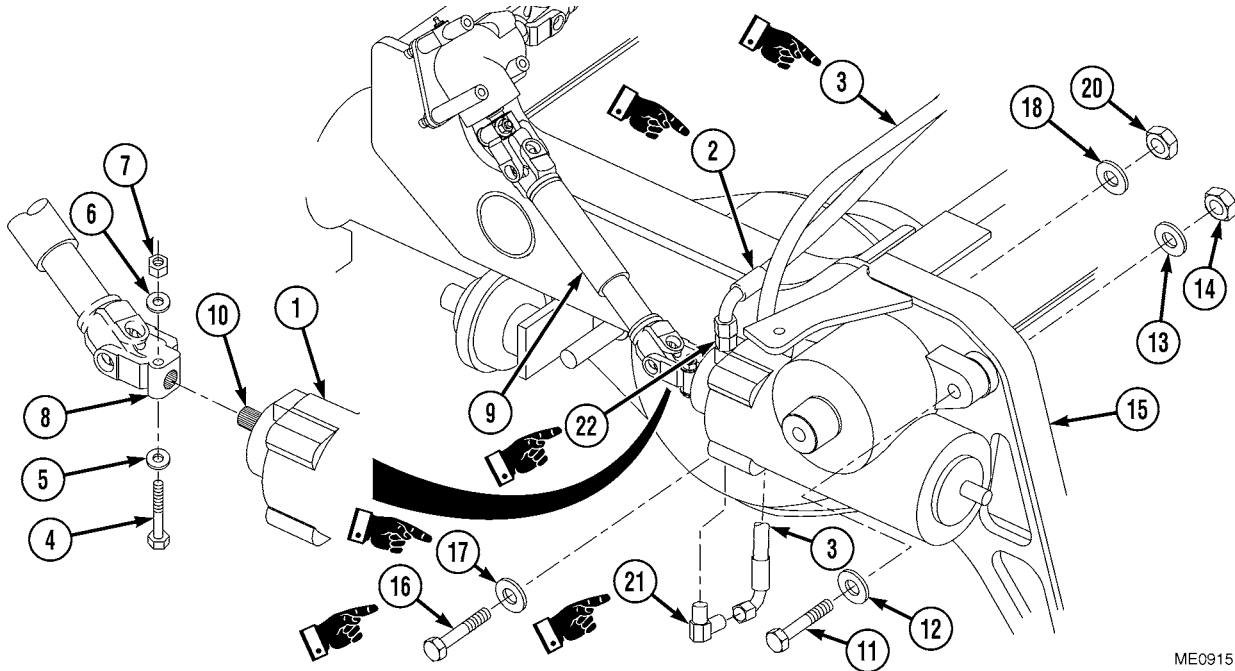
- (2) Place drain pan under power steering gear box (1).

### WARNING

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (3) Loosen power steering gear box to reservoir hose assembly (2). Allow oil to empty into drain pan.
- (4) Remove reservoir hose assembly (2).
- (5) Remove power steering pump to reservoir hose assembly (3).
- (6) Remove bolt (4), washer (5), washer (6), and self-locking nut (7) from U-joint clamp (8). Discard self-locking nut.
- (7) Compress slip joint (9) and remove U-joint clamp (8) from steering box assembly shaft (10).
- (8) Remove three bolts (11), washers (12), washers (13), and self-locking nuts (14) from power steering gear box (1) and frame (15). Discard self-locking nuts.
- (9) Remove bolt (16), washer (17), washer (18), self-locking nut (20), and power steering gear box (1) from frame (15). Discard self-locking nut.
- (10) Remove elbow (21) and fitting (22) from power steering gear box (1) and set aside for future use.

**b. Installation.**



ME0915

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Ensure power steering pump to reservoir hose assembly is clean and contains no foreign matter.

(0.1) Install fitting (22) and elbow (21) on power steering gear box (1).

(0.2) Install power steering gear box (1), bolt (16), washer (17), washer (18), and new self-locking nut (20) on frame (15). Torque nuts to 191 lbf/ft (259 N•m).

(1) Install three bolts (11), washers (12), washers (13), and new self-locking nuts (14) on power steering box (1) and frame (15). Torque nuts to 191 lbf/ft (259 N•m).

(2) Compress slip joint (9) and install U-joint clamp (8) on steering box assembly shaft (10).

(3) Install bolt (4), washer (5), washer (6), and new self-locking nut (7) on U-joint clamp (8).

(4) Install power steering pump to reservoir hose assembly (3) on power steering gear box (1).

(5) Install reservoir hose assembly (2) on power steering gear box (1).

- (6) Ensure power steering fluid reservoir is filled with clean oil (Para 5-5).
- (6.1) Install radiator (Para 9-5).
- (7) Start engine (TM 5-2420-230-10).
- (8) Bleed power steering system (Para K-3).
- (9) Shut OFF engine (TM 5-2420-230-10).
- (10) Install pitman arm (Para K-5).

**c. Adjustment (Setting Hydraulic Stops).**

**NOTE**

Hydraulic stop adjustment is only required for a new steering gearbox.

- (1) Start engine (TM 5-2420-230-10).

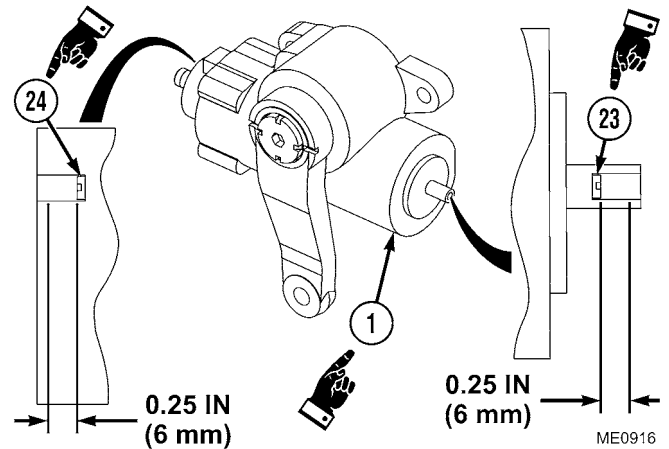
**WARNING**

Do not attempt to back out screws while wheels are in motion. Failure to comply may result in injury or death to personnel.

**CAUTION**

Do not back out adjusting screws completely or hydraulic oil will be released.

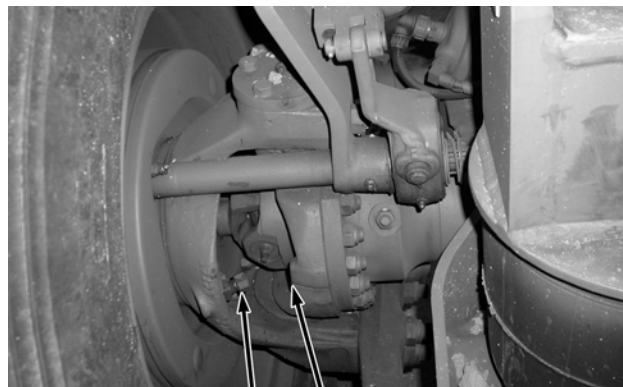
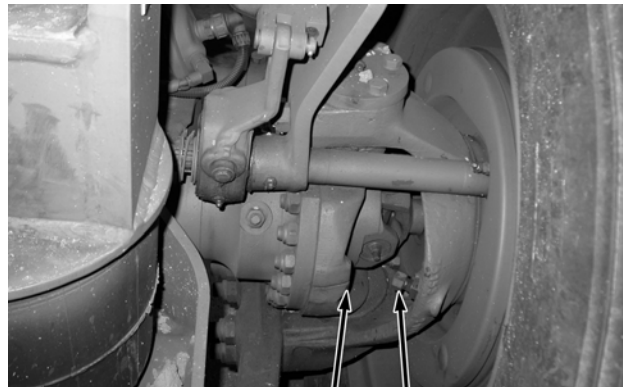
- (2) Back out left adjusting screw (23) from power steering gear box (1) to no more than 0.25 in. (6 mm).
- (3) Back out right adjusting screw (24) from power steering gear box (1) to no more than 0.25 in. (6 mm).



**WARNING**

Make sure personnel are clear of wheels before turning steering wheel. Failure to comply may result in injury or death to personnel.

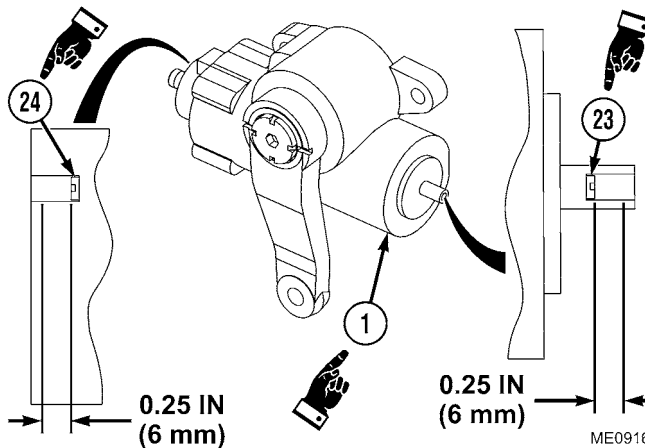
- (4) Turn steering wheel to full left.
- (5) Ensure clearance is 0.04 in. (1 mm) between left mechanical stop (25) and inside edge of left drive head assembly (26).
- (6) Screw left adjusting screw (23) into power steering gear box (1) until system relieves pressure. An audible sound will be heard.
- (7) Turn steering wheel to full right.
- (8) Ensure clearance is 0.04 in. (1 mm) between right mechanical stop (27) and inside edge of right drive head assembly (28).
- (9) Screw right adjusting screw (24) into power steering gear box (1) until system relieves pressure. An audible sound will be heard when pressure is relieved.



**d. Follow-On Maintenance.**

- (1) Functionally test power steering gear box (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





**5-10. STEERING WHEEL REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

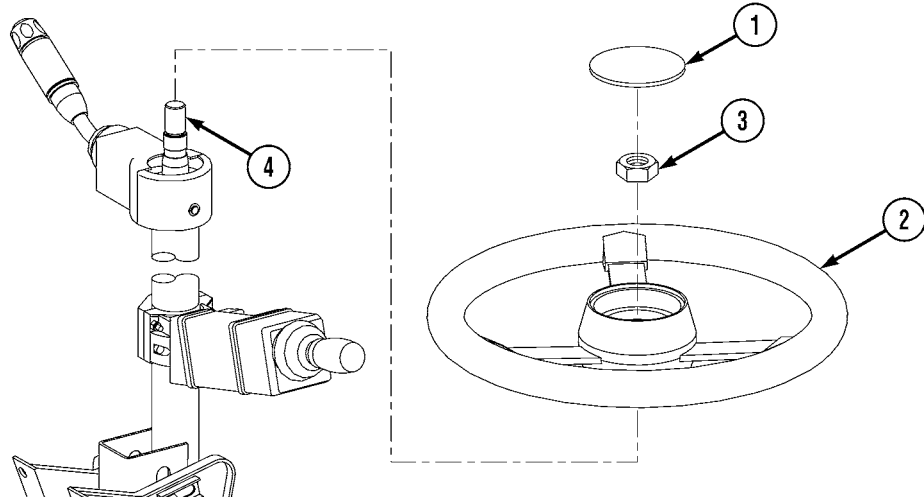
*Drawings Required*  
TM 5-2420-230-24P Figure 108

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Removal.**

**NOTE**

Prior to removal of the steering wheel, ensure wheels are pointing in the straight-ahead position.



ME0792

- (1) Remove steering wheel cap (1) from steering wheel (2).
- (2) Remove nut (3) and steering wheel (2) from steering column shaft (4).

**b. Installation.**

- (1) Install steering wheel (2) and nut (3) on steering column shaft (4).
- (2) Install steering wheel cap (1) on steering wheel (2).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## 5-12. PANHARD ROD REPLACEMENT.

This Task Covers:

- |                                   |                             |                                  |
|-----------------------------------|-----------------------------|----------------------------------|
| a. Front Panhard Rod Removal      | b. Rear Panhard Rod Removal | c. Rear Panhard Rod Installation |
| d. Front Panhard Rod Installation | e. Adjustment               | f. Follow-On Maintenance         |

### INITIAL SETUP

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Nut, self-locking, Item 123, Appendix D (4 per panhard rod)

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	"Do Not Operate" tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P Figure 120

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

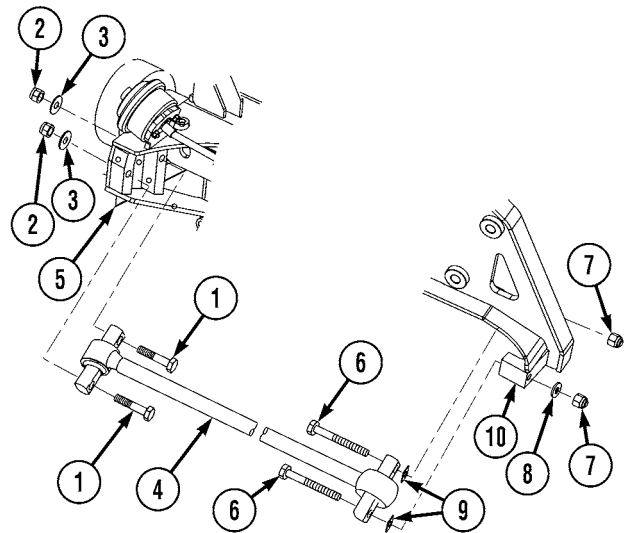
### a. Front Panhard Rod Removal.

- (1) Remove two bolts (1), self-locking nuts (2), washers (3), and front panhard rod (4) from front axle (5). Discard self-locking nuts.

#### NOTE

There is no washer on the inside bolt to connect the front panhard rod to the frame.

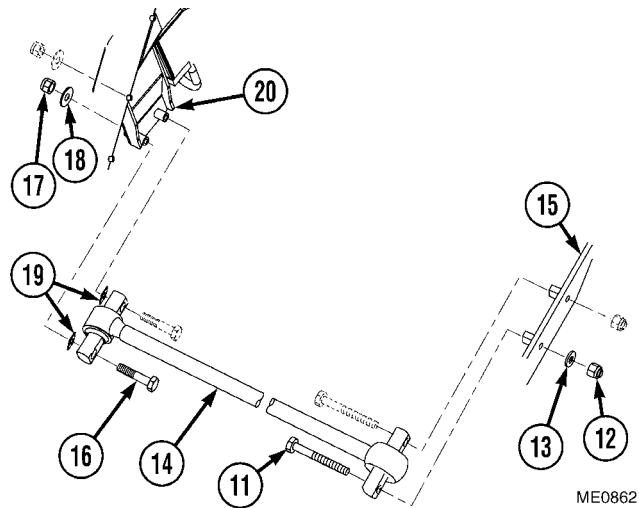
- (2) Remove two bolts (6), self-locking nuts (7), washer (8), shims (9), and front panhard rod (4) from frame (10). Discard self-locking nuts.



ME0861

**b. Rear Panhard Rod Removal.**

- (1) Remove bolts (11), self-locking nuts (12), washers (13), and rear panhard rod (14) from rear axle (15). Discard self-locking nuts.
- (2) Remove bolts (16), self-locking nuts (17), washers (18), shims (19), and rear panhard rod (14) from frame (20). Discard self-locking nuts.



**c. Rear Panhard Rod Installation.**

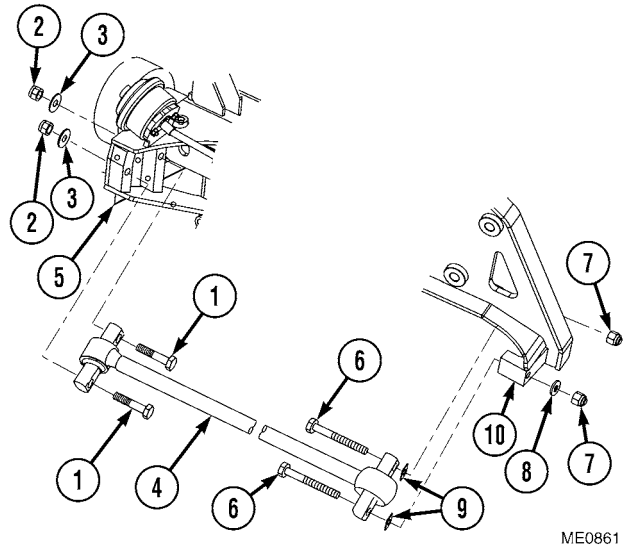
- (1) Install bolts (16), new self-locking nuts (17), washers (18), shims (19), and rear panhard rod (14) on frame (20). Tighten nuts to 95 lbf/ft (128 N•m).
- (2) Install bolts (11), new self-locking nuts (12), washers (13), and rear panhard rod (14) on rear axle (15). Tighten nuts to 95 lbf/ft (128 N•m).

**d. Front Panhard Rod Installation.**

**NOTE**

There is no washer on the inside bolt to connect the front panhard rod to the frame.

- (1) Install bolts (6), new self-locking nuts (7), washer (8), shims (9), and front panhard rod (4) on frame (10). Tighten nuts to 95 lbf/ft (128 N•m).
- (2) Install bolts (1), new self-locking nuts (2), washers (3), and front panhard rod (4) on front axle (5). Tighten nuts to 95 lbf/ft (128 N•m).



**e. Adjustment.**

**NOTE**

Both front and rear panhard rods are adjusted the same way.

- (1) Measure distance from center point on frame and axle to inside hub. Both sides must measure the same.
- (2) If both sides do not measure the same, add shims (9) and (19) as required until measurements are equal.

**f. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## 5-14. STEERING SHAFT MAINTENANCE.

This Task Covers:

- |                          |                             |                            |
|--------------------------|-----------------------------|----------------------------|
| a. Rear Shaft Removal    | b. Front Shaft Removal      | c. Disassembly             |
| d. Assembly              | e. Front Shaft Installation | f. Rear Shaft Installation |
| g. Follow-On Maintenance |                             |                            |

### INITIAL SETUP

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Hood opened.
TM 5-2420-230-10	Firewall removed.
Para 13-18	Nose cone removed (if removing front shaft).

*Materials/Parts*  
Grease, automotive, artillery, Item 30, Appendix C  
Nut self-locking, Item 104, Appendix D (4)  
Nut self-locking, Item 105, Appendix D (2)  
Nut self-locking, Item 122, Appendix D (3)

*Drawings Required*  
TM 5-2420-230-24P Figure 42  
TM 5-2420-230-24P Figure 109  
TM 5-2420-230-24P Figure 112

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

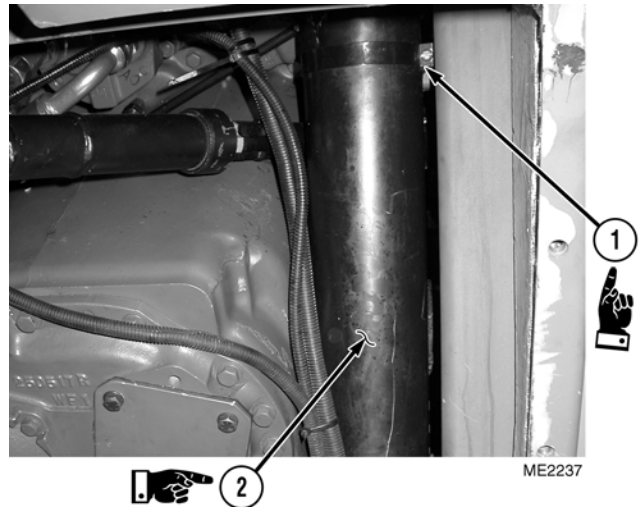
*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

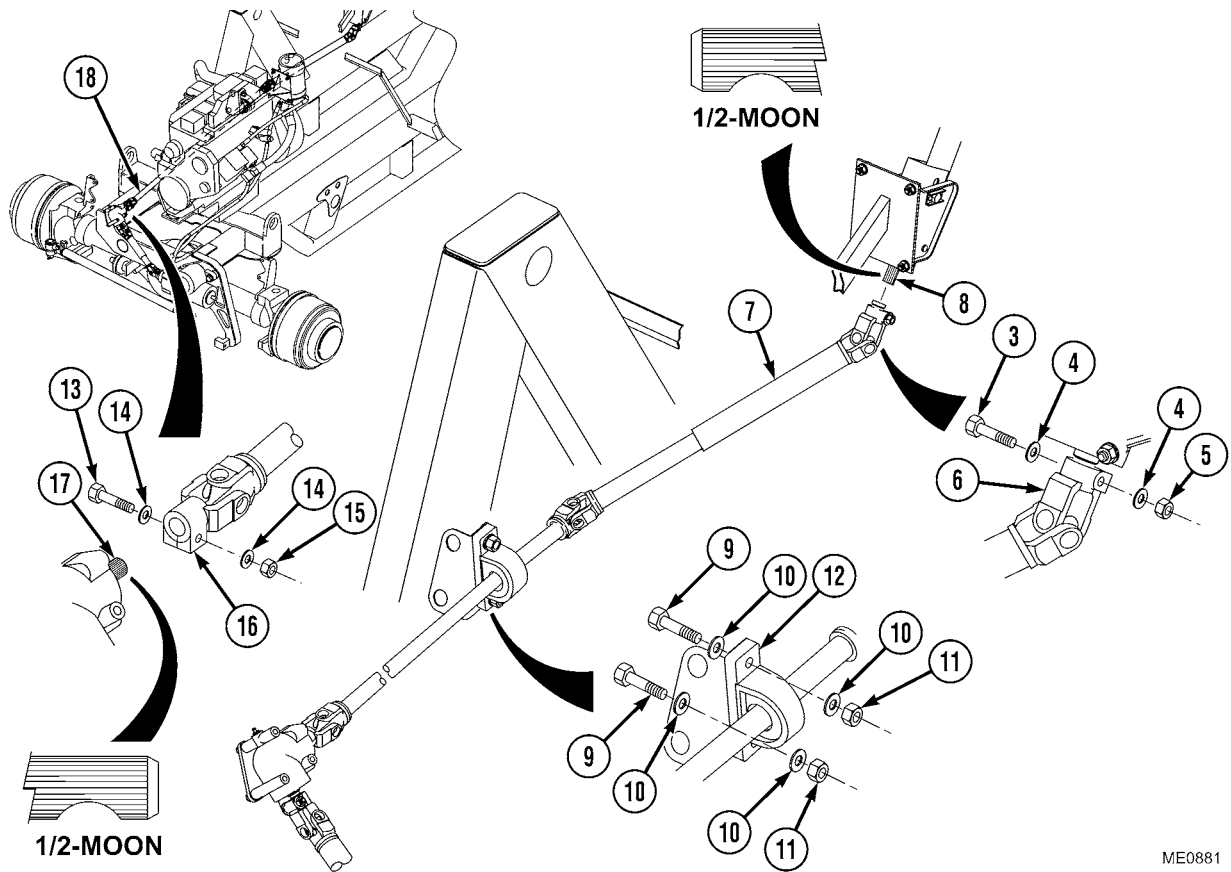
#### a. Rear Shaft Removal.

### NOTE

- The slip joints are precisely aligned on the steering shafts. Ensure alignment is maintained during maintenance. Do not separate.
- If front steering shaft only requires replacement, perform Steps b.1 through b.6 and e.1 through e.5

- (1) Loosen four clamps (1) and remove air cleaner pipe (2) from vehicle.

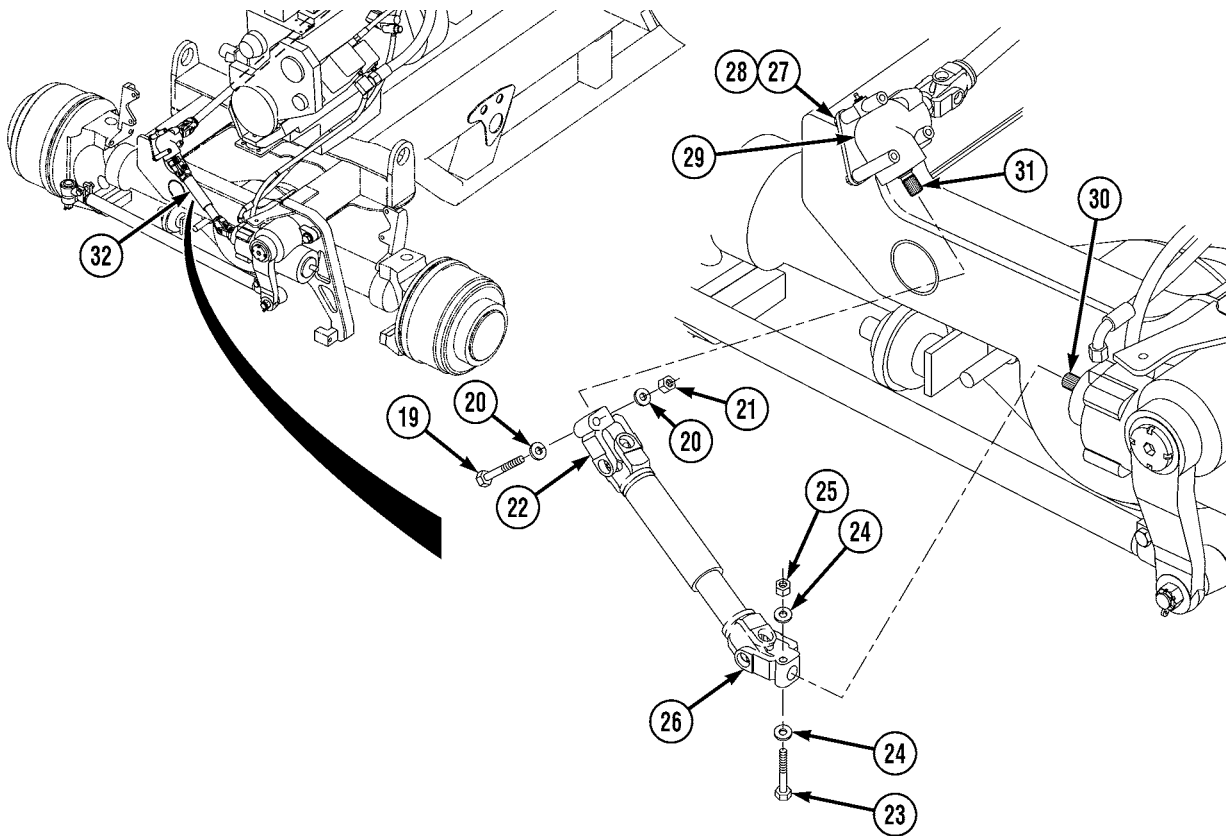




ME0881

- (2) Remove bolt (3), two washers (4), and self-locking nut (5) from U-joint (6). Discard self-locking nut.
- (3) Compress slip joint (7) to remove U-joint (6) from steering column shaft (8).
- (4) Remove two bolts (9), four washers (10), and two self-locking nuts (11) from carrier bearing (12). Discard self-locking nuts.
- (5) Remove bolt (13), two washers (14), and self-locking nut (15) from U-joint (16). Discard self-locking nut.
- (6) Remove U-joint (16) from miter box shaft (17).
- (7) Remove rear steering shaft (18) through crew compartment.

**b. Front Shaft Removal.**



ME0882

**NOTE**

The slip joints are precisely aligned on the steering shafts. Ensure alignment is maintained during maintenance. Do not separate.

- (1) Remove bolt (19), two washers (20), and self-locking nut (21) from U-joint (22). Discard self-locking nut.
- (2) Remove bolt (23), two washers (24), and self-locking nut (25) from U-joint (26). Discard self-locking nut.
- (3) Remove three self-locking nuts (27) and washers (28) from miter box (29). Discard self-locking nuts.
- (4) Remove U-joint (26) from steering box assembly shaft (30).
- (5) Remove U-joint (22) from miter box shaft (31).
- (6) Remove front steering shaft (32).



c. *Disassembly.*



Do not drop bearing cups. Needle bearings can be easily lost.

**NOTE**

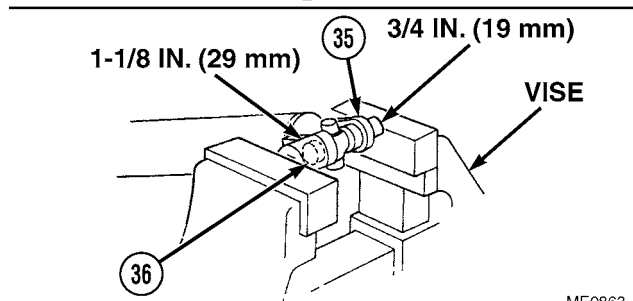
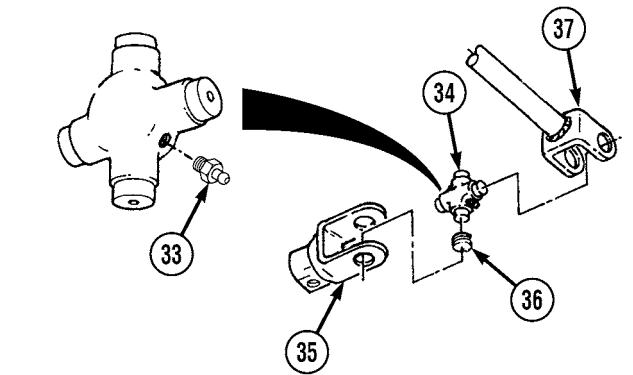
Removal procedures are the same for all steering shaft U-joints. The U-joint at the steering column shaft is shown.

- (1) Remove grease fitting (33) from cross (34).

**NOTE**

Ensure open end of socket is facing bearing cup.

- (2) Position steering gear yoke (35) in vise with 1 1/8-in. socket between vise jaw and bearing cup (36) being removed.



ME0863

**NOTE**

Ensure open end of socket is facing vise jaw.

- (3) Place 3/4-in. socket between opposite bearing cup (36) and vise jaw.
- (4) Press bearing cup (36) out of steering gear yoke (35). Remove bearing cup (36) from cross (34).
- (5) Reverse position of sockets and press remaining bearing cup (36) out of steering gear yoke (35).
- (6) Remove steering gear yoke (35) from cross (34).
- (7) Repeat Steps (2) through (5) for steering shaft yoke (37).
- (8) Remove cross (34) from steering shaft yoke (37).

*d. Assembly.*

**CAUTION**

Do not drop bearing cups. Needle bearings can be easily lost. Failure to comply will cause damage to equipment.

**NOTE**

Installation procedures are the same for all steering shaft U-joints. This procedure covers the U-joint attached to the steering column shaft.

- (1) Install cross (34) into steering shaft yoke (37).
- (2) Install bearing cup (36) into steering shaft yoke (37).

**CAUTION**

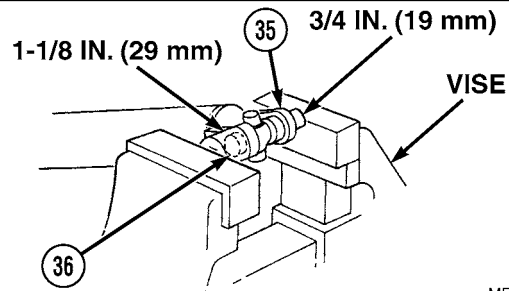
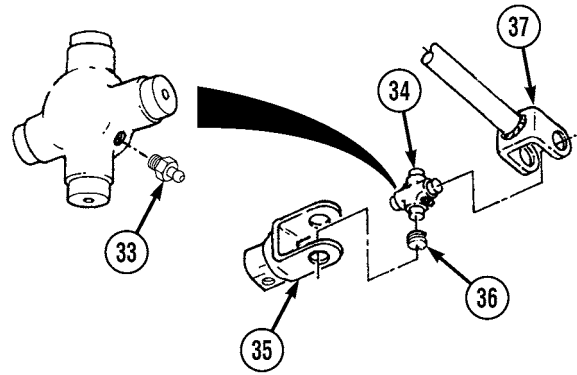
Ensure bearing cup is aligned with steering shaft yoke before pressing in with vise. Damage to cross and bearing cups will result if forced into yoke.

- (3) Place steering shaft yoke (37) in vise with 3/4-in. socket between vise jaw and bearing cup (36).
- (4) Press bearing cup (36) into steering shaft yoke (37).
- (5) Install other bearing cup (36) into steering shaft yoke (37).
- (6) Place steering shaft yoke (37) in vise with 3/4-in. socket between bearing cup (36) and vise jaw.
- (7) Press bearing cup (36) into steering shaft yoke (37).
- (8) Repeat Steps (2) through (7) to install steering gear yoke (35) on cross (34).

**CAUTION**

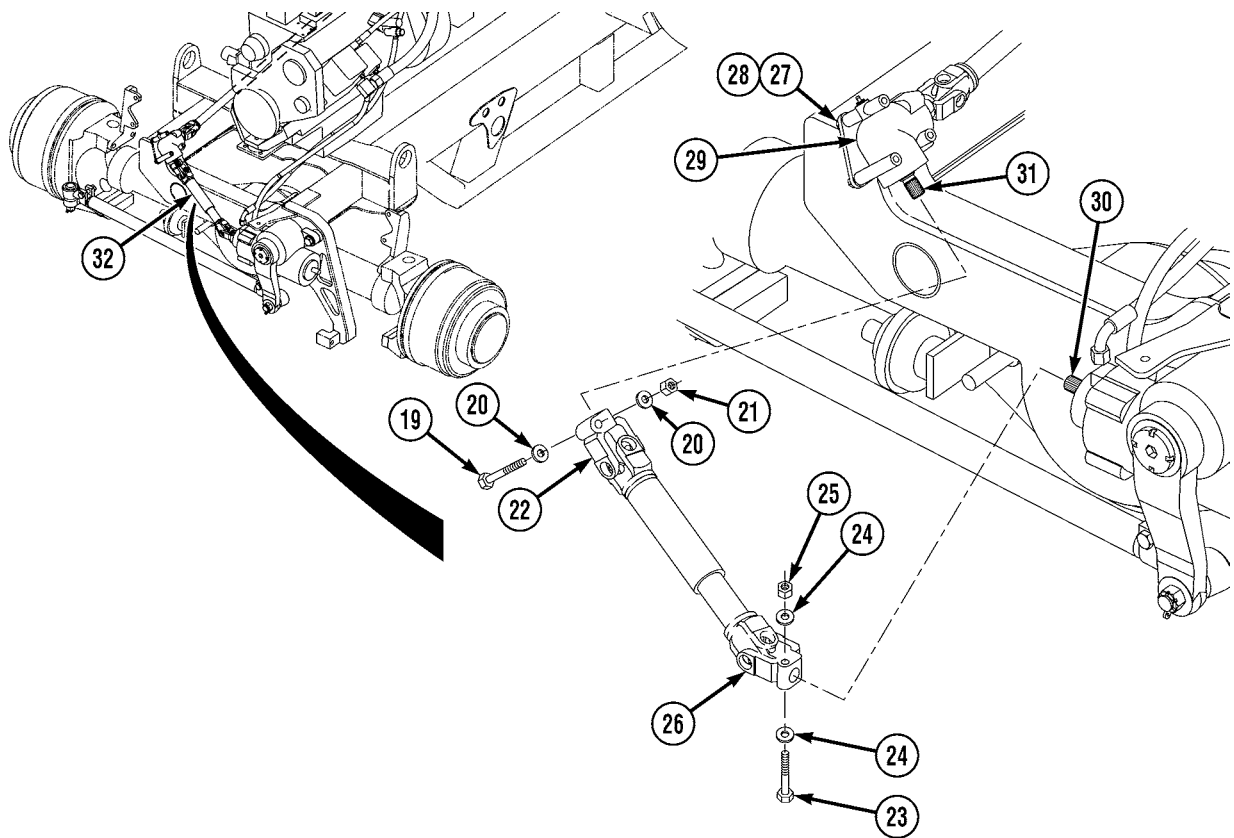
Ensure grease fitting on cross faces yoke. Damage to equipment will result if grease fitting is improperly installed.

- (9) Install grease fitting (33) on cross (34).
- (10) Grease U-joints (TM 5-2420-230-10).



ME0863

**e. Front Shaft Installation.**

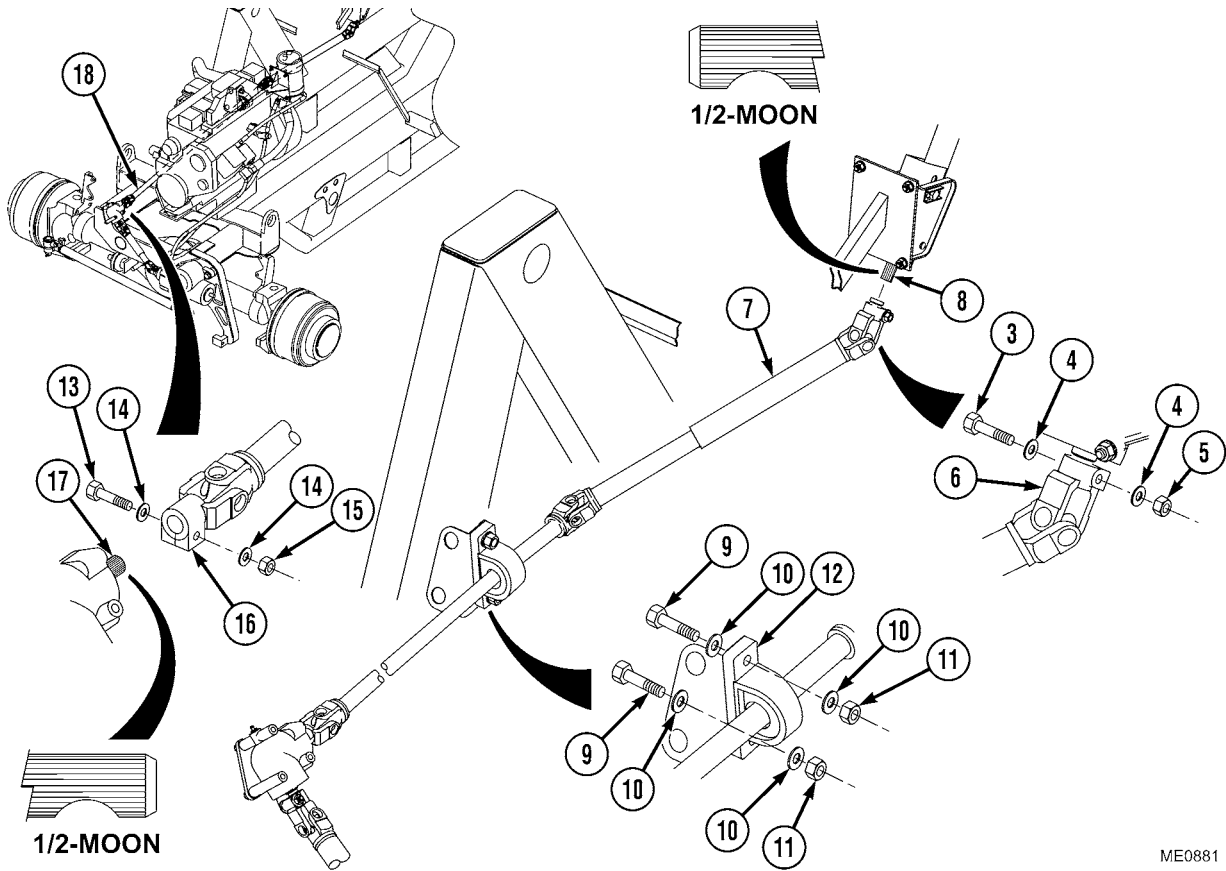


ME0882

**NOTE**

- The steering shaft slip joints are precisely aligned. It is important that alignment is maintained during maintenance.
- If steering shaft slip joint was separated, ensure scribe marks on slip and joint are aligned.

- (1) Install U-joint (22) on miter box shaft (31).
- (2) Install U-joint (26) on steering box assembly shaft (30).
- (3) Install bolt (23), two washers (24), and new self-locking nut (25) on U-joint (26). Tighten self-locking nut.
- (4) Install bolt (19), two washers (20), and new self-locking nut (21) on U-joint (22). Tighten self-locking nut.
- (5) Install miter box (29), three washers (28), and new self-locking nuts (27). Tighten self-locking nuts.



**f. Rear Shaft Installation.**

**NOTE**

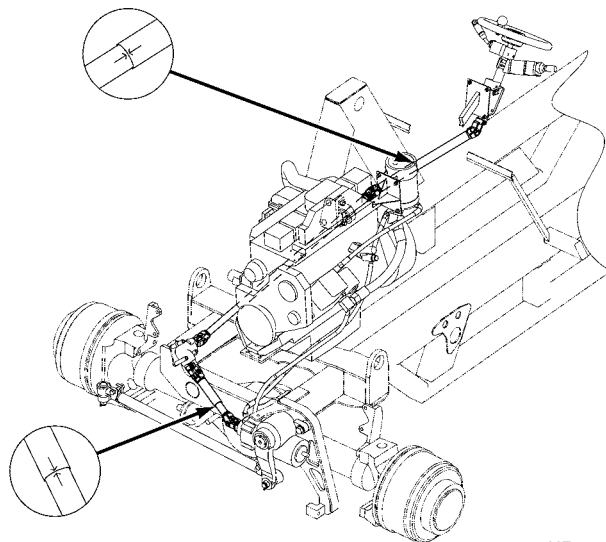
- The steering shaft slip joints are precisely aligned. It is important that alignment is maintained during maintenance.
- If steering shaft slip joint was separated, ensure scribe marks on slip and joint are aligned.

- (1) Position rear steering shaft (18) through crew compartment.

**NOTE**

Ensure half-moon groove is aligned with bolt hole and U-joint clamps.

- (2) Install U-joint (16) on miter box shaft (17).
- (3) Install bolt (13), two washers (14), and new self-locking nut (15) on U-joint (16). Tighten bolt to 98 lbf/ft (133 N•m).



**NOTE**

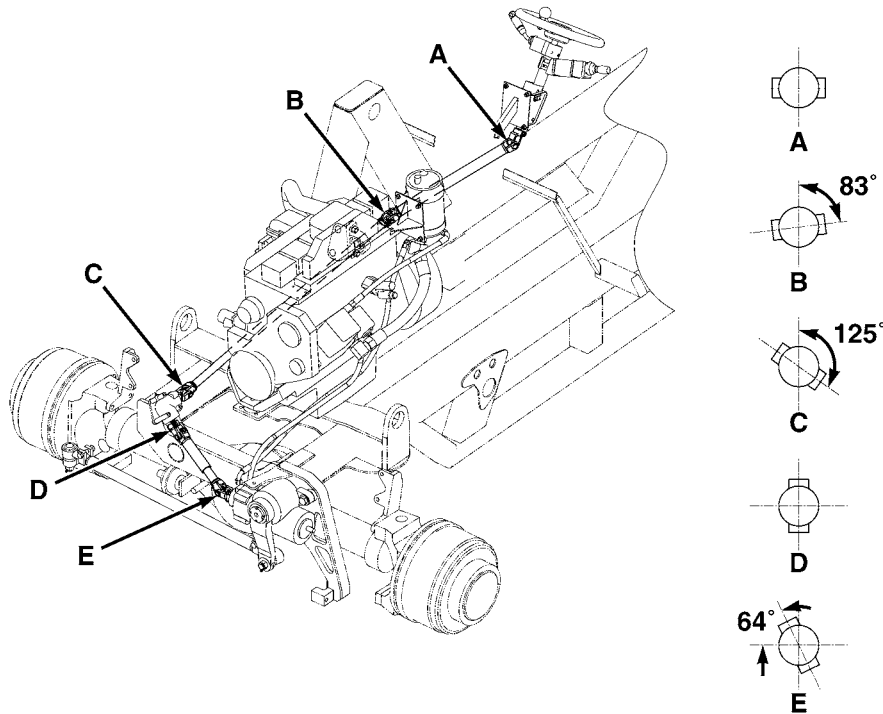
Measure distance between the carrier bearing and the closest steering shaft yoke. Ensure the distance is the same on both steering shafts.

- (4) Install two bolts (9), four washers (10), two new self-locking nuts (11) and carrier bearing (12). Tighten bolts to 98 lbf/ft (133 N•m).
- (5) Compress slip joint (7) and install U-joint (6) on steering column shaft (8).

**NOTE**

Ensure half-moon groove is aligned with bolt hole on U-joint clamps.

- (6) Install bolt (3), two washers (4), and new self-locking nut (5) on U-joint (6). Tighten bolt to 98 lbf/ft (133 N•m).

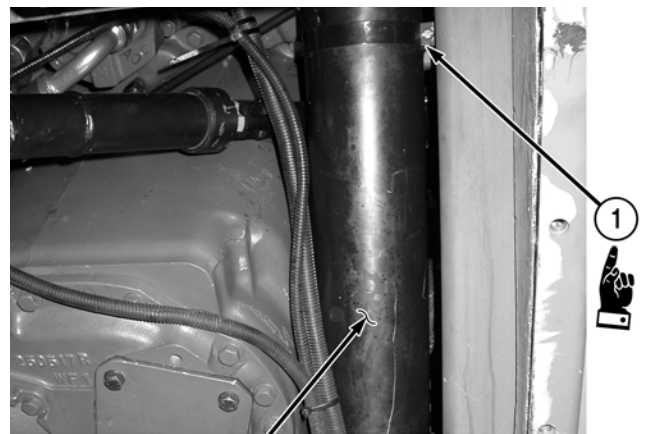


ME0153

- (7) Ensure U-joints are precisely aligned. It is important that alignment is maintained during maintenance. If U-joint alignment is not correct, remove shaft and repeat Steps (2) through (6).
- (8) Install air cleaner pipe (2) on vehicle and tighten four clamps (1).

**g. Follow-On Maintenance.**

- (1) Install firewall (TM 5-2420-230-10).
- (2) Install nose cone, if removed (Para 13-18).
- (3) Remove maintenance arm and lower FEL (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).



ME2237

**END OF TASK**

**5-15. DRAG LINK REPLACEMENT.**

This Task Covers:

- a. Inspection
- b. Removal
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Equipment Conditions*

*TM or Para*

*Condition Description*

TM 5-2420-230-10

Vehicle positioned on level ground.

*Tools and Special Tools*

Tool kit, common no. 2, Item 36, Appendix B

TM 5-2420-230-10

Parking brake applied.

Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Engine shut OFF.

*Materials/Parts*

Pin, cotter, Item 171, Appendix D (2)

TM 5-2420-230-10

Electrical master switch OFF.

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Drawings Required*

TM 5-2420-230-24P Figure 112

*References*

None

*Estimated Time to Complete*

Refer to MAC in Appendix B

**a. Inspection.**

The inspection procedure for steering linkages may require two maintenance personnel: one to move steering wheel and one to observe movement of steering linkages.

Inspect drag link for excessive backlash or free play using the following procedure:

- (1) Ensure front tires have correct air pressure (TM 5-2420-230-10)
- (2) Inspect drag link and tie rod for signs of damage and/or looseness. Replace as necessary.
- (3) Start engine and release parking brake (TM 5-2420-230-10).
- (4) With the aid of an assistant, move steering wheel from left to right and observe drag link ball joints for excessive movement. Replace drag link as necessary.
- (5) Shut OFF engine (TM 5-24240-230-10).

**b. Removal.**

**NOTE**

It may be necessary to use a ball joint splitter to break the drag links.

- (1) Remove cotter pins (1) and nuts (2) from drag links (3). Discard cotter pins.
- (2) Remove drag links (3).

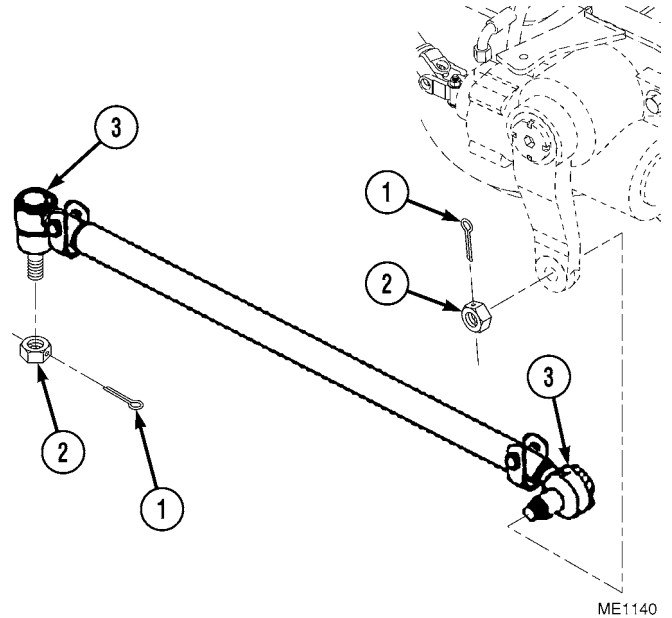
**c. Installation.**

Installation of the drag linkages is a reversal of the removal procedure with attention given to the following points:

**NOTE**

Measurement of old drag link must be same as new drag link.

- (1) Ensure nuts (2) are tightened.
- (2) Ensure new cotter pins (1) are installed.



ME1140

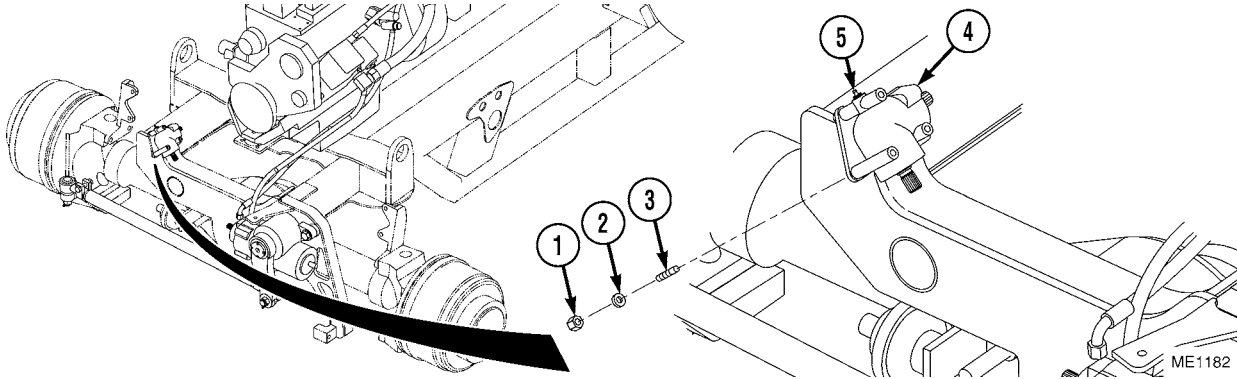
**d. Follow-On Maintenance.**

- (1) Lube drag link ball joints (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>5-16. STEERING MITER BOX REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i>	
<i>Materials/Parts</i> Grease, automotive, artillery, Item 30, Appendix C Loctite 243, Item 20, Appendix C Nut, self-locking, Item 122, Appendix D (3)	<i>TM or Para</i> Para 13-18 Para 5-14	<i>Condition Description</i> Nose cone removed. Steering shaft disconnected from miter box.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 109	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**



- (1) Remove three self-locking nuts (1), washers (2), studs (3), and miter box (4) from mounting plate (5). Discard self-locking nuts (1).
- (2) If required, remove studs (3) from miter box (4).

**b. Installation.**

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**NOTE**

Screw studs into miter box until studs bottom out in miter box holes.

- (1) If required, apply loctite 243 to three studs (3) and install miter box (4), three studs (3), washers (2), and new self-locking nuts (1) on mounting plate (5).
- (2) Grease miter box (TM 5-2420-230-10).

**c. Follow-On Maintenance.**

- (1) Install nose cone (Para 13-18).
- (2) Connect steering shaft to miter box (Para 5-14).

**END OF TASK**



**5-17. FRONT WHEEL ALIGNMENT.**

This Task Covers:

- a. Align Front Wheels
- b. Adjustment
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Equipment Conditions*

*TM or Para*

*Condition Description*

TM 5-2420-230-10

Vehicle positioned on level ground.

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

TM 5-2420-230-10

Electrical master switch OFF.

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

*Materials/Parts*

- Chalk, Item 6, Appendix C
- Cloth, lint-free, Item 10, Appendix C

TM 5-2420-230-10

Tire pressure correct.

Para 2-21

Vehicle raised (front axle only).

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Drawings Required*

TM 5-2420-230-24P Figure 101

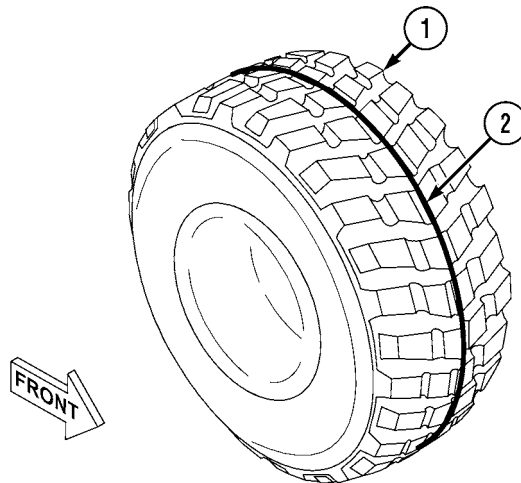
*References*

None

*Estimated Time to Complete Task*

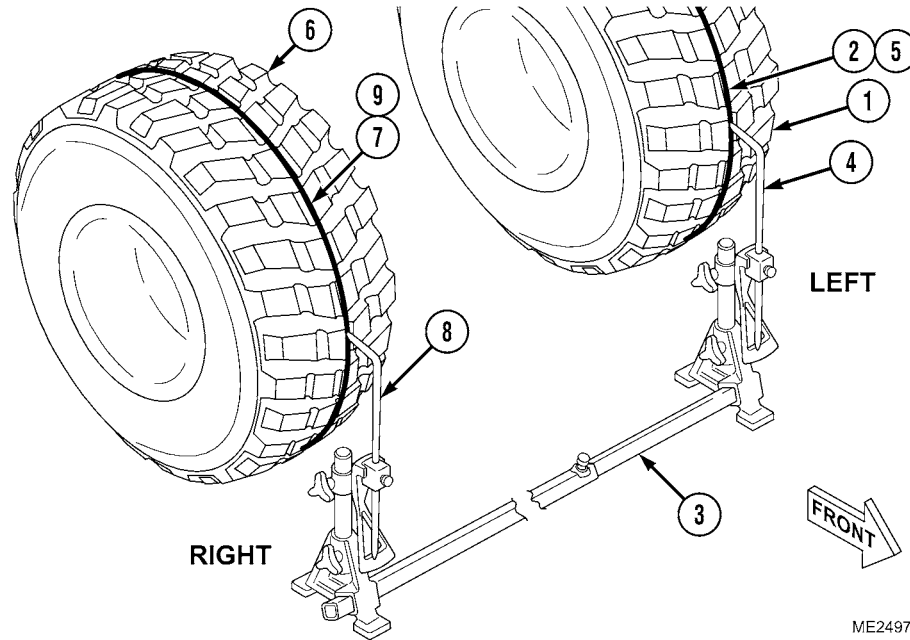
Refer to MAC in Appendix B

**a. Align Front Wheels.**



ME2496

- (1) Release parking brake (TM 5-2420-230-10).
- (2) Position chalk against center of left wheel and tire assembly (1).
- (3) Rotate left wheel and tire assembly (1) by hand until a 1-in. (25 mm) wide chalk mark (2) is made along center of tire tread.



- (4) Position fixed end of toe gauge (3) in front of left wheel and tire assembly (1).
- (5) Position fixed pointer (4) on center of chalk mark (2).

### NOTE

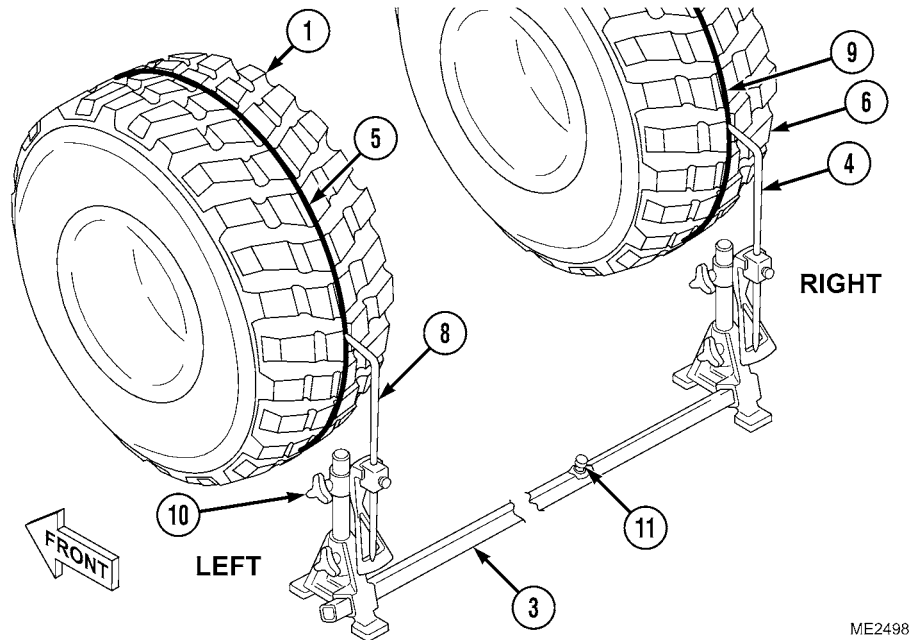
Beginning and end of scribe mark must intersect. If not, wipe off old chalk and rechalk tire.

- (6) Rotate left wheel and tire assembly (1) by hand until scribe marks (5) intersect on chalk mark (2).
- (7) Position chalk against center of right wheel and tire assembly (6).
- (8) Rotate right wheel and tire assembly (6) by hand until a 1-in. (25 mm) wide chalk mark (7) is made along center of tire tread.
- (9) Position adjustable end of toe gauge (3) in front of right wheel and tire assembly (6).
- (10) Position adjustable pointer (8) on center of chalk mark (7).

### NOTE

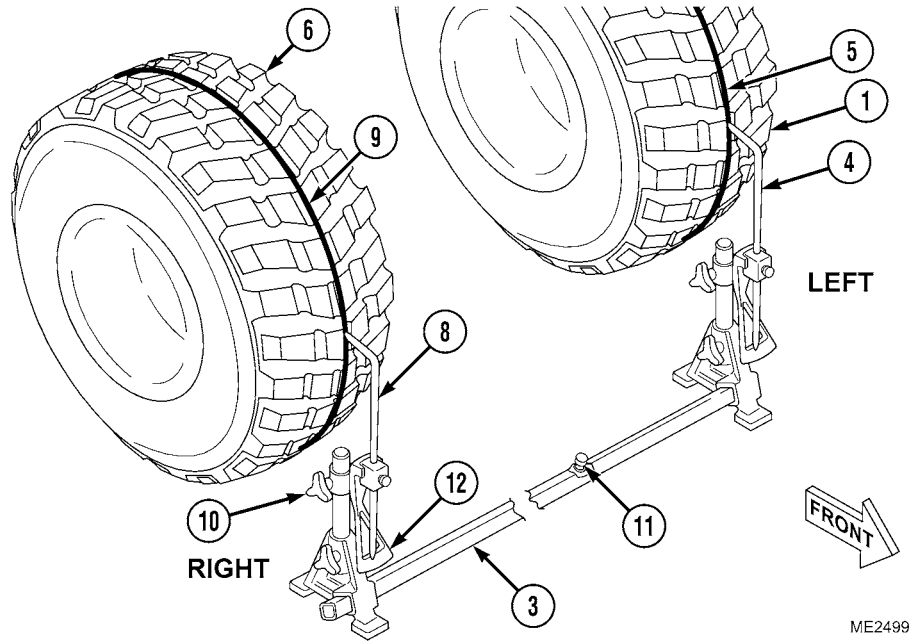
Beginning and end of scribe mark must intersect. If not, wipe off old chalk and rechalk tire.

- (11) Rotate right wheel and tire assembly (6) by hand until a scribe mark (9) is made along center of tire tread.
- (12) Lower vehicle from jacks.



ME2498

- (13) Position toe gauge (3) behind front wheel and tire assemblies.
- (14) Adjust fixed pointer (4) and adjustable pointer (8) to spindle height.
- (15) Align fixed pointer (4) with center of scribe mark on right wheel and tire assembly (6) tire tread, and hold in that position.
- (16) Set adjustable pointer (8) to "0" with thumbscrew (10).
- (17) Loosen thumbscrew (11) on toe gauge (3).
- (18) Position adjustable end of toe gauge (3) behind left wheel and tire assembly (1) and align adjustable pointer (8) with center of scribe mark (5) on tire tread. Hold adjustable pointer in that position.
- (19) Verify that adjustable pointer (8) is aligned with center of scribe mark (5) on left wheel and tire assembly (1).
- (20) Verify that fixed pointer (4) is aligned with center of scribe mark (9) on right wheel and tire assembly (6).
- (21) Tighten thumbscrew (11) on toe gauge (3).

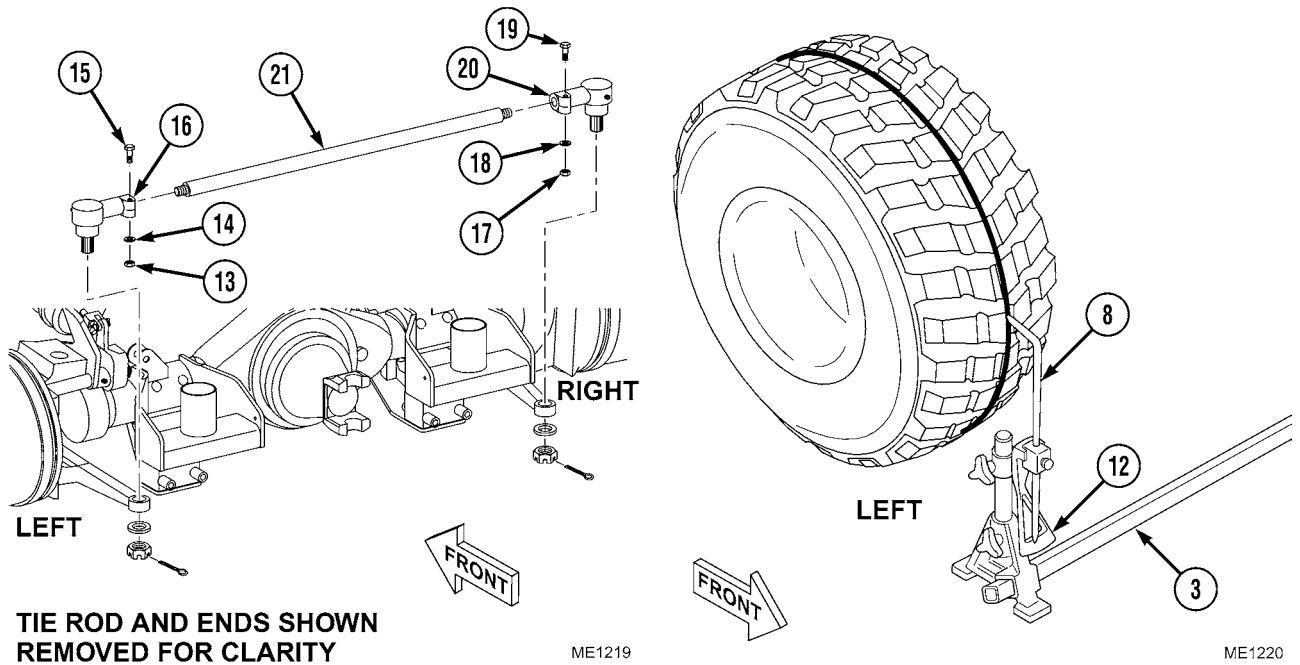


**NOTE**

When removing the toe gauge, do not bump or disturb the position of the pointers.

- (22) Remove toe gauge (3) from behind front wheel and tire assemblies, and position in front of front wheel and tire assemblies.
- (23) Align fixed pointer (4) with center of scribe mark (5) on left wheel and tire assembly (1), and hold in that position.
- (24) Use thumbscrew (10) to align adjustable pointer (8) with center of scribe mark (9) on right wheel and tire assembly (6).
- (25) Read scale (12) on adjustable pointer (8). If adjustable pointer has moved left of "0", toe-in readings are indicated. If adjustable pointer has moved right of "0", toe-out readings are indicated. Record readings.

**b. Adjustment.**



**TIE ROD AND ENDS SHOWN REMOVED FOR CLARITY**

ME1219

ME1220

- (1) Remove steering damper from tie rod (Para 5-18).
- (2) Remove nut (13), washer (14), and bolt (15) from left collar locking clamp (16).
- (3) Remove nut (17), washer (18), and bolt (19) from right collar locking clamp (20).
- (4) Adjust tie rod (21) to achieve a 0.08-in. (2 mm) toe-in reading on scale (12) and adjustable pointer (8).
- (5) Install bolt (19), washer (18), and nut (17) on right collar locking clamp (20).
- (6) Install bolt (15), washer (14), and nut (13) on left collar locking clamp (16).
- (7) Install steering damper on tie rod (Para 5-18).
- (8) Remove toe gauge (3).
- (9) Perform axle stop adjustment (Para K-4).

**c. Follow-On Maintenance.**

- (1) Lower vehicle (Para 2-22).
- (2) Start engine and perform road test (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

### 5-18. STEERING DAMPER REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

#### INITIAL SETUP

*Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Nut, self-locking, Item 105, Appendix D (2)  
 Nut, self-locking, Item 116, Appendix D (4 if required)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

TM or Para	Condition Description
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Para 2-21	Vehicle raised (front axle only).

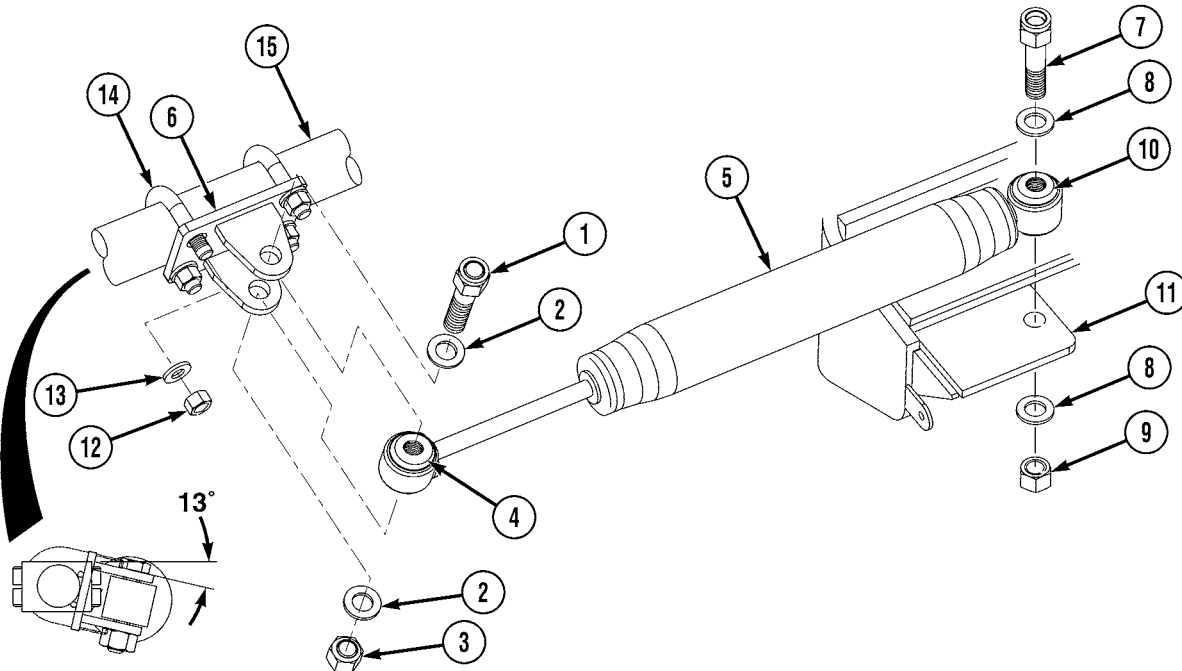
*Drawings Required*

TM 5-2420-230-24P Figure 113

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**



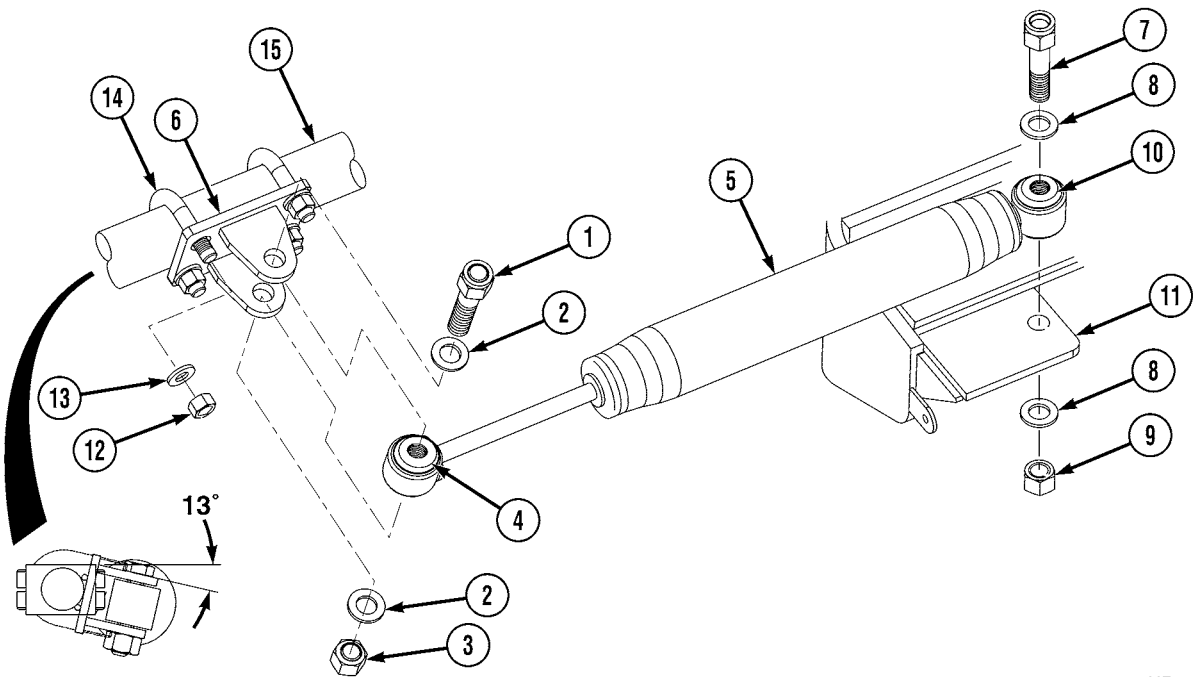
- (1) Remove bolt (1), two washers (2), self-locking nut (3), crush sleeve (4) (if required), and steering damper (5) from clamp (6). Discard self-locking nut.
- (2) Remove bolt (7), two washers (8), self-locking nut (9), crush sleeve (10) (if required), and steering damper (5) from damper mount (11). Discard self-locking nut.

**NOTE**

Scribe location of U-bolts prior to removal.

- (3) If required, remove four self-locking nuts (12), four washers (13), two U-bolts (14), and clamp (6) from tie rod (15).

**b. Installation.**



ME0874

**NOTE**

Ensure clamp, U-bolts, and steering damper clears axle center and drive shaft.

- (1) If required, install two U-bolts (14), clamp (6), four washers (13), and four new self-locking nuts (12) on tie rod (15). Align clamp on tie rod with marks made previously. Tighten self-locking nuts.
- (2) If required, install crush sleeves (4) and (10) in steering damper (5).
- (3) Install steering damper (5), bolt (7), two washers (8), and new self-locking nut (9) on damper mount (11). Tighten self-locking nuts.
- (4) Install damper (5), bolt (1), two washers (2), and new self-locking nut (3) on clamp (6). Tighten self-locking nut.

**c. Follow-On Maintenance.**

- (1) Lower vehicle (Para 2-21).
- (2) Start engine (TM 5-2420-230-10) and functionally test steering system (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





## CHAPTER 6 SUSPENSION

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	6-1	6-1
Vehicle Preparation and Isolation. . . . .	6-2	6-1
Restore IHMEE to Operational Readiness. . . . .	6-3	6-2
Check Strap Replacement. . . . .	6-4	6-2
Airbag Replacement. . . . .	6-5	6-4
Bump Stop Replacement. . . . .	6-6	6-7
Ride Level Valve (RLV) and Linkage Replacement. . . . .	6-7	6-8
Shock Absorber Maintenance. . . . .	6-8	6-11
Control Arm Replacement. . . . .	6-9	6-12
Sway Bar Replacement. . . . .	6-10	6-14

**6-1. GENERAL.**

This section identifies components associated with the suspension system. It details routine maintenance activities and removal and installation procedures for the following components:

- Check straps
- Shock absorbers
- Airbags
- Bump stops
- Sway bar
- Ride Level Valves (RLV) and linkages
- Control Rods

**6-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE), perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**6-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position, as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**6-4. CHECK STRAP REPLACEMENT.**

This Task Covers:

- |                          |            |                 |
|--------------------------|------------|-----------------|
| a. Inspection            | b. Removal | c. Installation |
| d. Follow-On Maintenance |            |                 |

**INITIAL SETUP**

<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, common no. 2, Item 36, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Nut, self-locking, Item 123, Appendix D (2)		
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P	Figure 114
<i>References</i>	<i>Estimated Time to Complete</i>	
None	Refer to MAC in Appendix B	

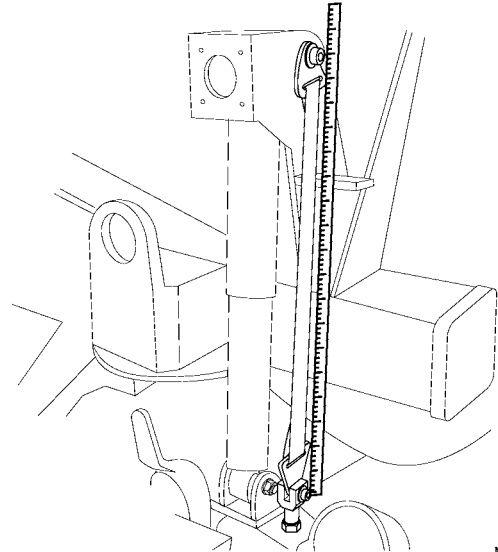
**a. Inspection.**

- (1) Visually inspect check straps for wear, damage, and contamination.
- (2) Jack vehicle and place jack stands (Para 2-21).

**NOTE**

The front and rear check straps are different lengths.

- (3) Ensure check straps are fully extended and measure distance between centers of check strap bolt holes. Check straps must not exceed 28 in. (715 mm) in the front and 25 in. (625 mm) in the rear.



ME0160

**b. Removal.**

- (1) If removing rear check strap, jack vehicle and place safety stands (Para 2-21).
- (2) If removing rear check strap, remove wheel and tire (TM 5-2420-230-10).
- (3) Remove shock absorber upper mounting bolt, washer, self-locking nut, and check strap fitting. Replace bolt and discard self-locking nut.
- (4) Remove check strap lower mounting bolt, washer, self-locking nut, and check strap fitting. Replace bolt and discard self-locking nut.

**c. Installation.**

Installation of the check straps is a reversal of the removal procedure with attention given to the following points:

- (1) Ensure correct length check strap is installed to appropriate axle.
- (2) Tighten shock absorber mounting bolts to 98 lbf/ft (133 N•m).
- (3) Ensure wheel nuts are tightened (TM 5-2420-230-10).

**d. Follow-On Maintenance.**

- (1) Lower vehicle (Para 2-21).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**6-5. AIRBAG REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

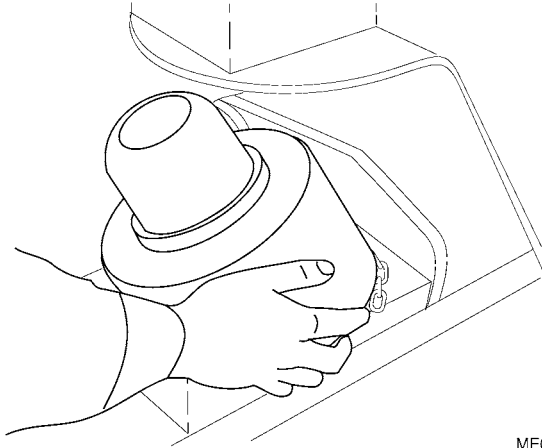
<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Petroleum, technical, Item 50, Appendix C Nut, self-locking, Item 123, Appendix D</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> Para 15-4 Para 2-21 Para 6-8</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 114 TM 5-2420-230-24P Figure 115</p> <p><i>Estimated Time to Complete</i> Refer to MAC in Appendix B</p>	<p><i>Condition Description</i> Air system drained. Vehicle raised. Remove shock absorber upper mounting bolt.</p>
--	---	--

**a. Removal.**

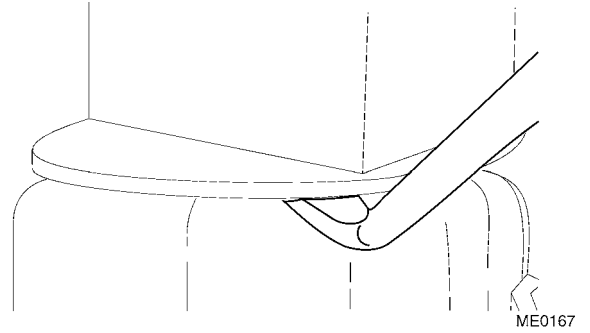
**WARNING**

To prevent injury, isolate air supply prior to working on airbags. Failure to comply may result in injury or death to personnel.

- (1) Isolate suspension air supply. With engine off and ignition switch set to IGN position, set MODE CONTROL switch to LIMP/C-130. When all air has been exhausted, turn each airbag tap off.
- (2) Deleted.
- (3) Remove RLV to axle link (Para 6-7).



ME0168



ME0167

**CAUTION**

Take care when using pry bar not to scratch or score airbag ring. Damage to the ring will render it unserviceable. Failure to comply may result in damage to equipment.

- (4) Use suitable pry bar to pry airbag off upper airbag ring.
- (5) Roll airbag back over piston.
- (6) Remove screw, washer, and piston retaining chain from axle.

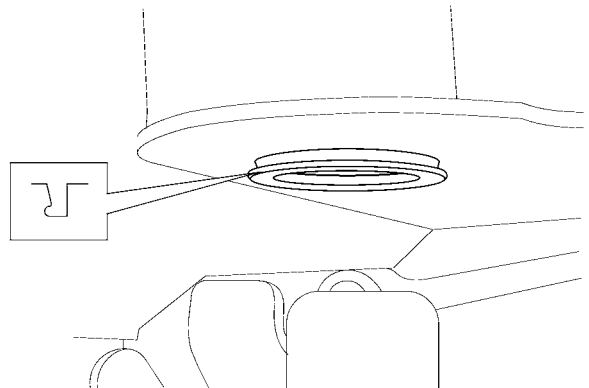
**NOTE**

The axles must be lowered to remove airbags.

- (7) Deleted.

**b. Inspection.**

Visually inspect airbag and ring for wear or damage. Replace or repair as necessary.



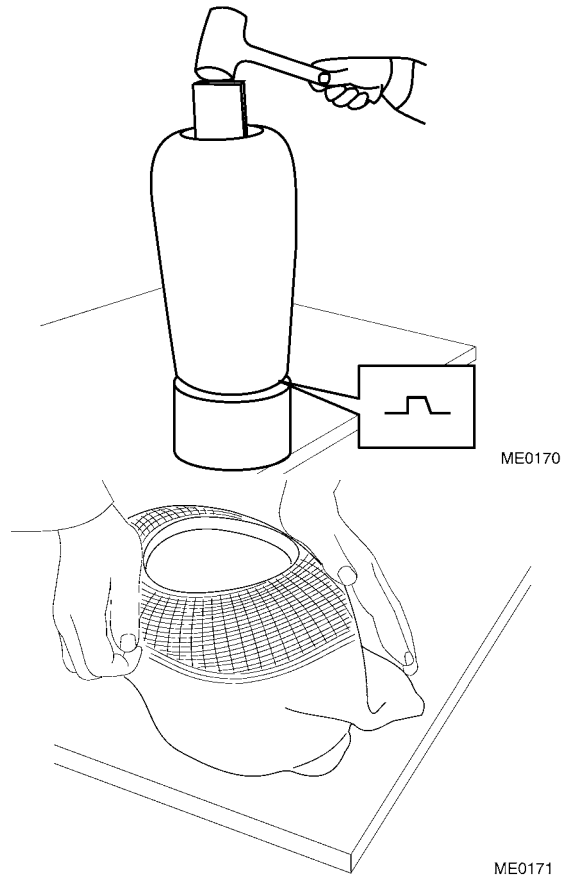
ME0169

**c. Installation.**

**NOTE**

It may be necessary to use a piece of wood and a hammer to get the airbag lip to seal on the piston lip taper.

- (1) Fit airbag to piston.
- (2) Inspect upper ring for damage.
- (3) Remove upper shock absorber bolt.
- (4) Place piston retaining chain on axle and secure with washer and screw.
- (5) Smear inside of airbag lip with technical petroleum.
- (6) Compress airbag and mate it with upper airbag ring.
- (7) Open airbag tap.
- (8) Raise jack under axle by approximately 4 in. (100 mm).
- (9) Start engine (TM 5-2420-230-10) and wait for air system pressure to build.
- (10) Shut OFF vehicle (TM 5-2420-230-10).
- (11) Move RLV link upward to allow air to enter airbag.
- (12) Refit RLV link to axle (Para 6-7).
- (13) Ensure airbag has inflated correctly and does not leak.
- (14) Deleted.



**d. Follow-On Maintenance.**

- (0.1) Install shock absorber upper mounting bolt (Para 6-8).
- (1) Lower vehicle (Para 2-21).
- (2) Start engine and functionally test airbags (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Check airbags for leaks.
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**6-6. BUMP STOP REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 6-5      Airbag removed.

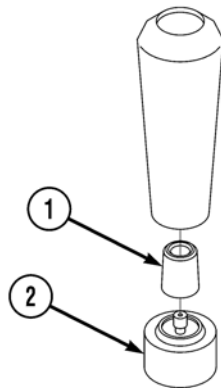
*Materials/Parts*  
None

*Drawings Required*  
TM 5-2420-230-24P Figure 115

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



ME1124

- (1) Remove bump stop (1) from piston (2).
- (2) Inspect bump stop for cracks, splits, and contamination. Replace if necessary.
- (3) Ensure airway on top of airbag mount is clean.

**b. Installation.**

Install bump stop (1) on piston (2) onto mounting point within airbag, using a rubber mallet.

**c. Follow-On Maintenance.**

Install airbag (Para 6-5).

**END OF TASK**





- (1) Remove two nuts (1), washers (2), bolts (3), and linkage (4) from valve assembly (5) and axle (6).

**NOTE**

If replacing RLV, record length of linkage for use during installation.

- (2) Loosen two clamps (7), and remove clamps and rod ends (8) from linkage (4).

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

- (3) Remove two air lines (9) from valve assembly (5).

**NOTE**

If removing rear RLV, perform Step (4). If removing front RLV, perform Step (5).

- (4) Remove two bolts (10), four washers (11), and valve assembly (5) from vehicle.
- (5) Remove two nuts (12), four washers (11), two bolts (10), and valve assembly (5) from vehicle.

**b. Installation.**

**NOTE**

- If installing rear RLV, go to Step (1). If installing front RLV, go to Step (2).
  - Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Install two bolts (10), four washers (11), and valve assembly (5) on vehicle. Go to Step (3).
  - (2) Install two bolts (10), four washers (11), valve assembly (5), and nuts (12) on vehicle.
  - (3) Install two air lines (9) on valve assembly (5).

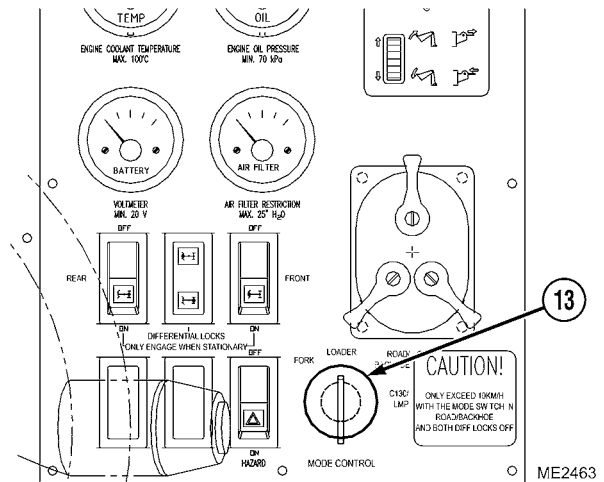
**NOTE**

Ensure that new linkages are the same length as the old linkages.

- (4) If necessary, cut linkage (4) to correct length.
- (5) Install two rod ends (8) on linkage (4) using two clamps (7). Tighten clamps.
- (6) Install linkage on axle (6) and valve assembly (5) with two bolts (3), washers (2), and nuts (1).

**c. Adjustment.**

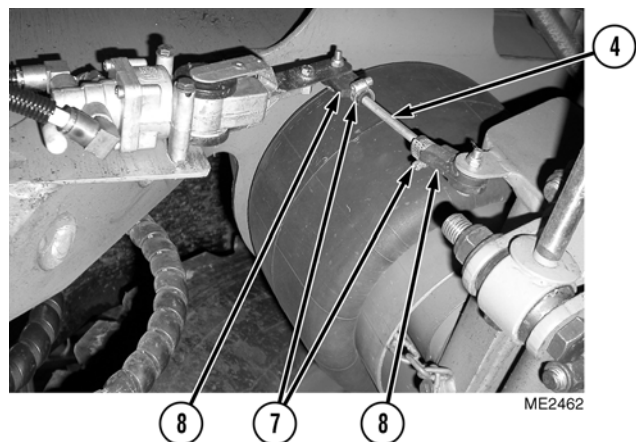
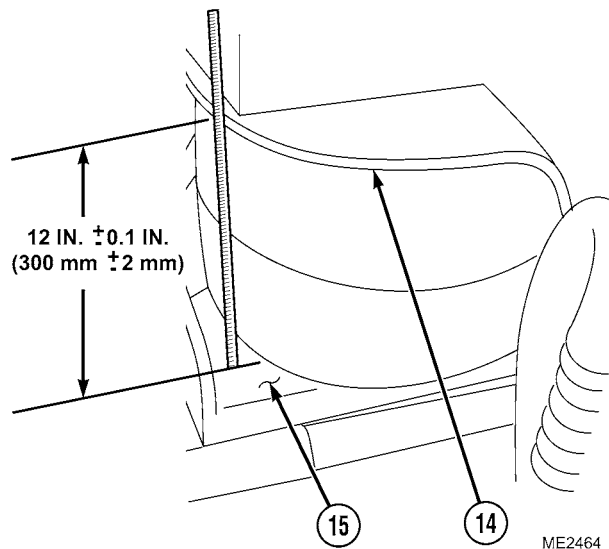
- (1) Start engine (TM 5-2420-230-10).
- (2) Ensure air system is full and vehicle is parked on level ground.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Set suspension MODE CONTROL switch (13) to ROAD/BACKHOE mode.
- (5) Check ride height by measuring distance between top (14) and bottom (15) air bag mounting plate on airbags.



**NOTE**

Average height is 12 ± 0.1 in. (300 ± 2 mm). It is important that the vehicle remains level. The variation in airbag dimension allows for manufacturing tolerances.

- (6) Loosen clamps (7), adjust rod ends (8) on linkage (4) to obtain the proper ride height. Tighten clamps.
- (7) Test drive vehicle over rough surfaces, bumps, or gutters to ensure proper suspension movement. Upon completion of test drive, perform Steps (8) through (10).
- (8) Park vehicle on level ground.
- (9) Ensure air pressure is at maximum pressure.
- (10) Visually inspect vehicle from approximately 30 ft. (10m) to ensure it looks level in relation to the ground.



**END OF TASK**

**6-8. SHOCK ABSORBER MAINTENANCE.**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-21	Vehicle raised.
TM 5-2420-230-10	Tire assembly removed.

*Materials/Parts*  
Bushing, shock, Item 36, Appendix D (4)  
Nut, self-locking, Item 123, Appendix D (2)

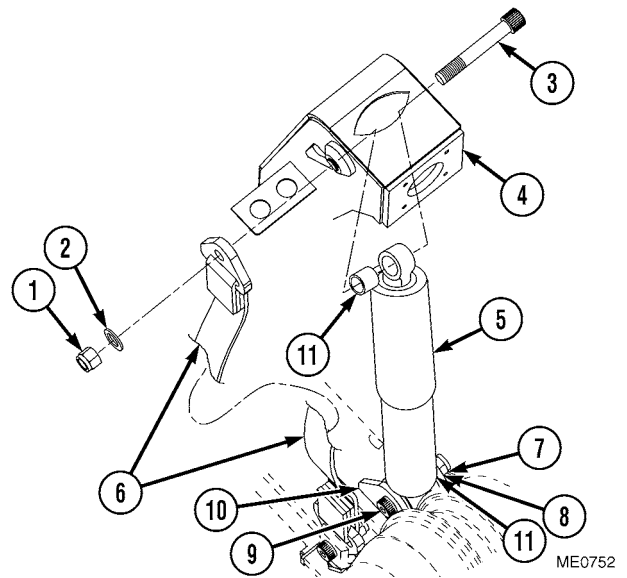
*Drawings Required*  
TM 5-2420-230-24P Figure 114

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

- (1) Remove self-locking nut (1), washer (2), and mounting bolt (3) from mount (4) at top of shock absorber (5). Discard self-locking nut.
- (2) Lay check strap (6) to the side.
- (3) Remove self-locking nut (7), washer (8), and mounting bolt (9) from mount (10) at bottom of shock absorber (5). Discard self-locking nut.
- (4) Remove shock absorber (5).



**b. Disassembly.**

Remove two bushings (11) from top and bottom of shock absorber (5).

**c. Assembly.**

Install two bushings (11) into top and bottom of shock absorber (5).

**d. Installation.**

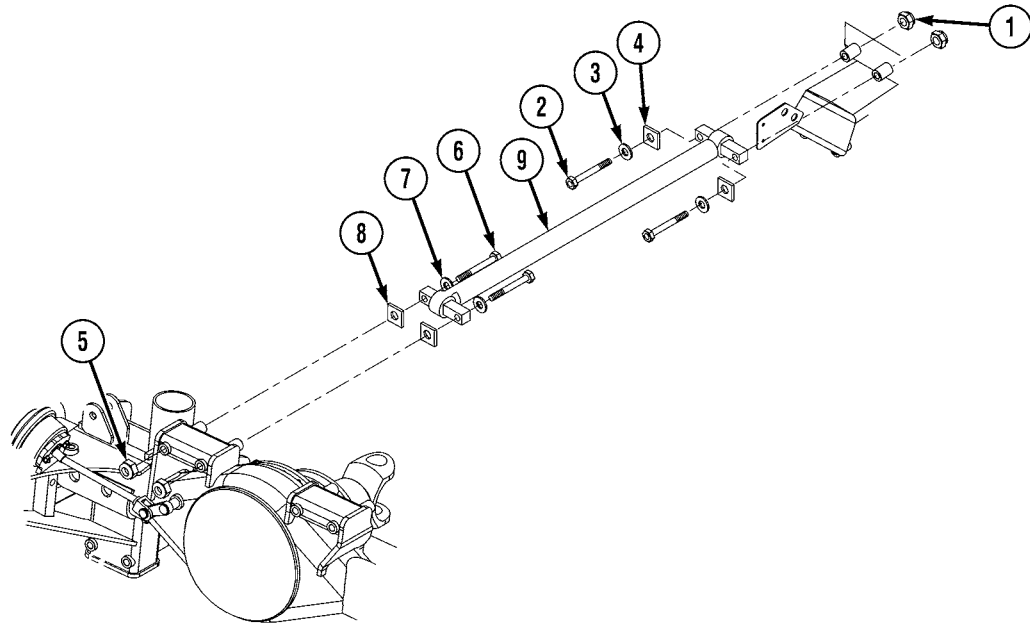
- (1) Install shock absorber (5) in bottom mount (10) with mounting bolt (9), washer (8), and new self-locking nut (7).
- (2) Install shock absorber (5) and check strap (6) to top mount (4) with mounting bolt (3), washer (2), and one new self-locking nut (1).
- (3) Tighten mounting bolts (3) and (9) to 98 lbf/ft (133 N•m).

**e. Follow-On Maintenance.**

- (1) Install wheel and tire assembly (TM 5-2420-230-10).
- (2) Lower vehicle (Para 2-21).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>6-9. CONTROL ARM REPLACEMENT.</b>	
This Task Covers:	
a. Removal	b. Installation
c. Follow-On Maintenance	
<b>INITIAL SETUP</b>	
<i>Test Equipment</i>	<i>Equipment Conditions</i>
None	<i>TM or Para</i>
	<i>Condition Description</i>
<i>Tools and Special Tools</i>	TM 5-2420-230-10 Vehicle positioned on level ground.
Tool kit, common no. 2, Item 36, Appendix B	TM 5-2420-230-10 Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10 Engine shut OFF.
	TM 5-2420-230-10 Electrical master switch OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10 “Do Not Operate” tag attached to ignition switch.
Nut, self-locking, Item 123, Appendix D (4)	
Shims, Item 252, Appendix D (as needed)	
<i>Personnel Required</i>	<i>Drawings Required</i>
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P Figure 118
<i>References</i>	<i>Estimated Time to Complete Task</i>
None	Refer to MAC in Appendix B



ME1043

**a. Removal.**

**NOTE**

All control arms are removed in the same manner. The front control arms are shown.

- (1) Remove two self-locking nuts (1), bolts (2), washers (3), and shims (4). Discard self-locking nuts.
- (2) Remove two self-locking nuts (5), bolts (6), washers (7), shims (8), and control arm (9). Discard self-locking nuts.
- (3) Deleted.

**b. Installation.**

**NOTE**

- All control arms are installed in the same manner. The front control arms are shown.
- Add shims as required.

- (1) Install shims (8), two bolts (6), washers (7), and new self-locking nuts (5). Tighten bolts to 94 lbf/ft (128 N•m).
- (2) Install control arm (9) with shims (4), two bolts (2), washers (3), and new self-locking nuts (1). Tighten bolts to 94 lbf/ft (128 N•m).
- (3) Deleted.

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

## 6-10. SWAY BAR REPLACEMENT.

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*  
None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Material/Parts*

- Nut, self-locking, Item 123, Appendix D (4)
- Nut, self-locking, Item 125, Appendix D (4)
- Washer, lock, Item 282, Appendix D (4)

*Personnel Required*

- MOS 62B, Construction Equipment Repairer (2)

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P Figure 119

*Estimated Time to Complete*

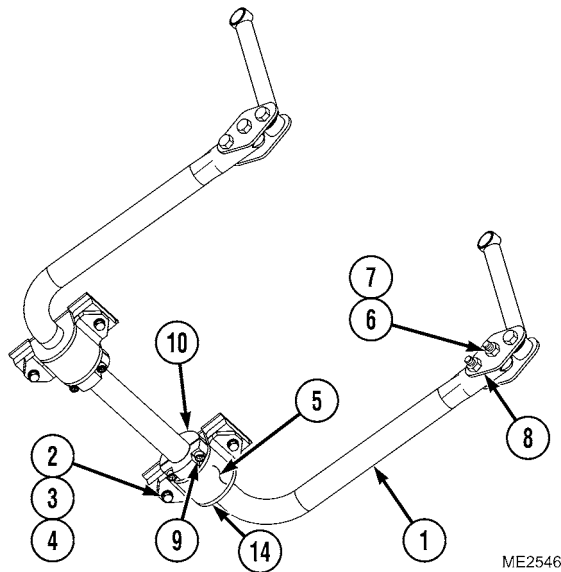
Refer to MAC in Appendix B

### a. Removal.

#### WARNING

The sway bar is heavy and it is under tension when installed. To prevent injury, take care when removing and installing sway bar. Failure to comply may result in injury or death to personnel.

- (1) Place jack under center of sway bar (1) and raise jack to support weight of sway bar.
- (2) Remove four bolts (2), washers (3), lockwashers (4), and two sway bar supports (5) from vehicle. Discard lockwashers.
- (3) Carefully lower jack.
- (4) Support sway bar (1) and remove four bolts (6) and self-locking nuts (7) from connecting arms (8). Discard self-locking nuts.
- (5) Remove four screws (9) from two split collars (10), and remove split collars from sway bar (1).



ME2546

**NOTE**

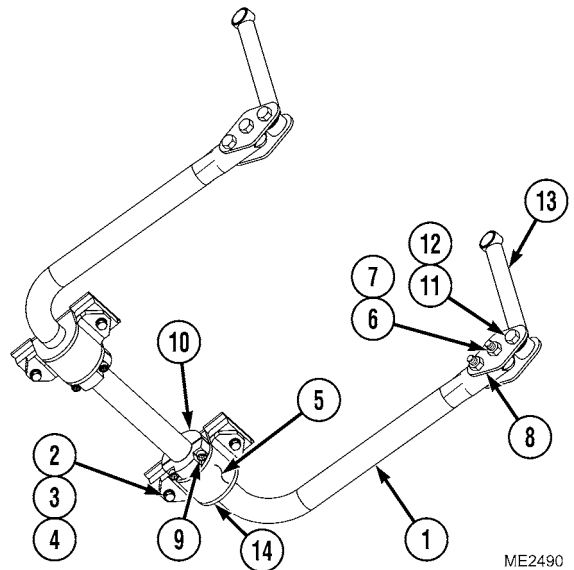
If tie rod bar requires replacement, record length of old tie-rod for new installation.

- (6) If required, remove four self-locking nuts (11), bolts (12), connecting arms (8), and two tie rod bars (13) from vehicle. Discard self-locking nuts.

**b. Inspection.**

Visually inspect sway bar (1), sway bar supports (5), connecting arms (8), and bushings (14) for damage, distortion, and/or cracks. Replace components as necessary.

**c. Installation.**



**NOTE**

Ensure sway bar is aligned equally.

- (1) If removed, install tie-rod bar (13) and connecting arms (8) on vehicle with four bolts (12) and new self-locking nuts (11). Torque self-locking nuts to 375 lbf/ft (508 N•m).
- (2) Place jack under center of sway bar (1), and raise jack to support weight of sway bar.
- (3) Install sway bar supports (5) on vehicle with four washers (4), new lockwashers (3), and bolts (2).
- (4) Carefully lower jack.
- (5) Position split collars (10) on sway bar (1) and secure with four screws (9).
- (6) Install sway bar (1) with four bolts (6) and new self-locking nuts (7). Torque self-locking nuts to 210 lbf/ft (285 N•m).

**d. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





## CHAPTER 7 FUEL SYSTEM

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	7-1	7-1
Preparation and Isolation. . . . .	7-2	7-1
Restore IHMEE to Operational Readiness. . . . .	7-3	7-2
Bleeding Fuel System. . . . .	7-4	7-2
Fuel Filter Replacement. . . . .	7-5	7-4
Fuel Tank Breather Replacement. . . . .	7-6	7-6
Fuel Tank Maintenance. . . . .	7-7	7-8
Fuel Shut-Off Valve Replacement. . . . .	7-8	7-11

**7-1. GENERAL.**

This section details routine maintenance activities and removal and replacement procedures for the following components:

- Fuel filters
- Fuel tank
- Fuel tank breather

**7-2. PREPARATION AND ISOLATION.**

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**7-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness by doing the following:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**7-4. BLEEDING FUEL SYSTEM.**

This Task Covers:

- a. Bleeding
- b. Follow-On Maintenance

**INITIAL SETUP**

<i>Test Equipment</i>	<i>Equipment Conditions</i>	<i>Condition Description</i>
None	<i>TM or Para</i>	
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Pan, drain, Item 29, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Cloth, lint-free, Item 10, Appendix C	TM 5-2420-230-10	Hood raised.
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer (2)	TM 5-2420-230-24P	Figure 35
<i>References</i>	<i>Estimated Time to Complete Task</i>	
None.	Refer to MAC in Appendix B	

**a. Bleeding.**

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

**NOTE**

If the engine does not start after a service or if the IHMEE has ran out of fuel, complete the following steps:

- (1) Ensure fuel is present in tank.
- (2) With the aid of an assistant, operate primer while starting engine.
  - (2.1) Place drain pan beneath secondary fuel filter.

**NOTE**

If engine fails to start, complete the following steps:

- (3) Remove fuel bleeder screw from top of secondary fuel filter.
- (4) Operate primer until a steady stream of fuel is visible, then install bleeder screw.
- (5) With the aid of an assistant, operate primer while starting engine.

**NOTE**

If engine still fails to start, complete the following steps:

- (6) Operate primer and loosen fuel injector lines at injectors.
- (7) When fuel is visible, turn over engine and tighten fuel injector lines one at a time.
- (8) If engine fails to start, replace fuel filters and go to Step (1).

**b. Follow-On Maintenance.**

- (1) Close engine hood (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

## 7-5. FUEL FILTER REPLACEMENT.

This Task Covers:

- |   |                                  |                                      |
|---|----------------------------------|--------------------------------------|
| a. Primary Fuel Filter (Fuel/Water Separator) Removal     | b. Secondary Fuel Filter Removal | c. Secondary Fuel Filter Replacement |
| d. Primary Fuel Filter (Fuel/Water Separator) Replacement | e. Follow-On Maintenance         |                                      |

### INITIAL SETUP

*Test Equipment*

None

*Tools and Special Tools*

Pan, drain, Item 29, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Cloth, lint-free, Item 10, Appendix C  
 Filter, fuel, primary, Item 50, Appendix D  
 Filter, fuel, secondary, Item 49, Appendix D  
 Turbine Fuel, Aviation, JP-8, Item 69, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
TM 5-2420-230-10	Hood raised.

*Drawings Required*

TM 5-2420-230-24P	Figure 16
TM 5-2420-230-24P	Figure 34

*Estimated Time to Complete*

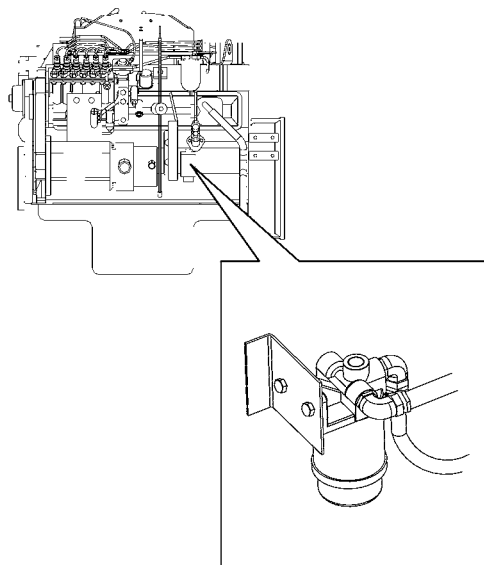
Refer to MAC in Appendix B

### a. Primary Fuel Filter (Fuel/Water Separator) Removal.

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

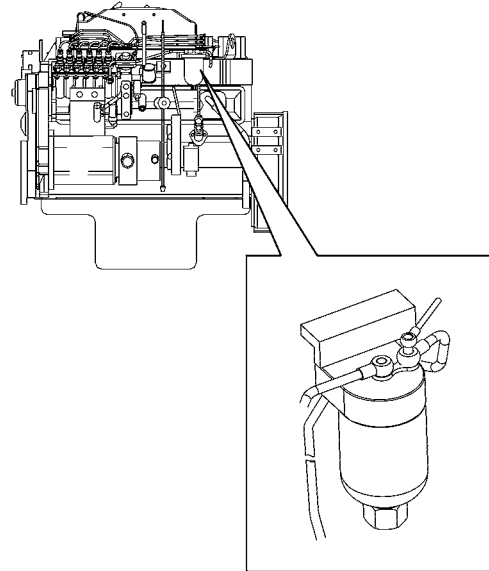
- (1) Place drain pan beneath primary filter.
- (2) Remove knurled fastener securing glass bowl.
- (3) Unscrew canister, drain fuel, and discard canister.



ME0214

**b. Secondary Fuel Filter Removal.**

- (1) Place suitable container beneath secondary filter.
- (2) Remove secondary filter canister by unscrewing it counterclockwise. Discard filter element.



ME0213

**c. Secondary Fuel Filter Replacement.**

- (1) Coat secondary filter canister sealing gasket with clean fuel.
- (2) Fill new secondary filter canister with clean fuel and install on filter head. Tighten per manufacturer's instructions on canister.
- (3) Prime fuel system by pumping primer button several times until resistance is felt. Primer is located just below secondary fuel filter.

**d. Primary Fuel Filter (Fuel/Water Separator) Replacement.**

- (1) Coat primary filter canister sealing gasket with clean fuel.
- (2) Fill new primary filter canister with clean fuel and install on filter head. Tighten per manufacturer's instructions on canister.
- (3) Prime fuel system by pumping primer button several times until resistance is felt. Primer is located just below secondary fuel filter.

**e. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10) and check for signs of fuel or air leaks.
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Close engine hood and secure clips (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

## 7-6. FUEL TANK BREATHER REPLACEMENT.

This Task Covers:

- a. Removal
- b. Cleaning
- c. Installation
- d. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*

None

*Tools and Special Tools*

Pan, drain, Item 29, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Cloth, lint-free, Item 10, Appendix C  
 Solvent, degreasing, Item 58, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P Figure 33

*Estimated Time to Complete*

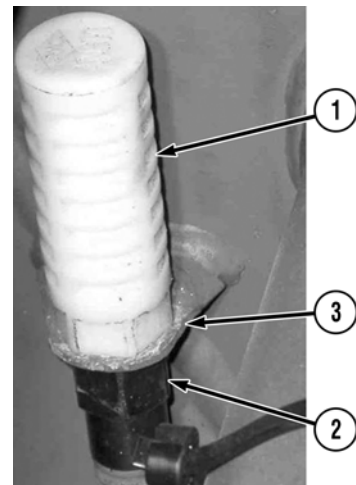
Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

Unscrew fuel tank breather (1) from adapter (2) at mounting bracket (3).



ME1132

**b. Cleaning.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

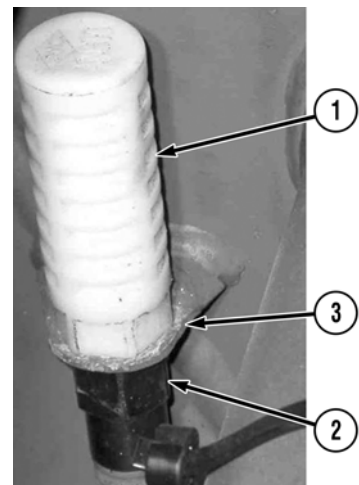
With the use of a lint-free cloth and degreasing solvent, inspect and clean fuel tank breather (1). Replace if necessary.

**c. Installation.**

- (1) Insert adapter (2) through mounting bracket (3) and screw on fuel tank breather (1) until tight.
- (2) After fuel tank breather (1) is installed, ensure fuel tank breather and lines are clear of any obstructions.

**d. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).



ME1132

**END OF TASK**

**7-7. FUEL TANK MAINTENANCE.**

This Task Covers:

- |                          |                |                 |
|--------------------------|----------------|-----------------|
| a. Removal               | b. Disassembly | c. Inspection   |
| d. Cleaning              | e. Assembly    | f. Installation |
| g. Follow-On Maintenance |                |                 |

**INITIAL SETUP**

*Test Equipment*

None

*References*

FM 10-20  
TB 43-0212

*Tools and Special Tools*

Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Right-front belly plate removed.
Para 13-14	Fuel tank step plate removed.
Para 12-37	Fuel sending unit removed.
Para 20-9	Fuel pickup tube removed.

*Materials/Parts*

Cap and plug set, Item 4, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Compound, sealing, pipe thread, Item 23, Appendix C  
Nut, self-locking, Item 111, Appendix D (4)  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Turbine Fuel, Aviation, JP-8, Item 69, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 32

*Estimated Time to Complete*

Refer to MAC in Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer



**a. Removal.**

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

**NOTE**

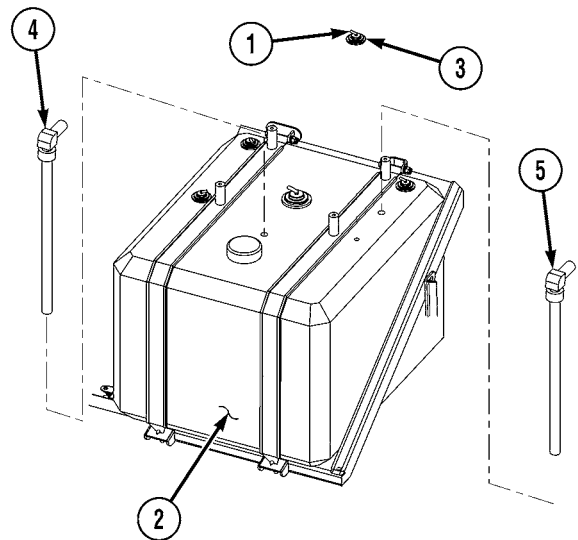
- Tag all hoses, wires, and tubes and note their positions before removal.
  - Remove cable ties as necessary.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Place drain pan beneath fuel tank.
  - (2) Remove fuel tank drain plug on bottom of tank. Empty fuel into drain pan.
  - (3) Remove four fuel tank breather hoses and seal openings with clean cloths.
  - (4) Loosen two hose clamps and remove supply and return fuel lines.
  - (5) Remove two self-locking nuts and washers from both ends of fuel tank securing straps. Discard self-locking nuts.
  - (6) Remove fuel tank.
  - (7) Inspect fuel tank securing straps for damage and replace as necessary.

**b. Disassembly.**

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

- (1) Remove four breather adapters (1) from fuel tank (2).
- (2) Remove nonmetallic grommet (3) from breather adapters (1).
- (3) Remove fuel supply fitting (4) and fuel return fitting (5) from fuel tank (2).



ME1244

**c. Inspection.**

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

- (1) Inspect rubber strips fitted to chassis and securing straps. Replace as necessary.
- (2) Inspect inside of fuel tank (FM 10-20 and TB 43-0212).

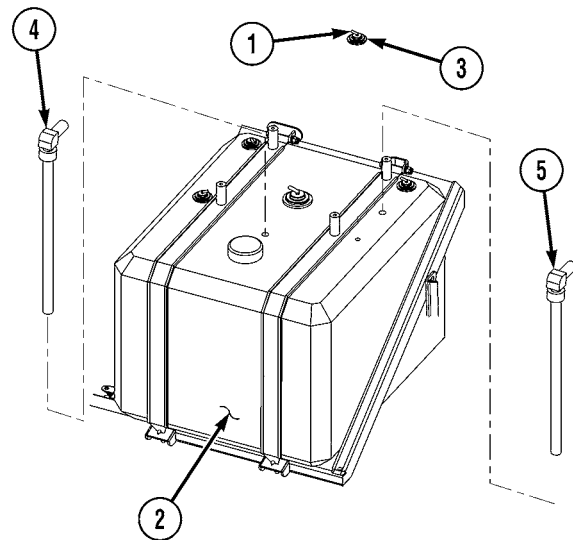
**d. Cleaning.**

Flush and clean fuel tank with clean fuel if necessary.

**e. Assembly.**

**WARNING**

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



ME1244

- (1) Apply sealing compound to threads of fuel supply fitting (4) and fuel return fitting (5).
- (2) Install fuel supply fitting (4) and fuel return fitting (5) in fuel tank (2).
- (3) Install nonmetallic grommets (3) on breather adapters (1).
- (4) Install breather adapters (1) in fuel tank (2).

**f. Installation.**

Steps for installing fuel tank are the reverse of removal procedure with attention given to the following points:

- (1) Replace fuel tank drain plug. Use sealing compound to prevent leakage.
- (2) Fill fuel tank with clean fuel.
- (3) Ensure new self-locking nuts are used.

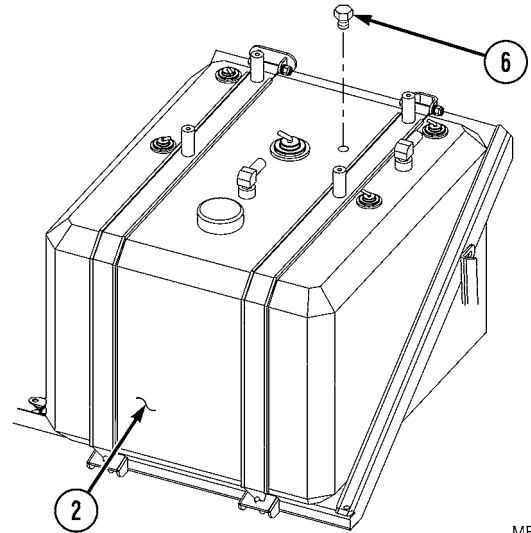
**g. Follow-On Maintenance.**

- (1) Install fuel sending unit (Para 12-37).

**NOTE**

If vehicle has cold weather kit, perform Steps (1.1) and (1.2).

- (1.1) Remove plug (6).
- (1.2) Install fuel pickup tube assembly (Para 20-9).
- (1.3) Install fuel tank step plate (Para 13-14).
- (2) Start engine (TM 5-2420-230-10) and check for leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Install right-front belly plate (TM 5-2420-230-10).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

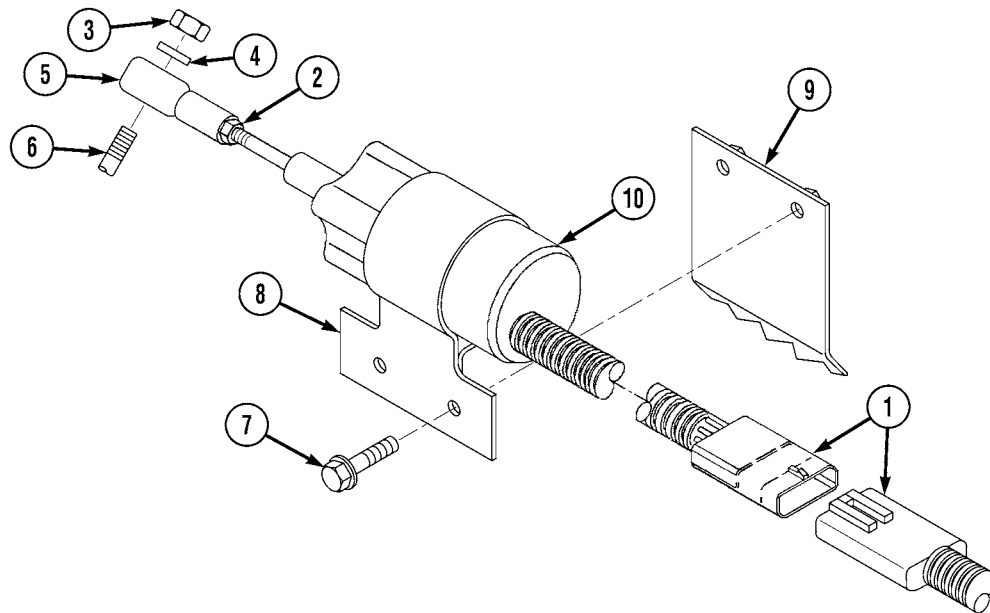


ME2480

**END OF TASK**

<b>7-8. FUEL SHUT-OFF VALVE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Nut, self-locking, Item 101, Appendix D	TM 5-2420-230-10	Engine shut OFF.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	TM 5-2420-230-10	Electrical master switch OFF.
<i>References</i> None	<i>Drawings Required</i> TM 5-2420-230-24P	“Do Not Operate” tag attached to ignition switch.
		Hood raised.
		<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B

**a. Removal.**



ME2220

**WARNING**

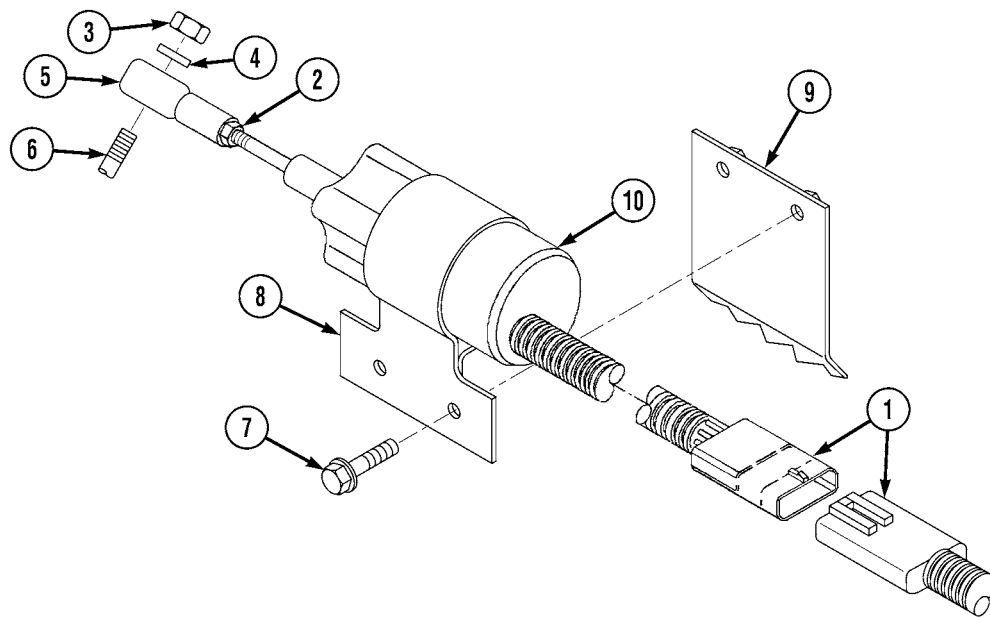
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

**NOTE**

Note length of shaft between fuel shut-off valve and fuel shut-off valve arm prior to removal to ensure proper installation.

- (1) Disconnect electrical connector (1).
- (2) Loosen jam nut (2).
- (3) Remove self-locking nut (3), washer (4), and fuel shut-off valve arm (5) from stud (6). Discard self-locking nut.
- (4) Remove two bolts (7), and valve bracket (8) from mounting bracket (9).
- (5) Remove fuel shut-off valve (10) from valve bracket (8).

**b. Installation.**



ME2220

**WARNING**

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

- (1) Loosen jam nut (2) on shut-off valve arm (5).
- (2) Install fuel shut-off valve (10) in valve bracket (8).
- (3) Install valve bracket (8) on mounting bracket (9) with two bolts (7).
- (4) Install washer (4), new self-locking nut (3), and fuel shut-off valve arm (5) on stud (6).

**NOTE**

For proper installation, ensure length of shaft is as noted prior to removal.

- (5) Tighten jam nut (2) and connect electrical connection (1).

**c. Follow-On Maintenance.**

- (1) Lower hood (TM 5-2420-230-10).
- (2) Start engine and functionally test fuel shut-off valve (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## CHAPTER 8 BRAKING SYSTEM

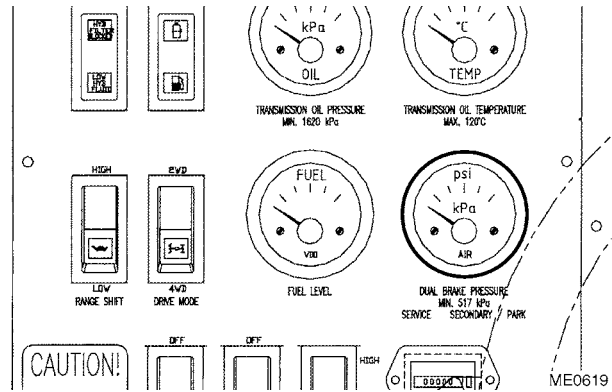
Contents	Para	Page
General. . . . .	8-1	8-1
System Operation - Basic Operation. . . . .	8-2	8-1
Vehicle Preparation and Isolation. . . . .	8-3	8-2
Restore IHMEE to Operational Readiness. . . . .	8-4	8-2
Slack Adjuster Replacement. . . . .	8-5	8-3
Brake Drum Replacement. . . . .	8-6	8-4
Spring Brake Chamber Replacement. . . . .	8-7	8-7
Spring Brake Chamber Caging. . . . .	8-8	8-10
Foot Treadle Valve Replacement. . . . .	8-9	8-11
Parking Brake Control Replacement. . . . .	8-10	8-13

### 8-1. GENERAL.

This section contains procedures that relate to maintenance activities detailed in Chapter 3, Preventive Maintenance Checks and Services (PMCS). This chapter should be read in conjunction with Appendix J. Components covered within this section include:

- Brake drum and mechanism
- Brake mechanism adjustment

The DUAL BRAKE PRESSURE gauge has two pointers, one white and one green. The white pointer is for service air and the green pointer is for park/secondary air.



### 8-2. SYSTEM OPERATION - BASIC OPERATION.

- a. General.** The brake system consists of four spring brake chambers, with one at each wheel. The engine-driven compressor has an integral governor set at 119 psi (820 kPa).
- b. Primary System.** When the foot brake pedal is depressed, air pressure is directed from the reservoirs, through the foot valve, to the spring brake chambers. Air pressure acts on the pneumatic diaphragm, which pushes the chamber rod. The chamber rod is connected to the slack adjuster and a shaft. This shaft operates the S-cam, which in turn brings the brake linings into contact with the brake drum, thus providing braking action.

The amount of braking action is directly proportional to the amount of effort applied to the foot brake pedal. As more pressure is applied to the foot brake pedal, more air pressure is directed to the brake chambers, and more braking action is applied to the vehicle. The system is provided with a pressure-reducing valve to prevent rear wheel lockup due to weight transfer as the brakes are applied.

**c. Secondary System.**

**NOTE**

Unlike a conventional split system, the brakes on all four wheels will operate.

The secondary system will operate if air pressure is lost in the primary system. The modulating valve will sense the loss of pressure in the primary system and the foot pedal will then modulate the release of air from the spring brake chamber. As the air pressure decreases, the spring brake chambers will operate under spring pressure, progressively applying the brakes.

**8-3. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE), perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**8-4. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position, as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.



**8-5. SLACK ADJUSTER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Pin, cotter, Item 38, Appendix D  
 Washer, lock, Item 271, Appendix D

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

TM or Para

*Condition Description*

Front brake shoe removed, as required.

Para J-5

Rear brake shoe removed, as required.

Para J-12

*Drawings Required*

TM 5-2420-230-24P Figure 101

TM 5-2420-230-24P Figure 135

TM 5-2420-230-24P Figure 136

TM 5-2420-230-24P Figure 137

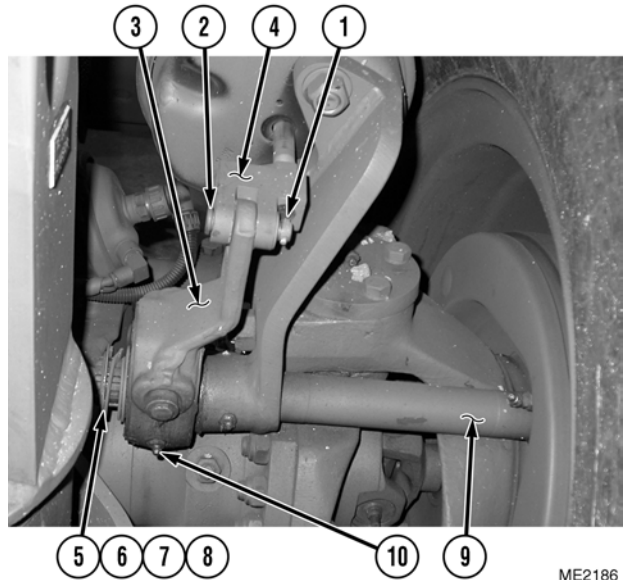
TM 5-2420-230-24P Figure 138

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**

- (1) Remove cotter pin (1) and clevis pin (2) from slack adjuster (3) and brake chamber (4). Discard cotter pin.
- (2) Remove retaining ring (5), washer (6), lockwasher (7), and spacer (8) from S-cam (9). Discard lockwasher.
- (3) Slide S-cam (9) outward and remove slack adjuster (3) from end of S-cam.
- (4) If required, remove lube fitting (10) from slack adjuster (3).



**b. Installation.**

- (1) If removed, install lube fitting (10) on slack adjuster (3).
- (2) Install slack adjuster (3) on S-cam (9) and slide S-cam inward.
- (3) Install spacer (8), new lockwasher (7), washer (6), and retaining ring (5) on S-cam (9).
- (4) Install slack adjuster (3) on brake chamber (4) with clevis pin (2) and new cotter pin (1).

**c. Follow-On Maintenance.**

- (1) Install front brake shoe (Para J-5) or rear brake shoe (Para J-12) as required.
- (2) Start engine and functionally test brake system (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

## 8-6. BRAKE DRUM REPLACEMENT.

This Task Covers:

- |                          |               |               |
|--------------------------|---------------|---------------|
| a. Removal               | b. Cleaning   | c. Inspection |
| d. Installation          | e. Adjustment | f. Testing    |
| g. Follow-On Maintenance |               |               |

### INITIAL SETUP

*Test Equipment*  
None

*References*  
TM 9-214  
TM 9-2610-200-14

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
TM 5-2420-230-10      Wheel and tire removed.

*Materials/Parts*  
Cloth, lint-free, Item 10, Appendix C  
CRC 5-56, Item 40, Appendix C  
Solvent, degreasing, Item 58, Appendix C

*Drawings Required*  
TM 5-2420-230-24P      Figure 101  
TM 5-2420-230-24P      Figure 103

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

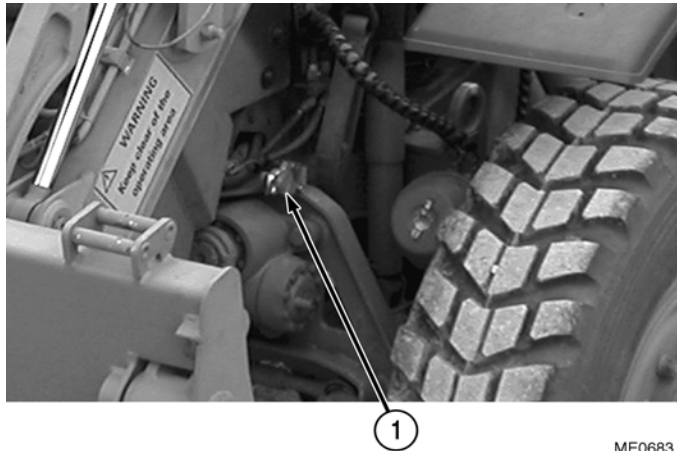
*Estimated Time to Complete*  
Refer to MAC in Appendix B

### NOTE

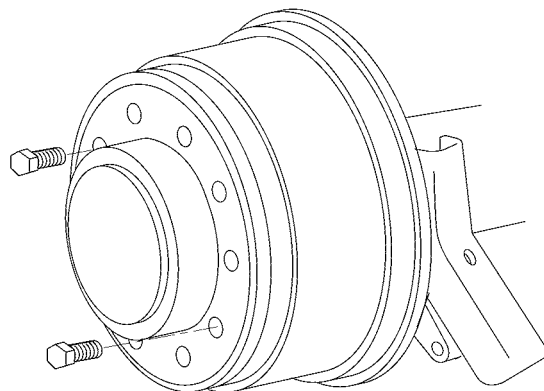
Maintenance procedures are shown for one brake drum only, but are performed the same way for all wheels.

#### a. Removal.

- (1) Release parking brake control. If there is insufficient air in air tanks, connect external air source to front, left glad hand fitting (1) or manually cage spring brake chamber (Para 8-8).
- (2) Rotate brake drum and ensure it rotates freely without binding on brake shoes.
- (3) Remove all paint from hub with wire brush and lubricate with CRC 5-56.
- (4) Remove retaining screw from brake drum to axle hub.
- (5) Install two setscrews into both of tapped holes until tight. Equally tighten both screws to remove brake drum.



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**b. Cleaning.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**WARNING**

- Wear dust mask and eye protection when removing dust from brake drum and mechanism. Failure to comply may result in personal injury.
  - To avoid personal injury, wear protective equipment when using compressed air. Failure to comply may result in injury or death to personnel.
- (1) Using degreasing solvent and a clean cloth, thoroughly remove all dust from brake drum and brake mechanism.
  - (2) Using compressed air, blow dry brake drum and brake mechanism.

**c. Inspection.**

Examination of brake components entails removal of brake drum, cleaning out dust, and inspection and adjustment of brake linings.

- (1) Examine brake drum for signs of scoring, heat cracks, wear, etc. Replace as necessary.
- (2) Inspect brake linings for damage, oil contamination, and wear. The minimum allowable thickness of the liner is 0.3 in. (8 mm), measured at the center of the brake shoe. Replace linings as necessary.
- (3) Inspect brake shoes for signs of glazing, heat cracks, or deterioration. Replace as necessary.
- (4) Check brake shoe rivets for signs of looseness and wear.
- (5) Inspect brake springs, anchor pins, and shoe retainers for signs of damage and/or wear. Replace as necessary.
- (6) Slightly operate brake adjuster and ensure shoe cam actuator moves.

**d. Installation.****CAUTION**

Failure to clean mating surfaces may cause the brake drum to distort upon tightening of wheel nuts.

- (1) Ensure mating surfaces of brake drum and axle flange are clean prior to replacement of brake drum.

- (2) With the aid of an assistant, install brake drum.
- (3) Install and secure brake drum retaining setscrews to a torque of 72-80 lbf/ft (98-109 N•m).
- (4) Install wheel and tire (TM 5-2420-230-10).
- (5) Adjust brakes per procedure provided.

**e. Adjustment.**



To avoid the possibility of the vehicle falling off the safety stands, ensure wheels on other axle are chocked front and rear.

**NOTE**

The procedure to adjust the brakes is carried out to each axle in turn.

- (1) Jack axle until wheels are clear of ground and fit safety stands (Para 2-21).
- (2) Release parking brake (TM 5-2420-230-10).
- (3) Ensure secondary air system is at full operating pressure of 1.15-1.17 psi (7.9-8.1 kPa).
- (4) Ensure spring brake chamber release tool has been removed from rear of chamber and is in stowed position.
- (5) Listen for any air leaks.
- (6) Ensure hub rotates freely.
- (7) Push in tapered locking collar that locks slack adjuster adjusting bolt.
- (8) Using a 9/16-in. wrench, rotate bolt hex head until it becomes fully tight.
- (9) Ensure hub will not rotate.

**NOTE**

Ensure tapered locking collar has locked over flats on hex head.

- (10) With wrench at 12-o'clock position, push in tapered locking collar and rotate bolt hex head in opposite direction by a quarter turn, visually ensuring S-cam rotates as you back off adjustment.
- (11) Rotate hub by hand and feel drag. There should only be very slight drag felt when adjustment is correct.
- (12) If there is excessive or insufficient drag felt by hand, carry out Steps (7) through (11) by rotating slack adjuster adjustment bolt by increments of one flat at a time until correct adjustment is achieved.
- (13) Carry out adjustment procedure for other wheel on axle.
- (14) Upon completion, apply parking brake, jack axle, remove safety stands, and lower axle to ground (Para 2-21).

**NOTE**

Each brake must be individually adjusted.

- (15) Carry out procedure for other axle.
- (16) Test brakes per procedure provided.

**f. Testing.**



The IHMEE requires an escort and may not exceed 42 mph (68 km/h) when operating on primary roads. Failure to comply may result in injury to personnel and/or damage to equipment.

- (1) Take vehicle for test drive (TM 5-2420-230-10). Carry out gentle braking to ensure correct operation of brakes.
- (2) When safe to do so, carry out heavy brake applications at increments of 10 mph (16 km/h) until you are satisfied vehicle is pulling up straight and efficiently at 42 mph (68 km/h).
- (3) When applying brakes heavily at 42 mph (68 km/h), check for the following problems:
  - (a) Is the vehicle pulling to left or right?
  - (b) Are any wheels locking up?
- (4) If vehicle is pulling in any direction or one wheel is locking, readjust brakes.
- (5) Using same procedure, adjust slack adjuster one bolt head flat at a time at relevant wheel, and retest at 42 mph (68 km/h).
- (6) After completing test run and upon returning to depot, travel 12-19 mi. (20-30 km) with no brake applications, stop vehicle and, by hand, feel all four hub reduction cover plates in turn.
- (7) Excessive temperature on one hub indicates a binding brake. Readjust brake on hottest hub.
- (8) Retest brakes. If problem still exists after 12-19 mi. (20-30 km), further investigation must be carried out.

**g. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>8-7. SPRING BRAKE CHAMBER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i>	
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Cloth, lint-free, Item 10, Appendix C Pin, cotter, Item 172, Appendix D Solvent, degreasing, Item 58, Appendix C Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>TM or Para</i> Para 15-4 Para 8-8	<i>Condition Description</i> Air system drained. Spring brake chambers caged.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 136 TM 5-2420-230-24P Figure 138	
	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B	

**a. Removal.**

**WARNING**

- To avoid possible fatal injuries, do not under any circumstances attempt to dismantle the spring brake chambers on the vehicle.
- Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**NOTE**

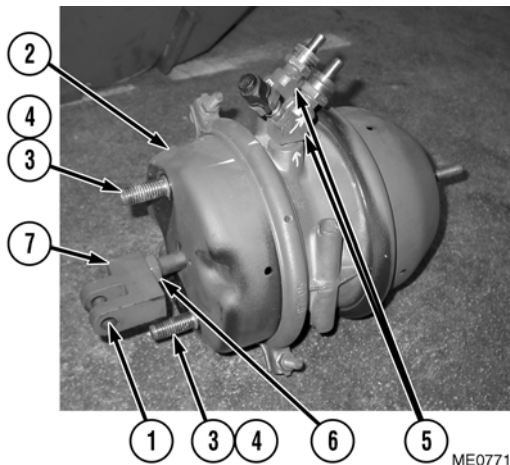
- Tag all hoses, wires, and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.
- All spring brake chambers are removed same way.

- (1) Remove all pneumatic fittings.
- (2) Remove clevis pin (1) and cotter pin from spring brake chamber (2). Discard cotter pin.
- (3) Remove two nuts (3) and washers (4) from spring brake chamber (2).
- (4) Remove spring brake chamber (2).
- (5) Remove supply and return air line elbow fittings (5).

**NOTE**

Note position and thread count on actuator rod.

- (6) Loosen jam nut (6) and remove clevis (7).



**b. Installation.**

Installation of the spring brake chamber is a reversal of the removal procedure with attention given to the following:

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**CAUTION**

Different size spring brake chambers are fitted to each axle. To ensure correct operation of the braking system, ensure correct size is fitted. Failure to comply may result in damage to vehicle.

- (1) Using degreasing solvent and a clean cloth, ensure pneumatic fittings are clean and free from debris.

**NOTE**

When installing clevis, locate in approximately the position noted when removed.

- (2) Install jam nut (6) and clevis (7).
- (3) Ensure all fittings are tightened.

**c. Follow-On Maintenance.**

- (1) Uncage spring brake chambers (Para 8-8).
- (2) Start engine to pressurize air system (TM 5-2420-230-10).
- (3) Check fittings for leaks and proper braking functions.
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Deleted.

**END OF TASK**





**NOTE**

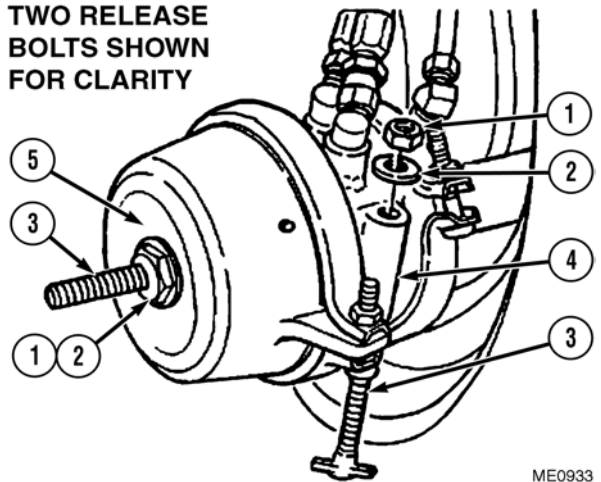
You will experience a large degree of resistance as you are compressing return spring.

- (6) Use adjustable wrench to continue winding nut (1) clockwise until nut bottoms out.
- (7) Stow wheel chocks, if applicable. Vehicle is now ready to be moved.

**b. Uncaging.**

- (1) Use 3/4-in. wrench to unwind nut (1) counterclockwise until nut is fully released.
- (2) Turn release bolt (3) and remove bolt.
- (3) Place release bolt (3), washer (2), and nut (1) in the stowage container on the spring brake chamber (4).
- (4) Tighten nut.

**TWO RELEASE BOLTS SHOWN FOR CLARITY**



**c. Follow-On Maintenance.**

- (1) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>8-9. FOOT TREADLE VALVE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i>	
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C Nut, self-locking, Item 103, Appendix D (3) Pin, cotter, Item 173.1, Appendix D	<i>TM or Para</i> Para 15-4 TM 5-2420-230-10 TM 5-2420-230-10	<i>Condition Description</i> Air system drained. Belly plate removed. Firewall removed
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 133	
	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B	

**a. Removal.**

- (1) Remove floor mats from cabin.
- (2) Remove four bolts from front center floor plate and remove floor plate.
- (3) Remove three self-locking nuts from brake pedal assembly and remove brake pedal. Discard self-locking nuts.
- (4) Remove cotter pin and pin from foot pedal to valve. Discard cotter pin.

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
  - Remove cable ties as necessary.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (5) Remove bolts from foot brake control and remove foot brake control.

**b. Installation.**

Installation of the foot brake control is a reversal of the removal procedure with attention given to the following points:

- (1) Ensure pneumatic fittings are clean and free from debris.
- (2) Ensure supply and exhaust fittings are not cross-connected.
- (3) Ensure all fittings are tightened.

**c. Follow-On Maintenance.**

- (0.1) Install firewall (TM 5-2420-230-10).
- (0.2) Install belly plate (TM 5-2420-230-10).
- (1) Start engine to pressurize air system (TM 5-2420-230-10).
- (2) Check operation of foot brake (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Deleted.

**END OF TASK**



- (2) Ensure all fittings are tightened.

**c. *Follow-On Maintenance.***

- (1) Start engine to pressurize air system (TM 5-2420-230-10).
- (2) Check operation of parking brake (TM 5-2420-230-10).
- (3) Check fittings for leaks.
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

## CHAPTER 9 COOLING SYSTEM

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	9-1	9-1
Vehicle Preparation and Isolation. . . . .	9-2	9-1
Restore IHMEE to Operational Readiness. . . . .	9-3	9-2
Cooling System Servicing. . . . .	9-4	9-2
Radiator Replacement. . . . .	9-5	9-4
Fan and Hydraulic Motor Maintenance. . . . .	9-6	9-6
Transmission Oil Cooler Replacement. . . . .	9-7	9-8
Hydraulic Oil Cooler Replacement. . . . .	9-8	9-10
Coolant Reservoir Replacement. . . . .	9-9	9-11
Fan Shroud Replacement. . . . .	9-10	9-15
Water Pump Replacement. . . . .	9-11	9-16

**9-1. GENERAL.**

This chapter contains the procedures that relate to the removal and installation of components associated with the cooling system. This chapter contains routine maintenance activities and removal and installation procedures for the following components:

- Coolant reservoir
- Radiator
- Cooling fan motor
- Transmission oil cooler
- Fan shroud
- Water pump
- Hydraulic oil cooler

**9-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to commencement of maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**9-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position.
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position, as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**9-4. COOLING SYSTEM SERVICING.**

This Task Covers:

a. Draining	b. Filling	c. Follow-On Maintenance
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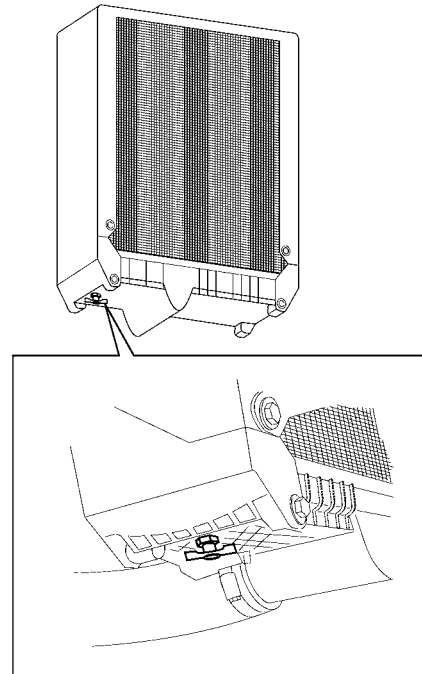
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Pan, drain, Item 29, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
<i>Materials/Parts</i>		
Antifreeze, Item 3, Appendix C	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Cloth, lint-free, Item 10, Appendix C	TM 5-2420-230-10	Hood raised.
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer	None	
<i>References</i>	<i>Estimated Time to Complete Task</i>	
TM 750-254	Refer to MAC in Appendix B	
TB 750-651		

**a. Draining.**

- (1) Place drain pan beneath drain tap on right side of radiator.

**WARNING**

- If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be relieved before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.
- Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.



ME0222

- (2) Open drain tap at bottom of radiator.
- (3) Remove pressure cap from coolant reservoir.
- (4) Close radiator drain tap after all coolant has been drained.

**b. Filling.**

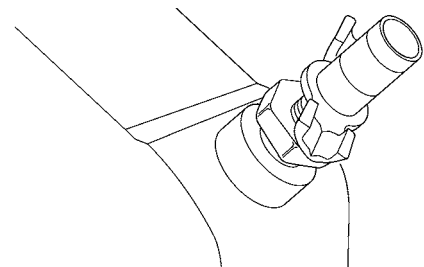
**CAUTION**

The only coolant authorized for use in the IHMEE is Ethylene Glycol. To avoid possible internal damage to the engine cooling system, use only Ethylene Glycol. Water may only be used in an emergency. If water is used, the cooling system must be drained, flushed, and refilled with Ethylene Glycol at the first opportunity. Failure to comply may result in damage to equipment.

**NOTE**

Ethylene Glycol is not supplied ready to use, and must be mixed prior to filling the cooling system. Refer to TB 750-651.

- (1) Open petcock on aftercooler housing.
- (2) Place cab interior heater to HEAT setting.
- (3) Add proper mixture of coolant through coolant reservoir up to bottom level of sight glass.
- (4) Close petcock when all air has been released from system.



ME0223

- (5) Replace coolant reservoir pressure cap to first notch.
- (6) Start engine (TM 5-2420-230-10).
- (7) Allow engine to reach normal operating temperature, then shut OFF engine (TM 5-2420-230-10).
- (8) Inspect coolant level. If necessary, add coolant until level of coolant is visible through sight glass.
- (9) Install coolant reservoir pressure cap.

**c. Follow-On Maintenance.**

- (1) Ensure radiator drain tap is secure.
- (2) Ensure no leaks are present on drain tap or radiator.
- (3) Ensure petcock on aftercooler housing is secure and no leaks are present.
- (4) Ensure coolant reservoir pressure cap is secured and tight.
- (5) Close engine hood and secure clips (TM 5-2420-230-10).
- (6) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>9-5. RADIATOR REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> Para 13-18 Para 9-4 <i>Condition Description</i> Nose cone removed. Cooling system drained.	
<i>Materials/Parts</i> Cardboard, Item 5, Appendix C (2) Ties, cable, Item 68, Appendix C Nut, self-locking, Item 103, Appendix D (12) Nut, self-locking, Item 112, Appendix D (4) Washer, lock, Item 280, Appendix D (18)	<i>Drawings Required</i> TM 5-2420-230-24P Figure 25  <i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)		

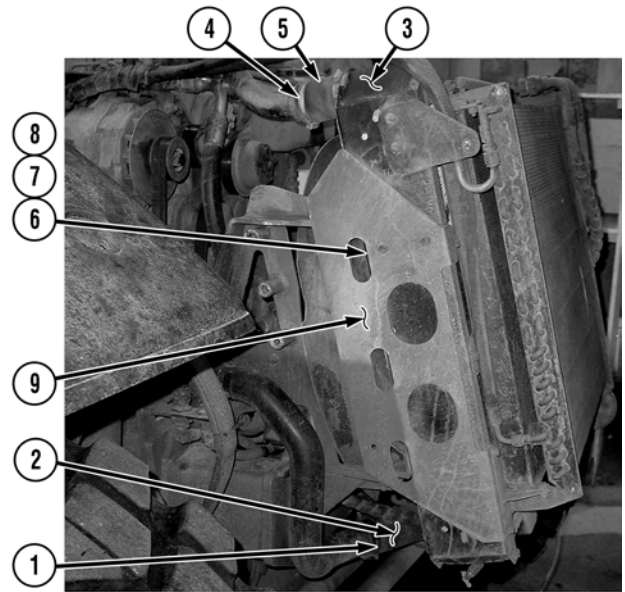


**a. Removal.**

**NOTE**

- It is not necessary to drain the Air-Conditioner (A/C) or hydraulic oil cooler systems to replace the radiator.
- Some coolant will remain in system after draining. Place suitable container under hoses prior to removal.

- (1) Remove four self-locking nuts, lockwashers, flat washers, and bolts securing A/C condenser. Discard self-locking nuts and lockwasher.
- (2) Protect A/C condenser core with cardboard, and place it on right wheel.
- (3) Secure A/C condenser core to fender arm with cable ties.
- (4) Remove eight self-locking nuts, lockwashers, flat washers, four angle brackets, and eight bolts securing hydraulic oil cooler. Discard self-locking nuts and lockwashers.
- (5) Protect hydraulic oil cooler core with cardboard, and place it on left wheel.
- (6) Secure hydraulic oil cooler core to fender arm with cable ties.
- (7) Remove two clamps (1) and lower radiator hoses (2) from radiator (3).
- (8) Remove two clamps (4) and upper radiator hoses (5) from radiator (3).
- (9) Remove six lockwashers (6), washers (7), and bolts (8) from radiator mount bracket (9). Discard lockwashers.
- (10) Remove radiator (3).
- (11) Remove four self-locking nuts, washers, rubber mounts, and bolts on radiator mount bracket (9). Discard self-locking nuts.
- (12) Remove radiator mount bracket (9).



ME0923

**b. Installation.**

- (1) Install four rubber mounts on radiator mount bracket (9) using bolts, washers, and new self-locking nuts.
- (2) Install radiator (3) on radiator mount bracket (9) with six bolts (8), washers (7), and new lockwashers (6). Torque bolts to 40 lbf/ft (54 N•m).
- (3) Install two clamps (4) and upper radiator hoses (5) on radiator (3). Tighten clamps to 50-70 lbf/in (5.6-7.9 N•m).
- (4) Install two clamps (1) and lower radiator hoses (2) on radiator (3). Tighten clamps to 50-70 lbf/in (5.6-7.9 N•m).
- (5) Remove cable ties securing hydraulic oil cooler core.
- (6) Remove cardboard and install hydraulic oil cooler with eight bolts, new lockwashers, flat washers, four angle brackets, and new self-locking nuts. Torque bolts to 11 lbf/ft (15 N•m).
- (7) Remove cable ties securing A/C condenser.
- (8) Remove cardboard and install A/C condenser with four bolts, new lockwashers, flat washers, and new self-locking nuts. Torque bolts to 11 lbf/ft (15 N•m).

**c. Follow-On Maintenance.**

- (1) Fill cooling system (Para 9-4).
- (2) Install nose cone (Para 13-18).

**END OF TASK**

**9-6. FAN AND HYDRAULIC MOTOR MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Inspection
- d. Assembly
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*References*  
None

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Key, square, Item 93, Appendix D  
Key, square, Item 94, Appendix D  
Nut, self-locking, Item 103, Appendix D (14)  
Seal, bearing, Item 234, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Equipment Conditions*  
*TM or Para*                      *Condition Description*  
Para 9-5                              Radiator removed.

*Drawings Required*  
TM 5-2420-230-24P Figure 27

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

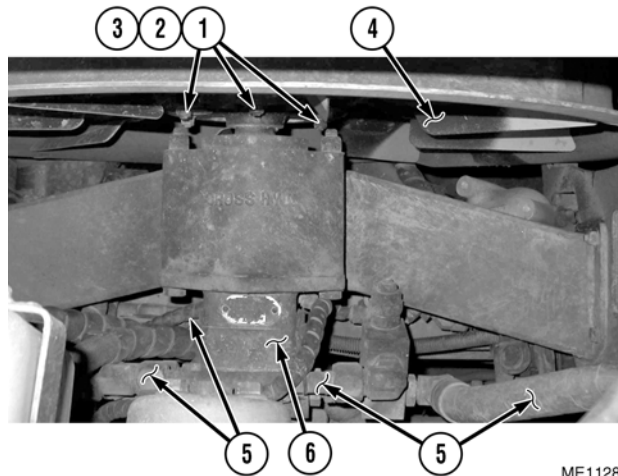
**NOTE**

- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.

- (1) Remove six bolts (1), 12 washers (2), and six self-locking nuts (3) and fan blade (4). Discard self-locking nuts.

**WARNING**

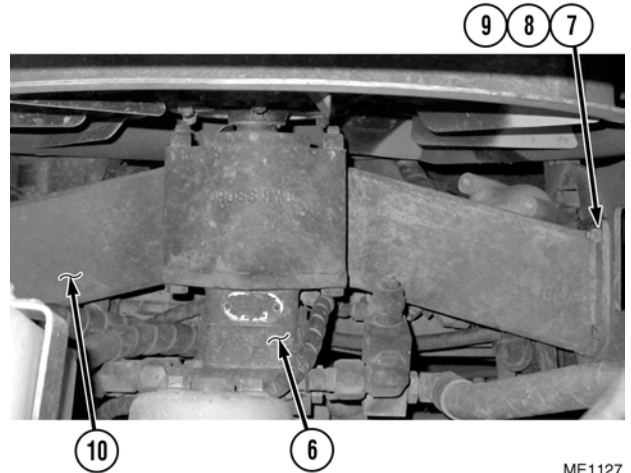
Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.



ME1128

- (2) Place drain pan and disconnect four hydraulic connector hoses (5) from fan hydraulic motor (6).

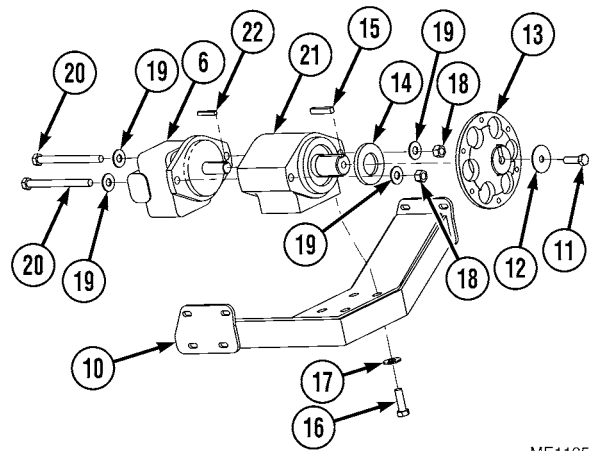
- (3) Remove eight bolts (7), 16 washers (8), and eight self-locking nuts (9) securing fan motor support (10) to chassis. Discard self-locking nuts.
- (4) Remove fan hydraulic motor (6) and fan motor support (10) from engine bay.



ME1127

**b. Disassembly.**

- (1) Remove bolt (11), washer (12), and fan hub (13).
- (2) Remove bearing seal (14). Discard seal.
- (3) Remove key (15). Discard key.
- (4) Remove four bolts (16), washers (17), and fan hydraulic motor (6) from fan motor support (10).
- (5) Remove two nuts (18), washers (19), and bolts (20).
- (6) Separate fan hydraulic motor (6) from bearing housing (21).
- (7) Remove key (22). Discard key.



ME1125

**c. Inspection.**

Inspection of the fan and hydraulic motor is limited to visual inspection. In the event of a failure of the pump or motor, a complete overhaul of the hydraulic system must be carried out. Visually inspect fan and hydraulic motor.

**d. Assembly.**

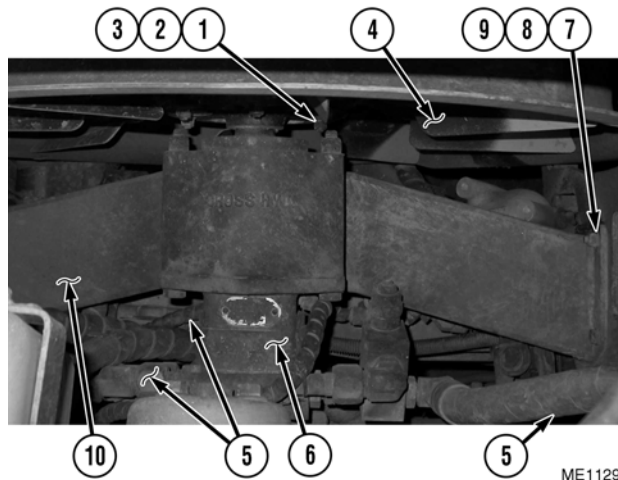
- (1) Install new key (22).
- (2) Place fan hydraulic motor (6) on clean mating surface of bearing housing (21).
- (3) Install two bolts (20), washers (19), and nuts (18).
- (4) Install fan hydraulic motor (6) on fan motor support (10) with four washers (17) and bolts (16).
- (5) Install new key (15).
- (6) Install new bearing seal (14).
- (7) Install fan hub (13) with washer (12) and bolt (11).

**e. Installation.**

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Position fan hydraulic motor (6) and fan motor support (10) in engine bay.
- (2) Connect four hydraulic connector hoses (5) to fan hydraulic motor (6).
- (3) Install fan motor support (10) to chassis with eight bolts (7), 16 washers (8), and eight new self-locking nuts (9). Tighten bolts.
- (4) Install fan blade (4) with six bolts (1), 12 washers (2), and six new self-locking nuts (3). Tighten bolts.



**f. Follow-On Maintenance.**

- (1) Install radiator (Para 9-5).
- (2) Check hydraulic oil level and fill as necessary (TM 5-2420-230-10).
- (3) Start engine (TM 5-2420-230-10) and check for hydraulic leaks.
- (4) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

**9-7. TRANSMISSION OIL COOLER REPLACEMENT.**

This Task Covers:

- |                          |             |                 |
|--------------------------|-------------|-----------------|
| a. Removal               | b. Cleaning | c. Installation |
| d. Follow-On Maintenance |             |                 |

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Solvent, degreasing, Item 58, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 280, Appendix D

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Hood raised.
Para 9-4	Cooling system drained.

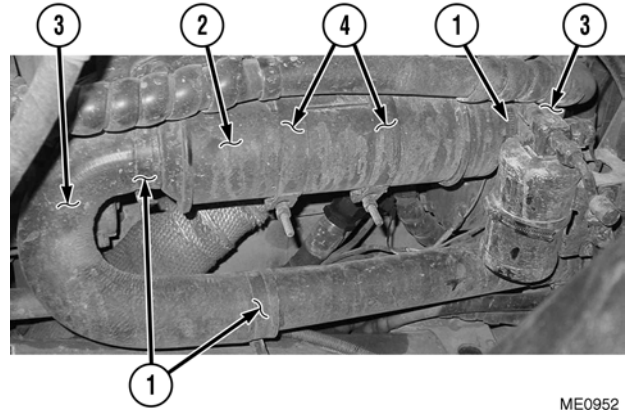
*Drawings Required*  
TM 5-2420-230-24P Figure 30

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

**NOTE**

- Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
- (1) Place drain pan and loosen three hose clamps (1) on transmission oil cooler (2).
  - (2) Remove two hoses (3) from transmission oil cooler (2).
  - (3) Loosen two mounting clamps (4) on transmission oil cooler (2). Discard lockwashers.
  - (4) Remove transmission oil cooler (2) from mounting clamps (4).



ME0952

**b. Cleaning.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

The transmission oil cooler must be cleaned with degreasing solvent at every transmission overhaul or installation.

**c. Installation.**

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Install transmission oil cooler (2) into two mounting clamps (4).
  - (2) Install two hoses (3) on transmission oil cooler (2) with three hose clamps (1). Tighten clamps to 50-70 lbf/in (5.6-7.9 N•m).

**d. Follow-On Maintenance.**

- (1) Fill cooling system (Para 9-4).
- (2) Check hydraulic oil level and fill as necessary (TM 5-2420-230-10).
- (3) Start engine (TM 5-2420-230-10) and check for leaks.
- (4) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

**9-8. HYDRAULIC OIL COOLER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Pan, drain, Item 29, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Cap and plug set, Item 4, Appendix C  
 Cardboard, Item 5, Appendix C  
 Nut, self-locking, Item 103, Appendix D (8)  
 Nut, self-locking, Item 112, Appendix D (4)  
 Tags, identification, Item 63, Appendix C  
 Ties, cable, Item 68, Appendix C  
 Washer, lock, Item 280, Appendix D (12)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 10-5	Hydraulic pressure released.
Para 13-18	Nose cone removed.

*Drawings Required*

TM 5-2420-230-24P Figure 25

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**

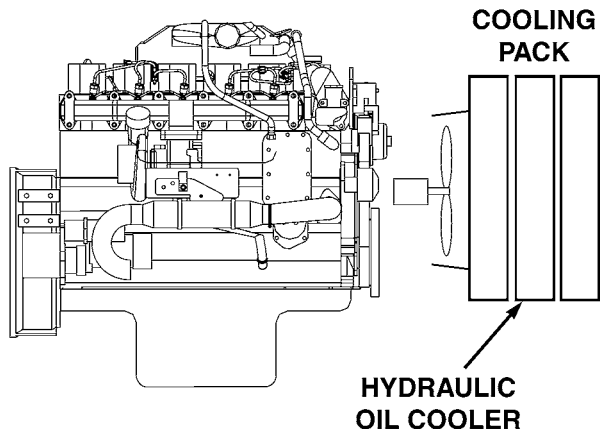
**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.
- It is not necessary to drain the Air-Conditioner (A/C) to replace the hydraulic oil cooler.

- (1) Place drain pan and remove hose clamps securing hydraulic oil cooler hoses.
- (2) Remove four self-locking nuts, lockwashers, flat washers, and bolts securing A/C condenser. Discard self-locking nuts and lockwashers.
- (3) Protect A/C condenser core with cardboard, and place it on right wheel.
- (4) Secure A/C condenser core to fender arm with cable ties.



ME0181

**WARNING**

To prevent injury from hot, spraying oil, do not remove hydraulic connection hoses until engine is cool.

- (5) Disconnect all hydraulic oil cooler lines from oil cooler.
- (6) Remove eight self-locking nuts, lockwashers, washers, and bolts securing hydraulic oil cooler. Discard self-locking nuts and lockwashers.
- (7) Remove hydraulic oil cooler.

**b. Inspection.**

**NOTE**

In the event of a hydraulic pump failure, the hydraulic oil cooler must be thoroughly flushed and cleaned.

- (1) Inspect oil cooler core for signs of blocked air fins. Check oil cooler core for signs of damage or fin deterioration. Repair as necessary.
- (2) Check oil cooler hose fittings for signs of leakage and/or damage. Repair as necessary.

**c. Installation.**

Installation of the hydraulic oil cooler is the reversal of the removal procedure with attention given to the following:

Ensure all hydraulic hoses are secure and no leaks are evident.

**d. Follow-On Maintenance.**

- (1) Start engine and check for leaks (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Install nose cone (Para 13-18).
- (4) Refill hydraulic oil (TM 5-2420-230-10).

**END OF TASK**

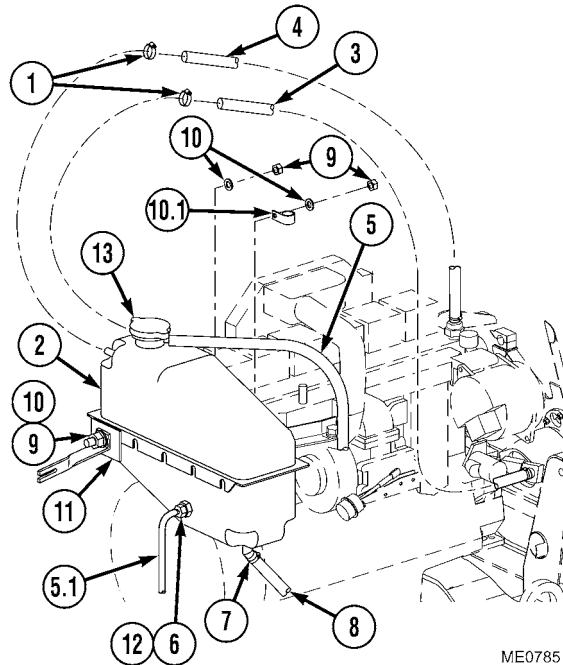
<b>9-9. COOLANT RESERVOIR REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> Para 9-4	
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Compound sealing, Loctite 567, Item 22, Appendix C Nut, self-locking, Item 110, Appendix D Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>Condition Description</i> Cooling system drained.	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 26	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.

- (1) Loosen two hose clamps (1) on top of coolant reservoir (2).
- (2) Remove hose (3) leading to radiator.
- (3) Remove hose (4) leading to thermostat housing.
- (4) Remove overflow hose (5) from filler neck on coolant reservoir (2).
- (5) Disconnect electrical wire (5.1) from low coolant sensor (6) on rear of coolant reservoir (2).
- (6) Loosen hose clamp (7) on bottom of coolant reservoir (2) and remove hose (8).
- (7) Remove three self-locking nuts (9), washers (10), and cushion clip (10.1) securing coolant reservoir (2) to support bracket (11). Discard self-locking nuts.
- (8) Remove coolant reservoir (2).
- (9) If necessary, remove low coolant sensor (6), adapter (12), and filler cap (13) from coolant reservoir (2).



ME0785



**b. Installation.**

**WARNING**

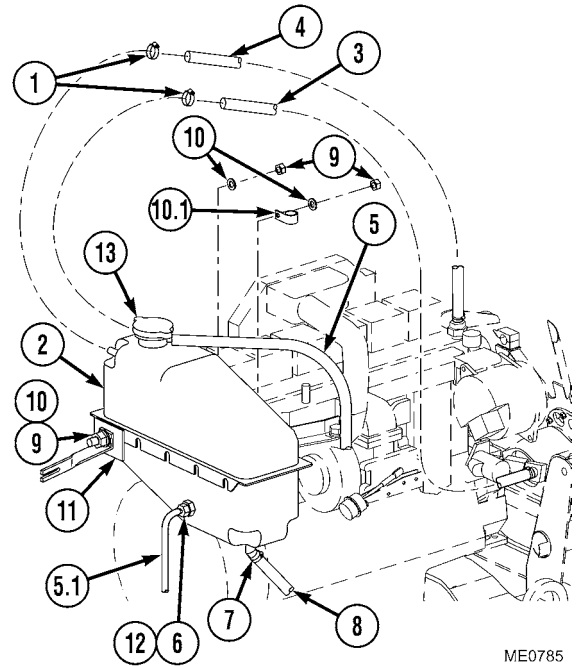
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from fire and use in well-ventilated area. If adhesive, solvents, or sealing compound get on skin or clothing, wash immediately with soap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

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Perform Steps (0.1) and (1) if removed.

(0.1) Apply sealing compound, Loctite 567, to threads of low coolant sensor (6) and adaptor (12).

- (1) Install low coolant sensor (6), adaptor (12), and filler cap (13) on coolant reservoir (2).
- (2) Place coolant reservoir (2) on bracket.
- (3) Install three new self-locking nuts (9) and washers (10) securing coolant reservoir (2) to support bracket (11).
- (4) Install hose (8) and tighten hose clamp (7) on bottom of coolant reservoir (2).
- (5) Connect electrical wire (5.1) to low coolant sensor (6) on rear of coolant reservoir (2).
- (6) Install overflow hose (5) connecting to filler neck on coolant tank reservoir (2).
- (7) Install hose (4) leading to thermostat housing.
- (8) Install hose (3) leading to radiator.
- (9) Tighten two hose clamps (1) on top of coolant reservoir (2).



ME0785

**c. Follow-On Maintenance.**

Fill cooling system (Para 9-4).

**END OF TASK**



**9-10. FAN SHROUD REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 9-5      Radiator removed.

*Materials/Parts*  
Washer, lock, Item 280, Appendix D (10)

*Drawings Required*  
TM 5-2420-230-24P Figure 25

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

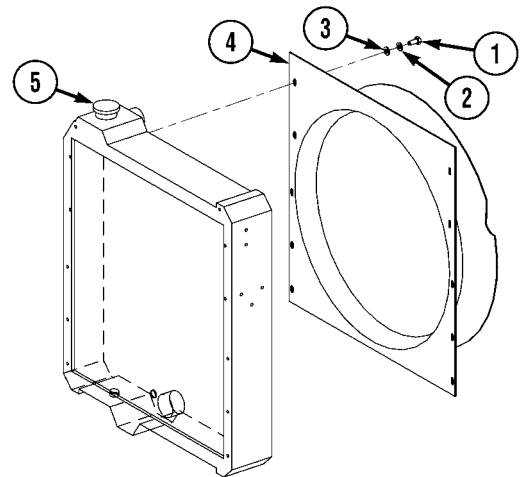
Remove 10 bolts (1), lockwashers (2), washers (3), and fan shroud (4) from radiator (5). Discard lockwashers.

**b. Installation.**

Install 10 washers (3), new lockwashers (2), and bolts (1) to secure fan shroud (4) to the radiator (5).

**c. Follow-On Maintenance.**

Install radiator (Para 9-5).



**END OF TASK**

ME0864

**9-11. WATER PUMP REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Antifreeze, Item 3, Appendix C  
Gasket, Item 65, Appendix D

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

<i>Equipment Conditions</i>	
<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Hood raised.
Para 9-4	Cooling system drained.

*Drawings Required*  
TM 5-2420-230-24P Figure 28

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

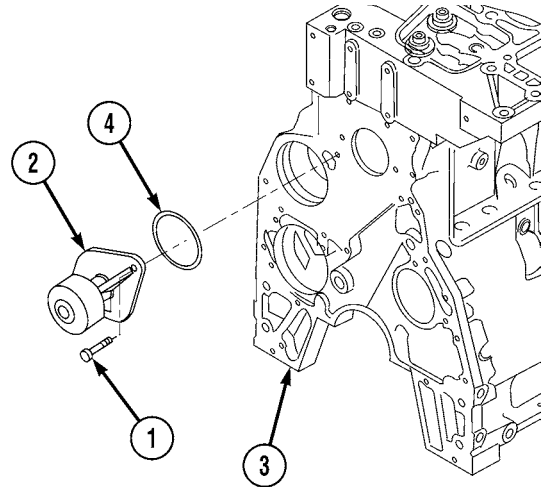
- (1) Remove two bolts (1) and water pump (2) from engine (3).
- (2) Remove gasket (4). Discard gasket.

**b. Installation.**

Install new gasket (4) and water pump (2) on engine (3) with two bolts (1).

**c. Follow-On Maintenance.**

Fill cooling system (Para 9-4).



ME1041

**END OF TASK**

## CHAPTER 10

### HYDRAULIC SYSTEM

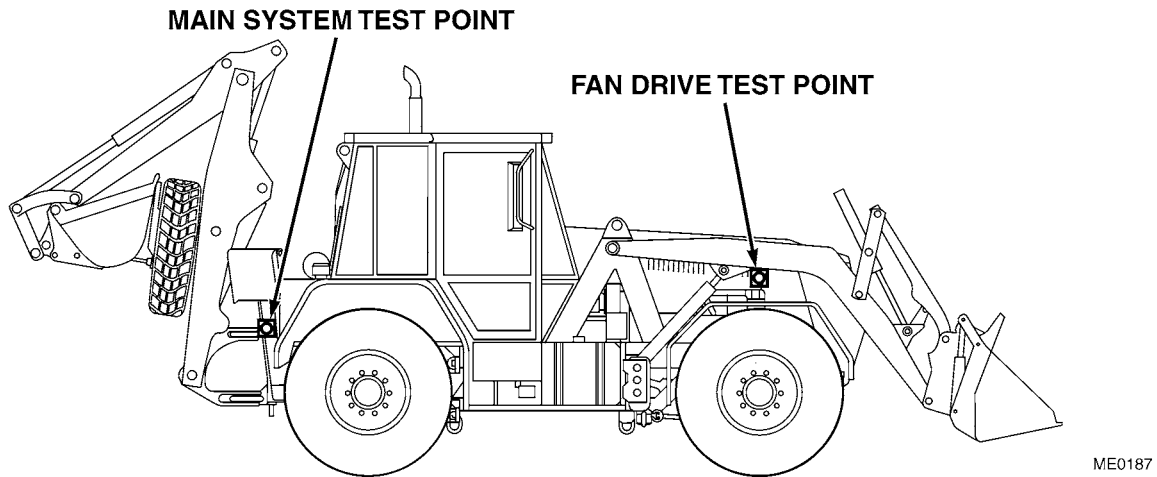
<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	10-1	10-1
Standard Hydraulic Procedures. . . . .	10-2	10-2
Vehicle Preparation and Isolation. . . . .	10-3	10-2
Restore IHMEE to Operational Readiness. . . . .	10-4	10-3
Releasing Hydraulic Pressure. . . . .	10-5	10-3
Hydraulic Pressure Testing. . . . .	10-6	10-6
Hydraulic Flow Testing. . . . .	10-7	10-8
Valve Block Service. . . . .	10-8	10-10
Hydraulic Oil Servicing. . . . .	10-9	10-12
Hydraulic Oil Filter Replacement. . . . .	10-10	10-13
Hydraulic Reservoir Maintenance. . . . .	10-11	10-15
Hydraulic Reservoir Sight Glass Replacement. . . . .	10-12	10-18
Hydraulic Oil Pump Replacement. . . . .	10-13	10-19
General Hydraulic Hose Replacement. . . . .	10-14	10-21
FEL Valve Block Maintenance. . . . .	10-15	10-23
Backhoe Valve Block Maintenance. . . . .	10-16	10-27
Bucket Cylinder Maintenance. . . . .	10-17	10-33
Boom Cylinder Maintenance. . . . .	10-18	10-36
Dipper Cylinder Maintenance. . . . .	10-19	10-39
Swing Cylinder Replacement. . . . .	10-20	10-42
Stabilizer Cylinder Replacement. . . . .	10-21	10-44
FEL Lift Cylinder Replacement. . . . .	10-22	10-47
Tilt Cylinder Maintenance. . . . .	10-23	10-50
Tilt Linkages Replacement. . . . .	10-24	10-53
4-In-1 Bucket Cylinder Maintenance. . . . .	10-25	10-54
Hydraulic Calibration Procedure. . . . .	10-26	10-56
Hydraulic Oil Sampling Valve Replacement. . . . .	10-27	10-61
General Hydraulic Cylinder Repair. . . . .	10-28	10-63
Hose Reel Assembly Maintenance. . . . .	10-29	10-67
Hose Reel Roller Replacement. . . . .	10-30	10-74
Hose Reel Spring Motor Replacement. . . . .	10-31	10-77
Hose Reel Switch Replacement. . . . .	10-32	10-80
Hose Reel Valve Replacement. . . . .	10-33	10-83
Hose Reel Hose Assembly Replacement. . . . .	10-34	10-85

**10-1. GENERAL.**

This section contains procedures that relate to maintenance activities detailed in Chapter 3, Preventive Maintenance Checks and Services (PMCS). The following components are covered in this section:

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Hydraulic oil</li> <li>• Hydraulic oil reservoir</li> <li>• Hydraulic oil lines and hoses</li> <li>• Hydraulic controls</li> <li>• Hydraulic calibration procedure</li> </ul> | <ul style="list-style-type: none"> <li>• Hydraulic oil filter</li> <li>• Hydraulic oil pump</li> <li>• Hydraulic cylinders</li> <li>• Hydraulic valve blocks</li> <li>• Hydraulic function test</li> </ul> |
|--|--|

## 10-2. STANDARD HYDRAULIC PROCEDURES.



- (1) Tag all hoses, wires, and tubes and note their positions before removal.
- (2) Ensure all hoses and tubes are disconnected and clear before removal.

### **CAUTION**

Cleanliness is essential for the correct and safe operation of the hydraulic system. Failure to comply may result in damage to equipment.

- (3) Ensure dirt and debris are not allowed to enter hydraulic system by capping and plugging all tubes, hoses, and fittings upon removal.
- (4) Remove cable ties as necessary.

## 10-3. VEHICLE PREPARATION AND ISOLATION.

### **a. Preparation.**

Prior to performing any maintenance procedures on the Interim High-Mobility Engineer Excavator (IHMEE), perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise Front-End Loader (FEL), install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach "Do Not Operate" tag to ignition switch (TM 5-2420-230-10).

**10-4. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position, as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**10-5. RELEASING HYDRAULIC PRESSURE.**

This Task Covers:

- a. Release Hydraulic System Pressure
- b. Release FEL Lift and Tilt Cylinder Hydraulic System Pressure
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
FO-4, Hydraulic schematic

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B  
Hydraulic valve manual override lever, BII,  
TM 5-2420-230-10

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	FEL and backhoe travel stops deployed.
TM 5-2420-230-10	Engine access panel removed.
TM 5-2420-230-10	Backhoe valve guard removed (for backhoe valve only).

*Materials/Parts*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Drawings Required*  
None

*Estimated Time to Complete*  
0.3 hr.

**a. Release Hydraulic System Pressure.**

**WARNING**

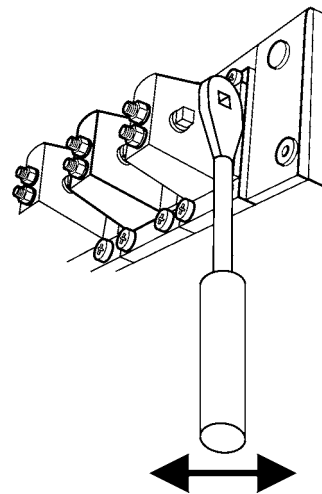
- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

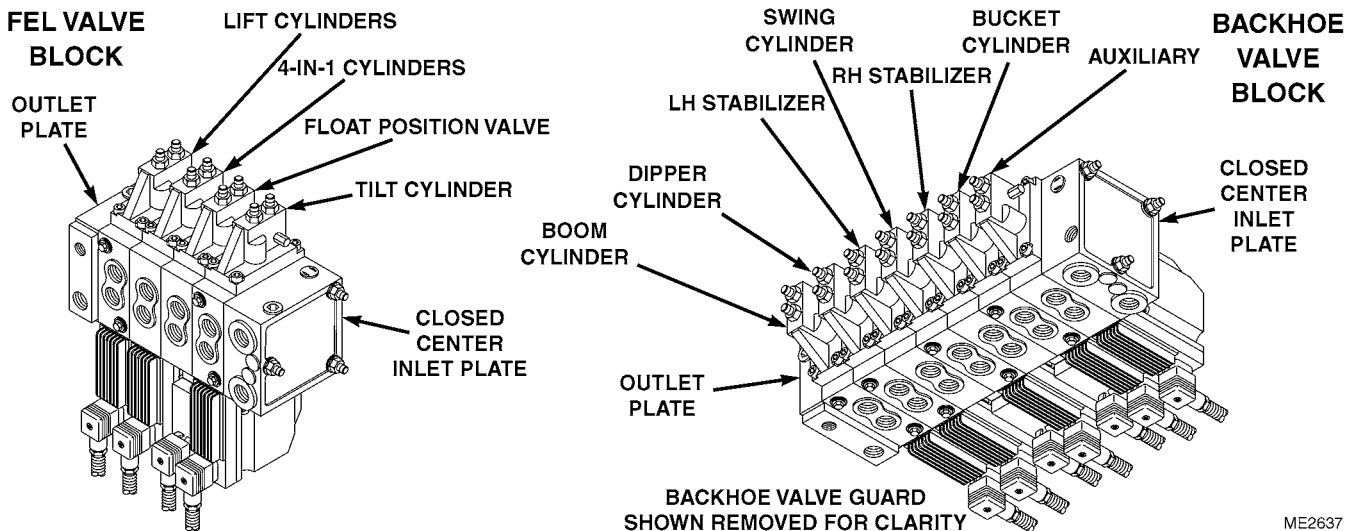
The FEL lift cylinder and tilt cylinders are fitted with load-holding valves. The following procedure will not release hydraulic pressure contained in them.

Prior to working on any hydraulic circuit, release hydraulic pressure:

- (1) Locate FEL hydraulic valve block at base of windshield.
- (2) Use hydraulic valve manual override lever to operate each valve back and forth until all hydraulic pressure is exhausted.
- (3) Locate backhoe hydraulic valve block under backhoe top plate.
- (4) Use hydraulic valve manual override lever to operate each valve back and forth until all pressure is exhausted.



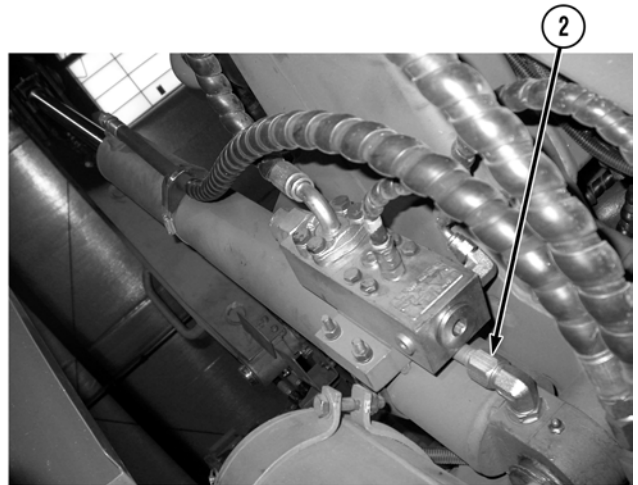
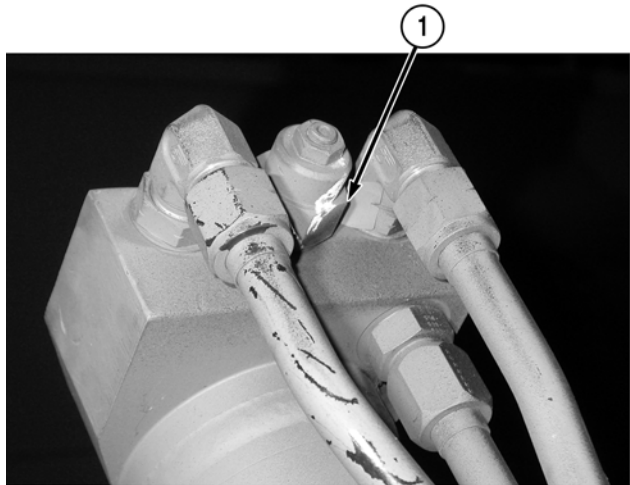
ME2636



ME2637



**b. Release FEL Lift and Tilt Cylinder Hydraulic System Pressure.**



ME0976

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (1) Release hydraulic pressure in tilt cylinders by rotating load-holding valve (1) one-quarter to one-half turn only on both tilt cylinders. After pressure is released, tighten load-holding valve (1) on both tilt cylinders.
- (2) Loosen hydraulic fitting (2) one-quarter to one-half turn only between load-holding valve and cylinder on both FEL lift cylinders. After hydraulic pressure has been released, tighten both hydraulic fittings (2).

**c. Follow-On Maintenance.**

- (1) Install engine access panel (TM 5-2420-230-10).
- (2) Install backhoe valve guard (TM 5-2420-230-10).

**END OF TASK**

## 10-6. HYDRAULIC PRESSURE TESTING.

This Task Covers:

- a. Testing
- b. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*

Gauge, pressure, capable of measuring 0 to 3,500 psi (0 to 24 132 kPa)

*Tools and Special Tools*

Hydraulic valve manual override lever, BII, TM 5-2420-230-10  
 Tool kit, general mechanics, Item 38, Appendix B  
 Tool outfit, HSTRU, Item 40.1, Appendix B

*Materials/Parts*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*References*

FO-4, Hydraulic schematic

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Spare tire and carrier assembly removed.
TM 5-2420-230-10	FEL and backhoe travel stops deployed.
TM 5-2420-230-10	Engine access panel removed (if required).

*Drawings Required*

None

*Estimated Time to Complete*

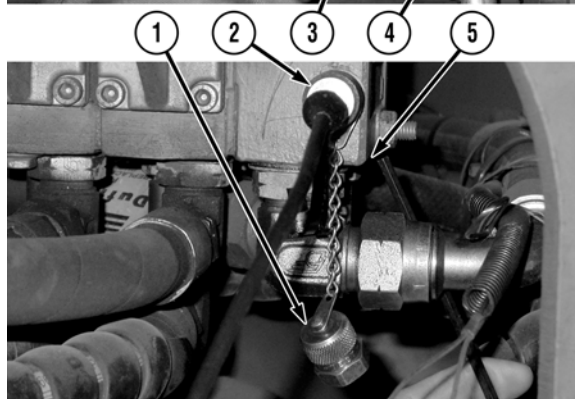
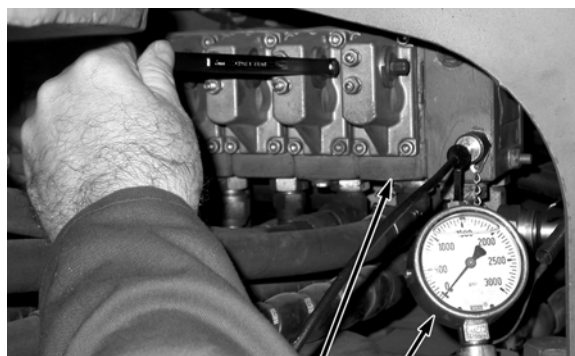
Refer to MAC in Appendix B

### a. Testing.

- (1) Remove cap (1) from test port (2) on backhoe valve block (3).
- (2) Install gauge (4) on test port (2).
- (3) Start engine and ensure engine speed is at idle and hydraulic master switch is in OFF position (TM 5-2420-230-10).
- (4) Use hydraulic valve manual override lever to stall out backhoe bucket hydraulic circuit on backhoe valve block (3).
- (5) Observe gauge (4). Gauge should read 3,000 psi (20 684 kPa).

### NOTE

- Backhoe relief valve only requires small amount of rotation to properly adjust hydraulic pressure.
- Turning backhoe relief valve clockwise increases hydraulic pressure and turning counterclockwise lowers the pressure.



ME2219

- (6) If pressure is not 3,000 psi (20 684 kPa), use 6-mm Allen wrench to rotate backhoe relief valve (5) until the correct pressure is displayed on gauge (4).

- (7) Remove engine access panel (TM 5-2420-230-10).

**NOTE**

If pressure is set at 3,000 psi (20 684 kPa), go to Step (12). If pressure will not adjust to 3,000 psi (20 684 kPa), go to Step (8).

- (8) With the aid of an assistant, use hydraulic valve manual override lever to stall out 4-in-1 bucket hydraulic circuit on FEL valve block (6).
- (9) Observe gauge (4). Gauge should read 3,000 psi (20 684 kPa).

**NOTE**

- FEL relief valve only requires small amount of rotation to properly adjust hydraulic pressure.
- Turning FEL relief valve clockwise increases hydraulic pressure and turning counterclockwise lowers the pressure.

- (10) With the aid of an assistant, use 6-mm Allen wrench to rotate FEL relief valve (7) until the correct pressure is displayed on gauge (4).

**NOTE**

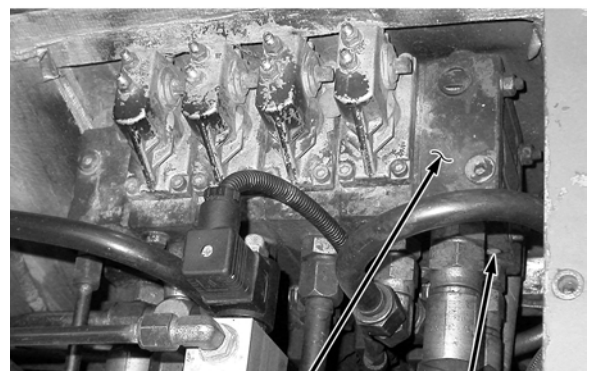
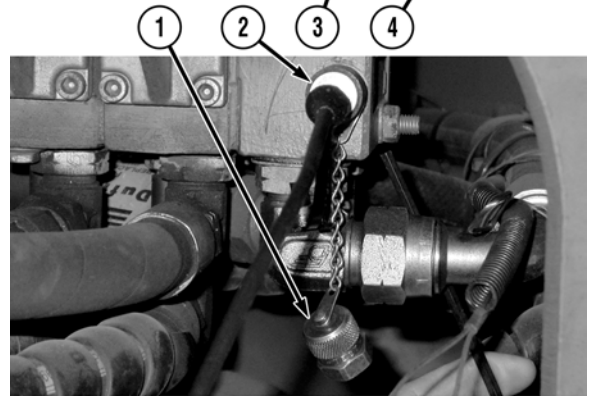
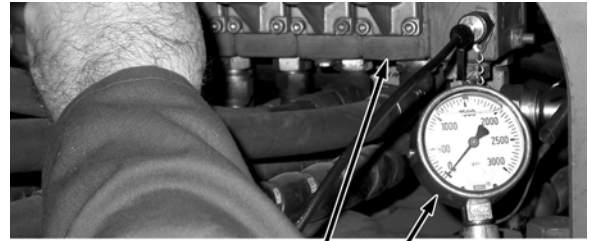
If pressure is set at 3,000 psi (20 684 kPa), go to Step (12). If pressure will still not adjust to 3,000 psi (20 684 kPa), go to Step (11).

- (11) Perform hydraulic flow test (Para 10-7).
- (12) Shut OFF engine (TM 5-2420-230-10).
- (13) Remove gauge (4) from test port (2) on backhoe valve block (3).
- (14) Install cap (1) on test port (2).

**b. Follow-On Maintenance.**

- (1) If removed, install engine access panel (TM 5-2420-230-10).
- (2) Install spare tire and carrier assembly (TM 5-2420-230-10).

**END OF TASK**



ME2222

**10-7. HYDRAULIC FLOW TESTING.**

This Task Covers:

- a. Testing
- b. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

Flow meter, capable of measuring 30 gpm (114 L/min)

*References*

FO-4, Hydraulic schematic

*Tools and Special Tools*

- Pan, drain, Item 29, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Tool outfit, HSTRU, Item 40.1, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 10-5	Hydraulic system pressure released (engine access panel left uninstalled).

*Materials/Parts*

None

*Drawings Required*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete*

Refer to MAC in Appendix B

**a. Testing.**

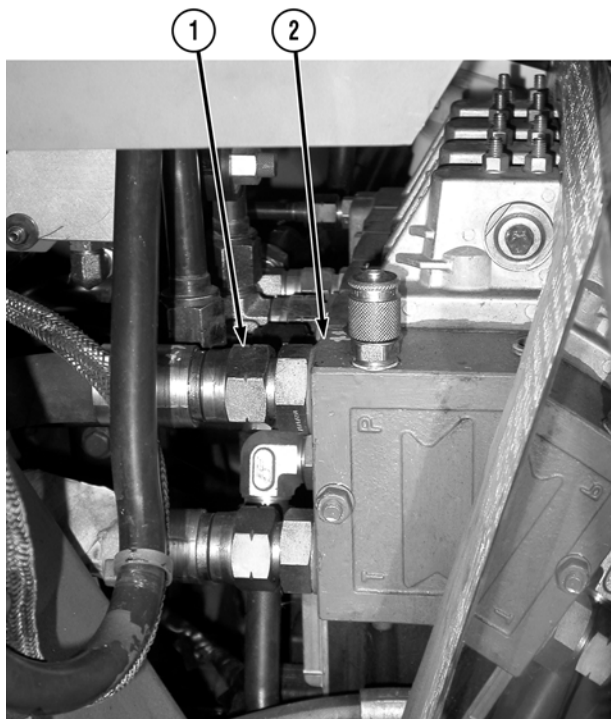
- (1) Place drain pan beneath supply hose (1) and FEL valve block (2)

**WARNING**

- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.
- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.

**NOTE**

- Ensure no 90-degree elbows or hoses with tight bends are used when connecting flow meter.
  - Ensure suitable hoses and fittings are used when connecting flow meter.
- (2) Disconnect supply hose (1) from FEL valve block (2).



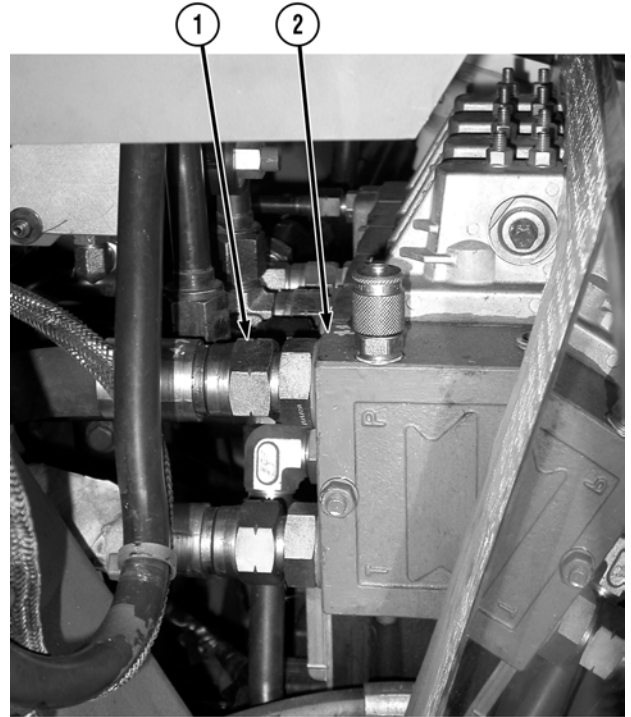
ME2218

- (3) Connect supply hose (1) to suitable flow meter using suitable fittings as required.
- (4) Using suitable hose and fittings, connect outlet port on flow meter to FEL valve block (2).
- (5) Ensure all hoses and fittings are tightened.

**NOTE**

Carefully read and follow any additional operating instructions provided by the flow meter manufacturer.

- (6) Start engine and set hand throttle to maintain engine speed at 2,000 RPM (TM 5-2420-230-10).
- (7) Observe gauge on flow meter. Flow rate should read no less than 24 gpm (91 L/min).
- (8) For further guidance, refer to and follow any applicable testing procedures or instructions accompanying flow meter.
- (9) Shut OFF engine (TM 5-2420-230-10).



ME2218

**WARNING**

- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.
  - The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- (10) Disconnect flow meter outlet hose from FEL valve block (2).
  - (11) Disconnect supply hose (1) from flow meter.
  - (12) Connect supply hose (1) to FEL valve block (2). Tighten hose.

**b. Follow-On Maintenance.**

- (1) Check for leaks.
- (2) Install engine access panel (TM 5-2420-230-10).

**END OF TASK**

**10-8. VALVE BLOCK SERVICE.**

This Task Covers:

- a. Servicing
- b. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
FO-4, Hydraulic schematic

*Tools and Special Tools*  
Hydraulic valve manual override lever, BII,  
TM 5-2420-230-10

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
TM 5-2420-230-10      FEL and backhoe travel stops  
TM 5-2420-230-10      deployed.

*Materials/Parts*  
None

TM 5-2420-230-10      Engine access panel removed.  
TM 5-2420-230-10      Backhoe valve guard removed.

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Drawings Required*  
None

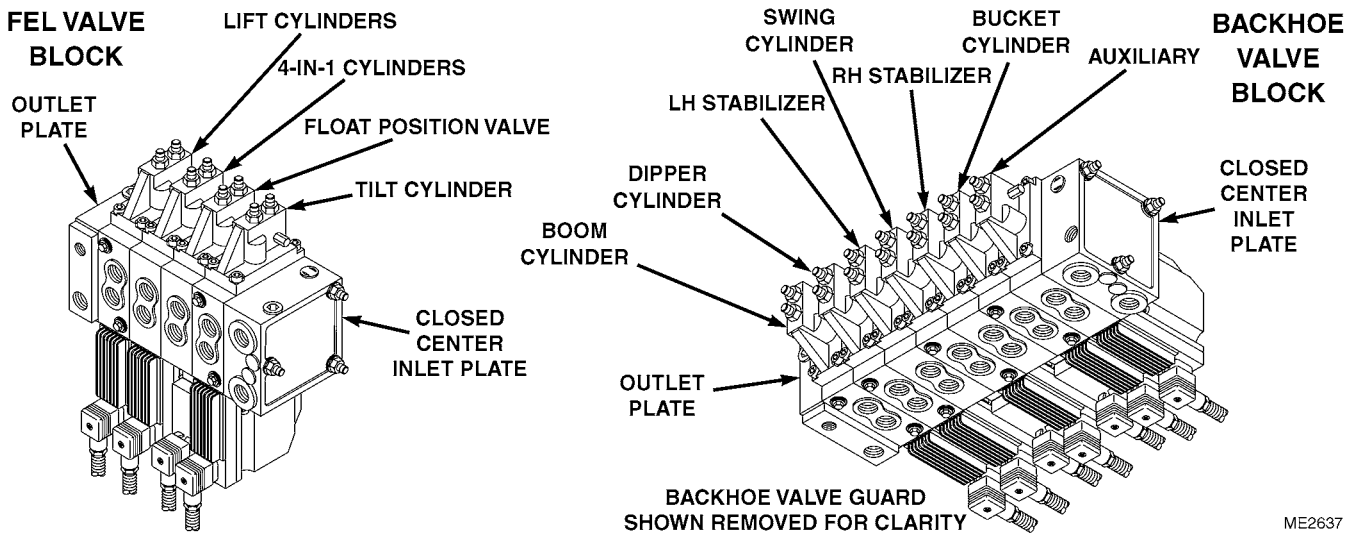
*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Servicing.**

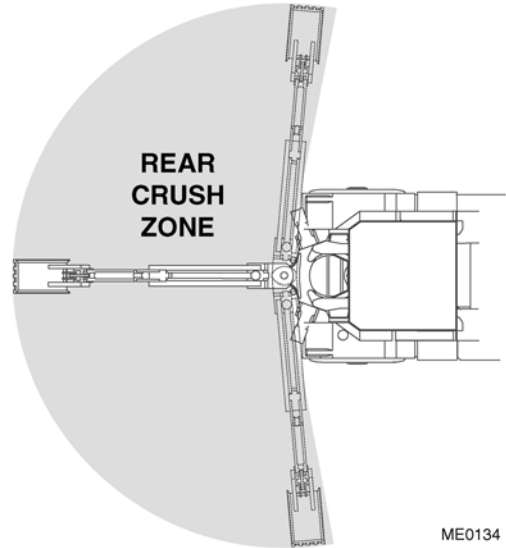
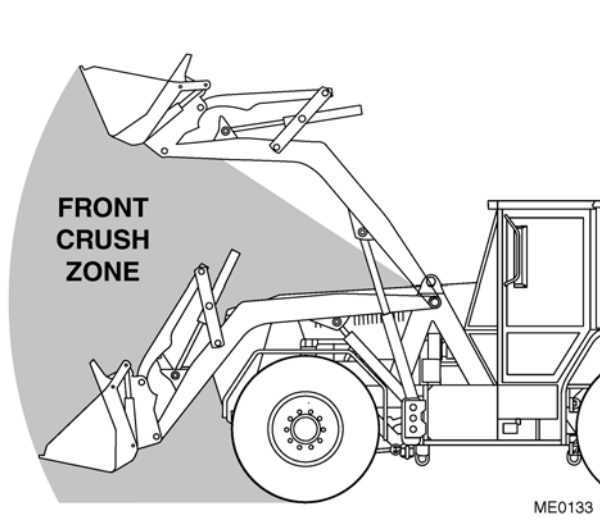


Every spool on the FEL and backhoe valve blocks must be manually operated. This is required to exercise the valve and flush any foreign matter that may cause the valve to fail. Failure to complete the following procedure may result in damage to equipment.

- (1) Start engine and ensure hydraulic master switch is OFF (TM 5-2420-230-10).



ME2637



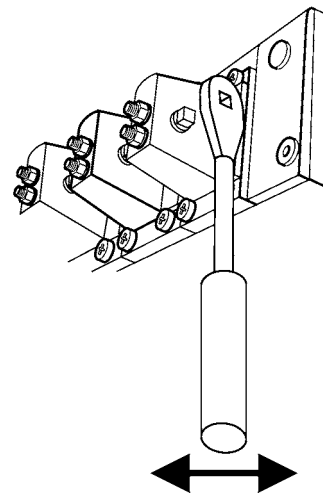
**WARNING**

You are within the backhoe crush zone when operating the backhoe valves. Ensure backhoe swing pin is in place to prevent backhoe from swinging and causing injury or death to personnel.

- (2) Locate backhoe hydraulic valve block under backhoe top plate. Use hydraulic valve manual override lever to operate every valve on FEL and backhoe valve blocks through its full range.
- (3) Shut OFF engine (TM 5-2420-230-10).

**b. Follow-On Maintenance.**

- (1) Install engine access panel (TM 5-2420-230-10).
- (2) Install backhoe valve guard (TM 5-2420-230-10).



**END OF TASK**

**10-9. HYDRAULIC OIL SERVICING.**

This Task Covers:

- a. Preparation
- b. Draining
- c. Refilling
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
FO-4, Hydraulic schematic

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Hood raised.
TM 5-2420-230-10	Front, left-hand belly plate removed.

*Materials/Parts*  
Compound, sealing, pipe thread, Item 22, Appendix C  
Dexron III, Item 27, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 152

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Preparation.**

**NOTE**

To raise the temperature of the hydraulic system oil, operate FEL or backhoe for 5 min.

- (1) Ensure hydraulic system is at normal operating temperature. This can be determined by feeling the hydraulic reservoir; it should be warm.
- (2) Ensure hydraulic components on IHMEE are in retracted position (TM 5-2420-230-10).

**b. Draining.**

- (1) Place drain pan beneath hydraulic reservoir.

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (2) Remove drain plug from bottom of hydraulic reservoir.
- (3) Allow hydraulic oil to completely drain from reservoir.



**WARNING**

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

- (4) Apply sealing compound to drain plug threads.
- (5) Refit drain plug in bottom of hydraulic reservoir.

**c. Refilling.**

Add fresh hydraulic oil to hydraulic reservoir until oil level is above LOW mark.

**d. Follow-On Maintenance.**

- (0.1) Close hood.
- (1) Start engine (TM 5-2420-230-10).
- (2) Operate FEL and backhoe to bleed system (TM 5-2420-230-10).
- (3) Check drain plug for signs of leakage. Tighten as necessary.
- (4) With all hydraulic components retracted, ensure oil level is correct (TM 5-2420-230-10).
- (5) Shut OFF engine (TM 5-2420-230-10).
- (6) Install front, left-hand belly plate (TM 5-2420-230-10).

**END OF TASK**

<b>10-10. HYDRAULIC OIL FILTER REPLACEMENT.</b>		
This Task Covers:		
a. Preparation	b. Removal	c. Replacement
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Front, left-hand belly plate removed.
<i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C Dexron III, Item 27, Appendix C Filter element, oil, Item 48.3, Appendix D	<i>Drawings Required</i> TM 5-2420-230-24P Figure 150	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B	

**a. Preparation.**

The hydraulic oil filter is changed as part of AOAP or whenever the blocked filter warning indicator on instrument panel is lit.

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first relieving system pressure to zero. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

To raise the temperature of hydraulic system oil, operate FEL or backhoe for 5 min.

Ensure hydraulic system is at normal operating temperature. This can be determined by feeling the hydraulic reservoir. It should be warm.

**b. Removal.**

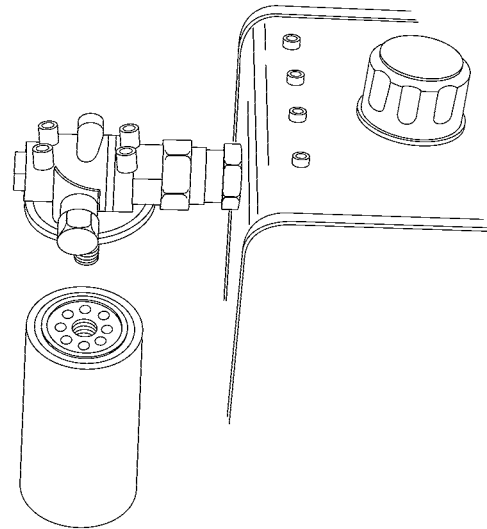
- (1) Position drain pan under vehicle.
- (2) Unscrew oil filter and discard.

**c. Replacement.**

- (1) Clean filter seal mating face with clean cloth.
- (2) Prefill new filter with clean oil, lubricate seal, and install filter. Follow manufacturer's installation instructions provided with new filter.

**d. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Operate FEL and backhoe to bleed system (TM 5-2420-230-10).
- (3) Check filter for signs of leakage. Tighten as necessary.
- (4) With all hydraulic components retracted, ensure oil level is correct (Para 10-9).
- (5) Shut OFF engine (TM 5-2420-230-10).
- (6) Install front, left-hand belly plate (TM 5-2420-230-10).



ME0192

**END OF TASK**

**10-11. HYDRAULIC RESERVOIR MAINTENANCE.**

This Task Covers:

- |             |                 |                          |
|-------------|-----------------|--------------------------|
| a. Removal  | b. Disassembly  | c. Inspection            |
| d. Assembly | e. Installation | f. Follow-On Maintenance |

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*References*  
None

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Compound sealing, Loctite 515, Item 21, Appendix C  
Compound sealing, Loctite 567, Item 22, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Dexron III, Item 27, Appendix C  
Nut, self-locking, Item 104, Appendix D (2)  
Nut, self-locking, Item 108, Appendix D (6)  
Solvent, degreasing, Item 58, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 10-9      Hydraulic reservoir drained.  
Para 13-15      Hydraulic reservoir step plate removed.

*Drawings Required*  
TM 5-2420-230-24P Figure 152

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

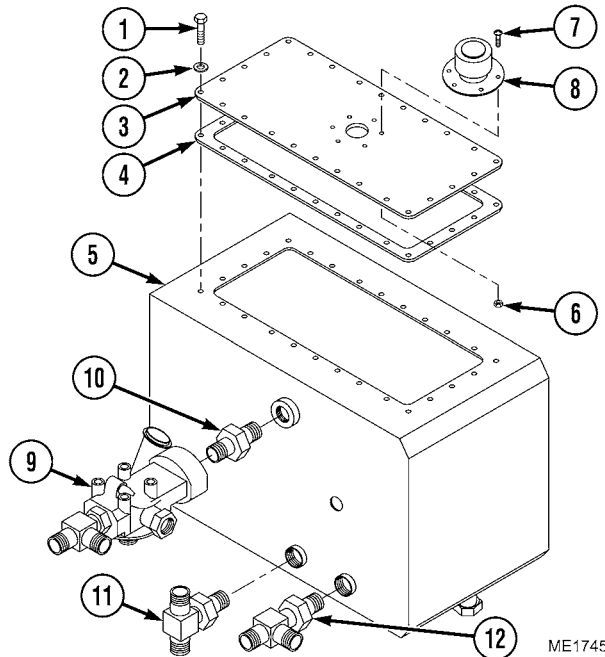
Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Tag all hoses and tubes and note their positions before removal.
  - Remove cable ties as necessary.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Remove supply and return connections at rear of reservoir.
  - (2) Remove bolts and self-locking nuts securing reservoir retaining straps. Discard self-locking nuts.
  - (3) Remove hydraulic reservoir.
  - (4) Deleted.

**b. Disassembly.**

- (0.1) Remove 28 bolts (1), washers (2), hydraulic reservoir lid (3), and gasket (4) from hydraulic reservoir (5).
- (0.2) Remove hydraulic reservoir sight glass (Para 10-12).
- (1) Remove six self-locking nuts (6), screws (7), and filler neck (8) from hydraulic reservoir lid (3). Discard self-locking nuts.
- (2) Remove hydraulic oil filter assembly (9) and fitting (10) from hydraulic reservoir (5).
- (3) Remove fittings (11) and (12) from hydraulic reservoir (5).



ME1745

**c. Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

- (1) Inspect for debris, damage, or contamination. Ensure reservoir is free from all foreign matter. Clean and flush with degreasing solvent and a clean cloth, as required.
- (2) Inspect rubber strips fitted to chassis and securing straps. Replace as necessary.

**d. Assembly.**

- (1) Install fittings (11) and (12) on hydraulic reservoir (5).
- (2) Install fitting (10) and hydraulic oil filter assembly (9) on hydraulic reservoir (5).

- (3) Install filler neck (8) on hydraulic reservoir lid (3) with six screws (7) and new self-locking nuts (6).
- (4) Install hydraulic reservoir sight glass (Para 10-12).
- (5) Ensure reservoir is free from dirt and debris by wiping with a clean cloth.

**WARNING**

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

- (6) Apply sealing compound, Loctite 515, to both sides of gasket (4).
- (7) Position gasket (4) on hydraulic reservoir (5).
- (8) Apply sealing compound, Loctite 567, to threads of bolt (1).
- (9) Install hydraulic reservoir lid (3) on gasket (4) and hydraulic reservoir (5) with 28 washers (2) and bolts (1).

**e. Installation.**

Installation of the hydraulic reservoir is the reverse of the removal procedure with special attention given to the following:

- (1) Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- (2) Ensure new self-locking nuts are used.
- (3) Install cable ties as necessary.
- (4) Deleted.

**f. Follow-On Maintenance.**

- (1) Fill hydraulic reservoir with clean oil (Para 10-9).
- (2) Start engine (TM 5-2420-230-10).
- (3) Bleed system by operating FEL and backhoe several times (TM 5-2420-230-10).
- (4) With all hydraulic components retracted, recheck oil level. Add oil as necessary (Para 10-9).
- (5) Shut OFF engine (TM 5-2420-230-10).
- (6) Install hydraulic reservoir step plate (Para 13-15).

**END OF TASK**



**10-13. HYDRAULIC OIL PUMP REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. New Pump Startup Procedure
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*References*  
None

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Dexron III, Item 27, Appendix C  
Gasket, hydraulic oil pump, Item 88, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 282, Appendix D (4)

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Firewall cover removed.
TM 5-2420-230-10	Center belly plate removed.
TM 5-2420-230-10	Engine access panel removed.
Para 10-5	Hydraulic system pressure released.

*Drawings Required*  
TM 5-2420-230-24P Figure 149  
TM 5-2420-230-24P Figure 156

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Disconnect all hydraulic lines on back of hydraulic pump.
  - (2) Remove four bolts and lockwashers at pump securing supply line from hydraulic reservoir to hydraulic pump. Discard lockwashers.
  - (3) Support pump and remove four bolts, washers, pump, and gasket from transmission. Discard gasket.
  - (4) Deleted.

**b. Installation.**

Installation of hydraulic oil pump is the reverse of the removal procedure with attention given to the following points:

**WARNING**

Always replace hoses with appropriate parts to prevent hoses from bursting. Failure to comply may result in injury or death to personnel.

**CAUTION**

Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Ensure pump is clean and free from foreign matter by wiping with a clean cloth.
  - (2) Place new gasket on hydraulic pump.
  - (3) Ensure new lockwashers are used and tighten all nuts to 190 lbf/ft (258 N•m).

**c. New Pump Startup Procedure.**

**CAUTION**

To avoid damage to hydraulic pump, do not run for more than 5 seconds if cavitation is heard. Failure to comply may result in damage to equipment. If cavitation is heard, shut OFF hydraulic system, wait 30 seconds, and restart system.

Start engine and listen for unusual sounds (TM 5-2420-230-10). If unusual sounds or vibrations are noticed, shut OFF engine and investigate to determine cause.

**d. Follow-On Maintenance.**

- (1) Check hydraulic reservoir and refill as required (Para 10-9).
- (2) Start engine and check for leaks (TM 5-2420-230-10).
- (3) Perform functional test (Para 10-26).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Replace center belly plate (TM 5-2420-230-10).
- (6) Replace engine access panel (TM 5-2420-230-10).
- (7) Replace firewall cover (TM 5-2420-230-10).
- (8) Deleted.

**END OF TASK**



**10-14. GENERAL HYDRAULIC HOSE REPLACEMENT.**

This Task Covers:

- a. Inspection
- b. Removal
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

FO-4, Hydraulic schematic

*Tools and Special Tools*

Pan, drain, Item 29, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 10-9	Hydraulic reservoir drained, if required.
Para 10-5	Hydraulic system pressure released.

*Materials/Parts*

Cap and plug set, Item 4, Appendix C  
 Cloth, lint-free, Item 10, Appendix C  
 Dexron III, Item 27, Appendix C  
 Tags, identification, Item 63, Appendix C  
 Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 156

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete*

Approximately 0.5 hr.

**a. Inspection.**

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
  - Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.
  - Always replace hoses with appropriate parts to prevent hoses from bursting. Failure to comply may result in injury or death to personnel.
- (1) Search for hydraulic leaks with piece of cardboard or other scrap material, taking care to protect hands and body from high-pressure fluids.
  - (2) Check all hoses and pipes for damage, looseness, fatigue, or signs of wear caused by rubbing. Replace as necessary.

**b. Removal.**

**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
- Remove clamps and/or cable ties as necessary.
- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- All hoses are removed and installed in a similar manner.
- To gain access to hoses, some components may need to be removed.

Loosen clamps or pipe connectors on each end and remove hose.

**c. Installation.**



Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install clamps and/or cable ties as necessary.
- (1) Using a clean cloth, ensure all hoses being installed are clean and free from foreign matter.
  - (2) Replace hoses.
  - (3) Ensure fittings are tightened.
  - (4) Wipe up any spillage using clean cloth.
  - (5) Upon completion of work, tighten all connections before restoring system pressure.

**d. Follow-On Maintenance.**

- (1) Check hydraulic reservoir and refill as required (Para 10-9).
- (2) Start engine and check for leaks (TM 5-2420-230-10).
- (3) Tighten hoses as required.
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-15. FEL VALVE BLOCK MAINTENANCE.**

This Task Covers:

- |             |                 |                          |
|-------------|-----------------|--------------------------|
| a. Removal  | b. Disassembly  | c. Repair                |
| d. Assembly | e. Installation | f. Follow-On Maintenance |

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (3)

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*References*  
None

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Nut, self-locking, Item 102, Appendix D (2)  
O-ring, Item 144.1, Appendix D (14)  
O-ring, Item 153.1, Appendix D (4)  
O-ring, Item 153.2, Appendix D (20)  
Parts kit, Item 168.1, Appendix D  
Parts kit, Item 168.2, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 280, Appendix D (4)

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Engine access panel removed.
Para 10-5	Hydraulic system pressure released.
Para 12-23	Center dash panel removed.

*Drawings Required*  
TM 5-2420-230-24P Figure 154  
TM 5-2420-230-24P Figure 163

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

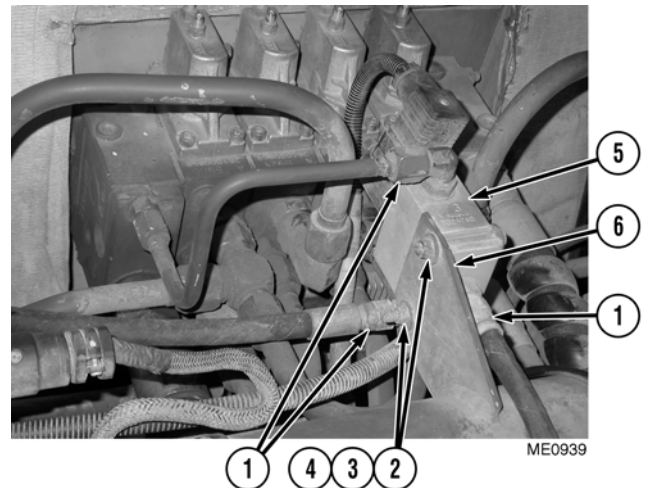
**a. Removal.**

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Tag all hoses, tubes, and wires and note their positions before removal.
- Remove cable ties as necessary.
- Ensure all hoses, wires, and tubes are disconnected and clear before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.



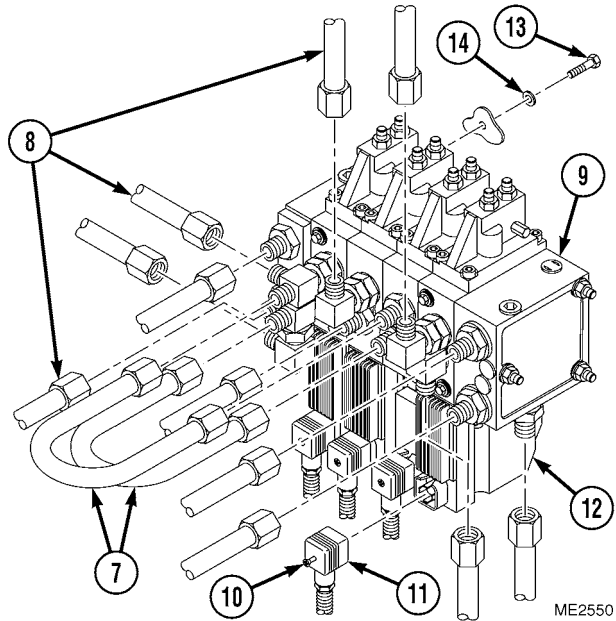
- (1) Place drain pan, and remove three hydraulic lines (1), two self-locking nuts (2), four washers (3), and two bolts (4) and remove bypass solenoid (5) from bracket (6). Discard self-locking nuts.

- (2) Remove 2 U-tubes (7) and 11 hydraulic lines (8) from valve block (9).
- (3) Loosen four screws (10) and disconnect plugs (11) from solenoid valves (12).

**WARNING**

Valve block weighs 56 lb. (25 kg). Use an assistant and follow safe working procedures when removing or installing valve block. Failure to comply may result in injury to personnel.

- (4) With the aid of an assistant, remove four bolts (13), lockwashers (14), and valve block (9) from vehicle. Discard lockwashers.

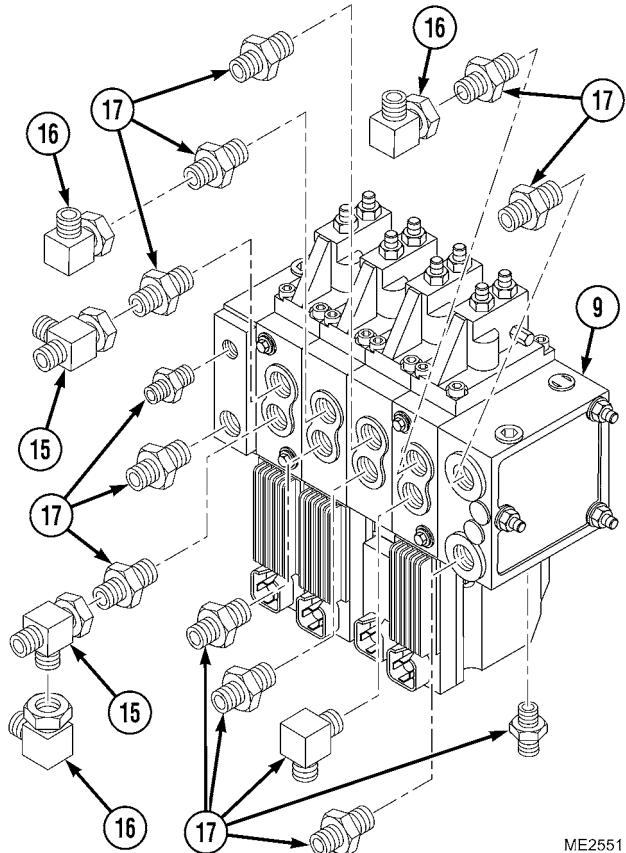


**b. Disassembly.**

**NOTE**

- Tag all fittings and note their positions before removal.
- Cap and plug all fittings and valve openings upon removal.

- (1) Remove two T-fittings (15) and three elbows (16) from valve block (9).
- (2) Remove 13 fittings (17) from valve block (9). Inspect O-rings on fittings. Replace any fitting with a damaged O-ring.



c. Repair.



Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

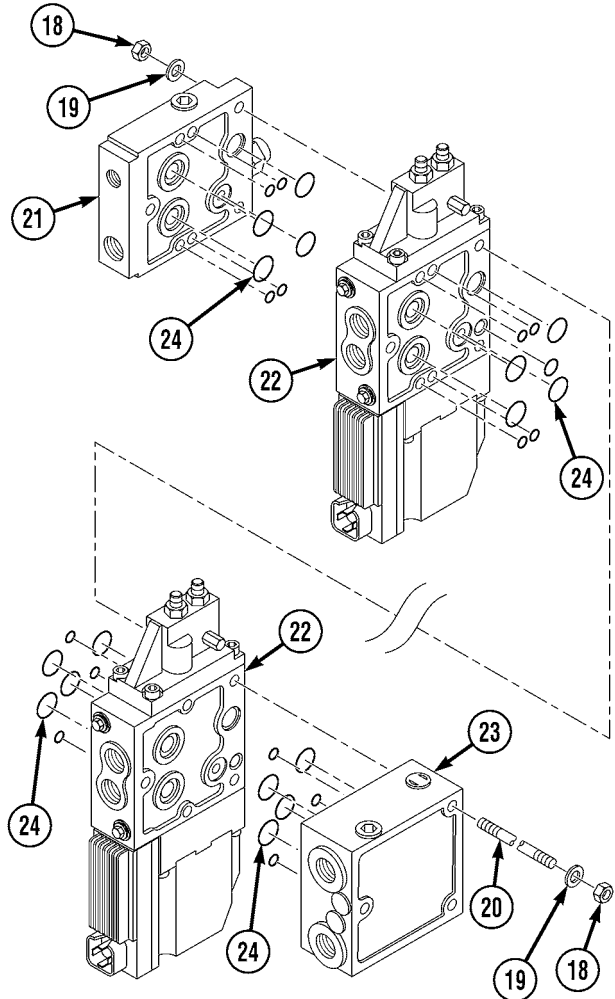
- This task lists repair steps for entire valve block; use steps as required.
- Tag all valve bodies and note their positions before removal. Ensure that valve bodies are reassembled in order noted.

- (1) Remove six nuts (18), washers (19), and three stems (20) from inlet section (21), four valve bodies (22), and outlet section (23).
- (2) Remove 38 O-rings (24) from between inlet section (21), 4 valve bodies (22), and outlet section (23). Discard O-rings.

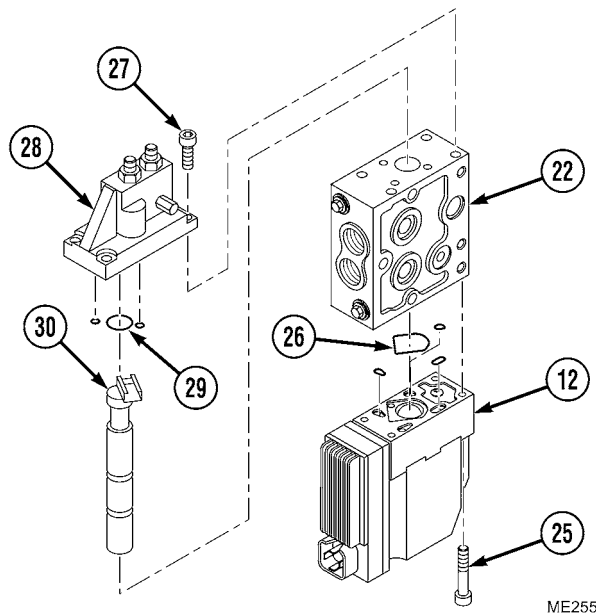
**NOTE**

All valve bodies are repaired in the same way.

- (3) Remove four screws (25), solenoid valve (12), and five O-rings (26) from valve body (22). Discard O-rings.
- (4) Remove four screws (27), control block (28), three O-rings (29), and spool (30) from valve body (22). Discard O-rings.
- (5) Inspect spool (30) and valve body (22) for scratches, scoring, and any other damage. If found, replace both spool and valve body.
- (6) Insert spool (30) in valve body (22) and install three new O-rings (29), control block (28), and four screws (27).
- (7) Install five new O-rings (26) and solenoid valve (12) on valve body (22) with four screws (25).
- (8) Assemble 38 new O-rings (24) between inlet section (21), four valve bodies (22), and outlet section (23), and install three stems (20), six washers (19), and nuts (18). Torque six nuts to 16 lbf/ft (22 N•m).



ME2552



ME2553

**d. Assembly.**

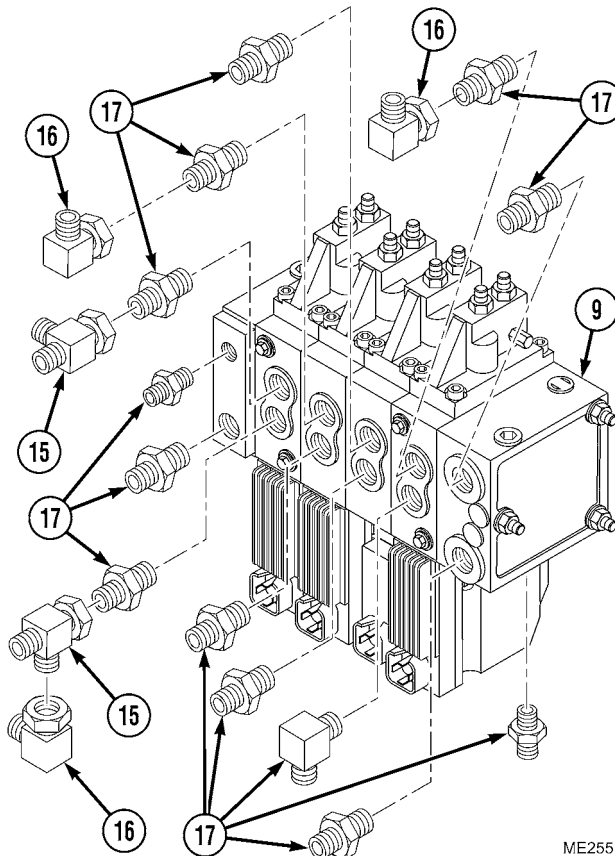
**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

Ensure all fittings are reinstalled to positions noted prior to removal.

- (1) Install 13 fittings (17) in valve block (9).
- (2) Install two T-fittings (15) and three elbows (16) on valve block (9).



ME2551

**e. Installation.**

**WARNING**

Valve block weighs 56 lb. (25 Kg). Use an assistant and follow safe working procedures when removing or installing valve block. Failure to comply may result in injury to personnel.

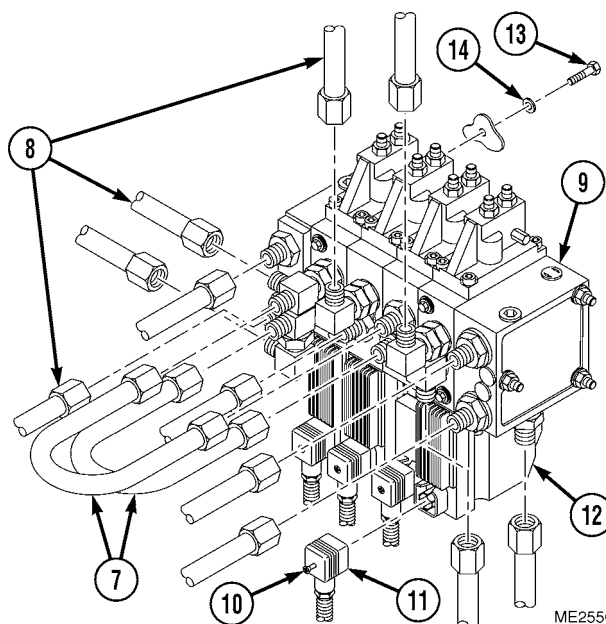
**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

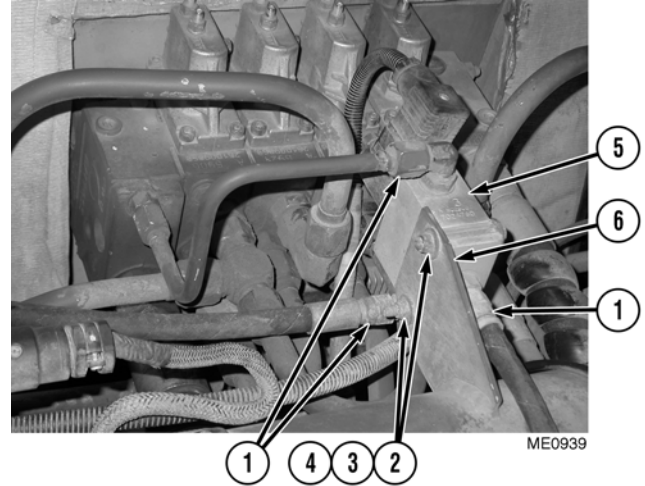
- Ensure all hoses, tubes, and wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) With the aid of two assistants, one inside cab and two positioning valve block (9) on vehicle, install valve block with four new lockwashers (14) and bolts (13).
- (2) Connect four plugs (11) to solenoid valves (12) and install screws (10).
- (3) Install 11 hydraulic lines (8) and 2 U-tubes (7) on valve block (9).



ME2550

- (4) Position bypass solenoid (5) on bracket (6) and install two bolts (4), four washers (3), and two new self-locking nuts (2).
- (5) Install three hydraulic lines (1) on bypass solenoid (5).



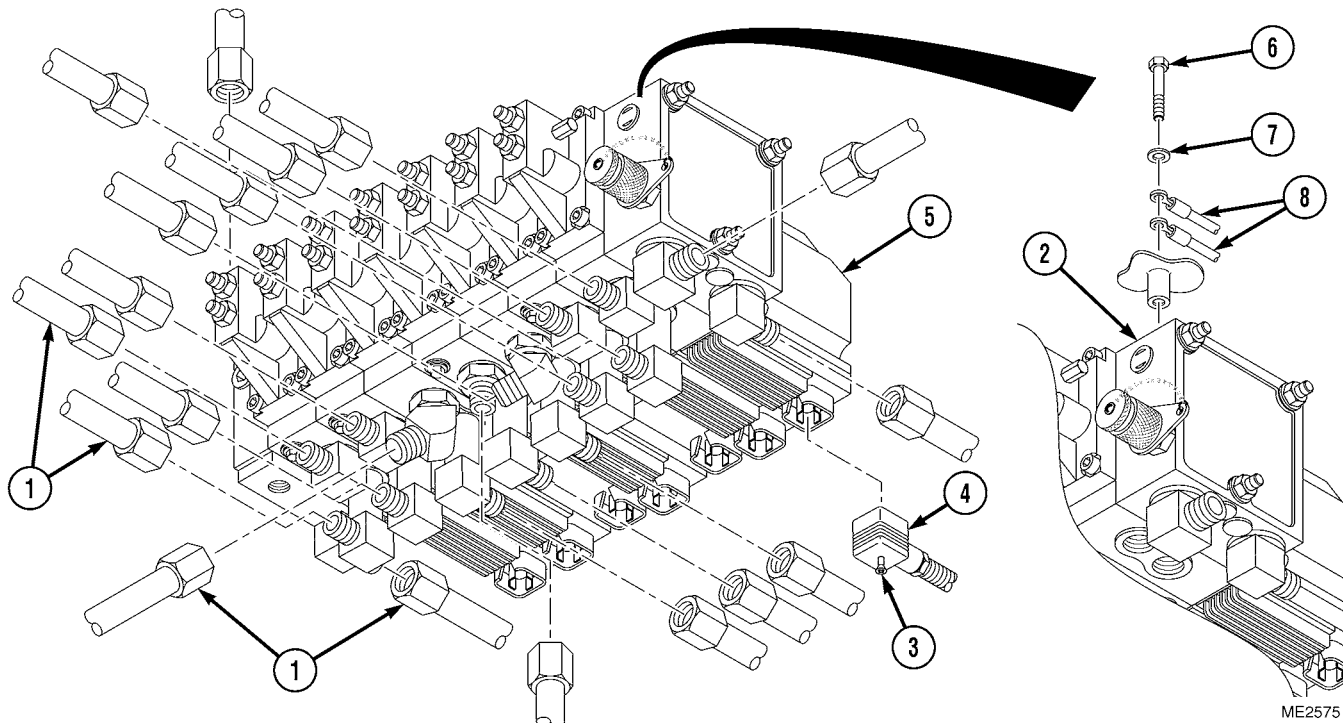
**f. Follow-On Maintenance.**

- (1) Start engine and check for leaks (TM 5-2420-230-10).
- (2) Perform service (Para 10-8) and pressure test (Para 10-6) on valve block.
- (3) Functionally test FEL cylinders (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) If valve block was replaced, apply new valve block labels (Para 13-13).
- (6) Install center dash panel (Para 12-23).
- (7) Install engine access panel (TM 5-2420-230-10).
- (8) Deleted.

**END OF TASK**

<b>10-16. BACKHOE VALVE BLOCK MAINTENANCE.</b>									
This Task Covers:									
a. Removal	b. Disassembly								
d. Assembly	e. Installation								
c. Repair									
f. Follow-On Maintenance									
<b>INITIAL SETUP</b>									
<i>Test Equipment</i> None	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)								
<i>Tools and Special Tools</i> Field maintenance, basic, Item 23, Appendix B Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B Equipment, suitable lifting	<i>References</i> None								
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C O-ring, Item 144.1, Appendix D (32) O-ring, Item 153.1, Appendix D (7) O-ring, Item 153.2, Appendix D (32) Parts kit, Item 168.2, Appendix D Parts kit, Item 168.3, Appendix D Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C Washer, lock, Item 280, Appendix D (4)	<i>Equipment Conditions</i> <table border="0"> <tr> <td><i>TM or Para</i></td> <td><i>Condition Description</i></td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Backhoe swung to one side.</td> </tr> <tr> <td>Para 10-5</td> <td>Hydraulic system pressure released.</td> </tr> <tr> <td>Para 15-6</td> <td>Air tank (20 L) removed.</td> </tr> </table>	<i>TM or Para</i>	<i>Condition Description</i>	TM 5-2420-230-10	Backhoe swung to one side.	Para 10-5	Hydraulic system pressure released.	Para 15-6	Air tank (20 L) removed.
<i>TM or Para</i>	<i>Condition Description</i>								
TM 5-2420-230-10	Backhoe swung to one side.								
Para 10-5	Hydraulic system pressure released.								
Para 15-6	Air tank (20 L) removed.								
	<i>Drawings Required</i> TM 5-2420-230-24P Figure 173								
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B								

**a. Removal.**



**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Tag all hoses, tubes, and wires and note their positions before removal.
  - Remove cable ties as necessary.
  - Ensure all hoses, wires, and tubes are disconnected and clear before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Place drain pan and remove 18 hydraulic lines (1) from valve block (2).
  - (2) Loosen seven screws (3) and disconnect plugs (4) from solenoid valves (5).

**WARNING**

Valve block weighs 95 lb. (43 kg). Use an appropriate lifting device with an assistant, and follow safe working procedures when removing or installing valve block. Failure to comply may result in injury to personnel.

- (3) Attach suitable lifting device and sling to valve block (2).
- (4) With the aid of an assistant, remove four bolts (6), lockwashers (7), two grounding wires (8), and valve block (2) from vehicle. Discard lockwashers.

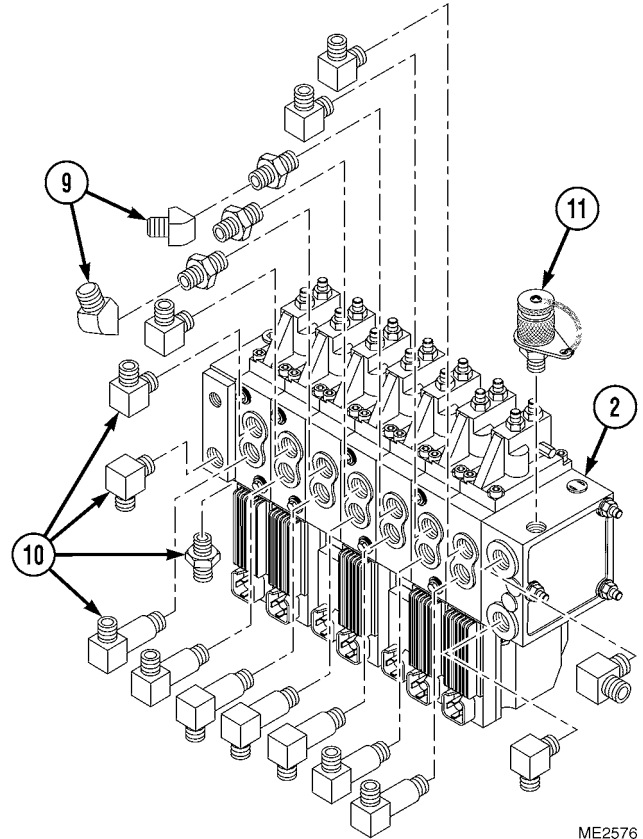


**b. Disassembly.**

**NOTE**

- Tag all fittings and note their positions before removal.
- Cap and plug all fittings and valve openings upon removal.

- (1) Remove two elbows (9) from valve block (2).
- (2) Remove 18 fittings (10) from valve block (2). Inspect O-rings on fittings. Replace any fitting with a damaged O-ring.
- (3) Remove test port (11) from valve block (2).



ME2576

**c. Repair.**

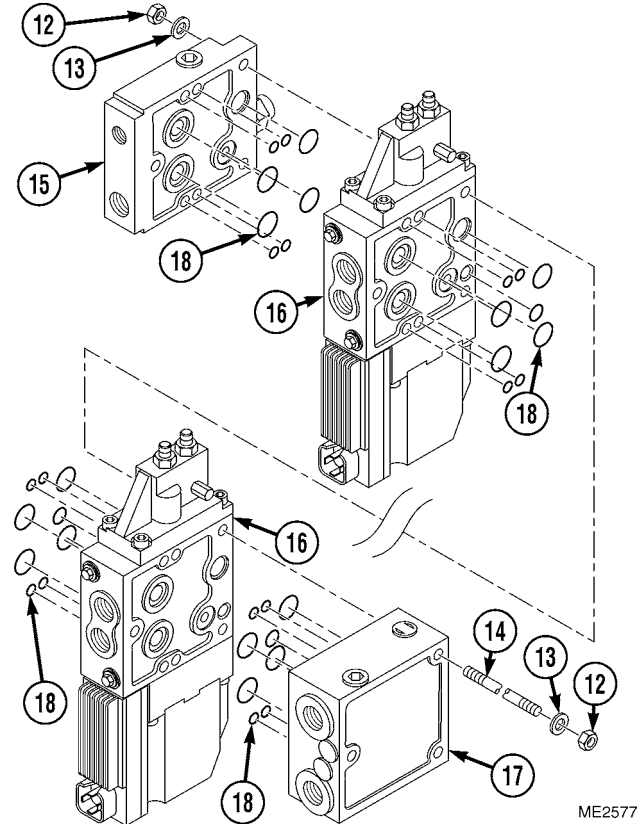


Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

- This task lists repair steps for entire valve block; use steps as required.
- Tag all valve bodies and note their positions before removal. Ensure that valve bodies are reassembled in order noted.

- (1) Remove six nuts (12), washers (13), and three stems (14) from inlet section (15), seven valve bodies (16), and outlet section (17).
- (2) Remove 71 O-rings (18) from between inlet section (15), 7 valve bodies (16), and outlet section (17). Discard O-rings.

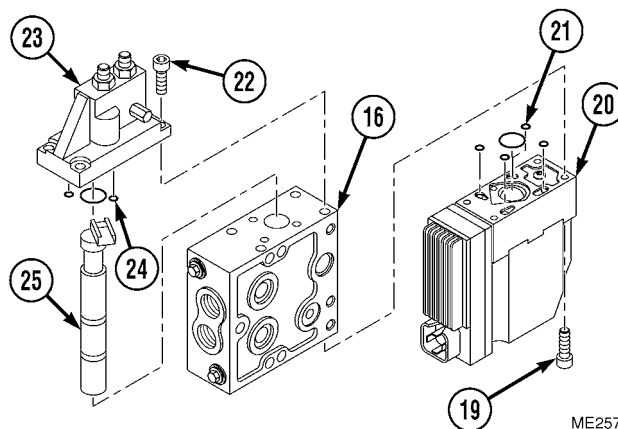


ME2577

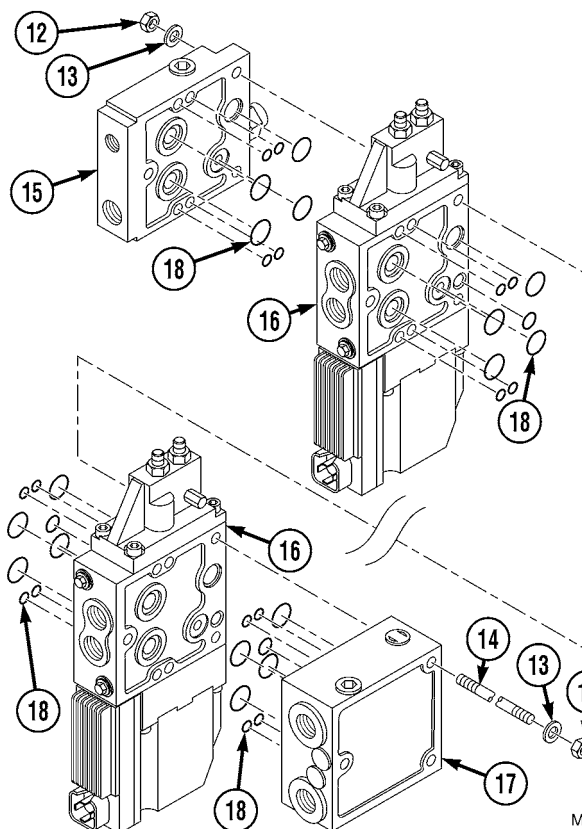
**NOTE**

All valve bodies are repaired in the same way.

- (3) Remove four screws (19), solenoid valve (20), and five O-rings (21) from valve body (16). Discard O-rings.
- (4) Remove four screws (22), control block (23), three O-rings (24), and spool (25) from valve body (16). Discard O-rings.
- (5) Inspect spool (25) and valve body (16) for scratches, scoring, and any other damage. If found, replace both spool and valve body.
- (6) Insert spool (25) in valve body (16) and install three new O-rings (24), control block (23), and four screws (22).
- (7) Install five new O-rings (21) and solenoid valve (20) on valve body (16) with four screws (19).
- (8) Assemble 71 new O-rings (18) between inlet section (15), four valve bodies (16), and outlet section (17), and install three stems (14), six washers (13), and nuts (12). Torque six nuts to 16 lbf/ft (22 N•m).



ME2578



ME2577

**d. Assembly.**

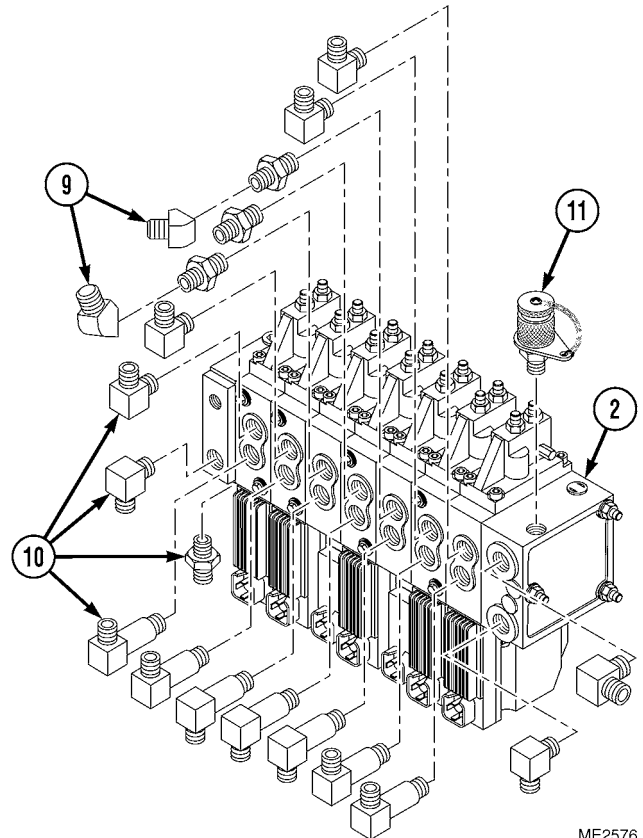


Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

Ensure all fittings are reinstalled to positions noted prior to removal.

- (1) Install test port (11) in valve block (2).
- (2) Install 18 fittings (10) in valve block (2).
- (3) Install two elbows (9) on valve block (2).



ME2576

**e. Installation.**



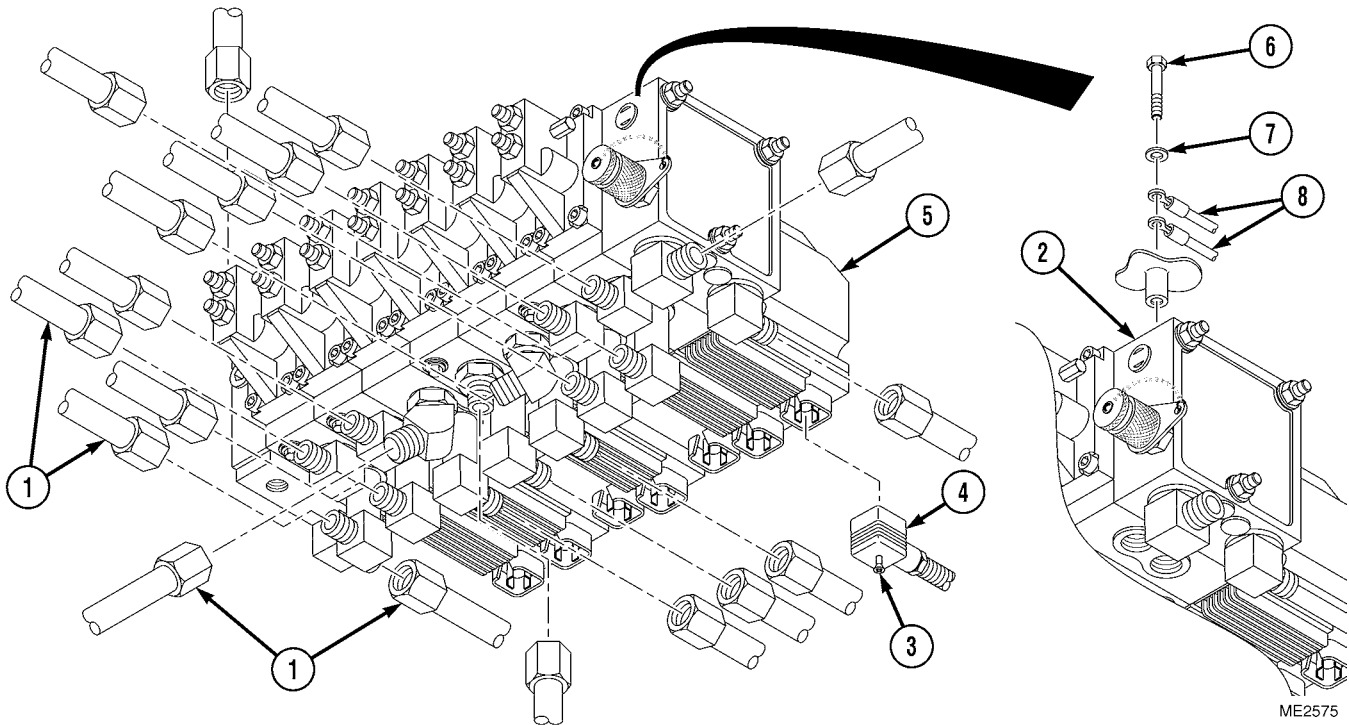
Valve block weighs 95 lb. (43 kg). Use an appropriate lifting device with an assistant, and follow safe working procedures when removing or installing valve block. Failure to comply may result in injury to personnel.



Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

- Ensure all hoses, tubes, and wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Attach suitable lifting device and sling to valve block (2).



- (2) With the aid of an assistant, position valve block (2) on vehicle.
- (3) Install valve block (2) and two grounding wires (8) with four new lockwashers (7) and bolts (6).
- (4) Connect seven plugs (4) to solenoid valves (5) and install screws (3).
- (5) Install 18 hydraulic lines (1) on valve block (2).

**f. Follow-On Maintenance.**

- (1) Install 20.0 L air tank (Para 15-6).
- (2) Start engine and check for leaks (TM 5-2420-230-10).
- (3) Perform service (Para 10-8) and pressure test (Para 10-6) on valve block.
- (4) Functionally test backhoe and stabilizer cylinders (TM 5-2420-230-10).
- (5) Position backhoe in stowed position (TM 5-2420-230-10).
- (6) Shut OFF engine (TM 5-2420-230-10).
- (7) If valve block was replaced, apply new valve block labels (Para 13-13).
- (8) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-17. BUCKET CYLINDER MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*  
Field, maintenance, basic, Item 23, Appendix B  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B  
Equipment, suitable lifting

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Backhoe fully extended.
Para 10-5	Hydraulic system pressure released.

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Grease, automotive and artillery, Item 30, Appendix C  
O-ring, Item 138, Appendix D (2)  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

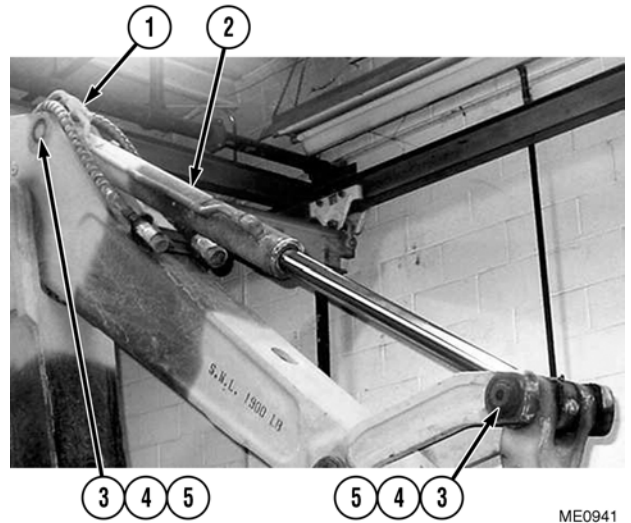
*Drawings Required*  
TM 5-2420-230-24P Figure 171  
TM 5-2420-230-24P Figure 172

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

- The backhoe must be supported when removing or installing any backhoe cylinder. Failure to comply may result in serious injury or death to personnel and damage to equipment.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.



**NOTE**

- Tag all hoses and tubes and note their positions before removal.
  - Remove cable ties as necessary.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Place drain pan under hydraulic hoses (1).
  - (2) Disconnect two hydraulic hoses (1) from bucket cylinder (2).

**WARNING**

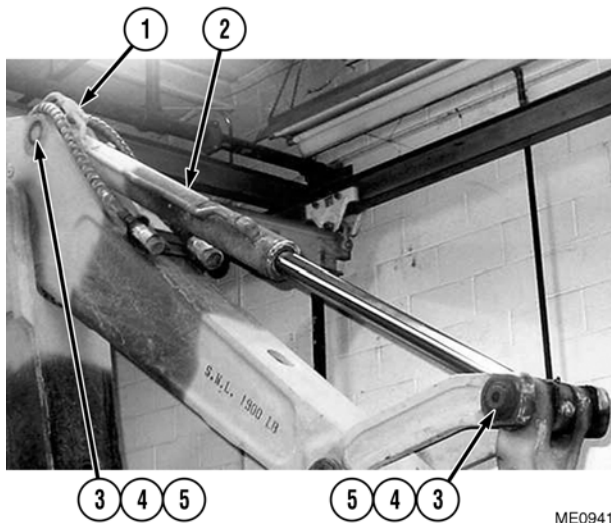
Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

- (3) Remove two circlips (3) and washers (4) from pivot pins (5).
- (4) Attach suitable lifting device and sling to bucket cylinder (2).

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

- (5) Remove pivot pins (5) from bucket cylinder (2). Remove bucket cylinder.



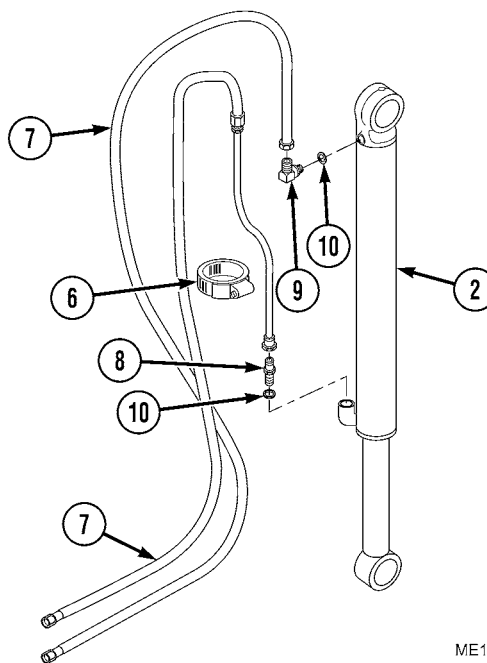
ME0941

**b. Disassembly.**

- (1) Remove clamp (6) from bucket cylinder (2).
- (2) Disconnect two hoses (7) from bucket cylinder (2).
- (3) Remove fitting (8), elbow (9), and two O-rings (10) from bucket cylinder (2). Discard O-rings.

**c. Assembly.**

- (1) Install fitting (8), elbow (9), and two new O-rings (10) on bucket cylinder (2).
- (2) Connect two hoses (7) to bucket cylinder (2).
- (3) Install clamp (6) on bucket cylinder (2).



ME1757

**d. Installation.**

**WARNING**

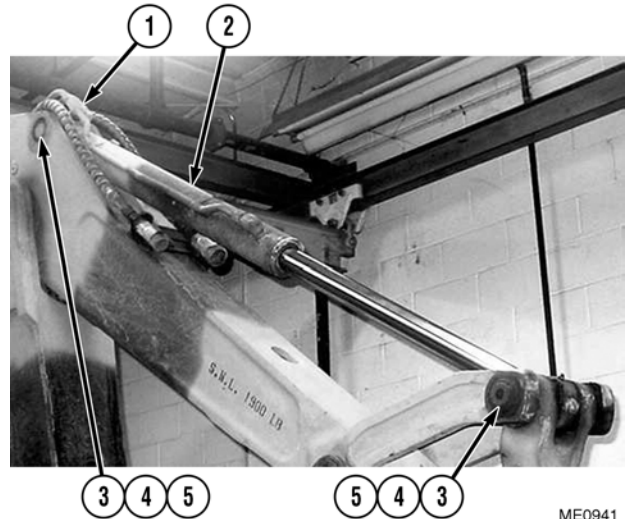
Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.



- (1) Attach suitable lifting device and sling to bucket cylinder (2).

**WARNING**

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

- (2) Use lifting device to position bucket cylinder (2) and install with two pivot pins (5) and circlips (3) and washers (4).
- (3) Connect two hydraulic hoses (1) to bucket cylinder (2).

**e. Follow-On Maintenance.**

- (1) Start engine and functionally test cylinder (TM 5-2420-230-10).
- (2) Check for leaks.
- (3) Fill reservoir as required.
- (4) Return backhoe in the stowed position (TM 5-2420-230-10).
- (5) Shut OFF engine (TM 5-2420-230-10).
- (6) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-18. BOOM CYLINDER MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*  
Field, maintenance, basic, Item 23, Appendix B  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B  
Equipment, suitable lifting

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Backhoe fully extended.
Para 10-5	Hydraulic system pressure released.
Para 15-4	Air system drained.

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Compound, sealing, pipe thread, Item 22, Appendix C  
Grease, automotive and artillery, Item 30, Appendix C  
O-ring, Item 138, Appendix D (2)  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 168  
TM 5-2420-230-24P Figure 169

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

- The backhoe must be supported when removing or installing any backhoe cylinder. Failure to comply may result in serious injury or death to personnel and damage to equipment.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Remove two glad hands.

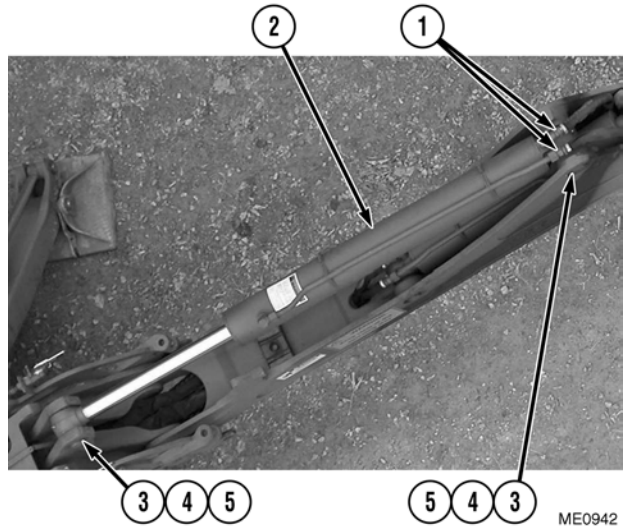


- (2) Place drain pan beneath hydraulic hoses (1).
- (3) Disconnect two hydraulic hoses (1) from boom cylinder (2).

**WARNING**

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

- (4) Remove four circlips (3) and washers (4) from two pivot pins (5).
- (5) Attach suitable lifting device and sling to boom cylinder (2).



**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

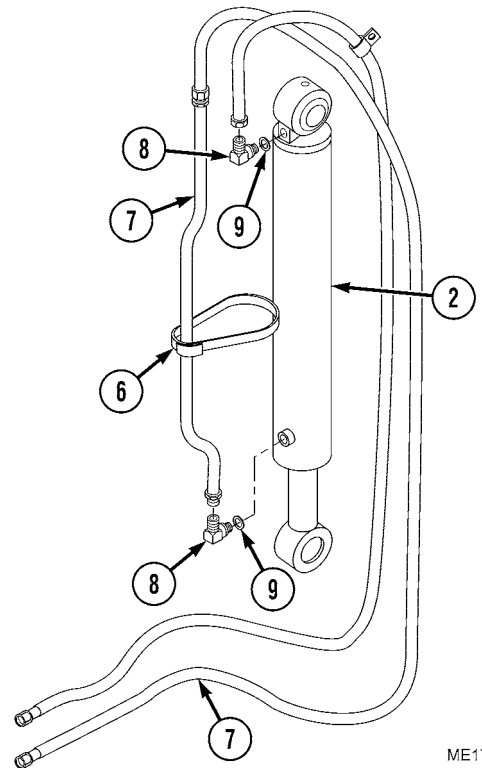
- (6) Remove two pivot pins (5) from boom cylinder (2).  
Remove boom cylinder.

**b. Disassembly.**

- (1) Remove clamp (6) from boom cylinder (2).
- (2) Disconnect hydraulic tubes (7) from boom cylinder (2).
- (3) Remove two elbows (8) and two O-rings (9) from boom cylinder (2). Discard O-rings.

**c. Assembly.**

- (1) Install two elbows (8) and two new O-rings (9) on boom cylinder (2).
- (2) Connect hydraulic tubes (7) to boom cylinder (2).
- (3) Install clamp (6) on boom cylinder (2).



**d. Installation.**

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

**NOTE**

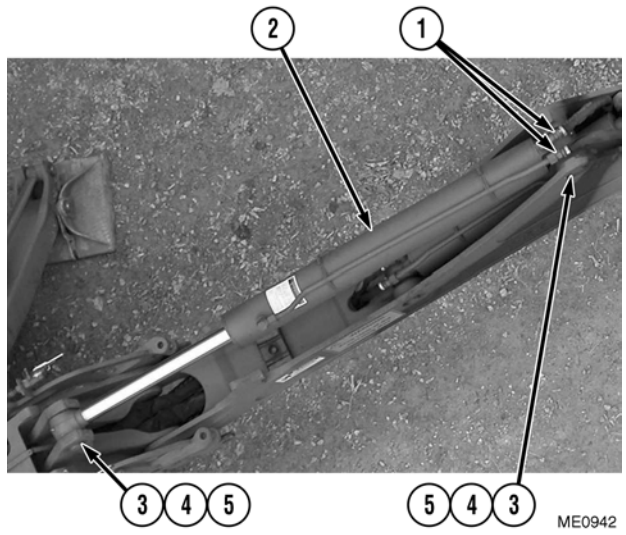
- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Attach suitable lifting device and sling to boom cylinder (2).

**WARNING**

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

- (2) Use lifting device to position boom cylinder (2) and install with two pivot pins (5) and four circlips (3) and washers (4).
- (3) Connect two hydraulic hoses (1) to boom cylinder (2).



**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (4) Apply sealing compound and install two glad hands.

**e. Follow-On Maintenance.**

- (1) Start engine and functionally test cylinder (TM 5-2420-230-10).
- (2) Check for leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Fill reservoir as required.
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-19. DIPPER CYLINDER MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*

- Field, maintenance, basic, Item 23, Appendix B
- Pan, drain, Item 29, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Equipment, suitable lifting

*References*

None

*Equipment Conditions*

*TM or Para*

TM 5-2420-230-10

Para 10-5

*Condition Description*

Backhoe fully extended.

Hydraulic system pressure released.

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Grease, automotive and artillery, Item 30, Appendix C
- O-ring, Item 138, Appendix D (2)
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 168

TM 5-2420-230-24P Figure 170

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

The backhoe must be supported when removing or installing any backhoe cylinder. Failure to comply may result in serious injury or death to personnel and damage to equipment.

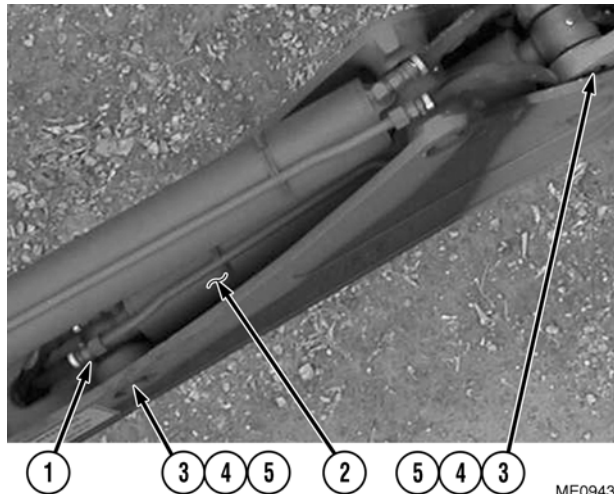
**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Place drain pan under components to be removed.

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (2) Disconnect two hydraulic hoses (1) from dipper cylinder (2).



ME0943

**WARNING**

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

- (3) Remove two circlips (3) and washers (4) from pivot pins (5).
- (4) Attach suitable lifting device and sling to dipper cylinder (2).

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

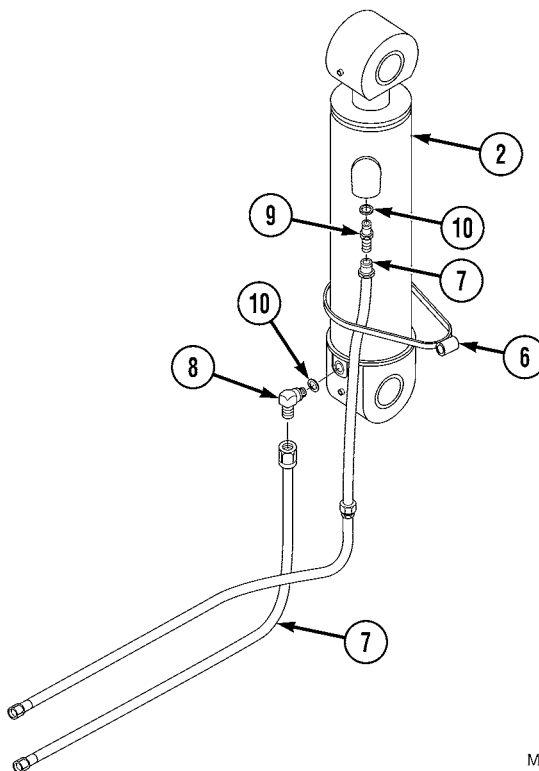
- (5) Remove pivot pins (5) from dipper cylinder (2). Remove dipper cylinder.

**b. Disassembly.**

- (1) Remove clamp (6) from dipper cylinder (2).
- (2) Disconnect two hoses (7) from dipper cylinder (2).
- (3) Remove elbow (8), fitting (9), and two O-rings (10) from dipper cylinder (2). Discard O-rings.

**c. Assembly.**

- (1) Install elbow (8), fitting (9), and two new O-rings (10) on dipper cylinder (2).
- (2) Connect two hoses (7) to dipper cylinder (2).
- (3) Install clamp (6) on dipper cylinder (2).



ME1755

**d. Installation.**

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

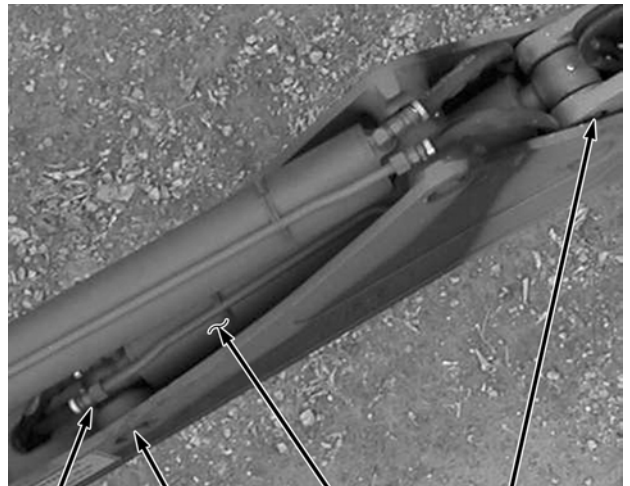
**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Attach suitable lifting device and sling to dipper cylinder (2).

**WARNING**

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

- (2) Use lifting device to position dipper cylinder (2) and install with two pivot pins (5), washers (4), and circlips (3).
- (3) Connect two hydraulic hoses (1) to dipper cylinder (2).



ME0943

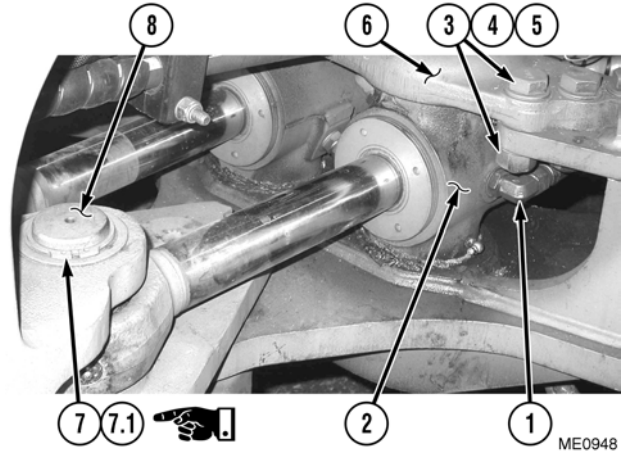
**e. Follow-On Maintenance.**

- (1) Start engine and functionally test cylinder (TM 5-2420-230-10).
- (2) Check for leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Fill reservoir as required (Para 10-9).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



- (1) Disconnect two hydraulic hoses (1) from swing cylinder (2).
- (2) Remove six nuts (3), bolts (4), and 12 washers (5) from cylinder cover plate (6).
- (3) Remove cylinder cover plate (6).



**WARNING**

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

- (4) Remove circlip (7) and washer (7.1) from pivot pin (8).
- (5) Attach suitable lifting device and sling to swing cylinder (2).

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

- (6) Remove pivot pin (8) from swing cylinder (2). Remove swing cylinder.
- (7) Remove fitting if necessary.

**b. Installation.**

- (1) Install fitting if necessary.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (2) Attach suitable lifting device and sling to swing cylinder (2).
  - (3) Use lifting device to position swing cylinder (2) on vehicle.
  - (4) Install pivot pin (8) in swing cylinder (2) with washer (7.1) and circlip (7).
  - (5) Install cylinder cover plate (6) with 6 bolts (4), 12 washers (5), and 6 nuts (3).
  - (6) Connect two hydraulic hoses (1) to swing cylinder (2).

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test cylinders (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>10-21. STABILIZER CYLINDER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	
<i>Tools and Special Tools</i> Field, maintenance, basic, Item 23, Appendix B Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B Equipment, suitable lifting	<i>References</i> None	
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Grease, automotive and artillery, Item 30, Appendix C Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 Para 10-5	<i>Condition Description</i> Stabilizers in down position. Hydraulic system pressure released.
	<i>Drawings Required</i> TM 5-2420-230-24P Figure 164 TM 5-2420-230-24P Figure 167	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Both stabilizer cylinders are removed and installed in the same way. Right side is shown.
- (1) Place drain pan under components to be removed.



**WARNING**

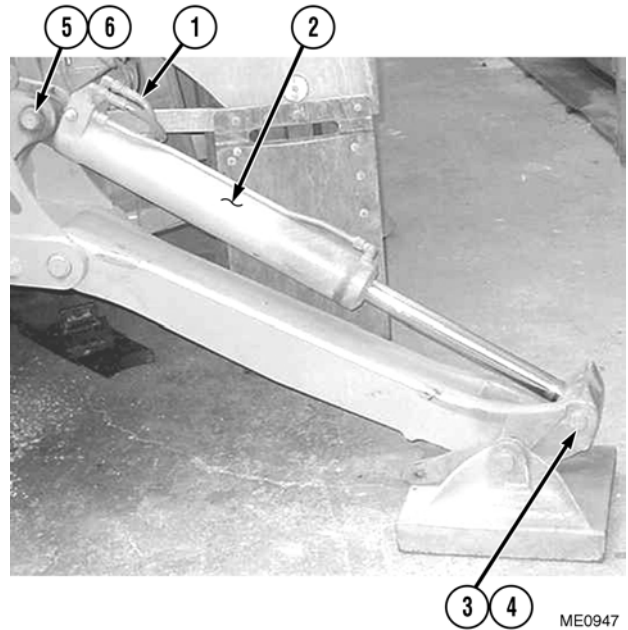
Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (2) Disconnect two hydraulic hoses (1) from stabilizer cylinder (2).

**WARNING**

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

- (3) Remove two circlips (3) from bottom pivot pin (4).
- (4) Remove bottom pivot pin (4) from stabilizer cylinder (2).
- (5) Remove two circlips (5) from top pivot pin (6).
- (6) Attach suitable lifting device and sling to stabilizer cylinder (2).



ME0947

**WARNING**

Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.

- (7) Remove top pivot pin (6) from stabilizer cylinder (2). Remove stabilizer cylinder.
- (8) Remove fittings as necessary

**b. Installation.**



Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Attach suitable lifting device and sling to stabilizer cylinder (2).

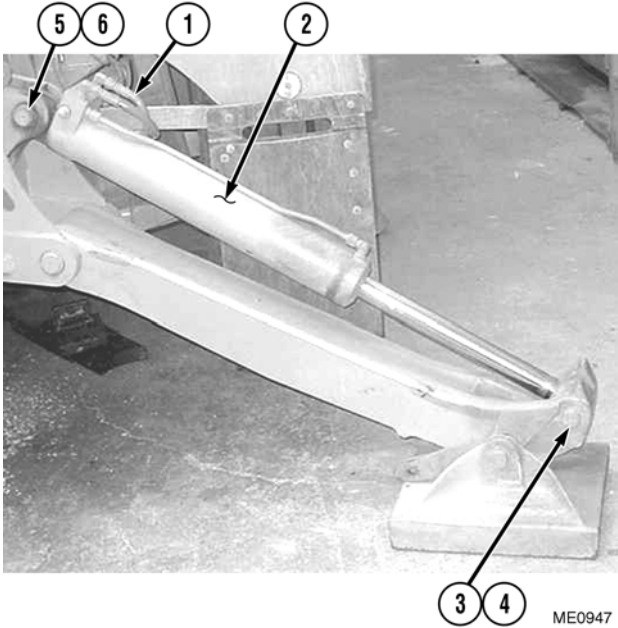


Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

- (2) Use lifting device to position stabilizer cylinder (2) and install with top pivot pin (6), two circlips (5), bottom pivot pin (4), and two circlips (3).
- (3) Install fittings if necessary.
- (4) Connect two hydraulic hoses (1) to stabilizer cylinder (2).

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test cylinders (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).



**END OF TASK**



- (1) Place drain pan under FEL lift cylinder (1).

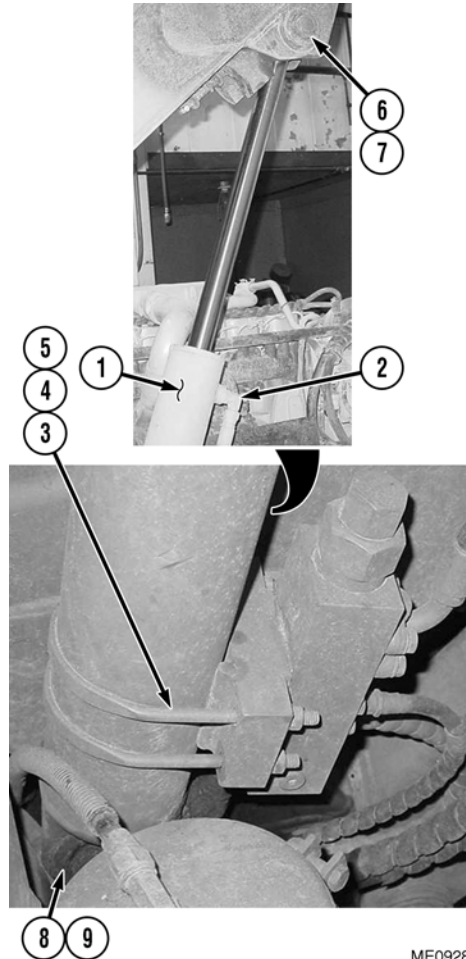
**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (2) Disconnect hose (2) and check block fitting from FEL lift cylinder (1).
- (3) Remove two U-bolts (3), nuts (4), and washers (5) from FEL lift cylinder (1) and secure check valve to chassis with cable ties.
- (4) Attach suitable lifting device and sling to FEL lift cylinder (1).

**WARNING**

- Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.



ME0928

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

- (5) Remove top circlip (6) from top pivot pin (7).
- (6) Remove top pivot pin (7) from FEL lift cylinder (1) and travel stop.
- (7) Remove bottom circlip (8) from bottom pivot pin (9).
- (8) Remove bottom pivot pin (9) from FEL lift cylinder (1).
- (9) Remove FEL lift cylinder (1).
- (10) Remove fittings if necessary.

**b. Installation.**



Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

**NOTE**

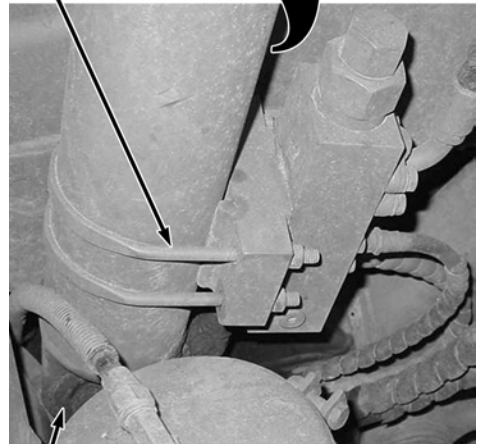
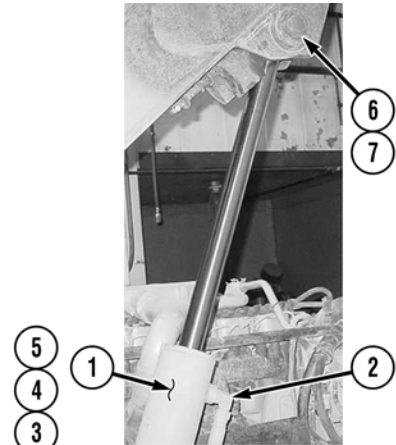
- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install fittings if necessary.
- (2) Attach suitable lifting device and sling to FEL lift cylinder (1).



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

- (3) Use lifting device to position FEL lift cylinder (1) and travel stop, and install with top pivot pin (7), top circlip (6), bottom pivot pin (9), and bottom circlip (8).
- (4) Remove cable ties securing check valve, and install on FEL lift cylinder (1) with two washers (5), nuts (4), and U-bolts (3).
- (5) Connect hydraulic hose (2) to FEL lift cylinder (1).



ME0928

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test cylinders (TM 5-2420-230-10).
- (2) Check for leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (3.1) Install front fender (Para 13-16).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-23. TILT CYLINDER MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*

Field, maintenance, basic, Item 23, Appendix B  
 Pan, drain, Item 29, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B  
 Equipment, suitable lifting

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Bucket on ground.
Para 10-5	Hydraulic system pressure released.
Para 12-35	Tilt-position potentiometer removed.

*Materials/Parts*

Cap and plug set, Item 4, Appendix C  
 Cloth, lint-free, Item 10, Appendix C  
 Grease, automotive and artillery, Item 30, Appendix C  
 Nut, self-locking, Item 114, Appendix D  
 Tags, identification, Item 63, Appendix C  
 Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P	Figure 155
TM 5-2420-230-24P	Figure 161

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**

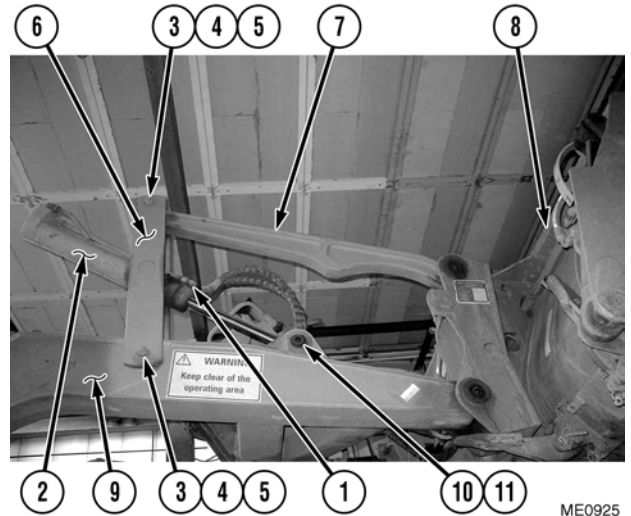
**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
- Remove cable ties as necessary.
- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Both tilt cylinders are removed and installed in the same way. Right side is shown.

- (1) Place drain pan beneath hydraulic hoses (1).

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

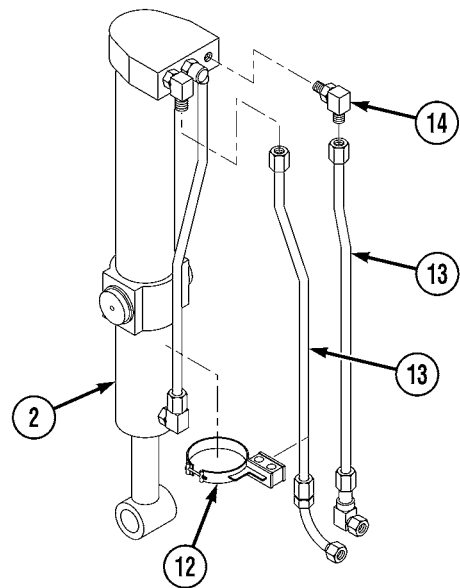


ME0925

- (2) Disconnect two hydraulic hoses (1) from tilt cylinder (2).
- (3) Remove two self-locking nuts (3), washers (4), and bolts (5) from outside pivot arm (6). Remove pivot arm (5). Discard self-locking nuts.
- (4) Rotate tilt linkage (7) on bucket (8).
- (5) Set tilt cylinder (2) on FEL arm (9).
- (6) Attach suitable lifting device and sling to tilt cylinder (2)

**WARNING**

- Hydraulic cylinder is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hydraulic cylinder. Failure to comply may result in injury or death to personnel.



ME1754

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

- (7) Remove circlip (10) from rod pin (11) and remove rod pin (11) from FEL arm (9) and tilt cylinder (2).
- (8) Remove tilt cylinder (2) from FEL arm (9).

**b. Disassembly.**

- (1) Remove clamp (12) from tilt cylinder (2).
- (2) Disconnect two hoses (13) from tilt cylinder (2).
- (3) Remove two elbows (14) from tilt cylinder (2).

**c. Assembly.**

- (1) Install two elbows (14) on tilt cylinder (2).
- (2) Connect two hoses (13) to tilt cylinder (2).
- (3) Install clamp (12) on tilt cylinder (2).

**d. Installation.**

**WARNING**

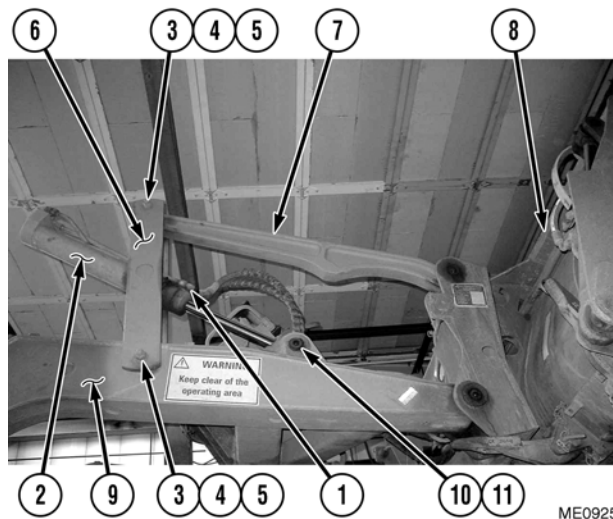
Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

**CAUTION**

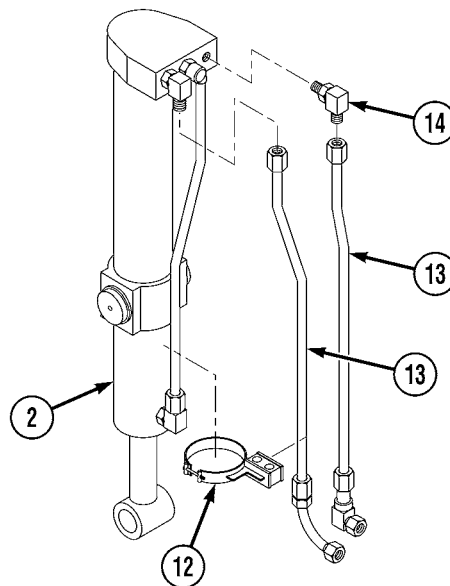
Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Attach suitable lifting device and sling to tilt cylinder (2). Use lifting device to position tilt cylinder (2) and install rod pin (11) into tilt cylinder (2) through FEL arm (9).
  - (2) Install circlip (10) on to rod pin (11).
  - (3) Use lifting device to raise tilt cylinder (2) and install pivot arm (6) on to FEL arm (9) and tilt linkage (7) with two bolts (5), washers (4), and new self-locking nuts (3).
  - (4) Connect two hydraulic hoses (1) to tilt cylinder (2).



ME0925



ME1754

**e. Follow-On Maintenance.**

- (1) Install potentiometer if required (Para 12-35).
- (2) Start engine and functionally test cylinders (TM 5-2420-230-10).
- (3) Perform hydraulic calibration if potentiometer was replaced (Para 10-26).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





**b. Installation.**

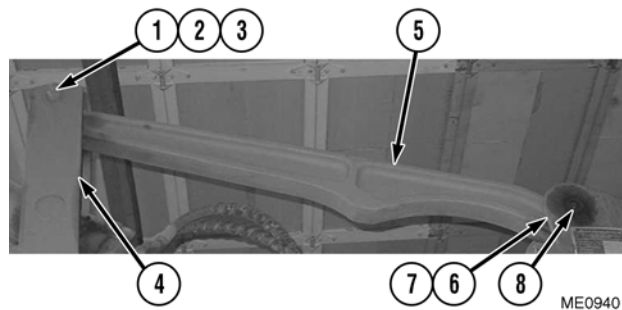
**WARNING**

Tilt linkages are heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving tilt linkages. Failure to comply may result in injury or death to personnel.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

- (1) Attach suitable lifting device and sling to tilt linkage (5).
- (2) Use lifting device to position tilt linkage (5) and install forward side of tilt linkage (5) with pivot pin (8), bolt (7), and nut (6).
- (3) Install bolt (2), washer (3), and new self-locking nut (1) through pivot arm (4) and rear side of tilt linkage (5).



**c. Follow-On Maintenance.**

- (1) Start engine and functionally test linkages (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-25. 4-IN-1 BUCKET CYLINDER MAINTENANCE.**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Bucket in dig position.
Para 10-5	Hydraulic system pressure released.

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Grease, automotive and artillery, Item 30, Appendix C  
Nut, self-locking, Item 111, Appendix D (2)  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 153

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

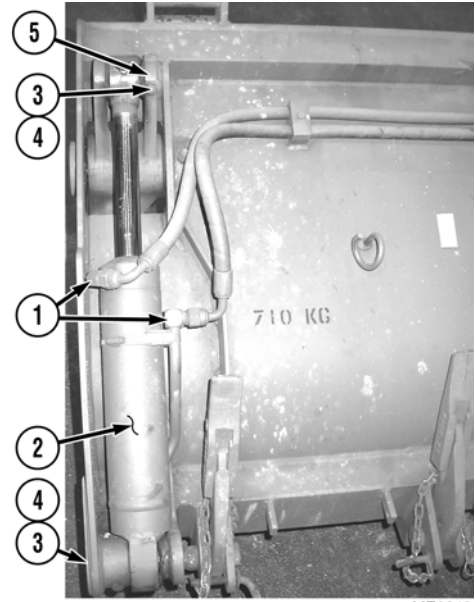
*Personnel Required*  
MOS 62B, Construction Equipment Repairer

**a. Removal.**

**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
- Remove cable ties as necessary.
- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Both 4-in-1 bucket cylinders are removed and installed in the same way. Left side is shown.

- (1) Place drain pan beneath hydraulic hoses (1).



ME0949

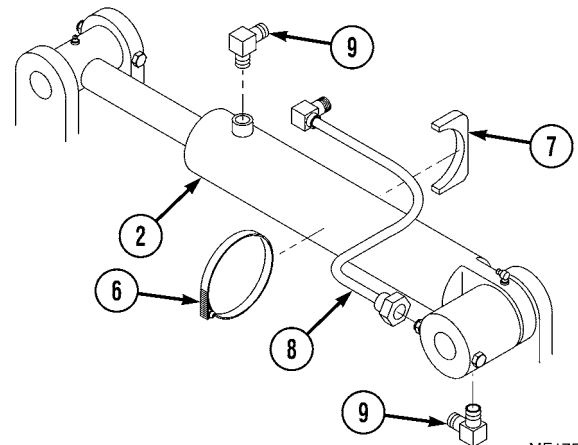
**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

- (2) Disconnect two hydraulic hoses (1) from 4-in-1 bucket cylinder (2).
- (3) Remove two self-locking nuts (3) and bolts (4) from pivot pins (5). Discard self-locking nuts.
- (4) Remove pivot pins (5) from 4-in-1 bucket cylinder (2).
- (5) Remove 4-in-1 bucket cylinder (2).

**b. Disassembly.**

- (1) Remove clamp (6) and collar (7) from 4-in-1 bucket cylinder (2).
- (2) Disconnect hose (8) from 4-in-1 bucket cylinder (2).
- (3) Remove two elbows (9) from 4-in-1 bucket cylinder (2).



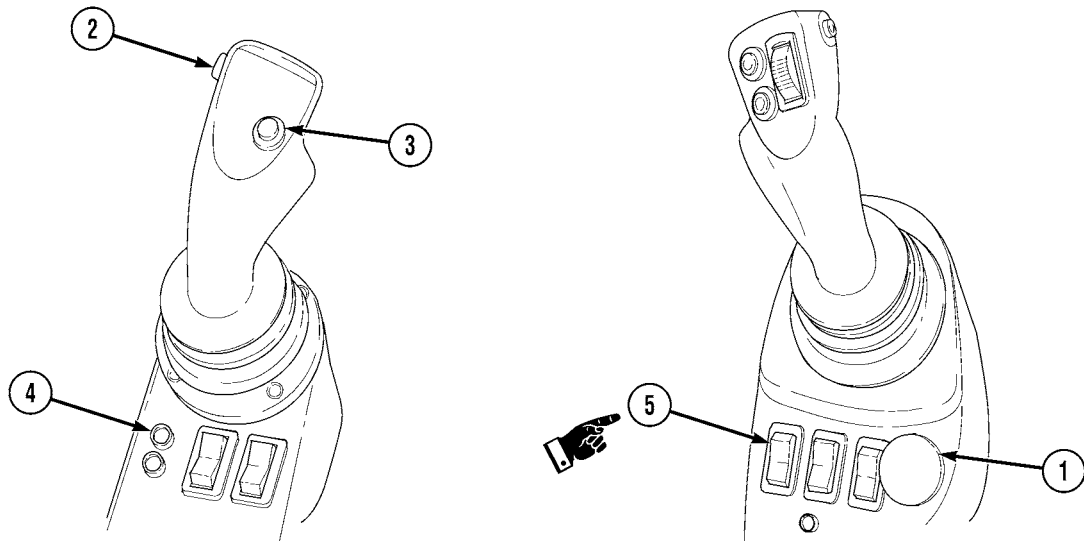
ME1753

**c. Assembly.**

- (1) Install two elbows (9) on 4-in-1 bucket cylinder (2).
- (2) Connect hose (8) to 4-in-1 bucket cylinder (2).
- (3) Install clamp (6) and collar (7) on 4-in-1 bucket cylinder (2).



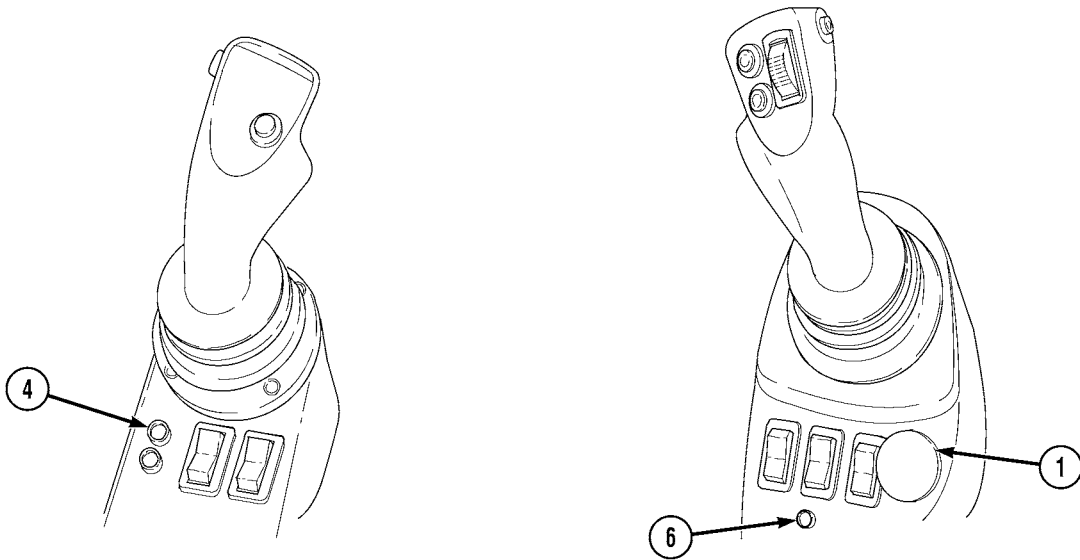
**a. Calibration.**



ME0649

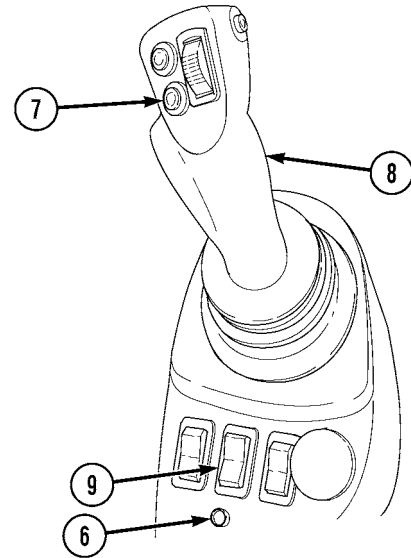
- (1) Start engine (TM 5-2420-230-10) with hydraulic master switch (1) in OFF position.
- (2) Hold down work selection (2) and bucket shaker (3) buttons while turning hydraulic master switch (1) to ON position. Keep buttons depressed for at least 4 seconds, then release them. Loader indicator lamp (4) will flash signals as follows: long, long, long, etc.
- (3) Raise loader arms to height of hood, then dump bucket completely forward until relief valve opens. Release control lever.
- (4) Press bucket shaker button (3) and memory button (5) for at least 4 seconds. Loader indicator lamp (4) will flash long and short signals as follows: long, short, long, short, etc.
- (5) Curl bucket completely back until relief valve opens. Release control lever.
- (6) Press bucket shaker button (3) and memory button (5) for at least 4 seconds. Loader indicator lamp (4) will flash long and short signals as follows: long, short, short, long, short, short, etc.
- (7) Raise loader arms until relief valve opens. Release control lever. Loader indicator lamp (4) will flash long signals as follows: long, long, long, etc.
- (8) Press bucket shaker button (3) and memory button (5) for at least 4 seconds. Loader indicator lamp (4) will flash long and short signals as follows: long, short, long, short, etc.
- (9) Lower loader arms completely down until relief valve opens. Release control lever.
- (10) Press bucket shaker button (3) and memory button (5) for at least 4 seconds. Loader indicator lamp (4) will flash long and short signals as follows: long, short, short, long, short, short, etc.
- (11) Turn hydraulic master switch (1) to OFF position for at least 4 seconds.
- (12) Calibration procedure is now completed. Functionally test system.

**b. Functional Test.**



- (1) To perform hydraulic function test on FEL:
  - (a) Turn hydraulic master switch (1) to ON position.
  - (b) Loader indicator lamp (4) on left-hand control lever should be ON.
  - (c) Run engine at 1,400 RPM and turn hydraulic master switch (1) to ON position.
  - (d) Check positioning of bucket by raising loader arms to height of hood and turning bucket completely forward (dumping) and then turning it completely in opposite direction (backward).
  - (e) Bucket should contact stops in both directions.
  - (f) With bucket completely turned backward, lower loader arms as low as possible.
  - (g) Arms should come up against stops.
  - (h) Lower bucket to ground so it is almost horizontal.
  - (i) Raise loader arms and observe bucket. Arms and bucket should start to move smoothly, and bucket should remain close to horizontal.
  - (j) Raise loader arms to their maximum height.
  - (k) Arms should contact stops.
  - (l) Float position indicator lamp (6) should be out.
  - (m) Turn bucket completely forward (dumping).

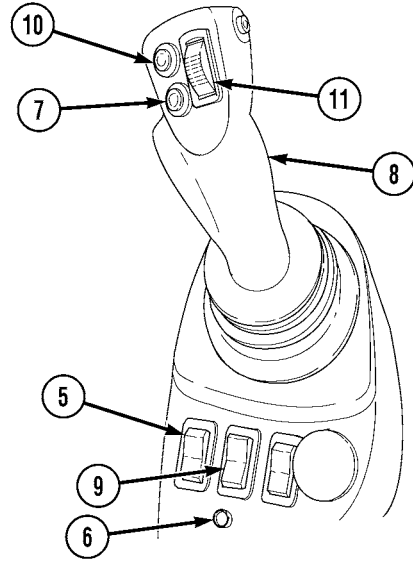
- (2) Select Mode 1 on loader mode selector.
  - (a) Hold down return-to-dig button (7) and move control lever (8) forward.
  - (b) Release control lever (8).
  - (c) Arms should lower to 15-24 in. (40-60 cm) from ground.
  - (d) Bucket should be closed and positioned horizontally.
  - (e) Float position indicator lamp (6) should flash.
  - (f) Press return-to-dig button (7) again, without moving control lever.
  - (g) Arms should lower to ground, and bucket should reach ground in horizontal position.
  - (h) Float position indicator lamp (6) should stay lit.
  - (i) Raise loader arms to maximum height.
  - (j) Float position indicator lamp (6) should go out.
  - (k) Turn bucket completely forward (dumping).



ME0652

- (3) Select Mode 2 on loader mode selector (9).
  - (a) Hold down return-to-dig button (7) and move control lever (8) forward.
  - (b) Release control lever (8).
  - (c) Arms should lower to ground.
  - (d) Bucket should be closed and positioned horizontally.
  - (e) Float position indicator lamp (6) should stay lit.
  - (f) Open and close bucket without touching arms.
  - (g) Float position indicator lamp (6) should stay lit all this time.
  - (h) Raise loader arms to their maximum height.
  - (i) Float position indicator lamp (6) should go out.
  - (j) Turn bucket completely forward (dumping).

- (4) Select Mode 3 on loader mode selector (9).
  - (a) Float position indicator lamp (6) should flash, showing that Mode 3 has been selected.
  - (b) Hold down return-to-dig button (7) and move control lever (8) forward.
  - (c) Release control lever (8).
  - (d) When arms are at hood height, pull back on control lever and release it.
  - (e) Ensure arms stop lowering, and bucket has not changed its position.
  - (f) Move bucket to about 2 in. (5 cm) off ground.
  - (g) Press on return-to-position control (10).
  - (h) Arms will raise to about 24 in. (60 cm) off ground and bucket will close to 18 in. (45 cm).
  - (i) Raise arms above hood and open bucket halfway.
  - (j) Press memory button (5).
  - (k) Raise loader arms to maximum height.
  - (l) Check antirollback device by trying to crowd bucket.
  - (m) Bucket should not come up against stop.
  - (n) Press return-to-position button (10).
  - (o) Arms and bucket return to position previously selected (just above hood).
  - (p) Lower arms and place bucket flat on ground.
  - (q) Raise loader arms as quickly as possible by pulling control lever (8) fully back.
  - (r) Lower arms to ground.
  - (s) Run engine at idle speed.
  - (t) Raise loader arms by pulling control lever fully back. During this period, accelerate engine and observe increase in speed of arms.
  - (u) Open and close 4-in-1 bucket by using rotary switch (11).
  - (v) Lower loader arms to ground with bucket level.
  - (w) Disconnect 4-in-1 bucket hydraulic connections.



ME0653

**c. Follow-On Maintenance.**

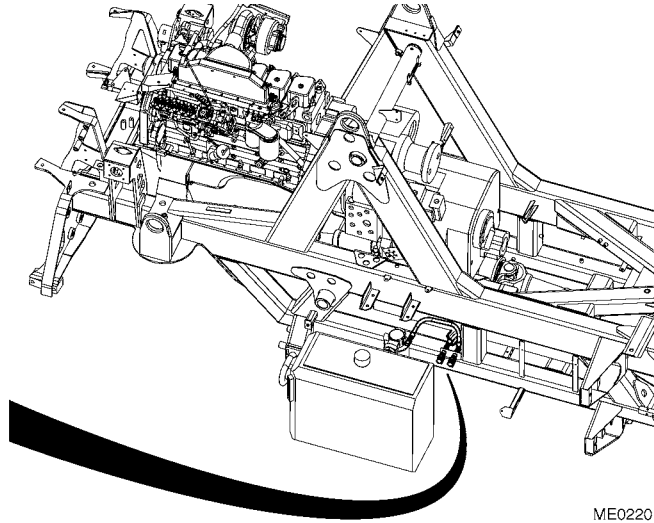
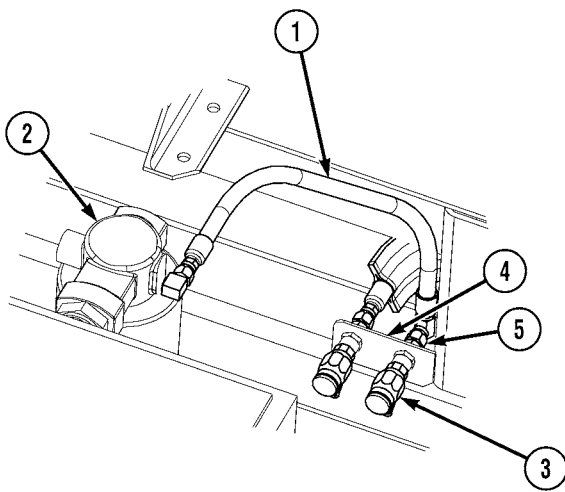
- (1) Install locking clevis (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**





**b. Installation.**



ME0220

**NOTE**

Install cable ties as necessary.

- (1) Install adapter (5) on hose (1).
- (2) Connect oil sampling valve (3) on bracket (4) and adapter (5).
- (3) Connect hose (1) to hydraulic oil filter (2) with sealing compound.

**c. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-28. GENERAL HYDRAULIC CYLINDER REPAIR.**

This Task Covers:

- a. Disassembly
- b. Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Bar, cylinder cap, Item 1.1, Appendix B  
Field maintenance, artillery, Item 22.1, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

<i>TM or Para</i>	<i>Condition Description</i>
Para 10-21	Stabilizer cylinder removed (as required).
Para 10-22	FEL lift cylinder removed (as required).
Para 10-23	Tilt cylinder removed (as required).
Para 10-25	4-in-1 bucket cylinder removed (as required).

*Material/parts*  
Cloth, lint-free, Item 10, Appendix C  
Grease, automotive and artillery, Item 30, Appendix C  
Kit, seal, Item 96.1, Appendix D (Tilt or 4-in-1 bucket cylinders)  
Kit, seal, Item 96.2, Appendix D (FEL lift cylinder)  
Kit, seal, Item 96.3, Appendix D (Stabilizer cylinder)  
Solvent, degreasing, Item 58, Appendix C

*Drawings Required*

TM 5-2420-230-24P	Figure 153
TM 5-2420-230-24P	Figure 154
TM 5-2420-230-24P	Figure 155
TM 5-2420-230-24P	Figure 167

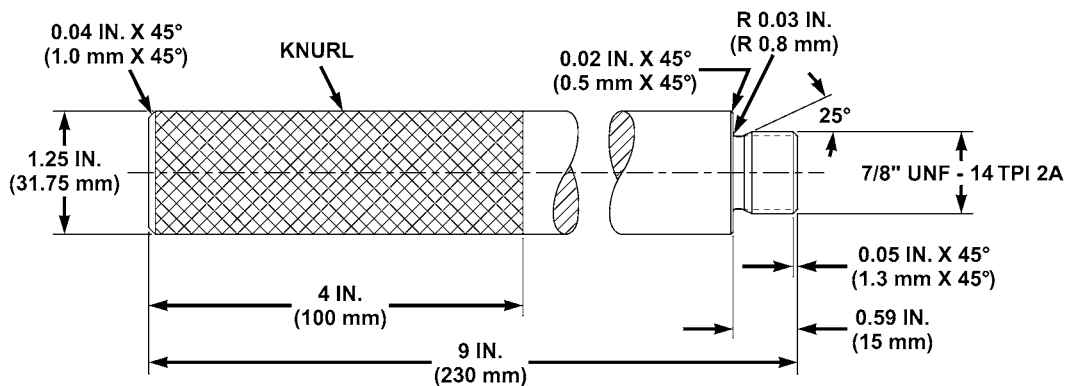
*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**NOTE**

This procedure only applies to the 4-in-1 bucket, tilt, stabilizer, and FEL lift cylinders. For all backhoe cylinder repair, refer to Appendix H.

**a. Disassembly.**



ME2564

- (1) If required, fabricate cylinder cap bar tool from 1.25 in. (31.75 mm) diameter 4140 steel stock. Machine stock to dimensions shown.

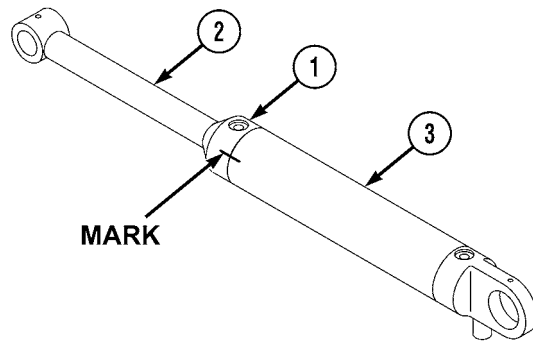
**WARNING**

- Hydraulic cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**NOTE**

- The 4-in-1 bucket, tilt, stabilizer, and FEL lift cylinders are disassembled in a similar manner. 4-in-1 bucket cylinder shown.
- It may be necessary to use a vice to hold cylinder in place to remove front cap.

- (2) Mark front cap (1) to note position.
- (3) Loosen front cap (1) and remove rod assembly (2) from barrel assembly (3).
- (4) Remove self-locking nut (4) from rod (5). Discard self-locking nut.
- (5) Remove seal (6) and piston (7) from rod (5). Discard seal.

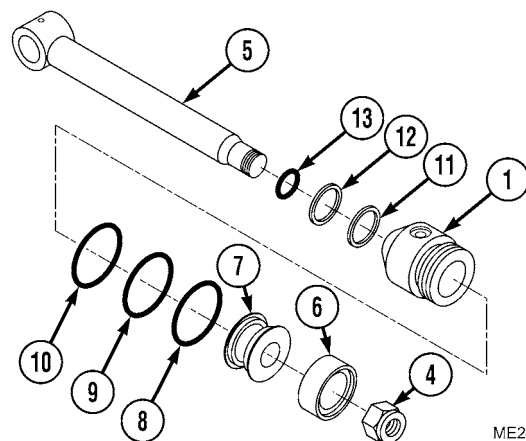


ME2457

**NOTE**

Perform Step (6) for stabilizer or FEL lift cylinders. Perform Step (7) for 4-in-1 bucket or tilt cylinders.

- (6) Remove O-ring (8), O-ring (9), O-ring (10), and front cap (1) from rod (5). Discard O-rings. Go to Step (8).
- (7) Remove O-ring (8), seal (9), and front cap (1) from rod (5). Discard O-ring and seal.
- (8) Remove and discard seal (11), wiper (12), and O-ring (13) from front cap (1). Discard seal, wiper, and O-ring.



ME2458

**b. Inspection.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
  - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
  - Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- (1) Clean all parts with degreasing solvent and lint-free cloth before a visual inspection. Ensure inside surface of tube is free of any dirt or debris.
  - (2) Inspect threads on rod, and inside barrel assembly, front cap, and bearing for wear or damage.
  - (3) Inspect interior of barrel assembly for scratches, scoring, and any other damage. If found, replace barrel assembly.
  - (4) Ensure rod is straight. If not, replace rod.
  - (5) Check for rust on any components. If found, repair or replace as required.

**c. Assembly.**

**WARNING**

Hydraulic cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.

**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

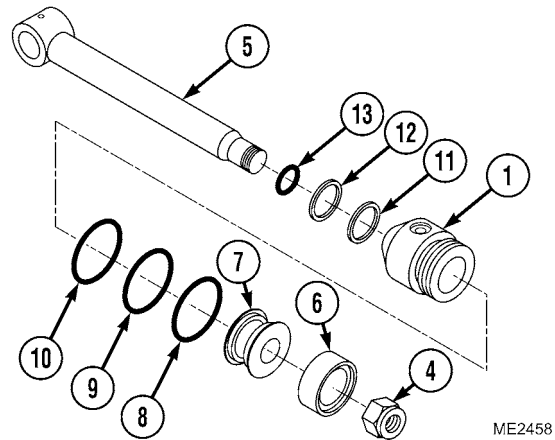
- The 4-in-1 bucket, tilt, stabilizer, and FEL lift cylinders are assembled in a similar manner. 4-in-1 bucket cylinder shown.
- It may be necessary to use a vice to hold cylinder in place to assemble front cap.
- Apply a coat of grease to all packing, O-rings, and seals prior to assembly.

- (1) Install new O-ring (13), new wiper (12), and new seal (11) on front cap (1).

**NOTE**

Perform Step (2) for stabilizer and FEL lift cylinders. Perform Step (3) for 4-in-1 bucket or tilt cylinders.

- (2) Install front cap (1), new O-ring (10), new O-ring (9), and new O-ring (8) on rod (5). Go to Step (4).
- (3) Install front cap (1), new seal (9), and new O-ring (8) on rod (5).
- (4) Position piston (7) and new seal (6) on rod (5).
- (5) Install new self-locking nut (4) on rod (5). Torque to 400 lbf/ft (542 N•m) for 4-in-1 bucket and tilt cylinders. Torque to 960 lbf/ft (1302 N•m) for lift and stabilizer cylinders.
- (6) Install rod assembly (2) by threading front cap (1) onto barrel assembly (3).

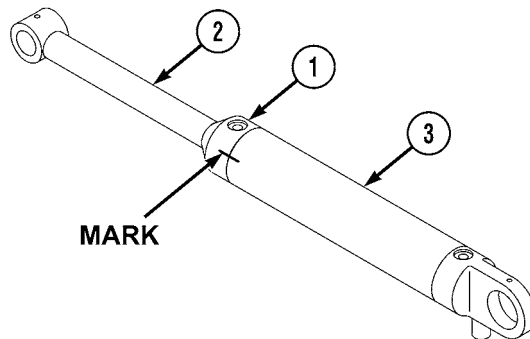


ME2458

**NOTE**

Ensure front cap is completely tightened prior to matching marks.

- (7) Tighten front cap (1) completely and match-up marks.



ME2459

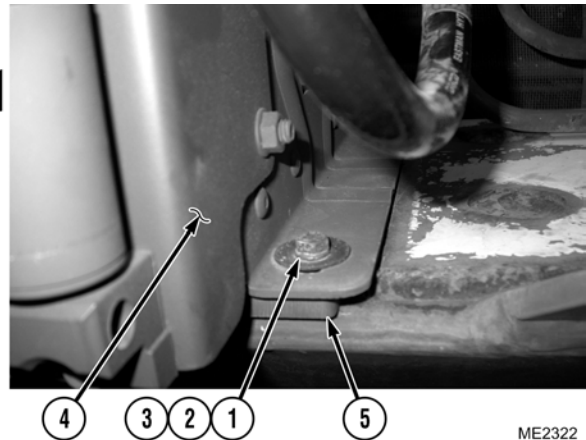
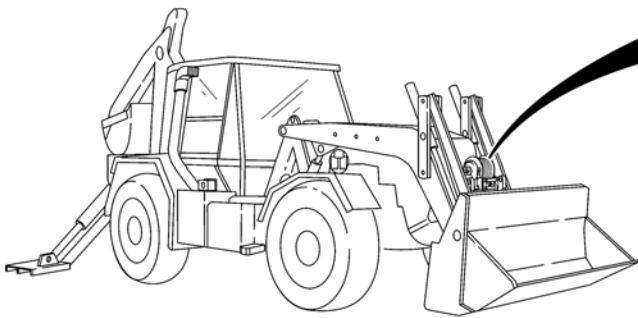
**d. Follow-On Maintenance.**

- (1) If removed, install stabilizer cylinder (Para 10-21).
- (2) If removed, install FEL lift cylinder (Para 10-22).
- (3) If removed, install tilt cylinder (Para 10-23).
- (4) If removed, install 4-in-1 bucket cylinder (Para 10-25).

**END OF TASK**

<b>10-29. HOSE REEL ASSEMBLY MAINTENANCE.</b>		
This Task Covers:		
a. Removal	b. Disassembly	c. Assembly
d. Installation	e. Follow-On Maintenance	
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	<i>Condition Description</i>
None	<i>TM or Para</i>	
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Field, maintenance, basic, Item 23, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Loctite 243, Item 20, Appendix C		
Loctite 567, Item 22, Appendix C	TM 5-2420-230-10	Hose reel stowed (cover removed).
Nut, self-locking, Item 110, Appendix D (2)		
Tags, identification, Item 63, Appendix C		
Ties, cable, Item 68, Appendix C		
Washer, lock, Item 280, Appendix D (8)		
	<i>Drawings Required</i>	
	TM 5-2420-230-24P	Figure 184
	TM 5-2420-230-24P	Figure 185
<i>Personnel Required</i>	<i>Estimated Time to Complete Task</i>	
MOS 62B, Construction Equipment Repairer (2)	Refer to MAC in Appendix B	
<i>References</i>		
None		

**a. Removal.**

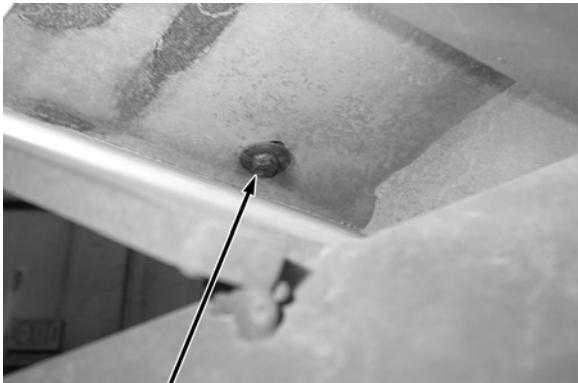


ME2322

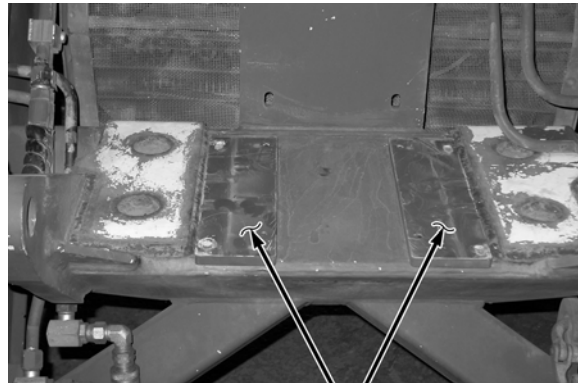
**WARNING**

Hose reel weighs 86 lb. (39 kg). Use an assistant and follow safe working procedures when lifting or moving hose reel. Failure to comply may result in injury or death to personnel.

- (1) With the aid of an assistant, remove four screws (1), lockwashers (2), washers (3), and hose reel (4) from two adaptor plates (5). Discard lockwashers.



ME2445



ME2446

**NOTE**

Perform Step (2) only if necessary.

- (2) Remove four screws (6), lockwashers (7), washers (8), and adaptor plates (5) from vehicle. Discard lockwashers.

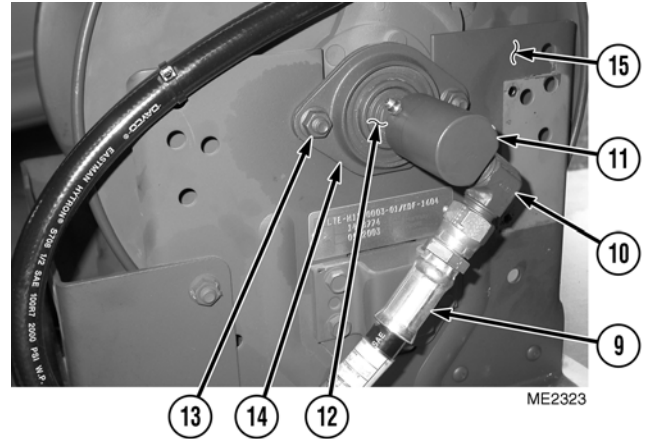
**b. Disassembly**

- (1) Remove hose reel hose assembly leaving fittings installed (Para 10-34).
- (2) Remove hose reel roller assembly (Para 10-30).
- (3) Remove hose reel spring motor and arbor (Para 10-31).
- (4) Remove hose reel valve assembly (Para 10-33).



**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.



**NOTE**

- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.

(5) Remove hose (9) from elbow (10).

(6) Remove elbow (10) from swivel joint (11).

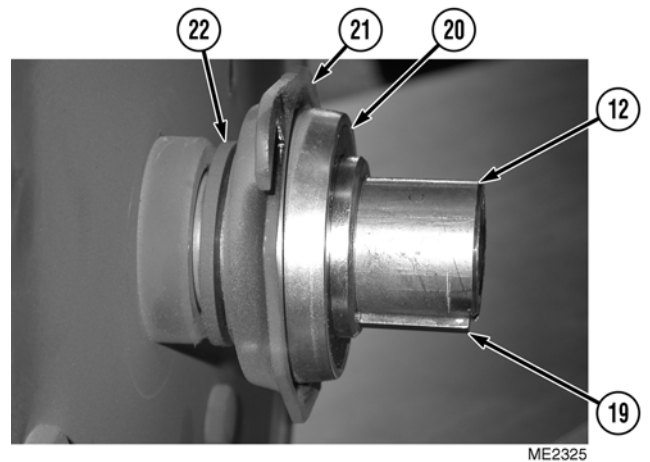
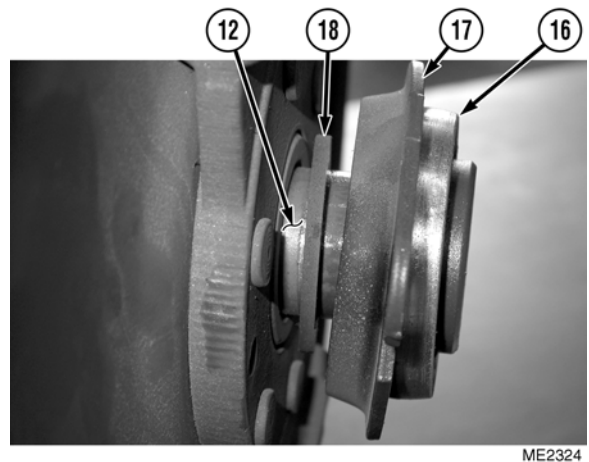
(7) Remove swivel joint (11) from hub assembly (12).

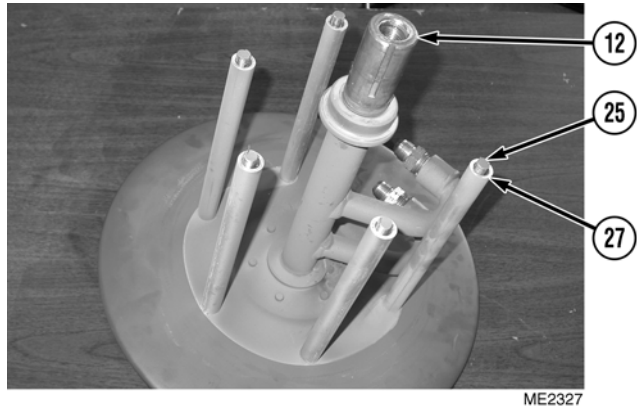
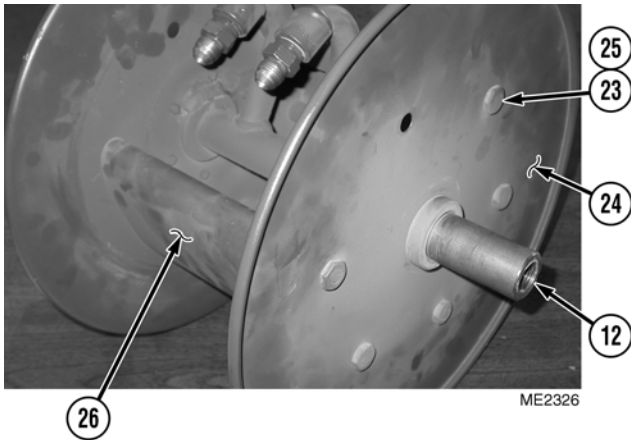
(8) Remove four nuts (13), two outer bearing retaining plates (14), and hub assembly (12) from frame (15).

(9) Remove bearing (16), inner bearing retaining plate (17), and hub spacer (18) from LH end of hub assembly (12).

(10) Remove key (19) from groove of hub assembly (12).

(11) Remove bearing (20), inner bearing retaining plate (21), and two hub spacers (22) from RH end of hub assembly (12).

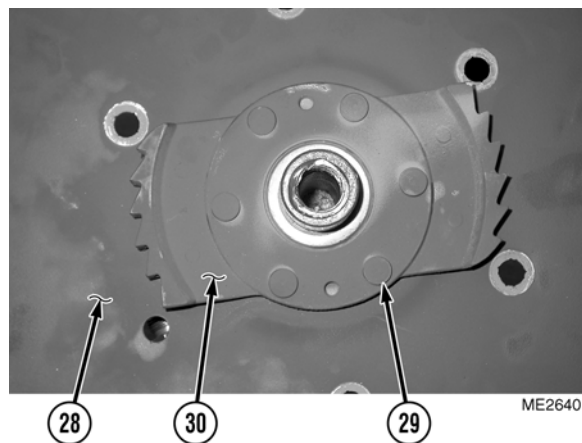




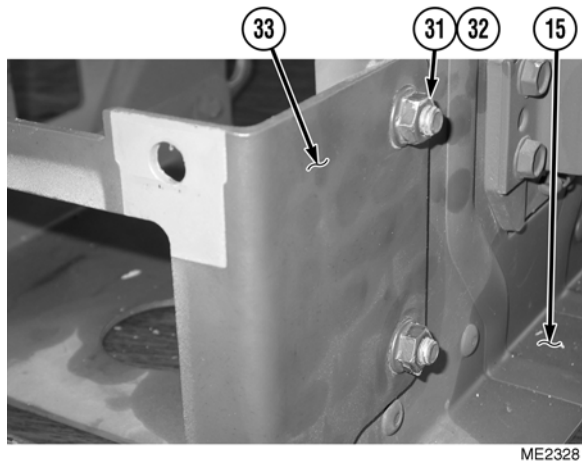
- (12) Remove five nuts (23) and rear disc (24) from five screws (25) and hub assembly (12).
- (13) Remove drum (26), five spacer pipes (27), and screws (25) from front disc (28).

**NOTE**

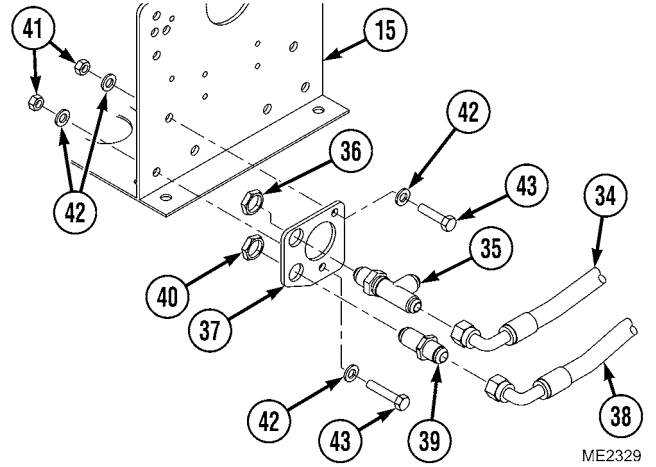
Front disc and hub assembly may be welded together. If front disc or hub assembly need to be replaced and is welded, both front disc and hub assembly must be replaced.



- (14) Remove six rivets (29) and ratchet wheel (30) from front disc (28). Discard rivets.
- (15) Remove four nuts (31), screws (32), and roller bracket (33) from frame (15).



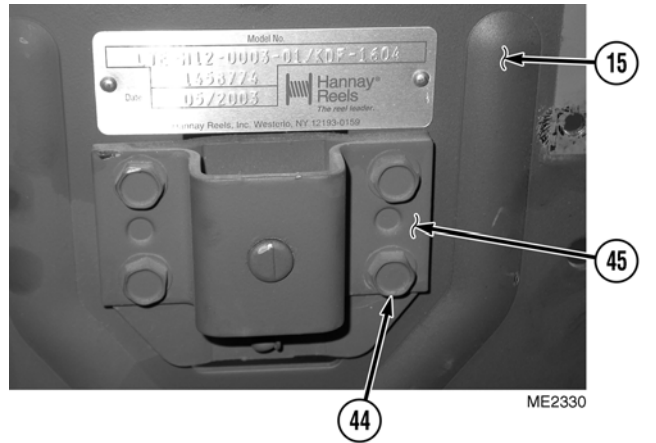
- (16) Remove hose (34) from T-fitting (35).
- (17) Remove nut (36) and T-fitting (35) from bracket (37).
- (18) Remove hose (38) from adaptor (39).
- (19) Remove nut (40) and adaptor (39) from bracket (37).
- (20) Remove two self-locking nuts (41), four washers (42), two screws (43), and bracket (37) from frame (15). Discard self-locking nuts.
- (21) Remove four screws (44) and pawl (45) from frame (15).



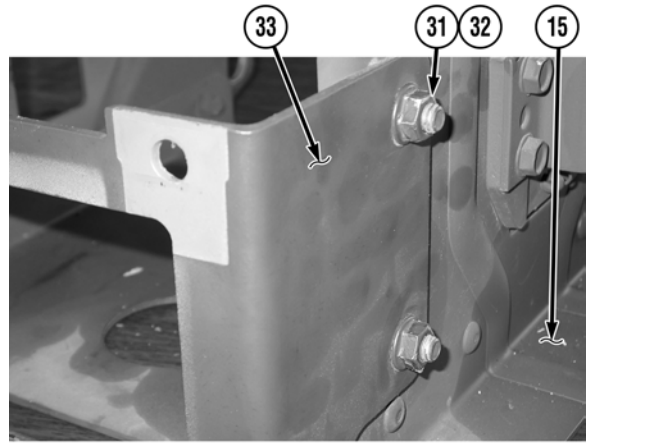
ME2329

**c. Assembly.**

- (1) Install pawl (45) on frame (15) with four screws (44).
- (2) Install bracket (37) on frame (15) with two screws (43), four washers (42), and two new self-locking nuts (41).
- (3) Install adaptor (39) on bracket (37) with nut (40).
- (4) Install hose (38) on adaptor (39).
- (5) Install T-fitting (35) on bracket (37) with nut (36).
- (6) Install hose (34) on T-fitting (35).
- (7) Install roller bracket (33) on frame (15) with four screws (32) and nuts (31).
- (8) Install ratchet wheel (30) on front disc (28) with six new rivets (29).
- (9) Install five screws (25), drum (26), and five spacer pipes (27) on front disc (28).
- (10) Install rear disc (24) on hub assembly (12) and five screws (25) with five nuts (23).

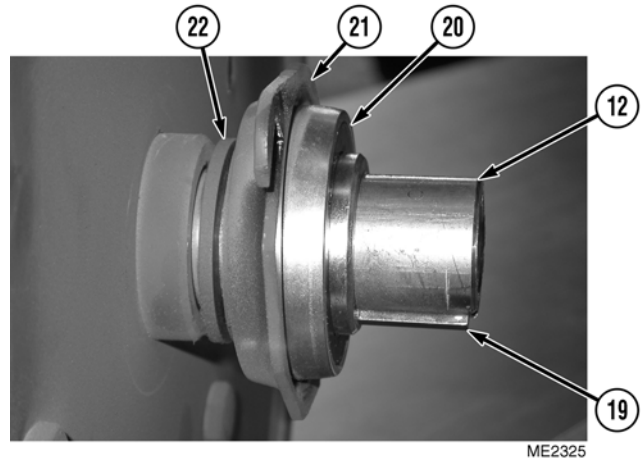


ME2330



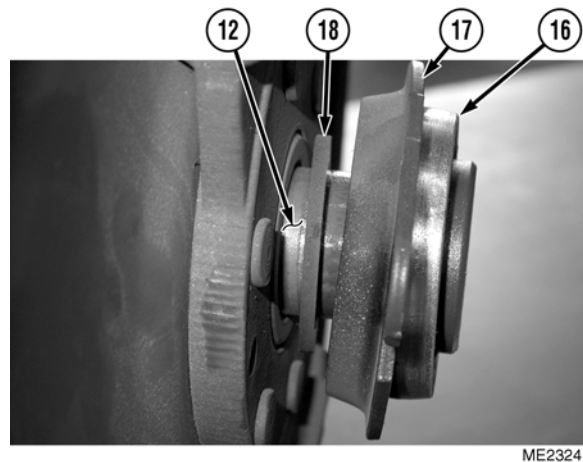
ME2328

- (11) Install two hub spacers (22), inner bearing retaining plate (21), and bearing (20) on hub assembly (12).
- (12) Install key (19) in groove of hub assembly (12).
- (13) Install hub spacer (18), inner bearing retaining plate (17), and bearing (16) on hub assembly (12).
- (14) Install hub assembly (12) and two outer bearing retaining plates (14) on frame (15) with four nuts (13).



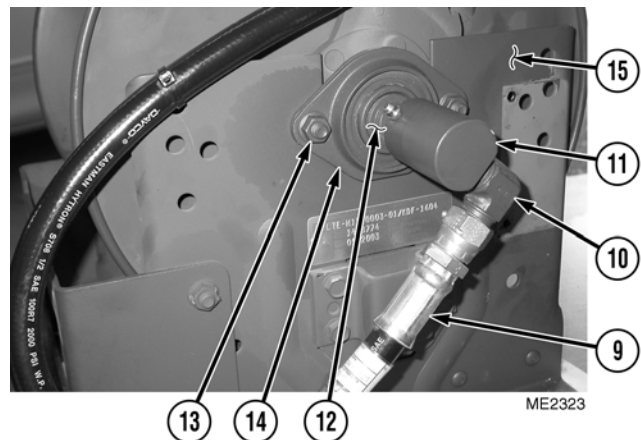
**WARNING**

- Always replace hoses with appropriate parts to prevent hoses from bursting. Failure to comply may result in injury or death to personnel.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.



**CAUTION**

Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris is not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

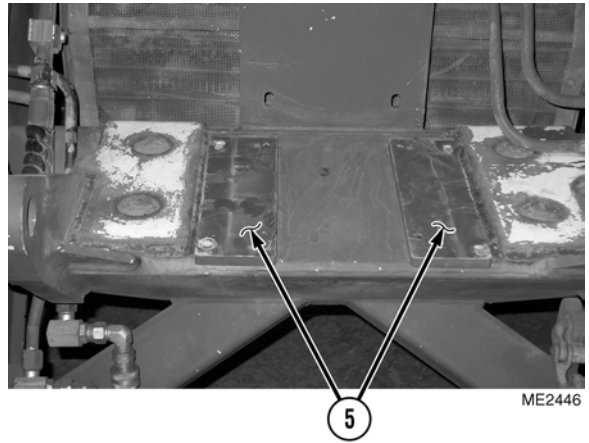
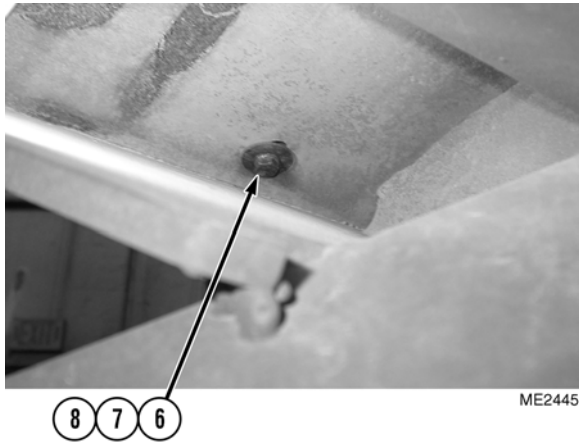


**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (15) Install swivel joint (11) on hub assembly (12).
  - (16) Apply Loctite 567 to elbow (10), and install elbow on swivel joint (11).
  - (17) Install hose (9) on elbow (10).

- (18) Install hose reel valve assembly (Para 10-33).
- (19) Install hose reel spring motor and arbor (Para 10-31).
- (20) Install hose reel roller assembly (Para 10-30).
- (21) Install hose reel hose assembly (Para 10-34).

**d. Installation.**



**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

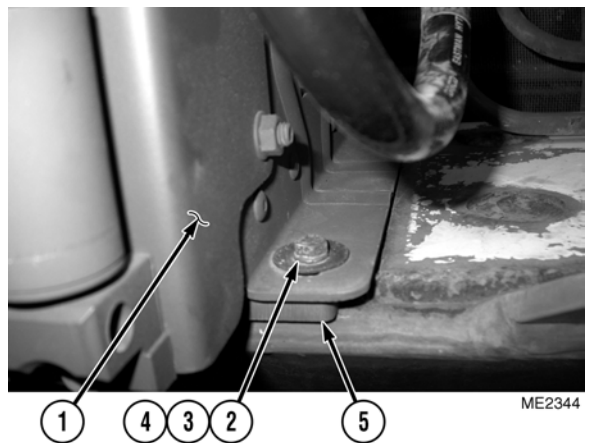
**NOTE**

Perform Steps (1) and (2) if required.

- (1) Apply Loctite 243 on four screws (6).
- (2) Install two adaptor plates (5) on vehicle with four washers (8), new lockwashers (7), and screws (6).

**WARNING**

Hose reel weighs 86 lb. (39 kg). Use an assistant and follow safe working procedures when lifting or moving hose reel. Failure to comply may result in injury or death to personnel.



- (3) Apply Loctite 243 on four screws (2).
- (4) With the aid of an assistant, install hose reel (1) on two adaptor plates (5) with four washers (4), new lockwashers (3), and screws (2).

**e. Follow-On Maintenance.**

- (1) Connect hose reel and check for proper operation and leaks (TM 5-2420-230-10).
- (2) Stow hose reel (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**10-30. HOSE REEL ROLLER REPLACEMENT.**

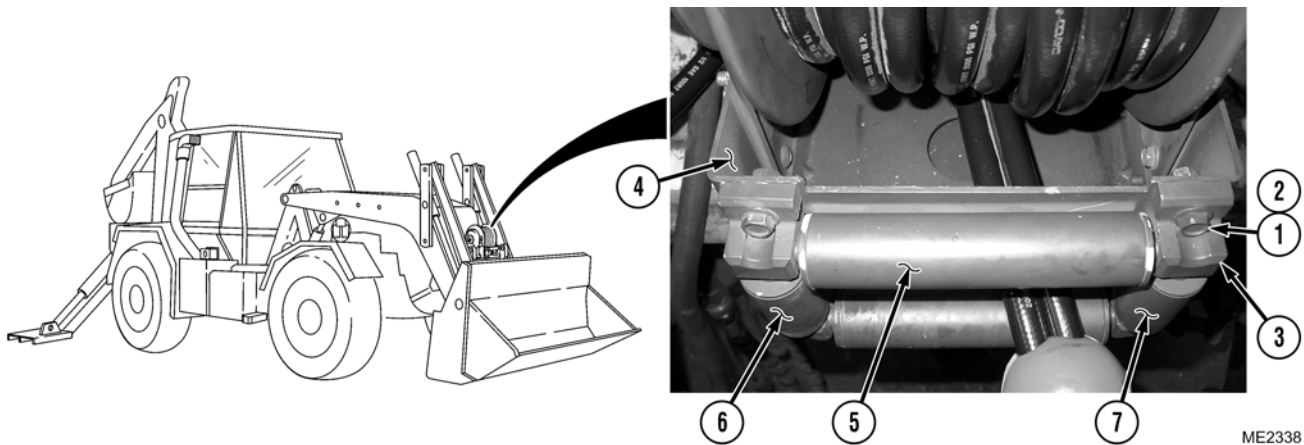
This Task Covers:

- |            |                 |                          |
|------------|-----------------|--------------------------|
| a. Removal | b. Installation | c. Follow-On Maintenance |
|------------|-----------------|--------------------------|

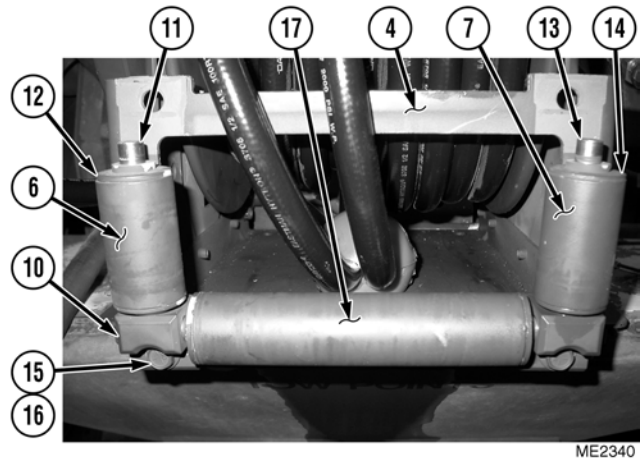
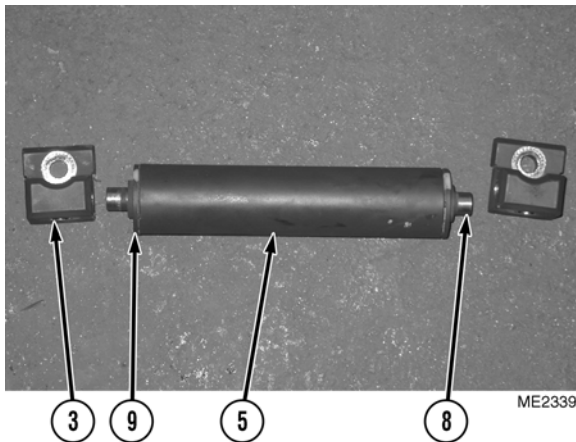
**INITIAL SETUP**

<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> None	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
<i>None Personnel Required</i> MOS 62B, Construction Equipment Repairer	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
	TM 5-2420-230-10	Hose reel stowed (cover removed).
<i>References</i> None	<i>Drawings Required</i> TM 5-2420-230-24P	Figure 185
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

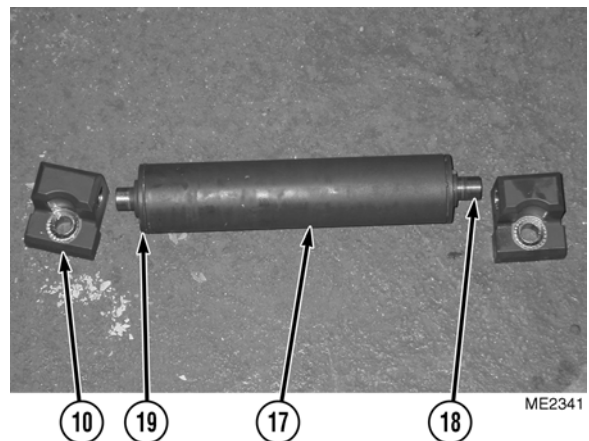
**a. Removal.**



- (1) Remove two nuts (1) and screws (2) from top two mounting blocks (3) and bracket (4).
- (2) Remove two mounting blocks (3) and roller (5) from rollers (6) and (7).



- (3) Remove two mounting blocks (3) from roller (5).
- (4) Remove two rods (8) and sleeve bearings (9) from roller (5).
- (5) Remove rollers (6) and (7) from two mounting blocks (10).
- (6) Remove rod (11) and two sleeve bearings (12) from roller (6).
- (7) Remove rod (13) and two sleeve bearings (14) from roller (7).
- (8) Remove two nuts (15), screws (16), mounting blocks (10), and roller (17) from bracket (4).
- (9) Remove mounting blocks (10) from roller (17).
- (10) Remove two pins (18) and sleeve bearings (19) from roller (17).

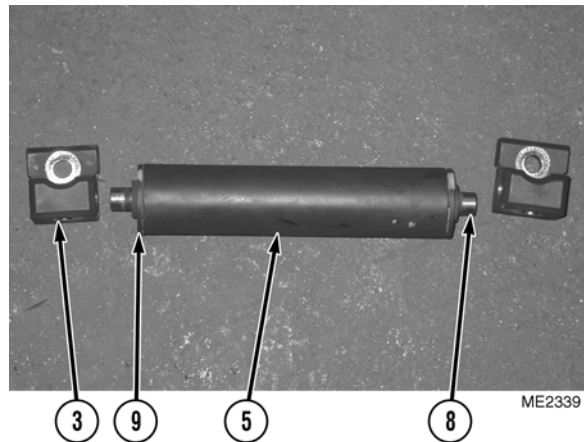
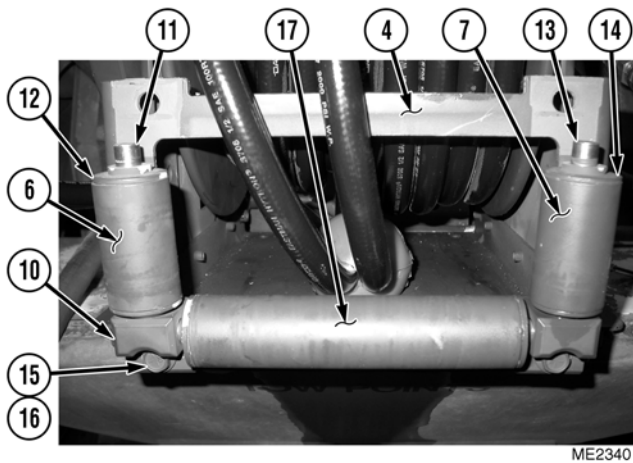


**b. Installation.**

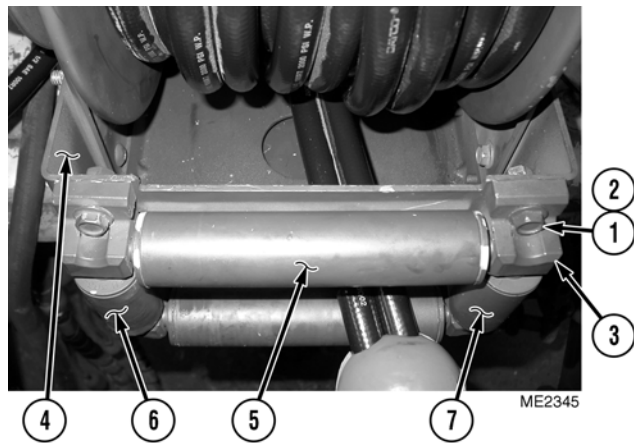
**NOTE**

Ensure hose stop is positioned outside of bracket before installing rollers.

- (1) Install two sleeve bearings (19) and pins (18) on roller (17).
- (2) Install two mounting blocks (10) on roller (17).



- (3) Install roller (17) and mounting blocks (10) on bracket (4) with two screws (16) and nuts (15).
- (4) Install two sleeve bearings (14) and rod (13) on roller (7).
- (5) Install two sleeve bearings (12) and rod (11) on roller (6).
- (6) Install two rollers (7) and (6) on two mounting blocks (10).
- (7) Install two sleeve bearings (9) and rods (8) on roller (5).
- (8) Install two mounting blocks (3) on roller (5).
- (9) Install roller (5) and mounting blocks (3) on rollers (6) and (7).
- (10) Install mounting blocks (3) on bracket (4) with two screws (2) and nuts (1).



**c. Follow-On Maintenance.**

- (1) Install hose reel cover (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**10-31. HOSE REEL SPRING MOTOR REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Loctite 567, Item 22, Appendix C  
Nut, self-locking, Item 117.1, Appendix D (2)  
Tags, identification, Item 63, Appendix C

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

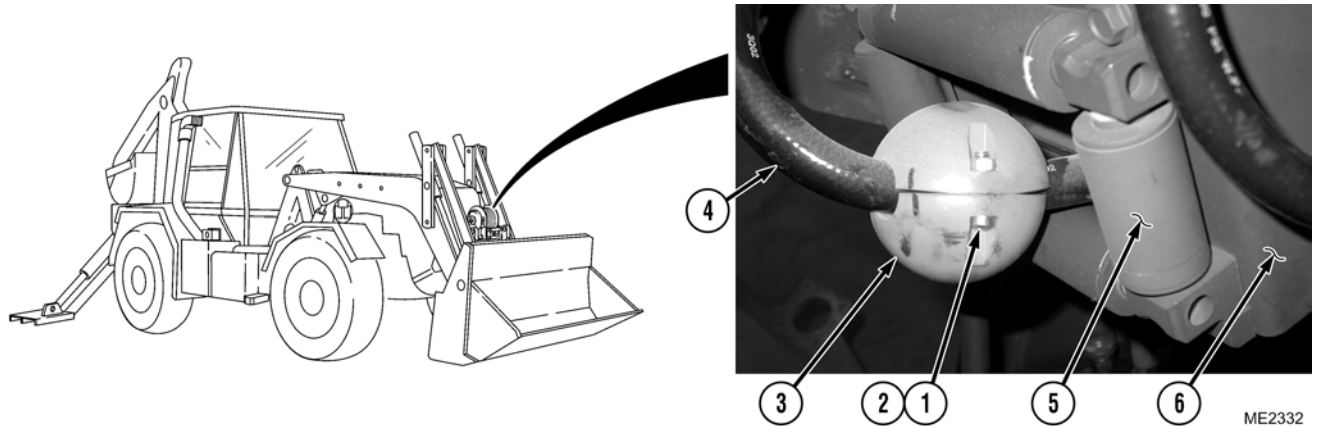
<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
TM 5-2420-230-10	Hose reel stowed (cover removed).

*Drawings Required*

TM 5-2420-230-24P	Figure 184
TM 5-2420-230-24P	Figure 185

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



**WARNING**

The spring motor is under tension when installed. To prevent injury, relieve tension before removing spring motor. Failure to comply may result in injury or death to personnel.

**NOTE**

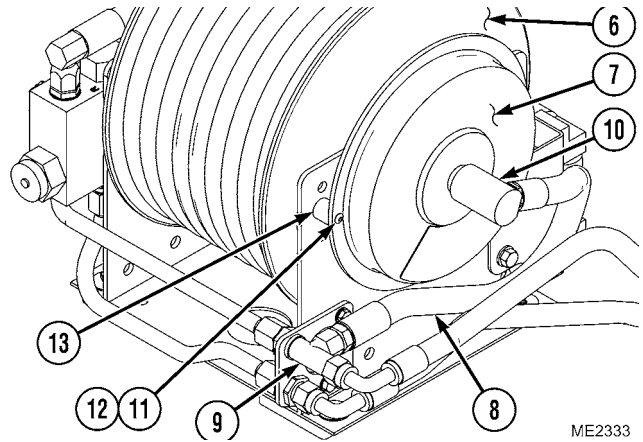
Perform Steps (1) through (3) to release tension on spring motor.

- (1) Remove two nuts (1), screws (2), and hose stop (3) from hoses (4).
- (2) Wind hose assembly (4) through roller assembly (5) onto hose reel (6).

- (3) Wind hose reel (6) in stowed direction until tension on spring motor (7) is relieved.

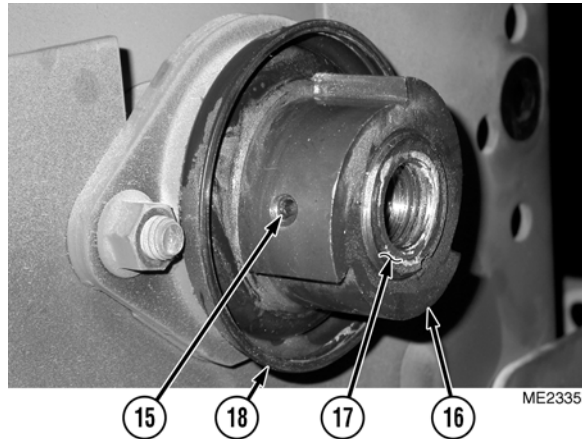
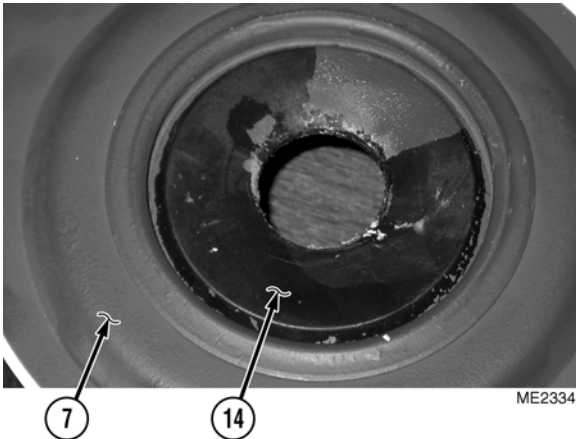
**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.



**NOTE**

- Tag all hoses and note their positions before removal.
  - Cap and plug all hoses upon removal.
- (4) Remove hose (8) from T-fitting (9) and swivel (10).
- (5) Remove swivel (10) from hose reel (6).
- (6) Remove two self-locking nuts (11), screws (12), spring motor (7) and spring mount spacers (13) from hose reel (6). Discard self-locking nuts.



**NOTE**

Perform Steps (7) through (9) only if spring caps and arbor need to be replaced.

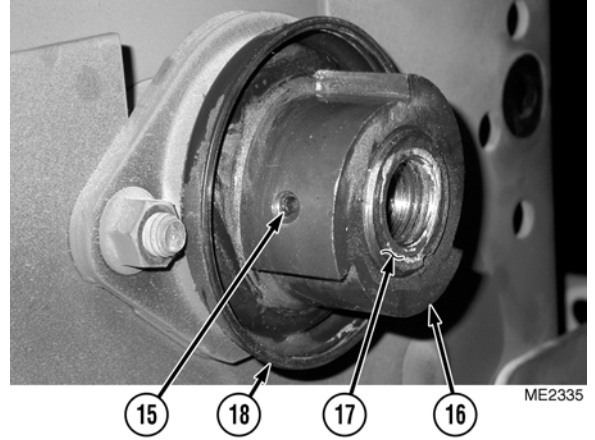
- (7) Remove outer spring cap (14) from spring motor (7).
- (8) Loosen set screw (15) and remove spring arbor (16) from hub assembly (17).
- (9) Remove inner spring cap (18) from hub assembly (17).

**b. Installation.**

**NOTE**

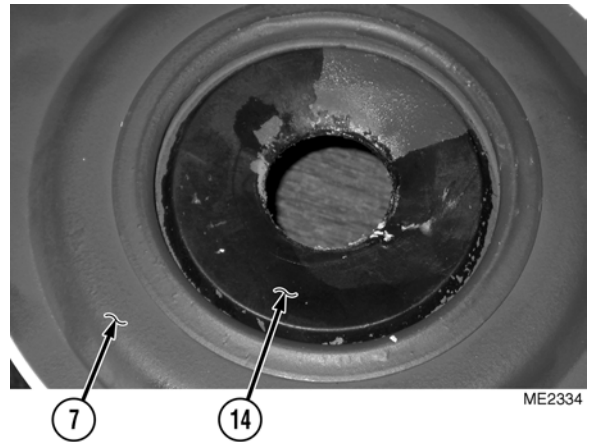
Perform Steps (1) through (3) only if spring caps and arbor were removed.

- (1) Install inner spring cap (18) on hub assembly (17).
- (2) Install spring arbor (16) and tighten set screw (15) on hub assembly (17).
- (3) Install outer spring cap (14) on spring motor (7).
- (4) Install spring motor (7) on hose reel (6) with two spring mount spacers (13), screws (12), and new self-locking nuts (11).
- (5) Install swivel (10) on hose reel (6).



**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.



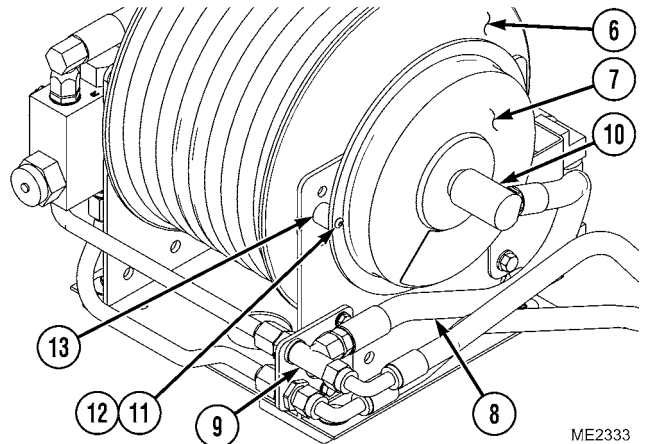
**CAUTION**

Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris is not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

Ensure all hoses are reconnected to positions noted prior to removal.

- (6) Apply Loctite 567 to end of hose (8).
- (7) Install hose (8) on swivel (10) and T-fitting (9).





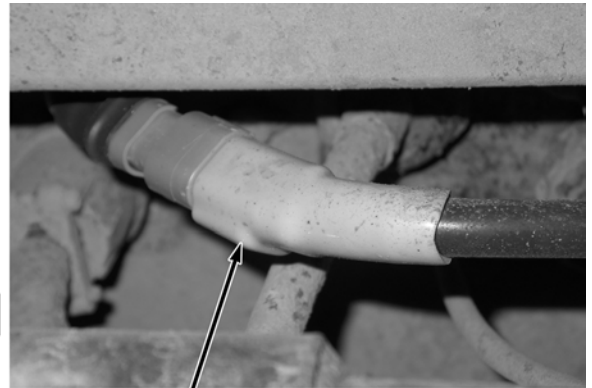
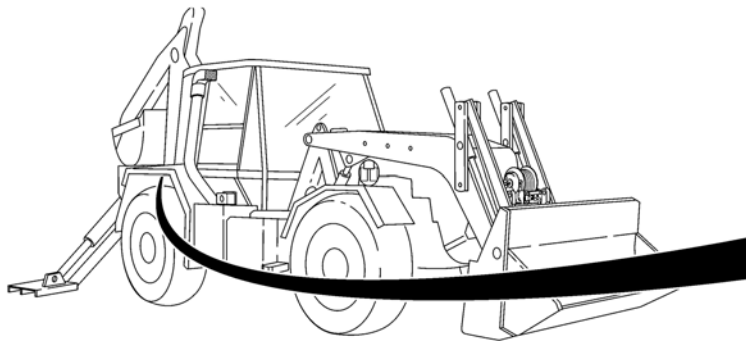
a. Removal.

**WARNING**

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

**NOTE**

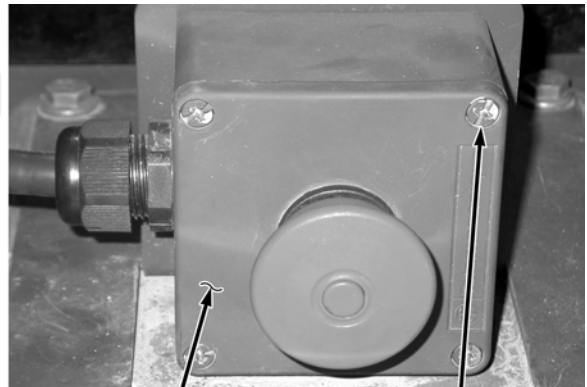
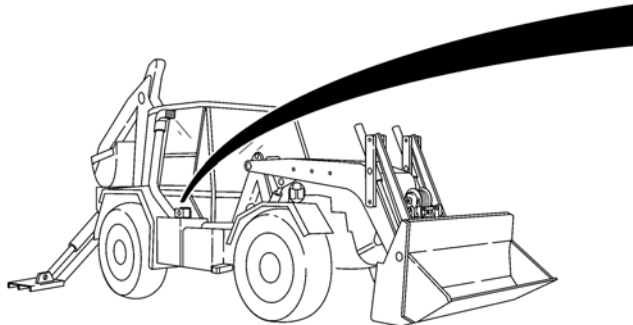
- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.



1

ME2454

- (1) Unplug connector (1).



3

2

ME2313

- (2) Loosen four screws (2) and remove cover of hose reel switch (3).

- (3) Remove two self-locking nuts (4), washers (5), screws (6), and hose reel switch (3) from switch bracket (7). Discard self-locking nuts.
- (4) If required, remove four screws (8), washers (9), and switch bracket (7) from vehicle.

**b. Installation**

- (1) If removed, install switch bracket (7) on vehicle with four washers (9) and screws (8).
- (2) Install hose reel switch (3) on switch bracket (7) with two screws (6), washers (5), and new self-locking nuts (4).
- (3) Install cover of hose reel switch (3) with four screws (2).

**WARNING**

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

**NOTE**

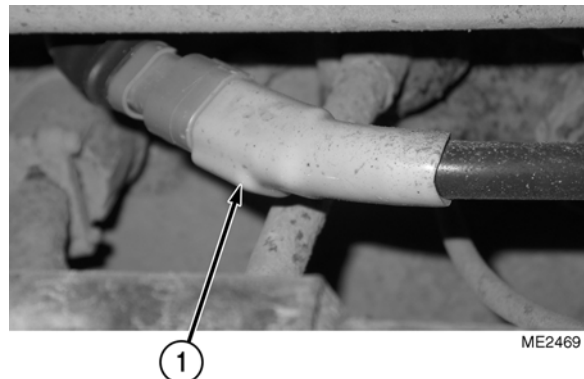
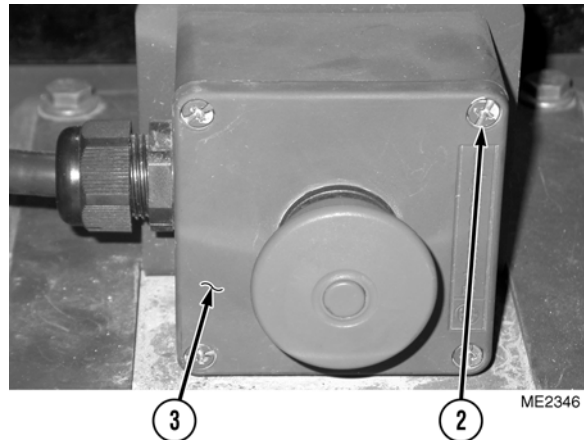
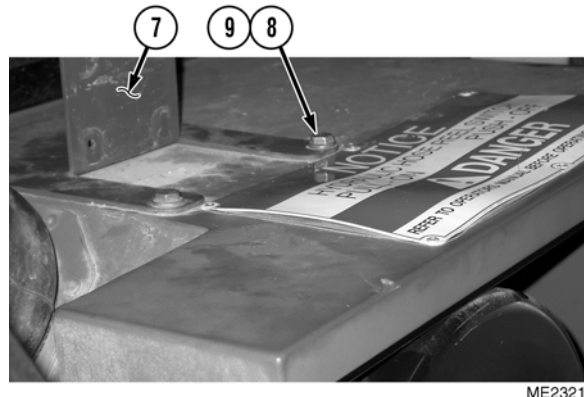
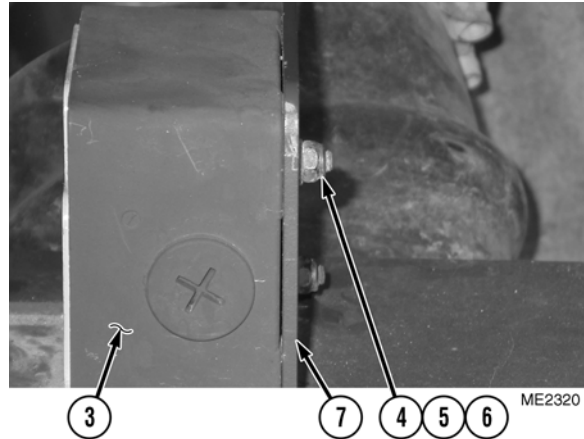
- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (4) Plug in connector (1).

**c. Follow-On Maintenance.**

- (1) Connect hose reel and check for proper operation (TM 5-2420-230-10).
- (2) Stow hose reel (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## 10-33. HOSE REEL VALVE REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

TM or Para

Condition Description

Para 10-29

Hose reel removed.

*Materials/Parts*

Cap and plug set, Item 4, Appendix C

Nut, self-locking, Item 109, Appendix D

Tags, identification, Item 63, Appendix C

Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 184

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

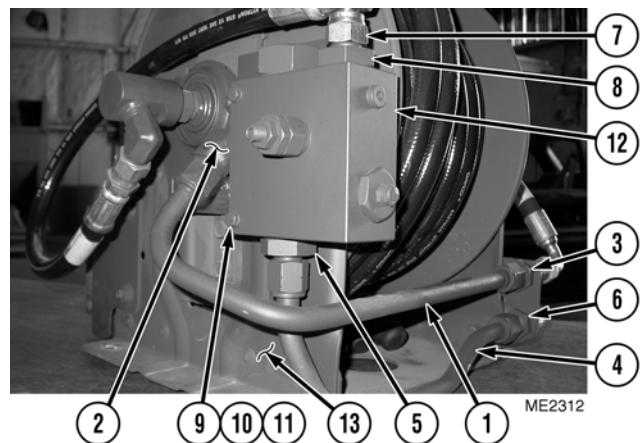
### a. Removal.

## WARNING

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

### NOTE

- Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
- (1) Remove tube (1) from elbow (2) and T-fitting (3).
  - (2) Remove tube (4) from adaptors (5) and (6).
  - (3) Remove hose (7) from adaptor (8).
  - (4) Remove two self-locking nuts (9), washers (10), screws (11), and valve assembly (12) from hose reel (13). Discard self-locking nuts.
  - (5) Remove elbow (2) and adaptors (5) and (8) from valve assembly (12). Inspect O-rings on adaptors. Replace any adaptor with a damaged O-ring.



**b. Installation.**

**WARNING**

Always replace hoses with appropriate parts to prevent hoses from bursting. Failure to comply may result in injury or death to personnel.

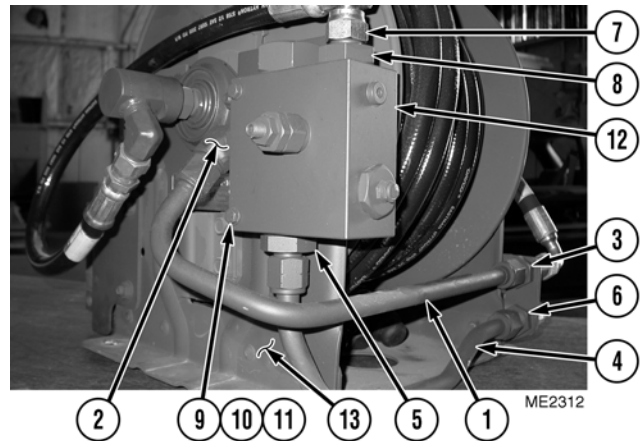
**CAUTION**

Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install adaptors (8), (5), and elbow (2) on valve assembly (12).
- (2) Install valve assembly (12) on hose reel (13) with two screws (11), washers (10), and new self-locking nuts (9).
- (3) Install hose (7) on adaptor (8).
- (4) Install tube (4) on adaptors (6) and (5).
- (5) Install tube (1) on T-fitting (3) and elbow (2).



**c. Follow-On Maintenance.**

Install hose reel (Para 10-29).

**END OF TASK**



**10-34. HOSE REEL HOSE ASSEMBLY REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Adjustment
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Loctite 567, Item 22, Appendix C

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

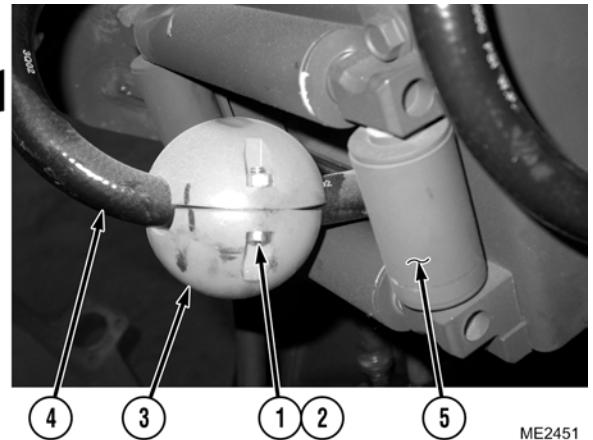
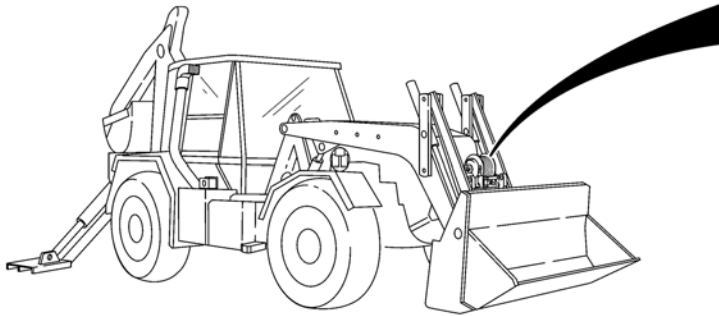
<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
TM 5-2420-230-10	Hose reel stowed (cover removed).

*Drawings Required*

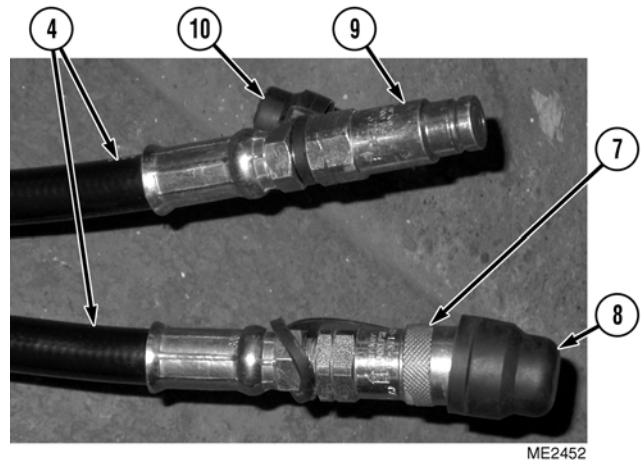
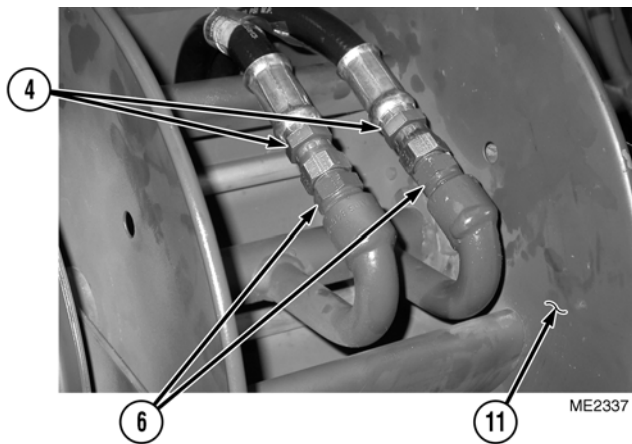
TM 5-2420-230-24P	Figure 184
TM 5-2420-230-24P	Figure 185

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



- (1) Remove two nuts (1), screws (2), and hose stop (3) from hose assembly (4).
- (2) Fully extend hose assembly (4) through hose roller (5).



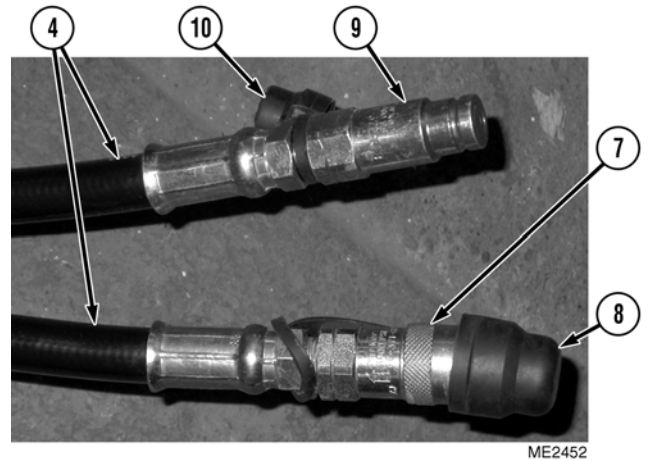
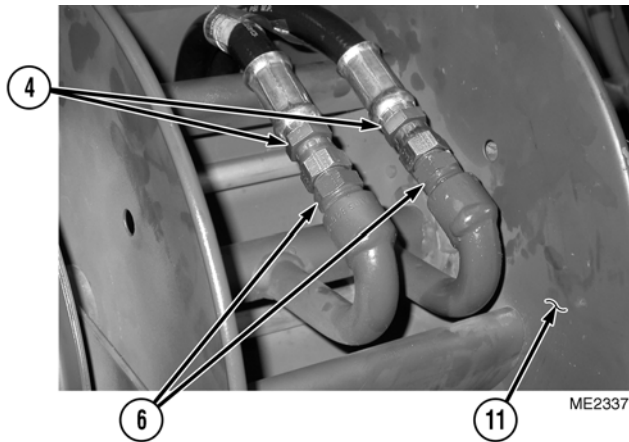
### WARNING

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

### NOTE

- Tag all hoses and note their positions before removal.
  - Cap and plug all hoses and fittings upon removal.
- (3) Remove hose assembly (4) from two adaptors (6).
  - (4) Remove coupler (7) and cap (8) from hose assembly (4).
  - (5) Remove nipple (9) and cap (10) from hose assembly (4).
  - (6) If required, remove two adaptors (6) from hose reel (11).

**b. Installation.**



**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

**CAUTION**

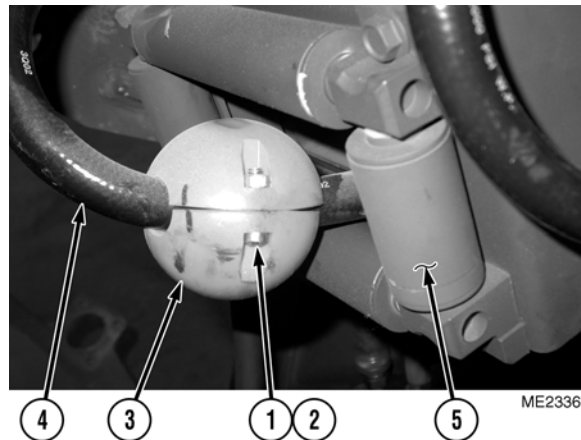
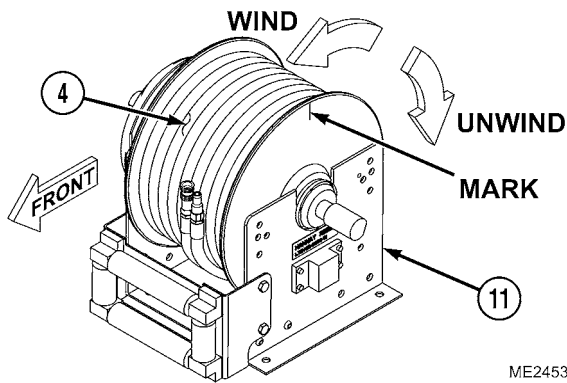
Cleanliness is essential for correct and safe operation of the hydraulic system. Ensure dirt and debris is not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

- (1) If removed, apply Loctite 567 on two adaptors (6) and install on hose reel (11).
- (2) Install cap (10) and nipple (9) on hose assembly (4).
- (3) Install cap (8) and coupler (7) on hose assembly (4).

**NOTE**

- Ensure all hoses are reconnected to positions noted prior to removal.
  - Ensure female coupler side of hose assembly is installed on return side of hose reel.
- (4) Install hose assembly (4) on two adaptors (6).

**c. Adjustment.**



- (1) Mark hose reel (11).
- (2) Using mark, wind hose assembly (4) onto hose reel (11), counting number of turns required to completely stow hose assembly. Record number of turns counted as value A.

**NOTE**

Total number of turns available on hose reel is 14.

- (3) Subtract value A from 14. Record difference as value B.
- (4) While retaining hose assembly (4) on hose reel (11), unwind spool a number of turns equal to value B.

**NOTE**

- When hose stop is at rest on hose reel rollers, pawl should not be engaged.
  - Ensure hose stop is positioned approximately 16 in. (400 mm) from end of hose assembly.
- (5) Pull hose assembly (4) through hose roller (5) and install hose stop (3) on hoses (4) and (5) with two screws (2) and nuts (1).

**d. Follow-On Maintenance.**

- (1) Stow hose reel (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

# CHAPTER 11

## EXHAUST SYSTEM

Contents	Para	Page
General. . . . .	11-1	11-1
Vehicle Preparation and Isolation. . . . .	11-2	11-1
Restore IHMEE to Operational Readiness. . . . .	11-3	11-2
Muffler Heat Shield Replacement. . . . .	11-4	11-2
Muffler Replacement. . . . .	11-5	11-3
Exhaust Pipes Replacement. . . . .	11-6	11-5

### 11-1. GENERAL.

This chapter contains routine maintenance activities and removal and installation procedures for the following components:

- Heat shield
- Muffler
- Exhaust pipes

### 11-2. VEHICLE PREPARATION AND ISOLATION.

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Turn OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).



**b. Installation.**

Steps in installation of muffler heat shield are the reverse of those in removal procedure.

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>11-5. MUFFLER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	c. Inspection	d. Installation
b. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i>	
	<i>TM or Para</i>	<i>Condition Description</i>
	Para 11-4	Muffler heat shield removed.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	Para 11-6	Exhaust pipe removed.
<i>Materials/Parts</i> Sealant, metal, Item 54, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 31	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B	
<i>References</i> None		

**a. Removal.**



Hot parts can burn personnel. Let hot parts cool before starting work.

- (1) Remove mounting bolts securing top and bottom of muffler.
- (2) Loosen clamp securing muffler to exhaust pipe.
- (3) Remove muffler.

**b. Inspection.**

**WARNING**

Hot parts can burn personnel. Let hot parts cool before starting work.

Inspect exhaust system for the defects listed below, using flashlight and mirror. It will be necessary to remove the belly plates to gain access to the exhaust system. If vehicle has been operating in a muddy environment, it may also be necessary to clean the underside.

- Holes
- Dents
- Damage
- Cracks
- Missing or loose mounts and fittings

**c. Installation.**

Installation of muffler is a reversal of removal procedure with attention given to the following points:

**WARNING**

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

- (1) Use metal sealant on joints.
- (2) Ensure clamp is tightened.

**d. Follow-On Maintenance.**

- (1) Start engine and ensure there are no exhaust leaks (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Install exhaust pipe (Para 11-6).
- (4) Install muffler heat shield (Para 11-4).

**END OF TASK**



**11-6. EXHAUST PIPES REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
TM 5-2420-230-10      Remove bellyplate, as required.

*Materials/Parts*  
Nut, self-locking, Item 102, Appendix D  
Sealant, metal, Item 54, Appendix C

*Drawings Required*  
TM 5-2420-230-24P      Figure 31

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete*  
Refer to MAC in Appendix B

**a. Removal.**



Hot parts can burn personnel. Let hot parts cool before starting work.

**NOTE**

The exhaust pipe consists of six sections; each section may be independently replaced.

- (1) Loosen clamps securing exhaust pipe.
- (2) Remove exhaust pipe.

**b. Installation.**

Installation of exhaust pipes is the reversal of removal procedure with attention given to the following points:



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

- (1) Use metal sealant on joints.
- (2) Ensure clamps are tightened.

**c. *Follow-On Maintenance.***

- (1) Start engine and ensure there are no exhaust leaks (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Install belly plates (as required) (TM 5-2420-230-10).

**END OF TASK**

## CHAPTER 12

### ELECTRICAL SYSTEM

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	12-1	12-2
Vehicle Preparation and Isolation. . . . .	12-2	12-2
Restore IHMEE to Operational Readiness. . . . .	12-3	12-2
Alternator Testing. . . . .	12-4	12-3
Battery Equalizer Testing. . . . .	12-5	12-4
Battery Replacement. . . . .	12-6	12-5
Battery Cable Replacement. . . . .	12-7	12-7
Electrical Master Switch Replacement. . . . .	12-8	12-9
NATO Slave Receptacle Replacement. . . . .	12-9	12-11
Alternator Replacement. . . . .	12-10	12-13
Starter Motor Replacement. . . . .	12-11	12-15
Master Light Switch Replacement. . . . .	12-12	12-17
Switch Replacement. . . . .	12-13	12-19
Rocker Switch Replacement. . . . .	12-14	12-21
Relay Replacement. . . . .	12-15	12-22
Starter Solenoid Replacement. . . . .	12-16	12-24
Auxiliary Defroster Switch Replacement. . . . .	12-16.1	12-25
Alarm Module Replacement. . . . .	12-16.2	12-27
Wiper Intermittent Relay Replacement. . . . .	12-17	12-32
Ignition Switch Replacement. . . . .	12-18	12-33
Power Distribution Panel (PDP) Assembly Replacement. . . . .	12-19	12-35
Charge Equalizer Replacement. . . . .	12-20	12-37
Main Hydraulic Master Switch Replacement. . . . .	12-21	12-38
Starter Button Replacement. . . . .	12-22	12-40
Gauge/Dash Panel Replacement. . . . .	12-23	12-42
Joystick Replacement. . . . .	12-24	12-43
Electronic Gear Shift (EGS) Replacement. . . . .	12-25	12-45
Indicator Arm Replacement. . . . .	12-26	12-46
General Wiring Harness Replacement. . . . .	12-27	12-48
General Wire Harness Repair. . . . .	12-28	12-50
Front Wiper Motor Replacement. . . . .	12-29	12-58
Rear Wiper Motor Replacement. . . . .	12-30	12-61
Washer Bottle Assembly and Bracket Replacement. . . . .	12-31	12-63
Electronic Control Unit (ECU) Replacement. . . . .	12-32	12-66
Hydraulic Solenoid Valve Replacement. . . . .	12-33	12-68
Pneumatic Solenoid Valve Replacement. . . . .	12-34	12-71
Pneumatic Valve Island Replacement. . . . .	12-34.1	12-73
Remote Shift Solenoid Coil Replacement. . . . .	12-34.2	12-75
General Sensor and Sending Units Replacement. . . . .	12-34.3	12-77
Tilt-Position Potentiometer Replacement. . . . .	12-35	12-79
FEL Arm Lift Potentiometer Replacement. . . . .	12-36	12-81
Fuel Sending Unit Replacement. . . . .	12-37	12-83
Reverse Alarm Replacement. . . . .	12-38	12-84
Dash Panel Wiring Harness Replacement. . . . .	12-39	12-85
Headlight Assembly Repair. . . . .	12-40	12-88
Rear Blackout Light Replacement. . . . .	12-41	12-90
Marker Light Assembly Replacement. . . . .	12-42	12-91
Mirror Clearance Light Replacement. . . . .	12-43	12-92
Taillight Replacement. . . . .	12-44	12-94
Light Bulb Replacement. . . . .	12-45	12-95

## 12-1. GENERAL.

This chapter contains routine maintenance activities and removal and installation procedures for the electrical system of the Interim High-Mobility Engineer Excavator (IHMEE) vehicle.

## 12-2. VEHICLE PREPARATION AND ISOLATION.

Prior to commencement of maintenance functions on the IHMEE, complete steps in the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

## 12-3. RESTORE IHMEE TO OPERATIONAL READINESS.

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**12-4. ALTERNATOR TESTING.**

This Task Covers:

a. Testing

b. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Equipment Conditions*

TM or Para

*Condition Description*

TM 5-2420-230-10

Vehicle positioned on level ground.

*Tools and Special Tools*

Multimeter, Item 28, Appendix B

TM 5-2420-230-10

Parking brake applied.

Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Electrical master switch ON.

TM 5-2420-230-10

Engine ON.

*Materials/Parts*

None

*Drawings Required*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*References*

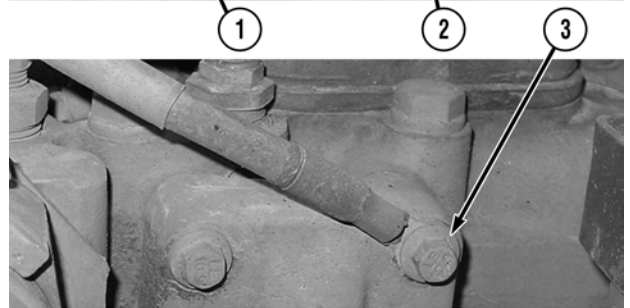
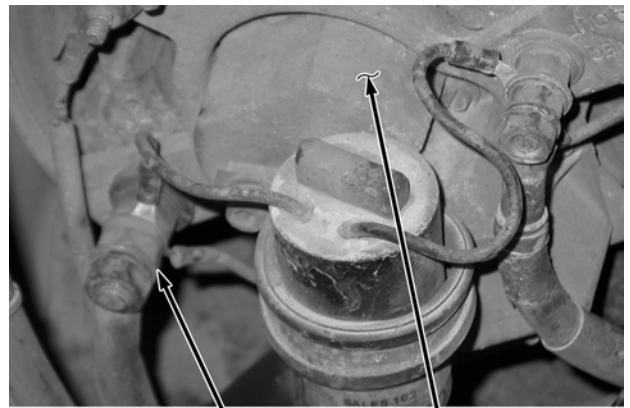
FO-3, Electrical schematic

**a. Testing.**

**WARNING**

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

- (1) Set multimeter to read DC voltage.
- (2) Place positive lead of multimeter on voltage output terminal (1) of alternator (2).
- (3) Place negative lead of multimeter on vehicle ground (3).
- (4) The multimeter should display 24-27.5 Vdc.
- (5) Set multimeter to read amperage.
- (6) The multimeter should display a maximum of 130 amperes.



ME1061

**b. Follow-On Maintenance.**

Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

## 12-5. BATTERY EQUALIZER TESTING.

This Task Covers:

- a. Testing
- b. Follow-On Maintenance

### INITIAL SETUP

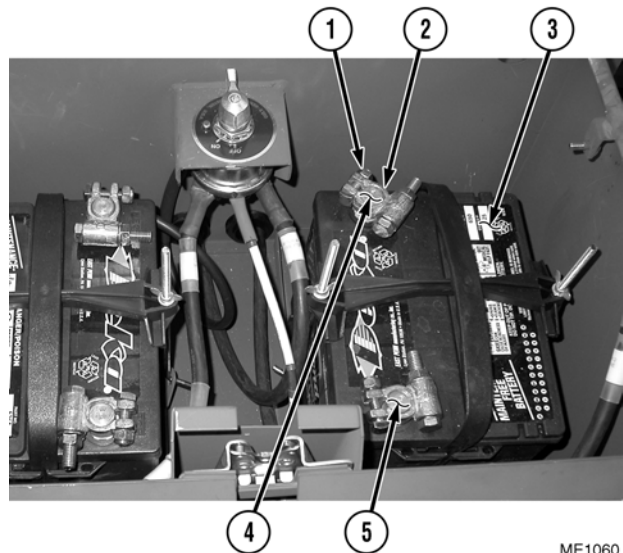
<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Multimeter, Item 28, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> None</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> FO-3, Electrical schematic</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p> <p><i>Condition Description</i> Vehicle positioned on level ground. Parking brake applied. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.</p> <p><i>Drawings Required</i> None</p> <p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>
---	---

#### a. Testing.

### WARNING

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

- (1) Set multimeter to read DC voltage.
- (2) Loosen nut (1) and disconnect positive (+) lead (2) of battery (3).
- (3) Place positive lead of multimeter on positive (+) terminal (4) of battery (3).
- (4) Place negative lead of multimeter on negative (-) terminal (5) of battery (3). Multimeter should read 12 vdc.
- (5) Install positive (+) lead (2) on battery (3) with nut (1). Tighten nut.
- (6) Repeat Steps (2) through (5) for other battery.



ME1060

#### b. Follow-On Maintenance.

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-6. BATTERY REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Cloth, lint-free, Item 10, Appendix C  
 Petroleum, technical, Item 50, Appendix C  
 Sodium bicarbonate, Item 57, Appendix C  
 Tags, identification, Item 63, Appendix C  
 Ties, cable, Item 68, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

TM 9-6140-200-14

*Equipment Conditions*

TM or Para

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

*Condition Description*

Vehicle positioned on level ground.  
 Parking brake applied.  
 Engine shut OFF.  
 Battery box opened.  
 Electrical master switch OFF.  
 "Do Not Operate" tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P Figure 44

*Estimated Time to Complete*

Refer to MAC in Appendix B

The IHMEE is equipped with dual, 12-volt batteries wired in series to provide the 24 volts required by the electrical system. Electrical components of the hydraulic system require 12 volts and are supplied through a load-sharing switch which balances the 12-volt load over the two batteries.

**a. Removal.**

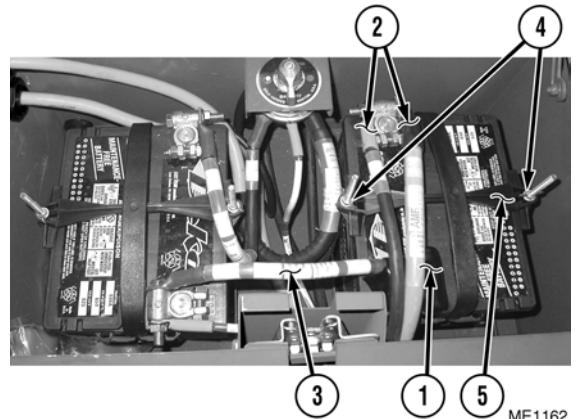
**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- Lead-acid battery gases can explode. Do not smoke, have open flames, or make sparks around a battery, especially if caps are off. Battery may give off gas which can explode. Failure to comply may result in injury or death to personnel.

**NOTE**

- Tag all wires and note their positions before removal
- Remove cable ties as required.
- Remove negative (-) cable before removing positive (+) cable.

- (1) Remove cable (1) from negative (-) battery post.
- (2) Remove cable (2) from positive (+) battery post.
- (3) Remove cross-over cable (3) from positive (+) battery post.
- (4) Remove two wing nuts (4), hold-down bracket (5), and battery.



ME1162

**b. Inspection.**

**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- Lead-acid battery gases can explode. Do not smoke, have open flames, or make sparks around a battery, especially if caps are off. Battery may give off gas which can explode. Failure to comply may result in injury or death to personnel.

- (1) Visually inspect battery for leaks and damage.

**NOTE**

Should buildup of sulfate be excessive, it may be necessary to replace battery terminals.

- (2) Check for excessive sulfate buildup on battery terminals. If present, remove batteries from battery compartment and thoroughly wash terminals with solution of sodium bicarbonate and hot water. After cleaning, thoroughly rinse terminals with hot water and dry with clean cloth.

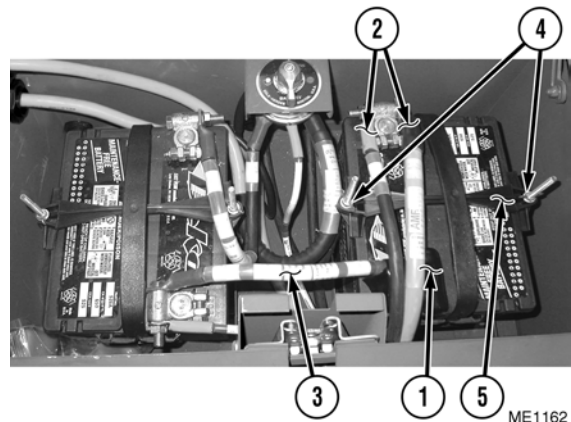
**c. Installation.**

Installation of the batteries is the reverse of the removal procedure, with attention given to the following:

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Install positive (+) cable before installing negative (-) cable.

- (1) Ensure battery compartment breather holes are not damaged and are free from obstruction.
- (2) Install battery into battery compartment using hold-down bracket (5) and two wing nuts (4).
- (3) Ensure positive (+) battery cable (2) terminal is tight and secure on battery post ensuring clamp bolt is not overtightened.
- (4) Ensure negative (-) battery cable (1) terminal is tight and secure on battery post ensuring clamp bolt is not overtightened.
- (5) Ensure positive (+) and negative (-) cables are attached to correct terminals.
- (6) Apply petroleum grease to terminals.



**d. Follow-On Maintenance.**

- (1) Start engine and check VOLTMETER for proper battery operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Close battery box (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





**WARNING**

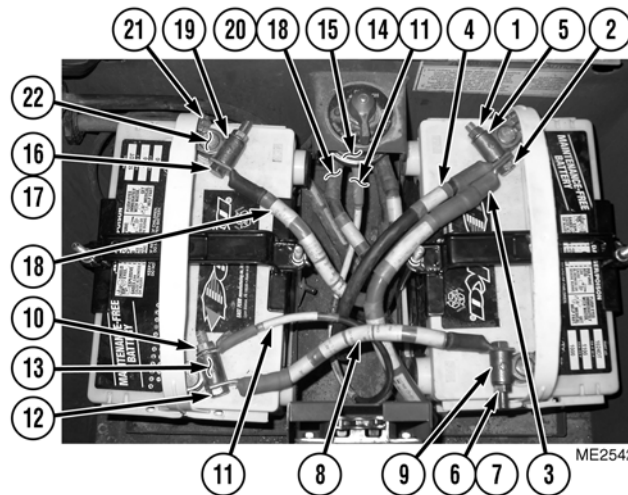
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

- (3) Remove nut (10), cable (11), bolt (12), and cable (8) from positive (+) terminal (13).
- (4) Remove nut (14), and cable (11) from master electrical switch (15).

**NOTE**

If vehicle has cold weather kit, remove three wires from negative (-) terminal in Step (5).

- (5) Remove nut (16), bolt (17), and cable (18) from negative (-) terminal (19).
- (6) Remove nut (20) and cable (18) from master electrical switch (15).
- (7) If required, loosen nut (21) and remove battery terminal (19) from battery post (22). Repeat for remaining terminals as necessary.



**b. Installation.**

**NOTE**

- Install positive (+) cable before installing negative (-) cable.
  - Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) If removed, install battery terminal (19) on battery post (22) and tighten nut (21). Repeat for remaining terminals as necessary.
  - (2) Connect cable (18) on battery isolation switch (15) with nut (20).

**NOTE**

If vehicle has cold weather kit installed, connect two wires to negative (-) terminal in Step (3).

- (3) Install cable (18) on bolt (17) and negative (-) terminal (19) with nut (16).
- (4) Install cable (8) on bolt (12) positive (+) terminal (13) and cable (11) on bolt (12) with nut (10).
- (5) Install cable (8) on bolt (7) and negative (-) terminal (9) with nut (6).

**NOTE**

If vehicle has cold weather kit installed, connect three wires to positive (+) terminal in Step (6).

- (6) Install two cables (3) and (4) on bolt (2) and positive (+) terminal (5) with nut (1).
- (7) Route cable (4) and refer to Para 12-16 for installation of cable on vehicle.

**c. Follow-On Maintenance.**

- (1) Start engine and check VOLTMETER for proper battery operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Close battery box (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>12-8. ELECTRICAL MASTER SWITCH REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Tags, identification, Item 63, Appendix C	TM 5-2420-230-10	Engine shut OFF.
Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	Electrical master switch OFF.
		“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P	Figure 44
<i>References</i> None	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

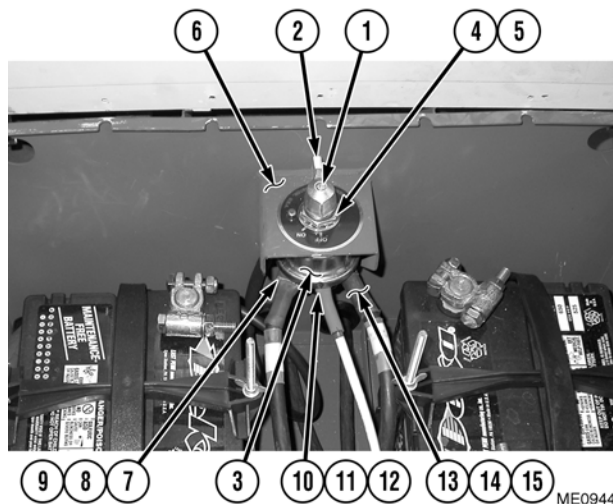
**NOTE**

- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.
- Ensure all wires are disconnected and cleared before removal.
- To gain access to cables, some components may need to be removed.

**WARNING**

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

- (1) Remove screw (1) from selector (2).
- (2) Remove selector (2) from electrical master switch (3).
- (3) Remove nut (4) and washer (5) from electrical master switch (3).
- (4) Remove electrical master switch (3) from mount (6).
- (5) Remove nut (7), washer (8), and wire (9) from electrical master switch (3).
- (6) Remove nut (10), washer (11), and wire (12) from electrical master switch (3).
- (7) Remove nut (13), washer (14), and two wires (15) from electrical master switch (3).



**b. Installation.**

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install wire (9), washer (8), and nut (7) on electrical master switch (3).
- (2) Install wire (12), washer (11), and nut (10) on electrical master switch (3).
- (3) Install two wires (15), washer (14), and nut (13) on electrical master switch (3).
- (4) Position electrical master switch (3) into mount (6).
- (5) Install washer (5) and nut (4) on electrical master switch (3).
- (6) Install selector (2) on electrical master switch (3).
- (7) Install screw (1) on selector (2).

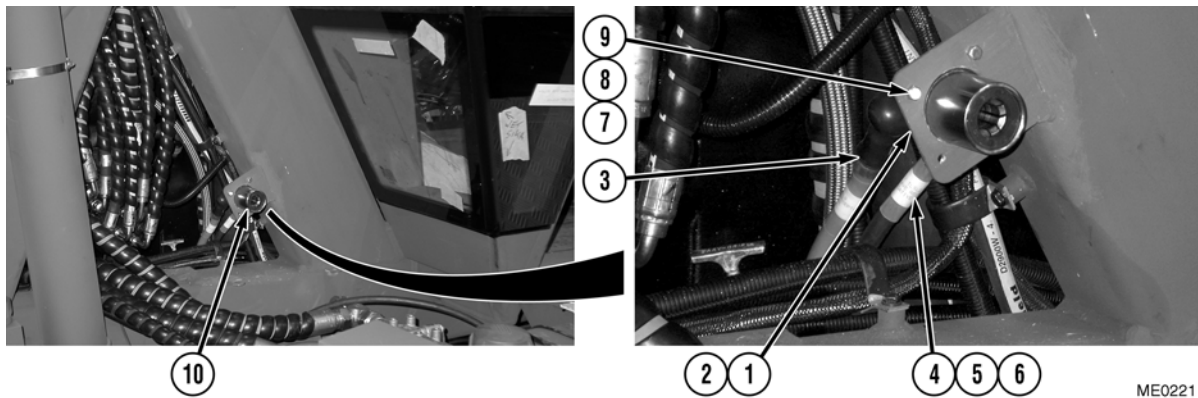
**c. Follow-On Maintenance.**

- (1) Start engine to check electrical master switch for proper operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

12-9. NATO SLAVE RECEPTACLE REPLACEMENT.		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Nut, self-locking, Item 108, Appendix D (4) Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C Washer, lock, Item 289.2, Appendix D (2)	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 44	
<i>References</i> None	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B	

**a. Removal.**



ME0221

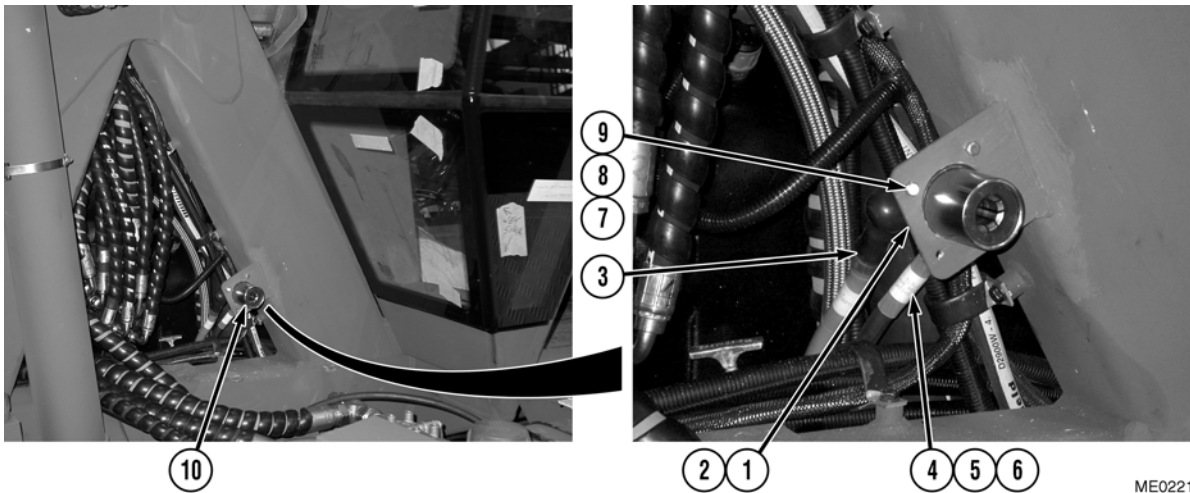
**WARNING**

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

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
- (1) Remove screw (1), lockwasher (2), and positive (+) battery cable (3). Discard lockwasher.
  - (2) Remove screw (4), lockwasher (5), and negative (-) battery cable (6). Discard lockwasher.
  - (3) Remove four self-locking nuts (7), washers (8), and bolts (9).
  - (4) Remove NATO slave receptacle (10).

**b. Installation.**



ME0221

**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install NATO slave receptacle (10) with four bolts (9), washers (8), and new self-locking nuts (7). Tighten nuts.
- (2) Install positive (+) battery cable (3) on NATO slave receptacle with new lockwasher (2) and screw (1).
- (3) Install negative (-) battery cable (6) on NATO slave receptacle with new lockwasher (5) and screw (4).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**b. Installation.**

**WARNING**

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

Steps in the installation of the alternator are the reverse of those in the removal procedure with attention given to the following points:

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Install pulley on alternator, if required.
  - (2) Ensure electrical connections are reattached correctly and securely.
  - (3) Ensure mounting bolts and nuts are tightened to 40 lbf/ft (54 N•m).

**c. Follow-On Maintenance.**

- (1) Install drive belt (Para 4-6).
- (2) Start engine and check VOLTMETER to verify proper alternator operation (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





**b. Installation.**

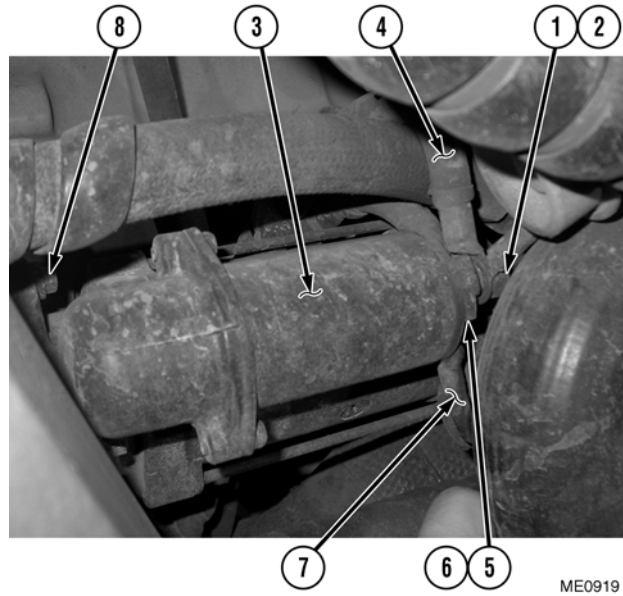
**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Position starter (3) on engine.
- (2) Install three bolts (8) securing starter (3) to engine. Tighten bolts to 32 lbf/ft (43 N•m).
- (3) Install wire (7) on starter (3) with washer (6) and nut (5).



**NOTE**

If vehicle has cold weather kit, install four wires on starter.

- (4) Install three wires (4) on starter (3) with washer (2) and nut (1).
- (5) Install hose on transmission oil cooler.

**c. Follow-On Maintenance.**

- (1) Replace right fender (Para 13-16).
- (2) Fill cooling system (Para 9-4).
- (3) Start engine to check starter for proper operation (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Lower hood (TM 5-2420-230-10).

**END OF TASK**

**12-12. MASTER LIGHT SWITCH REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Ties, cable, Item 68, Appendix C

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None.

*Equipment Conditions*  
*TM or Para*

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

*Drawings Required*

TM 5-2420-230-24P Figure 73

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*Condition Description*

Vehicle positioned on level ground.

Parking brake applied.

Engine shut OFF.

Electrical master switch OFF.

“Do Not Operate” tag attached to ignition switch.

**a. Removal.**

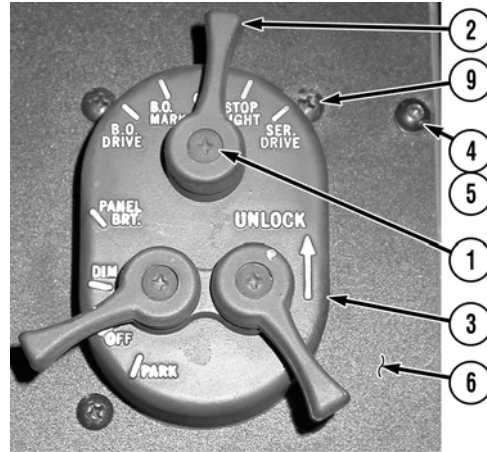
**WARNING**

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

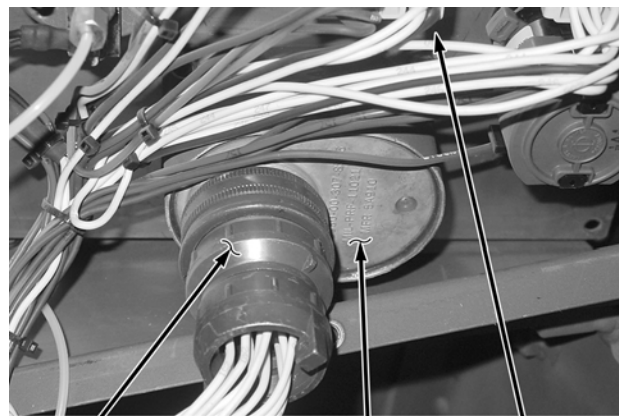
**NOTE**

Remove cable ties as necessary.

- (1) Remove three screws (1) and knobs (2) from master light switch (3).
- (2) Remove eight screws (4), washers (5), and dash panel (6).
- (3) Disconnect cannon plug (7) from master light switch (3).
- (4) Remove four nuts (8) from screws (9).
- (5) Remove four screws (9) and master light switch (3) from dash panel (6).



ME1765



ME1764

**b. Installation.**

**NOTE**

Install cable ties as necessary.

- (1) Install four screws (9) and master light switch (3) on dash panel (6).
- (2) Install four nuts (8) on screws (9).
- (3) Connect cannon plug (7) to master light switch (3).
- (4) Install dash panel (6) with eight screws (4) and washers (5).
- (5) Install knobs (2) on master light switch (3) with three screws (1).

**c. Follow-On Maintenance.**

- (1) Start vehicle and check for proper operation of master light switch (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-13. SWITCH REPLACEMENT.**

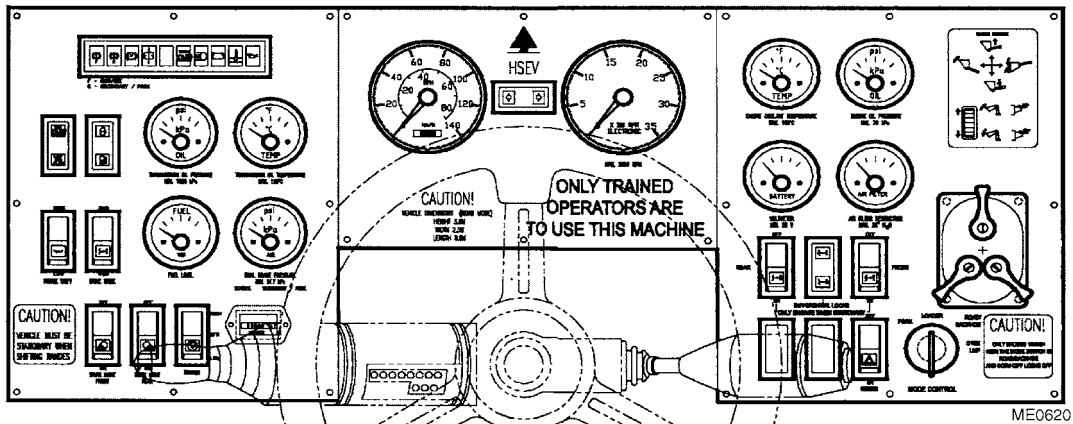
This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> FO-3, Electrical schematic</p>	<p><i>Equipment Conditions</i> TM or Para TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p> <p><i>Condition Description</i> Vehicle positioned on level ground. Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 71 TM 5-2420-230-24P Figure 72 TM 5-2420-230-24P Figure 73</p> <p><i>Estimated Time to Complete</i> Approximately 0.5 hr.</p>
---	---

**a. Removal.**



**WARNING**

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

**NOTE**

- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.
- To gain access to harnesses, some components may need to be removed.
- Ensure all wires are disconnected and cleared before removal.
- All switches are removed and installed in the same way.

- (1) Remove screws and washers securing instrument panel.
- (2) Carefully lift instrument panel to gain access to connections and components.
- (3) Remove switch's electrical connection(s).
- (4) From rear of instrument panel, disengage switch retaining tabs.
- (5) Remove switch from front of instrument panel.

**b. Inspection.**

Inspect electrical switches for the following defects:

- Loose or broken terminals
- Physical damage
- Water damage
- Evidence of overheating

**c. Installation.**

**WARNING**

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

Steps in the installation of a switch are the reverse of those in the removal procedure, with attention given to the following points:

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Ensure electrical connection(s) is secure.
  - (2) Ensure no electrical cables are trapped when replacing instrument panel.

**d. Follow-On Maintenance.**

- (1) Start engine and functionally test switch for proper operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

12-14. ROCKER SWITCH REPLACEMENT.		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	Engine shut OFF.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	TM 5-2420-230-10	Electrical master switch OFF.
<i>References</i> None	<i>Drawings Required</i> TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P	“Do Not Operate” tag attached to ignition switch. Figure 48 Figure 71 Figure 72 Figure 73 Figure 189
		<i>Estimated Time to Complete Task</i> Approximately 0.5 hr.

**a. Removal.**

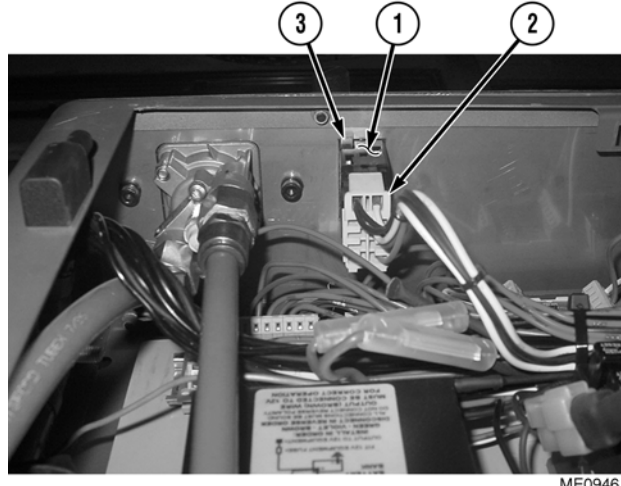
**WARNING**

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

**NOTE**

- Remove cable ties as necessary.
- Ensure all wires are disconnected and cleared before removal.
- To gain access to switches, some components may need to be removed.
- All rocker switches are removed and installed in a similar manner.

- (1) Access rear of rocker switch (1).
- (2) Remove electrical connector (2) from rocker switch (1).
- (3) Squeeze clips (3) and push up on bottom of rocker switch (1).



ME0946

**b. Installation.**

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install rocker switch (1). Ensure clips (3) snap into place.
- (2) Ensure pins are aligned and install electrical connector (2) on rocker switch (1).

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test rocker switch for proper operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

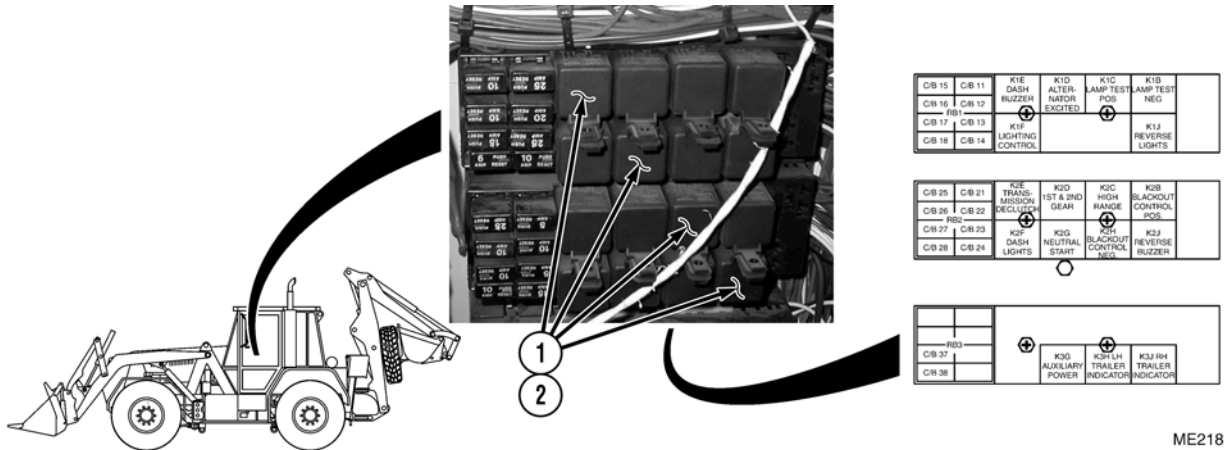
**END OF TASK**

**12-15. RELAY REPLACEMENT.**

This Task Covers:			
a. Removal	b. Installation	c. Follow-On Maintenance	
<b>INITIAL SETUP</b>			
<i>Test Equipment</i>	<i>Equipment Conditions</i>		
None	<i>TM or Para</i>	<i>Condition Description</i>	
	TM 5-2420-230-10	Vehicle positioned on level ground.	
<i>Tools and Special Tools</i>	TM 5-2420-230-10	Parking brake applied.	
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Engine shut OFF.	
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.	
None	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.	
<i>Personnel Required</i>	TM 5-2420-230-10	PDP door opened.	
MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i>		
	TM 5-2420-230-24P	Figure 48	
<i>References</i>	<i>Estimated Time to Complete Task</i>		
FO-1, Power Distribution Panel layout	Approximately 0.5 hr.		
FO-2, Power Distribution Panel schematic			



**a. Removal.**



ME2187

**WARNING**

- Most relays always have electrical current going to them and can cause severe injury to personnel. Care must be exercised when working in PDP box.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

**NOTE**

There are 12-vdc relays and 24-vdc relays. Relays are removed and installed in the same manner. Refer to electrical schematic for identification of relays.

Remove relay (1) from relay socket (2) in power distribution box.

**b. Installation.**

**NOTE**

There are 12-vdc relays and 24-vdc relays. Relays are removed and installed in the same manner. Refer to electrical schematic for identification of relays.

Install relay (1) in relay socket (2) of the distribution box.

**c. Follow-On Maintenance.**

- (1) Close PDP door (TM 5-2420-230-10).
- (2) Start engine and functionally test relay for proper operation (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



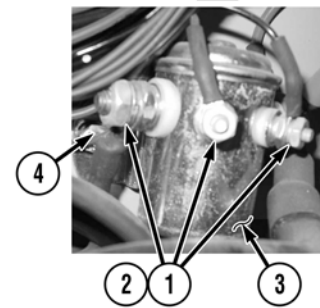
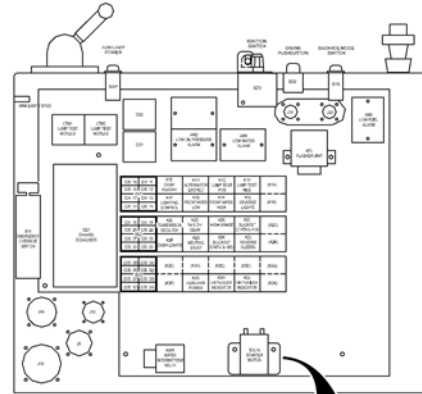
**b. Installation.**

**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Install starter solenoid (3) with two bolts (4).
  - (2) Install four wires (2) and nuts (1) to starter solenoid (3).



ME2203

**c. Follow-On Maintenance.**

- (1) Close PDP door (TM 5-2420-230-10).
- (2) Start engine (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>12-16.1. AUXILIARY DEFROSTER SWITCH REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i>	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM or Para TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Materials/Parts</i> Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10	Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 48	
<i>References</i> None	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

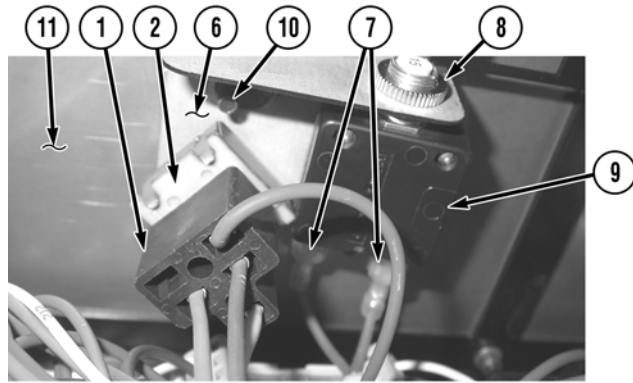
**WARNING**

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

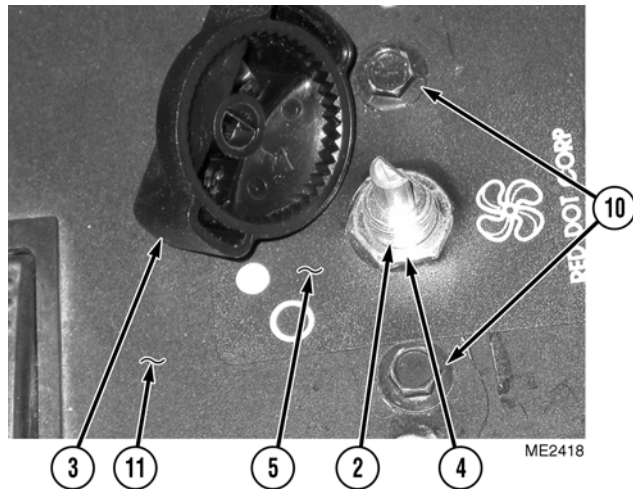
**NOTE**

- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.

- (1) Remove wire harness (1) from switch (2).
- (2) Remove knob (3) from switch (2).
- (3) Remove nut (4), plate (5), and switch (2) from bracket (6).
- (4) If required, remove two wires (7), nut (8), and circuit breaker (9) from bracket (6).
- (5) If required, remove two screws (10) and bracket (6) from PDP (11).



ME2419



ME2418

**b. Installation.**

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) If removed, install bracket (6) on PDP (11) with two screws (10).
- (2) If removed, install circuit breaker (9) on bracket (6) with nut (8) and two wires (7).
- (3) Position switch (2) in bracket (6).
- (4) Install plate (5) and nut (4) on switch (2).
- (5) Install knob (3) on switch (2).

**c. Follow On Maintenance.**

- (1) Start engine and operate defroster switch to ensure it is functioning properly (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Close PDP door (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-16.2. ALARM MODULE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Adjustment
- d. Adjustment
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

- Resistor tool, variable, Item 32.1, Appendix B
- Tool kit, electric, Item 37, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

F01

*Equipment Conditions*

TM or Para

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

*Condition Description*

- Vehicle positioned on level ground.
- Parking brake applied.
- Engine shut OFF.
- Electrical master switch OFF.
- “Do Not Operate” tag attached to ignition switch.
- PDP door open.

*Drawings Required*

TM 5-2420-230-24P Figure 48

TM 5-2420-230-24P Figure 208

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

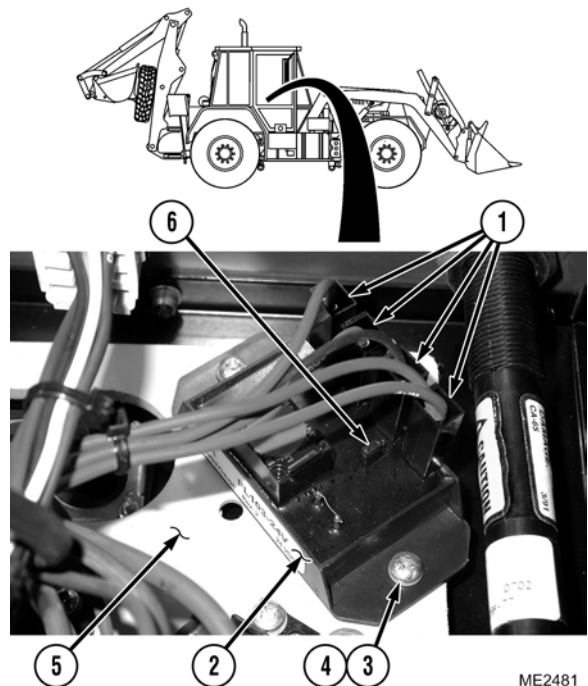
**a. Removal.**

**WARNING**

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

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
  - Ensure all wires and plugs are disconnected and clear before removal.
  - All alarm modules are removed in the same manner. Low Fuel Alarm is shown.
- (1) Remove wire connectors (1) from module (2).
  - (2) Remove two screws (3), washers (4), and module (2) from power resistor board (5).



ME2481

**b. Installation.**

**NOTE**

Rise/fall bridge is set to “rising” alarm position when bridge is on two pins closest to wire connectors and is set to “falling” alarm position when bridge is on two pins farthest to wire connectors. “Falling” alarm setting is shown.

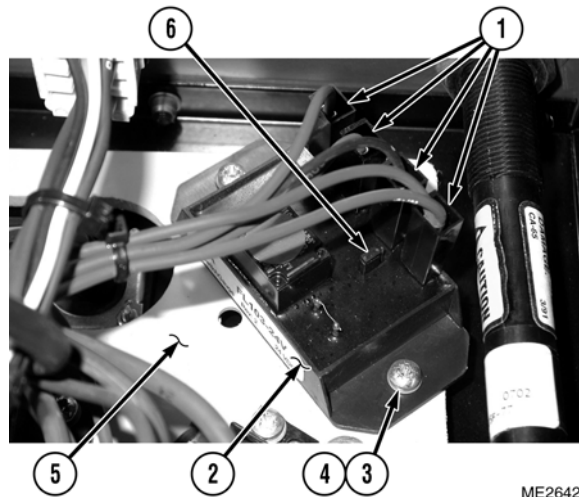
- (1) Position rise/fall bridge (6) to proper setting for alarm. HIGH WATER ALARM module should be set to “rising” position. LOW OIL, LOW FUEL, and LOW WATER ALARM modules should be set to “falling” position.

**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (2) Install module (2) on power resistor board (5) with two washers (4) and screws (3).
  - (3) Install wire connectors (1) on module (2).
  - (4) Adjust module (2) per Steps c or d.

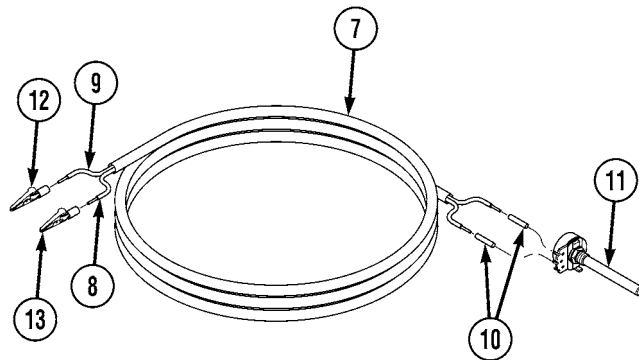


**c. HIGH WATER TEMP ALARM and LOW OIL PRESSURE ALARM Module Adjustment.**

**NOTE**

After installing the HIGH WATER TEMP ALARM and LOW OIL PRESSURE ALARM, an adjustment is necessary. Both modules are adjusted in a similar manner.

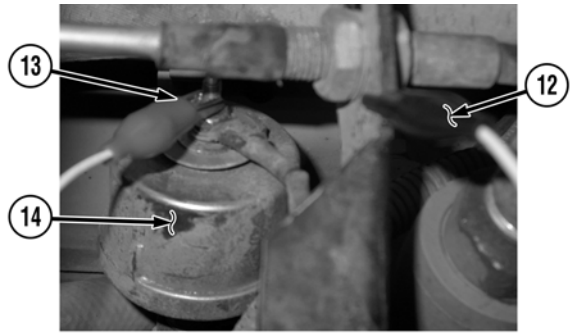
- (1) If required, assemble variable resistor tool.
  - (a) Cut a 10 ft. (3 m) length of 18-gage power cable (7).
  - (b) Strip both ends of wires (8) and (9), leaving 0.25 in (6 mm) of bare wire.
  - (c) Cut two 2-in. (50 mm) strips of shrink tubing (10), placing one on each end of wires (8) and (9).
  - (d) Connect wire (8) to positive (+) side of variable resistor (11).
  - (e) Connect wire (9) to negative (-) side of variable resistor (11).
  - (f) Slide shrink tubing (10) over connections of wires (8) and (9) variable resistor (11). Install tubing.
  - (g) Connect ground clip (12) to wire (9).
  - (h) Connect power clip (13) to wire (8).



**NOTE**

The adjustment to the alarm modules for the engine oil pressure and engine coolant temperature gauges are performed in a similar manner. Engine oil pressure gauge and sending unit is shown.

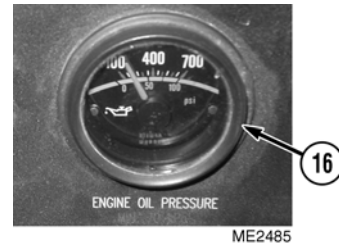
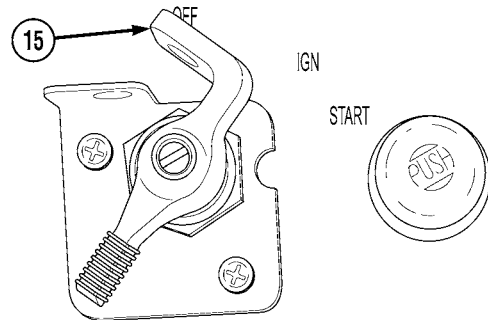
- (2) Connect power clip (13) to sending unit (14), and ground clip (12) to a good ground on vehicle.



**WARNING**

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

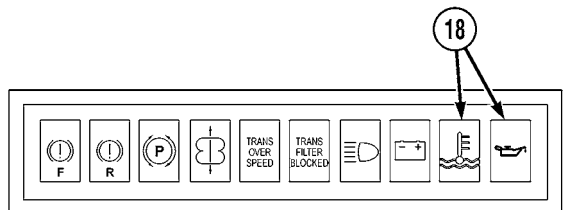
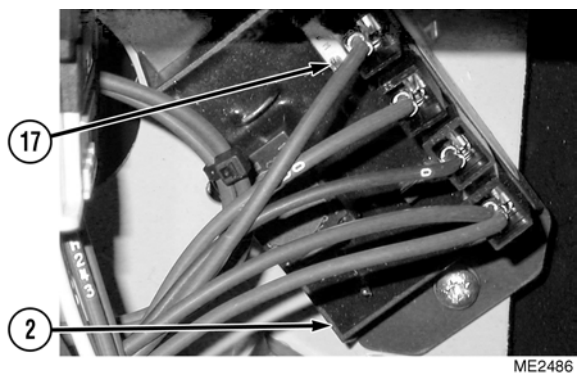
- (3) Turn electrical master switch ON (TM 5-2420-230-10).
- (4) Turn ignition switch (15) to IGN position.
- (5) Using variable resistor tool, set needle on gauge (16) to proper position for alarm to come on. ENGINE COOLANT TEMPERATURE gauge should be set at 210 °F (99 °C). ENGINE OIL PRESSURE gauge should be set at 30 psi (207 kPa).



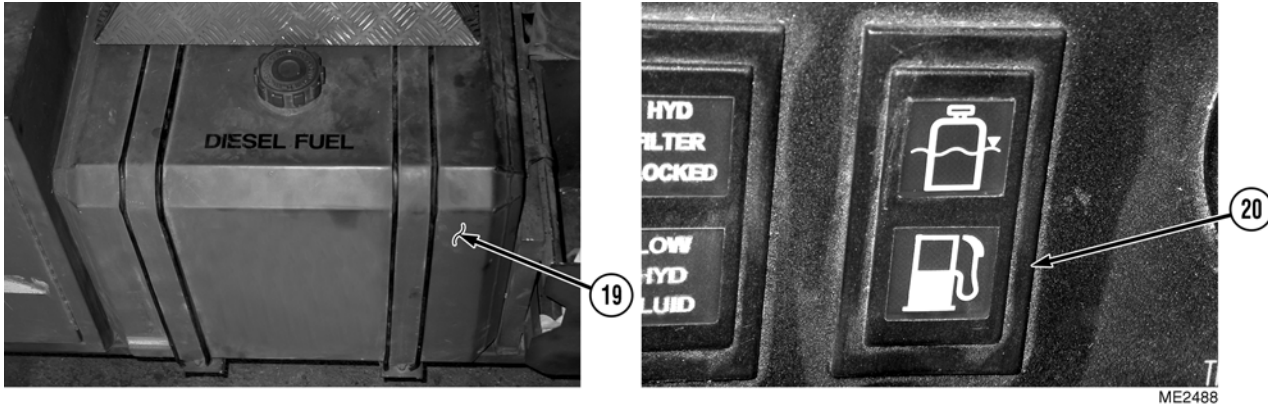
**NOTE**

There will be a metallic click when the module activates the indicator light.

- (6) Turn set screw (17) on module (2) until appropriate indicator light (18) comes on. Turn variable resistor (11) to move needle on gauge (16). Indicator should come on when gauge reading is outside of normal range, and go out when gauge is in normal range.
- (7) Turn OFF ignition switch (15).
- (8) Turn electrical master switch OFF (TM 5-2420-230-10).
- (9) Remove positive clip (13) from sending unit (14) and remove ground clip (12) from vehicle.



**d. LOW FUEL ALARM and LOW WATER ALARM Module Adjustment.**



**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- No smoking, flames, sparks, or glowing hot objects are allowed by 50 ft. (15 m) of vehicle.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

**NOTE**

- Perform Steps (1) thru (6) to adjust LOW FUEL ALARM.
- Perform Steps (7) thru (8) to verify proper operation of LOW WATER ALARM.

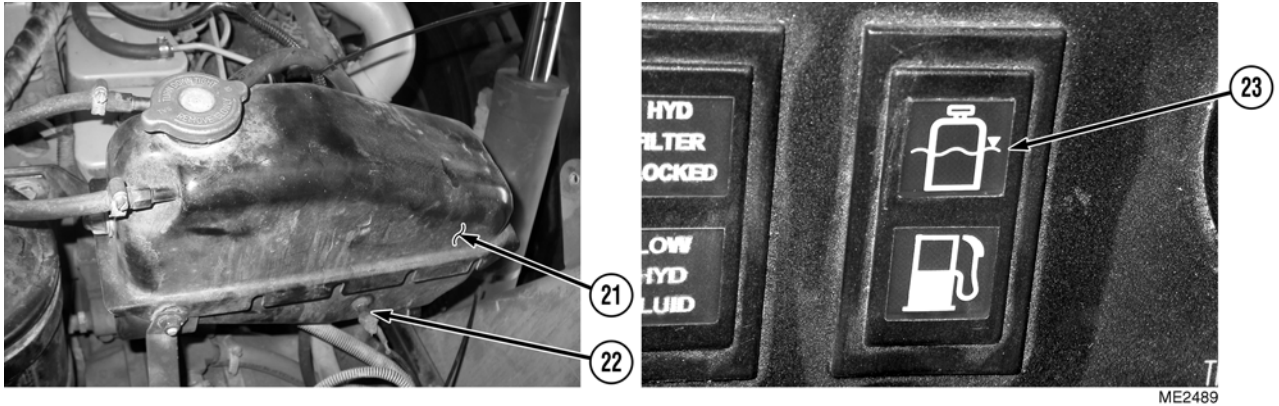
- (1) Drain fuel tank (19) (Para 7-7).
- (2) Add 13 gal. (50 L) of fuel to fuel tank (19).
- (3) Turn electrical master switch ON (TM 5-2420-230-10).
- (4) Turn ignition switch (15) to IGN position.

**NOTE**

After installing LOW FUEL ALARM, an adjustment is necessary.

- (5) Adjust set screw (17) until fuel indicator light (20) comes on.
- (6) Fill fuel tank (19) (TM 5-2420-230-10). Fuel indicator light (20) should go out.





## WARNING

- If vehicle has been operating, use extreme care to avoid being burned when removing radiator cap or coolant reservoir cap. Sudden release of pressure can cause a steam flash which could seriously injure personnel. Use heavy rags to protect hands. Slowly loosen cap to the first stop and allow pressure to be released before removing cap completely. After use, securely tighten cap. Failure to comply may result in injury or death to personnel.
- Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.

## CAUTION

The only coolant authorized for use in the IHMEE is Ethylene Glycol. To avoid possible internal damage to the engine coolant system, use only Ethylene Glycol. Water may only be used in an emergency. If water is used, the coolant system must be drained, flushed, and refilled with Ethylene Glycol at the first opportunity. Failure to comply may result in damage to equipment.

## NOTE

Ethylene Glycol is not supplied ready to use, and must be mixed prior to filling the cooling system. Refer to TB 750-651.

- (7) Drain coolant from coolant tank (21) until it reaches level of sending unit (22). Low coolant indicator light (23) should be lit.
- (8) After verifying proper operation of LOW WATER ALARM module, fill coolant tank (21) to proper level (Para 9-4).

### e. Follow-On Maintenance.

- (1) Close PDP door (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tage from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## 12-18. IGNITION SWITCH REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*

None

*Equipment Conditions*

TM or Para

*Condition Description*

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Vehicle positioned on level ground.

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

*Materials/Parts*

Tags, identification, Item 63, Appendix C

TM 5-2420-230-10

Electrical master switch OFF.

Ties, cable, Item 68, Appendix C

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

TM 5-2420-230-10

PDP door opened.

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Drawings Required*

TM 5-2420-230-24P Figure 48

*References*

None

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

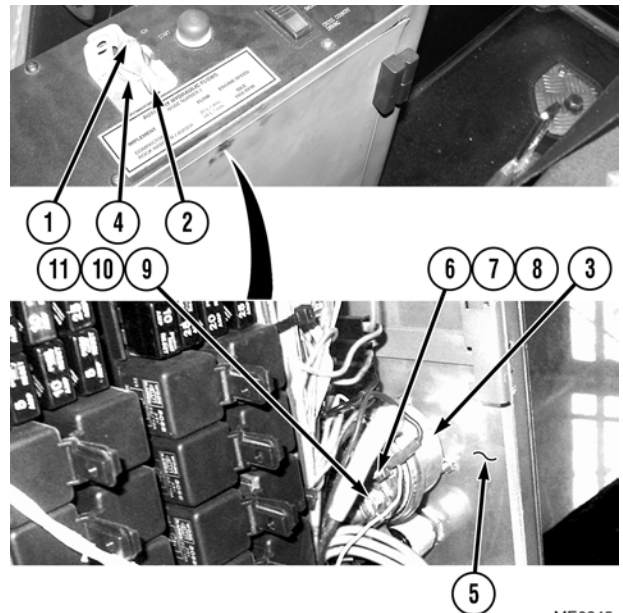
### a. Removal.

## WARNING

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

### NOTE

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
  - Ensure all wires are disconnected and cleared before removal.
- (1) Remove screw (1) and selector (2) from ignition switch (3).
  - (2) Remove nut (4) from ignition switch (3).
  - (3) Remove ignition switch (3) from PDP (5).
  - (4) Remove nut (6), washer (7), and wire (8) from ignition switch (3).
  - (5) Remove nut (9), washer (10), and wire (11) from ignition switch (3).



ME0945

**b. Installation.**

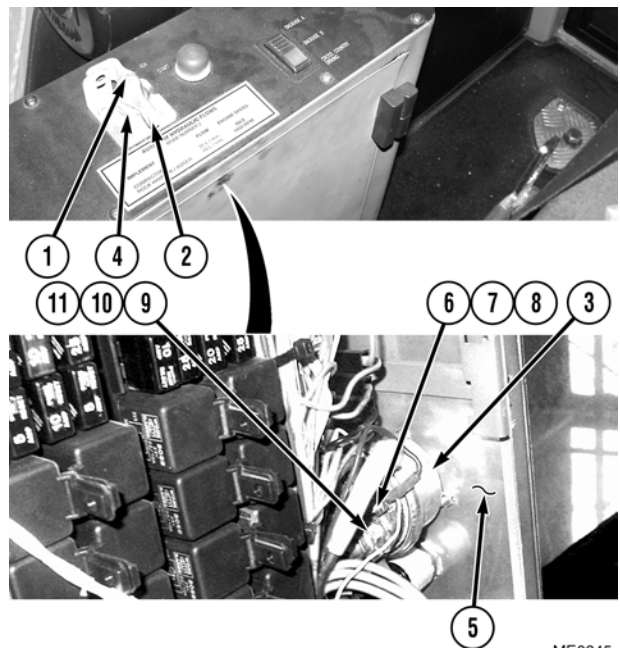
**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install wire (11), washer (10), and nut (9) on ignition switch (3).
- (2) Install wire (8), washer (7), and nut (6) on ignition switch (3).
- (3) Position ignition switch (3) into PDP (5).
- (4) Install nut (4) securing ignition switch (3) to PDP (5).
- (5) Install selector (2) onto ignition switch (3).
- (6) Install screw (1) onto ignition switch (3).



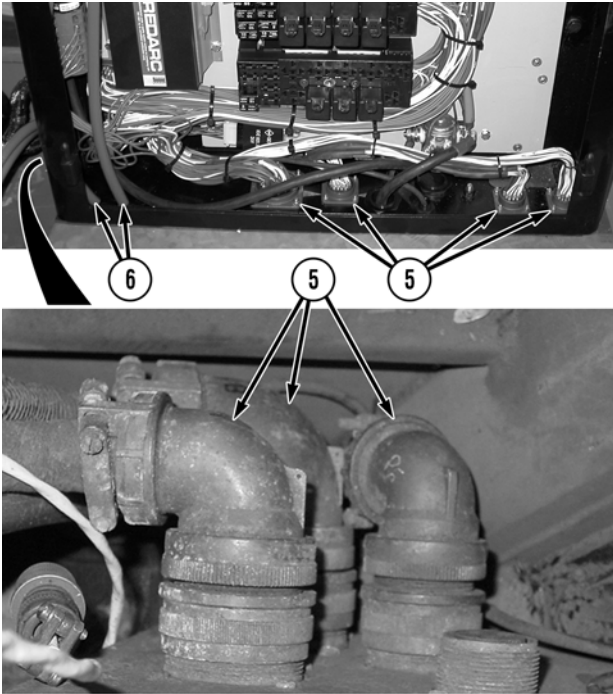
**c. Follow-On Maintenance.**

- (1) Close PDP door (TM 5-2420-230-10).
- (2) Start engine and functionally test ignition switch for proper operation (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

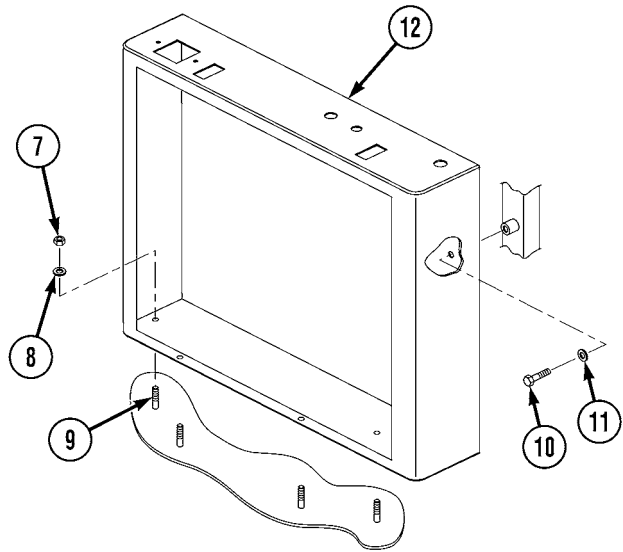
ME0945

**END OF TASK**





ME1707



ME1708

- (2) Disconnect seven electrical connectors (5).
- (3) Loosen glands (6) securing parking brake air lines. Remove Sikaflex 221 sealant using a sharp knife or cutting instrument as necessary.
- (4) Remove four self-locking nuts (7) and washers (8) from chassis studs (9). Discard self-locking nuts.
- (5) Remove bolt (10) and washer (11) from PDP (12).
- (6) Remove PDP (12).

**b. Installation.**

- (1) Position PDP (12) and install washer (11) and bolt (10).
- (2) Install four washers (8) and new self-locking nuts (7) onto chassis studs (9).

**WARNING**

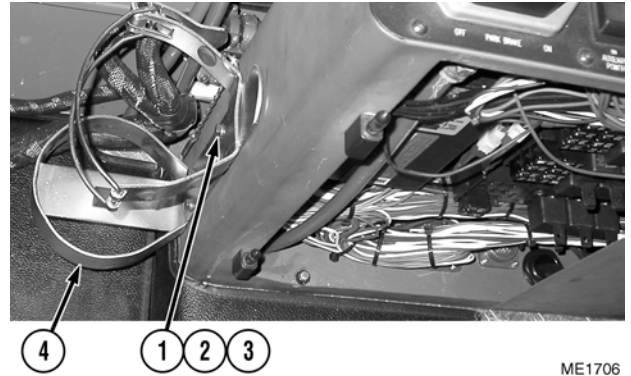
Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (3) Tighten glands (6) and seal parking brake air lines using Sikaflex 221 black sealant.
- (4) Connect seven electrical connectors (5).

- (5) Install four bolts (3), washers (2), nuts (1), and fire extinguisher bracket (4).

**c. Follow-On Maintenance.**

- (1) Install rocker switches (Para 12-14).
- (2) Install ignition switch (Para 12-18).
- (3) Install starter button (Para 12-22).
- (4) Install parking brake control (Para 8-10).
- (5) Install throttle control (Para 13-5).
- (5.1) Install auxiliary defroster switch (Para 12-16.1).



**NOTE**

If replacing PDP assembly and vehicle has cold weather hit, refer to Para 20-4 for modification to PDP assembly before proceeding.

- (5.2) Install ether start pushbutton (Para 20-14).
- (6) Install belly plates as necessary (TM 5-2420-230-10).
- (7) Start engine and functionally test appropriate electrical systems for proper operation (TM 5-2420-230-10).
- (8) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

<b>12-20. CHARGE EQUALIZER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Tags, identification, Item 63, Appendix C	TM 5-2420-230-10	Engine shut OFF.
Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	Electrical master switch OFF.
	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
	TM 5-2420-230-10	PDP door opened.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P	Figure 48
<i>References</i> None.	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

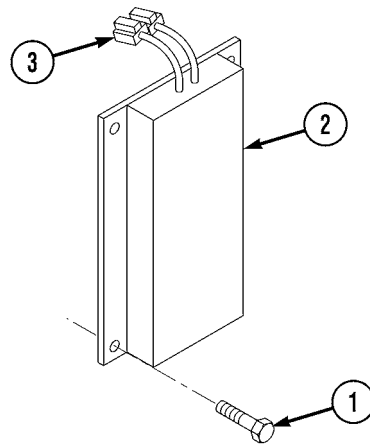
**a. Removal.**



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

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as required.
- (1) Remove four bolts (1) from charge equalizer (2).
  - (2) Disconnect wire harness (3) from charge equalizer (2).



ME1766

**b. Installation.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as required.
- (1) Install charge equalizer (2) with four bolts (1).
  - (2) Connect wire harness (3) into charge equalizer (2).

**c. Follow-On Maintenance.**

- (1) Close PDP door (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-21. MAIN HYDRAULIC MASTER SWITCH REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Ties, cable, Item 68, Appendix C

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*  
TM or Para  
TM 5-2420-230-10

*Condition Description*  
Vehicle positioned on level ground.

Parking brake applied.

Engine shut OFF.

Electrical master switch OFF.

“Do Not Operate” tag attached to ignition switch.

*Drawings Required*  
TM 5-2420-230-24P Figure 186

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B



**a. Removal.**

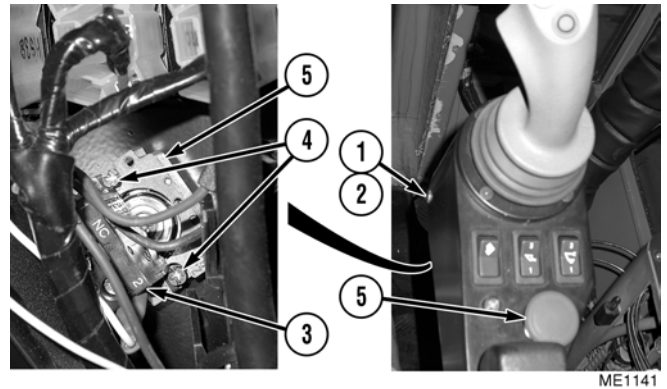
**WARNING**

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

**NOTE**

Remove cable ties as necessary.

- (1) Remove two screws (1) and fold down cover plate (2).
- (2) Loosen screw and disconnect electrical connector (3).
- (3) Loosen two screws (4).
- (4) Rotate main hydraulic master switch (5) one quarter turn and remove.



**b. Installation.**

**NOTE**

Install cable ties as necessary.

- (1) Position main hydraulic master switch (5) and tighten two screws (4).
- (2) Connect electrical connector (3) and tighten screw.
- (3) Install cover plate (2) with two screws (1).

**c. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

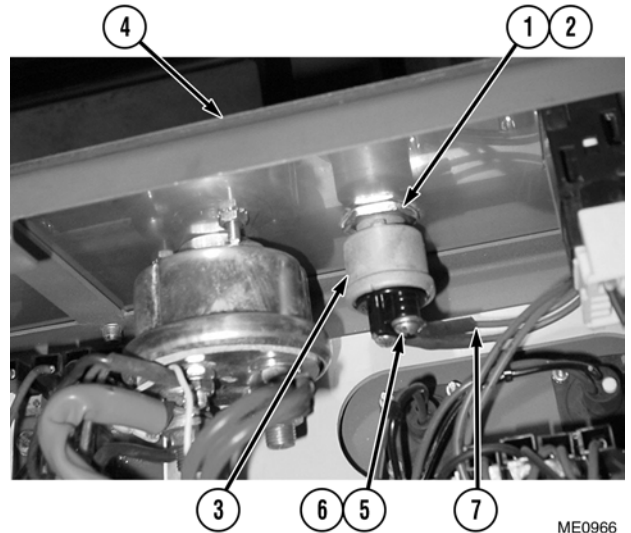


**b. Installation.****WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- If vehicle has cold weather kit installed, connect three wires to starter button.



- (1) Install two wires (7), washers (6), and screws (5) onto starter button (3).
- (2) Position starter button (3) in PDP (4).
- (3) Install washer (2) and nut (1) onto starter button (3).

**c. Follow-On Maintenance.**

- (1) Close PDP door (TM 5-2420-230-10).
- (2) Start engine to test starter button for proper operation (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**b. Installation.**

**WARNING**

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

The installation of a gauge is the reverse of the removal procedure, with attention given to the following:

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Ensure electrical connection is secure.
  - (2) Ensure mechanical connections are secure (if applicable).

**c. Follow-On Maintenance.**

- (0.1) Install inclinometer and bracket (center dash panel only) (Para 13-8.1).
- (1) Start engine and functionally test gauge for proper operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>12-24. JOYSTICK REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	Engine shut OFF.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P	Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.
<i>References</i> None	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

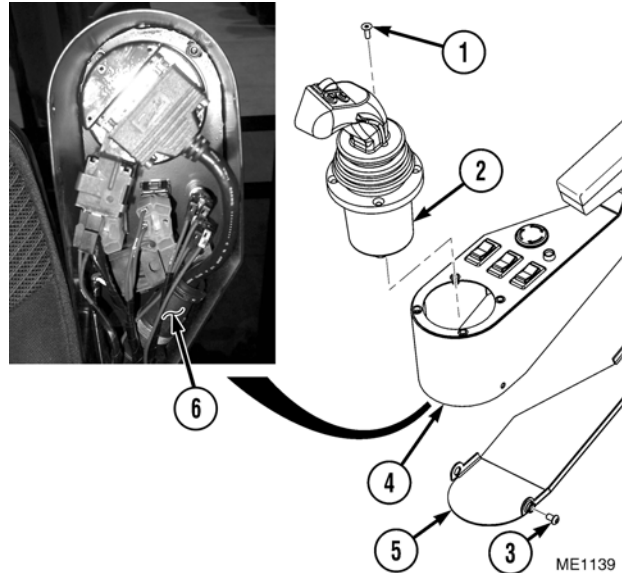
**WARNING**

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

**NOTE**

- Remove cable ties as necessary.
- Ensure all wires are disconnected and cleared before removal.
- Left and right joysticks are removed in the same way.

- (1) Remove four screws (1) from joystick (2).
- (2) Remove four screws (3) from operator's seat arm (4) and remove bottom cover (5).
- (3) Disconnect electrical connector (6).
- (4) Remove joystick (2) from operator's seat arm (4).



**b. Installation.**

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install joystick (2) and four screws (1) in operator's seat arm (4).
- (2) Connect electrical connector (6).
- (3) Install bottom cover (5) to operator's seat arm (4) with four screws (3).

**c. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Perform hydraulic calibration (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-25. ELECTRONIC GEAR SHIFT (EGS) REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Equipment Conditions*

TM or Para

*Condition Description*

TM 5-2420-230-10

Vehicle positioned on level ground.

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

*Materials/Parts*

Nut, self-locking, Item 108, Appendix D (2)

TM 5-2420-230-10

Electrical master switch OFF.

Ties, cable, Item 68, Appendix C

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Drawings Required*

TM 5-2420-230-24P Figure 70

*References*

None

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**

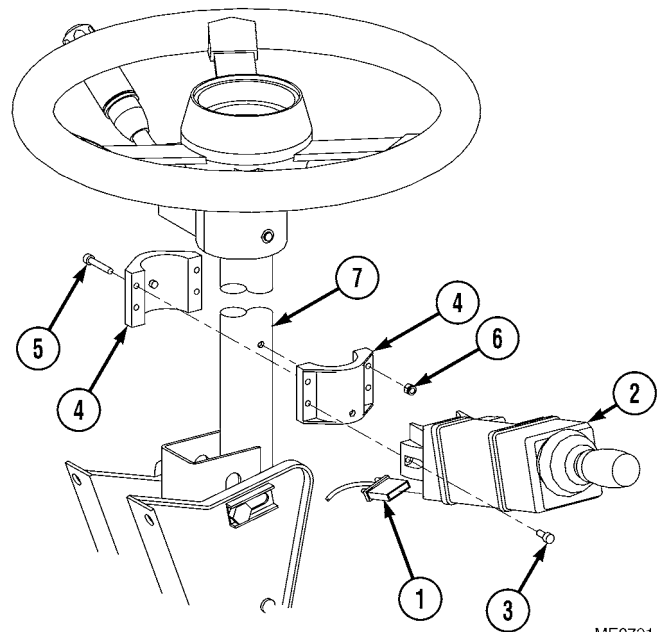
**WARNING**

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

**NOTE**

Remove cable ties as necessary.

- (1) Disconnect wiring harness (1) from EGS (2).
- (2) Remove screws (3) and EGS (2) from mounting clamp (4).
- (3) If required, remove screws (5), self-locking nuts (6), and mounting clamp (4) from steering column (7). Discard self-locking nuts.



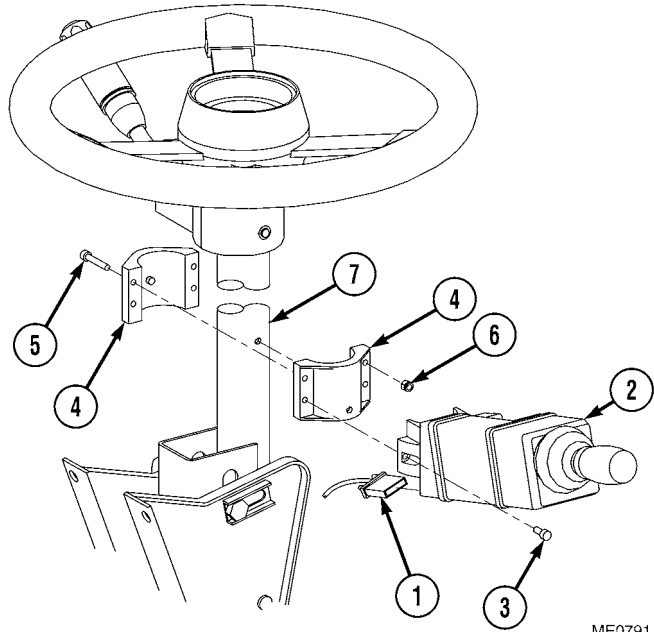
ME0791

**b. Installation.**

**NOTE**

Install cable ties as necessary.

- (1) If required, align mounting clamp (4) with locator pin. Secure mounting clamp on steering column (7) with screws (5) and new self-locking nuts (6).
- (2) Install EGS (2) and screws (3) on mounting clamp (4).
- (3) Connect wiring harness (1) to EGS (2).



**c. Follow-On Maintenance.**

- (1) Start engine and check for proper operation of EGS (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-26. INDICATOR ARM REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Ties, cable, Item 68, Appendix C

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

- TM or Para
  - TM 5-2420-230-10
  - TM 5-2420-230-10
  - TM 5-2420-230-10
  - TM 5-2420-230-10
- Condition Description*  
Vehicle positioned on level ground.  
Parking brake applied.  
Engine shut OFF.  
Electrical master switch OFF.  
“Do Not Operate” tag attached to ignition switch.

*Drawings Required*  
TM 5-2420-230-24P Figure 70

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B



**a. Removal.**

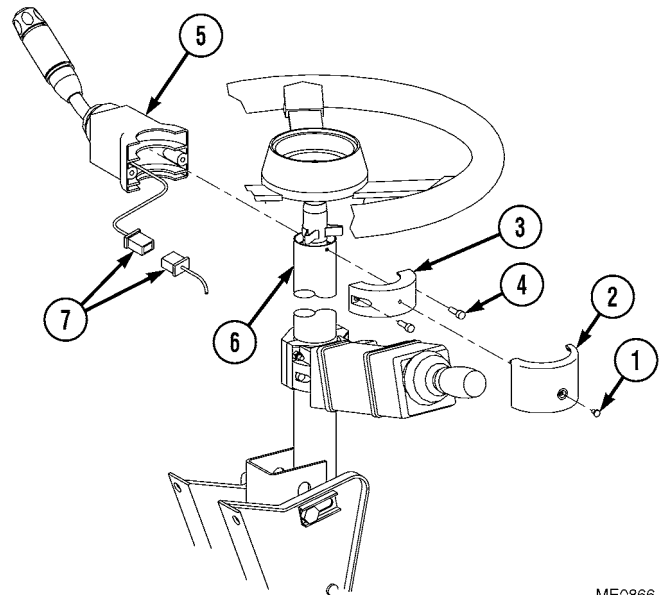
**WARNING**

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

**NOTE**

Remove cable ties as necessary.

- (1) Remove screw (1) and mounting clamp cover (2) from mounting clamp (3).
- (2) Remove screws (4), mounting clamp (3), and indicator arm (5) from steering column (6).
- (3) Disconnect wiring harness (7) from indicator arm (5).



**b. Installation.**

**NOTE**

Install cable ties as necessary.

- (1) Connect wiring harness (7) to indicator arm (5).
- (2) Install indicator arm (5), mounting clamp (3), and screws (4) on steering column (6).
- (3) Install mounting clamp cover (2) and screw (1) on mounting clamp (3).

**c. Follow-On Maintenance.**

- (1) Start engine and check for proper operation of indicator arm (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

ME0866

**12-27. GENERAL WIRING HARNESS REPLACEMENT.**

This Task Covers:

- a. Inspection
- b. Removal
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> FO-3, Electrical schematic</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p> <p><i>Drawings Required</i> None</p> <p><i>Estimated Time to Complete</i> Refer to MAC in Appendix B</p>	<p><i>Condition Description</i> Vehicle positioned on level ground. Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch. Hood raised (as required).</p>
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**a. Inspection.**

Inspect wiring harnesses for the following defects:

- Loose or broken wires
- Damaged insulation
- Faulty or loose connectors
- Water damage
- Crushed
- Evidence of overheating

**b. Removal.**

**WARNING**

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

**NOTE**

- Remove cable clamps or mounting hardware as required.
  - Tag all wires and note their positions before removal.
  - Remove cable ties as required.
  - To gain access to harnesses, some components may need to be removed.
  - Ensure all wires are disconnected and cleared before removal.
  - All harnesses are removed and installed the same way.
- (1) Disconnect connectors or plugs, as required.
  - (2) Remove harness from vehicle.

**c. Installation.**

Steps in the installation of an electrical harness are the reverse of those in the removal procedure with attention given to the following points:

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Ensure harness is routed correctly.
  - (2) Ensure securing clamps and mounting hardware are replaced.
  - (3) Align connectors, plugs, or pins, and ensure they are correctly connected.

**d. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10) and check operation of electrical components to ensure harness is operating correctly (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Close hood, if required (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-28. GENERAL WIRE HARNESS REPAIR.**

This Task Covers:

- |                             |                            |                            |
|-----------------------------|----------------------------|----------------------------|
| a. General                  | b. Type 1 Connector Repair | c. Type 2 Connector Repair |
| d. Type 3 Connector Repair  | e. Type 4 Connector Repair | f. Group I Terminal Repair |
| g. Group II Terminal Repair | h. Follow-On Maintenance   |                            |

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
TM 43-0158

*Tools and Special Tools*

- Insertor, electrical contact, Item 26, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, electric, Item 37, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

- |                   |   |
|-------------------|---|
| <i>TM or Para</i> | <i>Condition Description</i>                      |
| TM 5-2420-230-10  | Vehicle positioned on level ground.               |
| TM 5-2420-230-10  | Parking brake applied.                            |
| TM 5-2420-230-10  | Engine shut OFF.                                  |
| TM 5-2420-230-10  | Electrical master switch OFF.                     |
| TM 5-2420-230-10  | “Do Not Operate” tag attached to ignition switch. |

*Materials/Parts*

- Heatshrink, Item 35, Appendix C

*Personnel Required*

- MOS 62B, Construction Equipment Repairer

*Drawings Required*  
None

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. General.**



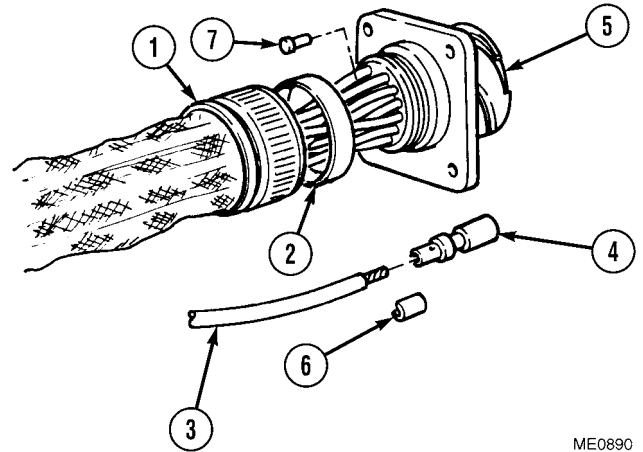
Terminals come in different styles and sizes. To prevent damage, be sure to use only the exact replacements. Do not attempt to modify terminal to fit.

**NOTE**

Repeat procedure(s) as necessary.

**b. Type 1 Connector Repair.**

- (1) Disassembly.
  - (a) Unscrew cover (1).
  - (b) Slide plastic sleeve (2) back.
  - (c) Remove wire (3) and terminal (4) from connector (5).



ME0890

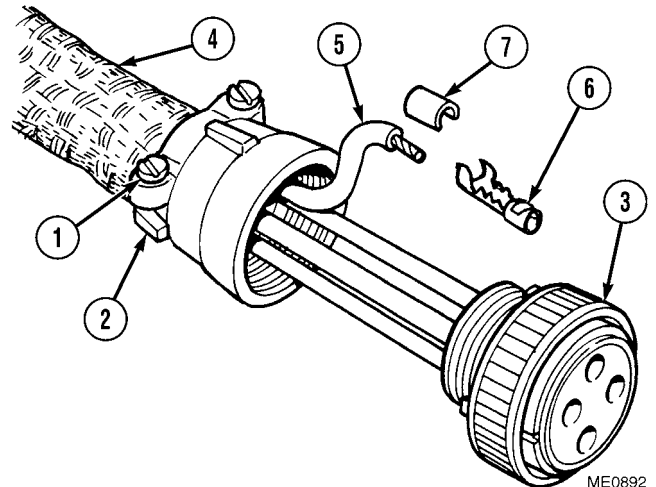
**NOTE**

Cut as close to damaged terminal as possible.

- (d) Cut off damaged terminal (4) at end of wire (3). Remove insulation (6) 0.25 in. (6 mm) from end of wire (3). Discard terminal.
- (2) Assembly.
    - (a) Install new terminal (4) on wire (3) and crimp in place.
    - (b) Install terminal (4) in connector (5).
    - (c) Install sealing plugs (7) in unused holes.
    - (d) Slide plastic sleeve (2) against connector (5).
    - (e) Install cover (1) on connector (5).

**c. Type 2 Connector Repair.**

- (1) Disassembly.
  - (a) Remove two screws (1) and cable clamp (2) from connector (3).
  - (b) Remove heat shrink (4).
  - (c) Remove wire (5) and terminal (6) from connector (3).



ME0892

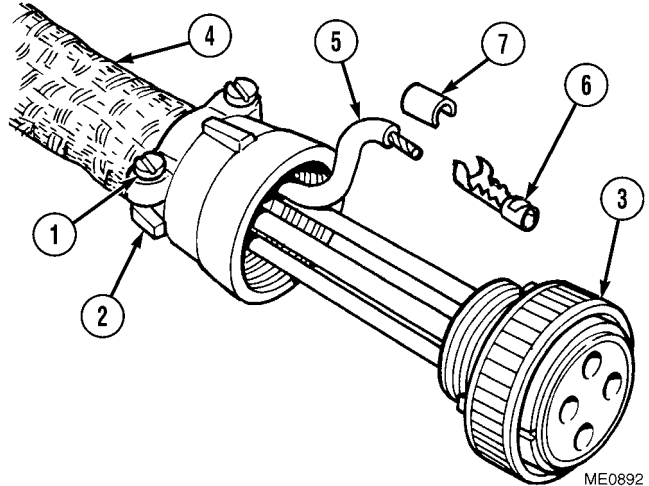
**NOTE**

Cut as close to damaged terminal as possible.

- (d) Cut off damaged terminal (6) at end of wire (5). Remove insulation (7) 0.25 in. (6 mm) from end of wire (3). Discard terminal.

(2) Assembly.

- (a) Install new terminal (6) on wire (5) and crimp in place.
- (b) Install terminal (6) in connector (3).
- (c) Install cable clamp (2) on connector (3) with two screws (1).
- (d) Install heat shrink (4) around wires (5).

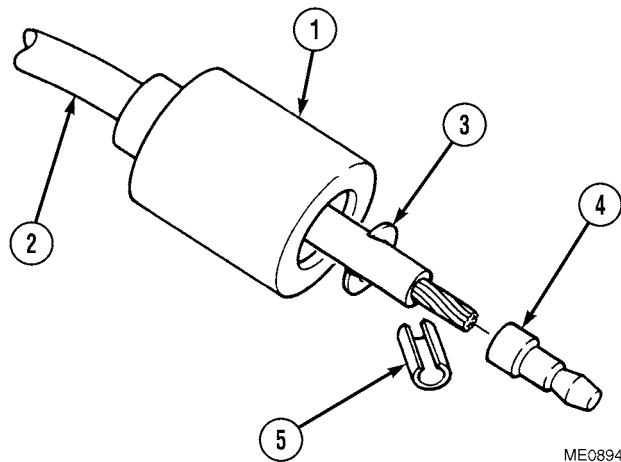


ME0892

**d. Type 3 Connector Repair.**

(1) Disassembly.

- (a) Slide outer shell (1) back on wire (2).
- (b) Remove C-washer (3) from wire (2).
- (c) Cut damaged terminal (4) from wire (2).
- (d) Trim end of wire (2) as needed to make an undamaged end.



ME0894

**NOTE**

If trimming causes wire to become too short, refer to TM 43-0158.

- (e) Remove 0.4 in. (10 mm) of insulation (5) from end of wire (2).

(2) Assembly.

- (a) Install new terminal (4) on wire (2).
- (b) Install C-washer (3) on wire (2) just below terminal (4).
- (c) Slide outer shell (1) over C-washer (3) and terminal (1).
- (d) Be sure no bare wire (2) is visible outside of outer shell (1).

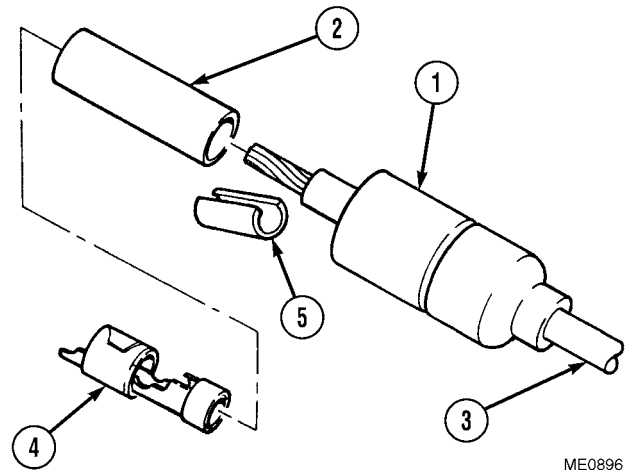
**e. Type 4 Connector Repair.**

- (1) Disassembly.
  - (a) Slide outer shell (1) and sleeve (2) back on wire (3).
  - (b) Remove damaged contact (4) from wire (3).
  - (c) Trim end of wire (3) as needed to make an undamaged end.

**NOTE**

If trimming causes wire to become too short, refer to TM 43-0158.

- (d) Remove 0.25 in. (6 mm) of insulation (5) from end of wire (3).
- (2) Assembly.
    - (a) Install sleeve (2) over end of wire (3).
    - (b) Install new contact (4) over end of wire (3).
    - (c) Crimp contact (4) securely in place.
    - (d) Slide outer shell (1) over sleeve (2) and contact (4).
    - (e) Ensure no bare wire (3) shows outside of outer shell (1).



ME0896

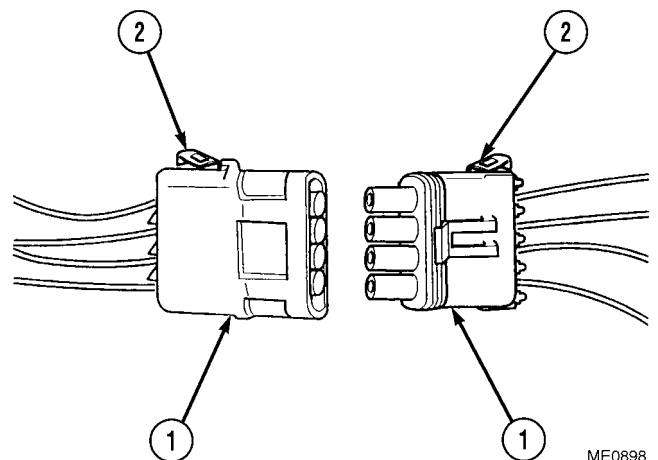
**f. Group I Terminal Repair.**

- (1) Disassembly.

**NOTE**

- Connector is removed by gently prying on clip and pulling up on connector.
- All group I connectors are repaired the same way. The number of wires in connector may vary.
- Both halves of the connector are repaired the same way.

- (a) Disconnect connector (1).
- (b) Unlatch and open two secondary locks (2) on connector (1).



ME0898

**WARNING**

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

- (c) Insert removal tool into cavity (3) on connector (1) until seated.
- (d) Pull wire (4) back through connector (1) and remove tool.

**NOTE**

- Do Step (e) only if terminal is still attached to wire.
- Make cut directly behind damaged terminal.

- (e) Cut terminal (5) and wire seal (6) from wire (4). Discard terminal and seal.

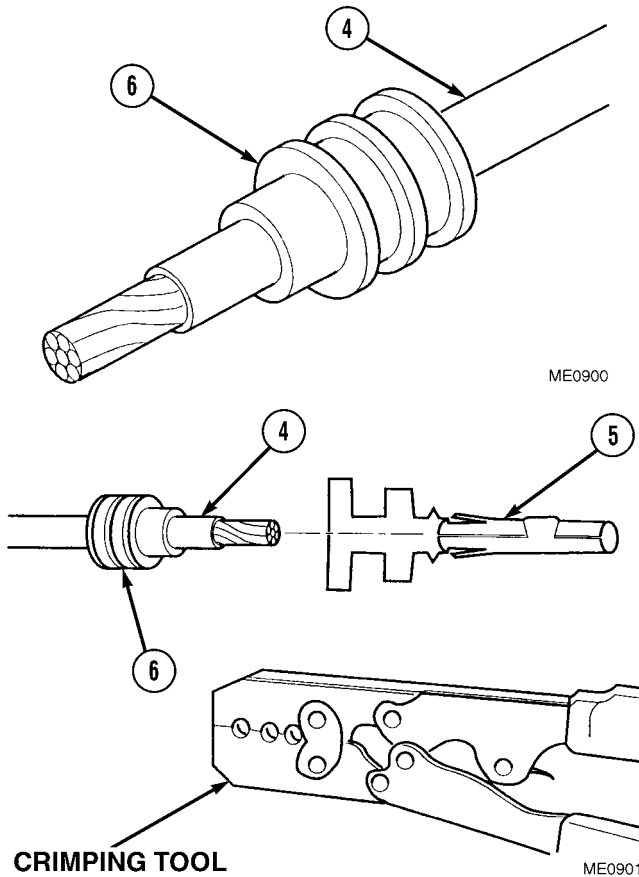
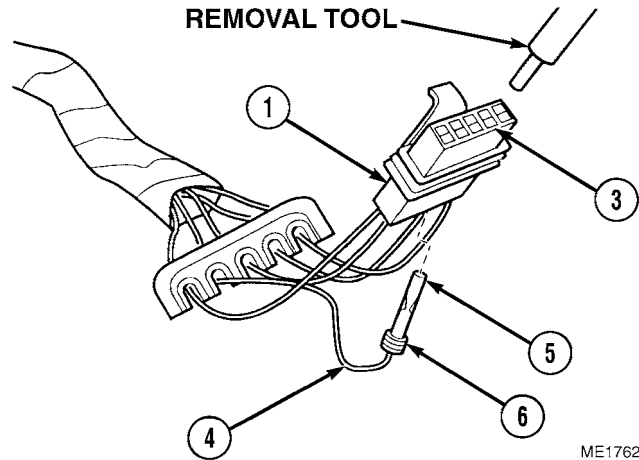
- (1) Assembly.

- (a) Insert 1 in. (25 mm) of wire (4) through new wire seal (6).

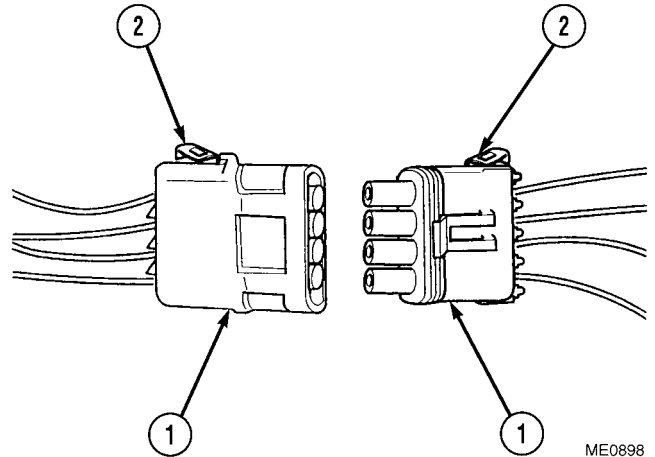
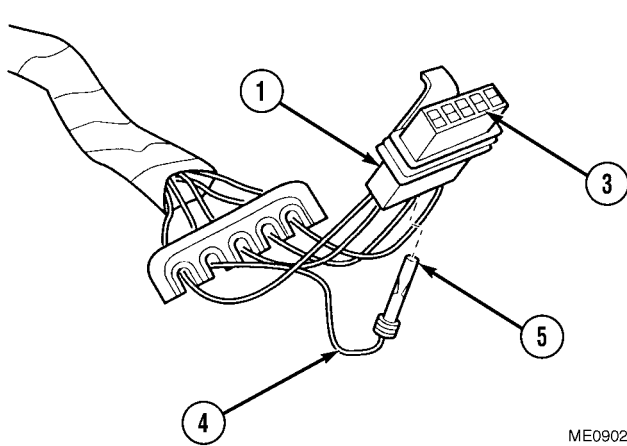
**CAUTION**

Strip wire after placing it through seal to prevent damage to individual wire strands.

- (b) Strip end of wire (4) leaving 0.25 in. (6 mm) of bare wire.
- (c) Insert new terminal (5) in locating hole of crimp tool using proper hole according to the gauge of wire (4).
- (d) Slide seal (6) down to end of insulation on wire (4).







**NOTE**

Wire and seal should be positioned so larger wings of terminal will crimp around seal and smaller wings will crimp around exposed bare wire.

- (e) Position wire (4) in terminal (5).
- (f) Press handles of crimp tool together until ratchet releases and crimp is complete.
- (g) Push new terminal (5) and wire (4) through connector (1) into cavity (3) until seated.
- (h) Close two secondary locks (2) on connector (1).
- (i) Connect connector (1).

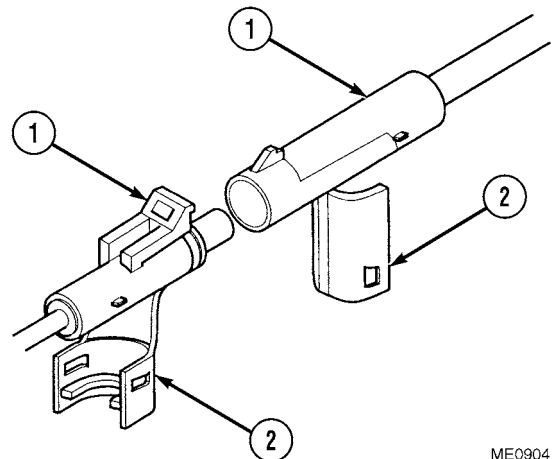
**g. Group II Terminal Repair.**

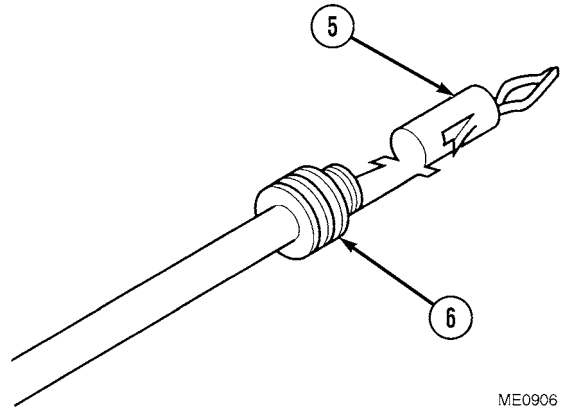
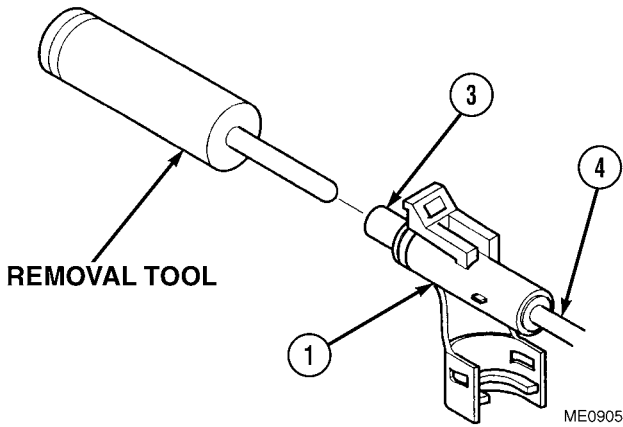
- (1) Disassembly.

**NOTE**

- Connector is removed by gently pulling up on clip and pulling on connector.
- All Group II connectors are repaired the same way. Number of wires in connector may vary.
- Both halves of the connector are repaired the same way.

- (a) Disconnect connector (1).
- (b) Unlatch and remove two secondary locks (2) on connector (1).





**WARNING**

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

- (c) Insert removal tool into terminal connector cavity (3) until seated.
- (d) Pull wire (4) back through connector (1) and removal tool.

**NOTE**

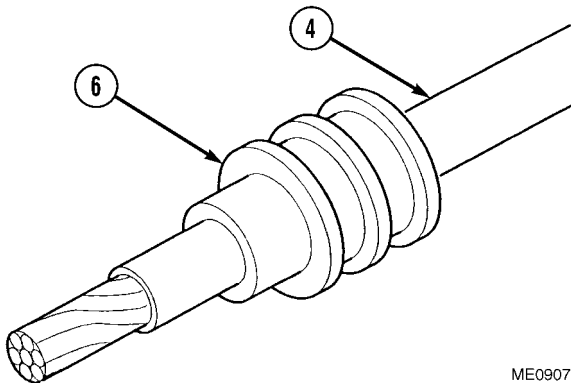
- Do Step (e) only if connector is still attached to wire.
- Make cut directly behind damaged terminal.
- (e) Cut off damaged terminal (5) and wire seal (6). Discard terminal and seal.

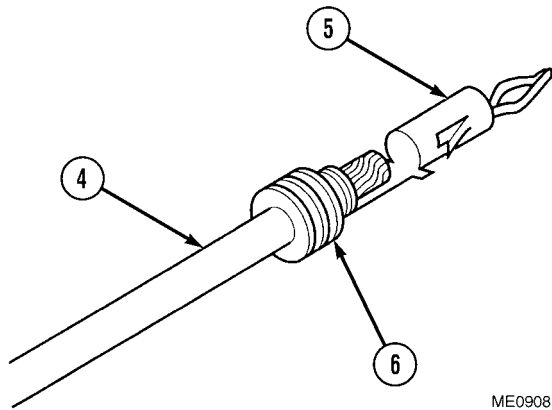
(2) Assembly.

**CAUTION**

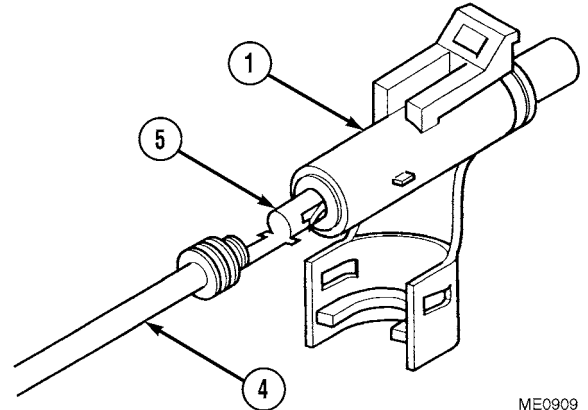
Strip wire after placing it through seal to prevent damage to individual strands.

- (a) Insert 1 in. (25 mm) of wire (4) through new wire seal (6).
- (b) Strip end of wire (4) leaving 0.25 in. (6 mm) of bare wire.





ME0908



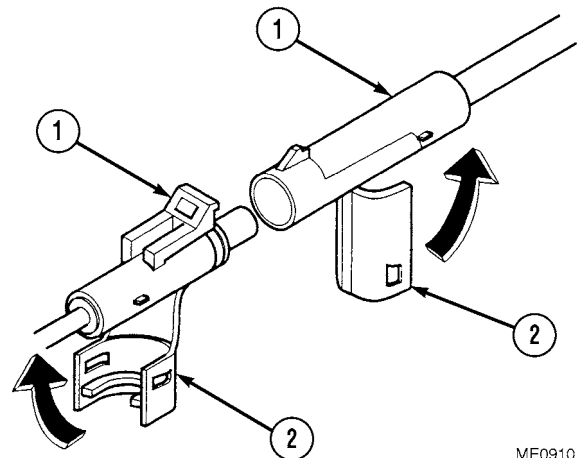
ME0909

- (c) Insert new terminal (5) in locating hole of crimp tool using the proper hole according to gauge of wire (4).
- (d) Slide wire seal (6) down to end of insulation on wire (4).

**NOTE**

Wire and seal should be positioned so larger wings of terminal will crimp around insulation and smaller wings will crimp around bare wire.

- (e) Position wire (4) on terminal (5).
- (f) Press handles of crimp tool together until ratchet releases and crimp is complete.
- (g) Push new terminal (5) and wire (4) through connector (1) until seated.
- (h) Install two secondary locks (2) on connector (1).
- (i) Connect connector (1).



ME0910

***h. Follow-On Maintenance.***

- (1) Start engine (TM 5-2420-230-10) and check operation of electrical components to ensure harness is operating correctly (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-29. FRONT WIPER MOTOR REPLACEMENT.**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*  
None

*Equipment Conditions*

*TM or Para*

*Condition Description*

Para 13-22

Wiper blades removed.

*Tools and Special Tools*

Para 13-24

Windshield defrost cover removed.

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

*Drawings Required*

Ties, cable, Item 68, Appendix C

TM 5-2420-230-24P Figure 65

*Personnel Required*

*Estimated Time to Complete Task*

MOS 62B, Construction Equipment Repairer

Refer to MAC in Appendix B

*References*

None

**a. Removal.**

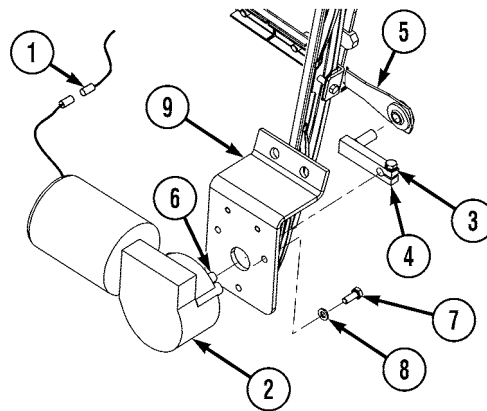
**WARNING**

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

**NOTE**

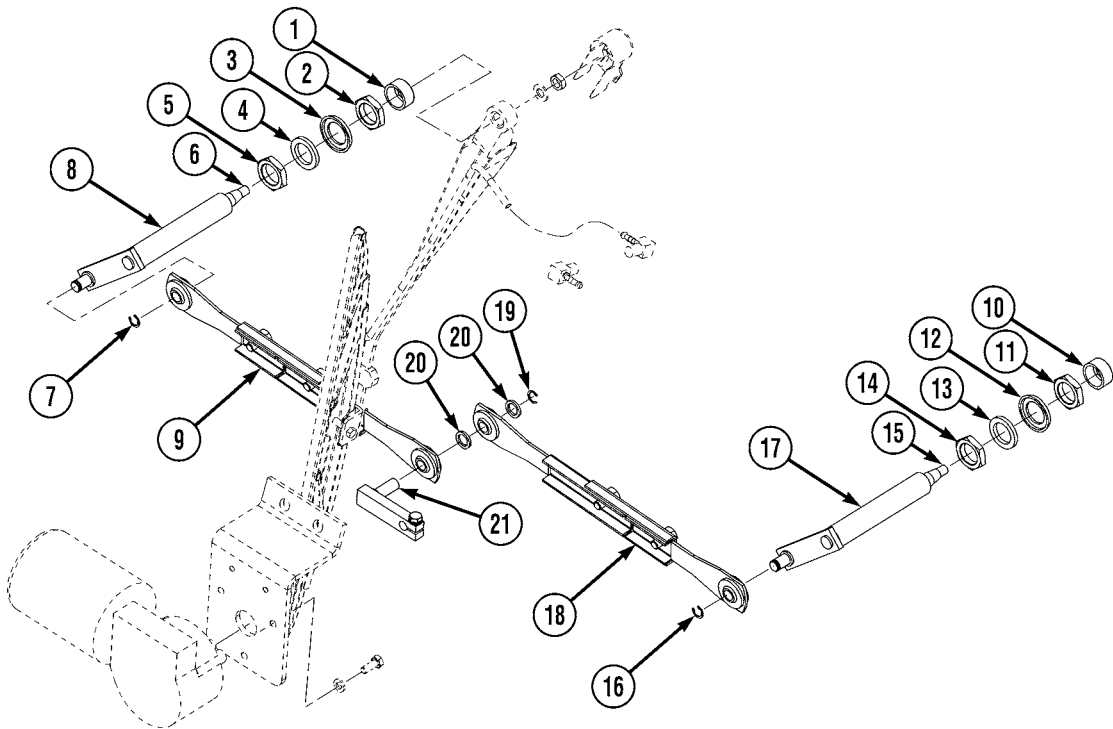
- Remove cable ties as necessary.
- Ensure all wires are disconnected and cleared before removal.
- All wiring harnesses are removed and installed in a similar manner.
- To gain access to wiring, some components may need to be removed.

- (1) Disconnect wiring harness (1) from wiper motor (2).
- (2) Loosen bolt (3) on crank arm (4) securing wiper motor (2) to linkage bar (5), and remove crank arm (4) from wiper motor gearbox shaft (6).
- (3) Remove three bolts (7) and washers (8) securing wiper motor (2) to mounting bracket (9).



ME1164

**b. Disassembly.**



ME1165

- (1) Remove retainer cap (1), nut (2), spacer (3), washer (4), and nut (5) from left spindle shaft (6).
- (2) Remove snap ring (7) and left spindle assembly (8) from left linkage bar (9).
- (3) Remove retainer cap (10), nut (11), spacer (12), washer (13), and nut (14) from right spindle shaft (15).
- (4) Remove snap ring (16) and right spindle assembly (17) from right linkage bar (18).
- (5) Remove snap ring (19), two washers (20), right linkage bar (18), and left linkage bar (9), from crank arm shaft (21).

**c. Assembly.**

- (1) Install two washers (20), right linkage bar (18), left linkage bar (9), and snap ring (19) on crank arm shaft (21).
- (2) Install right spindle assembly (17) and snap ring (16) on right linkage bar (18).
- (3) Install nut (14), washer (13), spacer (12), nut (11), and retainer cap (10) on right spindle shaft (15).
- (4) Install left spindle assembly (8) and snap ring (7) on left linkage bar (9).
- (5) Install nut (5), washer (4), spacer (3), nut (2), and retainer cap (1) on left spindle shaft (6).

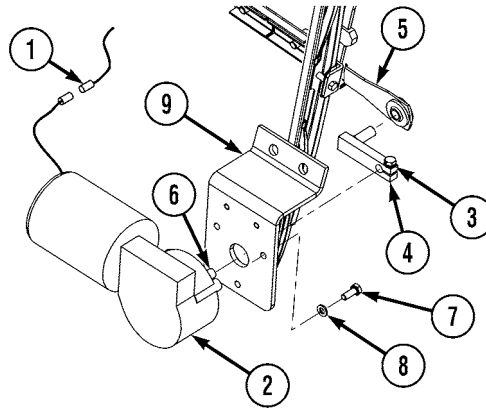
**d. Installation.**

**WARNING**

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

**NOTE**

Install cable ties as necessary.



ME1164

- (1) Install three washers (8) and bolts (7) securing wiper motor (2) to mounting bracket (9).
- (2) Install crank arm (4) on wiper motor gearbox shaft (6) and tighten bolt (3) on crank arm (4) securing wiper motor (2) to linkage bar (5).
- (3) Ensure all bolts are tightened.
- (4) Connect wiring harness (1) to wiper motor (2).
- (5) Relocate wiper arm to desired park position and install crank arm (4) on wiper motor gearbox shaft (6). Tighten bolt (3) on crank arm (4) securing wiper motor (2) to linkage bar (5).

**e. Follow-On Maintenance.**

- (1) Install windshield defrost cover (Para 13-24).
- (2) Wiper blade replaced (Para 13-22).
- (3) Start engine and functionally test front wiper motor (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**b. Installation.**

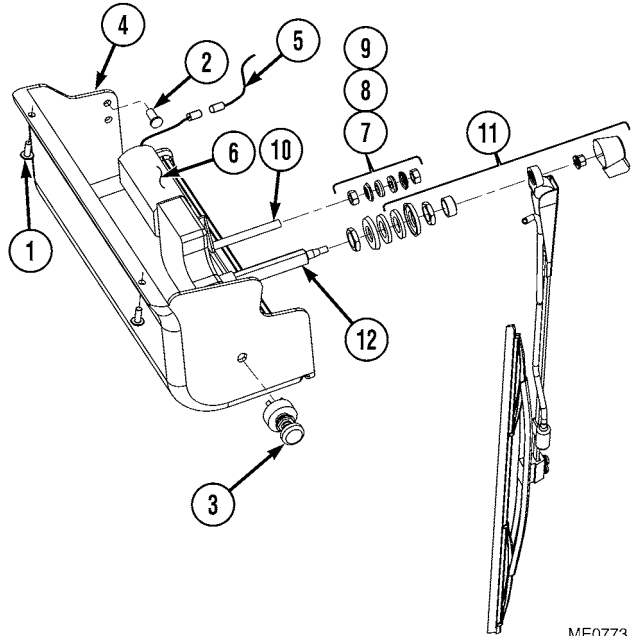
**WARNING**

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

**NOTE**

Install cable ties as necessary.

- (1) Place rear wiper motor mount (10) and rear wiper motor gearbox shaft (12) in position and secure bushing (9), washer (8), and nut (7) to rear wiper motor mount (10). Install rear wiper arm assembly (11) to rear wiper motor gearbox shaft (12).
- (2) Connect wiring harness (5) to rear wiper motor (6).
- (3) Operate wiper and switch off to check proper park position. If wiper is in proper park position, proceed to Step (5), if not, proceed to Step (4).
- (4) Relocate wiper arm to desired park position and install rear wiper arm assembly (11) to rear wiper motor gearbox shaft (12).
- (5) Install two screws (1), two grommets (2), wiper/washer switch (3), and wiper motor cover (4).
- (6) Ensure all bolts are tightened.



ME0773

**c. Follow-On Maintenance.**

- (1) Wiper blade replaced (Para 13-22).
- (2) Start engine and functionally test rear wiper motor (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## 12-31. WASHER BOTTLE ASSEMBLY AND BRACKET REPLACEMENT.

This Task Covers:

- a. Removal    b. Installation    c. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item X, Appendix D (2)  
Washer, lock, Item 279, Appendix D (2)  
Washer, lock, Item 281, Appendix D (3)

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
TM 5-2420-230-10	Hood raised.

*Drawings Required*

TM 5-2420-230-24P	Figure 15
TM 5-2420-230-24P	Figure 67

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

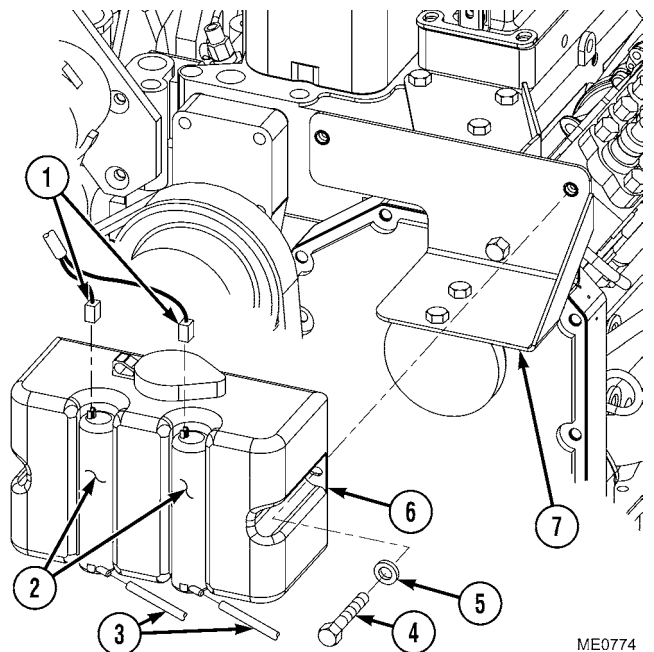
**a. Removal.**

**WARNING**

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

**NOTE**

- Tag all hoses and wires and note their positions before removal.
  - Remove cable ties as necessary.
  - Ensure all hoses and wires are disconnected and cleared before removal.
- (1) Remove two wiring harness plugs (1) from two washer pumps (2).
  - (2) Remove two washer hoses (3) from two washer pumps (2).
  - (3) Remove two bolts (4), lockwashers (5), and washer bottle assembly (6) from washer bottle bracket (7). Discard lockwashers.
  - (4) If required, remove washer pumps (2) from washer bottle assembly (6).



ME0774

**NOTE**

Steps (5) and (6) are only required if washer bottle bracket needs to be removed.

- (5) While supporting oil filter assembly (8), remove two screws (9) and lockwashers (10). Set oil filter assembly aside, ensuring that it is properly supported. Discard lockwashers.

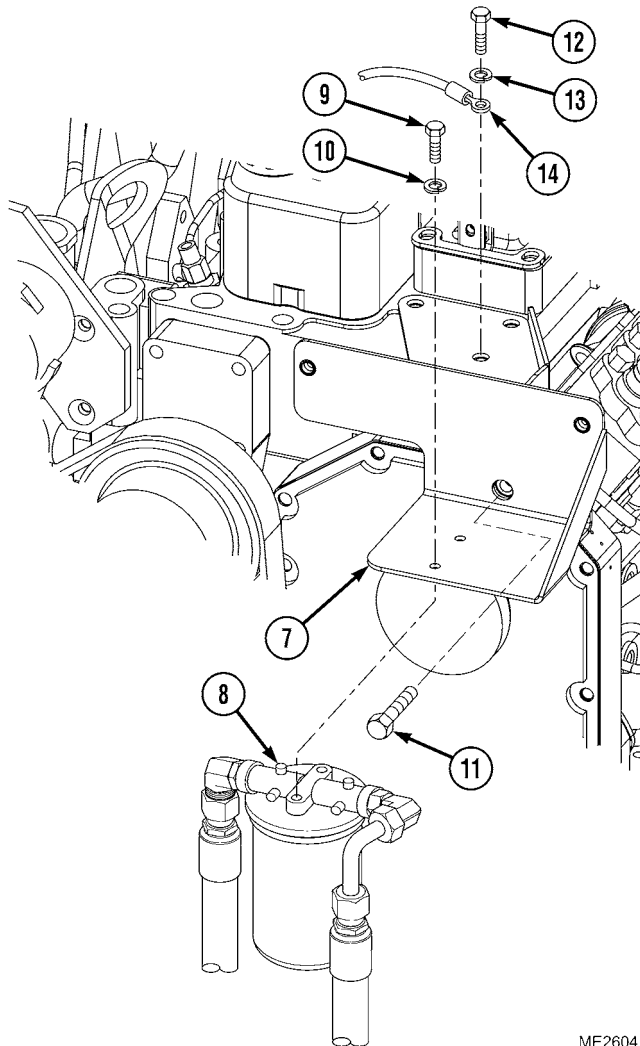
**WARNING**

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

**NOTE**

Thermostat ground wire is only on vehicles equipped with a cold weather kit.

- (6) Remove bolt (11), three screws (12), lockwashers (13), thermostat ground wire (14) (if equipped), and washer bottle bracket (7) from vehicle. Discard lockwashers.



ME2604

**b. Installation.**

**NOTE**

- Ensure all hoses and wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Steps (1) and (2) are only required if washer bottle bracket was removed.
- Thermostat ground wire is only on vehicles equipped with a cold weather kit.

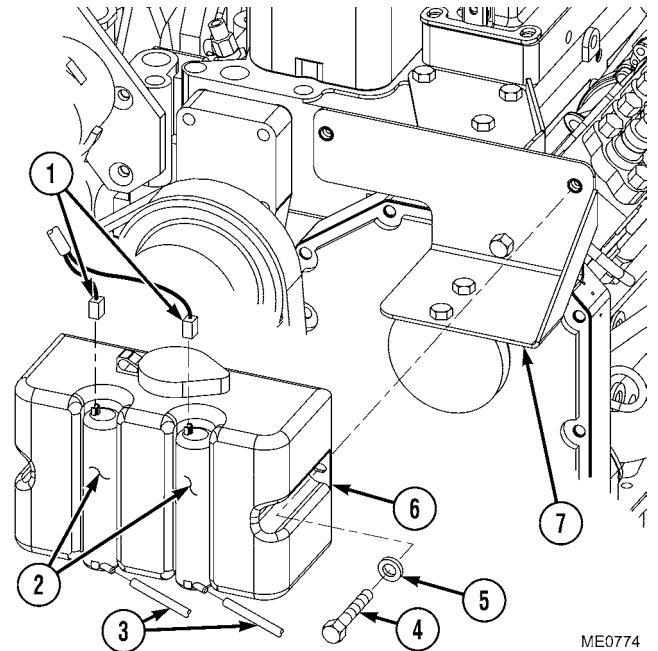
- (1) Install washer bottle bracket (7) and thermostat ground wire (14) (if equipped) on vehicle with three new lockwashers (13), screws (12), and bolt (11).
- (2) Position oil filter assembly (8) under washer bottle bracket (7), and install with two new lockwashers (10) and screws (9).

- (3) If removed, insert washer pumps (2) into washer bottle assembly (6).
- (4) Install washer bottle assembly (6) on washer bottle bracket (7) with two new lockwashers (5) and bolts (4).
- (5) Install two washer hoses (3) on washer pumps (2).

**WARNING**

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

- (6) Connect two wiring harness plugs (1) to washer pumps (2).



ME0774

**c. Follow-On Maintenance.**

- (1) Fill washer bottle assembly (6) with washer fluid (TM 5-2420-230-10).
- (1) Close engine hood and secure clips (TM 5-2420-230-10).
- (1) Start engine and functionally test front and rear washers to ensure they are operating correctly (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**b. Installation.**

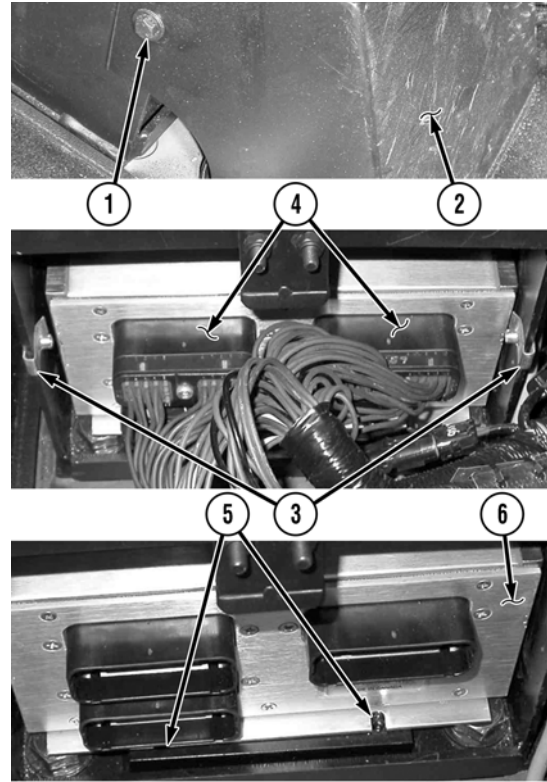
**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install seal, if previously removed.
- (2) Install ECU (6) and install two bolts (5).
- (3) Install wiring connectors (4) and tighten.
- (4) Install retaining clips (3) with cover plate (2).
- (5) Secure cover plate (2) with two bolts (1). Tighten bolts.



ME0865

**c. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Carry out hydraulic calibration procedure (Para 10-26).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-33. HYDRAULIC SOLENOID VALVE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

<i>Equipment Conditions</i>	<i>Condition Description</i>
TM or Para TM 5-2420-230-10	Engine access panel removed (FEL valve only).
Para 15-6	Air tank (20 L) removed (backhoe valve only).
Para 10-5	Hydraulic pressure released.

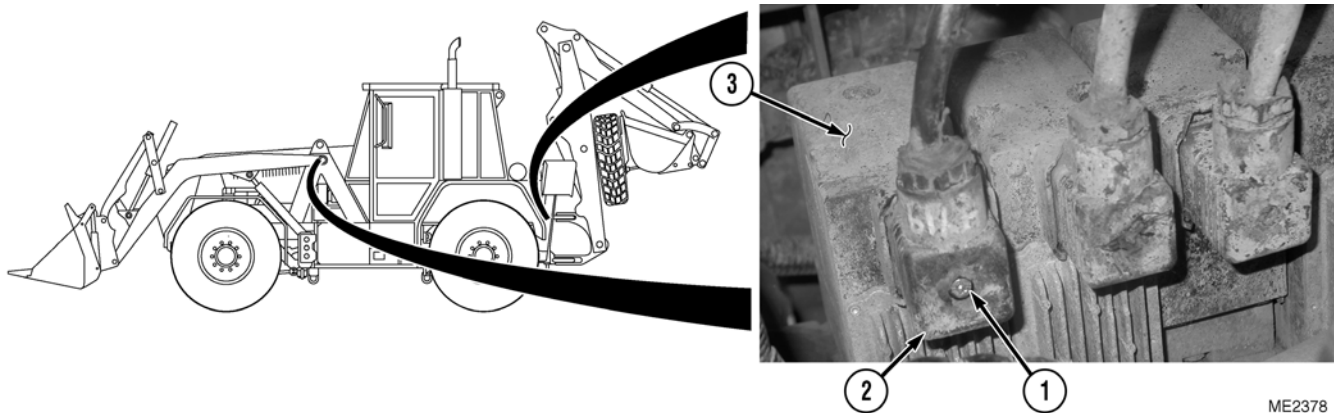
*Materials/Parts*  
Parts kit, Item 168.3, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 163  
TM 5-2420-230-24P Figure 173

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



ME2378

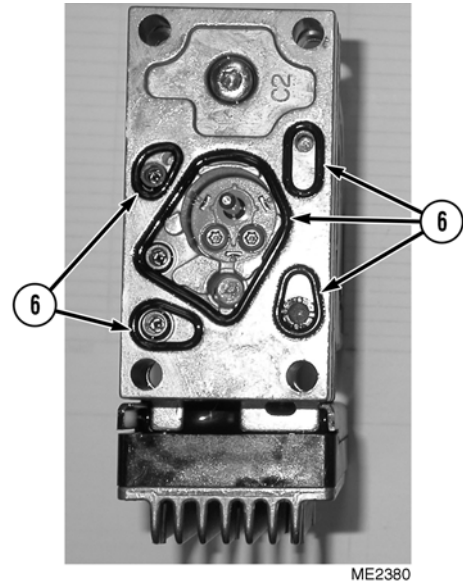
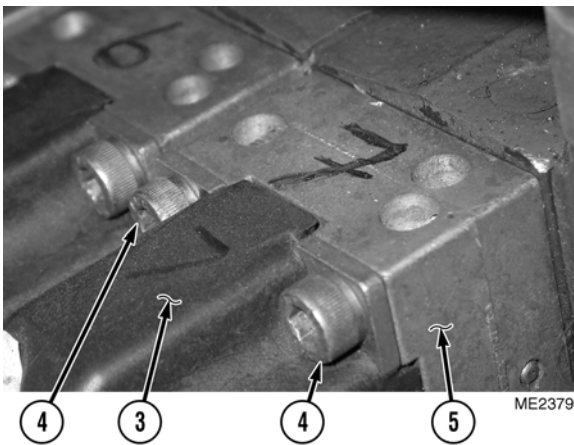
**WARNING**

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

**NOTE**

- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.
- All hydraulic solenoids are removed the same way.

(1) Loosen screw (1) and disconnect electrical connector (2) from solenoid valve (3).



## WARNING

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in serious injury or death to personnel.
  - Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.
- (2) Remove four screws (4) and solenoid valve (3) from valve block (5).
  - (3) Remove five O-rings (6) from solenoid valve (3). Discard O-rings.

### **b. Installation.**

## NOTE

- Install cable ties as necessary.
  - Ensure all wires are reconnected to positions noted prior to removal.
  - All solenoids are installed the same way.
- (1) Install five new O-rings (6) on solenoid valve (3).

## CAUTION

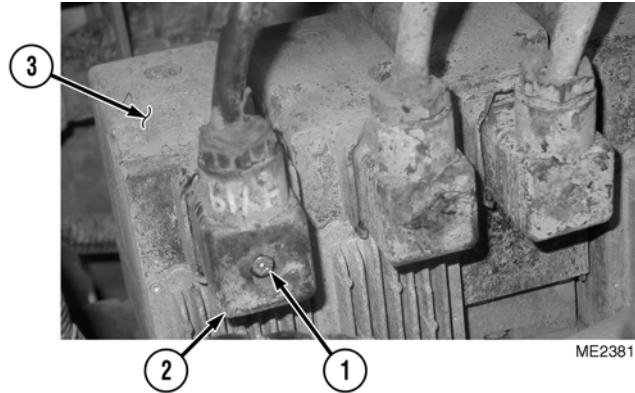
Cleanliness is essential for the correct and safe operation of the hydraulic system. Failure to comply may result in damage to equipment.

- (2) Install solenoid valve (3) on valve block (5) with four screws (4).

**WARNING**

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

- (3) Install electrical connector (2) on solenoid valve (3) with screw (1).



**c. Follow-On Maintenance.**

- (1) If removed, install 20 L air tank (Para 15-6).
- (2) Start engine (TM 5-2420-230-10).
- (3) Operate FEL or backhoe (TM 5-2420-230-10) to bleed system.
- (4) Check solenoid valves for signs of leakage. Tighten as necessary.
- (5) With all hydraulic components retracted, ensure oil level is correct (Para 10-9).
- (6) Shut OFF engine (TM 5-2420-230-10).
- (7) If removed, install engine access panel (TM 5-2420-230-10).

**END OF TASK**





**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eye can occur from released pressure. Failure to comply may result in injury or death to personnel.

- (2) Remove air line (3) from valve assembly (2).
- (3) Remove four self-locking nuts (4), washers (5), screws (6), and valve assembly (2) from holding bracket (7). Discard self-locking nuts.
- (4) Remove eight air lines (8) from valve assembly (2).

**b. Installation.**

**WARNING**

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

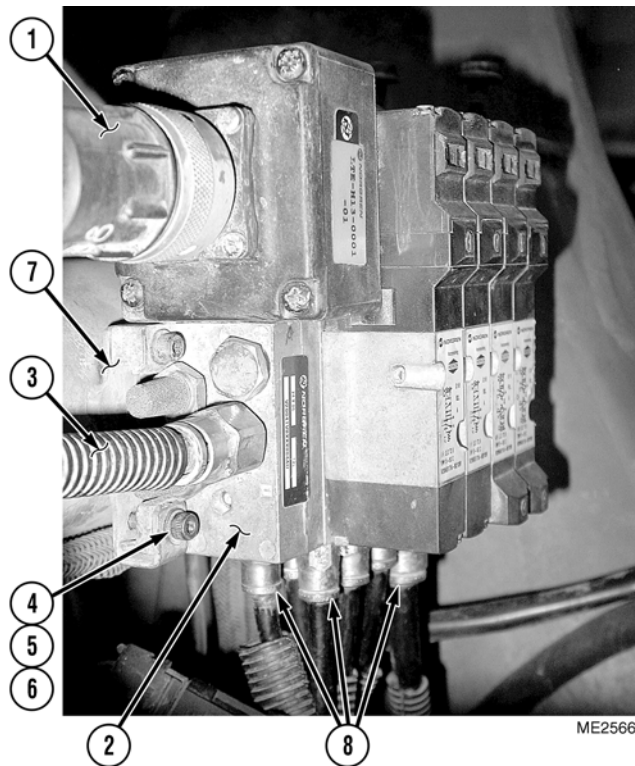
**NOTE**

- Ensure all wires and hoses are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install eight air lines (8) on valve assembly (2).
- (2) Install valve assembly (2) on holding bracket (7) with four screws (6), washers (5), and new self-locking nuts (4).
- (3) Install air line (3) on valve assembly (2).
- (4) Install electrical connector (1) on valve assembly (2).

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test to ensure differential locks, ride level valves, 2WD/4WD, and HIGH/LOW are operating correctly (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Install engine access panel (TM 5-2420-230-10).



**END OF TASK**



**b. Installation.**

**WARNING**

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

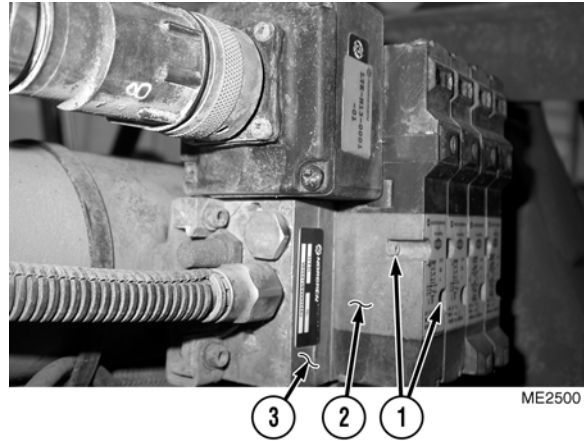
**NOTE**

The four valve islands are installed in the same manner.

- (1) Plug valve island (2) into pneumatic valve assembly (3) and install two screws (1).

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test to ensure appropriate pneumatic function is operating correctly (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Install engine access panel (TM 5-2420-230-10).



**END OF TASK**

## 12-34.2. REMOTE SHIFT SOLENOID COIL REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

*TM or Para*

*Condition Description*

TM 5-2420-230-10

Engine access panel removed.

TM 5-2420-230-10

Hood raised.

*Materials/Parts*

O-ring, Item 150.1, Appendix D (2)

Tags, identification, Item 63, Appendix C

Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 89

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

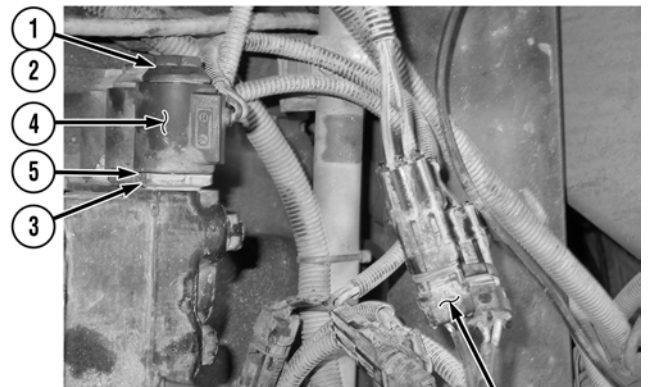
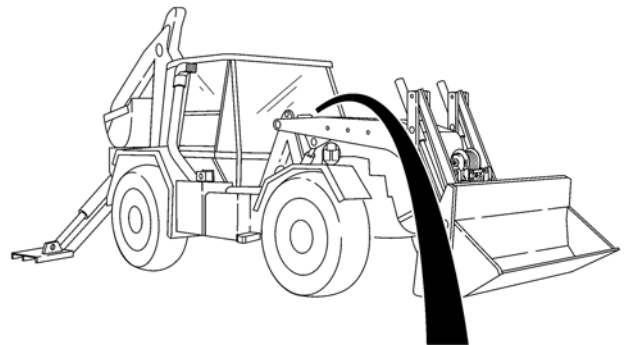
### a. Removal.

#### WARNING

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

#### NOTE

- Tag all wires, and note their positions before removal.
  - Remove cable ties as necessary.
  - All five solenoid coils are removed in the same manner.
- (1) Remove nut (1) and O-ring (2) from spool cartridge (3). Discard O-ring.
  - (2) Remove solenoid coil (4) and O-ring (5) from spool cartridge (3). Discard O-ring.
  - (3) Disconnect solenoid coil (4) from wiring harness (6).



6

ME2562

**b. Installation.**

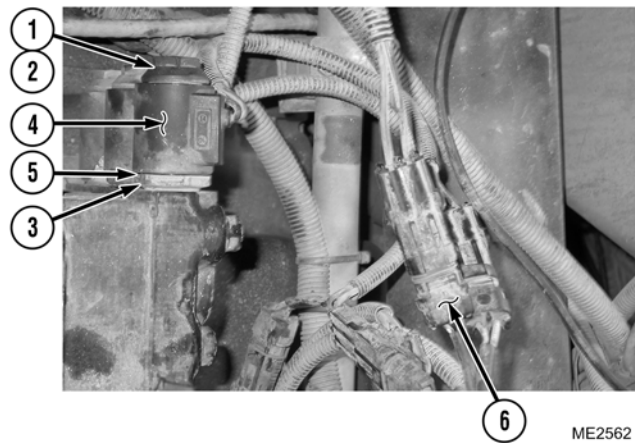
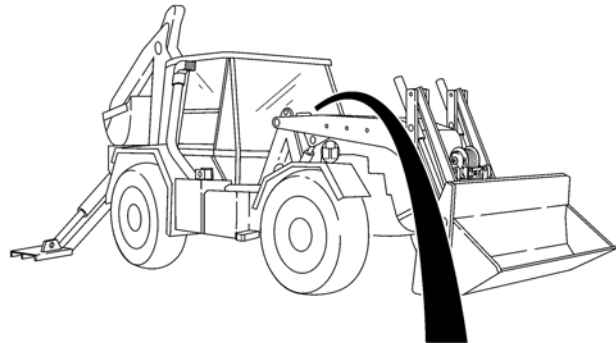
**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- All five solenoid coils are installed in the same manner.

- (1) Connect solenoid coil (4) to wire harness (6).
- (2) Install new O-ring (5), and solenoid coil (4) on spool cartridge (3).
- (3) Install new O-ring (2), and nut (1) on spool cartridge (3).



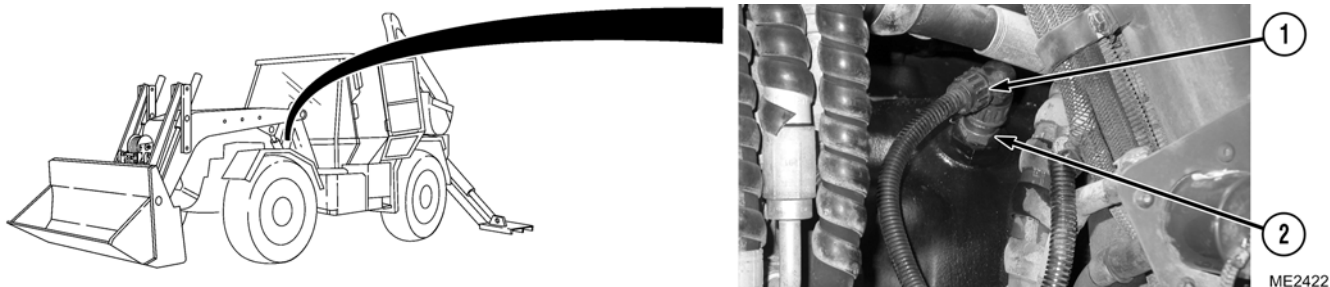
ME2562

**c. Follow-On Maintenance.**

- (1) Close hood (TM 5-2420-230-10).
- (2) Install engine access panel (TM 5-2420-230-10).
- (3) Start engine and functionally test transmission (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**





**NOTE**

It may be necessary to remove fasteners in order to disconnect electrical connector.

- (1) Remove electrical connector (1) from sensor (2).



The speed sensor reducer location is preset from factory. Ensure reducer position is not changed when removing or installing speed sensor. Failure to comply may result in damage to equipment.

- (2) Remove sensor (2) from vehicle.

**b. Installation.**



Sensors, sending units and switches come in different styles and sizes. To prevent damage, be sure to use only the exact replacement. Do not attempt to modify, or damage to equipment may occur.

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- It may be necessary to install fasteners in order to connect electrical connector.

- (1) Install sensor (2) on vehicle.
- (2) Install electrical connector (1) on sensor (2).

**c. Follow-On Maintenance.**

- (1) If purged, charge A/C system (Para 19-4).
- (2) Start engine and verify that appropriate gauge or indicator is operating properly (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) If removed, install belly plates (TM 5-2420-230-10) or hydraulic reservoir step plate (Para 13-15).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





**b. Installation.**

**WARNING**

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

**NOTE**

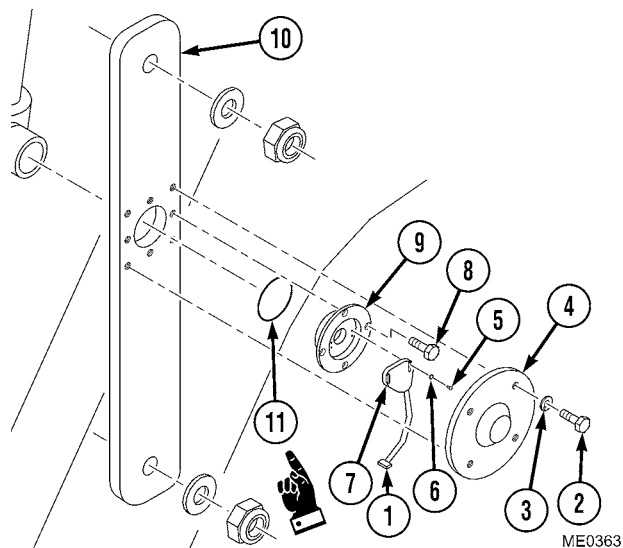
Install cable ties as necessary.

(0.1) If remove, install new O-ring (11) on potentiometer plate (9).

- (1) If required, install potentiometer plate (9) on FEL arm (10) with four bolts (8).
- (2) Install potentiometer (7) with two screws (5) and washers (6).
- (3) Install dust cover (4) with four bolts (2) and new lockwashers (3).
- (4) Connect potentiometer switch (1).

**c. Follow-On Maintenance.**

- (1) Start engine and perform hydraulic calibration procedure (Para 10-26).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).



**END OF TASK**



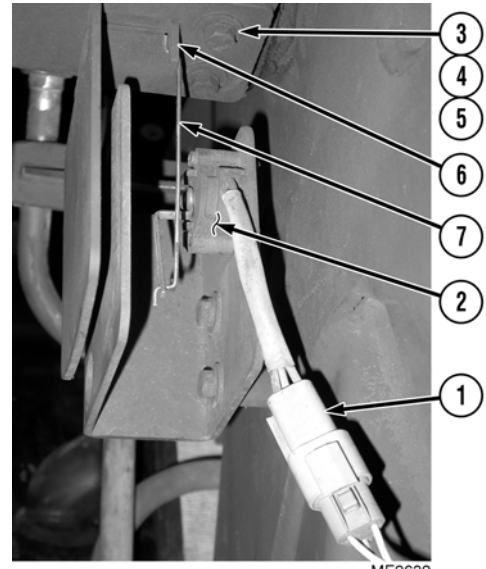
**NOTE**

Ensure potentiometer link is installed as noted prior to removal.

- (3) Position link (7) on potentiometer (2) and bracket (6) and install bracket on vehicle with two washers (5), new lockwashers (4), and bolts (3).
- (4) Connect wiring harness (1) on potentiometer (2).

**c. Follow-On Maintenance.**

- (1) Start engine and perform hydraulic calibration procedure (Para 10-26).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).



**END OF TASK**



**b. Installation.**

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

Steps in the installation of the sender unit are the reverse of those in the removal procedure with attention given to the following points:

- (1) Handle sender unit carefully.
- (2) Use new gasket and lockwashers when reinstalling sender unit in fuel tank.

**c. Follow-On Maintenance.**

- (1) Start engine and functionally check for operation of fuel gauge (TM 5-2420-230-10).
- (2) Check for leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Replace fuel tank step plate (Para 13-14).
- (5) Deleted.

END OF TASK

**12-38. REVERSE ALARM REPLACEMENT.**

This Task Covers:

- |            |                 |                          |
|------------|-----------------|--------------------------|
| a. Removal | b. Installation | c. Follow-On Maintenance |
|------------|-----------------|--------------------------|

**INITIAL SETUP**

<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.
Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P Figure 56	
<i>References</i>	<i>Estimated Time to Complete Task</i>	
None	Refer to MAC in Appendix B	

**a. Removal.**



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

**NOTE**

Remove cable ties as necessary.

- (1) Remove two screws (1) and washers (2).
- (2) Remove reverse alarm (3).
- (3) Disconnect electrical connector (4).

**b. Installation.**

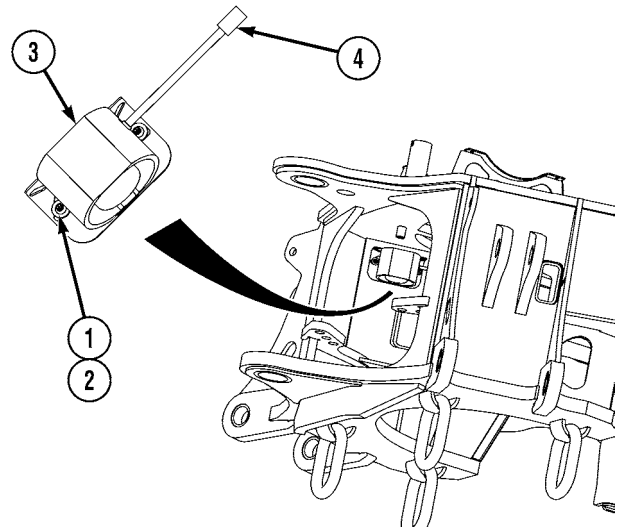
**NOTE**

Install cable ties as necessary.

- (1) Install the reverse alarm (3) on vehicle with two washers (2) and screws (1).
- (2) Connect electrical connector (4).

**c. Follow-On Maintenance.**

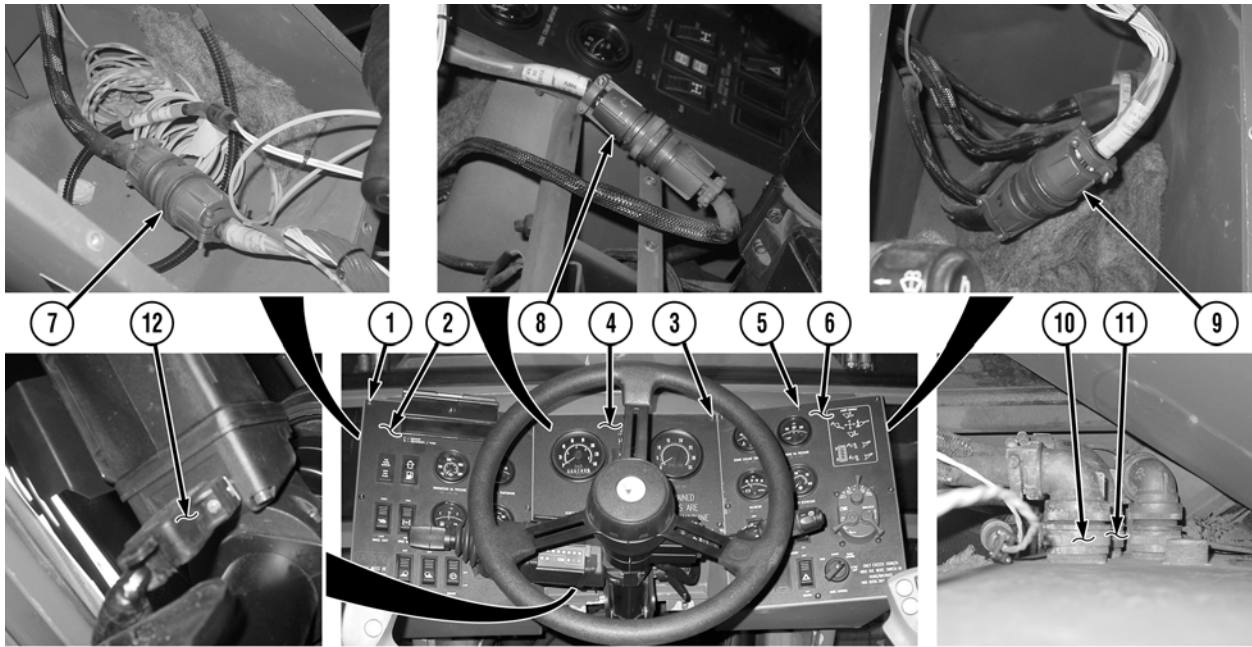
- (1) Start vehicle and test reverse alarm (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).



**END OF TASK**

<b>12-39. DASH PANEL WIRING HARNESS REPLACEMENT.</b>			
This Task Covers:			
a. Removal	b. Installation	c. Follow-On Maintenance	
<b>INITIAL SETUP</b>			
<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.	
<i>Materials/Parts</i> Tags, identification, Item 63, Appendix C	TM 5-2420-230-10	Engine shut OFF.	
Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	Electrical master switch OFF.	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	Para 13-8.1	"Do Not Operate" tag attached to ignition switch.	
<i>References</i> None	<i>Drawings Required</i> TM 5-2420-230-24P	Inclinometer and bracket removed (center dash panel only).	
		Figure 68	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B		

**a. Removal.**



**WARNING**

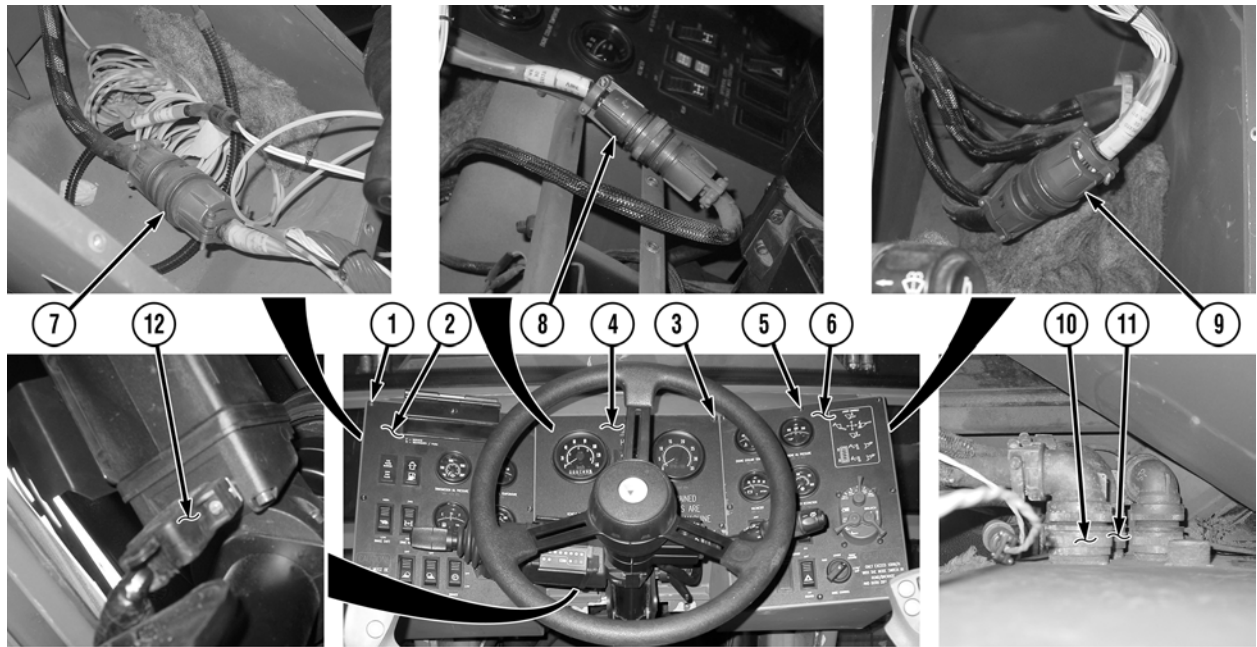
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
  - Ensure all wires are disconnected and cleared before removal.
  - This task replaces all harnesses; use steps as required.
- (1) Remove eight screws (1) from left dash panel (2).
  - (2) Remove five screws (3) from center dash panel (4).
  - (3) Remove eight screws (5) from right dash panel (6).
  - (4) Remove left dash panel (2), center dash panel (4), and right dash panel (6) from frame.
  - (5) Disconnect electrical connectors (7) from left dash panel harness.
  - (6) Disconnect electrical connectors (8) from center dash panel harness.
  - (7) Disconnect electrical connectors (9) from right dash panel harness.
  - (8) Disconnect electrical connectors (10) and (11) from PDP.
  - (9) Disconnect electrical connector (12) from EGS.
  - (10) Remove harness from cab.



**b. Installation.**



**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
- (1) Connect electrical connector (12) to EGS.
  - (2) Connect electrical connectors (11) and (10) to PDP.
  - (3) Connect electrical connectors (9) to right dash panel harness.
  - (4) Connect electrical connectors (8) to center dash panel harness.
  - (5) Connect electrical connectors (7) to left dash panel harness.
  - (6) Position right dash panel (6) and tighten down with eight screws (5).
  - (7) Position center dash panel (4) and tighten down with five screws (3).
  - (8) Position left dash panel (2) and tighten down with eight screws (1).

**c. Follow-On Maintenance.**

- (0.1) Install inclinometer and bracket (center dash panel only) (Para 13-8.1).
- (1) Start engine and functionally check gauges, lights, and buzzer for proper operation (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**12-40. HEADLIGHT ASSEMBLY REPAIR.**

This Task Covers:

- a. Disassembly
- b. Assembly
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Headlight removed.

*Materials/Parts*

- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C
- Nut, Self-locking, Item 110, Appendix D
- Nut, Self-locking, Item 115.1, Appendix D (2)
- Washer, Lock, Item 279, Appendix D (4)
- Washer, Lock, Item 280, Appendix D (4)

*Drawings Required*

TM 5-2420-230-24P Figure 53

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*Personnel Required*

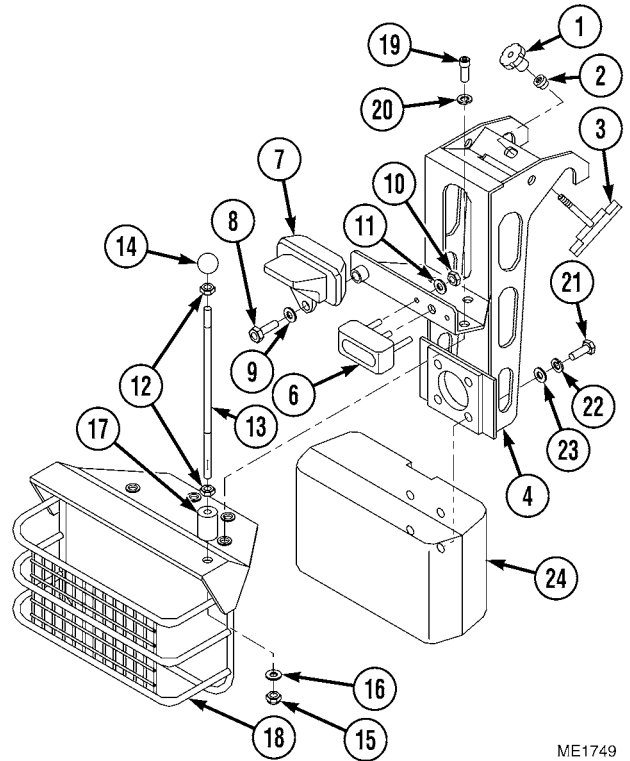
MOS 62B, Construction Equipment Repairer

**NOTE**

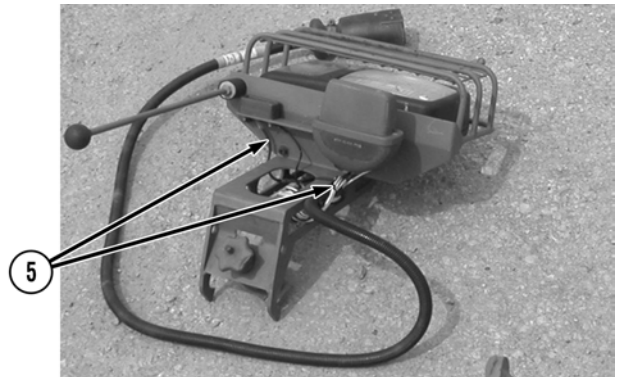
- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.
- Ensure all wires are disconnected and clear before removal.
- Both headlights are repaired in the same manner. Left side is shown.
- If replacing defective light bulb, see Para 12-45.

**a. Disassembly.**

- (1) Remove knob (1), boss (2), and T-bar (3) from bracket (4).
- (2) Disconnect electrical harness connections (5) from blackout marker (6) and blackout drive light (7).
- (3) Remove bolt (8), washer (9), and blackout drive light (7) from bracket (4).
- (4) Remove two self-locking nuts (10), washers (11), and blackout marker (6) from bracket (4). Discard self-locking nut.
- (5) Loosen two nuts (12) on vision rod (13) and remove ball (14) from vision rod.
- (6) Remove self-locking nut (15) and flat washer (16) from vision rod (13). Discard self-locking nut.
- (7) Remove vision rod (13) and rubber mount (17) from grill (18).
- (8) Remove rubber mount (17) from vision rod (13).
- (9) Remove two nuts (12) from vision rod (13).
- (10) Remove four screws (19), lockwashers (20), and grill (18) from bracket (4). Discard lockwashers.
- (11) Remove four bolts (21), lockwashers (22), and flat washers (23) from bracket (4) and drive light (24). Discard lockwashers.



ME1749



ME1748

**b. Assembly.**

- (1) Install drive light (24) on bracket (4) with four flat washers (23), new lockwashers (22), and bolts (21).
- (2) Install grill (18) on bracket (4) with four new lockwashers (20) and screws (19).
- (3) Install two nuts (12), ball (14), and rubber mount (17) on vision rod (13).
- (4) Install vision rod (13) on grill (18) with flat washer (16) and new self-locking nut (15). Tighten nuts (12).
- (5) Install blackout marker (6) on bracket (4) with two washers (11) and new self-locking nuts (10).
- (6) Install blackout drive light (7) on bracket (4) with washer (9) and bolt (8).
- (7) Connect electrical harness connections (5) to blackout marker (6) and blackout drive light (7).
- (8) Install T-bar (3) on bracket (4) with boss (2) and knob (1).

**c. Follow-On Maintenance.**

Install headlight (TM 5-2420-230-10).

**END OF TASK**





**c. Follow-On Maintenance.**

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Place ignition switch in ON position (TM 5-2420-230-10).
- (3) Functionally test marker lights (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>12-43. MIRROR CLEARANCE LIGHT REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> Tags, Identification, Item 63, Appendix C	TM 5-2420-230-10	Engine shut OFF.
Ties, cable, Item 68, Appendix C	TM 5-2420-230-10	Electrical master switch OFF.
		“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P	Figure 59
<i>References</i> None	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

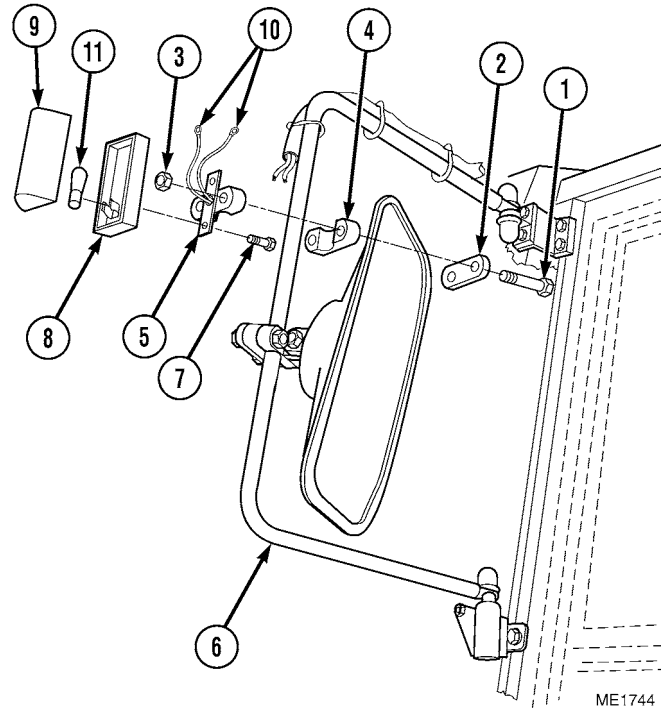
**NOTE**

- Left and right mirror clearance lights remove the same way. Left side shown.
- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.

**WARNING**

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

- (1) Remove bolts (1), mounting plate (2), nuts (3), clamp (4), and bracket (5) on mirror mounting bracket (6).
- (2) Remove screws (7) and bracket (5) from light fixture (8).
- (3) Remove protective cover (9) from light fixture (8).
- (4) Disconnect wires (10) from light fixture (8).
- (5) If required, remove bulb (11) from light fixture (8). Discard bulb (11).



**b. Installation.**

**NOTE**

Install cable ties as necessary.

- (1) If required, install new bulb (11) on light fixture (8).
- (2) Connect wires (10) to light fixture (8).
- (3) Install protective cover (9) on light fixture (8).
- (4) Install screws (7) and bracket (5) on light fixture (8).
- (5) Install bolts (1), mounting plate (2), nuts (3), clamp (4), and bracket (5) on mirror mounting bracket (6).

**c. Follow-On Maintenance.**

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Functionally test mirror mounted clearance light (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**









## CHAPTER 13

### BODY, CAB, AND CHASSIS

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	13-1	13-1
Preparation and Isolation. . . . .	13-2	13-2
Restore IHMEE to Operational Readiness. . . . .	13-3	13-2
Accelerator Pedal Replacement. . . . .	13-4	13-2
Hand Throttle Replacement. . . . .	13-5	13-3
Boom Lock Pedal and Cable Replacement. . . . .	13-6	13-5
Radio Mount Replacement. . . . .	13-7	13-7
Rifle Rack and Mount Replacement. . . . .	13-8	13-8
Inclinometer Replacement. . . . .	13-8.1	13-10
Operator's Seat Anchor Replacement. . . . .	13-8.2	13-11
Hand Control Pod Assembly Replacement. . . . .	13-9	13-13
Operator's Seat Replacement. . . . .	13-10	13-14
Operator's Seat Belt Replacement. . . . .	13-11	13-16
Deleted. . . . .	13-12	13-18
Data Plate Replacement. . . . .	13-13	13-19
Fuel Tank Step Plate Replacement. . . . .	13-14	13-21
Hydraulic Reservoir Step Plate Replacement. . . . .	13-15	13-22
Front Fender Replacement. . . . .	13-16	13-23
Rear Fender and Mudflap Replacement. . . . .	13-17	13-25
Nose Cone Maintenance. . . . .	13-18	13-27
Engine Hood Maintenance. . . . .	13-19	13-31
General Sheet Metal Repair. . . . .	13-20	13-32
Glass Replacement. . . . .	13-21	13-34
Wiper Blade and Arm Replacement. . . . .	13-22	13-39
Sun Visor Replacement. . . . .	13-23	13-42
Windshield Defrost Cover Replacement. . . . .	13-24	13-43
Mirror Replacement. . . . .	13-25	13-44
Mirror Bracket Replacement. . . . .	13-26	13-46
Battery Stowage Box Maintenance. . . . .	13-27	13-47
Air Cleaner Filter Replacement. . . . .	13-27.1	13-53
A/C Filter Replacement. . . . .	13-27.2	13-55
A/C Precleaner Replacement. . . . .	13-28	13-57
Air Cleaner/Stowage Box Repair. . . . .	13-29	13-58
Door Assembly Replacement. . . . .	13-30	13-62
Door Hinge Replacement. . . . .	13-31	13-65
Door Handle Replacement. . . . .	13-32	13-66
Door Gas Strut Replacement. . . . .	13-33	13-68
Wheel and Tire Repair. . . . .	13-34	13-69
Auxiliary Defroster Ducting Replacement. . . . .	13-35	13-70
Auxiliary Defroster Heater Maintenance. . . . .	13-36	13-72
Military Load Classification (MLC) Placard Replacement. . . . .	13-37	13-80

**13-1. GENERAL.**

This chapter contains routine maintenance activities and removal and replacement procedures for the following components:

- Chassis
- Windows
- Cab
- Mirrors

**13-2. PREPARATION AND ISOLATION.**

Prior to commencement of maintenance on the Interim High-Mobility Engineer Excavator (IHMEE), perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place battery isolation switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**13-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place battery isolation switch to ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**13-4. ACCELERATOR PEDAL REPLACEMENT.**

This Task Covers:

- |            |                 |                          |
|------------|-----------------|--------------------------|
| a. Removal | b. Installation | c. Follow-On Maintenance |
|------------|-----------------|--------------------------|

**INITIAL SETUP**

<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.
Pin, cotter, Item 170.1, Appendix D	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P	Figure 43
<i>References</i>	<i>Estimated Time to Complete Task</i>	
None	Refer to MAC in Appendix B	

**a. Removal.**

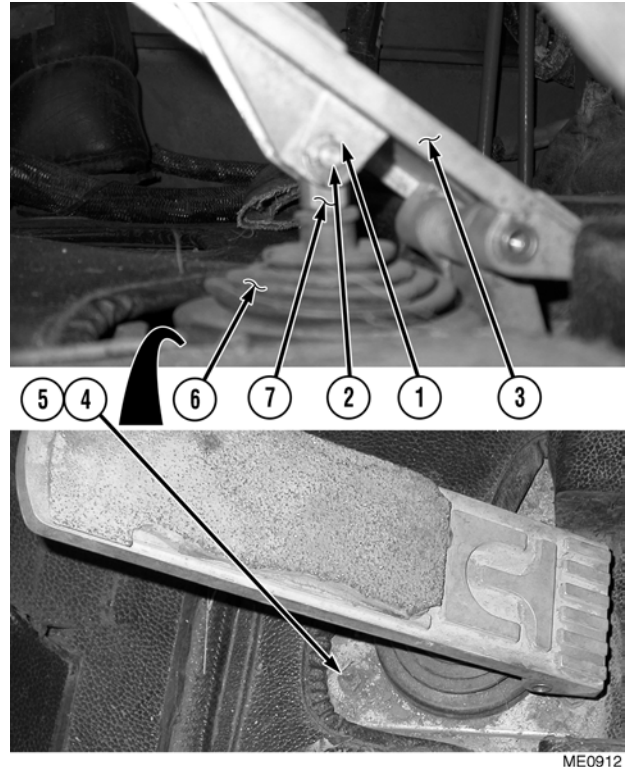
- (1) Remove cotter pin (1) and pin (2) from accelerator pedal (3). Discard cotter pin.
- (2) Remove four bolts (4) and washers (5) from accelerator pedal (3).
- (3) Remove rubber boot (6) from accelerator linkage (7).

**b. Installation.**

- (1) Insert accelerator linkage (7) into rubber boot (6).
- (2) Install accelerator pedal (3) with four bolts (4) and washers (5).
- (3) Install pin (2) and new cotter pin (1) in accelerator pedal (3).

**c. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Test operation of accelerator pedal (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).



ME0912

**END OF TASK**

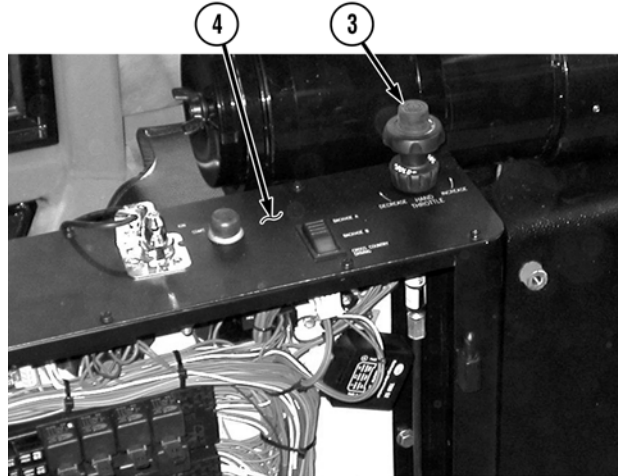
<b>13-5. HAND THROTTLE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10 <i>Condition Description</i> Center belly plate removed.	
<i>Materials/Parts</i> Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P      Figure 43	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

Remove cable ties as necessary.

- (1) Open PDP doors.
- (2) Loosen nut (1) and washer (2) from hand control (3).
- (3) Loosen nut (5) and remove cable (6) from PDP (4) to accelerator pedal.
- (4) Remove hand throttle (3) from PDP (4).

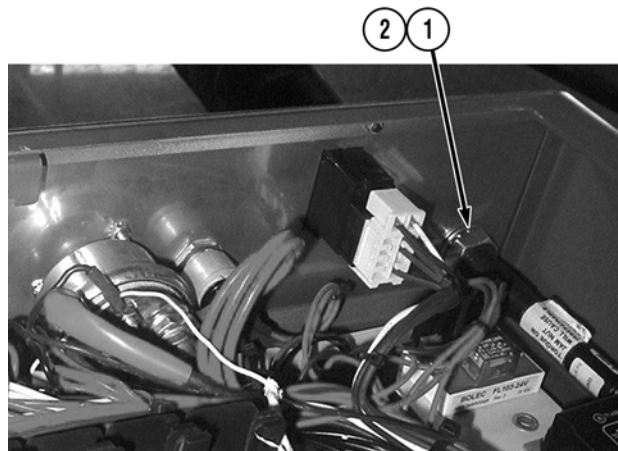


**b. Installation.**

**NOTE**

Install cable ties as necessary.

- (1) Route cable (6) from accelerator pedal through PDP (4).
- (2) Tighten nut (5).
- (3) Install hand throttle (3) to PDP (4).
- (4) Install washer (2) and nut (1) onto hand throttle (3).

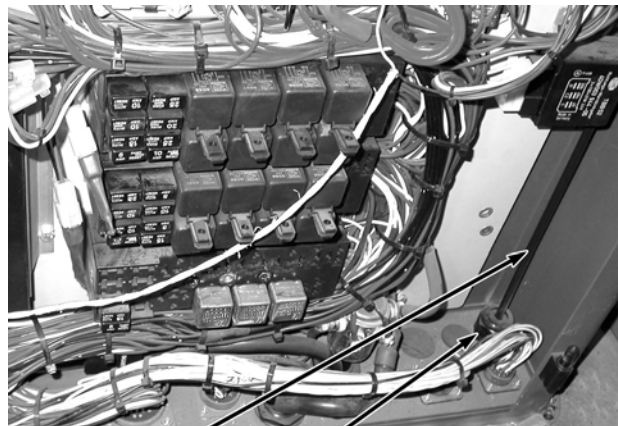


ME1242

**c. Follow-On Maintenance.**

Install belly plates (TM 5-2420-230-10).

**END OF TASK**



ME1712

**13-6. BOOM LOCK PEDAL AND CABLE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Adjustment
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Nut, self-locking, Item 109, Appendix D (6)
- Nut, self-locking, Item 111, Appendix D
- Nut, self-locking, brass, Item 127, Appendix D

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

*TM or Para*

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

TM 5-2420-230-10

*Condition Description*

Vehicle positioned on level ground.

Parking brake applied.

Engine shut OFF.

Electrical master switch OFF.

“Do Not Operate” tag attached to ignition switch.

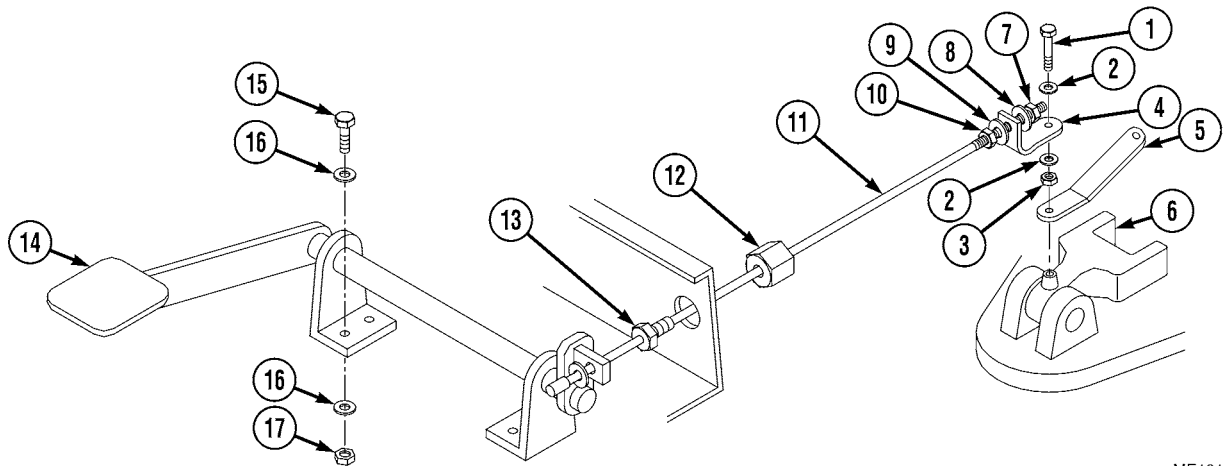
*Drawings Required*

TM 5-2420-230-24P Figure 165

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

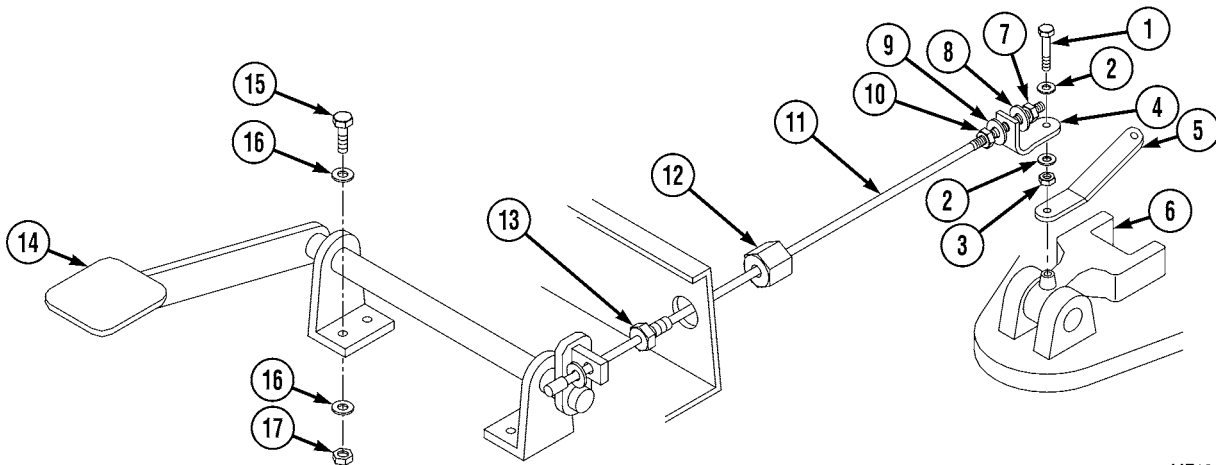
**a. Removal.**



ME1216

- (1) Remove bolt (1), two washers (2), self-locking nut (3), boom lock pedal cable mount (4), and spring bracket lock (5) from latch (6). Discard self-locking nut.
- (2) Remove self-locking nut (7), washer (8), washer (9), self-locking nut (10), and boom lock pedal cable mount (4) from boom lock pedal cable (11). Discard self-locking nuts.
- (3) Remove brass self-locking nut (12) from cable guide (13). Discard brass self-locking nut.
- (4) Remove cable guide (13) from lock pedal cable (11).
- (5) Remove boom lock pedal cable (11) from boom lock pedal (14).
- (6) Remove four bolts (15), eight washers (16), four self-locking nuts (17), and boom lock pedal (14). Discard self-locking nuts.
- (7) If required, remove latch (6).

**b. Installation.**



ME1216

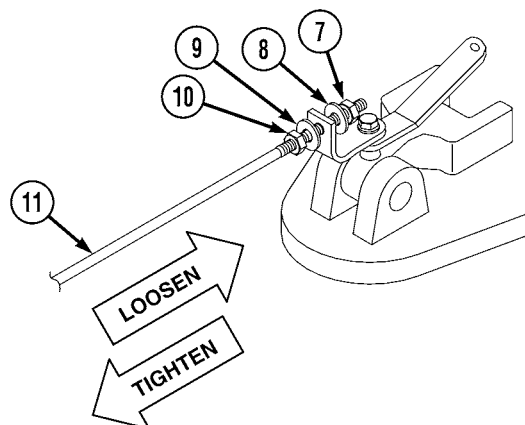
- (1) If removed, install latch (6).
- (2) Install boom lock pedal (14) and four bolts (15), eight washers (16) and four new self-locking nuts (17). Tighten self-locking nuts.
- (3) Install boom lock pedal cable (11) on boom lock pedal (14).
- (4) Install cable guide (13) on boom lock pedal cable (11).
- (5) Install new brass self-locking nut (12) on cable guide (13).
- (6) Install new self-locking nut (10), washer (9), boom lock pedal cable mount (4), washer (8), and new self-locking nuts (7) on boom lock pedal cable (11).
- (7) Install bolt (1), two washers (2), new self-locking nut (3), boom lock pedal cable mount (4), and spring bracket lock (5) on latch (6).

**c. Adjustment.**

**NOTE**

The boom lock pedal cable needs to have approximately 0.13 to 0.25 in. (3 to 6 mm) free play to function properly.

- (1) To tighten boom lock pedal cable:
  - (a) Loosen self-locking nut (10) and tighten self-locking nut (7).
  - (b) Tighten self-locking nut (10).
- (2) To loosen boom lock pedal cable:
  - (a) Loosen self-locking nut (7) and tighten self-locking nut (10).
  - (b) Tighten self-locking nut (7).



ME1732



**d. Follow-On Maintenance.**

- (1) Start engine and functionally test boom lock pedal (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>13-7. RADIO MOUNT REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> None	TM 5-2420-230-10	Engine shut OFF.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	TM 5-2420-230-10	Electrical master switch OFF.
<i>References</i> None	<i>Drawings Required</i> TM 5-2420-230-24P Figure 204	“Do Not Operate” tag attached to ignition switch.
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

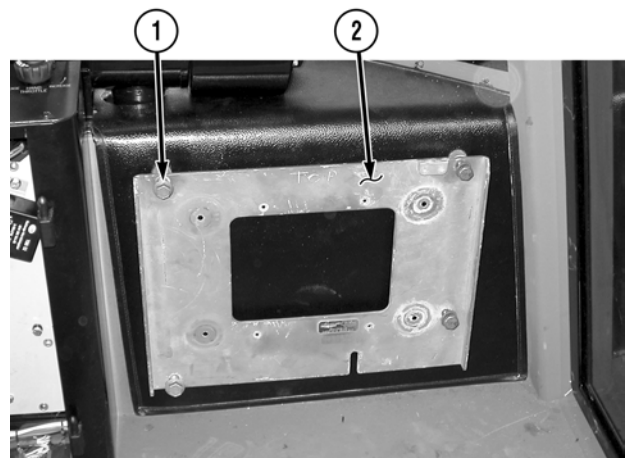
- (1) Remove four bolts (1) securing radio mount (2).
- (2) Remove radio mount (2).

**b. Installation.**

Install radio mount (2) with bolts (1). Tighten bolts.

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

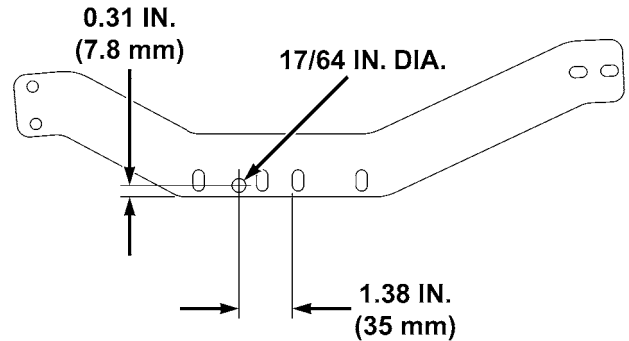
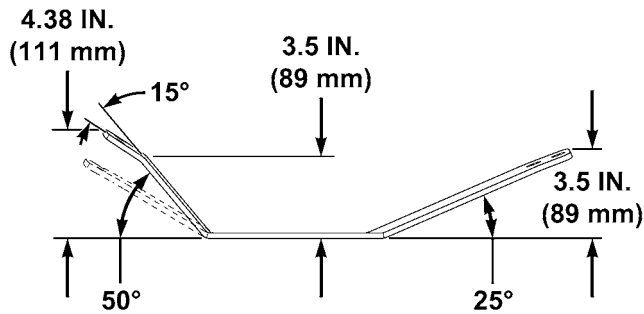


ME0215

**END OF TASK**



**b. Installation.**



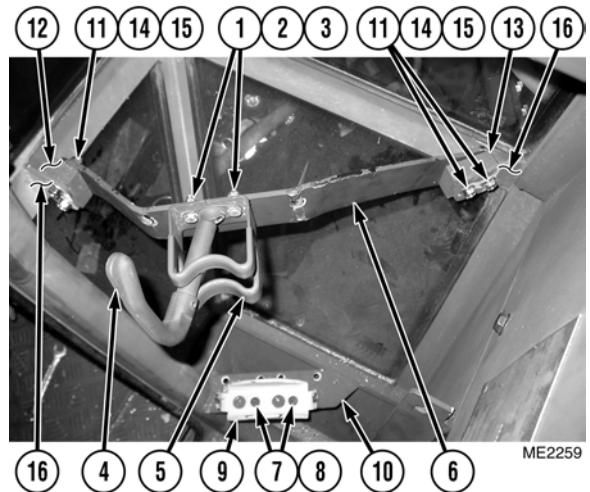
ME2609

ME2608

**NOTE**

- If gun mount bracket was not removed, go to Step (5).
- If replacing gun mount bracket, modify new bracket per steps (1) through (3) before installation. If reinstalling old gun mount bracket, go to Step (4).
- Dimensions shown are approximate. It may be necessary for you to modify the gun mount bracket to slightly different dimensions to correctly fit your vehicle.

- (1) Bend both sides of bracket to approximate dimensions shown.
- (2) Measure and mark hole position on bracket (6).
- (3) Using a 17/64-in. bit, drill hole through bracket (6).
- (4) Install bracket (6), spacer (12), and spacer (13) on flanges (16) with four bolts (15), washers (14), and nuts (11).
- (5) Install rifle mount (9) on bracket (10) with two bolts (8) and nuts (7).
- (6) Install storage rack (5) and catch mount (4) on bracket (6) with two bolts (3), washers (2), and nuts (1).



ME2259

**c. Follow On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





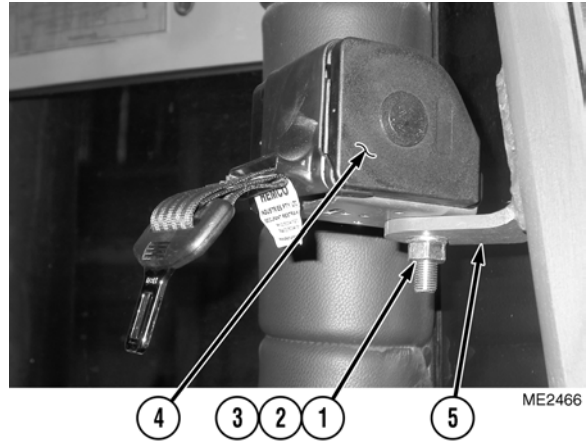
**NOTE**

Before tightening nut, orient the belt end so that it is aligned with the buckle end on the rear of seat.

- (2) Install new belt assembly (4) on bracket (5) with new bolt (3), new washer (2), and new nut (1). Torque nut to 22 lbf/ft (30 N•m).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).



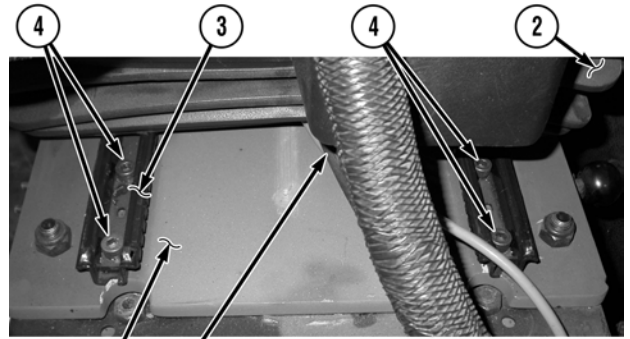
**END OF TASK**







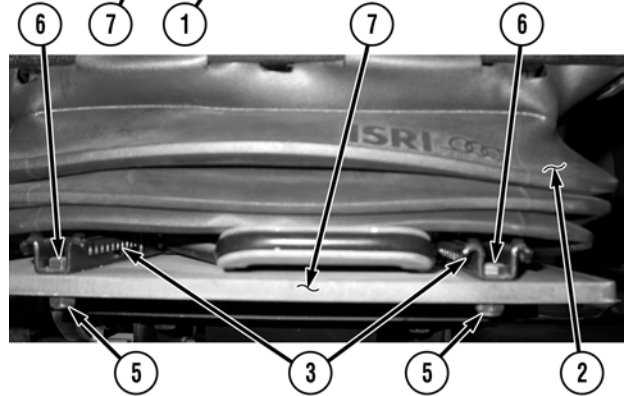
- (1) Disconnect air supply line (1).
- (2) Disconnect all wiring connectors.
- (3) Slide seat (2) to foremost position on slides (3) and remove four screws (4).
- (4) Slide seat (2) to rearmost position on slides (3) and remove self-locking nuts (5) and screws (6). Discard self-locking nuts.
- (5) Remove seat (2) from swivel base (7).



**b. Installation.**

**WARNING**

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



ME1007

- (1) Slide seat (2) fully forward on slides (3).
- (2) Align holes on slides (3) with holes in swivel base (7) and install four screws (4).
- (3) Slide seat (2) to rearmost position on slides (3) and install two screws (6) and two new self-locking nuts (5).
- (4) Connect and tighten air supply line (1).
- (5) Connect all wiring connectors.

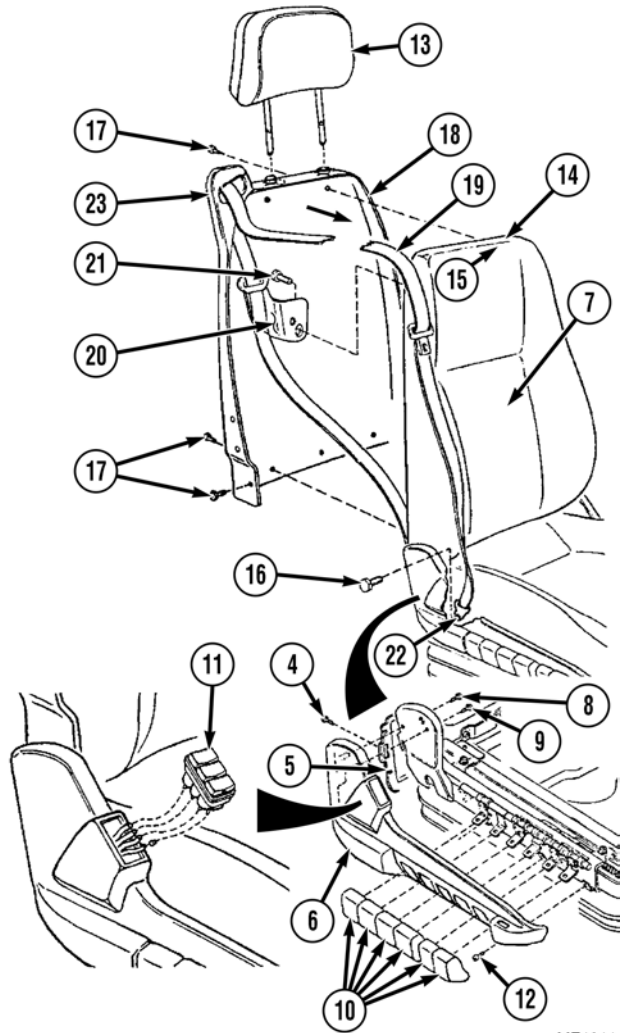
**c. Follow-On Maintenance.**

- (1) Install hand control pod assemblies (Para 13-9).
  - (1.1) Install operator's seat anchor buckle (Para 13-8.2).
- (2) Functionally test seat (TM 5-2420-230-10).

**END OF TASK**

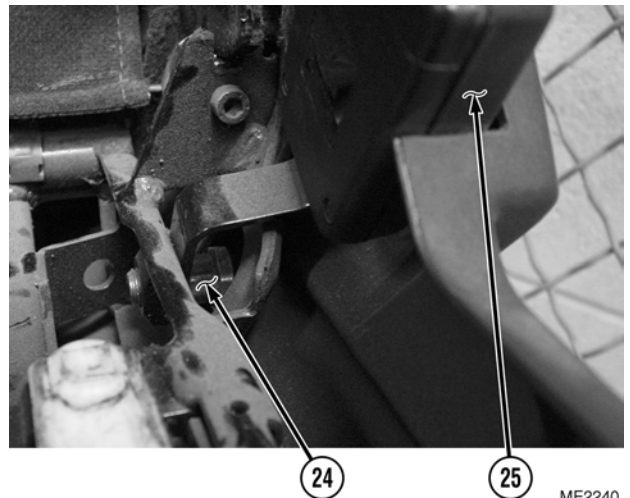


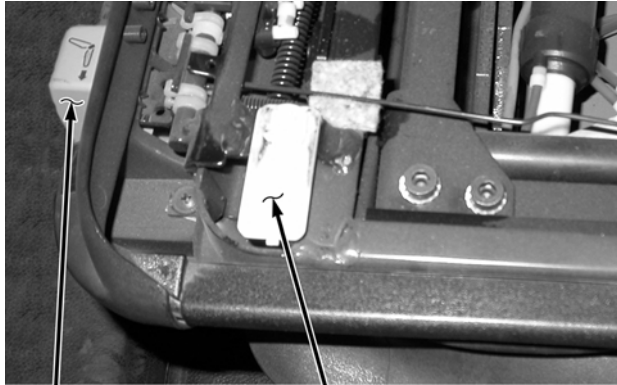
- (3) Remove two pins (4).
- (4) Press in on rear plastic cover (5) on both sides of seat and unhook rear plastic cover from side covers (6).
- (5) Fold backrest (7) forward and remove two screws (8).
- (6) Fold backrest (7) rearward and remove two front screws (9).
- (7) Remove operating handles (10) from right side of seat.
- (8) Remove lumbar support valve (11) from right side of seat.
- (9) Remove two screws (12) and side covers (6).
- (10) Raise headrest (13) to highest position.
- (11) Press in on spring (14) through cushion (15) and remove headrest (13).
- (12) Remove seat belt attachment screw (16) and seven screws (17) from backrest cover (18).
- (13) Pull seat belt (19) out slightly, loosen backrest cover (18) at bottom and lift backrest cover up out of seat belt reversing guide (20).
- (14) Remove screw (21) from belt reversing guide (20).
- (15) Push seat belt (19), along with seat belt tongue and anchor plate (22), through opening (23) in backrest cover (18).
- (16) Remove buckle attachment bolt (24) and buckle (25).



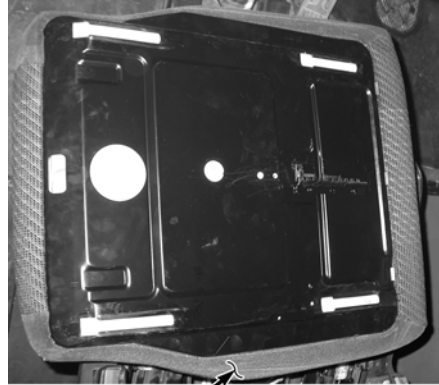
**b. Installation.**

- (1) Install buckle (25) with buckle attachment bolt (24).
- (2) Feed seat belt (19) and seat belt tongue and anchor plate (22) through opening (23) in backrest cover (18).
- (3) Install screw (21) on belt reversing guide (20).
- (4) Install seat belt attachment screw (16) through anchor plate (22).
- (5) Install seven screws (17) through backrest cover (18).
- (6) Install headrest (13).
- (7) Install two screws (12) into side covers (6).
- (8) Assemble lumbar support valve (11).
- (9) Install operating handles (10).
- (10) Fold backrest (7) rearward and install two front screws (9).
- (11) Fold backrest (7) forward and install two rear screws (8).
- (12) Hook rear plastic cover (5) into side plastic covers (6) and install two pins (4) to secure rear plastic cover in place.





ME2227



ME2241

(13) Align four keyholes on bottom side of seat cushion (2) onto slides (3).

(14) While lifting lever (1), push seat cushion down and in direction of backrest onto the slides (3).

**c. Follow-On Maintenance.**

- (1) Install operator's seat anchor buckle (Para 13-8.2).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**13-12. DELETED.**

**13-13. DATA PLATE REPLACEMENT.**

This Task Covers:

- |                        |                          |                   |
|------------------------|--------------------------|-------------------|
| a. Type 1 Removal      | b. Type 1 Installation   | c. Type 2 Removal |
| d. Type 2 Installation | e. Type 3 Removal        | f. Cleaning       |
| g. Type 3 Installation | h. Follow-On Maintenance |                   |

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Cloth, lint-free, Item 10, Appendix C
- Rivet, Item 220, Appendix D (4)
- Solvent, degreasing, Item 58, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P	Figure 17
TM 5-2420-230-24P	Figure 205

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**NOTE**

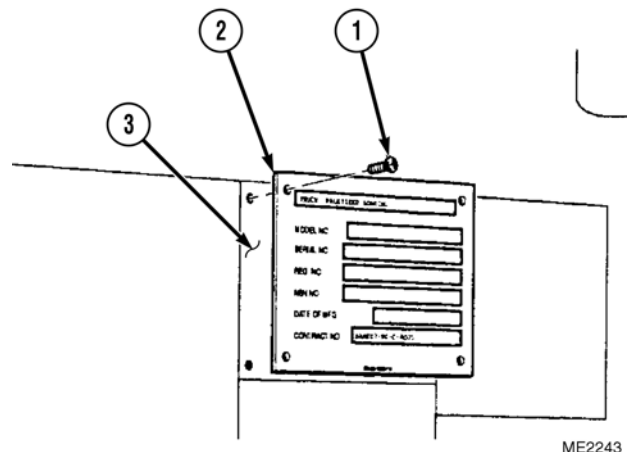
- Subparagraphs (a) through (g) show all typical data plates used on the IHMEE.
- Refer to TM 5-2420-230-10 for location of all data plates.

**a. Type 1 Removal.**

Remove four screws (1) and data plate (2) from frame (3).

**b. Type 1 Installation.**

Install data plate (2) on frame (3) with four screws (1).



**c. Type 2 Removal.**

Using a 1/8 in. drill bit, remove four rivets (1) and data plate (2) from frame (3). Discard rivets.

**d. Type 2 Installation.**

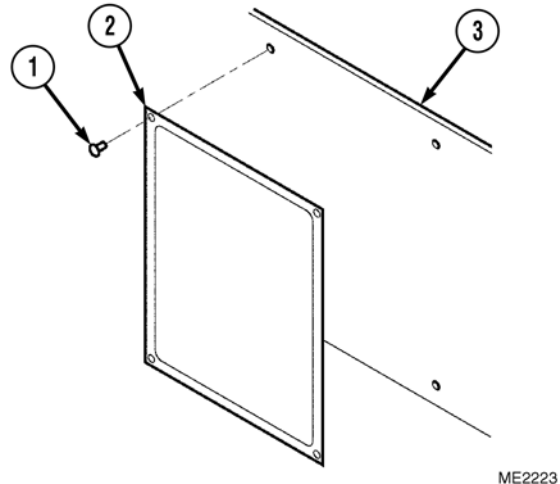
Install data plate (2) on frame (3) with four new rivets (1).

**e. Type 3 Removal.**

Pry data plate (1) away from frame (2).

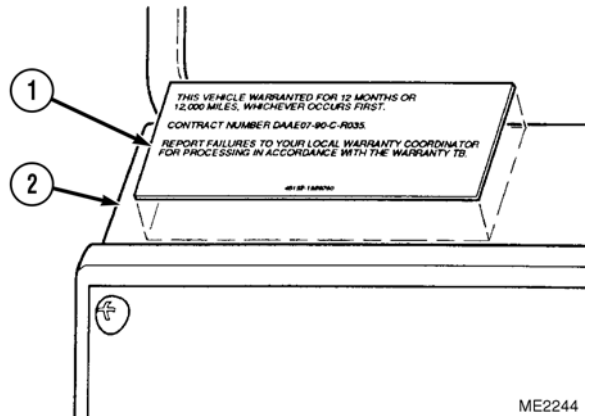
**f. Cleaning.**

(1) Ensure surface is free of any dirt or debris.



**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.



- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

(2) Clean with lint-free cloth and degreasing solvent.

**g. Type 3 Installation.**

Peel paper off data plate (1) and place on frame (2).

**h. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

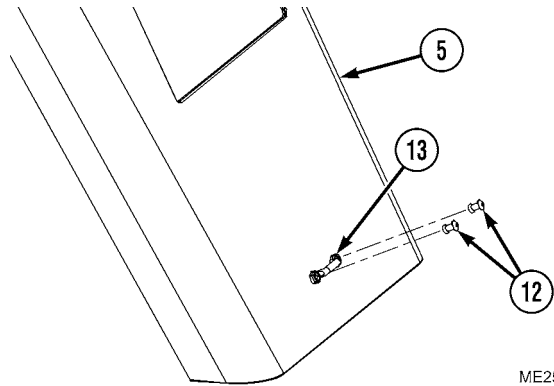








- (5) If required, remove two rivets (12) and footmans loop (13) from fender (5). Discard rivets.
- (6) If required, remove four bolts (14), lockwashers (15) and arm assembly (16) from vehicle. Discard lockwashers.

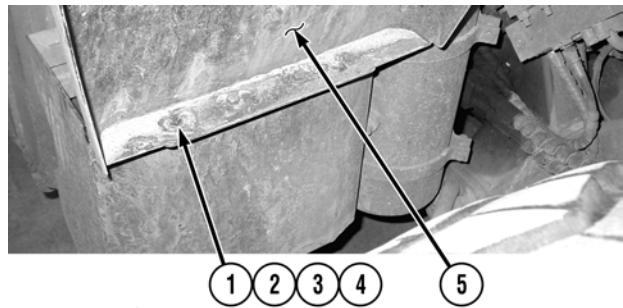


ME2543

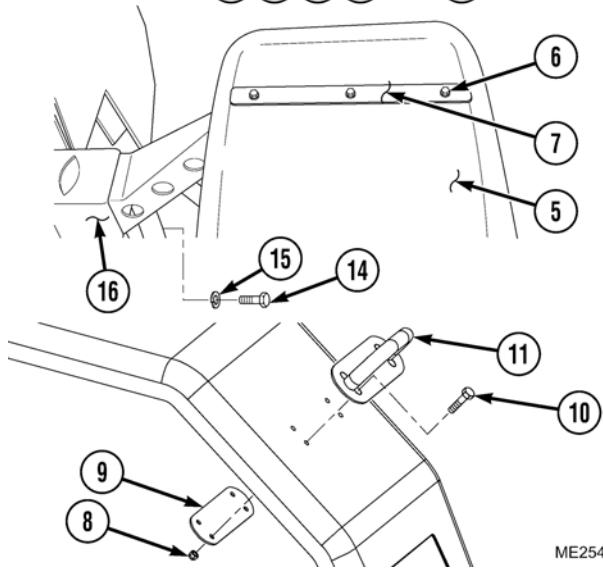
**b. Installation.**

**WARNING**

Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.



- (1) If removed, apply sealing compound to four bolts (14) and install arm assembly (16) on vehicle with four new lockwashers (15) and bolts.
- (2) Position front fender (5) on vehicle.
- (3) Apply sealing compound to three bolts (6) and install hold-down strip (7) on front fender (5).
- (4) Install retainer plate (4), four bolts (1), washers (2), and new self-locking nuts (3) on front fender (5).
- (5) If removed, install footmans loop (13) on fender (5) with two new rivets (12).



ME2544

**NOTE**

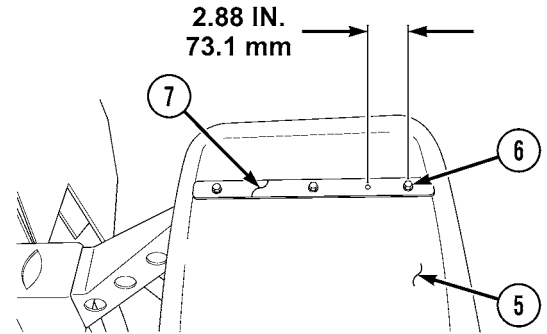
Step (6) is for the right front fender only.

- (6) If removed, install grab handle (11) and backing plate (9) with four bolts (10) and new self-locking nuts (8).

**NOTE**

If fender, hold down-strip, or arm assembly has been replaced, modifications must be made prior to installation of the MLC placard. Follow Steps (7) and (8).

- (7) From outside hole position on hold-down strip (7), remove bolt (6), and measure in from center of hole position 2.88 in. (73.1 mm) and mark hole position on hold-down strip (7).
- (8) Using a 11/32 -in. drill bit, drill hole through hold-down strip (7), fender (5) and arm assembly (16).



**c. Follow On Maintenance.**

- (1) Install MLC placard (Para 13-37) (right front fender only).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

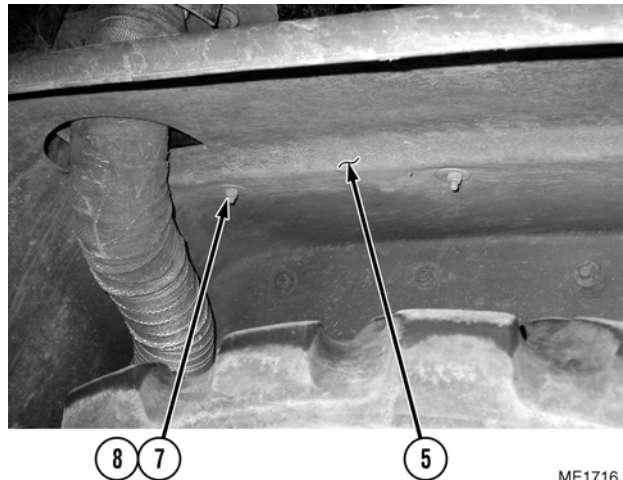
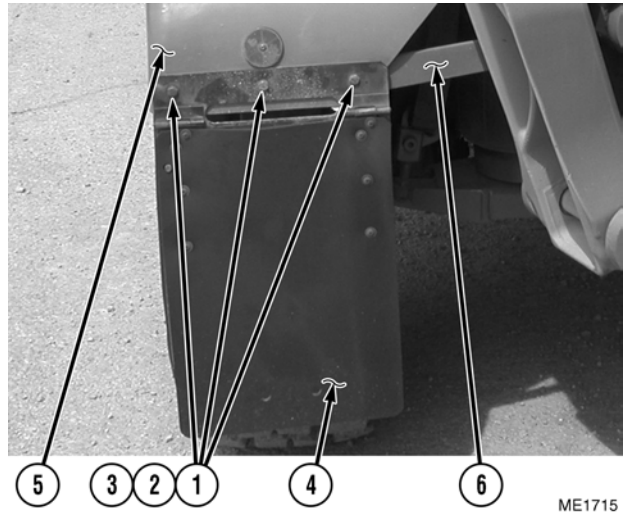
<b>13-17. REAR FENDER AND MUDFLAP REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow- On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Tire removed.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	Para 12-44 Para 12-42 Para 11-6	Taillight removed. Marker light removed. Exhaust pipe removed, left fender only.
<i>Materials/Parts</i> Nut, self-locking, Item 119, Appendix D (10) Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	Para 12-41 Para 13-28	Blackout light removed, right fender only. Precleaner removed, right fender only.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)	<i>Drawings Required</i> TM 5-2420-230-24P Figure 148	
<i>References</i> None.	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
- Remove cable ties as necessary.
- Ensure all hoses, wires, and tubes are disconnected and clear before removal.
- Both rear fenders are removed in the same manner. Left fender shown.

- (1) Remove three self-locking nuts (1), bolts (2), washers (3), and mudflap assembly (4) from fender (5) and bracket (6). Discard self-locking nuts.
- (2) Remove two self-locking nuts (7) and bolts (8) from cab (9) and fender (5). Discard self-locking nuts.
- (3) Remove two bolts (10) from body (11) and fender (5).
- (4) Remove 15 bolts (12) and washers (13) and fender (5) from body (11).

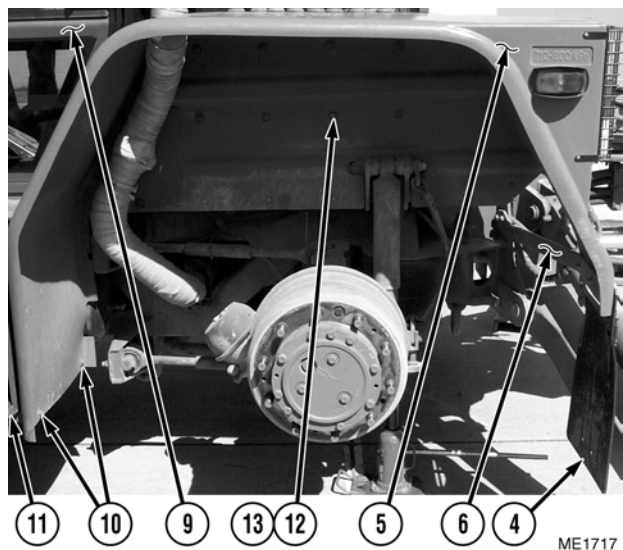


**b. Installation.**

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install 15 bolts (12), washers (13), and fender (5) on body (11).
- (2) Install two bolts (10) on body (11) and fender (5).
- (3) Install two bolts (8) and new self-locking nuts (7) on cab (9) and fender (5).
- (4) Install three bolts (2), washers (3), new self-locking nuts (1) and mudflap assembly (4) on fender (5) and bracket (6).



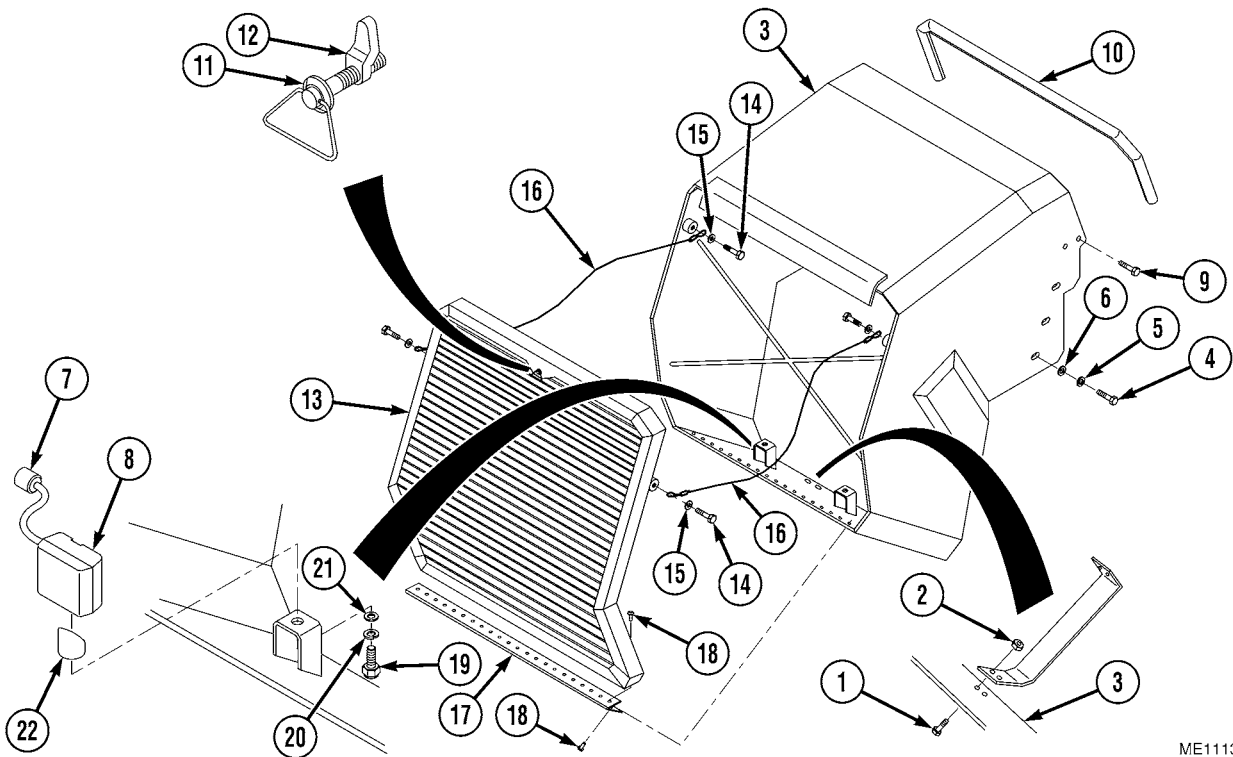
**c. Follow-On Maintenance.**

- (1) Install taillight (Para 12-44).
- (2) Install marker lights (Para 12-42).
- (3) Install blackout light, right fender only (Para 12-41).
- (4) Install precleaner, right fender only (Para 13-28).
- (5) Install exhaust pipe, left fender only (Para 11-6).
- (6) Install tire (TM 5-2420-230-10).
- (7) Test all lights (TM 5-2420-230-10).

**END OF TASK**

<b>13-18. NOSE CONE MAINTENANCE.</b>		
This Task Covers:		
a. Removal	b. Repair	c. Installation
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	<i>Condition Description</i>
None	<i>TM or Para</i>	
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, automotive maintenance, common no. 2, Item 36, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	FEL raised and maintenance arm installed.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.
Nut, self-locking, Item 111, Appendix D (2)	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Rivet, Item 223, Appendix D (43)		
Seal, Item 232, Appendix D		
Washer, lock, Item 280, Appendix D (2)	<i>Drawings Required</i>	
Washer, lock, Item 282, Appendix D (6)	TM 5-2420-230-24P	Figure 142
<i>Personnel Required</i>	<i>Estimated Time to Complete Task</i>	
MOS 62B, Construction Equipment Repairer (2)	Refer to MAC in Appendix B	
<i>References</i>		
None		

**a. Removal.**



ME1113

**WARNING**

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

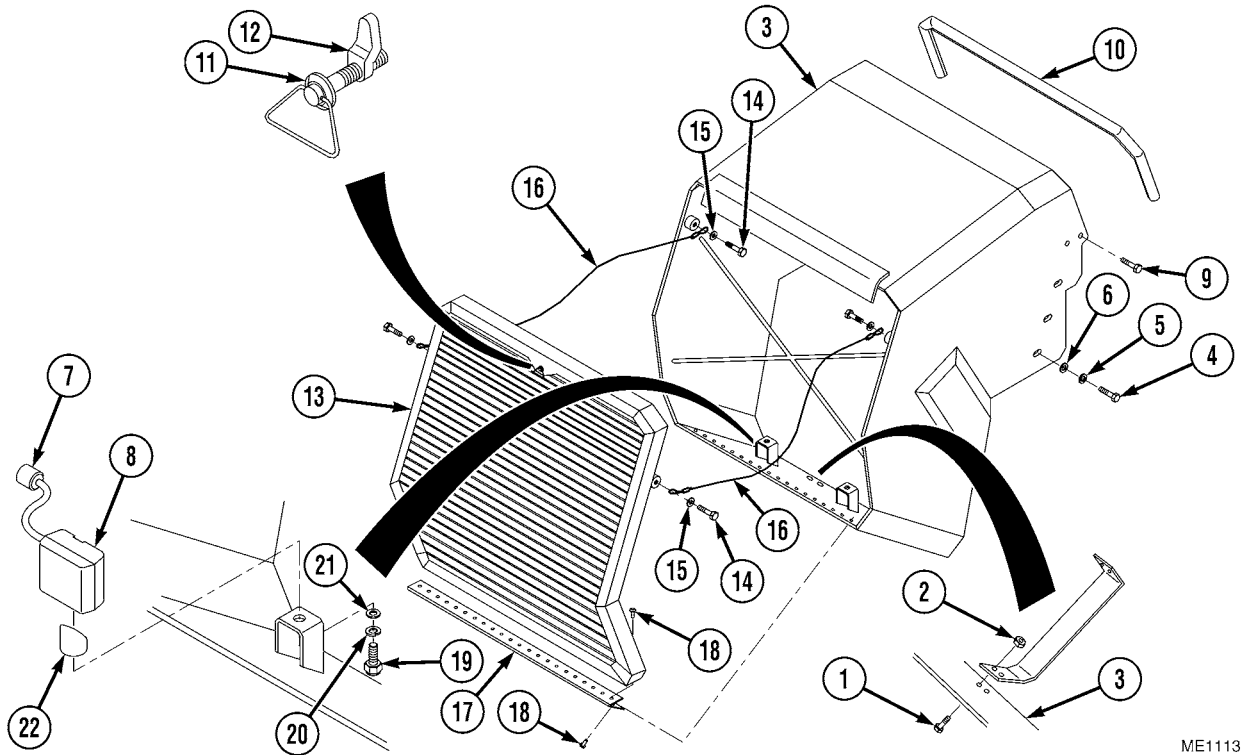
**NOTE**

Both sides are removed in same manner, left side shown.

- (1) Remove two bolts (1) and self-locking nuts (2) from the nose cone (3). Discard self-locking nuts.
- (2) Remove six bolts (4), lockwashers (5), and washer (6) from the nose cone (3). Discard lockwashers.
- (3) Disconnect two electrical connectors (7) from the light assembly (8).
- (4) Remove nose cone (3) from vehicle.

**b. Repair.**

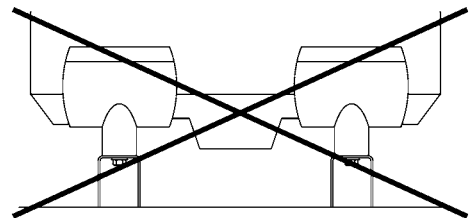
- (1) Remove four bolts (9) and seal (10).
- (2) Remove bolt (11) and latch (12) from grill (13).
- (3) Open grill (13).
- (4) Remove four bolts (14), washers (15), and two wires (16) from nose cone (3).



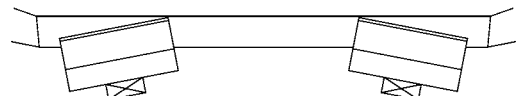
ME1113

- (5) Remove 43 rivets (18) connecting hinge (17) to nose cone (3). Discard rivets.
- (6) Remove bolt (19), washer (20), lockwasher (21), ball socket (22), and light assembly (8) from nose cone (3). Discard lockwasher.
- (7) Repeat Step (6) for other light assembly (8).
- (8) Install bolt (19), washer (20), new lockwasher (21), ball socket (22), and light assembly (8) on nose cone (3).
- (9) Position light assembly (8) level horizontally and angled outward as far as possible without hitting grill (13).
- (10) Install 43 new rivets (18) connecting hinge (17) and grill (13) on nose cone (3).
- (11) Install four bolts (14), washers (15), and two wires (16) to grill (13).
- (12) Install bolt (11) and latch (12) to grill (13).
- (13) Close grill (13).
- (14) Install bolt (9) and seal (10) to nose cone (3).

**WRONG**

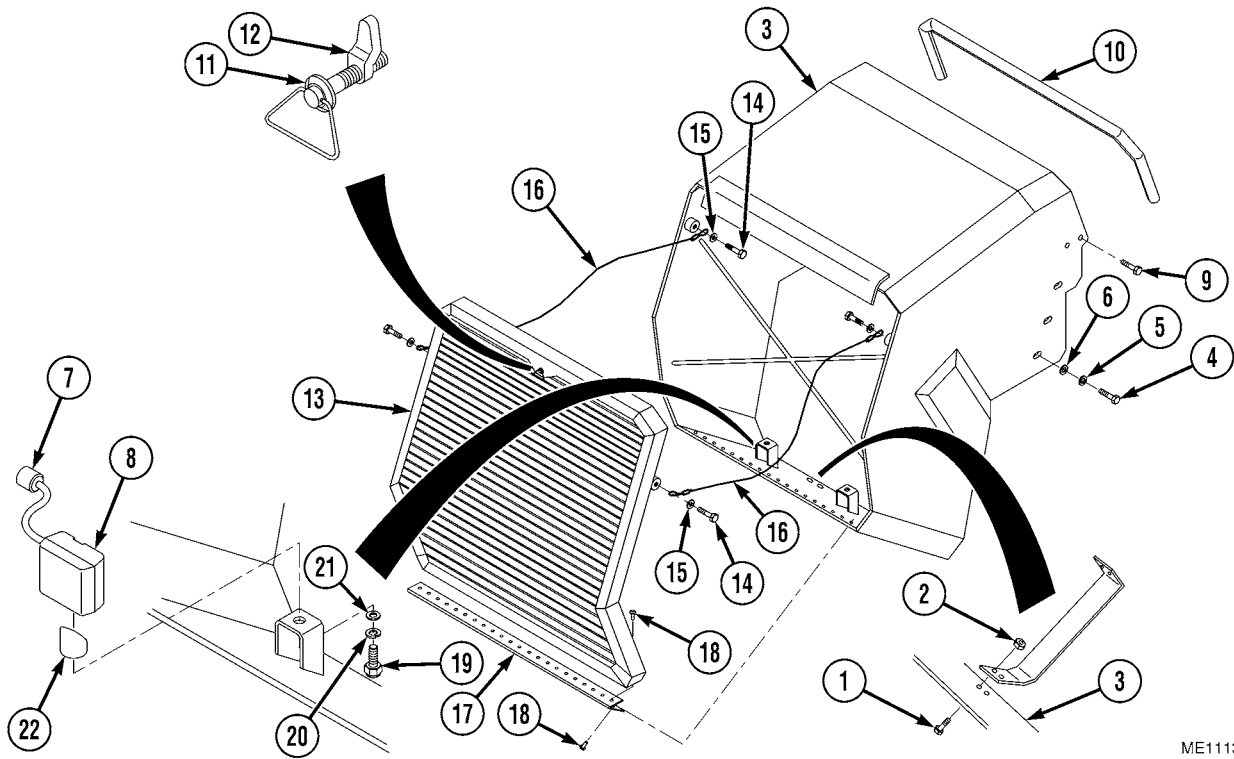


**CORRECT**



ME1215

**c. Installation.**



ME1113

- (1) Install nose cone (3) on vehicle with six bolts (4), new lockwashers (5), and washers (6).
- (2) Install two bolts (1) and new self-locking nut (2) on nose cone (3).

**d. Follow-On Maintenance.**

- (1) Functionally test work lights (TM 5-2420-230-10).
- (2) Remove maintenance arm and lower FEL (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**13-19. ENGINE HOOD MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Insert, threaded, Item 92, Appendix D (10) Nut, Self-Locking, Item 109, Appendix D (6) Seal, Item 231, Appendix D (2) Seal, Item 233, Appendix D</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)</p> <p><i>References</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 143</p> <p><i>Estimated Time to Complete</i> Refer to MAC in Appendix B</p>	<p><i>Condition Description</i> FEL travel stops deployed. Vehicle positioned on level ground. Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch. Hood raised.</p>
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**a. Removal.**

- (1) Remove nuts at lower end of both hood struts.
- (2) Remove six bolts, washers, and self-locking nuts from hinges on frame. Discard self-locking nuts.
- (3) Remove hood.
- (4) Remove securing clips.

**b. Disassembly.**

- (1) Remove two nuts at upper end of two hood struts.
- (2) Remove six bolts and two hinges from hood.
- (3) If required, remove six threaded inserts. Discard threaded inserts.
- (4) Remove four bolts and flexible draw latch.
- (5) If required, remove four threaded inserts. Discard threaded inserts.
- (6) Remove seal from each side of hood. Discard seals.

**c. Assembly.**

- (1) Install new seals on each side of hood.
- (2) If removed, install four new threaded inserts.

- (3) Install two flexible draw latches with four bolts.
- (4) If removed, install six new threaded inserts.
- (5) Install two hinges on hood with six bolts.
- (6) Install upper end of hood struts with two nuts.

**d. Installation.**

- (1) Place hood in position.
- (2) Install six bolts, washers, and new self-locking nuts in hinges on frame.
- (3) Install lower end of hood struts with two nuts. Tighten nuts.

**e. Follow-On Maintenance.**

- (1) Close hood (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>13-20. GENERAL SHEET METAL REPAIR.</b>		
This Task Covers:		
a. Dents	b. Cracks or Breaks	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B Tool kit, welders, Item 40, Appendix B	TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10	Parking brake applied. Engine shut OFF. Electrical master switch OFF.
<i>Materials/Parts</i> None	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> None	
<i>References</i> TC 9-237	<i>Estimated Time to Complete Task</i> None	

**a. Dents.**

Straighten minor body dents by bumping with a soft-faced hammer while using a wooden block backing.

**b. Cracks or Breaks.**

**WARNING**

- CARC paint contains isocyanate (HDI) which is highly irritating to skin and respiratory system. High concentrations of HDI can produce symptoms of itching and reddening of skin, a burning sensation in throat and nose and watering of the eyes. In extreme concentrations, HDI can cause cough, shortness of breath, pain during respiration, increased sputum production, and chest tightness. The following precautions must be taken whenever using CARC paint:
- ALWAYS use air line respirators when using CARC paint unless air sampling shows exposure to be below standards. Use chemical cartridge respirator if air sampling is below standards.
- DO NOT let skin or eyes come in contact with CARC paint. Always wear protective equipment (gloves, ventilation mask, safety goggles, etc.).
- DO NOT use CARC paint without adequate ventilation.
- NEVER weld or cut CARC-coated materials.
- DO NOT grind or sand painted equipment without high-efficiency air purifying respirators in use.
- BE AWARE of CARC paint exposure symptoms; symptoms can occur a few days after initial exposure. Seek medical help immediately if symptoms are detected.
- Unsafe welding practices can cause serious injury from fire, explosions, or harmful agents. Allow only authorized personnel to weld or cut metals, and follow safety precautions in TC 9-237. Protective clothing and goggles must be worn, adequate protective equipment used, a suitable fire extinguisher kept nearby, and requirements of TC 9-237 strictly followed.

**CAUTION**

IHMEE must be properly prepared before welding, or damage to equipment may result.

Repair minor skin cracks or breaks by installing patches.

**c. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**13-21. GLASS REPLACEMENT.**

This Task Covers:

- a. Inspection
- b. Removal
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

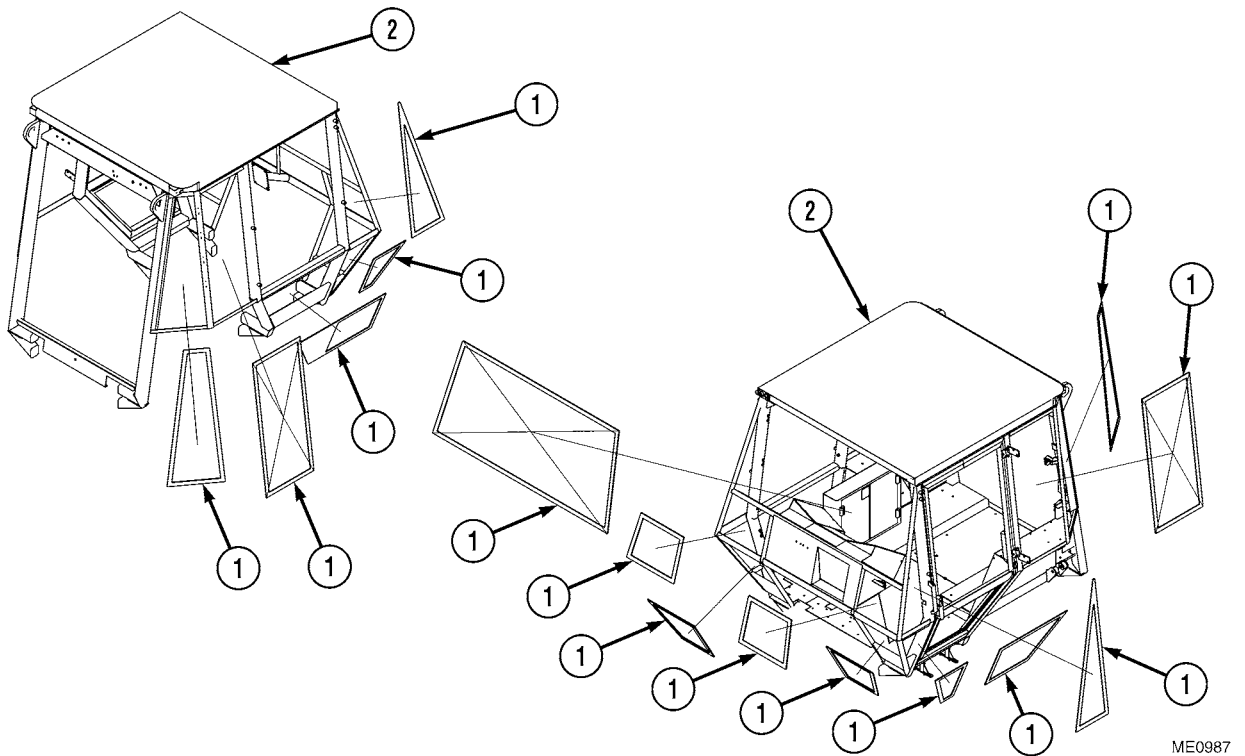
<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Adhesive, Sikaflex 255FC, Item 1, Appendix C Cleaner, Sikaflex 205, Item 8, Appendix C Primer, Sikaflex 210T, Item 51, Appendix C Tape, masking, Item 66, Appendix C</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 Para 13-22</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 191</p> <p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>	<p><i>Condition Description</i> Vehicle positioned on level ground. Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do No Operate” tag attached to ignition switch. Wipers removed, if required.</p>
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**a. Inspection.**

There are no routine maintenance activities (other than cleaning and visual inspection) detailed for vehicle glass. Inspect glass for the following:

- (1) Check for broken or damaged glass.
- (2) Tape all broken glass.
- (3) Ensure glass is securely bonded to frame.
- (4) Cab windows are bonded to frames; replacement is a specialist’s task.
- (5) Ensure sliding windows open and close correctly.
- (6) Ensure securing devices function correctly.
- (7) Replace glass only with genuine ADI parts.

**b. Removal.**



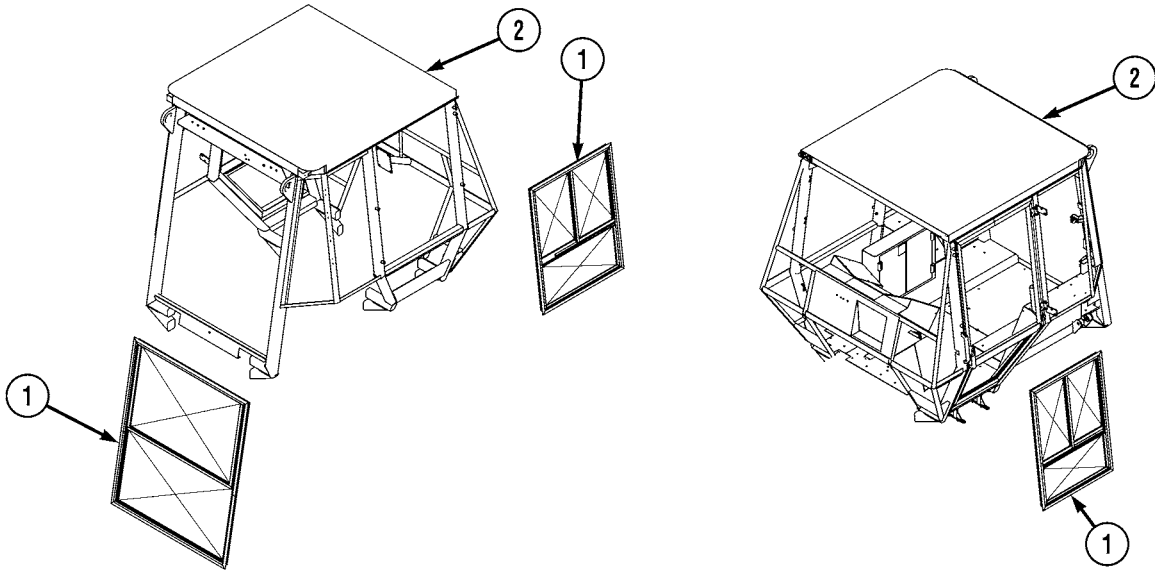
ME0987

**WARNING**

Wear protective goggles, face shield, and gloves when working with glass. Failure to comply may result in injury or death to personnel.

**NOTE**

- The removal procedures are the same for all window glass.
- To remove window glass, perform Steps (1) and (2).
- To remove left-side window assembly, right-side window assembly, or rear window assembly, proceed to Step (3).



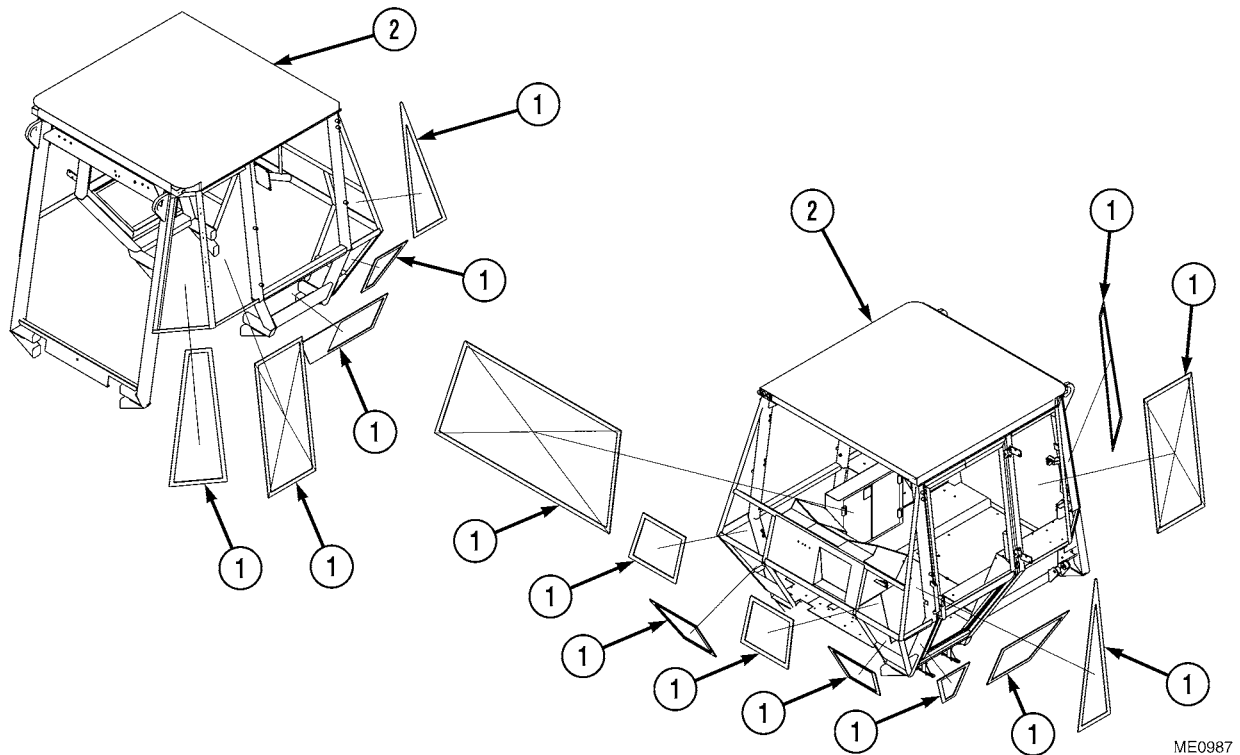
ME0988

**WARNING**

Wear protective goggles, face shield, and gloves when working with glass. Failure to comply may result in injury or death to personnel.

- (1) Cut around all inside and outside edges of window (1).
- (2) Apply outward pressure to window (1) and remove window from cabin frame (2).
- (3) Cut around all inside and outside edges of window assemblies.
- (4) Apply outward pressure to window assemblies and remove window assemblies from cabin frame.

**c. Installation.**



ME0987

**WARNING**

- Wear protective goggles, face shield, and gloves when working with glass. Failure to comply may result in injury or death to personnel.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

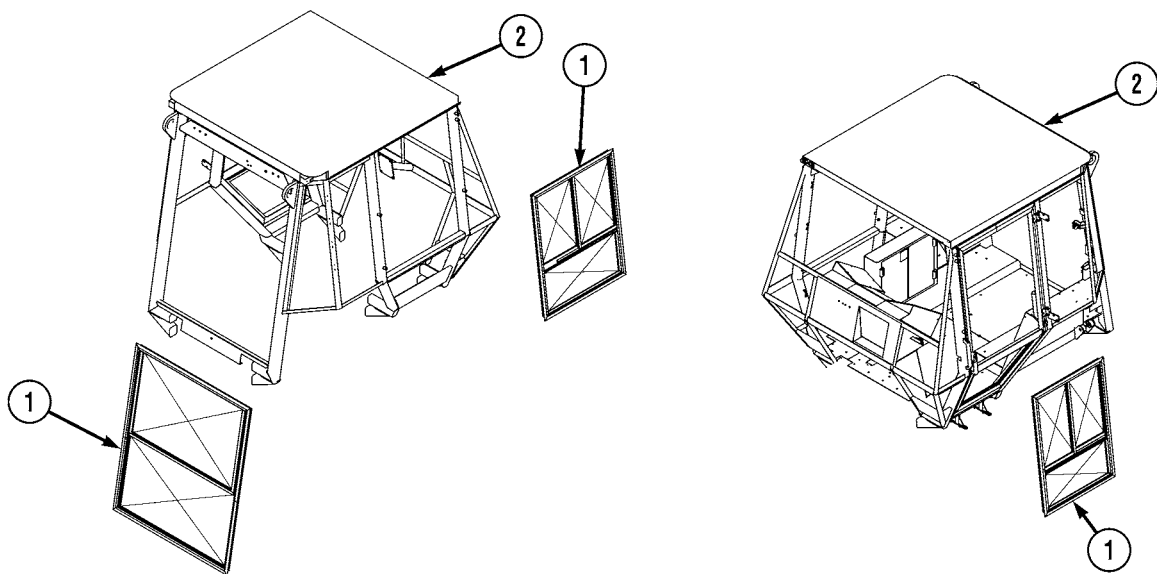
**NOTE**

- The installation procedures are the same for all window glass.
  - To install window glass, perform Steps (1) through (11).
  - Individual window glass is not to be replaced on left-side window assembly, right-side window assembly, or rear window assembly. These assemblies are assembled in the factory as complete units. If assembly glass must be replaced, replace the entire window assembly. To install left-side window assembly, right-side window assembly, or rear window assembly, perform Steps (1) through (11).
  - Ensure adhesive application is uniform and has no gaps. Adhesive should be 0.3 in. (8 mm) wide and 0.5-0.6 in. (12-15 mm) high.
- (1) Remove all material down to the pinch weld.
  - (2) Clean cabin frame (2) with Sikaflex 205 cleaner.

**WARNING**

Wear protective goggles, face shield, and gloves when working with glass. Failure to comply may result in injury or death to personnel.

- (3) Clean inside and outside edges of new window (1) with Sikaflex 205 cleaner.
- (4) Apply Sikaflex Primer 210T to exposed paint and metal on pinch weld. Let primer dry for 10 min.
- (5) Apply Sikaflex 255FC adhesive to bonding area of new window (1). Adhesive beading should be triangular in shape, approximately 0.3 in. (8 mm) wide at the base, and 0.5-0.6 in. (12-15 mm) high. Ensure beading is evenly applied.
- (6) Position new window (1) in cabin frame (2) and apply slight pressure.
- (7) Remove excess adhesive from around new window (1).
- (8) Remove any remaining excess adhesive from new window (1).
- (9) Tape new window (1) to cabin frame (2) and allow adhesive to dry for 24 hours.
- (10) Remove tape from new window (1).
- (11) Check window for proper adhesive bond. If a proper bond is not established, repeat Steps (1) through (10).



ME0988

**d. Follow-On Maintenance.**

- (1) Install wipers, if required (Para 13-22).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



<b>13-22. WIPER BLADE AND ARM REPLACEMENT.</b>		
This Task Covers:		
a. Inspection	b. Removal	c. Installation
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	<i>Condition Description</i>
None	<i>TM or Para</i>	
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.
Cap and plug set, Item 4, Appendix C	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Tags, identification, Item 63, Appendix C		
Ties, cable, Item 68, Appendix C		
	<i>Drawings Required</i>	
<i>Personnel Required</i>	TM 5-2420-230-24P	Figure 65
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P	Figure 66
<i>References</i>	<i>Estimated Time to Complete Task</i>	
None	Refer to MAC in Appendix B	

**a. Inspection.**

There are no routine maintenance activities (other than visual inspection) detailed for vehicle wipers. Inspect front and rear wipers for the following:

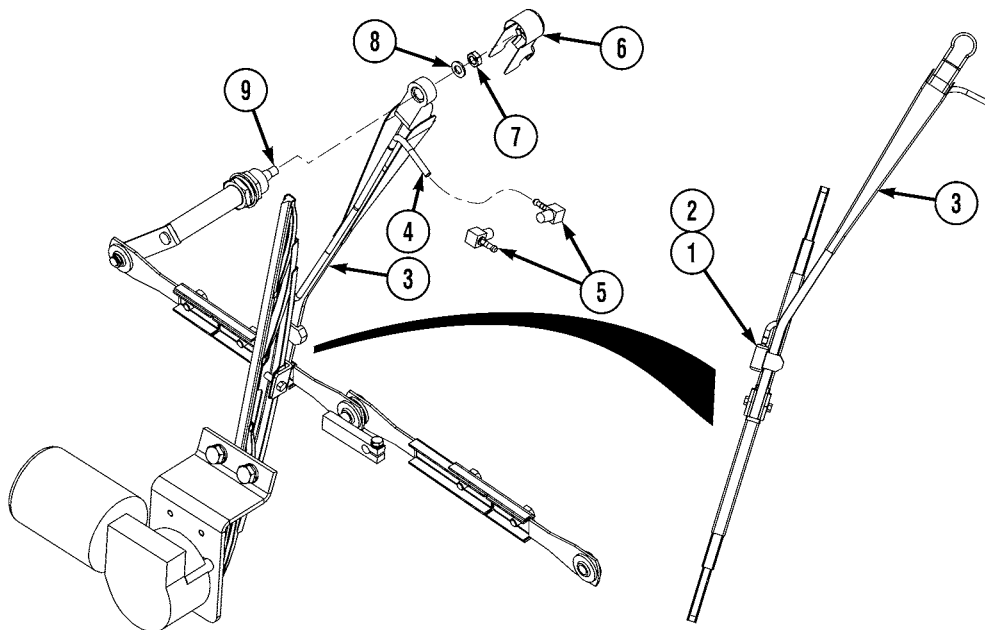
- (1) Ensure wiper blades are free of damage. Repair/replace as necessary.
- (2) Ensure wiper arms are free of damage and misalignment. Repair as necessary.

**NOTE**

To avoid damaging wiper blades and arms, do not operate wipers on dry windshield.

- (3) Functionally test wipers. Ensure wipers clear windshield and park correctly. Repair as necessary.

**b. Removal.**

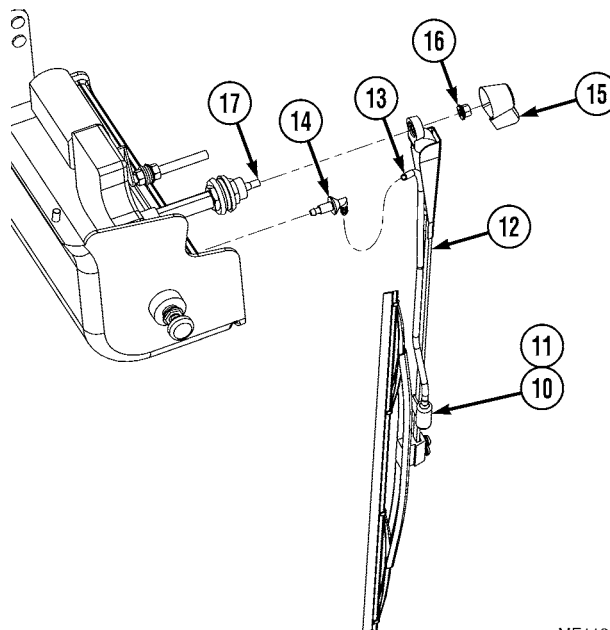


ME1179

**NOTE**

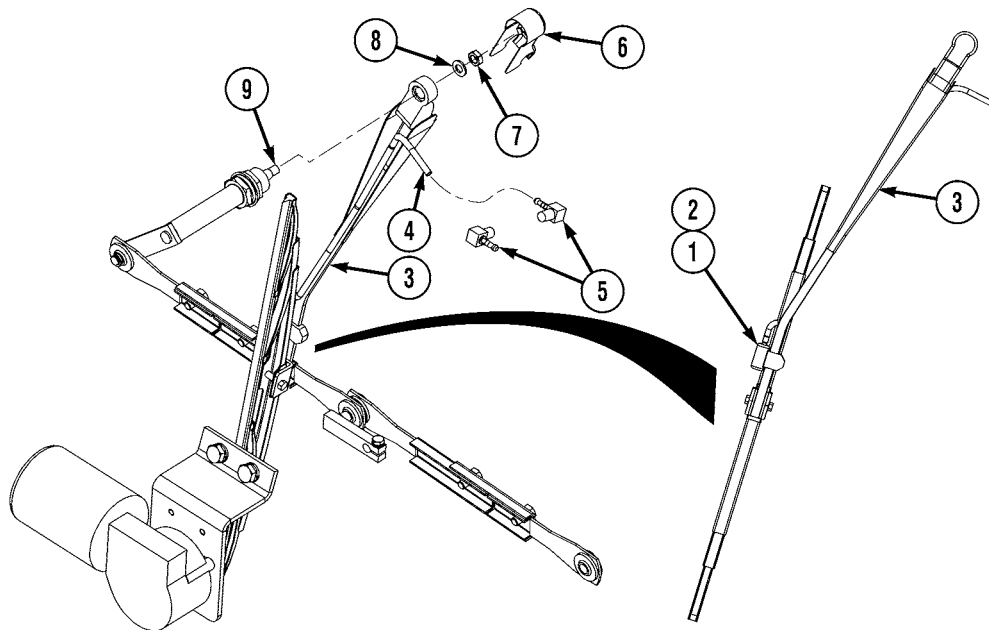
- Tag all hoses, wires, and tubes and note their positions before removal.
- Remove cable ties as necessary.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Procedures to remove the front wipers are identical. Steps (1) through (3) describe how to remove the front wipers. Steps (4) through (6) describe how to remove the rear wiper arm.
- To replace only the wiper blade, perform Steps (1) and (2) for the front wiper blade and Steps (4) and (5) for the rear wiper blade.

- (1) Remove snap clip (1) and wiper nozzle (2) from wiper arm (3).
- (2) Remove wiper hose (4) from elbow (5).
- (3) Remove protective cover (6), nut (7), washer (8), and wiper arm (3) from spindle shaft (9).
- (4) Remove snap clip (10) and wiper nozzle (11) from rear wiper arm (12).
- (5) Remove wiper hose (13) from elbow (14).
- (6) Remove protective cover (15), nut (16), and rear wiper arm (12) from spindle shaft (17).



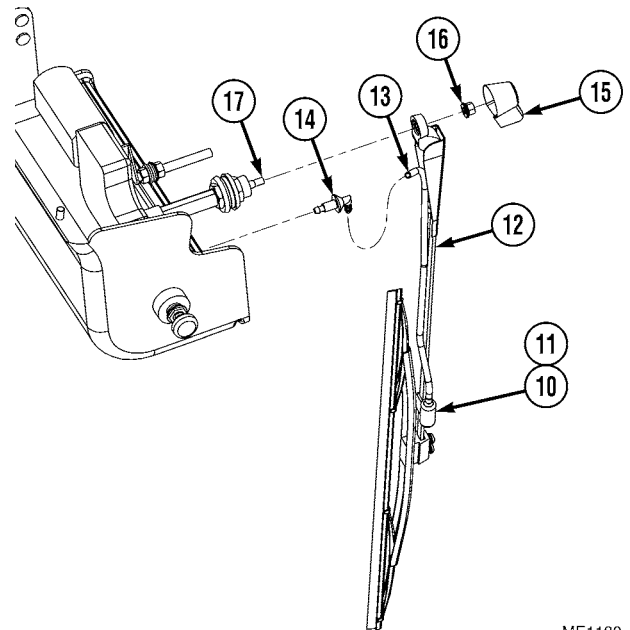
ME1180

**c. Installation.**



ME1179

- (1) Install rear wiper arm (12), nut (16), and protective cover (15) on spindle shaft (17).
- (2) Install wiper hose (13) on elbow (14).
- (3) Install wiper nozzle (11) and snap clip (10) on rear wiper arm (12).
- (4) Install wiper arm (3), washer (8), nut (7), and protective cover (6) on spindle shaft (9).
- (5) Install wiper hose (4) on elbow (5).
- (6) Install wiper nozzle (2) and snap clip (1) on wiper arm (3).



ME1180

**d. Follow-On Maintenance.**

- (1) Functionally test front and rear wipers (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**





**13-25. MIRROR REPLACEMENT.**

This Task Covers:

- a. Inspection
- b. Removal
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

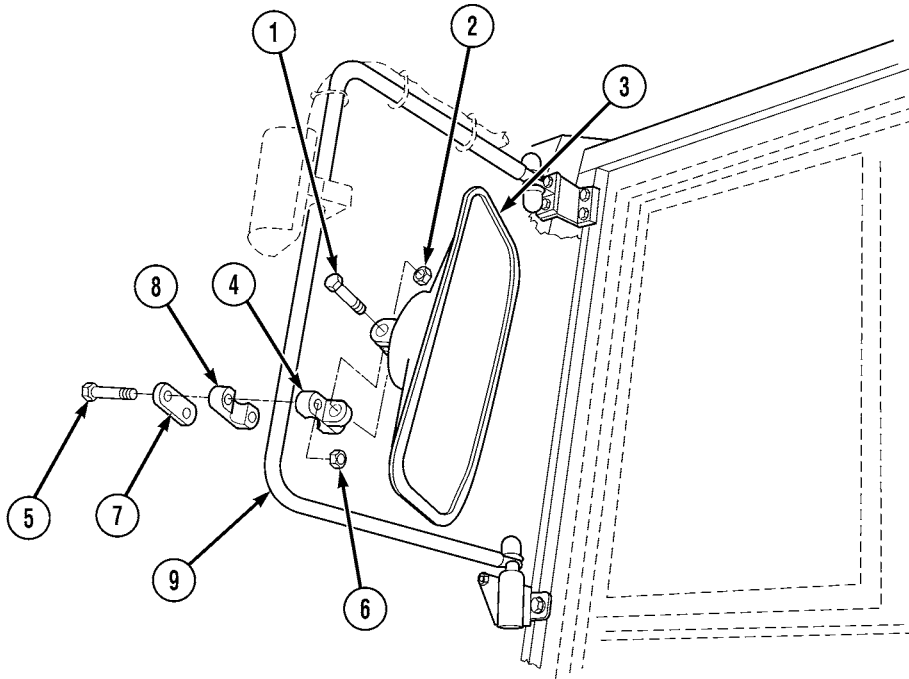
<p><i>Test Equipment</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10</p>	<p><i>Condition Description</i> Vehicle positioned on level ground.</p>
<p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p>	<p>TM 5-2420-230-10 TM 5-2420-230-10</p>	<p>Parking brake applied. Engine shut OFF.</p>
<p><i>Materials/Parts</i> None</p>	<p>TM 5-2420-230-10 TM 5-2420-230-10</p>	<p>Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.</p>
<p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p>	<p><i>Drawings Required</i> TM 5-2420-230-24P TM 5-2420-230-24P</p>	<p>Figure 194 Figure 195</p>
<p><i>References</i> None</p>	<p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>	

**a. Inspection.**

There are no routine maintenance activities (other than visual inspection) detailed for vehicle mirrors. Inspect left and right mirrors for the following:

- (1) Ensure mirror glass is free of damage. Replace as necessary.
- (2) Ensure mirror mounting arms are free of damage and misalignment. Replace as necessary.

**b. Removal.**



ME0993

**NOTE**

Both sides remove and install the same way. Left side is shown.

- (1) Remove bolt (1), nut (2), and mirror (3) from rear mounting clamp (4).
- (2) Remove bolts (5), nuts (6), mounting plate (7), front mounting clamp (8), and rear mounting clamp (4) from mirror mounting bracket (9).

**c. Installation.**

- (1) Install bolts (5), mounting plate (7), front mounting clamp (8), rear mounting clamp (4), and nuts (6) on mirror mounting bracket (9).
- (2) Install mirror (3) on rear mounting clamp (4) using bolt (1) and nut (2).

**d. Follow-On Maintenance.**

- (1) Adjust mirror to give a clear and unobstructed view behind vehicle, with no blind spots (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



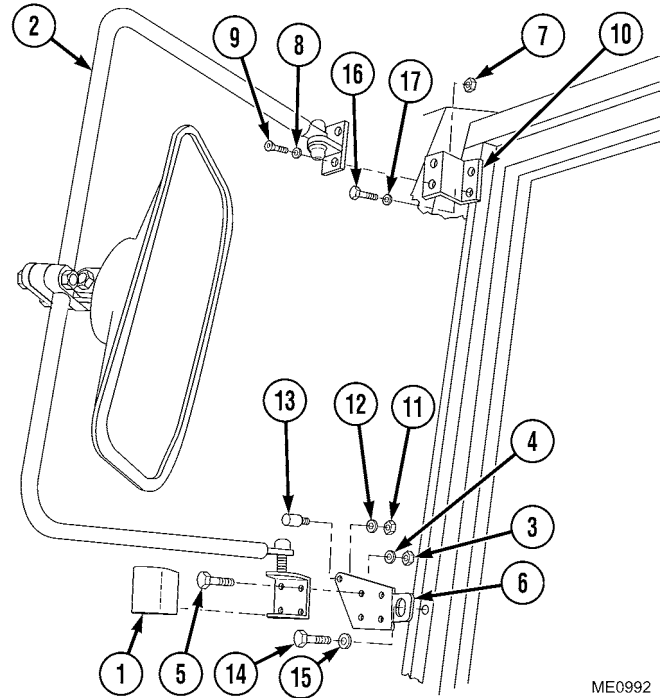


**b. Installation.**

**NOTE**

- Perform Steps (1) through (3) only if brackets were removed.
- The left and right side remove and install the same way. Left side is shown.

- (1) Install upper bracket (10) on vehicle with two washers (17) and bolts (16).
- (2) Install lower bracket (6) on vehicle with washer (15) and bolt (14).
- (3) Install buffer (13) on lower bracket (6) with washer (12) and nut (11).
- (4) Install mirror assembly (2) on upper bracket (10) with two screws (9), washers (8), and new self-locking nuts (7).
- (5) Install mirror assembly (2) on lower bracket (6) with four bolts (5), washers (4), and new self-locking nuts (3).
- (6) Install cover (1) on mirror assembly (2).



ME0992

**13-27. BATTERY STOWAGE BOX MAINTENANCE.**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Belly plate beneath battery stowage box removed.
Para 12-7	Battery cables removed.
Para 12-6	Batteries removed.
Para 12-8	Master power switch remove.
Para 20-19	Remove electrical outlet (if equipped).

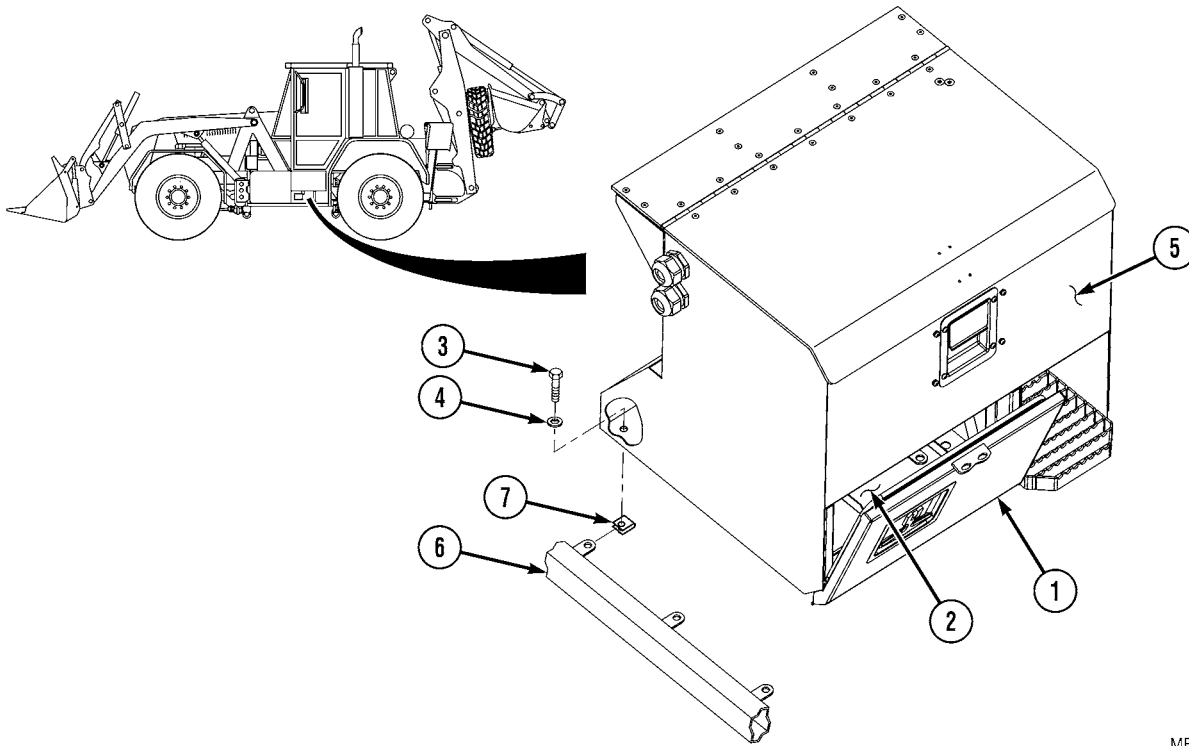
*Materials/Parts*  
Grommet, blanking, Item 90, Appendix D  
Nut, self-locking, Item 109, Appendix D (3)  
Rivet, Item 221, Appendix D (7)  
Rivet, Item 222, Appendix D (8)  
Seal, Item 233.1, Appendix D

*Drawings Required*  
TM 5-2420-230-24P Figure 44

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

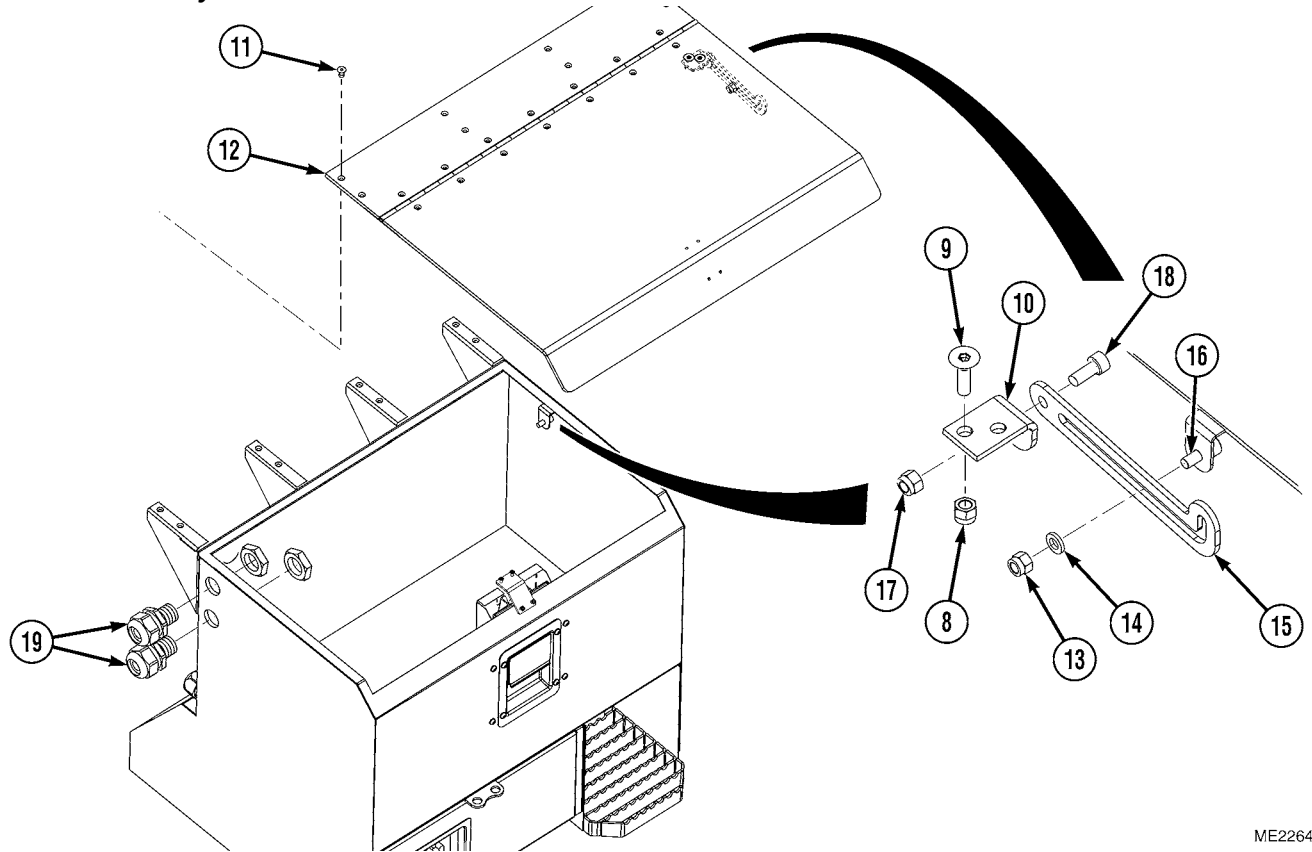
**a. Removal.**



ME0972

- (1) Open tool box door (1) and remove all items from the battery tool box (2).
- (2) Remove bolts (3), washers (4), and battery storage box (5) from chassis frame (6).
- (3) Remove clipnuts (7) from chassis frame (6).

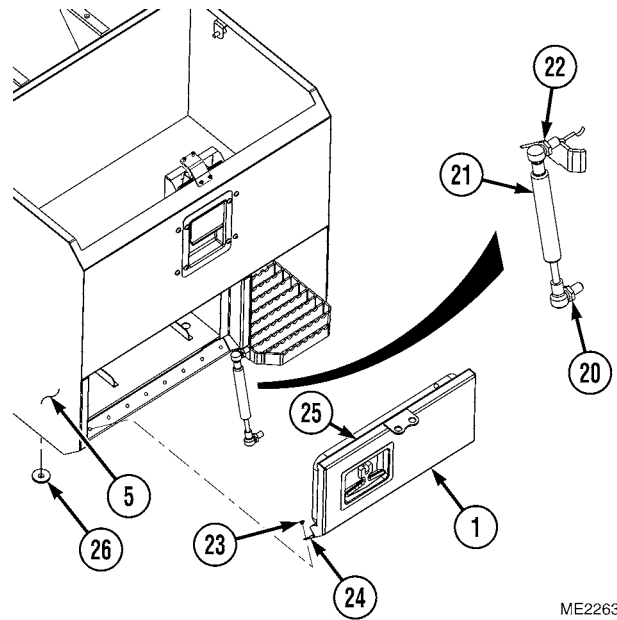
**b. Disassembly.**



ME2264

- (1) Remove two nuts (8) and screws (9) from lid stop bracket (10).
- (2) Remove eight rivets (11) from lid assembly (12). Discard rivets.
- (3) Remove battery storage box lid assembly (12).
- (4) Remove self-locking nut (13), washer (14), and battery storage box lid stop bracket slide (15) from stud (16). Discard self-locking nut.
- (5) Remove self-locking nut (17), screw (18), and battery storage box lid stop bracket slide (15) from battery storage box lid stop bracket (10). Discard self-locking nut.
- (6) Remove two glands (19) from battery storage box (5).

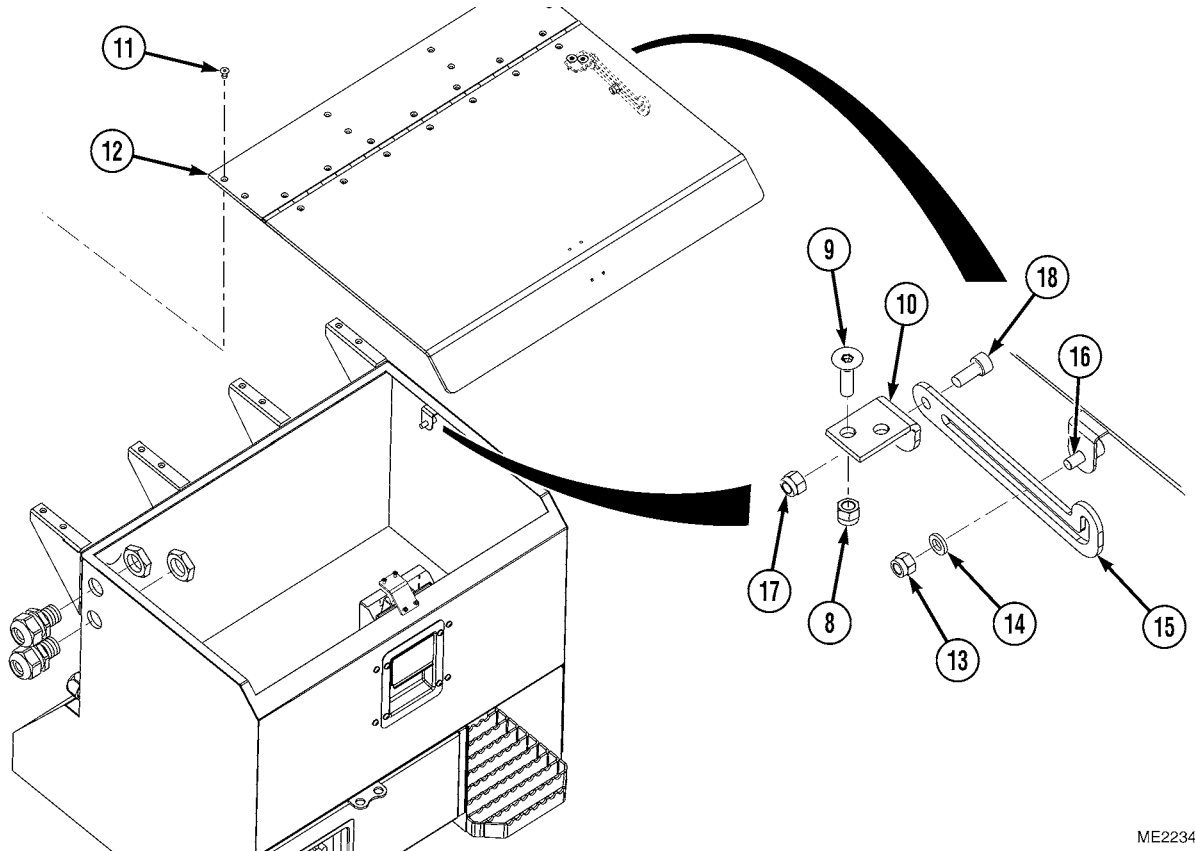
- (7) Remove nut (20) from lower end of tool box door strut (21).
- (8) Remove nut (22) from upper end of tool box door strut (21).
- (9) Remove tool box door strut (21).
- (10) Remove seven rivets (23) from tool box door hinge (24). Discard rivets.
- (11) Remove tool box door (1).
- (12) If required, remove seal (25) from tool box door (1).
- (13) If required, remove blanking grommet (26) from battery stowage box (5). Discard blanking grommet.



ME2263

**c. Assembly.**

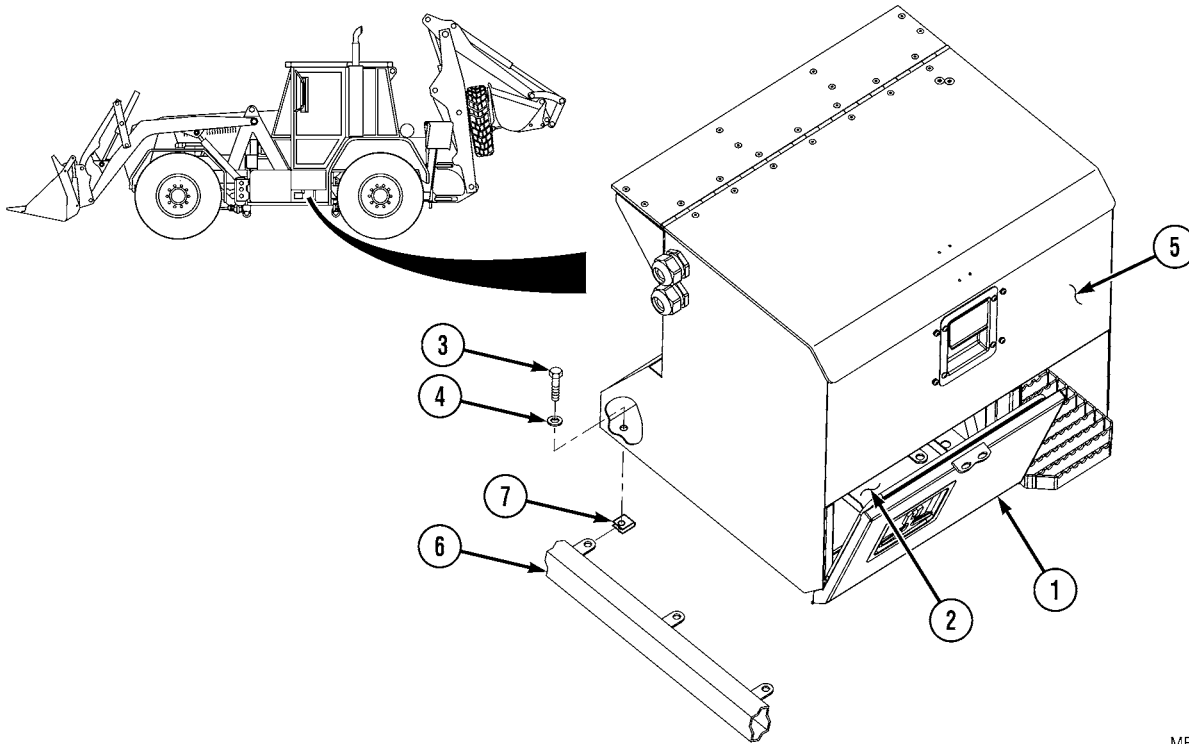
- (1) If removed, install new blanking grommet (26) in battery stowage box (5).
- (2) If removed, install new seal (25) on tool box door (1).
- (3) Install tool box door (1) with seven new rivets (23).
- (4) Install tool box door strut (21) with nuts (20) and (22).



ME2234

- (5) Install two glands (19) in battery storage box (5).
- (6) Install battery storage box lid stop bracket slide (15) on battery storage box lid stop bracket (10) with screw (18) and new self-locking nut (17).
- (7) Install battery storage box lid stop bracket slide (15) on stud (16) with washer (13) and new self-locking nut (14).
- (8) Install battery storage box lid assembly (12) on battery storage box (5) with eight new rivets (11).
- (9) Install battery storage box lid stop bracket (10) on battery storage box lid assembly (12) with two screws (9) and nuts (10).

**d. Installation.**



ME0972

**NOTE**

If replacing battery box and vehicle has cold weather kit, refer to Para 20-4 for modifications to battery box before proceeding.

- (1) Install clipnuts (7) on chassis frame (6).
- (2) Install bolts (3), washers (4), and battery storage box (5) on chassis frame (6).
- (3) Return all items removed from the battery tool box (2) and close tool box door (1).

**e. Follow-On Maintenance.**

- (1) Install belly plate beneath battery storage box (5) (TM 5-2420-230-10).
- (2) Install master power switch (Para 12-8).
- (3) If equipped, install electrical outlet (Para 20-19).
- (4) Install batteries (Para 12-6).
- (5) Install battery cables (Para 12-7).

**END OF TASK**

**13-27.1. AIR CLEANER FILTER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Inspection
- c. Cleaning
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Tools and Special Tools*  
None

*Materials/Parts*  
Cloth, lint-free, Item 10, Appendix C  
Filter element, Item 48.1, Appendix D

*Drawings Required*  
TM 5-2420-230-24P Figure 42

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

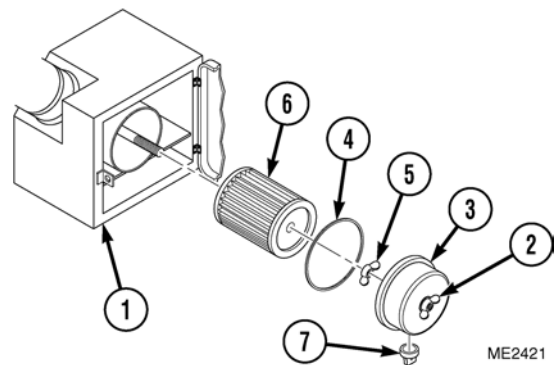
*Estimated Time to Complete Task*  
Refer to MAC in Appendix B



Do not operate engine without air filter installed. Failure to comply may result in damage to equipment.

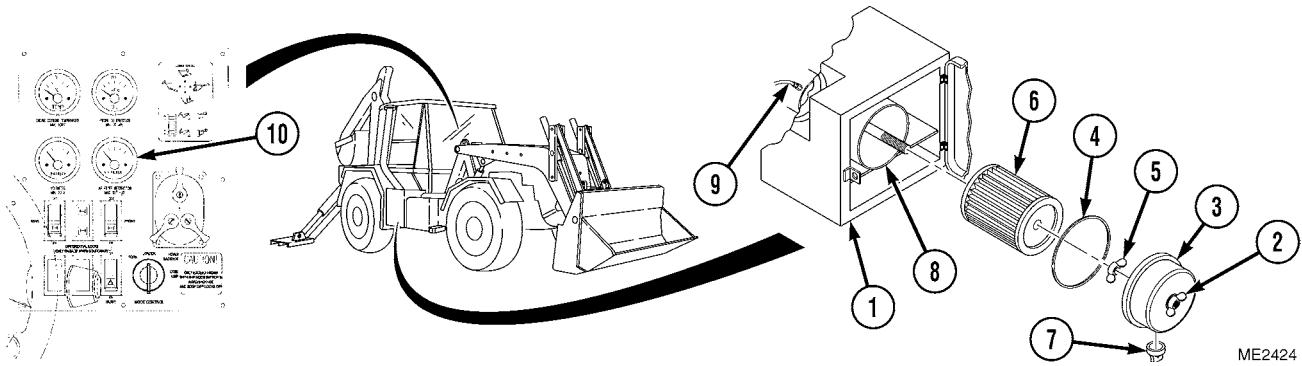
**a. Removal.**

- (1) Open air cleaner compartment (1).
- (2) Loosen wingnut (2) and remove cap (3).
- (3) Remove sealing ring (4). Do not discard sealing ring.
- (4) Remove wingnut (5) and filter element (6). Discard filter element.
- (5) Remove dust boot (7) from cap (3).



**b. Inspection.**

- (1) Inspect dust boot (7) and sealing ring (4) for signs of damage or deterioration.



- (2) Inspect air cleaner housing (8) for damage and/or deterioration.
- (3) Inspect air line (9), which services AIR FILTER RESTRICTION gauge (10), for signs of damage, looseness, and/or deterioration.
- (4) If dust boot (7), sealing ring (4), air cleaner housing (8), or air line (9) is damaged or deteriorated, replace it.

**c. Cleaning.**

- (1) Wipe down cap (3), sealing ring (4), and air cleaner housing (8) with clean rag.
- (2) Thoroughly clean all dust from dust boot (7).

**d. Installation.**

- (1) Install dust boot (7) on cap (3).
- (2) Install new filter element (6) with wingnut (5).
- (3) Install sealing ring (4) on air cleaner housing (8).
- (4) Place cap (3) on air cleaner housing (8) with dust boot (7) positioned at bottom. Tighten wingnut (2).
- (5) Close air cleaner filter compartment (1).

**e. Follow-On Maintenance.**

- (1) Start engine and check AIR FILTER RESTRICTION gauge (10) to ensure it reads below 25 in. H<sub>2</sub>O (625 mm H<sub>2</sub>O) (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**13-27.2. A/C FILTER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Inspection
- c. Cleaning
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> None</p> <p><i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C Filter element, Item 48.2, Appendix D</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p> <p><i>Condition Description</i> Vehicle positioned on level ground. Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 187</p> <p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>
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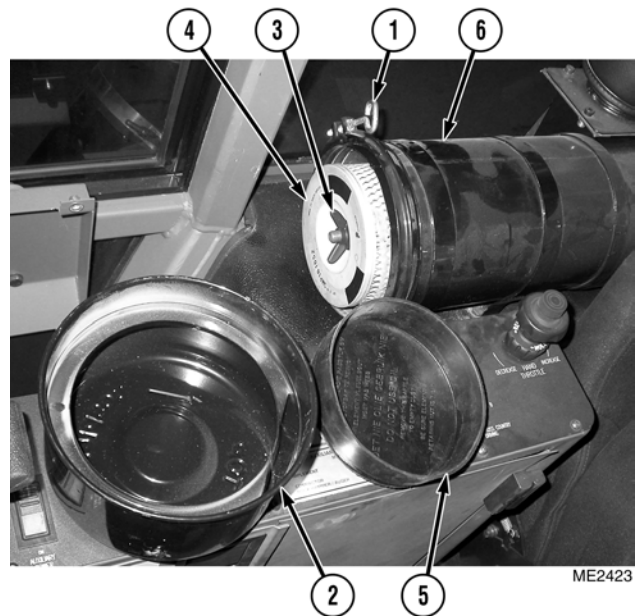
Do not operate A/C unit without filter installed. Failure to comply may result in damage to equipment.

**a. Removal.**

- (1) Loosen thumb screw (1) and remove cap (2).
- (2) Remove wingnut (3) and filter element (4). Discard filter element.
- (3) Remove dust boot (5) from cap (2).

**b. Inspection.**

- (1) Inspect dust boot (5) for signs of damage or deterioration.
- (2) Inspect A/C filter housing (6) for damage and/or deterioration.
- (3) If dust boot (5) or A/C filter housing (6) is damaged or deteriorated, replace it.



ME2423

**c. Cleaning.**

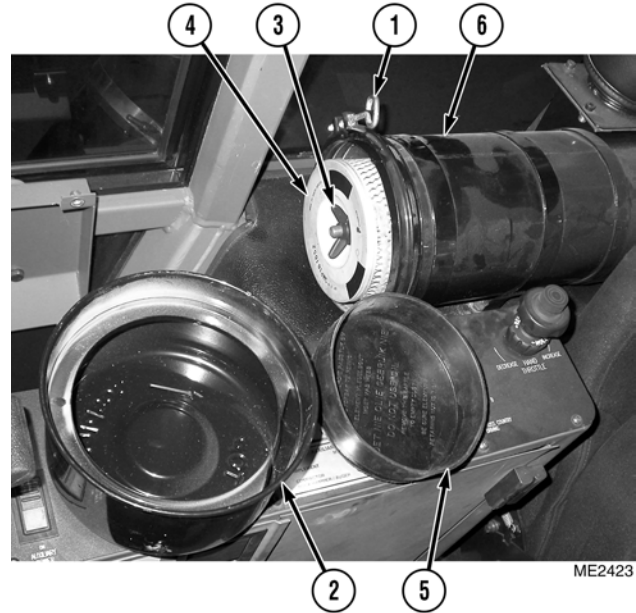
- (1) Wipe down A/C filter housing (6) and cap (2) with clean cloth.
- (2) Thoroughly clean all dust from dust boot (5).

**d. Installation.**

- (1) Install dust boot (5) on cap (2).
- (2) Install new filter element (4) with wingnut (3).
- (3) Place cap (2) on A/C filter housing (6) with opening in cap positioned at top.
- (4) Tighten thumb screw (1).

**e. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).



**END OF TASK**



**13-29. AIR CLEANER/STOWAGE BOX REPAIR.**

This Task Covers:

- a. Removal
- b. Repair
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Belly plate beneath air cleaner stowage box removed.
Para 13-27.1	Air cleaner filter removed.
Para 10-32	Hose reel switch removed.
Para 20-13	Ether start assembly removed (if equipped).

*Materials/Parts*  
Grommet, Item 89, Appendix D  
Nut, self-locking, Item 103, Appendix D (2)  
Nut, self-locking, Item 109, Appendix D (4)  
Rivet, Item 224, Appendix D (8)  
Seal, pinchweld, Item 246, Appendix D

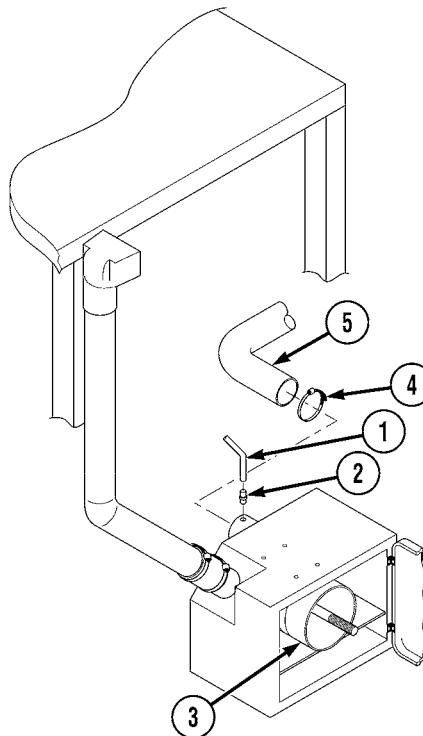
*Drawings Required*  
TM 5-2420-230-24P Figure 42  
TM 5-2420-230-24P Figure 202

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

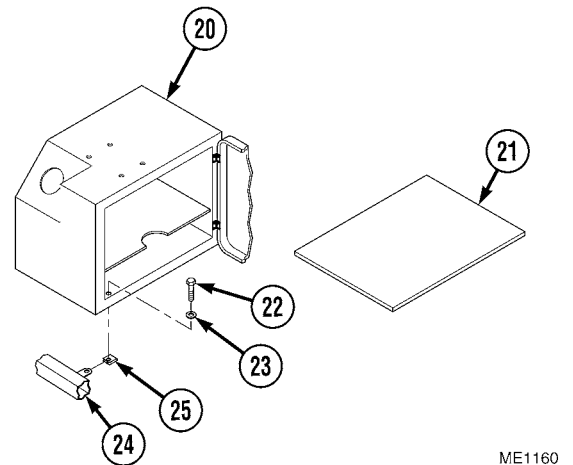
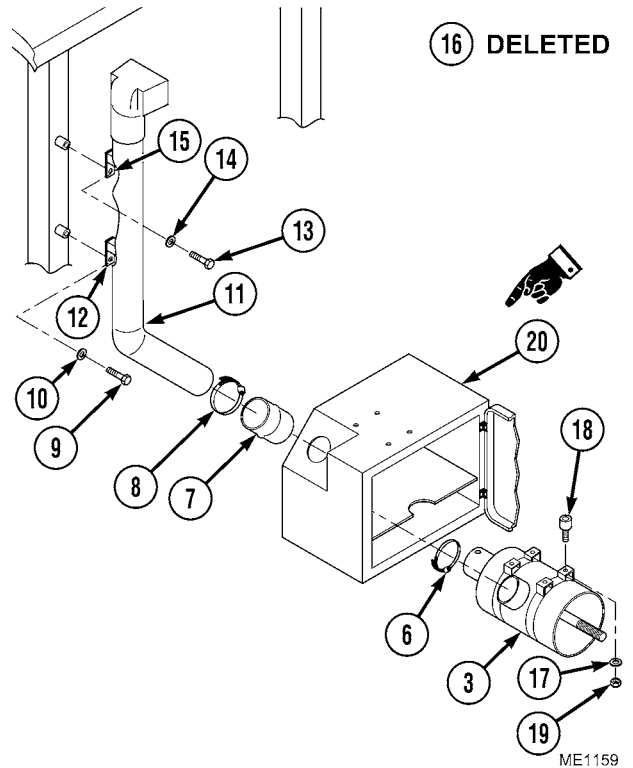
**a. Removal.**

- (1) Remove flexible tube (1) and adapter (2) from rear of air cleaner housing (3).
- (2) Loosen band clamp (4) and remove rubber elbow (5) from rear of air cleaner housing (3).



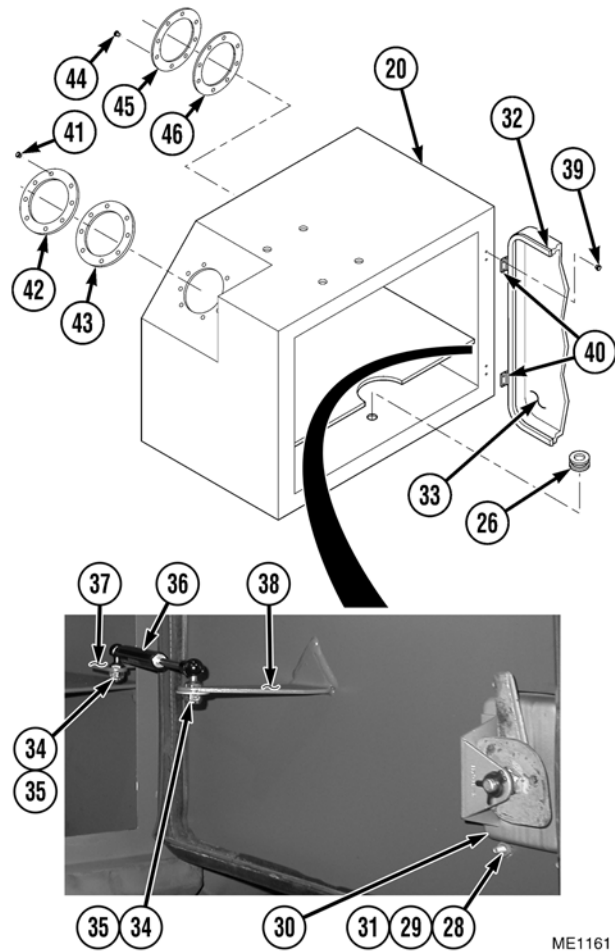
ME1158

- (3) Remove lower band clamp (6) from rubber tube (7).
- (4) Remove upper band clamp (8) from rubber tube (7).
- (5) Remove bolt (9), washer (10), and air cleaner intake tube (11) from lower bracket (12).
- (6) Remove bolt (13), washer (14), and air cleaner intake tube (11) from upper bracket (15).
- (7) Remove air cleaner intake tube (11) from rubber tube (7).
- (8) Remove air cleaner housing (3) from air cleaner stowage box (20).
- (8.1) Remove four self-locking nuts (19), washers (17), and cushion connectors (18) from air cleaner housing (3). Discard self-locking nuts.
- (9) Remove rubber tube (7) from air cleaner housing (3).
- (10) Remove rubber mat (21) from air cleaner stowage box (20).
- (11) Remove four bolts (22), washers (23), and air cleaner stowage box (20) from frame (24).
- (12) Remove four clipnuts from frame (24).



**b. Repair.**

- (1) Remove grommet (26) from air cleaner stowage box (20). Discard used grommet.
- (2) Remove four cushion connectors from air cleaner stowage box (20).
- (3) Remove four self-locking nuts (28), washers (29), and latch (30) from studs (31). Discard used self-locking nuts.
- (4) Remove pinchweld seal (32) from air cleaner stowage box door (33). Discard used pinchweld seal.
- (5) Remove self-locking nut (34), washer (35), and gas strut (36) from inner strut bracket (37). Discard used self-locking nut.
- (6) Remove self-locking nut (34), washer (35), and gas strut (36) from outer strut bracket (38). Discard used self-locking nut.
- (7) Remove rivets (39), hinge (40), and air cleaner stowage box door (33) from air cleaner stowage box (20). Discard used rivets.
- (8) Remove rivets (41), inlet support (42), and inlet seal (43) from air cleaner stowage box (20). Discard used rivets.
- (9) Remove rivets (44), outlet support (45), and outlet seal (46) from air cleaner stowage box (20). Discard rivets.

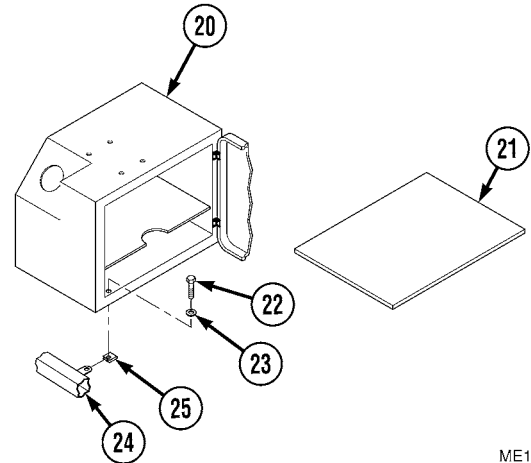


ME1161

- (10) Install outlet seal (46), outlet support (45), and new rivets (44) on air cleaner stowage box (20).
- (11) Install inlet seal (43), inlet support (42), and new rivets (41) on air cleaner stowage box (20).
- (12) Install hinge (40) on tool box door (33) with new rivets (39).
- (13) Install hinge (40) and tool box door (33) on air cleaner stowage box (20) with new rivets (39).
- (14) Install gas strut (36), washer (35), and new self-locking nut (34) on outer strut bracket (38).
- (15) Install gas strut (36), washer (35), and new self-locking nut (34) on inner strut bracket (37).
- (16) Install new pinchweld seal (32) on tool box door (33).
- (17) Install latch (30), four washers (29), and new self-locking nuts (28) on studs (31).
- (18) Install four cushion connectors on air cleaner stowage box (20).
- (19) Install new grommet (26) on air cleaner stowage box (20).

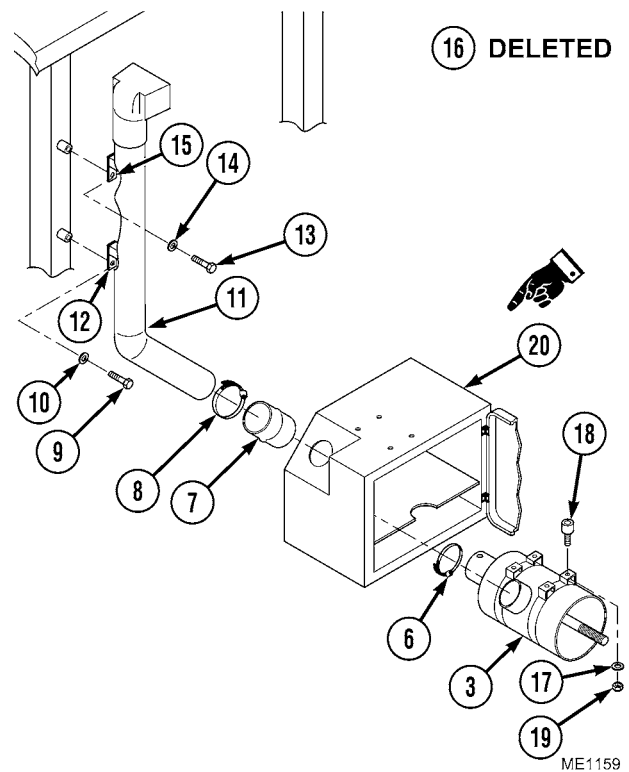
**c. Installation.**

- (1) Install four clipnuts (25) on frame (24).
- (2) Install air cleaner stowage box (20) on frame (24) with four bolts (22) and washers (23).
- (3) Install rubber mat (21) in air cleaner stowage box (20).



ME1160

- (4) Install rubber tube (7) on air cleaner housing (3).
- (4.1) Install four cushion connectors (18), washers (17), and new self-locking nuts (19) on air cleaner housing (3).
- (5) Install air cleaner housing (3) in air cleaner stowage box (20). Make sure that half of rubber tube (7) extends outside of intake hole.
- (6) Install air cleaner intake tube (11) on rubber tube (7).
- (7) Install air cleaner intake tube (11), washer (14), and bolt (13) on upper bracket (15).
- (8) Install washer (10) and bolt (19) on lower bracket (12) of air cleaner intake tube (11).
- (9) Install upper band clamp (8) on rubber tube (7).
- (10) Install lower band clamp (6) on rubber tube (7).



ME1159

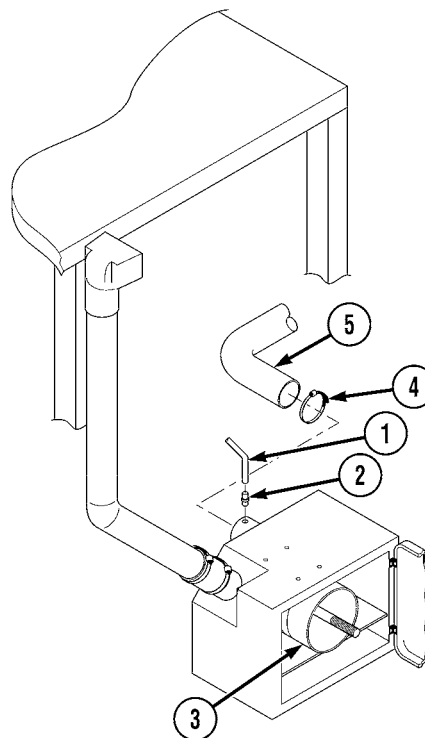
- (11) Install rear band clamp (4) and rubber elbow (5) on rear of air cleaner housing (3).
- (12) Install adapter (2) and flexible tube (1) on rear of air cleaner housing (3).

**d. Follow-On Maintenance.**

**NOTE**

If replacing stowage box and vehicle has cold weather kit, refer to Para 20-4 for modifications to stowage box before proceeding.

- (0.1) Install ether start assembly (Para 20-13) (if equipped).
- (0.2) Install hose reel switch (Para 13-32).
- (1) Install air cleaner filter (Para 13-27.1).
- (2) Install belly plate beneath air cleaner stowage box (TM 5-2420-230-10).



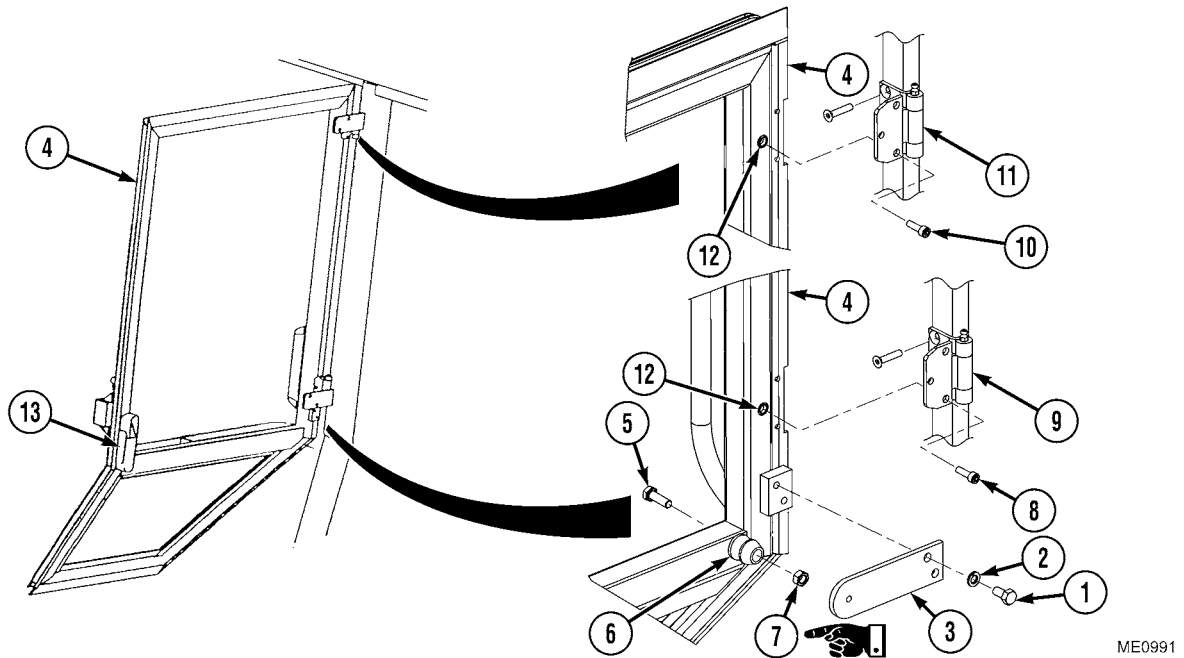
ME1158

**END OF TASK**

<b>13-30. DOOR ASSEMBLY REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> TM or Para Para 13-33	
<i>Materials/Parts</i> Insert, threaded, Item 92, Appendix D (6) Washer, lock, Item 280, Appendix D (2)	<i>Condition Description</i> Gas strut removed.	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)	<i>Drawings Required</i> TM 5-2420-230-24P Figure 192	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	



**a. Removal.**



**NOTE**

- If replacement of cab door becomes necessary, first install hinges to door and then install door to cab.
- Adjust hinges as required to ensure good fit of door with rubber seal making good contact with cab around entire door perimeter.

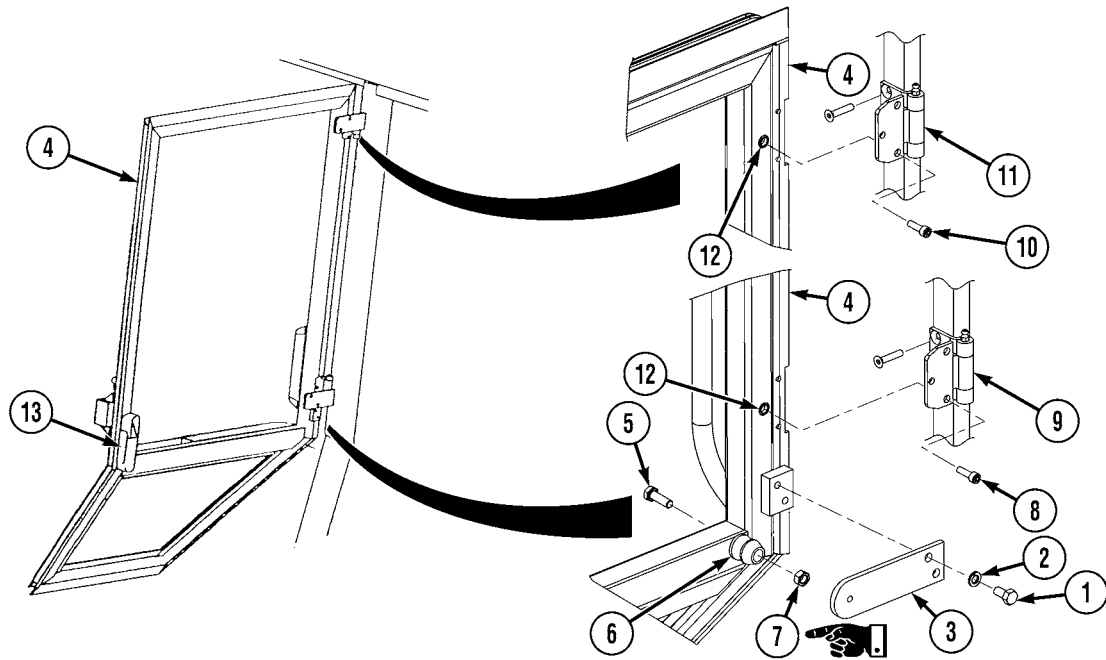
- (1) Remove two screws (1), lockwashers (2), and door stop plate (3) from door assembly (4). Discard lockwashers.
- (2) Remove screw (5), rubber door holder (6), and nut (7) from door assembly (4).

**CAUTION**

A second mechanic must hold door in place while door hinge screws are being removed. Failure to comply could result in damage to the door assembly.

- (3) Remove three screws (8) and door assembly (4) from bottom door hinge (9).
- (4) Remove three screws (10) and door assembly (4) from top door hinge (11).
- (5) If required, remove six threaded inserts (12) from door assembly (4). Discard threaded inserts.
- (6) If required, remove hinges (9) and (11) (Para 13-31) and door handle (13) (Para 13-32).

**b. Installation.**



ME0991



A second mechanic must hold door in place while door hinge screws are being installed. Failure to comply could result in damage to the hinges or door assembly.

- (1) If removed, install door handle (13) (Para 13-32) and hinges (9) and (11) (Para 13-31).
- (2) If removed, install six new threaded inserts (12) in door assembly (4).
- (3) Install three screws (10) and door assembly (4) on top door hinge (11).
- (4) Install three screws (8) and door assembly (4) on bottom door hinge (9).
- (5) Install screw (5), rubber door holder (6), and nut (7) on door assembly (4).
- (6) Install two screws (1), new lock washers (2), and door stop plate (3) on door assembly (4).

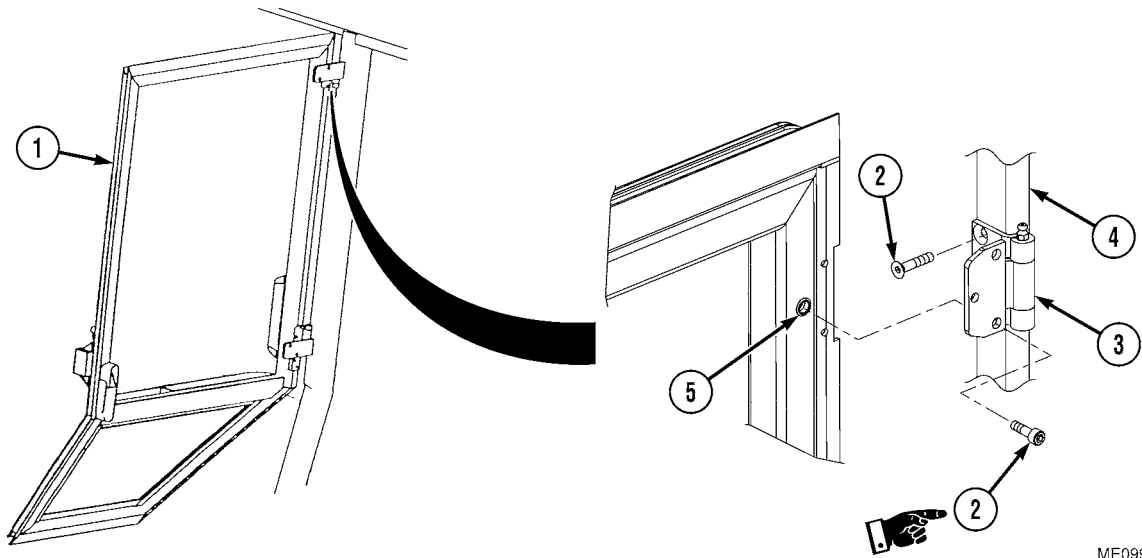
**c. Follow-On Maintenance.**

- (1) Install gas strut (Para 13-33).
- (2) If removed, install glass (Para 13-21).

**END OF TASK**



**b. Installation.**



ME0990

- (1) If removed, install three new threaded inserts (5).
- (2) Install six screws (2) and hinge (3) on frame (4).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**13-32. DOOR HANDLE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Rivet, Item 222, Appendix D (2)

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

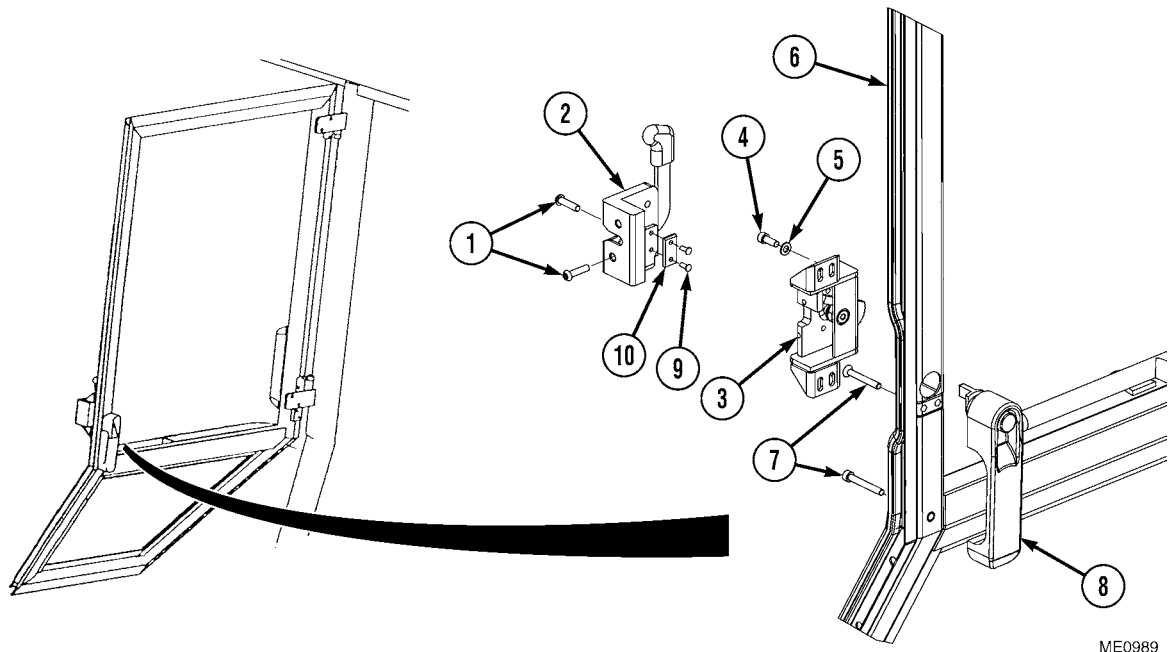
- |                   |   |
|-------------------|---|
| <i>TM or Para</i> | <i>Condition Description</i>                      |
| TM 5-2420-230-10  | Vehicle positioned on level ground.               |
| TM 5-2420-230-10  | Parking brake applied.                            |
| TM 5-2420-230-10  | Engine shut OFF.                                  |
| TM 5-2420-230-10  | Electrical master switch OFF.                     |
| TM 5-2420-230-10  | “Do Not Operate” tag attached to ignition switch. |

*Drawings Required*

- |                   |            |
|-------------------|------------|
| TM 5-2420-230-24P | Figure 192 |
| TM 5-2420-230-24P | Figure 193 |

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



ME0989

- (1) Remove four screws (1) and cab door lock (2) from door latch mount (3).
- (2) Remove four screws (4), washers (5), and door latch mount (3) from door assembly (6).
- (3) Remove three screws (7) and handle (8) from door assembly (6).
- (4) If required, remove two rivets (9) and door latch plate (10) from cab door lock (2). Discard rivets.
- (5) If required, remove nut, washer, and striker bolt.

**b. Installation.**

- (1) Install handle (8) on door assembly (6) with three screws (7). Tighten screws.
- (2) Install door latch mount (3) on door assembly (6) with four screws (4) and washers (5).
- (3) If removed, install door latch plate (10) on cab door lock (2) with two new rivets (9).
- (4) Install cab door lock (2) on door latch mount (3) with four screws (1).
- (5) If removed, install striker bolt, washer, and nut. Tighten nut.

**c. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**13-34. WHEEL AND TIRE REPAIR.**

This Task Covers:

- a. Disassembly
- b. Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
TM 9-2610-200-14

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
TM 5-2420-230-10      Wheel and tire removed.

*Materials/Parts*  
None

*Drawings Required*  
TM 5-2420-230-24P      Figure 104

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Disassembly.**

For disassembly of the wheel and tire, refer to TM 9-2610-200-14.

**b. Inspection.**

Refer to TM 9-2610-200-14.

**NOTE**

Refer to TM 5-2420-230-10 for proper inflation.

**c. Assembly.**

For assembly of the wheel and tire, refer to TM 9-2610-200-14.

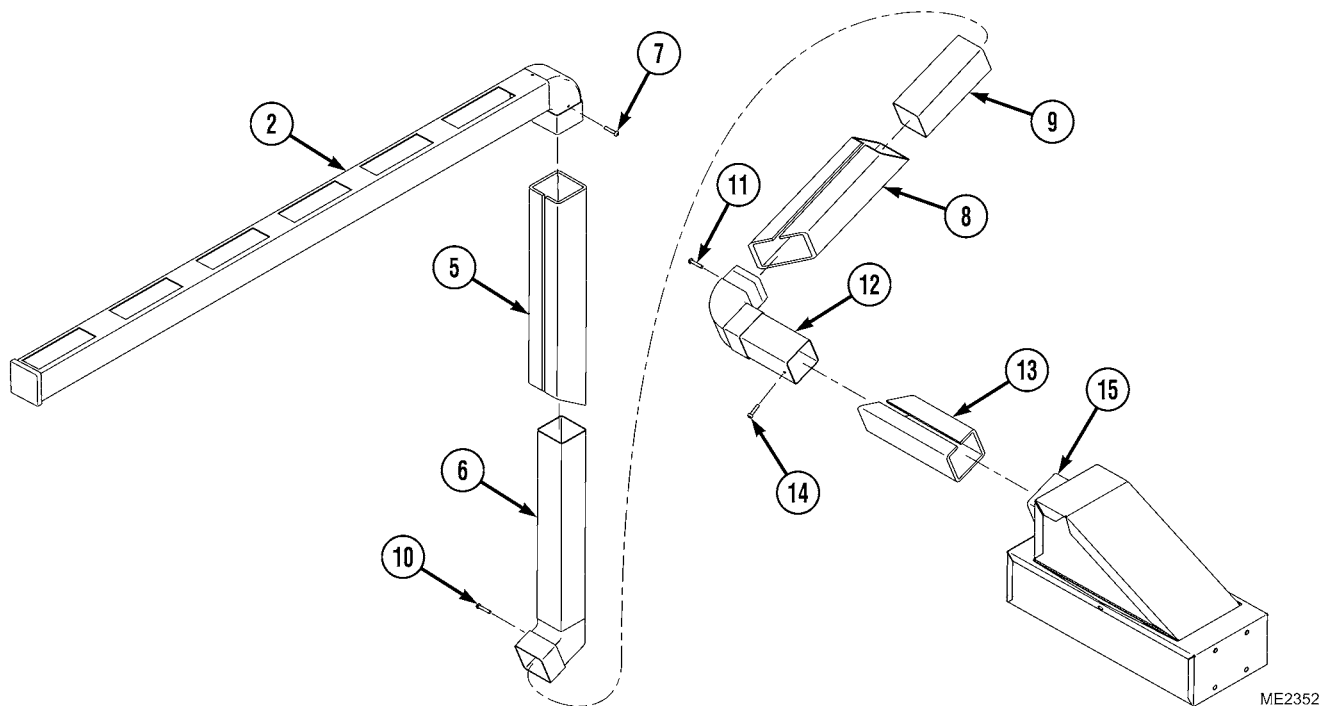
**d. Follow-On Maintenance.**

Install wheel and tire (TM 5-2420-230-10).

**END OF TASK**



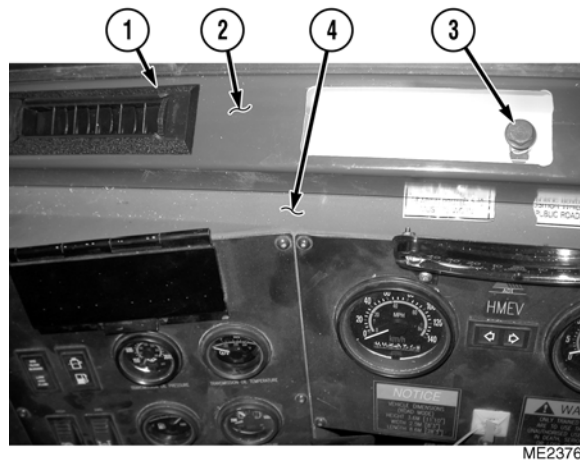




- (3) Remove insulation (5) from duct (6). Discard insulation.
- (4) Remove two screws (7) and duct (2) from duct (6).
- (5) Remove insulation (8) from duct (9). Discard insulation.
- (6) Remove two screws (10) and duct (6) from duct (9).
- (7) Remove two screws (11) and duct (9) from duct (12).
- (8) Remove insulation (13) from duct (12). Discard insulation.
- (9) Remove two screws (14) and duct (12) from adapter (15).

**b. Installation**

- (1) Install duct (12) on adapter (15) with two screws (14).
- (2) Install duct (9) on duct (12) with two screws (11).
- (3) Install duct (6) on duct (9) with two screws (10).
- (4) Install duct (2) on duct (6) with two screws (7).
- (5) Install new insulation (13) on duct (12).
- (6) Install new insulation (8) on duct (9).
- (7) Install new insulation (5) on duct (6).



(8) Install duct (2) on dash (4) with three screws (3).

(9) Install six louvers (1) in duct (2).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**13-36. AUXILIARY DEFROSTER HEATER MAINTENANCE.**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  

<i>TM or Para</i>	<i>Condition Description</i>
Para 9-4	Cooling system drained.

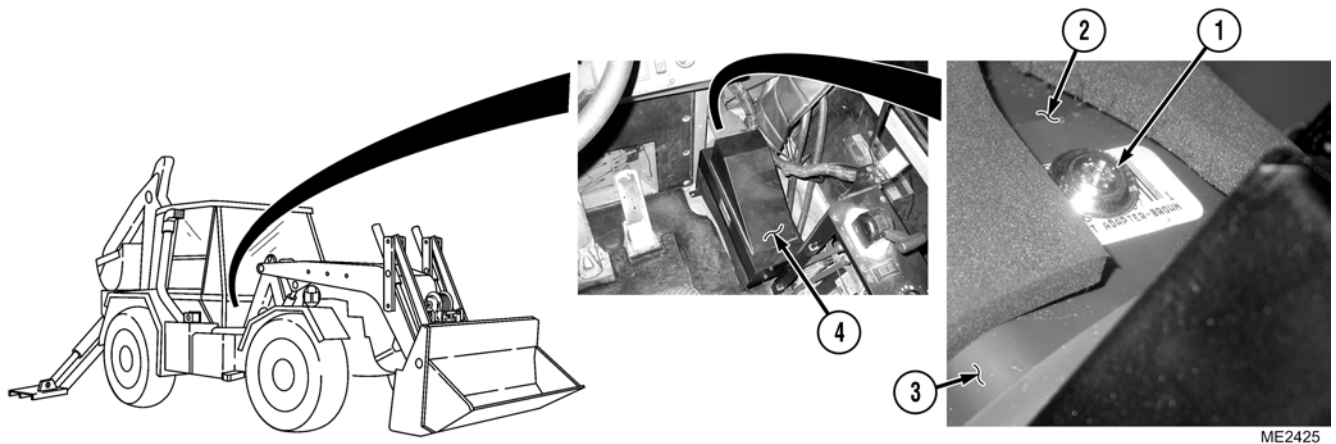
*Materials/Parts*  
 Cap and plug set, Item 4, Appendix C  
 O-rings, Item 156.1, Appendix D (2)  
 Tags, identification, Item 63, Appendix C  
 Ties, cable, Item 68, Appendix C  
 Washer, lock, Item 290.1, Appendix D (4)

*Drawings Required*  
 TM 5-2420-230-24P Figure 188

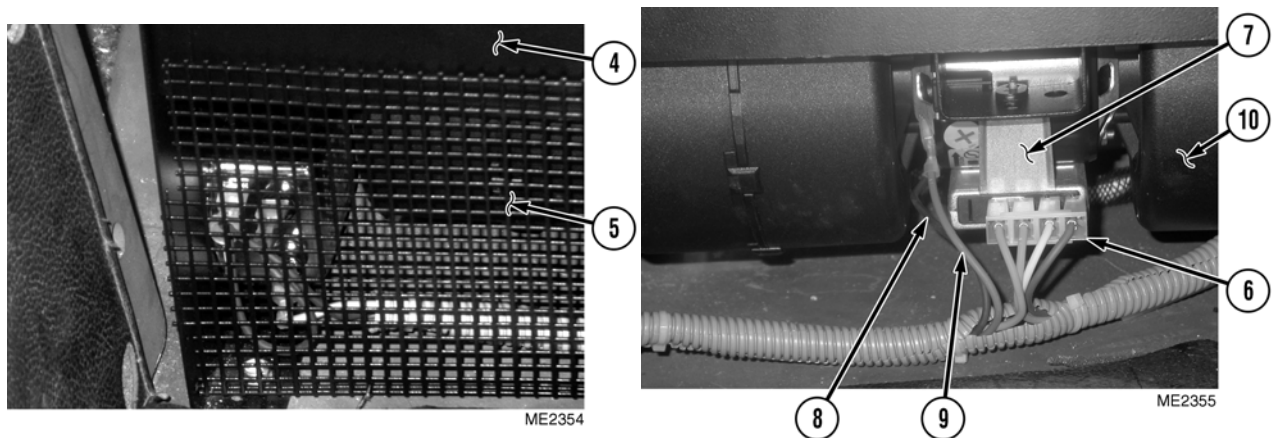
*Estimated Time to Complete Task*  
 Refer to MAC in Appendix B

*Personnel Required*  
 MOS 62B, Construction Equipment Repairer

a. Removal.



- (1) Remove two screws (1) and duct (2) from adapter (3) on defroster assembly (4).



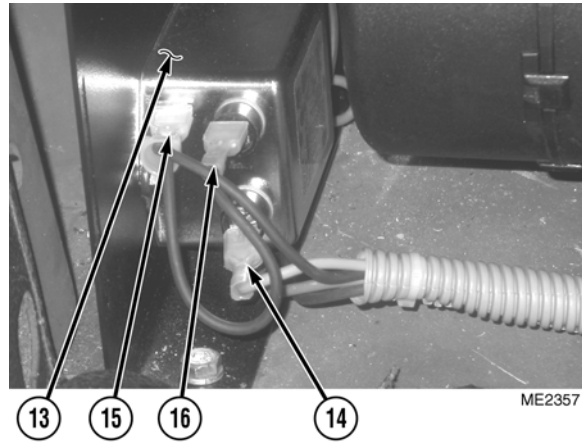
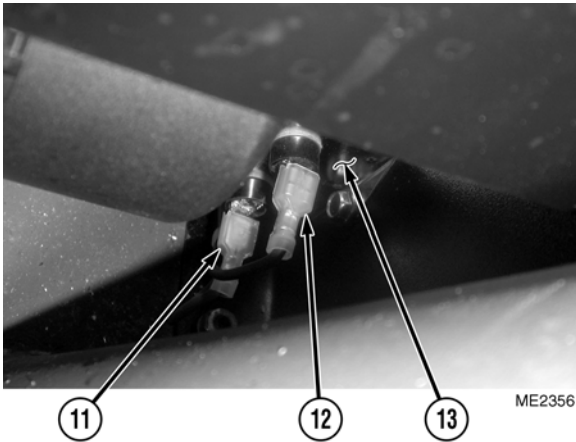
- (2) Bow grille (5) and remove tabs of grille from slots on defroster assembly (4).

**WARNING**

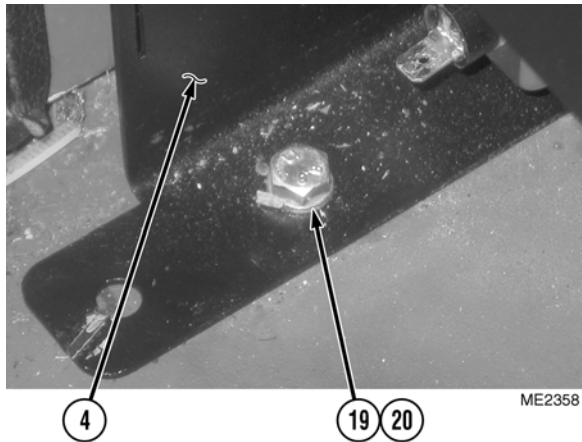
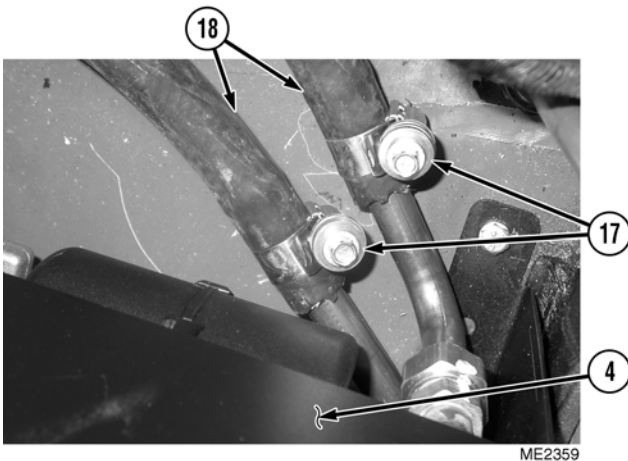
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
- (3) Disconnect connector (6) from motor resistor (7).
- (4) Disconnect two wires (8) and (9) from fan motor assembly (10).



- (5) Disconnect two wires (11) and (12) from EMI filter (13).
- (6) Disconnect two wires (14) and (15) and jumper wire (16) from EMI filter (13).



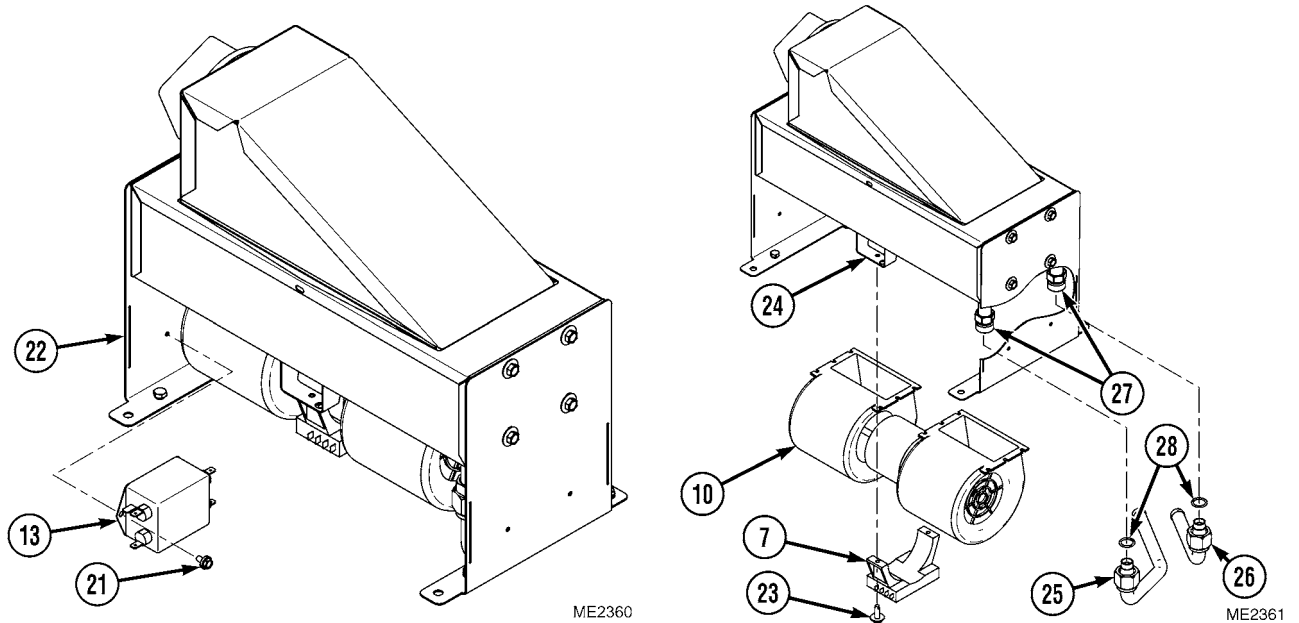
**WARNING**

Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.

**NOTE**

- Tag all hoses and note their positions before removal.
  - Cap and plug all hoses and fittings upon removal.
- (7) Loosen two clamps (17), and remove two hoses (18) from defroster assembly (4).
  - (8) Remove four screws (19), lockwashers (20), and defroster assembly (4) from vehicle. Discard lockwashers.

**b. Disassembly.**



**NOTE**

Perform Step (1) only if removal of EMI filter is required.

- (1) Remove two screws (21) and EMI filter (13) from heater mounting leg (22).

**NOTE**

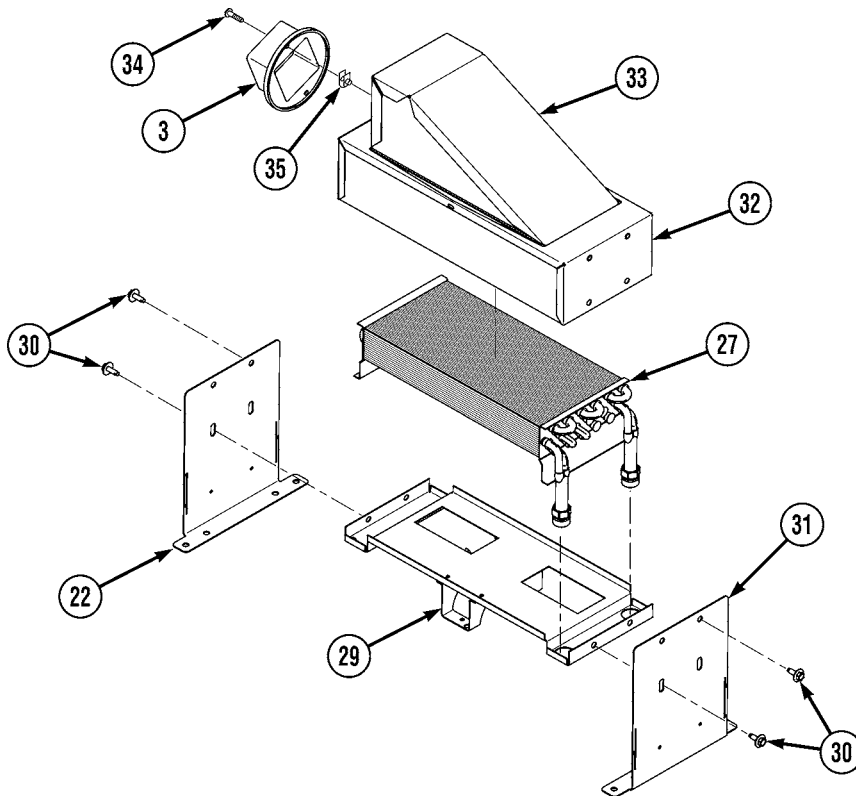
Perform Step (2) only if removal of fan motor assembly is required.

- (2) Remove two screws (23), motor resistor (7), and fan motor assembly (10) from motor bracket (24).

**NOTE**

Perform Steps (3) through (7) only if removal of heater core is required.

- (3) Remove tubes (25) and (26) from heater core (27).
- (4) Remove O-rings (28) from two tubes (25) and (26). Discard O-rings.



ME2362

- (5) While supporting motor bracket (29), remove eight screws (30) and two heater mounting legs (22) and (31) from housing (32) and motor bracket.
- (6) Remove housing (32) and plenum (33) from heater core (27).
- (7) Remove motor bracket (29) from heater core (27).
- (8) Remove two screws (34) and adapter (3) from plenum (33).
- (9) Remove two clip-on nuts (35) from plenum (33).

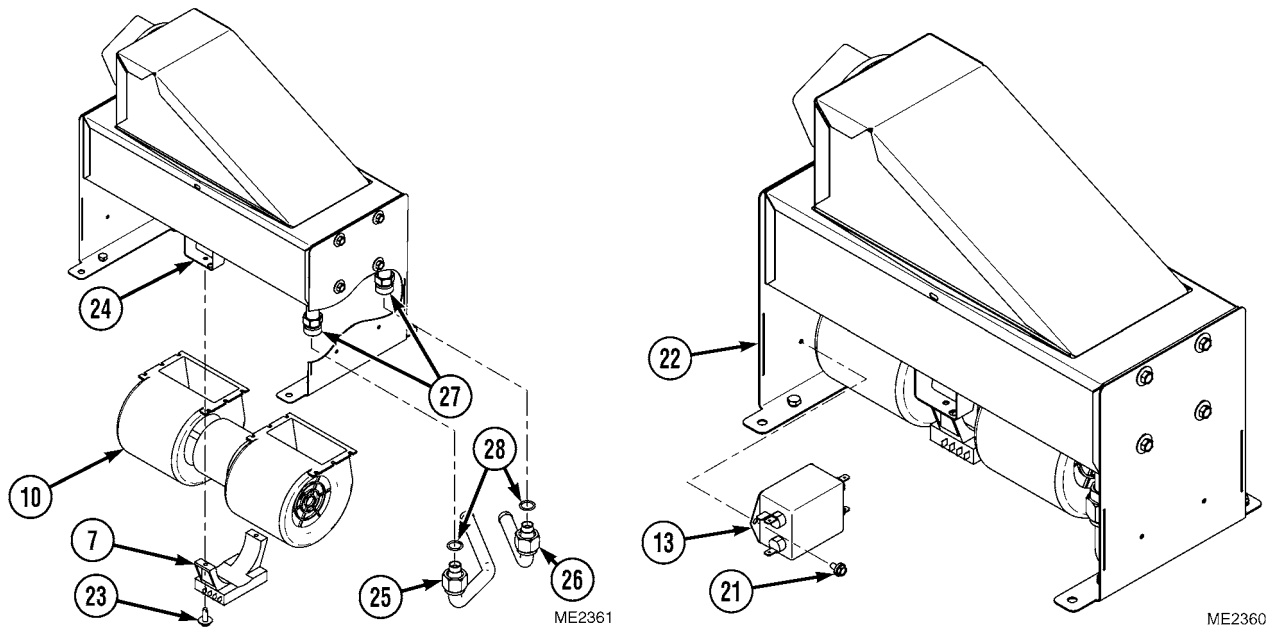
**c. Assembly.**

- (1) Install two clip-on nuts (35) in plenum (33).
- (2) Install adapter (3) on plenum (33) with two screws (34).

**NOTE**

Perform Steps (3) through (7) only if heater core was removed.

- (3) Position motor bracket (29) on heater core (27).
- (4) Position plenum (33) and housing (32) on heater core (27).
- (5) While supporting motor bracket (29), install two heater mounting legs (31) and (22) on motor bracket and housing (32) with eight screws (30).



- (6) Install two new O-rings (28) on two tubes (26) and (25).
- (7) Install tubes (26) and (25) on heater core (27).

**NOTE**

Perform Step (8) only if fan motor assembly was removed.

- (8) Install fan motor assembly (10) and motor resistor (7) on motor bracket (24) with two screws (23).

**NOTE**

Perform Step (9) only if EMI filter was removed.

- (9) Install EMI filter (13) on front heater mounting leg (22) with two screws (21).

**d. Installation.**

- (1) Install two hoses (18) on defroster assembly (4) with two clamps (17). Torque clamps to 30 lbf/in. (3.4 N•m).

**WARNING**

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

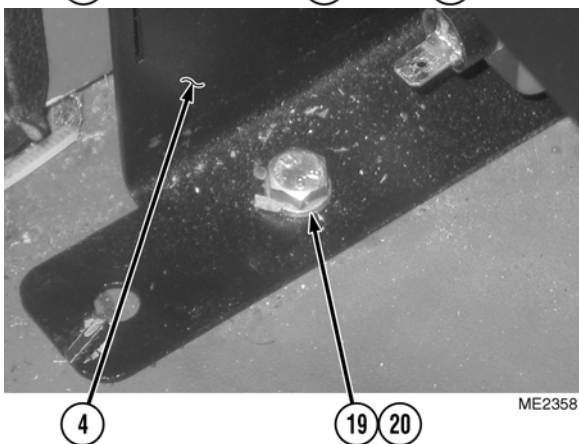
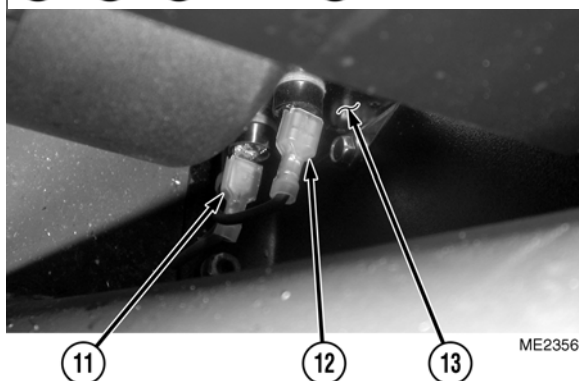
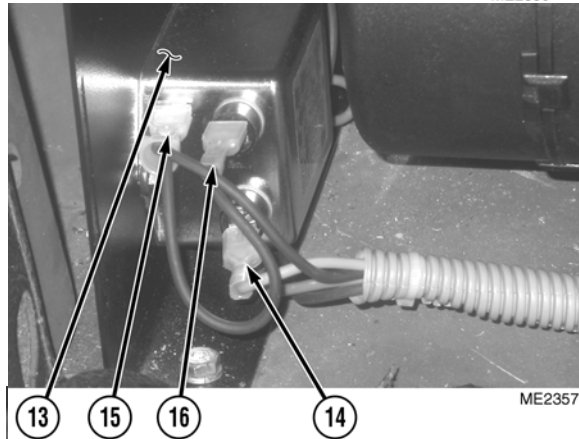
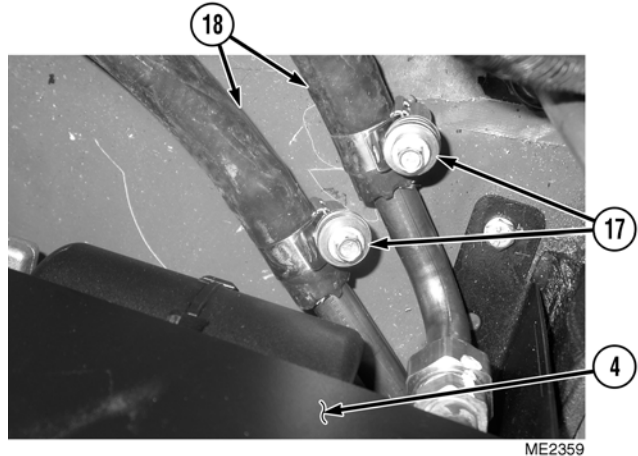
**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

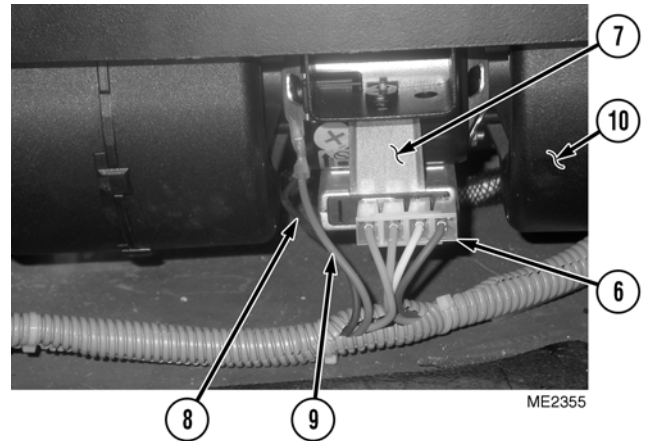
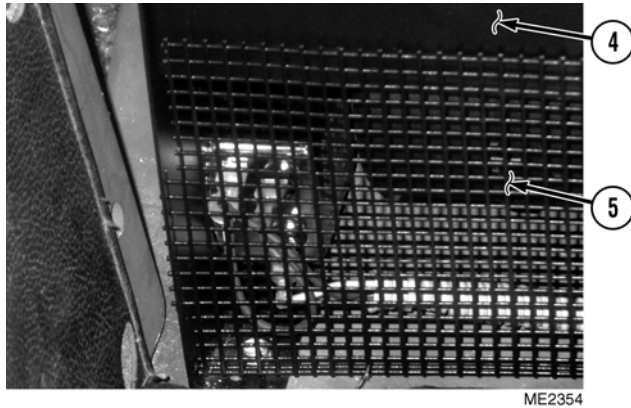
- (2) Connect jumper wire (16) and two wires (15) and (14) to EMI filter (13).
- (3) Connect two wires (12) and (11) to EMI filter (13).
- (4) Install defroster assembly (4) on vehicle with four new lockwashers (20) and screws (19).

**NOTE**

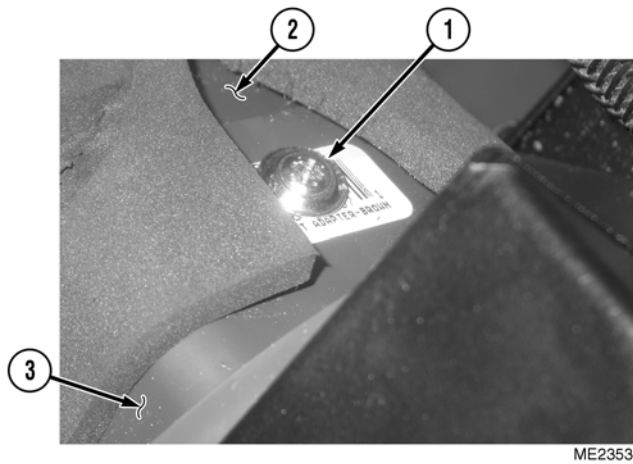
Ensure all hoses are reconnected to positions noted prior to removal.







- (5) Connect two wires (9) and (8) to motor (10).
- (6) Connect connector (6) to motor resistor (7).
- (7) Install grille (5) on defroster assembly (4).



- (8) Install duct (2) on adapter (3) with two screws (1).

**e. Follow-On Maintenance.**

- (1) Fill cooling system (Para 9-4).
- (2) Start engine (TM 5-2420-230-10) and check for leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**



## CHAPTER 14

### DRIVE TRAIN AND AXLES

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	14-1	14-1
Preparation and Isolation. . . . .	14-2	14-1
Restore IHMEE to Operational Readiness. . . . .	14-3	14-2
Axle Hub and Differential Oil Servicing. . . . .	14-4	14-2
Drive Shaft and U-Joint Maintenance. . . . .	14-5	14-5
Front Axle Assembly Replacement. . . . .	14-6	14-9
Rear Axle Assembly Replacement. . . . .	14-7	14-11
Axle Housing Breather Replacement. . . . .	14-8	14-13
Front Axle Hub Breather Replacement. . . . .	14-9	14-15

**14-1. GENERAL.**

This chapter contains procedures which relate to maintenance activities detailed in Chapter 3, Preventive Maintenance Checks and Services (PMCS) and relate to removal and installation of components associated with the axles and the drivetrain. This section is to be read in conjunction with Appendix J.

**14-2. PREPARATION AND ISOLATION.**

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE), complete the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**14-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**14-4. AXLE HUB AND DIFFERENTIAL OIL SERVICING.**

This Task Covers:

- a. Changing Axle Hub Oil                      b. Changing Differential Oil                      c. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p> <p><i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B</p> <p><i>Materials/Parts</i> Chock, wheel, Item 7, Appendix C Oil, lubricating, gear, GO 80W/90, Item 42, Appendix C</p> <p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p> <p><i>References</i> None</p>	<p><i>Equipment Conditions</i> TM or Para Para 2-21 TM 5-2420-230-10</p> <p><i>Condition Description</i> Vehicle raised. Parking brake released.</p> <p><i>Drawings Required</i> TM 5-2420-230-24P Figure 98 TM 5-2420-230-24P Figure 99 TM 5-2420-230-24P Figure 100 TM 5-2420-230-24P Figure 101 TM 5-2420-230-24P Figure 102 TM 5-2420-230-24P Figure 103</p> <p><i>Estimated Time to Complete</i> Refer to MAC in Appendix B</p>
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**a. Changing Axle Hub Oil.**

**NOTE**

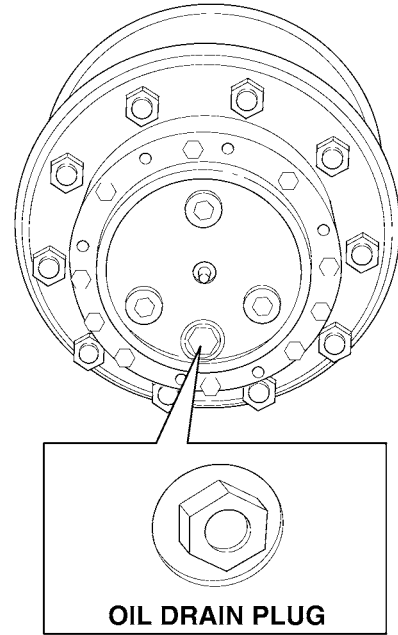
Changing oil on front and rear axles involves both planetary hub assemblies and differential centers.

- (1) Ensure vehicle is in N (Neutral) and chocked with chock block.
- (2) Place drain pan under axle hub.
- (3) Rotate wheels so axle hub oil drain plug is in 6 o'clock position.

**WARNING**

If vehicle has recently been driven, oil may be hot. To avoid personal injury, wear appropriate safety equipment. Failure to comply may result in injury or death to personnel.

- (4) Remove oil drain plug and drain oil into drain pan.
- (5) Inspect drain plug for metal shavings. If excessive metal shavings are found, notify supervisor.
- (6) When oil is completely drained, replace oil drain plug and tighten securely.



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**NOTE**

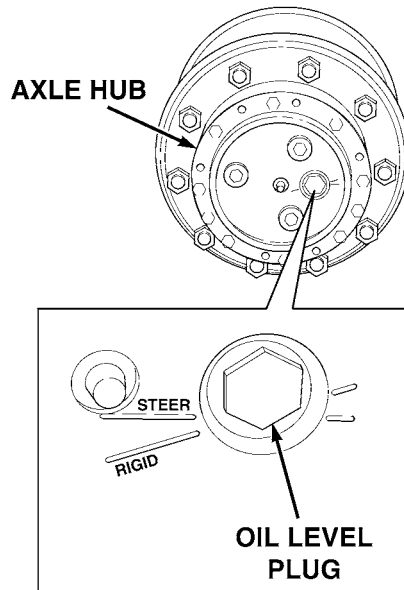
The axle hub oil level plug has two levels, marked STEER and RIGID. Ensure correct level is used for each axle. Front axle is the STEER axle, and the rear axle is the RIGID axle.

- (7) Rotate wheels until oil level plug is aligned for the axle hub being serviced.
- (8) Remove oil level plug from axle hub.

**CAUTION**

Ensure oil is level with bottom of oil level plug hole. Failure to comply may cause severe damage to the equipment.

- (9) Fill axle hubs with correct grade of oil. Secure oil drain plug and repeat procedure for remaining axle hubs.



ME0198

**b. Changing Differential Oil.**

- (1) Place drain pan under differentials.

**WARNING**

If vehicle has recently been driven, oil may be hot. To avoid personal injury, wear appropriate safety equipment. Failure to comply may result in injury or death to personnel.

- (2) Remove differential oil drain plug and drain oil.
- (3) Inspect drain plug for metal shavings. If excessive metal shavings are found, notify supervisor.
- (4) When oil is completely drained, replace oil drain plug and tighten securely.

**CAUTION**

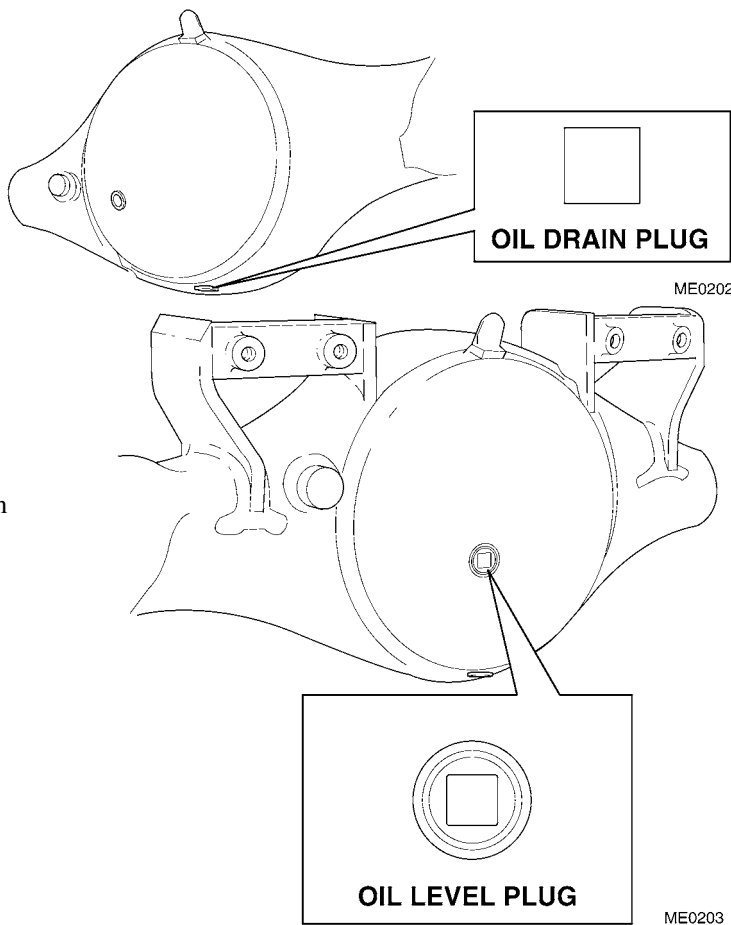
Ensure oil is level with bottom of oil level plug hole. Failure to comply may cause severe damage to the equipment.

- (5) Remove oil level plug from center bowls and fill differential.
- (6) Replace oil level plug and tighten securely.

**c. Follow-On Maintenance.**

- (1) Apply parking brake (TM 5-2420-230-10).
- (2) Lower vehicle (Para 2-21).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**14-5. DRIVE SHAFT AND U-JOINT MAINTENANCE.**

This Task Covers:

- |               |                 |                          |
|---------------|-----------------|--------------------------|
| a. Inspection | b. Removal      | c. Disassembly           |
| d. Assembly   | e. Installation | f. Follow-On Maintenance |

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Center belly plate removed.
Para 2-21	Vehicle raised.

*Materials/Parts*

- Cloth, lint-free, Item 10, Appendix C
- Grease, automotive and artillery, Item 30, Appendix C
- Nut, self-locking, Item 126, Appendix D (16)

*Drawings Required*

TM 5-2420-230-24P	Figure 105
TM 5-2420-230-24P	Figure 106

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete*

Refer to MAC in Appendix B

**a. Inspection.**

- (1) Inspect front and rear drive shaft U-joints for looseness and/or stiffness within bearing cap rollers.
- (2) If necessary, remove drive shaft to facilitate checking U-joints.
- (3) If any looseness and/or stiffness is present, replace U-joints. Inspect drive shaft slip splines for signs of wear. Repair or replace as necessary.
- (4) Lubricate U-joints. Ensure four bearing seals of each U-joint are purged of old abrasive contaminants.
- (5) Each bearing cap seal is designed to pop when greased. If seal fails to purge, move drive shaft from side to side while applying grease gun pressure. This will allow greater clearance on thrust end of bearing that is not purging.



The bearing cap seals must purge to ensure correct lubrication of all four U-joint bearings. If seal fails to purge, release seal tension on bearing cap. Failure to comply may result in damage to equipment.

- (6) On relevant bearing cap, unfasten and remove two bearing cap retaining bolts.
- (7) Loosely install two new serrated bolts which incorporate lock patch.
- (8) Grease U-joints. Ensure lubricant purges from bearing cap seal. With clean cloth, wipe off excessive grease.
- (9) Completely install bolts. Ensure bearing plates are flush with yoke faces. Torque bolts to 38-48 lbf/ft. (52-65 N·m).



If operating in a cold environment, slip spline assembly should be activated by driving vehicle to displace grease before it can stiffen. Otherwise, slip yoke plug may be forced out due to hydraulic pressure. This causes loss of grease and allows abrasive contaminants to enter slip spline. Failure to comply may result in damage to equipment.

**NOTE**

If releasing tension fails to clear grease passage, dismantle U-joint to determine cause of blockage.

- (10) Lubricate drive shaft yoke and slip spline.
- (11) Apply grease until lubricant appears at welch plug pressure relief hole. Welch plug is located at slip yoke end of spline.
- (12) Cover pressure relief hole with finger and continue to apply pressure until grease appears at slip yoke seal. This will ensure complete lubrication of spline.

***b. Removal.***

**NOTE**

Removal procedures are the same for all drive shaft U-joints.

- (1) Remove self-locking nuts and bolts on drive shaft to axle flange. Discard self-locking nuts.
- (2) Support drive shaft and remove eight self-locking nuts and bolts on drive shaft to gear box flange. Discard self-locking nuts.
- (3) Remove drive shaft.



c. *Disassembly.*



Do not drop bearing cups. Needle bearings can be easily lost, which will cause damage to the vehicle.

- (1) Remove grease fitting (1) from cross (2).

**NOTE**

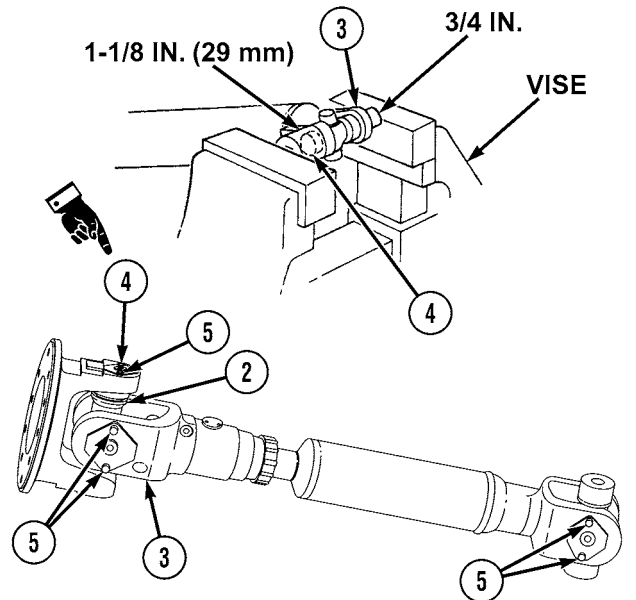
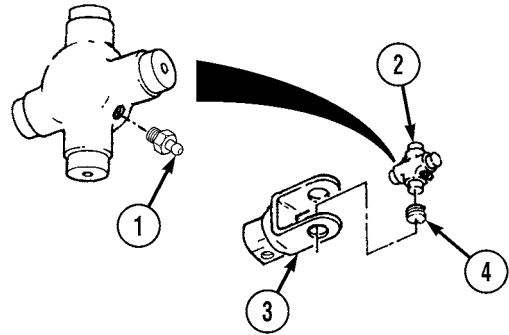
Ensure open end of socket is facing bearing cup.

- (2) Position drive shaft yoke (3) in vise with 1 1/8-in. (29 mm) socket between vise jaw and bearing cup (4) being removed.

**NOTE**

Ensure open end of socket is facing vise jaw.

- (3) Remove two bolts (5) on each end of bearing caps.
- (4) Place 1 1/8-in. (29 mm) socket between opposite bearing cup (4) and vise jaw.
- (5) Press bearing cup (4) out of drive shaft yoke (3). Remove bearing cup (4) from cross (2).
- (6) Reverse position of sockets and press remaining bearing cup (4) out of drive shaft yoke (3).
- (7) Remove drive shaft yoke (3) from cross (2).
- (8) Repeat Steps (2) through (5) for drive shaft yoke (3).
- (9) Remove cross (2) from drive shaft yoke (3).



ME1181

**d. Assembly.**



Do not drop bearing cups. Needle bearings can be easily lost. Failure to comply will cause damage to equipment.

**NOTE**

Installation procedures are the same for all steering shaft U-joints. This procedure covers the U-joint attached to the steering column shaft.

- (1) Install cross (2) into drive shaft yoke (3).
- (2) Install bearing cup (4) into drive shaft yoke (3).



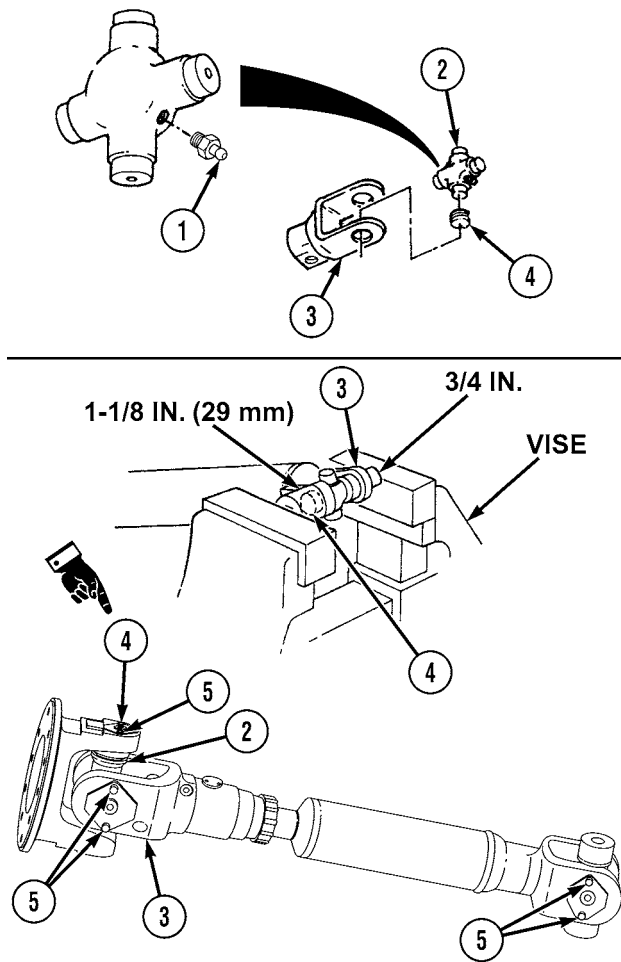
Ensure bearing cup is aligned with drive shaft yoke before pressing in with vise. Damage to cross and bearing cups will result if forced into yoke.

- (3) Place drive shaft yoke (3) in vise with 1 1/8-in. (29 mm) socket between vise jaw and bearing cup (4).
- (4) Press bearing cup (4) into drive shaft yoke (3).
- (5) Install other bearing cup (4) into drive shaft yoke (3).
- (6) Place drive shaft yoke (3) in vise with 1 1/8-in. (29 mm) socket between bearing cup (4) and vise jaw.
- (7) Press bearing cup (4) into drive shaft yoke (3).
- (8) Repeat Steps 2 through 7 to install drive shaft yoke (3) on cross (2).



Ensure grease fitting on cross faces yoke. Damage to equipment will result if grease fitting is improperly installed.

- (9) Install grease fitting (1) into cross (2).
- (10) Grease U-joints (TM 5-2420-230-10).



ME1181

**e. Installation.**

Installation of the drive shaft is a reversal of the removal procedure with attention given to the following points:

- (1) Ensure alignment marks are aligned when refitting drive shaft.
- (2) Ensure all securing nuts and bolts are replaced and tightened to specified torque (Appendix E).
- (3) If a new drive shaft is fitted, ensure it is adequately lubricated prior to driving vehicle.

**f. Follow-On Maintenance.**

- (1) Install center belly plate (TM 5-2420-230-10).
- (2) Lower vehicle (Para 2-21).
- (3) Deleted.

**END OF TASK**

<b>14-6. FRONT AXLE ASSEMBLY REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	FEL raised and maintenance arm installed.
<i>Tools and Special Tools</i>		
Tool kit, common no. 2, Item 36, Appendix B	Para 15-4	Air system drained.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Front tires removed.
	Para 8-8	Front brakes caged.
<i>Materials/Parts</i>	Para 14-5	Front drive shaft removed.
Cap and plug set, Item 4, Appendix C	Para 14-8	Front differential breather removed.
Tags, identification, Item 63, Appendix C		
Ties, cable, Item 68, Appendix C	Para 6-8	Front shock absorbers removed.
<i>Personnel Required</i>	Para 6-4	Front check straps removed.
MOS 62B, Construction Equipment Repairer (2)	Para 6-5	Front air bags removed.
<i>References</i>	<i>Drawings Required</i>	
None	TM 5-2420-230-24P	Figure 100
	<i>Estimated Time to Complete</i>	
	Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
  - Ensure all hoses, wires, and tubes are disconnected and clear before removal.
  - Keep shims for assembly.
- (1) Remove bolts securing panhard rod and remove panhard rod.
  - (2) Remove nut securing tapered ball joint on steering drag link.
  - (3) Disconnect steering drag link from axle.

**WARNING**

To prevent personal injury, ensure air is exhausted from primary and secondary pneumatic systems prior to starting work. Failure to comply may result in injury or death to personnel.

- (4) Disconnect four pneumatic connections for front brakes.
- (5) Disconnect pneumatic connections to front Ride Level Valves (RLV).
- (6) Disconnect pneumatic connection for front differential lock actuating valve.
- (7) Disconnect electrical connection for front differential lock actuating valve.

**WARNING**

The front axle assembly is heavy. To avoid personal injury, exercise extreme care when manually handling axle. Failure to comply may result in injury or death to personnel.

- (8) Support front axle assembly with floor jack and remove eight bolts securing four control arms to axle.
- (9) Remove front axle.

**b. Installation.**

Installation of the front axle housing assembly is the reverse of the removal procedure with attention given to the following points:

- (1) Ensure all fittings are tightened.
- (2) Ensure all pneumatic connections are correctly connected.
- (3) Ensure all electrical connections are correctly connected.
- (4) Perform functional check of electrical and pneumatic systems associated with rear axle. Test drive vehicle to ensure correct operation of brakes.

**c. Follow-On Maintenance.**

- (1) Install front air bags (Para 6-5).
- (2) Install front check straps (Para 6-4).
- (3) Install front shock absorbers (Para 6-8).
- (4) Install front differential breather (Para 14-8).
- (5) Install front drive shaft (Para 14-5).
- (6) Uncage front brakes (Para 8-8).
- (7) Install front tires (TM 5-2420-230-10).
- (8) Remove maintenance arm and lower FEL (TM 5-2420-230-10).
- (9) Install center belly plate (TM 5-2420-230-10).
- (10) Align front end (Para 5-17).
- (11) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>14-7. REAR AXLE ASSEMBLY REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	<i>Condition Description</i>
None	TM or Para TM 5-2420-230-10	FEL raised and maintenance arm installed.
<i>Tools and Special Tools</i>	Para 15-4	Air system drained.
Tool kit, common no. 2, Item 36, Appendix B	TM 5-2420-230-10	Rear tires removed.
Tool kit, general mechanics, Item 38, Appendix B	Para 8-8	Rear brakes caged.
<i>Materials/Parts</i>	Para 14-5	Rear drive shaft removed.
Cap and plug set, Item 4, Appendix C	Para 14-8	Rear differential breather removed.
Tags, identification, Item 63, Appendix C	Para 6-8	Rear shock absorbers removed.
Ties, cable, Item 68, Appendix C	Para 6-4	Rear check straps removed.
<i>Personnel Required</i>	Para 6-5	Rear air bags removed.
MOS 62B, Construction Equipment Repairer (3)	Para 6-10	Sway bar removed.
<i>References</i>	<i>Drawings Required</i>	
None	TM 5-2420-230-24P Figure 102	
	<i>Estimated Time to Complete</i>	
	Refer to MAC in Appendix B	

**a. Removal.**

**WARNING**

To prevent personal injury, exercise care when positioning vehicle stands beneath axle housing. Failure to comply may result in injury or death to personnel.

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
  - Ensure all hoses, wires, and tubes are disconnected and clear before removal.
  - Keep shims for assembly.
- (1) Remove bolts securing panhard rod and remove panhard rod.
  - (2) Remove bolts securing rear drive shaft to axle and move drive shaft to one side.

**WARNING**

To prevent personal injury, ensure air is exhausted from primary and secondary pneumatic system prior to working on system. Failure to comply may result in injury or death to personnel.

- (3) Disconnect and cap and plug two pneumatic connections for rear brakes.
- (4) Disconnect RLV linkage at axle to rear RLVs.
- (5) Disconnect and cap and plug pneumatic connection for rear differential lock actuating valve.
- (6) Disconnect electrical connection for rear differential lock actuating valve.
- (7) Remove rear differential breather pipe.

**WARNING**

The rear axle assembly is heavy. Always use lifting device to support axle. To avoid personal injury, exercise extreme care when manually handling axle. Failure to comply may result in injury or death to personnel.

- (8) Support rear axle assembly and remove two bolts securing control arm to axle on each of four control arms. Remove rear axle.

**b. Installation.**

Installation of rear axle housing assembly is the reversal of the removal procedure with attention given to the following points:

- (1) Ensure all fittings are tightened to specified torque (Appendix E).
- (2) Ensure all pneumatic connections are correctly connected.
- (3) Ensure all electrical connections are correctly connected.
- (4) Replace sway bar (Para 6-10).

**c. Follow-On Maintenance.**

- (1) Install rear air bags (Para 6-5).
- (2) Install rear check straps (Para 6-4).
- (3) Install rear shock absorbers (Para 6-8).
- (4) Install rear differential breather (Para 14-8).
- (5) Install rear drive shaft (Para 14-5).
- (6) Uncage rear brakes (Para 8-8).
- (7) Install rear tires (TM 5-2420-230-10).
- (8) Remove maintenance arm and lower FEL (TM 5-2420-230-10).
- (9) Install center belly plate (TM 5-2420-230-10).
- (10) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>14-8. AXLE HOUSING BREATHER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Cleaning	c. Installation
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i>	TM 5-2420-230-10	Electrical master switch OFF.
Cloth, lint-free, Item 10, Appendix C	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Compound, sealing, pipe thread, Item 23, Appendix C		
Solvent, degreasing SD, Item 58, Appendix C	TM 5-2420-230-10	Hood raised.
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer	TM 5-2420-230-24P	Figure 98
	TM 5-2420-230-24P	Figure 99
<i>References</i>	<i>Estimated Time to Complete</i>	
None	Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

Two axle housing breathers on the IHMEE must be routinely removed and cleaned. The breather for the front axle is located near the top of the left-hand A-frame under the hood. The breather for the rear axle is located on the chassis at the center rear of the vehicle behind the air tank.

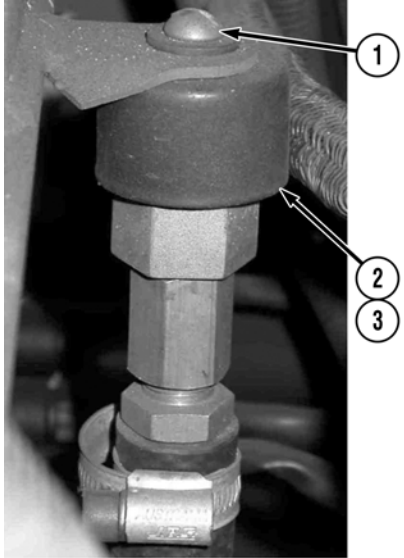
Remove screw (1) from top of breather, protection cap (2), and filter element (3).

**b. Cleaning.**

**WARNING**

To avoid personal injury, wear protective equipment when using compressed air. Failure to comply may result in injury or death to personnel.

- (1) Clean immediate area around front and rear breathers using compressed air and a clean cloth.



ME0779

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- To avoid personal injury, wear protective equipment when using compressed air. Failure to comply may result in injury or death to personnel.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (2) Wash filter element (3) in degreasing solvent and dry using compressed air and a clean cloth.
- (3) Inspect components for damage, deterioration, or blockages. Replace components as necessary.

**c. Installation.**

- (1) Assemble filter element (3), protection cap (2), and screw (1).
- (2) Ensure threads of breather clean.
- (3) Apply sealing compound to threads.
- (4) Replace protection cap (2) and tighten screw (1) securely.



**d. Follow-On Maintenance.**

- (1) Close hood (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

14-9. FRONT AXLE HUB BREATHER REPLACEMENT.		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
<i>Materials/Parts</i> None	TM 5-2420-230-10	Wheels turned to extreme lock.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	TM 5-2420-230-10	Engine shut OFF.
<i>References</i> None	TM 5-2420-230-10	Electrical master switch OFF.
		“Do Not Operate” tag attached to ignition switch.
	<i>Drawings Required</i> TM 5-2420-230-24P Figure 101 TM 5-2420-230-24P Figure 103	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

Both sides remove and install the same way. Left side is shown.

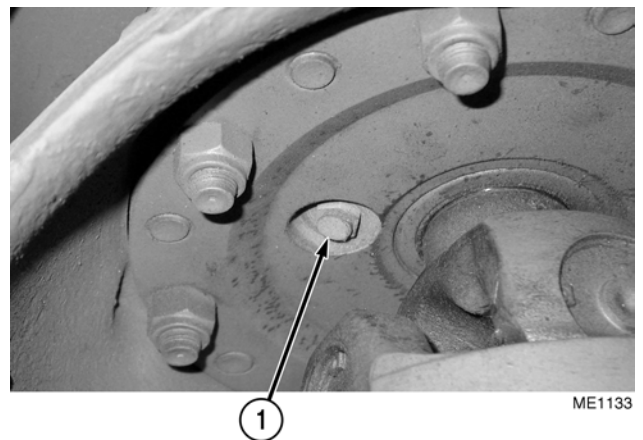
Unscrew breather cap (1) and remove cap.

**b. Installation.**

Install breather cap (1). Tighten.

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).



**END OF TASK**



## CHAPTER 15

### PNEUMATIC SYSTEM

Contents	Para	Page
General. . . . .	15-1	15-1
Vehicle Preparation and Isolation. . . . .	15-2	15-1
Restore IHMEE to Operational Readiness. . . . .	15-3	15-2
Draining Air System. . . . .	15-4	15-2
Air Valve Replacement. . . . .	15-5	15-4
Air Tank Replacement. . . . .	15-6	15-5
Brake Control Valve Replacement. . . . .	15-7	15-10
Air Line Replacement. . . . .	15-8	15-12
Air Governor Replacement. . . . .	15-9	15-13
Air Compressor Replacement. . . . .	15-10	15-15
Air Drier Replacement. . . . .	15-11	15-16
Air Drier Desiccant Replacement. . . . .	15-12	15-18

**15-1. GENERAL.**

**a. *Pneumatic System.*** This section identifies the components associated with the pneumatic system. There are no routine maintenance activities (other than visual inspection) detailed for the following components:

**NOTE**

The components listed below are of such a physical nature that maintenance requirements consist only of periodic visual inspection by the operator or maintenance personnel. If one of these components malfunctions or is determined to be defective, refer to repair or installation procedures detailed in the relevant manufacturer’s maintenance manuals.

- Air compressor
- Governor

**b. *Components.*** Procedures for other components that do require maintenance are included in this chapter. These components include:

- Air tanks
- Air drier
- Air drier desiccant

**15-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, complete the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**15-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority

**15-4. DRAINING AIR SYSTEM.**

This Task Covers:

- |             |               |                          |
|-------------|---------------|--------------------------|
| a. Draining | b. Inspection | c. Follow-On Maintenance |
|-------------|---------------|--------------------------|

**INITIAL SETUP**

<i>Test Equipment</i>	<i>Equipment Condition</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Special Tools</i>		
Pan, drain, Item 29, Appendix B	TM 5-2420-230-10	Parking brake applied.
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Engine shut OFF.
	TM 5-2420-230-10	Electrical master switch OFF.
<i>Materials/Supplies</i>	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
Soap solution, Item 56, Appendix C		
<i>Personnel Required</i>	<i>Drawings Required</i>	
MOS 62B, Construction Equipment Repairer	None	
<i>References</i>	<i>Estimated Time to Complete Task</i>	
FO-5, Pneumatic schematic	0.3 hr.	

**a. Draining.**

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**NOTE**

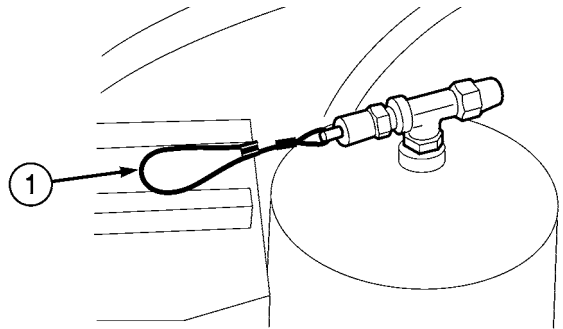
All pneumatic tanks have a drain valve supplied with a pull cable of type used to drain the system.

- (1) To drain the system, pull on seven release air tank cables (1) until all air has been released.

**NOTE**

Excessive moisture indicates a defective air drier, which must be replaced as soon as possible (Para 15-11).

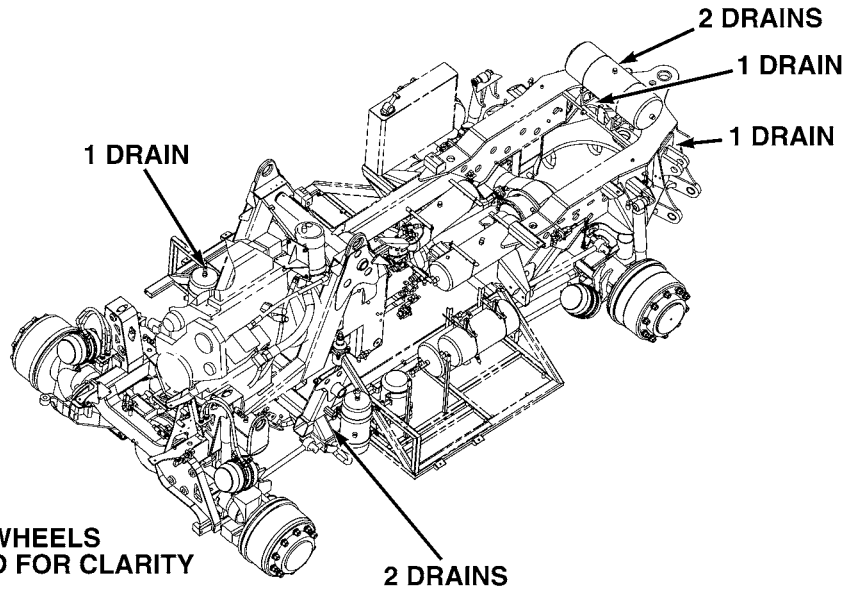
- (2) Place drain pan under air tanks when air is being drained. Inspect drain pan for moisture.



**TYPICAL AIR TANK  
DRAIN RELEASE CABLE**

ME2246

**b. Inspection.**



**BODY, CAB, AND WHEELS  
SHOWN REMOVED FOR CLARITY**

ME2247

- (1) Examination of air tanks requires removal of belly plates (TM 5-2420-230-10) to gain access and visually inspect air tanks for the following:
  - Damage, loose fittings, and mountings
  - Air leaks; use leak-detecting liquid
  - Corrosion

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>15-5. AIR VALVE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> FO-5, Pneumatic schematic	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i>	
<i>Materials/Parts</i> Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Belly plates removed (if required).
	Para 15-4	Air system drained.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 125	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

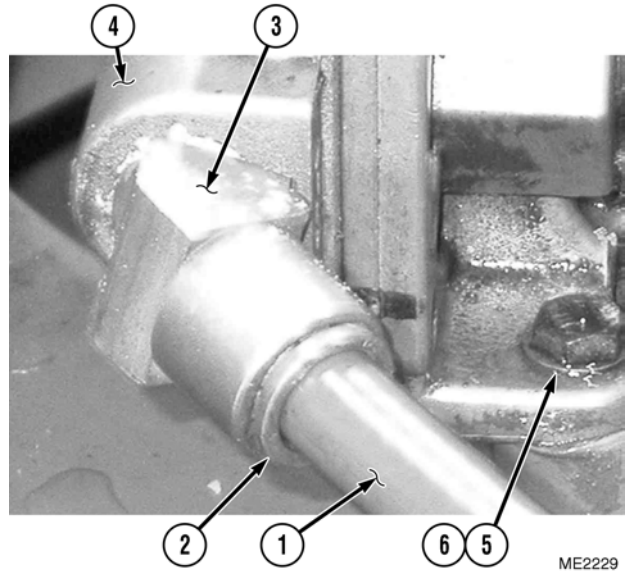


Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**NOTE**

- All air valves are removed and installed in the same manner.
- Remove cable ties as necessary.
- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes and fittings upon removal.

- (1) Remove air lines (1) by pushing in on brass coupling (2) and pulling air line at the same time.
- (2) Remove fitting (3) from air valve (4).
- (3) Remove bolts (5) and washers (6) from air valve (4).



**b. Installation.**

- (1) Position air valve (4) and install washers (6) and bolts (5).
- (2) Install fittings (3) on air valve (4).
- (3) Install air lines (1) by pushing in on brass coupling (2) and air lines at the same time.

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test appropriate pneumatic systems (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Install belly plates, if required (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>15-6. AIR TANK REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> TM or Para TM 5-2420-230-10	<i>Condition Description</i> Belly plates removed, as needed.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	Para 15-4 Para 15-8	Air system drained. Air lines removed.
<i>Materials/Parts</i> Nut, self-locking, Item 104, Appendix D (4) Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P TM 5-2420-230-24P	Figure 126 Figure 127 Figure 128 Figure 129 Figure 130 Figure 131
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	
<i>References</i> None		

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**a. Removal.**

**NOTE**

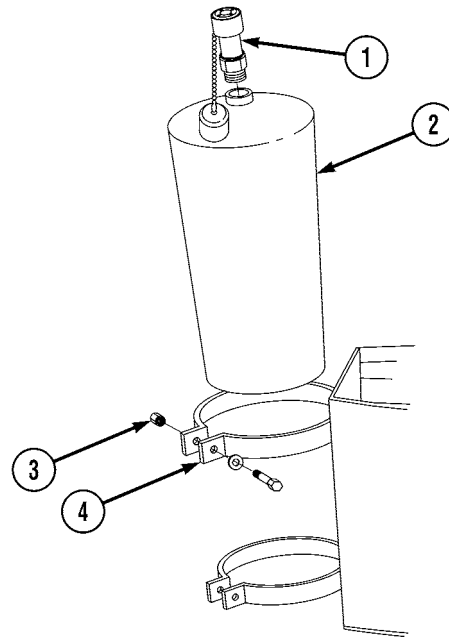
- Remove cable ties as necessary.
- Tag all hoses, wires, and tubes and note their positions before removal.

(1) Air tank (9.7L).

**NOTE**

Both left and right air lines are removed in the same manner.

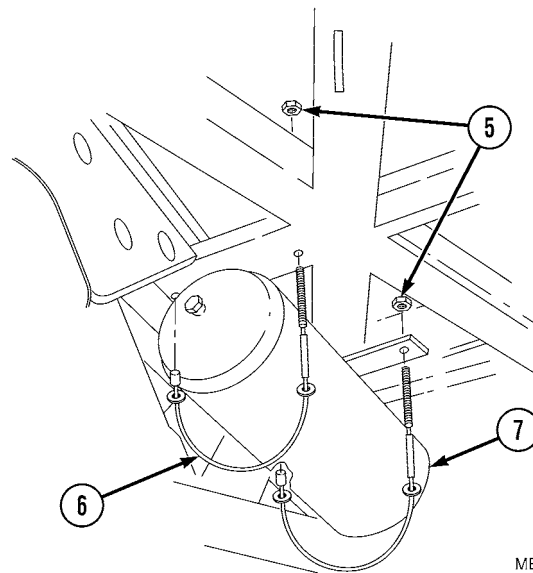
- (a) Remove quick accessories coupling (1) from left-hand air tank (2).
- (b) Remove two self-locking nuts (3). Discard self-locking nuts.
- (c) Remove air tank (2) from two air tank clamps (4).
- (d) Remove fitting, if required.



ME2228

(2) Air tank (13.8L) or (20L).

- (a) Disconnect air lines from air tank (7).
- (b) Remove two self-locking nuts (5). Discard self-locking nuts.
- (c) Remove two air tank cables (6).
- (d) Remove air tank (7).
- (e) Remove fitting, if required.

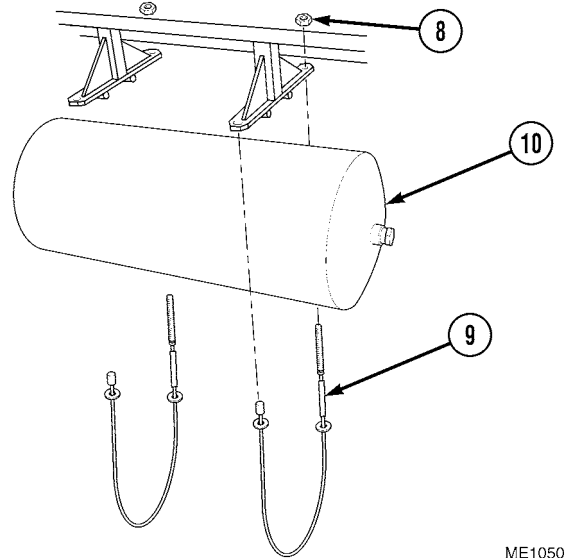


ME1049



(3) Air tank (16.8L).

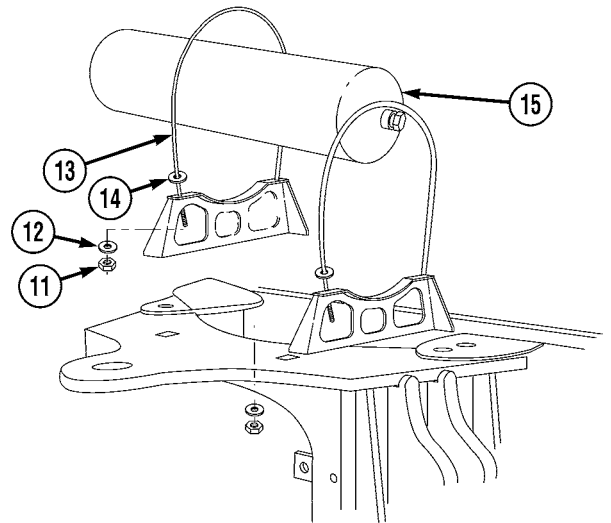
- (a) Disconnect air lines from air tank (10).
- (b) Remove two self-locking nuts (8). Discard self-locking nuts.
- (c) Remove two air tank cables (9).
- (d) Remove air tank (10).
- (e) Remove fitting, if required.



ME1050

(4) Air tank (28L).

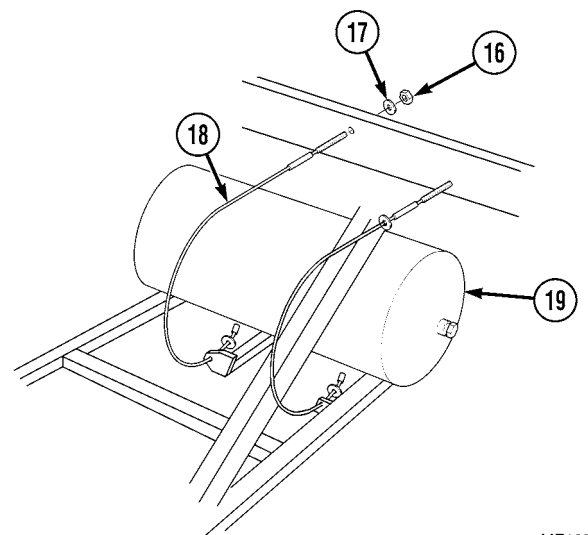
- (a) Disconnect air lines from air tank (15).
- (b) Remove two self-locking nuts (11) and washers (12).
- (c) Remove two air tank cables (13) and washers (14).
- (d) Remove air tank (15).
- (e) Remove fitting, if required.



ME1051

(5) Air tank (28L).

- (a) Disconnect air lines from air tank (19).
- (b) Remove clamps as necessary.
- (c) Remove two self-locking nuts (16) and washers (17). Discard self-locking nuts.
- (d) Remove two air tank cables (18).
- (e) Remove air tank (19).



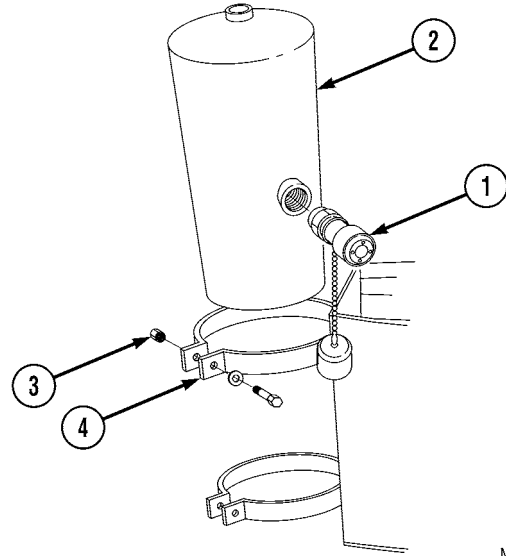
ME1052

**b. Installation.**

**NOTE**

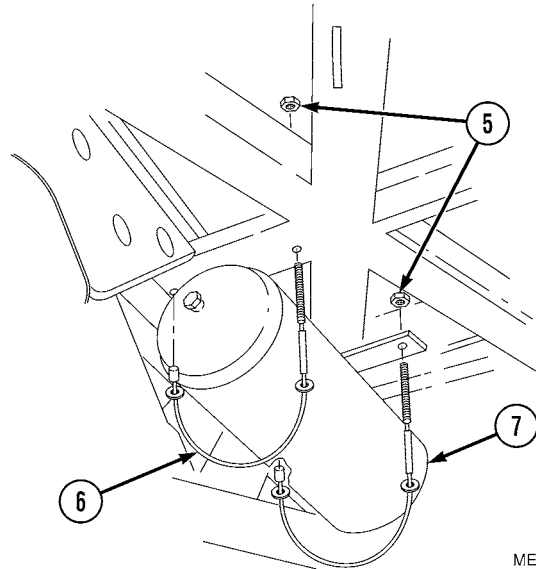
Left and right air tanks are installed in the same manner.

- (1) Air tank (9.7L).
  - (a) Install fittings, if required.
  - (b) Position air tank (2) into air tank clamps (4).
  - (c) Install quick accessories coupling (1) to air tank (2).
  - (d) Tighten two new self-locking nuts (3).



ME1048

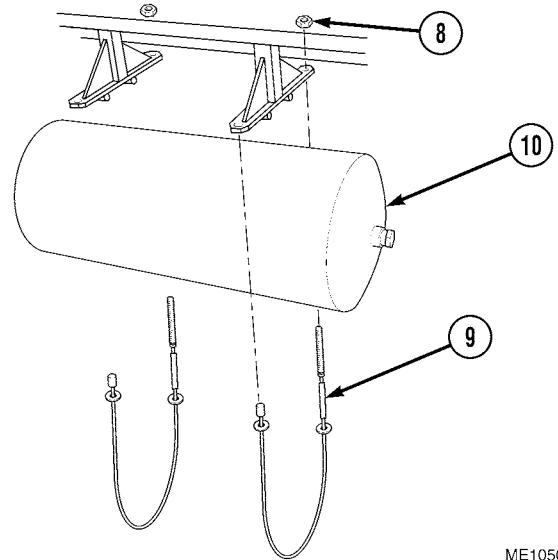
- (2) Air tank (13.8L) or (20L).
  - (a) Install fittings, if required.
  - (b) Position air tank (7).
  - (c) Install two air tank cables (6).
  - (d) Install two new self-locking nuts (5).
  - (e) Install air lines onto air tank (7).



ME1049

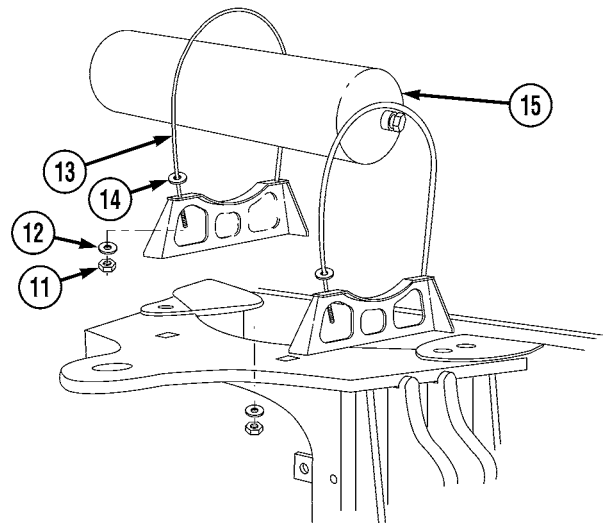
(3) Air tank (16.8L).

- (a) Install fittings, if required.
- (b) Position air tank (10).
- (c) Install two air tank cables (9).
- (d) Install four new self-locking nuts (8).
- (e) Install air lines onto air tank (10).



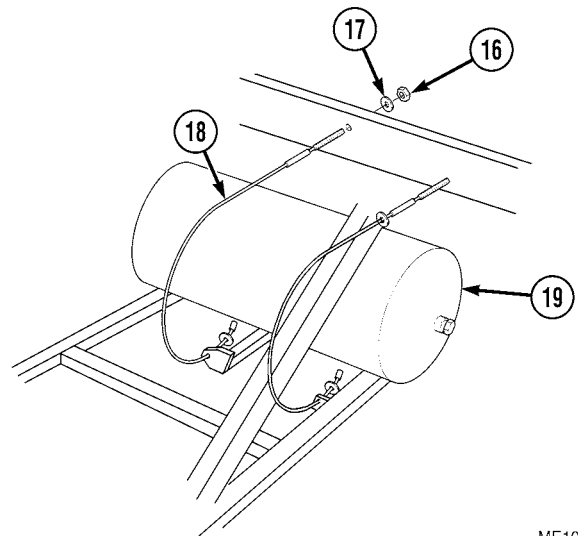
(4) Air tank (28L).

- (a) Install fittings, if required.
- (b) Position air tank (15).
- (c) Install two air tank cables (13) and washers (14).
- (d) Install four new self-locking nuts (11) and washers (12).
- (e) Install air lines onto air tank (15).



(5) Air tank (28L).

- (a) Install fittings, if required.
- (b) Position air tank (19).
- (c) Install two air tank cables (18).
- (d) Install four new self-locking nuts (16) and washers (17).
- (e) Install clamps as necessary.
- (f) Install air lines onto air tank (19).



**c. Follow-On Maintenance.**

- (1) Replace air lines (Para 15-8).
- (2) Start engine and functionally test appropriate pneumatic systems.
- (3) Check for air leaks.
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Install belly plates, as needed (TM 5-2420-230-10).

**END OF TASK**

<b>15-7. BRAKE CONTROL VALVE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> Para 15-4	
	<i>Condition Description</i> Air system drained.	
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 125	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**WARNING**

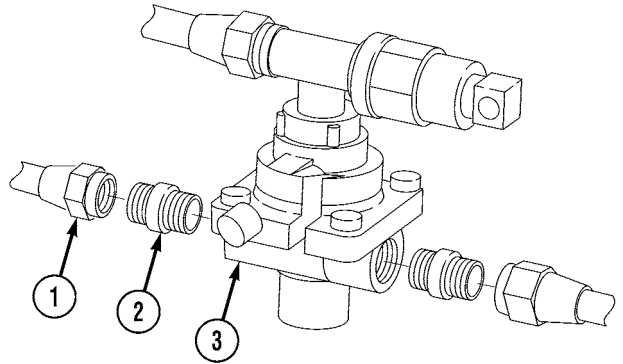
Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**a. Removal.**

**NOTE**

- All control valves are removed and installed in the same manner.
- Remove cable ties as necessary.
- Tag all hoses and tubes and note their positions before removal.

- (1) Remove air lines (1) from fittings (2).
- (2) Remove fittings (2) from control valve (3).
- (3) Remove control valve (3).



ME1045

**b. Installation.**

- (1) Install control valve (3).
- (2) Install fittings (2) in control valve (3).
- (3) Install air lines (1) on fittings (2).

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test appropriate pneumatic systems.
- (2) Check for air leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**15-8. AIR LINE REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP***Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

Cap and plug set, Item 4, Appendix C

Tags, identification, Item 63, Appendix C

Ties, cable, Item 68, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

FO-5, Pneumatic schematic

*Equipment Conditions**TM or Para*

Para 15-4

TM 5-2420-230-10

*Condition Description*

Air system drained.

Belly plates removed, as needed.

*Drawings Required*

TM 5-2420-230-24P Figure 125

*Estimated Time to Complete Task*

Approximately 0.5 hr.

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**a. Removal.****NOTE**

- All air lines, both ends are removed and installed in the same manner.
- Remove cable ties as necessary.
- Tag all hoses and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.

Remove air lines (1) by pushing in on brass coupling (2) and pulling air line at the same time.

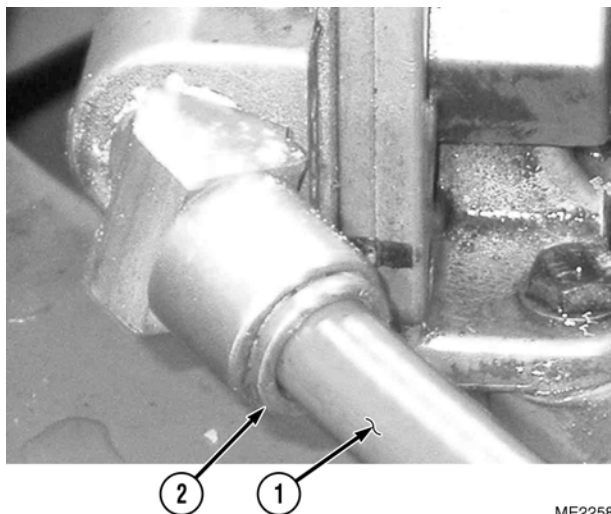
**b. Installation.****NOTE**

Install cable ties as needed.

Install air lines (1) by pushing in on brass coupling (2) and air lines at the same time.

**c. Follow-On Maintenance.**

- (1) Start engine and functionally test appropriate pneumatic systems.
- (2) Check for air leaks.
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Install belly plates, if required (TM 5-2420-230-10).



ME2258

**END OF TASK**

**15-9. AIR GOVERNOR REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Follow-On Maintenance
- c. Installation
- d. Adjustment

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Condition*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Hood raised.
TM 5-2420-230-10	FEL raised and maintenance arm installed.
Para 15-4	Air system drained.

*Materials/Supplies*  
Cap and plug set, Item 4, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 123

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

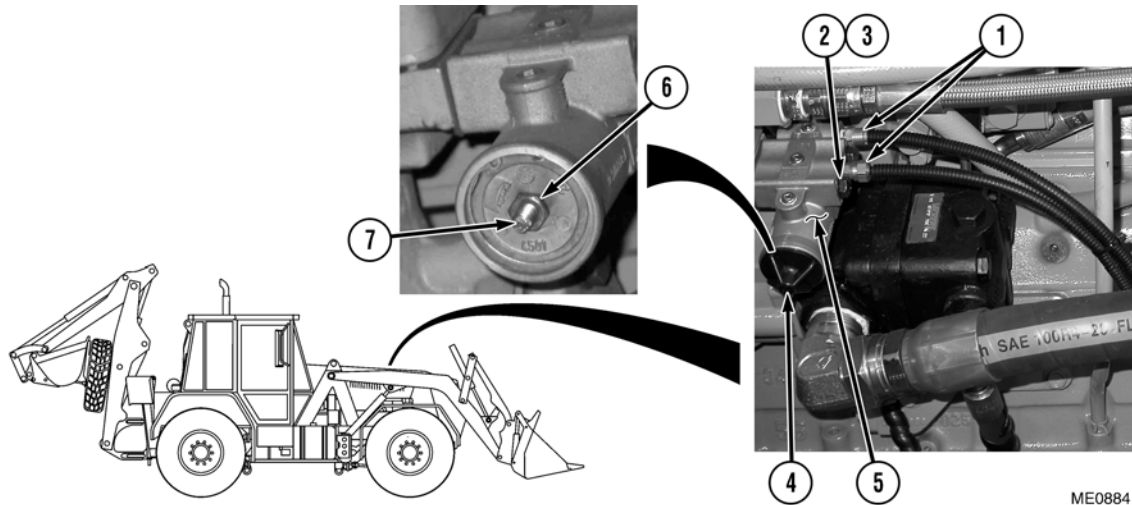
**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**a. Removal.**

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
- Remove cable ties as necessary.
- Cap and plug all tubes, hoses, and fittings upon removal.



- (1) Remove two air line fittings (1).
- (2) Remove two bolts (2), washers (3), and air governor (5).

**b. Installation.**

- (1) Install air governor (5) with two washers (2) and bolts (1). Tighten bolts.
- (2) Install two air line fittings (3).

**c. Adjustment.**

- (1) Unscrew cap (4) from air governor (5).
- (2) Loosen jam nut (6).

**NOTE**

- One complete turn will change adjustment approximately 15 psi (103 kPa).
  - Turning adjusting screw in will decrease air governor cutout air pressure.
  - Turning adjusting screw out will increase air governor cutout air pressure.
- (3) Adjust adjusting screw (7) until desired air governor cutout pressure is obtained.
  - (4) Holding adjusting screw (7), tighten jam nut (6) securely.
  - (5) Press and release brake to reduce air pressure to below 100 psi (690 kPa).
  - (6) Start engine (TM 5-2420-230-10).
  - (7) Observe air pressure when air governor (5) cuts out.
  - (8) Repeat Steps (2) through (7) until air governor cutout is approximately 120 - 125 psi (827 - 862 kPa).
  - (9) Shut OFF engine (TM 5-2420-230-10).
  - (10) Install cap (4).



**d. Follow-On Maintenance.**

- (1) Lower hood (TM 5-2420-230-10).
- (2) Lower FEL.
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

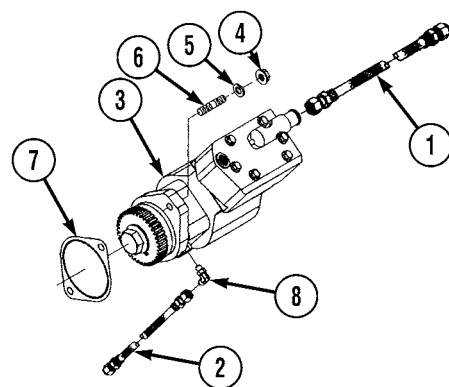
**END OF TASK**

<b>15-10. AIR COMPRESSOR REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> <i>Condition Description</i> Para 13-16      Left fender removed, if required. Para 15-9      Air governor removed. Para 5-8      Power steering pump removed.	
<i>Materials/Parts</i> Cap and plug set, Item 4, Appendix C Gasket, Item 70, Appendix D Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 122	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

**NOTE**

- Ensure all hoses are disconnected and clear before removal.
  - Tag all hoses and note their positions before removal.
  - Cap and plug all hoses and fittings upon removal.
  - Remove cable ties as necessary.
- (1) Remove air supply line (1).
  - (2) Remove oil supply line (2) at bottom of air compressor (3).
  - (3) Remove two nuts (4) and washers (5) from engine studs (6).
  - (4) Remove air compressor (3) and gasket (7). Discard gasket.
  - (5) Remove elbow (8), as necessary.



ME2190

**b. Installation.**

**NOTE**

- Ensure all hoses are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Ensure hoses are clean and contain no foreign matter.

- (1) Install elbow (8), if necessary.
- (2) Install new gasket (7) on air compressor (3).
- (3) Install air compressor (3) with two washers (5) and nuts (4) on engine studs (6). Torque nuts to 57 lbf/ft (77 N•m).
- (4) Install oil supply line (2) at bottom of air compressor (3).
- (5) Install air supply line (1).

**c. Follow-On Maintenance.**

- (1) Install power steering pump (Para 5-8).
- (2) Install air governor (Para 15-9).
- (2.1) Install left fender, if required (Para 13-16).
- (3) Start engine and functionally test pneumatic system (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

<b>15-11. AIR DRIER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Condition</i>	
<i>Materials/Supplies</i> Cap and plug set, Item 4, Appendix C Tags, identification, Item 63, Appendix C Ties, cable, Item 68, Appendix C	<i>TM or Para</i> Para 15-4 TM 5-2420-230-10	<i>Condition Description</i> Air system drained. Left front belly plate removed.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 132	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

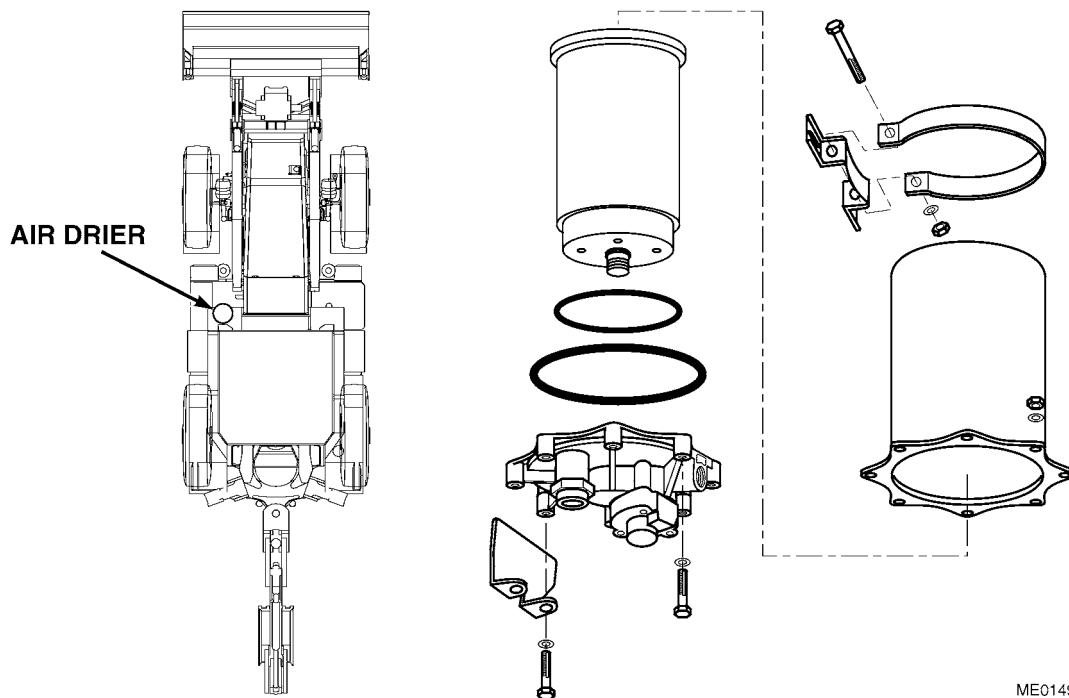
**a. Removal.**

**WARNING**

Ensure air pressure is drained to 0 psi (0 kPa) before taking off any air components. If pressure is not released, components could blow off and harm personnel. The IHMEE air system is pressurized to 119 psi (820 kPa). Do not drain air from a tank with any part of body in air spray path. Skin embolisms and/or debris in eyes can occur from released pressure. Failure to comply may result in injury or death to personnel.

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
  - Remove cable ties as necessary.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Loosen nut and bolt from upper strap.
  - (2) Support air drier assembly and remove two nuts, bolts, and washers from drier to mounting bracket.
  - (3) Remove air drier assembly from mounting bracket.



ME0149

**b. Installation.**

Steps in the installation of the air drier are the reverse of those in the removal procedure, with attention given to the following point:

Ensure pneumatic connections are correct and secure.

**c. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10).
- (2) Check air drier for leaks.

- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Install left front belly plate (TM 5-2420-230-10).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**15-12. AIR DRIER DESICCANT REPLACEMENT.**

This Task Covers:

- |            |                 |                          |
|------------|-----------------|--------------------------|
| a. Removal | b. Installation | c. Follow-On Maintenance |
|------------|-----------------|--------------------------|

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Condition*  

<i>TM or Para</i> Para 15-11	<i>Condition Description</i> Air drier removed.
---------------------------------	--

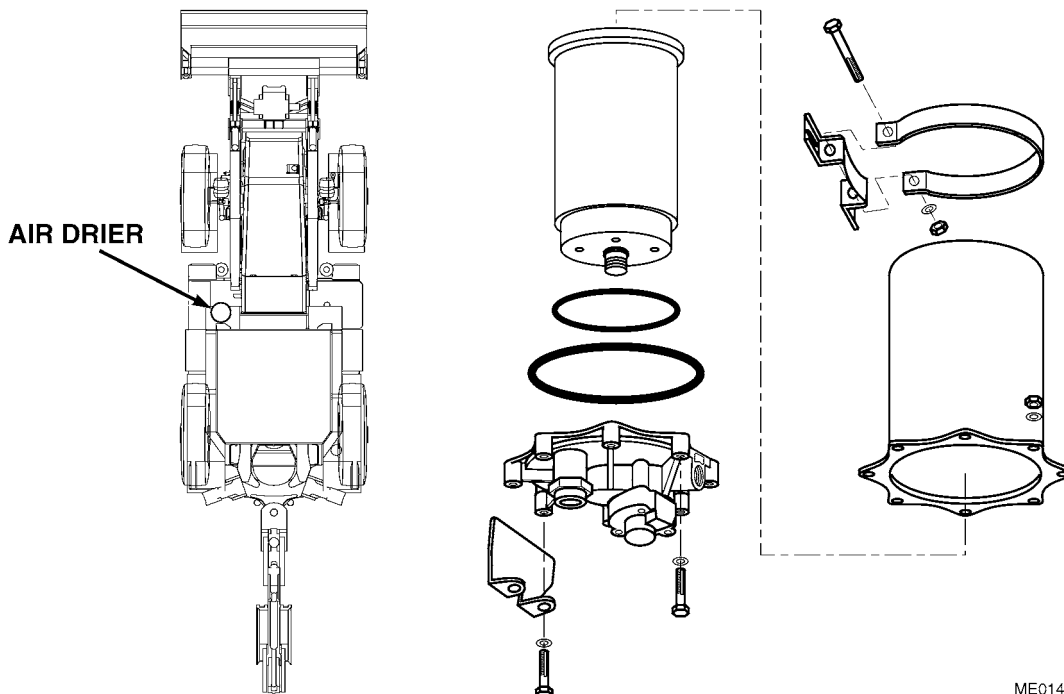
*Materials/Parts*  
Parts, kit, air drier, Item 168.1, Appendix D

*Drawings Required*  
TM 5-2420-230-24P Figure 132

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



ME0149

- (1) Remove remaining 6 nuts, bolts, and 12 special washers securing end cover to housing.
- (2) Remove end cover and O-ring. Discard O-ring.
- (3) Using a strap wrench, remove desiccant cartridge and O-ring. Discard O-ring and cartridge.

**b. Installation.**

Steps in installation of the desiccant cartridge are the reverse of those in the removal procedure, with attention given to the following points:

- (1) Install desiccant cartridge in accordance with instructions supplied with cartridge.
- (2) Thoroughly clean and inspect drier assembly and end cover for corrosion, pitting, and cracks. Replace any damaged components. Minor corrosion or pitting of exterior of components may be repaired.
- (3) Ensure all fittings are tightened in correct sequence.

**c. Follow-On Maintenance.**

Install air drier (Para 15-11).

**END OF TASK**



## CHAPTER 16

### BACKHOE

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	16-1	16-1
Vehicle Preparation and Isolation. . . . .	16-2	16-1
Restore IHMEE to Operational Readiness. . . . .	16-3	16-2
Stabilizer Arm Maintenance. . . . .	16-4	16-2
Tow Pintle Replacement. . . . .	16-5	16-5
Hitch Assembly Replacement. . . . .	16-6	16-6

**16-1. GENERAL.**



Hydraulic cleanliness is essential to the correct and safe operation of the backhoe. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

This section identifies backhoe components. There are no routine maintenance activities (other than visual inspection) detailed for the following components:

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>• Structure</li> <li>• Hydraulic cylinders</li> <li>• Pins</li> <li>• Hoses and pipelines</li> </ul> | <ul style="list-style-type: none"> <li>• Bucket</li> <li>• Valve block</li> <li>• Bushings</li> <li>• Load-holding valves on stabilizer arm cylinders</li> </ul> |
|---|--|

**16-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance functions on the backhoe of the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, complete the following steps:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).
- (7) Release hydraulic pressure (Para 10-5).

**16-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**16-4. STABILIZER ARM MAINTENANCE.**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Field, maintenance, basic, Item 23, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B  
Equipment, suitable lifting

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Stabilizer lowered.
Para 10-5	Hydraulic system pressure released.

*Materials/Parts*  
Grease, automotive and artillery, Item 30, Appendix C  
Grease, electrical, Item 32, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 164

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B



**a. Removal.**

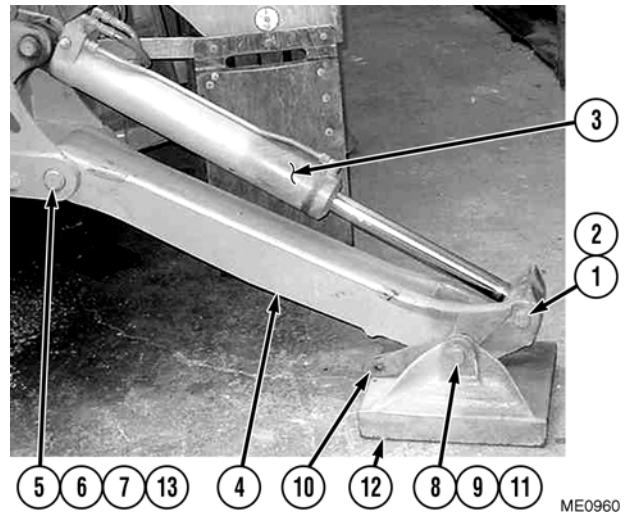
**WARNING**

- The stabilizer arms are heavy. To avoid personal injury, exercise extreme care when manually handling the stabilizer arms. Failure to comply may result in injury or death to personnel.
- Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

- (1) Remove circlip (1) and pin (2) from cylinder (3).
- (2) Attach suitable lifting device and sling to cylinder (3).
- (3) Using lifting device and sling, raise cylinder (3) and secure to cabin lifting eye.
- (4) Attach suitable lifting device and sling to stabilizer arm (4).
- (5) Using lifting device and sling, take weight off upper stabilizer pivot pin (5).
- (6) Remove two circlips (6), two washers (7), and upper stabilizer pivot pin (5) from stabilizer arm (4).
- (7) Using lifting device and sling, remove stabilizer arm (4).



**b. Disassembly.**

- (1) Remove two circlips (8), lower pivot pin (9), safety bracket (10), and two washers (11) from stabilizer arm (4) and foot plate (12).
- (2) If required, remove bushings (13) from upper pivot on stabilizer arm (Para 17-6).

**c. Assembly.**

- (1) If required, install bushings (13) in upper pivot on stabilizer arm (Para 17-6).

**NOTE**

Apply grease to pins before installing.

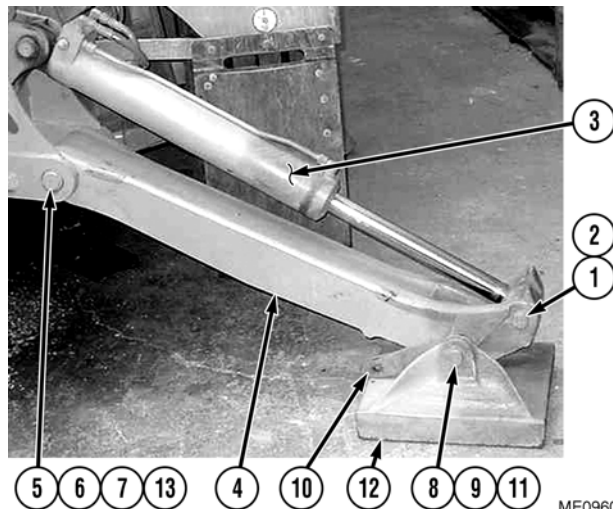
- (2) Install foot plate (12) and safety bracket (10) onto stabilizer arm (4) using lower pivot pin (9), two circlips (8), and washers (11).

**d. Installation.**

**WARNING**

The stabilizer arms are heavy. To avoid personal injury, exercise extreme care when manually handling the stabilizer arms. Failure to comply may result in injury or death to personnel.

- (1) Using lifting device and sling, position stabilizer arm (4).
- (2) Install stabilizer arm (4) onto vehicle using upper stabilizer pivot pin (5), two circlips (6), and washers (7).
- (3) Remove lifting device and sling from stabilizer arm (4).
- (4) Attach suitable lifting device and sling to cylinder (3).
- (5) Using lifting device and sling, lower cylinder (3) into position.



**WARNING**

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

- (6) Install cylinder (3) with pin (2) and circlip (1).

**e. Follow-On Maintenance.**

- (1) Raise stabilizer arm (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

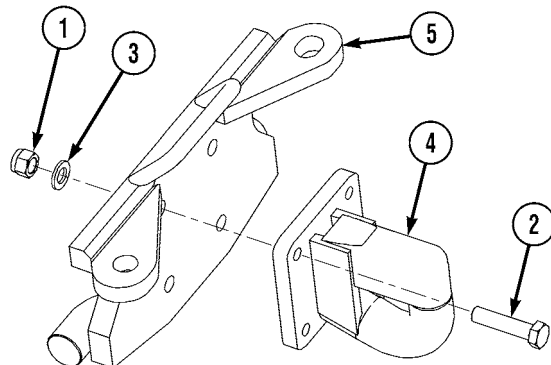
<b>16-5. TOW PINTLE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10	Parking brake applied.
	TM 5-2420-230-10	Engine shut OFF.
<i>Materials/Parts</i> Nut, self-locking, Item 113, Appendix D (4)	TM 5-2420-230-10	Electrical master switch OFF.
	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	TM 5-2420-230-10	Tow hitch removed.
<i>References</i> None	<i>Drawings Required</i> TM 5-2420-230-24P	Figure 175
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

- (1) Remove four self-locking nuts (1), bolts (2), and washers (3) from tow pintle (4). Discard self-locking nuts.
- (2) Remove tow pintle (4) from tow hitch (5).

**b. Installation.**

Install tow pintle (4) onto tow hitch (5) with four bolts (2), washers (3), and new self-locking nuts (1).



ME2209

**c. Follow-On Maintenance.**

- (1) Install tow hitch (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**16-6. HITCH ASSEMBLY REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Equipment Conditions*

TM or Para

*Condition Description*

Vehicle positioned on level ground.

*Tools and Special Tools*

- Field, maintenance, basic, Item 23, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Equipment, suitable lifting

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

TM 5-2420-230-10

Electrical master switch OFF.

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

*Materials/Parts*

- Grease, automotive and artillery, Item 30, Appendix C
- Nut, self-locking, Item 113, Appendix D
- Washer, lock, Item 283, Appendix D

TM 5-2420-230-10

Tow hitch removed.

*Drawings Required*

TM 5-2420-230-24P Figure 175

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*References*

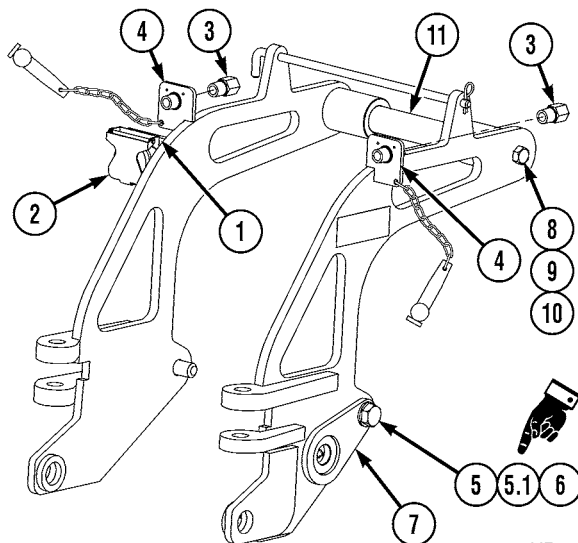
None

**a. Removal.**

**WARNING**

Hitch assembly is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hitch assembly. Failure to comply may result in injury or death to personnel.

- (1) Remove four screws (1) from trailer electrical connector (2) and remove trailer electrical connector from hitch assembly.
- (2) Remove two hoses (3) from glad hands (4).
- (3) Attach suitable lifting device and sling to both sides of hitch assembly.
- (4) Remove two bolts (5), lockwashers (5.1), and washers (6) from two hitch pins (7). Discard lockwashers.
- (5) Remove hitch pins (7) from hitch assembly.
- (6) Remove bolt (8), washer (9), self-locking nut (10), and alignment pin (11) from hitch assembly. Discard self-locking nut.
- (7) Lift hitch assembly from backhoe.



ME2245

**b. Installation.**

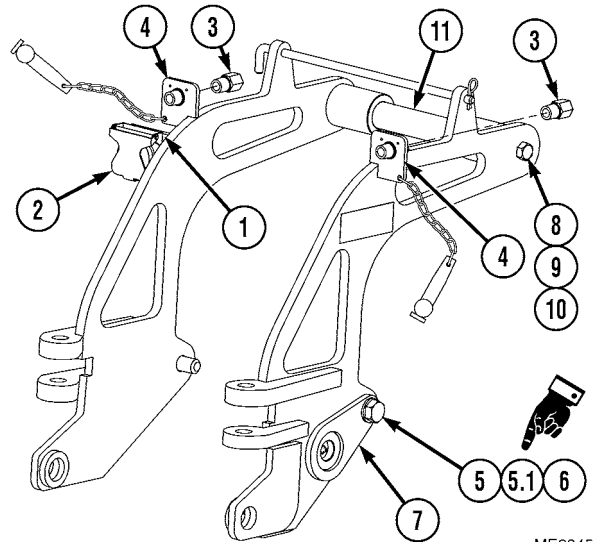
**WARNING**

Hitch assembly is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving hitch assembly. Failure to comply may result in injury or death to personnel.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

- (1) Attach suitable lifting device and sling to both sides of hitch assembly.
- (2) Use lifting device to position hitch assembly and install alignment pin (11), bolt (8), washer (9), and new self-locking nut (10).
- (3) Install two hitch pins (7) with two bolts (5), new lockwashers (5.1), and washers (6).
- (4) Install two hoses (3) to glad hands (4).
- (5) Install trailer electrical connector (2) with four screws (1) to hitch assembly.



ME2245

**c. Follow-On Maintenance.**

- (1) Install tow hitch (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



## CHAPTER 17

### FRONT-END LOADER (FEL)

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	17-1	17-1
Vehicle Preparation and Isolation. . . . .	17-2	17-1
Restore IHMEE to Operational Readiness. . . . .	17-3	17-2
Front-End Loader (FEL) Arm Maintenance. . . . .	17-4	17-2
Cutting Edge Replacement. . . . .	17-5	17-12
General Bushing Replacement. . . . .	17-6	17-13
4-in-1 Bucket Repair. . . . .	17-7	17-15

**17-1. GENERAL.**



Hydraulic cleanliness is essential for the correct and safe operation of the FEL. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

This chapter contains procedures relating to the maintenance requirements of the Front-End Loader (FEL). Components covered within this section include:

- Valve block
- Pins and bushings
- FEL arms

**17-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to performing any maintenance activities on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, complete the following procedure:

- (1) Ensure vehicle is positioned on level ground (TM 5-2420-230-10).
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).
- (7) Release hydraulic pressure (Para 10-5).

**17-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch to ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

The components listed above are of such a physical nature that routine maintenance requirements consist simply of a visual inspection by the operator or maintenance personnel.

**17-4. FRONT-END LOADER (FEL) ARM MAINTENANCE.**

This Task Covers:

- |             |                 |                          |
|-------------|-----------------|--------------------------|
| a. Removal  | b. Disassembly  | c. Inspection            |
| d. Assembly | e. Installation | f. Follow-On Maintenance |

**INITIAL SETUP**

*Test Equipment*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*

- Adapter, pivot pin, Item 1, Appendix B
- Field maintenance, basic, Item 23, Appendix B
- Pan, drain, Item 29, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Equipment, suitable lifting

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	4-in-1 bucket removed.
TM 5-2420-230-10	Engine access panel removed.
Para 10-5	Hydraulic pressure released.
Para 13-19	Engine hood removed.
Para 12-36	FEL arm potentiometer removed.
Para 10-29	Hose reel assembly removed.

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Dunnage, suitable
- Grease, automotive and artillery, Item 30, Appendix C
- Reflector, rectangular, amber, Item 181, Appendix D (2)
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 160

*Estimated Time to Complete*

Refer to MAC in Appendix B



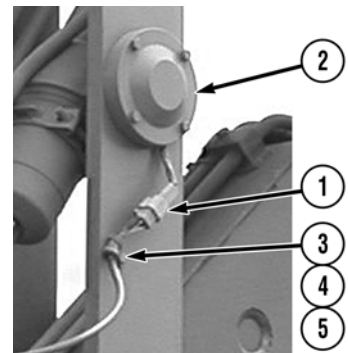
**a. Removal.**

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Left and right FEL arms are both removed the same. Left arm shown.
  - Tag all hoses, wires, and tubes and note their positions before removal.
  - Ensure all hoses, wires, and tubes are disconnected and clear before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
  - Place drain pan beneath hoses and tubes before disconnecting.
- (1) Disconnect two FEL hydraulic hoses located at upper rear of loader arm.
  - (2) Disconnect wiring (1) from tilt-position potentiometer (2), located at front of left loader arm.
  - (3) Remove bolt (3), washer (4), and cushion clamp (5).



ME0775

**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). To avoid personal injury, exercise extreme care when manually handling the FEL arms. Failure to comply may result in injury or death to personnel.

- (4) Attach suitable lifting device and sling to FEL arms.

**WARNING**

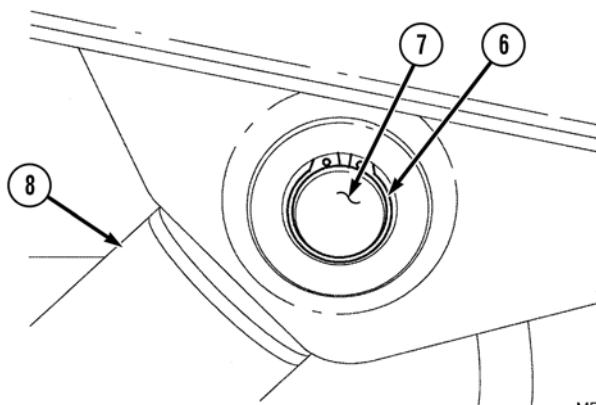
Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.



LIFTING POINTS

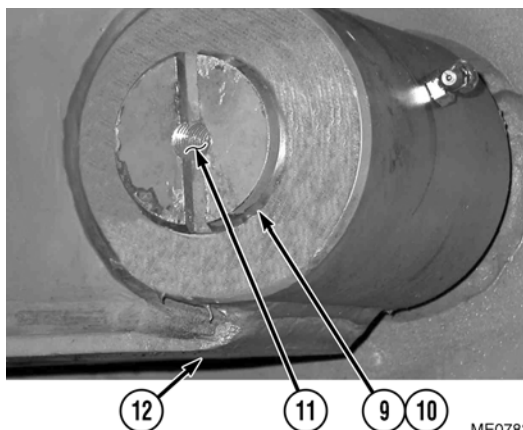
ME0977

- (5) Remove circlip (6) securing inside of upper pivot (7) on both FEL lift cylinders (8).



ME0094

- (6) Remove circlip (9) and washer (10) from rear pivot pin (11) on both FEL arms (12).

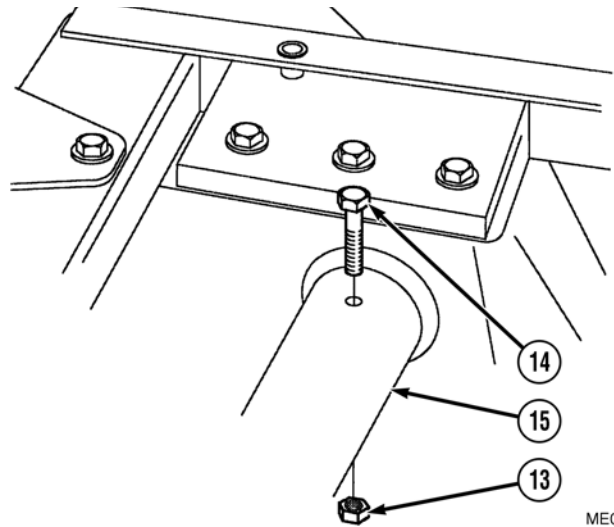


ME0783

- (7) Remove nut (13) and bolt (14) from each end of rear pivot pin housing (15).

**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). To avoid personal injury, exercise extreme care when manually handling the FEL arms. Failure to comply may result in injury or death to personnel.



ME0095

- (8) Using lifting device and sling, take weight off loader arm pivot pins.
- (9) Using a soft hammer, remove upper pivot pin (7) from FEL lift cylinder (8).
- (10) Secure FEL lift cylinder (8) to chassis with cable ties.
- (11) Attach 12-mm pivot pin adapter to rear pivot pin (11).
- (12) Using slide hammer, remove rear pivot pin (11).
- (13) Repeat Steps (9) through (12) on other side.
- (14) Use a lifting device and sling to remove FEL arm from vehicle and place on suitable dunnage.

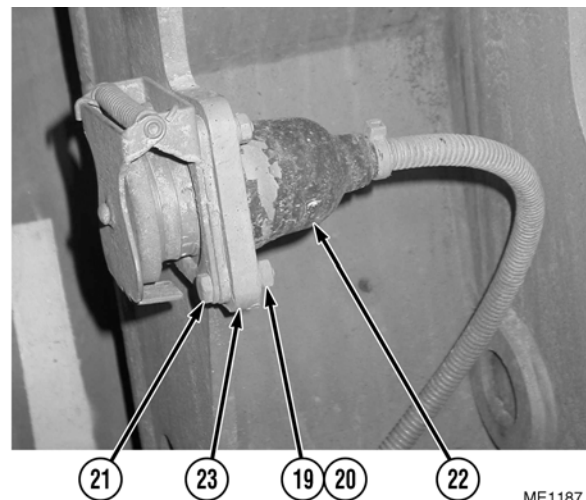
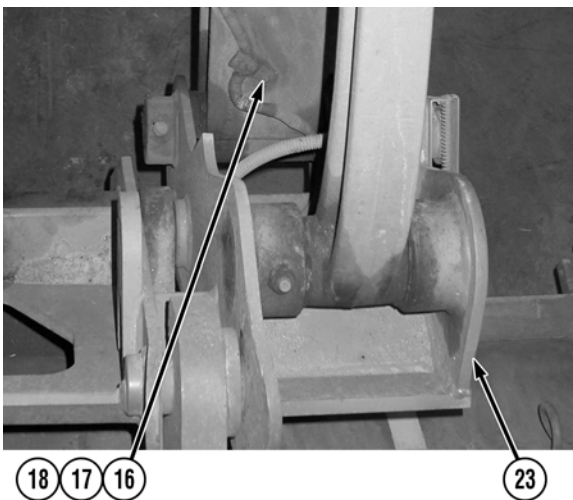
**b. Disassembly.**

**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). Ensure FEL arms are directly supported before disassembly. Failure to comply may result in serious injury or death to personnel.

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove clamps and cable ties as necessary.
- Ensure all hoses, wires, and tubes are disconnected and clear before removal.
- Place drain pan beneath hoses and tubes before disconnecting.



- (1) Remove bolt (16), washer (17), and cushion clamp (18) on each FEL arm.
- (2) Remove four nuts (19), washers (20), screws (21) and front light wire harness (22) on each side of quick-hitch assembly (23).
- (3) Remove both tilt cylinders (Para 10-23).

**WARNING**

Quick-hitch assembly is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving quick-hitch assembly. Failure to comply may result in injury or death to personnel.

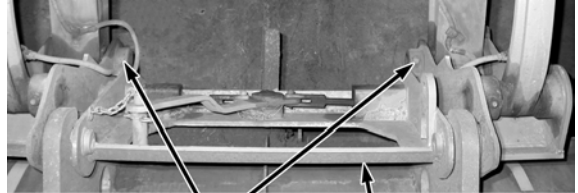
- (4) Attach lifting device and sling to quick-hitch assembly (23).

- (5) Remove both tilt linkages (Para 10-24).

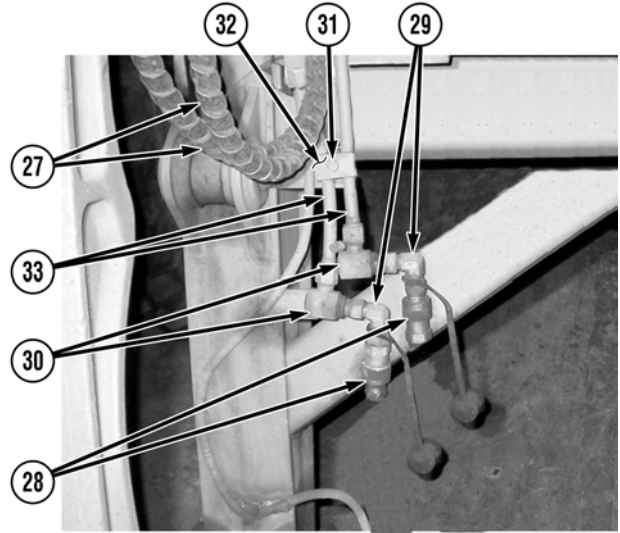
**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). Ensure FEL arms are directly supported before disassembly. Failure to comply may result in serious injury or death to personnel.

- (6) Remove two nuts (24), bolts (25), and pins (26).
- (7) Lift and remove quick-hitch assembly (23).
- (8) Remove two tilt cylinder hoses (27) on each side of FEL arm assembly.
- (9) Remove two quick-disconnect fittings (28), elbows (29), and swivel elbows (30).
- (10) Remove four bolts (31), clamps (32), and two tubes (33) from right FEL arm.

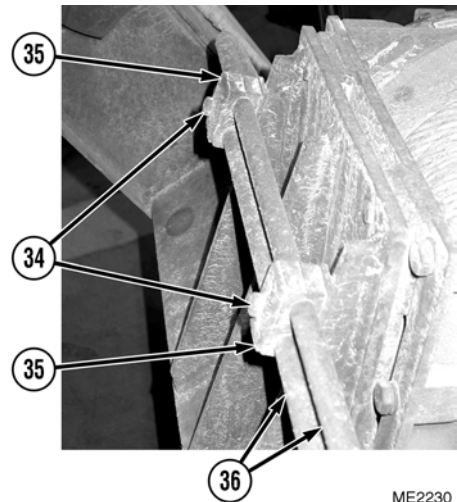


ME2231



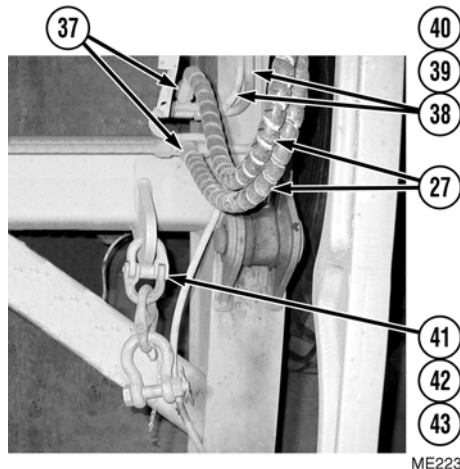
ME2233

- (11) Remove two bolts (34), clamps (35), and tubes (36) from winch mount.



ME2230

- (12) Remove two T-fittings (37).
- (13) Remove four bolts (38), clamps (39), and two tubes (40) from left FEL arm.
- (14) Remove pin (41), spacer (42), and locking clevis (43).



**c. Inspection.**

- (1) Inspect FEL arm assembly for damaged or broken welds.
- (2) Inspect pins and bushings for damage. Replace damaged pins or bushings (Para 17-6).
- (3) Ensure pins and bushings are adequately lubricated.

**d. Assembly.**

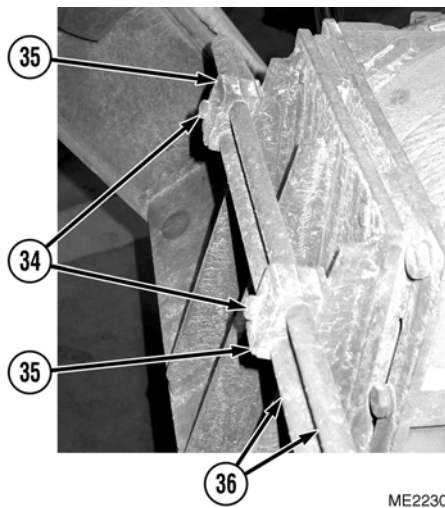
**WARNING**

FEL arm assembly weighs approximately 1,543 lb. (700 kg). Ensure FEL arms are directly supported before disassembly. Failure to comply may result in serious injury or death to personnel.

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install locking clevis (43) with spacer (42) and pin (41).
- (2) Install two tubes (40) on left FEL arm with four clamps (39) and bolts (38).
- (3) Install two T-fittings (37).
- (4) Install two tubes (36) on winch mount with two clamps (35) and bolts (34).

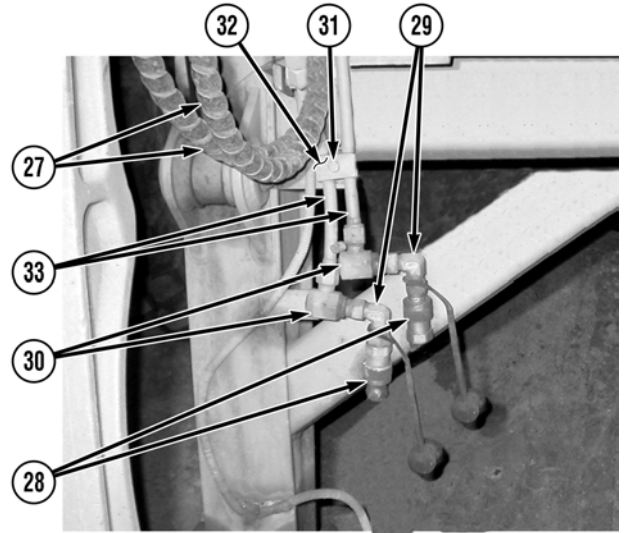


- (5) Install two tubes (33) on right FEL arm with four clamps (32) and bolts (31).
- (6) Install two swivel elbows (30), elbows (29), and quick-disconnect fittings (28).

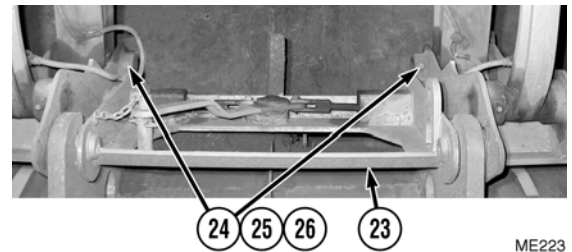
**WARNING**

Quick-hitch assembly is heavy. Use an appropriate lifting device and follow safe working procedures when lifting or moving quick-hitch assembly. Failure to comply may result in injury or death to personnel.

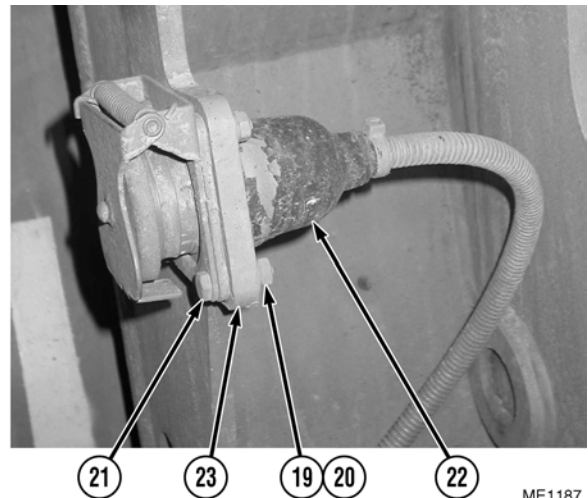
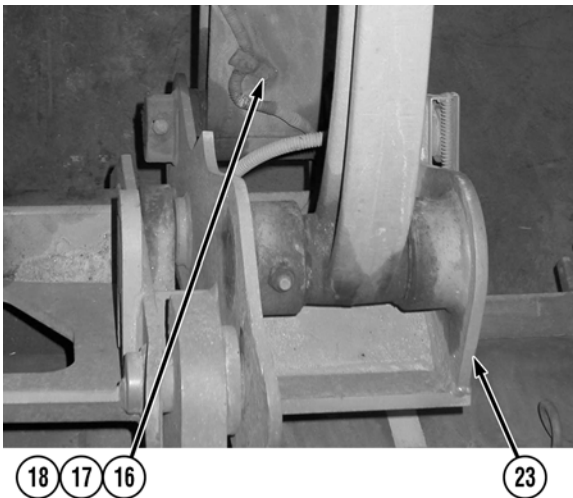
- (7) Attach lifting device and sling to quick-hitch assembly (23).
- (8) Use lifting device to position quick-hitch assembly (23) and install with two pins (26), bolts (25), and nuts (24).
- (9) Install both tilt linkages (Para 10-24).
- (10) Install both tilt cylinders (Para 10-23).
- (11) Install two tilt cylinder hoses (27) on each side of FEL arm assembly.



ME2233



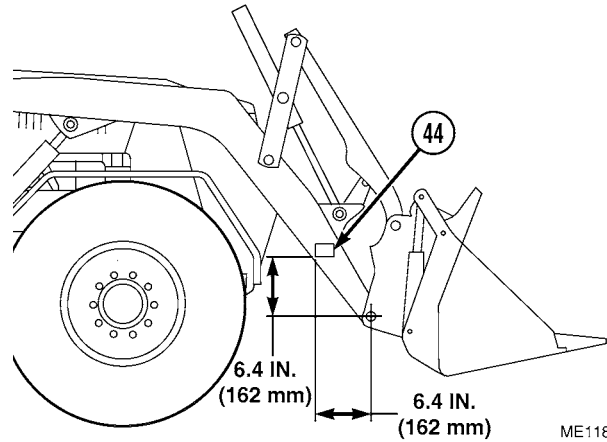
ME223



ME1187

- (12) Install front light wire harness (22) on each side of quick-hitch assembly (23) with four screws (21), washers (20), and nuts (19). Position cushion clamp (18) on front light wire harness (22) and install on FEL arm with washer (17) and bolt (16). Repeat for other FEL arm.

- (13) Apply self-adhesive reflector (44) to outside of each FEL arm as shown.
- (14) Apply stencils to loader arms as detailed in Stowage and Sign Guide (TM 5-2420-230-10).



ME1189

**e. Installation.**

**WARNING**

Loader arm assembly weighs approximately 1,543 lb. (700 kg). To avoid personal injury, exercise extreme care when manually handling the loader arms. Failure to comply may result in injury or death to personnel.

**CAUTION**

Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.

- (1) Attach suitable lifting device and sling to FEL arms.
- (2) Using lifting device and sling, align and install FEL arm assembly.

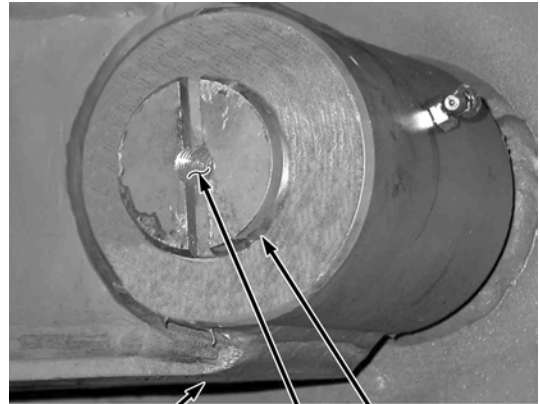


**LIFTING POINTS**

ME0977



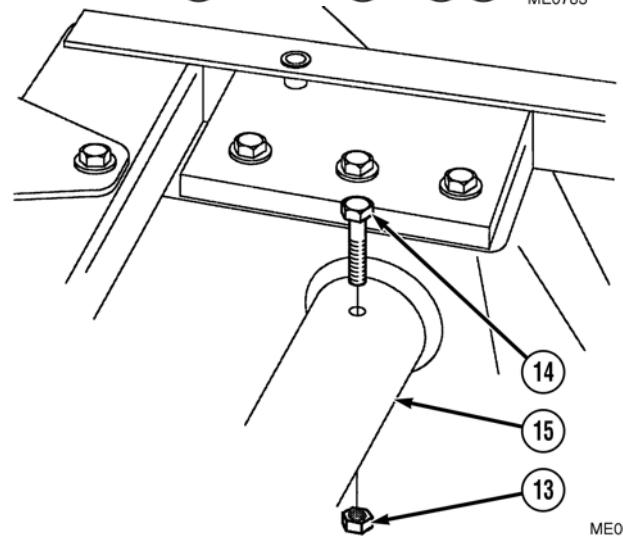
- (3) Install FEL arm rear pivot pins (11).



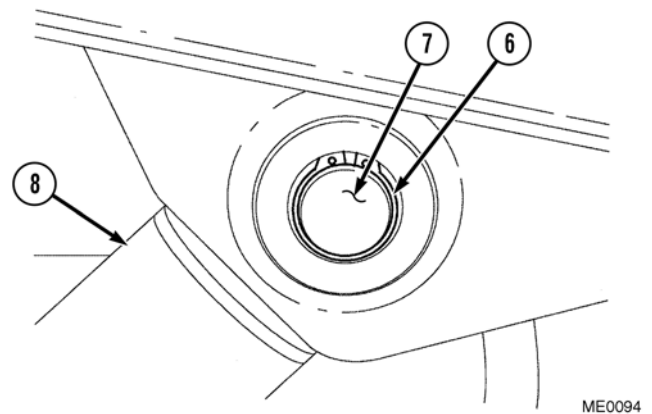
- (4) Install bolt (14) and nut (13) on each end of rear pivot pin housing (15).

**WARNING**

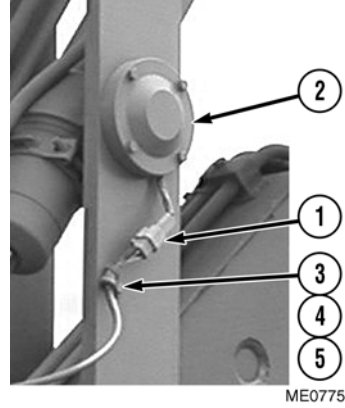
Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.



- (5) Install washer (10) and circlip (9) on rear pivot pin (11) for each FEL arm (12).
- (6) Remove cable ties securing FEL lift cylinder (8) to chassis.
- (7) Secure travel stop and lift cylinder (8) by aligning upper pivot pin (7) and travel stop.
- (8) Secure inside of upper pivot pin (7) to FEL lift cylinder (8) with circlip (6) on each side of vehicle.
- (9) Remove lifting device and sling.
- (10) Connect two FEL hydraulic hoses located on upper rear of FEL arm.



- (11) Connect wiring (1) for tilt-position potentiometer (2).
- (12) Position cushion clamp (5) on wire harness. Install cushion clamp (5) with washer (4) and bolt (3). Tighten bolt.



**f. Follow-On Maintenance.**

- (1) Install FEL arm potentiometer (Para 12-36).
- (2) Install engine hood (Para 13-19).
- (2.1) Install hose reel assembly (Para 10-29).
- (3) Start engine and check for leaks (TM 5-2420-230-10).
- (4) Functionally test FEL arms (TM 5-2420-230-10).
- (5) Shut OFF engine (TM 5-2420-230-10).
- (6) Install engine access panel (TM 5-2420-230-10).
- (7) Install 4-in-1 bucket (TM 5-2420-230-10).

**END OF TASK**

**17-5. CUTTING EDGE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Drawings Required*  
TM 5-2420-230-24P Figure 162

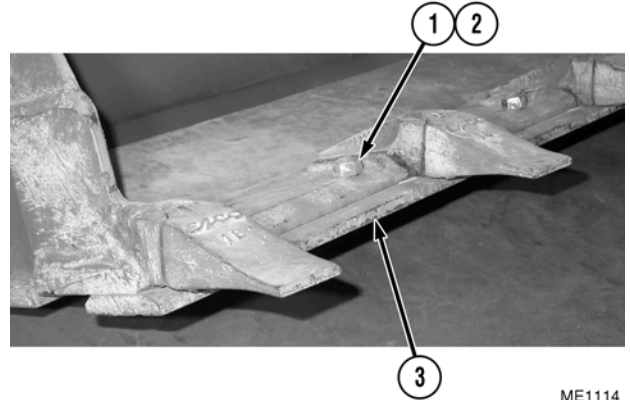
*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

The cutting edge is heavy. To avoid personal injury, exercise extreme care when manually handling the cutting edge. Failure to comply may result in injury to personnel.

Remove 10 nuts (1), bolts (2), and cutting edge (3).



ME1114

**b. Installation.**

Install cutting edge (3) with 10 bolts (2) and nuts (1).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>17-6. GENERAL BUSHING REPLACEMENT.</b>															
This Task Covers:															
a. Removal	b. Inspection														
d. Follow-On Maintenance	c. Installation														
<b>INITIAL SETUP</b>															
<i>Test Equipment</i> None	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)														
<i>Tools and Special Tools</i> Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>References</i> None														
<i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C Grease, electrical, Item 32, Appendix C Solvent, degreasing, Item 58, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 153 TM 5-2420-230-24P Figure 154 TM 5-2420-230-24P Figure 155 TM 5-2420-230-24P Figure 160 TM 5-2420-230-24P Figure 161 TM 5-2420-230-24P Figure 162 TM 5-2420-230-24P Figure 164 TM 5-2420-230-24P Figure 166 TM 5-2420-230-24P Figure 168 TM 5-2420-230-24P Figure 172														
<i>Equipment Conditions</i>	<i>Estimated Time to Complete</i> Refer to MAC in Appendix B														
<table border="0"> <thead> <tr> <th><i>TM or Para</i></th> <th><i>Condition Description</i></th> </tr> </thead> <tbody> <tr> <td>TM 5-2420-230-10</td> <td>Vehicle positioned on level ground.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Parking brake applied.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Engine shut OFF.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Electrical master switch OFF.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>“Do Not Operate” tag attached to ignition switch.</td> </tr> <tr> <td></td> <td>Component removed as required.</td> </tr> </tbody> </table>	<i>TM or Para</i>	<i>Condition Description</i>	TM 5-2420-230-10	Vehicle positioned on level ground.	TM 5-2420-230-10	Parking brake applied.	TM 5-2420-230-10	Engine shut OFF.	TM 5-2420-230-10	Electrical master switch OFF.	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.		Component removed as required.	
<i>TM or Para</i>	<i>Condition Description</i>														
TM 5-2420-230-10	Vehicle positioned on level ground.														
TM 5-2420-230-10	Parking brake applied.														
TM 5-2420-230-10	Engine shut OFF.														
TM 5-2420-230-10	Electrical master switch OFF.														
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.														
	Component removed as required.														

**a. Removal.****WARNING**

To avoid personal injury, prior to removing a bushing, ensure component is adequately supported. Failure to comply may result in injury or death to personnel.

- (1) Ensure component is adequately supported.
- (2) Using appropriate removal tool, remove bushing.

**b. Inspection.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

- (1) Clean area to be inspected with degreasing solvent and a clean cloth.
- (2) Inspect area for damage, corrosion, and looseness.
- (3) Ensure bushing is adequately lubricated.
- (4) Repair or replace as necessary.

**c. Installation.**

- (1) Inspect housing for damage.

**WARNING**

To prevent injury, always replace bushings with authorized parts only. Failure to comply may result in injury or death to personnel.

- (2) Ensure replacement bushing is the correct item.
- (3) Using appropriate tool, install bushing.

**d. Follow-On Maintenance.**

- (1) Install appropriate component.
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**17-7. 4-IN-1 BUCKET REPAIR.**

This Task Covers:

- a. Disassembly    b. Assembly    c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Field maintenance, basic, Item 23, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B  
Equipment, suitable lifting

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	4-in-1 bucket removed.
TM 5-2420-230-10	Bucket teeth removed.
TM 5-2420-230-10	Ripper teeth removed (if required).
Para 17-5	Cutting edge removed.
Para 10-25	4-in-1 bucket cylinder removed.

*Materials/Parts*  
Bushing, Item 27, Appendix D (2)  
Bushing, Item 28, Appendix D (2)  
Dunnage, suitable  
Grease, automotive and artillery, GAA, Item 30, Appendix C  
Grease, electrical, Item 32, Appendix C  
Nut, self-locking, Item 112, Appendix D (2)  
Nut, self-locking, Item 115, Appendix D (5)

*Drawings Required*  
TM 5-2420-230-24P Figure 162

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

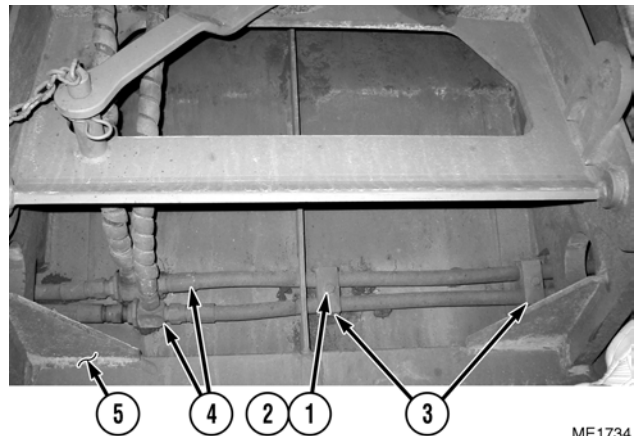
*Personnel Required*  
MOS 62B, Construction Equipment Repairer

**a. Disassembly.**

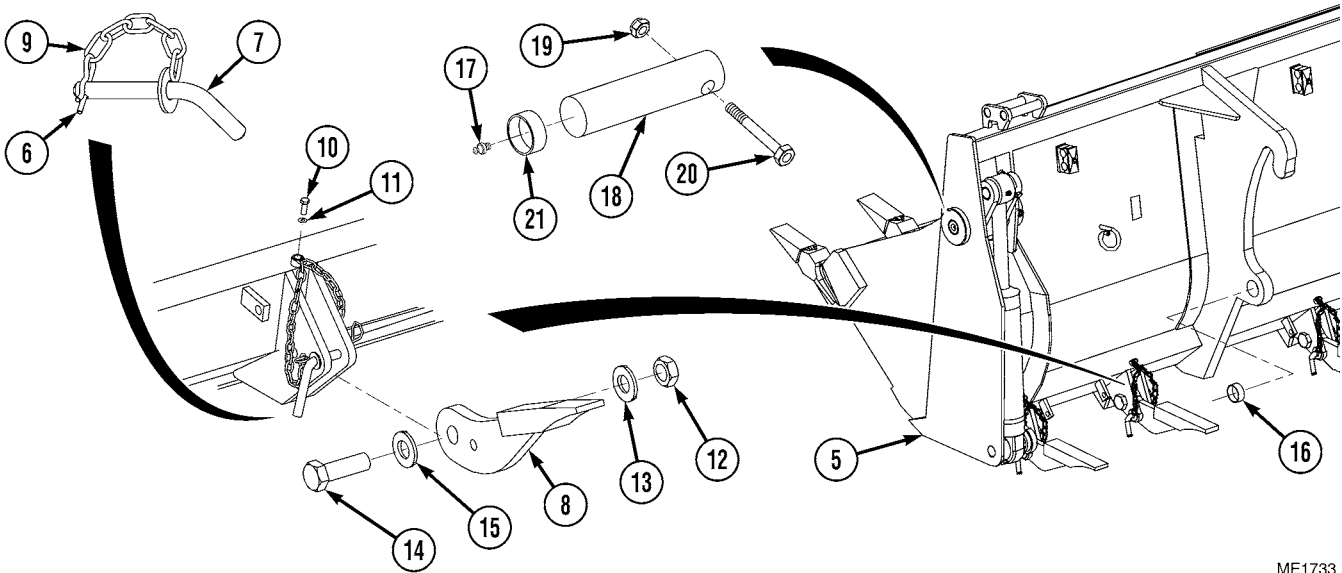
**WARNING**

Ensure that the bucket is directly supported before assembly/disassembly. Failure to comply may result in serious injury or death to personnel.

- (1) Remove four bolts (1), washers (2), clamps (3), and two hose assemblies (4) from bucket (5).



ME1734



ME1733

- (2) Remove retaining pin (6) from pin (7).

**NOTE**

All pins are removed in the same manner.

- (3) Remove pin (7) from bucket (5) and ripper arm (8).
- (4) Remove retaining pin (6) from chain (9).
- (5) Remove bolt (10), washer (11), chain (9), and pin (7) from bucket (5).

**NOTE**

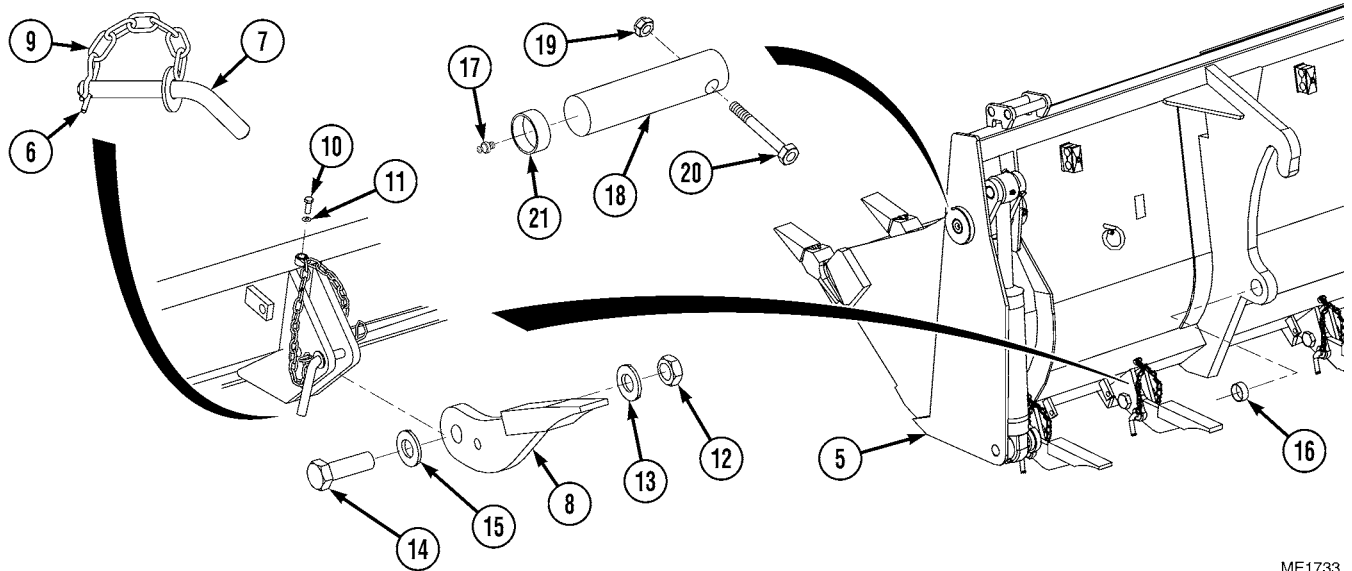
All five ripper arms are removed in the same manner.

- (6) Remove self-locking nut (12) and washer (13) from bolt (14). Discard self-locking nuts.
- (7) Remove bolt (14), washer (15), and ripper arms (8) from bucket (5).
- (8) If required, remove two bushings (16) from bucket (5). Discard bushings.
- (9) Remove grease zerker (17) from pin (18) on both sides of bucket (5).
- (10) Remove self-locking nut (19) and bolt (20) on each side of bucket (5). Discard self-locking nut.
- (11) Attach suitable lifting device and sling to bucket (5).
- (12) Using dunnage, position bucket (5) so lower half is flush with ground.
- (13) Support upper half of bucket (5).
- (14) Remove pin (18) from each side of bucket (5).
- (15) Lower and remove lifting device and sling from bucket (5).
- (16) If required, remove two bushings (21) from both sides of bucket (5). Discard bushings.

**b. Assembly.**



Ensure pins are lubricated before installing. Failure to comply could result in damage to equipment.



ME1733

- (1) Attach lifting device and sling on upper half of bucket (5).
- (2) Lift and align upper half of bucket (5) with the lower half.
- (3) If required, install two new bushings (21) on both sides of bucket (5).
- (4) Install pins (18) on both sides of bucket (5).
- (5) Install bolt (20) and new self-locking nut (19) in pin (18) on each side of bucket (5).
- (6) Remove dunnage, lifting device, and sling from bucket (5).
- (7) Install grease zerk (17) in pin (18) on each side of bucket (5).
- (8) If required, install bushing (16) on each side of bucket (5).

**NOTE**

All five ripper arms are installed in the same manner.

- (9) Install ripper arm (8), bolt (14), and washer (15) on bucket (5).
- (10) Install new self-locking nut (12) and washer (13) on bolt (14).



Ensure that the bucket is directly supported before assembly/disassembly. Failure to comply may result in serious injury or death to personnel.

- (11) Install chain (9) and pin (7) on bucket (5) with bolt (10) and washer (11).
- (12) Install retaining pin (6) on chain (9).
- (13) Install pin (7) on bucket (5) and ripper arm (8).
- (14) Install retaining pin (6) on pin (7).

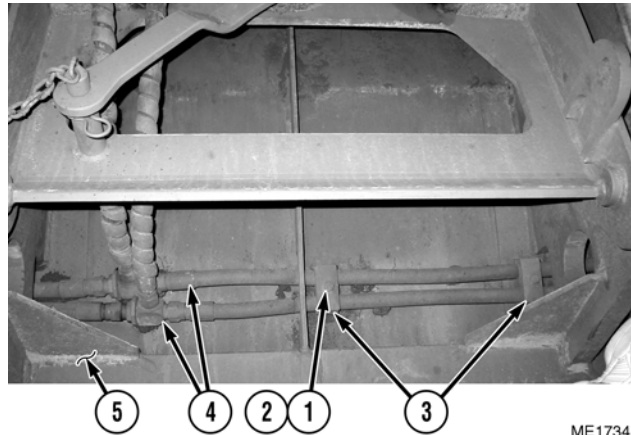
**NOTE**

Ensure hose assemblies are properly routed before securing clamps.

- (15) Install two hose assemblies (4) on bucket (5) with four clamps (3), bolts (1), and washers (2).

**c. Follow-On Maintenance.**

- (1) Install 4-in-1 bucket cylinders (Para 10-25).
- (2) Install cutting edge (Para 17-5).
- (3) Install ripper teeth (if required) (TM 5-2420-230-10).
- (4) Install bucket teeth (TM 5-2420-230-10).
- (5) Install 4-in-1 bucket (TM 5-2420-230-10).



**END OF TASK**



## CHAPTER 18

### FORKLIFT ATTACHMENT

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	18-1	18-1
Vehicle Preparation and Isolation. . . . .	18-2	18-1
Restore IHMEE to Operational Readiness. . . . .	18-3	18-1
Forklift Tines Replacement. . . . .	18-4	18-2

**18-1. GENERAL.**

The forklift is attached to the Front-End Loader (FEL) arms with a quick-hitch mounting.

**18-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to commencement of maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

**18-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

### 18-4. FORKLIFT TINES REPLACEMENT.

This Task Covers:

- a. Removal                                      b. Installation                                      c. Follow-On Maintenance

#### INITIAL SETUP

*Test Equipment*

None

*Tools and Special Tools*

None

*Materials/Parts*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*References*

None

*Equipment Conditions*

TM or Para	Condition Description
TM 5-2420-230-10	4-in-1 bucket removed from vehicle.
TM 5-2420-230-10	Forklift attachment installed on vehicle.
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P Figure 177

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

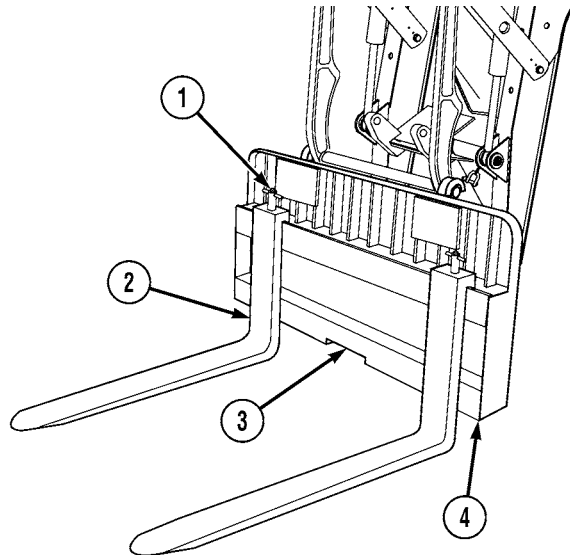
#### a. Removal.

- (1) Lift tab (1) on top of left-hand forklift tine (2).
- (2) Slide forklift tine (2) to center detent (3) of frame (4).

**WARNING**

Forklift tine is heavy. Use an assistant and follow safe working procedures when removing or installing forklift tine. Failure to comply may result in injury to personnel.

- (3) With the aid of an assistant, pull bottom of forklift tine (2) forward; then lift tine off frame (4).
- (4) Repeat steps (1)) through (3)) for right-hand tine.



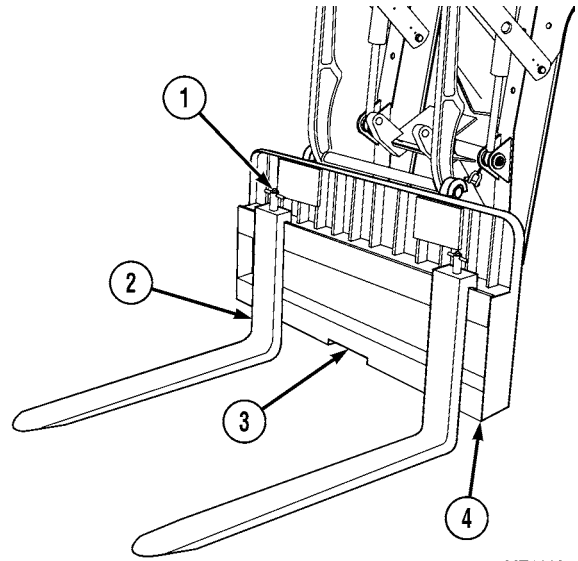
ME1112

**b. Installation.**

**WARNING**

Forklift tine is heavy. Use an assistant and follow safe working procedures when removing or installing forklift tine. Failure to comply may result in injury to personnel.

- (1) With the aid of an assistant, position top of forklift tine (2) on center of frame (4).
- (2) Position bottom of forklift tine (2) into detent (3) of frame (4).
- (3) Lift tab (1) and slide forklift tine (2) to left position of frame (4).
- (4) Repeat Steps (1) through (3) for right-hand side.



ME1112

**c. Follow-On Maintenance.**

- (1) Remove forklift attachment from vehicle (TM 5-2420-230-10).
- (2) Install 4-in-1 bucket on vehicle (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

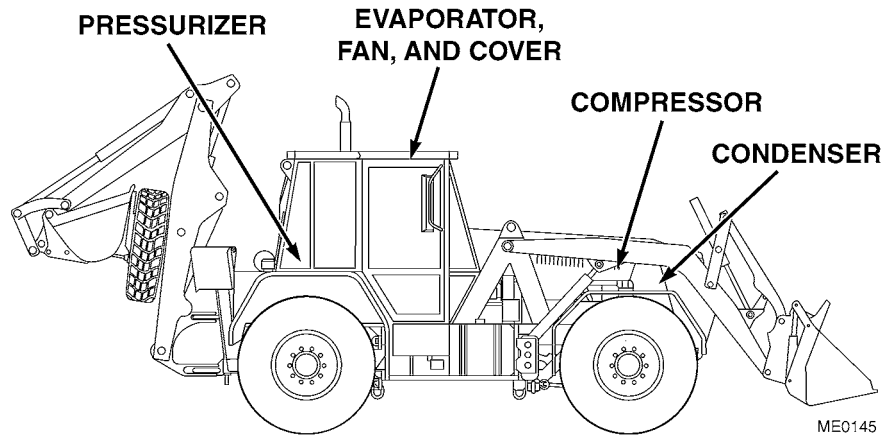


## CHAPTER 19

### AIR-CONDITIONING (A/C) SYSTEM

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	19-1	19-1
Vehicle Preparation and Isolation. . . . .	19-2	19-2
Restore IHMEE to Operational Readiness. . . . .	19-3	19-2
A/C System Servicing. . . . .	19-4	19-3
A/C Cover Replacement. . . . .	19-5	19-11
A/C Pressurizer Replacement. . . . .	19-6	19-12
A/C Condenser Replacement. . . . .	19-7	19-14
A/C Compressor Replacement. . . . .	19-8	19-15
A/C Receiver-Drier Replacement. . . . .	19-9	19-18
A/C Evaporator Assembly Maintenance. . . . .	19-10	19-19

**19-1. GENERAL.**



This chapter contains procedures that relate to the replacement of components associated with the A/C system. This chapter contains routine maintenance activities and replacement procedures for the following components:

- A/C Compressor
- A/C Evaporator and fan
- A/C Condenser
- A/C Pressurizer
- A/C Cover
- Receiver/Drier

## **19-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to commencement of maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach “Do Not Operate” tag to ignition switch (TM 5-2420-230-10).

## **19-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

**19-4. A/C SYSTEM SERVICING.**

This Task Covers:

- a. Leak Test
- b. Recovery
- c. Evacuation
- d. Charging
- e. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10</p>	<p><i>Condition Description</i> Vehicle positioned on level ground.</p>
<p><i>Tools and Special Tools</i> Reclaimer, refrigerant, Item 32, Appendix B Tool kit, general mechanics, Item 38, Appendix B Tool kit, refrigeration equipment, Item 39, Appendix B</p>	<p>TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10</p>	<p>Parking brake applied. Engine shut OFF. Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.</p>
<p><i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C R-134a refrigerant, Item 52, Appendix C</p>	<p>TM 5-2420-230-10</p>	<p>Hood raised.</p>
<p><i>Personnel Required</i> MOS 52C, Utilities Equipment Repairer</p>	<p><i>Drawings Required</i> None</p>	
<p><i>References</i> None.</p>	<p><i>Estimated Time to Complete Task</i> 1.0 hr.</p>	

**NOTE**

Replace receiver-drier if one or more of the following conditions occur before you purge A/C system:

- A/C system has been previously opened for service
- Receiver-drier has been operated for 2 or more years
- Large A/C system leak (break in hose or line)
- Too much air or moisture in A/C system
- A/C system opened for longer than 5 min.

**a. Leak Test.**

**WARNING**

- Contact with refrigerant can cause frostbite. Keep hands and face away to prevent personal injury.
- Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty.
- Always use caution if a fitting is removed. Slowly loosen the fitting. If the system is still under pressure, release it slowly in a well-ventilated area.
- Do not smoke when servicing air conditioners or wherever refrigerant gas may be present. Personal injury or death can result from inhaling refrigerant through a lit cigarette.

**NOTE**

- If service work is required on an A/C system, the refrigerant must be recovered first before components are removed.

- The A/C system must contain at least 0.88 lb. (0.4 kg) of refrigerant. The manifold gage set can determine if pressure exists in the system.
- Leaks that are in the high side of the A/C system are more easily found if the air conditioner is operated for 5 to 10 min. The leak test must be performed immediately after the unit is turned off. The leak test for the high side needs to be performed before the pressure in the A/C system equalize.
- Leaks that are in the low side of the A/C system are more easily found if the air conditioner has been shut off for 5 to 10 min. The leak test for the low side needs to be performed before the pressure in the A/C system equalize.

- (1) Move leak detector sensor tip along possible leak points, at a rate of one inch per second.
- (2) Leak detector will notify mechanic if leak is present in A/C system.

**b. Recovery.**

If service is required on the air conditioning system, refrigerant must be recovered before A/C system components are removed. Use the following procedure:

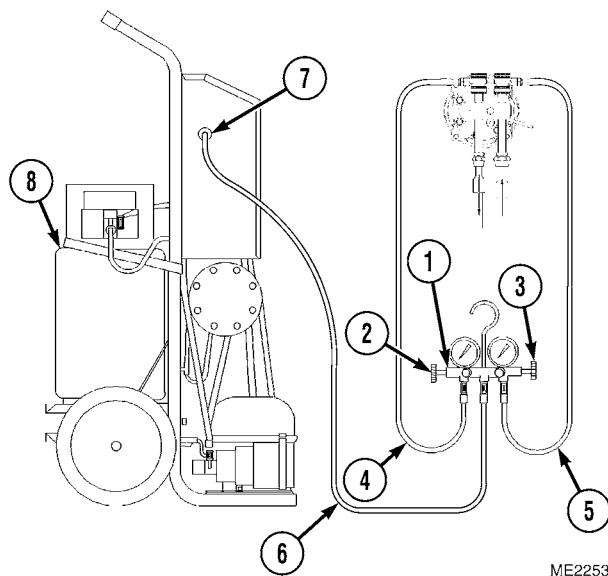
**NOTE**

Refrigerant identifier will prevent other refrigerants from contaminating R-134a recovery and charging tools. Refrigerant identifier will also detect a percentage of air that may be in the A/C system.

- (1) Use refrigerant identifier to ensure refrigerant in A/C system is R134a
- (2) Make sure that both manifold gauge set (1) valves (2) and (3) are closed. Turn valves (2) and (3) clockwise to close.

**WARNING**

- Contact with refrigerant can cause frostbite. Keep hands and face away to prevent personal injury.
- Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty.
- Do not smoke when servicing air conditioners or wherever refrigerant gas may be present. Personal injury or death can result from inhaling refrigerant through a lit cigarette.



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- (3) Install manifold gage set (1) low-side hose (4) to suction (low) side of A/C compressor.
- (4) Install manifold gage set (1) high-side hose (5) to discharge (high) side of A/C compressor.



**WARNING**

- Contact with refrigerant can cause frostbite. Keep hands and face away to prevent personal injury.
- Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty.
- Do not smoke when servicing air conditioners or wherever refrigerant gas may be present. Personal injury or death can result from inhaling refrigerant through a lit cigarette.
- Personal injury or death can result from inhaling refrigerant. Only vent refrigerant in a well-ventilated area.

**NOTE**

Only open manifold gage set valves long enough to purge air from charging hose.

- (5) Slowly open valves (2) and (3) and purge air from charging hose (6).
- (6) Attach charging hose (6) to recovery station inlet (7).

**NOTE**

One valve is for vapor and the other valve is for liquid.

- (7) Ensure valves on refrigerant recovery tank (8) are open.
- (8) Follow recovery station OEM instructions and recover R-134a refrigerant.

**c. Evacuation.**

**CAUTION**

- Moisture will combine with metals in the refrigerant system and this will produce highly corrosive by-products. The by-products are oxides, iron hydroxide, and aluminum hydroxide and they will damage the A/C system.
- Moisture in the A/C system can freeze and damage the expansion valve and orifice tube. If there is water in the system the water must be removed.

**NOTE**

- If replacement of a component is necessary or repair of a component is necessary, refrigerant must be recovered from A/C system.
- If A/C system has lost any charge after a long period of time, refrigerant in A/C system must be recovered.
- It is necessary to perform evacuating procedure to delete all air and moisture from the A/C system.
- A complete charge must never be given to a system without first performing the evacuating procedure.

If the system has been left open for more than a half hour, the system has been exposed to air and moisture. A new receiver-dryer must be installed ([Para 19-9](#)).

**NOTE**

Evacuating the A/C system with a vacuum pump will boil and remove any water in the system. Remove water from the A/C system by evacuating the system with a vacuum pump (Table 19-1).

**Table 19-1. Boiling Point of Water Under Vacuum**

Ambient Temperature °F (°C)	Vacuum Required To Boil Water In A/C System inHg (kPa)
100 °F (38 °C)	28 inHg (95 kPa)
90 °F (32 °C)	28.5 inHg (96.5 kPa)
81 °F (27 °C)	28.8 inHg (97.5 kPa)
70 °F (21 °C)	29.2 inHg (98.8 kPa)

- (1) Ensure that valves (2) and (3) are closed.
- (2) Disconnect the charging hose (6) from inlet (7) on refrigerant service unit.
- (3) Check the oil level in the vacuum pump. Add oil as necessary. Refer to the vacuum pump OEM manual for the correct procedure.
- (4) Connect charging hose (6) to inlet (9) on vacuum pump.
- (5) Open valves (2) and (3) completely. Turn valves (2) and (3) counterclockwise to open.
- (6) Evacuate A/C system. Refer to vacuum pump OEM manual for operation instructions.

**NOTE**

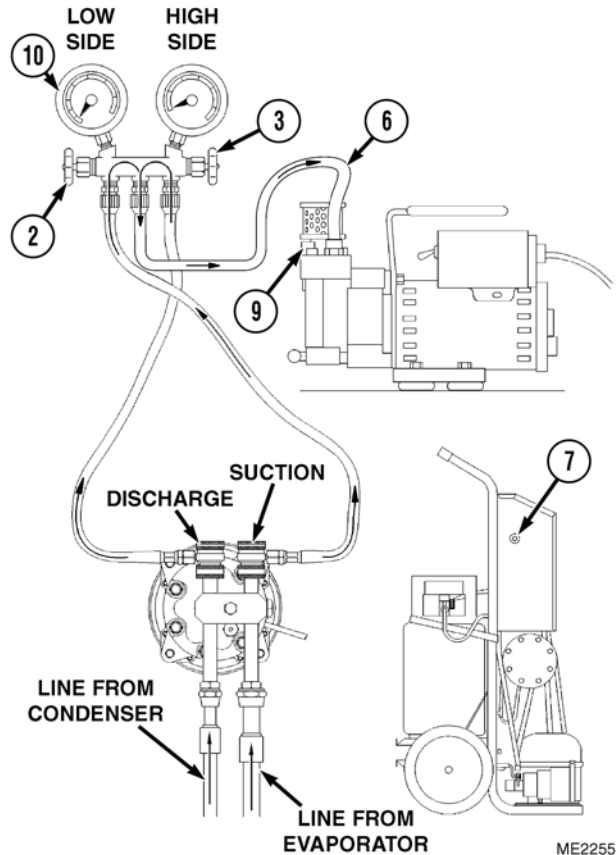
At high elevations, less vacuum is required. 28 inHg to 29 inHg (95 kPa to 98 kPa) is the required specification at sea level. For every 1,000 ft (305 m) above sea level, decrease the required specification by 1 inHg (3 kPa).

- (7) Operate the vacuum pump until the low pressure gauge (10) indicates a vacuum between 28 inHg to 29 inHg (95 kPa to 98 kPa).
- (8) After the vacuum in the A/C system reaches between 28 inHg to 29 inHg (95 kPa to 98 kPa), operate vacuum pump for a minimum of 90 min.

**NOTE**

The evacuating procedure removes air and moisture from the system. Do not use the vacuum pump primarily to indicate a system leak.

- (9) If the specific vacuum cannot be reached, the A/C system may have a leak. Repair all leaks and repeat Steps (1) through (8).



- (10) After 28 inHg to 29 inHg (95 kPa to 98 kPa) vacuum has been reached and held for an additional 90 min., close manifold gauge set (1) valves (2) and (3) completely.
- (11) Turn OFF the vacuum pump. Refer to the vacuum pump OEM manual for operation instructions.

### NOTE

- Excessive vacuum loss is an indication of a possible leak in the system.
  - The maximum amount of vacuum loss in 5 min. must not be more than 2 inHg (7 kPa). Repair all leaks and repeat Steps (1) through (11).
- (12) If the vacuum loss does not exceed 2 inHg (7 kPa) in 5 min., the system is ready to charge.

#### **d. Charging.**

### WARNING

- Contact with refrigerant can cause frostbite. Keep hands and face away to prevent personal injury.
- Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty.
- Do not smoke when servicing air conditioners or wherever refrigerant gas may be present. Personal injury or death can result from inhaling refrigerant through a lit cigarette.

### CAUTION

Do not charge the air conditioning system with liquid refrigerant through the compressor suction ports. This could seriously damage the compressor.

### NOTE

- Charging should be performed at air temperatures of 70 °F (21 °C) and above. Changes in ambient air temperatures will affect the systems ability to take a charge and will vary gauge readings.
- When adding a partial charge to the air conditioning system, if there is no evidence of air in the system and there are no system leaks, it is not necessary to discharge and evacuate the A/C system.
- Operating A/C system periodically during the off-season will lubricate the seals and reduce possibilities of refrigerant loss.
- Up to 7 oz. (200 g) of refrigerant loss per year is considered normal.
- Steps (1) through (3) only need to be performed if a partial charge is being done.

- (1) Install manifold gage set (1) low-side hose (4) to suction (low) side of A/C compressor.
- (2) Install manifold gage set (1) high-side hose (5) to discharge (high) side of A/C compressor.

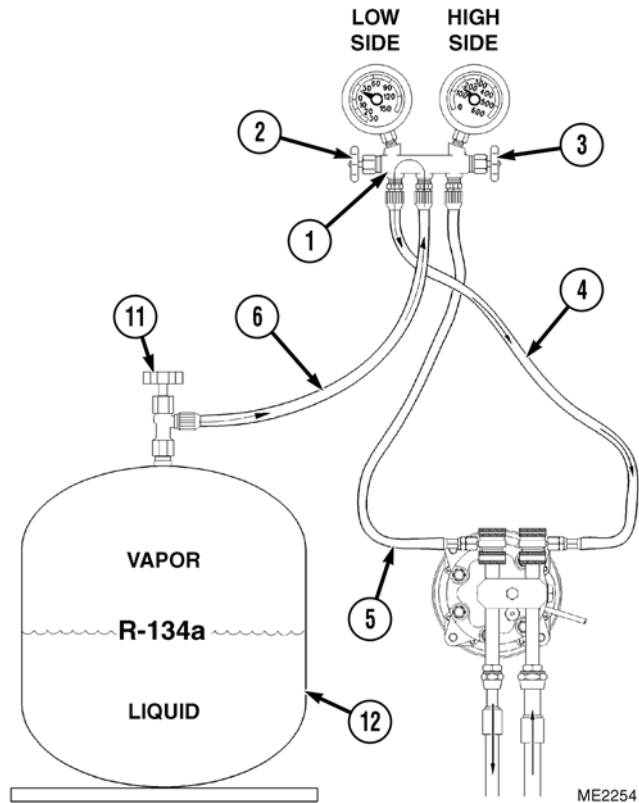
**WARNING**

Personal injury or death can result from inhaling refrigerant. Only vent refrigerant in a well-ventilated area.

**NOTE**

Only open manifold gage set valves long enough to purge air from charging hose.

- (3) Slowly open valves (2) and (3) and purge air from charging hose (6).
- (4) Connect charging hose (6) to R-134a refrigerant tank valve (11).



**WARNING**

- Contact with refrigerant can cause frostbite. Keep hands and face away to prevent personal injury.
- Protective goggles must always be worn when refrigerant lines are opened, even if the gauges indicate the system is empty.
- Do not smoke when servicing air conditioners or wherever refrigerant gas may be present. Personal injury or death can result from inhaling refrigerant through a lit cigarette.

**CAUTION**

Do not invert the R-134a refrigerant tank while charging the system. Liquid refrigerant entering the low side of the A/C system will permanently damage the compressor.

- (5) Ensure that the R-134a refrigerant tank (12) stands vertically upwards, to ensure that only refrigerant vapor can be charged into the A/C system.
- (6) Open refrigerant tank valve (11) on R-134a refrigerant tank (12).
- (7) Start engine (TM 5-2420-230-10).
- (8) Using the hand-throttle, set the engine RPM at 1,500 (TM 5-2420-230-10).
- (9) Set the A/C controls to HIGH COOL (TM 5-2420-230-10).

**WARNING**

Do not open high side valve on manifold gauge set while charging the A/C system.

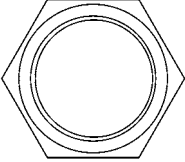
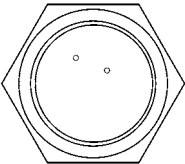
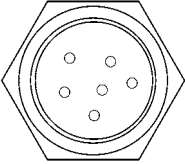
- (10) Slowly open valve (3) on manifold gauge set (1).
- (11) Continue charging until bubbles disappear from receiver-drier sight glass (Table 19-2) and high side/low side pressures are within acceptable range (Table 19-3).
- (12) Close refrigerant tank valve (11) on R-134a refrigerant tank (12).
- (13) Close valve (3) on manifold gauge set (1).
- (14) Shut off engine (TM 5-2420-230-10).
- (15) Disconnect charging hose (6) from R-134a refrigerant tank valve (11).
- (16) Disconnect manifold gauge set (1) from A/C compressor.

**e. Follow-On Maintenance.**

- (1) Lower hood (TM 5-2420-230-10).
- (2) Start engine and functionally test A/C system (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10)
- (4) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**Table 19-2. A/C Sight Glass Check**

<b>Sight Glass Appearance</b>	<b>Refrigerant Condition</b>	<b>Action Required</b>
No liquid. 	No refrigerant charge.	Charge the system with R-134a Refrigerant  Check that shut-off valves are open.  Check that the receiver-drier is not blocked.
Clear liquid or some bubbles appear only during cooling modes. 	Good refrigerant charge.	System is normal
Bubbles in stream. 	Refrigerant charge is low.	System requires refrigerant charge.

**Table 19-3. High Side/Low Side Gauge Pressures at Ambient Temperature Cross-reference**

<b>Ambient Temperature °F (°C)</b>	<b>High Side Pressure psi (kPa)</b>	<b>Low Side Pressure psi (kPa)</b>
61 °F (16 °C)	123 - 174 psi (850 - 1 200 kPa)	3 - 15 psi (20 - 100 kPa)
70 °F (21 °C)	152 - 254 psi (1 050 - 1 750 kPa)	3 - 15 psi (20 - 100 kPa)
81 °F (27 °C)	181 - 276 psi (1 250 - 1 900 kPa)	3 - 15 psi (20 - 100 kPa)
90 °F (32 °C)	203 - 312 psi (1 400 - 2 150 kPa)	4 - 22 psi (30 - 150 kPa)
100 °F (38 °C)	232 - 334 psi (1 600 - 2 300 kPa)	4 - 29 psi (30 - 200 kPa)
109 °F (43 °C)	276 - 363 psi (1 900 - 2 500 kPa)	4 - 36 psi (30 - 250 kPa)

**END OF TASK**

**19-5. A/C COVER REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

TM or Para

*Condition Description*

TM 5-2420-230-10

Vehicle positioned on level ground.

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

TM 5-2420-230-10

Electrical master switch OFF.

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

*Drawings Required*

TM 5-2420-230-24P Figure 187

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**

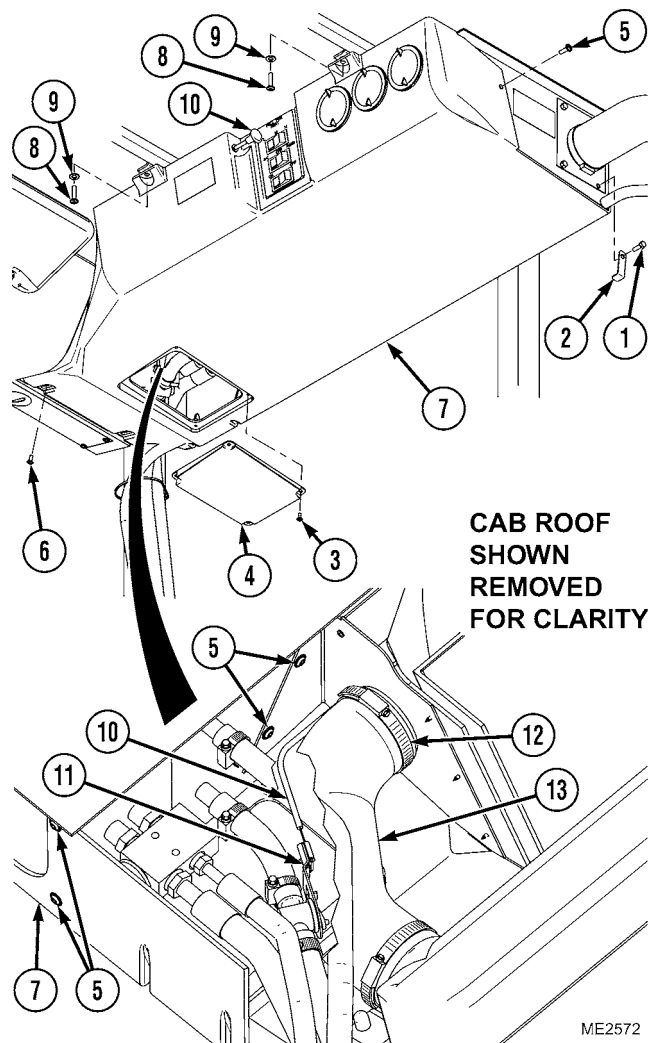
- (1) Remove screw (1) and mounting bracket (2).
- (2) Remove four screws (3) and access cover (4).
- (3) Remove five screws (5) and two screws (6).
- (4) While supporting A/C cover (7), remove two screws (8) and washers (9).
- (5) Detach cable (10) from heater control (11).
- (6) Loosen hose clamp (12) and remove air duct (13) from A/C cover (7).

**b. Installation.**

- (1) While supporting A/C cover (7), install air duct (13) on cover with hose clamp (12).
- (2) Attach cable (10) to heater control (11).
- (3) Install two washers (9) and screws (8).
- (4) Install five screws (5) and two screws (6).
- (5) Install access cover (4) with four screws (3).
- (6) Install mounting bracket (2) with screw (1).

**c. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).



**CAB ROOF  
SHOWN  
REMOVED  
FOR CLARITY**

ME2572

**END OF TASK**

**19-6. A/C PRESSURIZER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Equipment Conditions*  
TM or Para  
TM 5-2420-230-10

*Condition Description*  
Vehicle positioned on level ground.

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10  
TM 5-2420-230-10

Parking brake applied.  
Engine shut OFF.

*Materials/Parts*  
Nut, self-locking, Item 110, Appendix D (4)

TM 5-2420-230-10  
TM 5-2420-230-10

Electrical master switch OFF.  
“Do Not Operate” tag attached to ignition switch.

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Drawings Required*  
TM 5-2420-230-24P Figure 187

*References*  
None

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

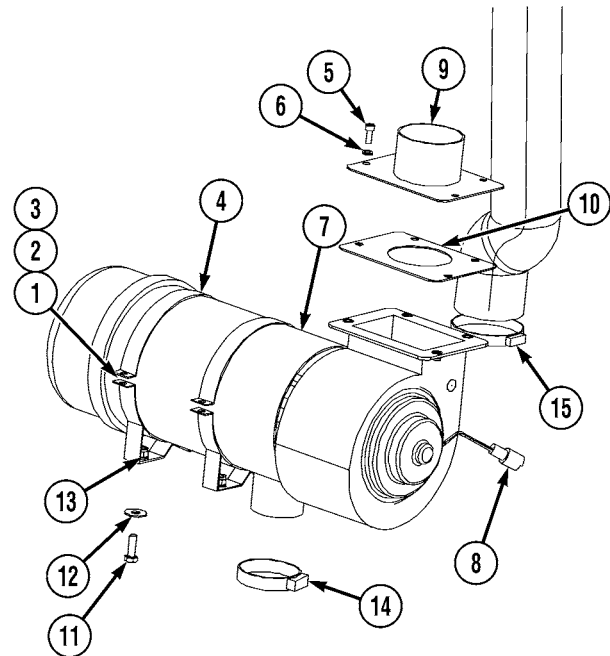
**a. Removal.**

- (1) Remove two bolts (1), washers (2), and nuts (3) from two pressurizer mounting bands (4).
- (2) Remove four bolts (5) and washers (6) from pressurizer tank (7).

**WARNING**

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

- (3) Disconnect electrical connector (8).
- (4) Remove pressurizer tank adapter assembly (9) and pressurizer tank gasket (10).
- (5) Remove four bolts (11), washers (12), self-locking nuts (13), and two pressurizer mounting bands (4). Discard self-locking nuts.
- (6) Remove hose clamps (14) and (15).
- (7) Remove pressurizer tank (7).



ME1192



**b. Installation.**

- (1) Install two pressurizer mounting bands (4), four bolts (11), washers (12), and new self-locking nuts (13).
- (2) Install pressurizer tank (7).
- (3) Install hose clamps (14) and (15).
- (4) Install pressurizer tank adapter assembly (9) and pressurizer tank gasket (10).
- (5) Install four bolts (5) and washers (6) on pressurizer tank (7).
- (6) Install two bolts (1), washers (2), and nuts (3) from two pressurizer mounting bands (4).

**WARNING**

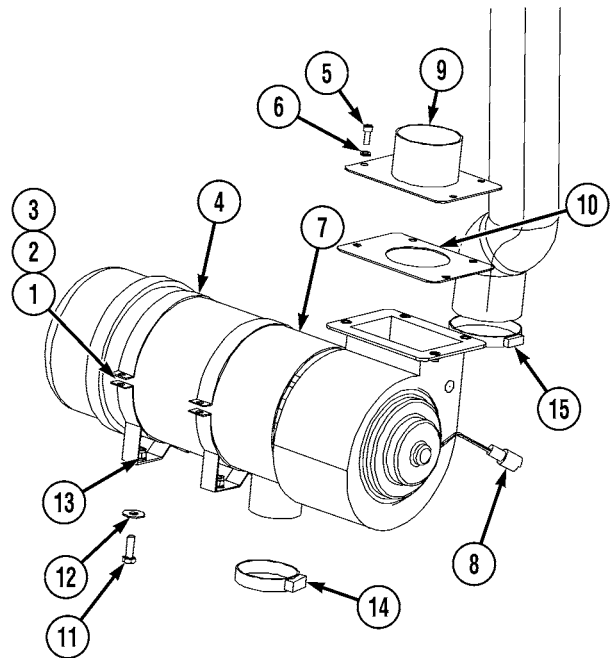
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

- (7) Connect electrical connector (8).

**c. Follow-On Maintenance.**

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Functionally test pressurizer (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



ME1192

**19-7. A/C CONDENSER REPLACEMENT.**

This Task Covers:

- a. Removal                                      b. Installation                                      c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Air conditioner service equipment, Item 39, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*                      *Condition Description*  
Para 13-18                      Nose cone removed.  
Para 19-4                        A/C system purged.

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Nut, self-locking, Item 112, Appendix D (4)  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 280, Appendix D

*Drawings Required*  
TM 5-2420-230-24P    Figure 25  
TM 5-2420-230-24P    Figure 189

*Personnel Required*  
MOS 52C, Utilities Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

**NOTE**

- Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
  - Ensure all hoses and tubes are disconnected and clear before removal.
- (1) Remove bolts securing horn to A/C condenser.
  - (2) Disconnect A/C lines from condenser.
  - (3) Remove four self-locking nuts, lockwashers, flat washers, and bolts securing A/C condenser. Discard self-locking nuts and lockwashers.
  - (4) Remove condenser core and lockwashers.

**b. Installation.**

Installation of the A/C condenser is the reversal of the removal procedure with attention given to the following:

**NOTE**

- Ensure all hoses and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

Use new self-locking nuts.

**c. Follow-On Maintenance.**

- (1) Install nose cone (Para 13-18).
- (2) Charge A/C system (Para 19-4).

**END OF TASK**

## 19-8. A/C COMPRESSOR REPLACEMENT.

This Task Covers:

- |            |                 |                          |
|------------|-----------------|--------------------------|
| a. Removal | b. Installation | c. Follow-On Maintenance |
|------------|-----------------|--------------------------|

### INITIAL SETUP

*Test Equipment*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Nut, self-locking, Item 111, Appendix D (4)
- Oil, lubricating, Item 41.1, Appendix C
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C
- Washer, lock, Item 282, Appendix D (3)

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 13-18	Nose cone removed.
TM 5-2420-230-10	Steering wheel turned full left.
Para 13-16	Right front fender removed (do not remove MLC placard or grab handle).
Para 4-6	Drive belt removed (from A/C compressor pulley only).
Para 19-9	A/C receiver-drier removed.

*Drawings Required*

TM 5-2420-230-24P Figure 189

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

### a. Removal.

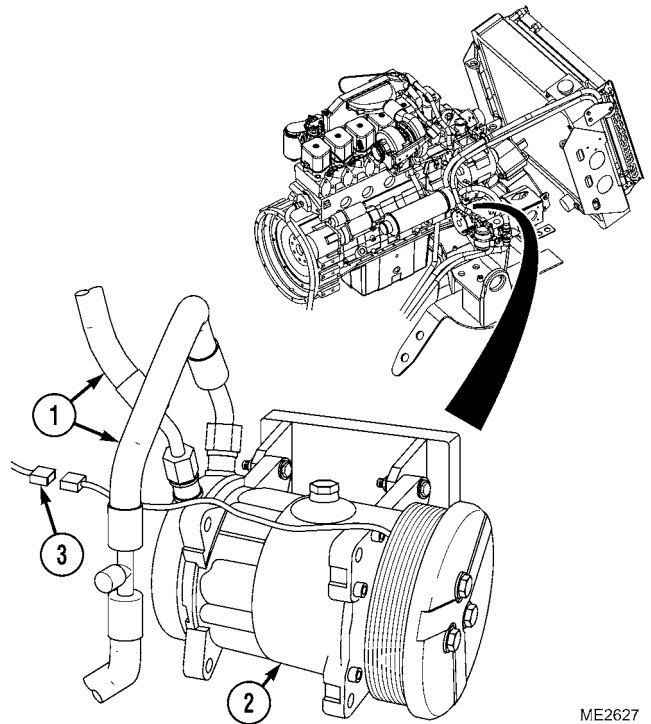
#### NOTE

- Tag all hoses, wires, and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
  - Ensure all hoses, wires, and tubes are disconnected and clear before removal.
- (1) Disconnect two hoses (1) from compressor (2).

#### WARNING

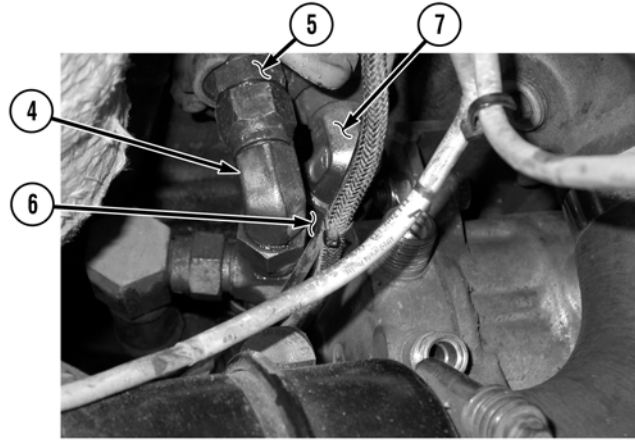
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

- (2) Disconnect harness (3) from compressor (2).



ME2627

- (3) Remove elbow (4) and fitting (5) from engine oil cooler.
- (4) Remove hose (6) and elbow (7) from engine oil cooler.
- (5) Remove four self-locking nuts (8), eight washers (9), four bolts (10), and compressor (2) from bracket (11). Discard self-locking nuts.
- (6) Remove oil plug (12) from compressor (2).
- (7) Drain, measure, and record quantity of oil removed from compressor (2).
- (8) If required, remove three bolts (13), lockwashers (14), and bracket (11). Discard lockwashers.



ME2629

**b. Installation.**

**NOTE**

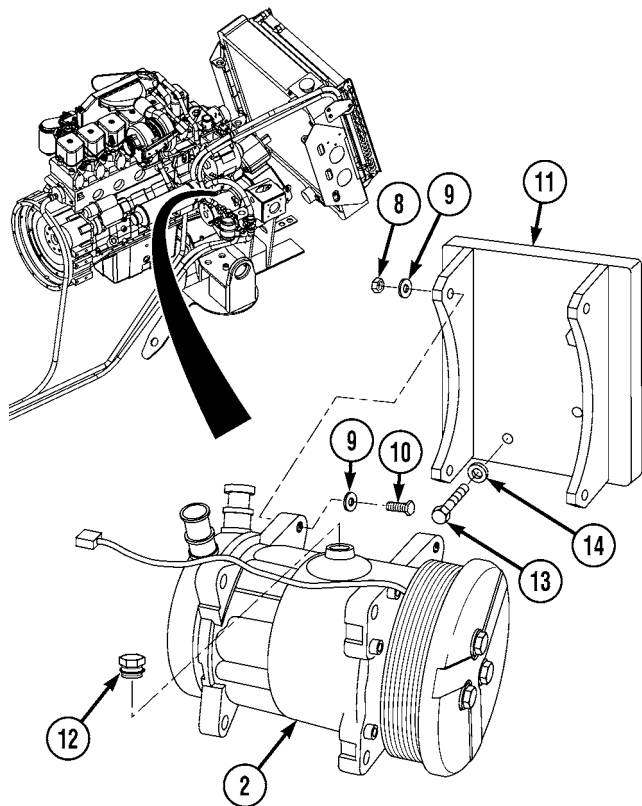
- Ensure all hoses, wires and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) If removed, install bracket (11) with three new lockwashers (14) and bolts (13).

**NOTE**

Compressor may be shipped with preserving oil and caps on ports.

- (2) If necessary, remove shipping caps and oil from compressor (2).
- (3) Remove oil plug (12) from new compressor (2). Inspect O-ring on oil plug. Replace oil plug if O-ring is damaged.
- (4) Drain oil from new compressor (2).
- (5) Using same amount of new oil as recorded in removal, fill new compressor (2).
- (6) Install oil plug (12) on compressor (2). Torque plug to 14 lbf/ft (19 N•m).
- (7) Install compressor (2) on bracket (11) with four bolts (10), eight washers (9), and four new self-locking nuts (8).
- (8) Install elbow (7) and hose (6) on engine oil cooler.
- (9) Install fitting (5) and elbow (4) on engine oil cooler.



ME2628

**WARNING**

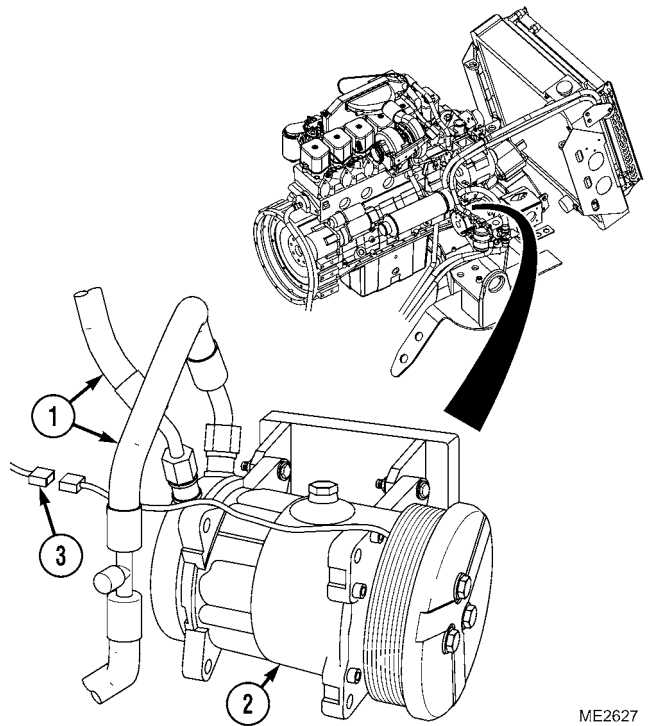
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

- (10) Connect harness (3) to compressor (2).
- (11) Connect two hoses (1) to compressor (2).

**c. Follow-On Maintenance.**

- (1) Install A/C receiver-drier (Para 19-9).
- (2) Install drive belt on A/C compressor pulley (Para 4-6).
- (3) Install right front fender (Para 13-16).
- (4) Install nose cone (Para 13-18).

**END OF TASK**



ME2627

**19-9. A/C RECEIVER-DRIER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> FEL arms raised and maintenance arm installed.
TM 5-2420-230-10	Hood raised.
Para 12-34.2	Remove A/C pressure switch.

*Materials/Parts*  
Cap and plug set, Item 4, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 189

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

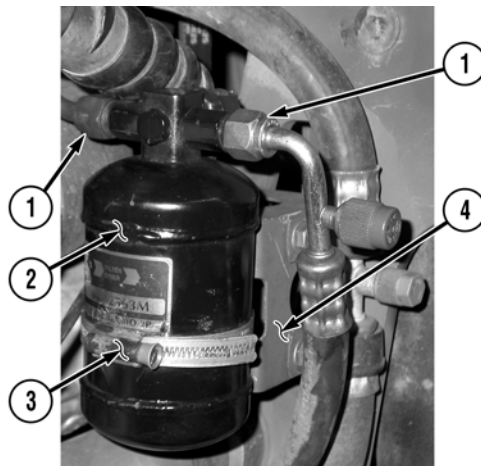
**WARNING**

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

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
- Cap and plug all tubes, hoses, and fittings upon removal.
- Remove cable ties as necessary.
- Ensure all hoses, wires, and tubes are disconnected and clear before removal.

- (1) Remove two hoses (1) from receiver-drier (2). Inspect O-rings on hoses. Replace any hose with a damaged O-ring.
- (2) Loosen hose clamp (3) and remove receiver-drier (2) from bracket (4).

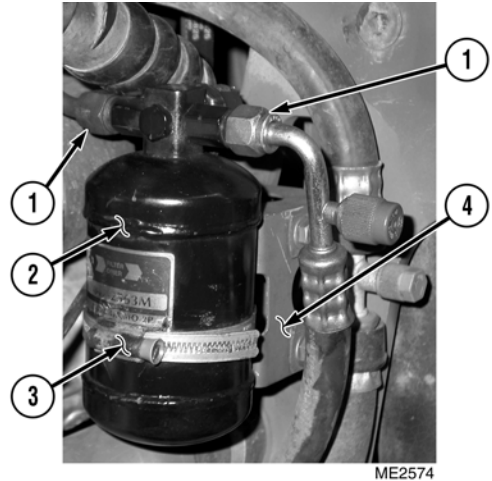


**b. Installation.**

**NOTE**

- Ensure all hoses, wires and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install receiver-drier (2) on bracket (4) and tighten hose clamp (3).
- (2) Install two hoses (1) on receiver-drier (2).



**c. Follow-On Maintenance.**

- (1) Install A/C pressure switch (Para 12-34.2).
- (2) Lower hood (TM 5-2420-230-10).
- (3) Remove maintenance arm and lower FEL (TM 5-2420-230-10).

**END OF TASK**

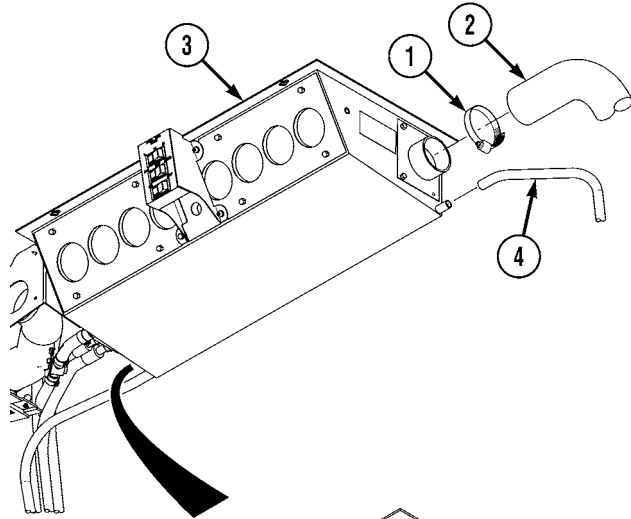
<b>19-10. A/C EVAPORATOR ASSEMBLY MAINTENANCE.</b>		
This Task Covers:		
a. Removal	b. Disassembly	c. Assembly
d. Installation	e. Follow-On Maintenance	
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Drain pan, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> Para 19-4 <i>Condition Description</i> A/C system purged. Para 19-5      A/C cover removed.	
<i>Materials/Parts</i> Decal, A/C controls, Item 39.1, Appendix D Tag, identification, Item 63, Appendix C Tape, tacky, Item 66.1, Appendix C Ties, cable, Item 68, Appendix C Washer, lock, Item 279, Appendix D	<i>Drawings Required</i> TM 5-2420-230-24P Figure 187	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

a. Removal.

**NOTE**

- Tag all hoses, ducts, and wires and note their positions before removal.
- Cap and plug all hoses and fittings upon removal.
- Remove cable ties as necessary.
- Ensure all hoses, ducts, and wires are disconnected and clear before removal.

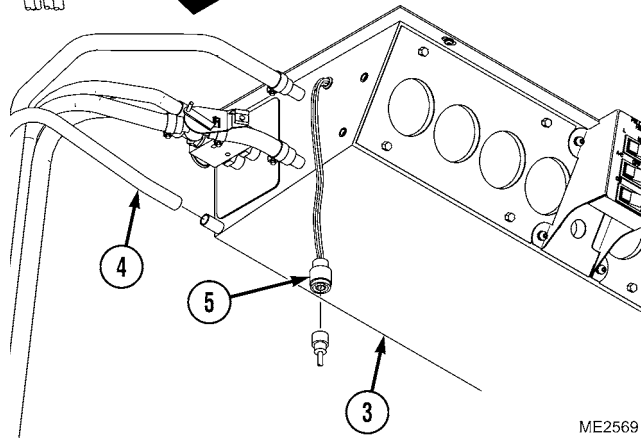
- (1) Loosen hose clamp (1) and remove air duct (2) from evaporator assembly (3).
- (2) Remove two drain lines (4) from evaporator assembly (3).



**WARNING**

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

- (3) Disconnect electrical connector (5) from evaporator assembly (3).



ME2569

**NOTE**

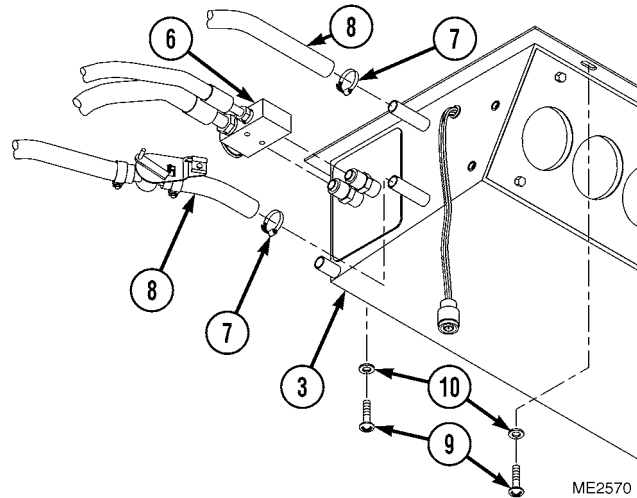
Record length of tacky tape to be replaced.

- (4) Remove tacky tape and TX valve (6) from evaporator assembly (3). Discard tacky tape.

**WARNING**

Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.

- (5) Place a drain pan, loosen two hoses clamps (7) and remove coolant lines (8) from evaporator assembly (3).



ME2570

**WARNING**

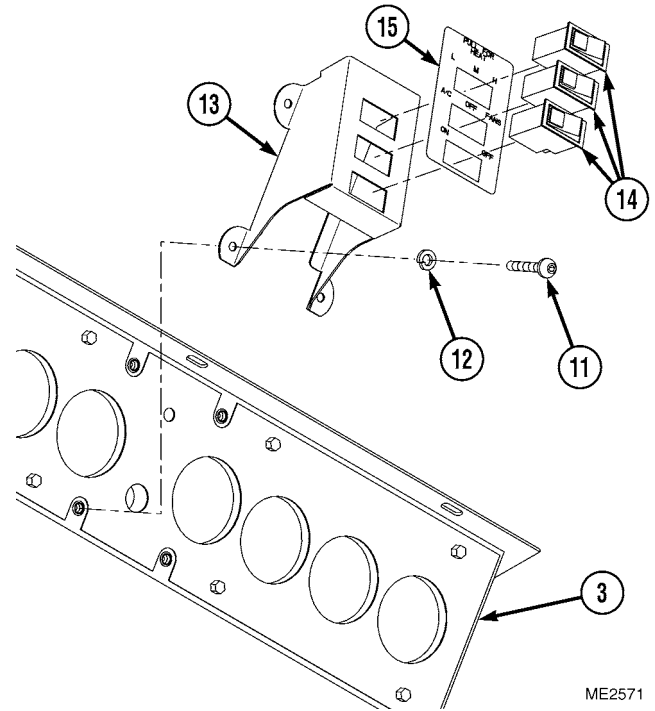
Evaporator assembly is heavy. Use an assistant and follow safe working procedures when removing or installing evaporator assembly. Failure to comply may result in injury to personnel.

- (6) With the aid of an assistant, remove five bolts (9), washers (10), and evaporator assembly (3) from vehicle.



**b. Disassembly.**

- (1) Remove four screws (11), lockwashers (12), and bracket assembly (13) from evaporator assembly (3). Discard lockwashers.
- (2) Remove three rocker switches (14) from bracket assembly (13) (Para 12-14).
- (3) Remove decal (15) from bracket assembly (13) (Para 13-13). Discard decal.



**c. Assembly.**

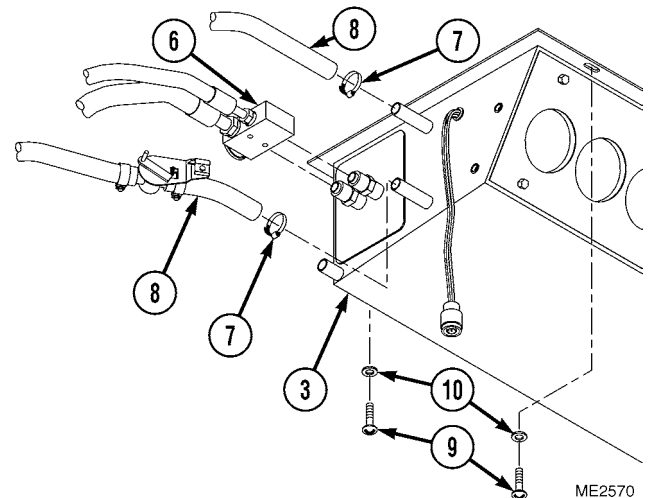
- (1) Install new decal (15) on bracket assembly (13) (Para 13-13).
- (2) Install three rocker switches (14) on bracket assembly (13) (Para 12-14).
- (3) Install bracket assembly (13) on evaporator assembly (3) with four new lockwashers (12) and screws (11).

**d. Installation.**

**NOTE**

- Ensure all hoses, ducts, and wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) With the aid of an assistant, install evaporator assembly (3) on vehicle with five washers (10) and bolts (9).
- (2) Install two hoses clamps (7) and coolant lines (8) on evaporator assembly (3).
- (3) Install TX valve (6) on evaporator assembly (3). Wrap TX valve as required with new tacky tape.

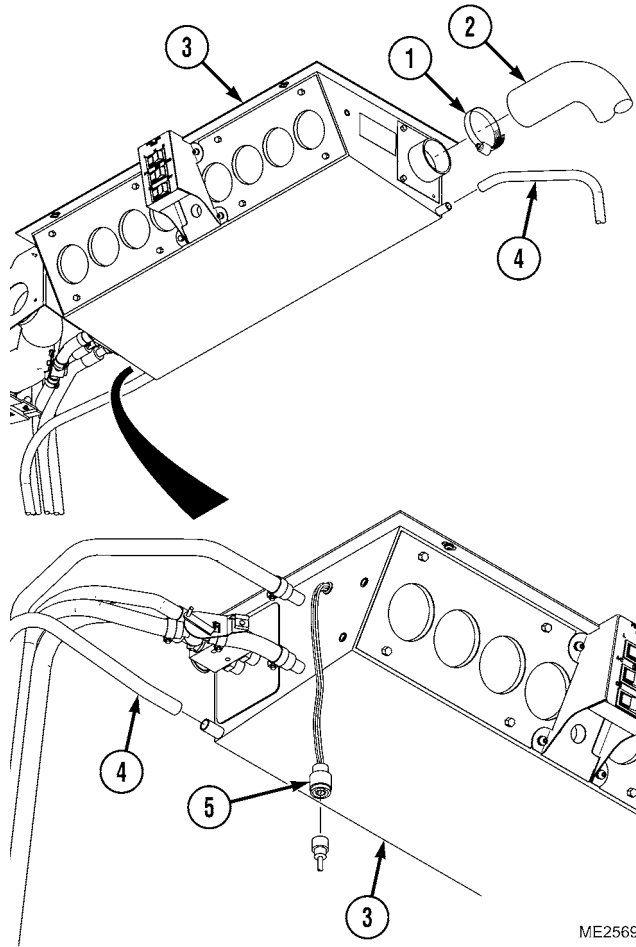


- (4) Connect electrical connector (5) to evaporator assembly (3).
- (5) Install two drain lines (4) on evaporator assembly (3).
- (6) Install hose clamp (1) and air duct (2) on evaporator assembly (3).

**e. Follow-On Maintenance.**

- (1) Install A/C cover (Para 19-5).
- (2) Charge A/C system (Para 19-4).

**END OF TASK**

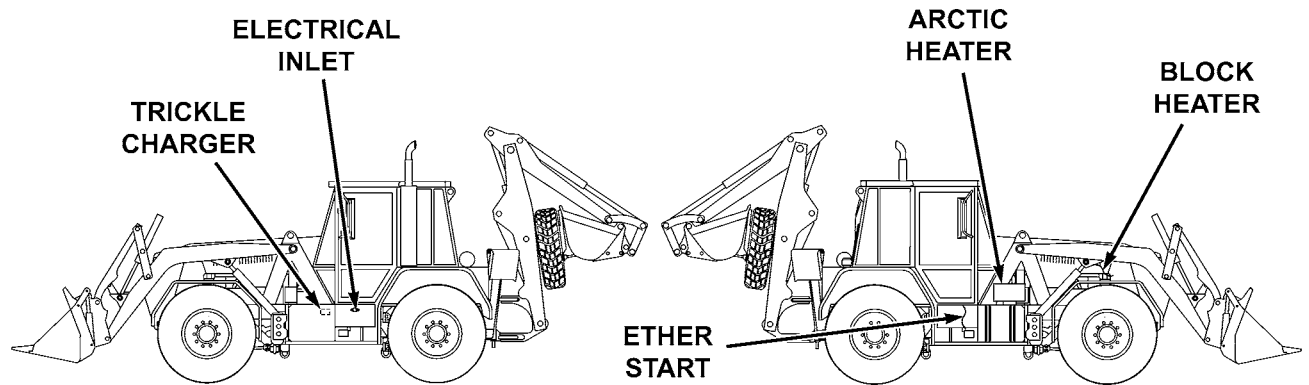


ME2569

## CHAPTER 20 COLD WEATHER KIT

<b>Contents</b>	<b>Para</b>	<b>Page</b>
General. . . . .	20-1	20-1
Vehicle Preparation and Isolation. . . . .	20-2	20-2
Restore IHMEE to Operational Readiness. . . . .	20-3	20-2
Cold Weather Kit Initial Installation. . . . .	20-4	20-3
Arctic Heater Assembly Maintenance. . . . .	20-5	20-18
Combustion Air Blower Replacement. . . . .	20-6	20-26
Control Unit Replacement. . . . .	20-7	20-28
Flame Sensor Replacement. . . . .	20-8	20-29
Fuel Metering Pump Replacement. . . . .	20-9	20-31
Glow Pin Replacement. . . . .	20-10	20-37
Overheat and Temperature Sensors Replacement. . . . .	20-11	20-40
Water Pump Replacement. . . . .	20-12	20-42
Ether Start Assembly Replacement. . . . .	20-13	20-44
Ether Start Pushbutton Replacement. . . . .	20-14	20-47
Starting Fluid (Ether) Cylinder Replacement. . . . .	20-15	20-49
Ether Start Thermostat Replacement. . . . .	20-16	20-51
Engine Block Heater Replacement. . . . .	20-17	20-53
Battery Trickle Charger Replacement. . . . .	20-18	20-55
Electrical Outlet Replacement. . . . .	20-19	20-58

**20-1. GENERAL.**



ME2382

This chapter contains procedures that relate to the replacement of components associated with the cold weather kit. This chapter contains routine maintenance activities and replacement procedures for the following components:

- Arctic Heater
- Ether Start
- Block Heater
- Battery Trickle Charger
- Electrical Outlet

## **20-2. VEHICLE PREPARATION AND ISOLATION.**

Prior to commencement of maintenance on the Interim High-Mobility Engineer Excavator (IHMEE) vehicle, perform the following procedure:

- (1) Ensure vehicle is positioned on level ground.
- (2) Ensure parking brake is applied (TM 5-2420-230-10).
- (3) Raise FEL, install maintenance arm, and lower FEL onto maintenance arm, as required (TM 5-2420-230-10).
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Place electrical master switch in OFF position (TM 5-2420-230-10).
- (6) Attach "Do Not Operate" tag to ignition switch (TM 5-2420-230-10).

## **20-3. RESTORE IHMEE TO OPERATIONAL READINESS.**

Upon completion of maintenance activities, restore power and return vehicle to operational readiness using the following procedure:

- (1) Place electrical master switch in ON position (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).
- (3) Ensure parking brake is applied (TM 5-2420-230-10).
- (4) Start engine (TM 5-2420-230-10).
- (5) Raise FEL, remove maintenance arm, and lower FEL to ground or travel position as required (TM 5-2420-230-10).
- (6) Complete necessary documents and return IHMEE to relevant authority.

Complete necessary documents and return IHMEE to relevant authority.

**20-4. COLD WEATHER KIT INITIAL INSTALLATION.**

This Task Covers:

- a. Arctic Heater
- b. Block Heater
- c. Trickle Charger
- d. Electrical Outlet
- e. Ether Start
- f. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*

- Blade kit, hole saw, Item 2.1, Appendix B
- Pan, drain, Item 29, Appendix B
- Tool Kit, common no. 2, Item 36, Appendix B
- Tool Kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Compound, sealing, Loctite 567, Item 22, Appendix C
- Kit, cold weather installation, (Michele 1)
- Tags, identification, Item 63, Appendix C
- Tape, Electrical, Item 65, Appendix C
- Ties, cable, Item 68, Appendix C
- Washer, lock, Item 281, Appendix D

*Personnel Required*

- MOS 62B, Construction Equipment Repairer (2)

*References*

- TM 43-0139

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	FEL raised and maintenance arm installed.
TM 5-2420-230-10	PDP door opened.
TM 5-2420-230-10	Hood raised.

*Equipment Conditions — Continued*

TM 5-2420-230-10	Rear outer RH belly plate removed.
Para 13-29	Air cleaner/stowage box removed.
Para 13-14	Fuel tank step plate removed.
Para 13-15	Hydraulic reservoir step plate removed.
Para 12-6	Batteries removed.
Para 9-4	Cooling system drained.

*Drawings Required*

TM 5-2420-230-24P	Figure 26
TM 5-2420-230-24P	Figure 32
TM 5-2420-230-24P	Figure 33
TM 5-2420-230-24P	Figure 41
TM 5-2420-230-24P	Figure 44
TM 5-2420-230-24P	Figure 48
TM 5-2420-230-24P	Figure 50
TM 5-2420-230-24P	Figure 146
TM 5-2420-230-24P	Figure 189
TM 5-2420-230-24P	Figure 202
TM 5-2420-230-24P	Figure 203
TM 5-2420-230-24P	Figure 207

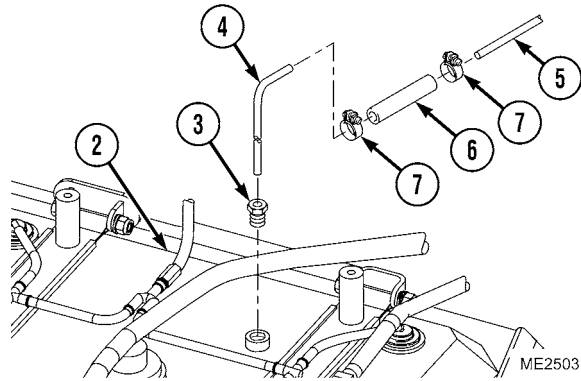
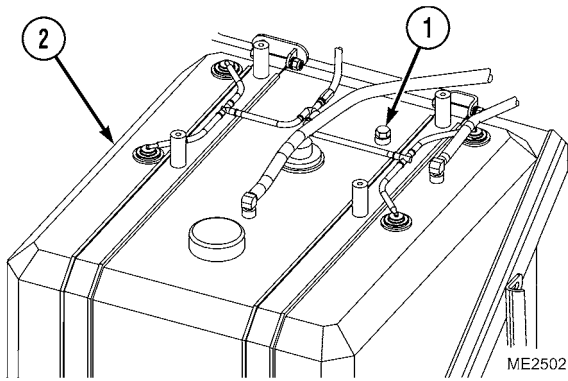
*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**WARNING**

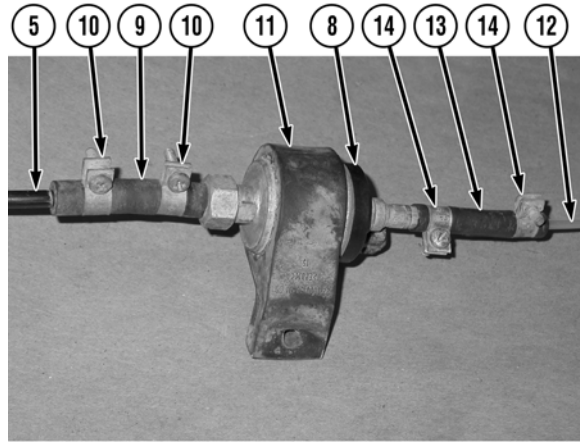
Hot parts and fluids can burn personnel. If vehicle has been operating, let engine cool before starting work. Avoid contact with hot fluid when removing hoses or fittings. Failure to comply may result in serious injury or death to personnel.

a. Arctic Heater.

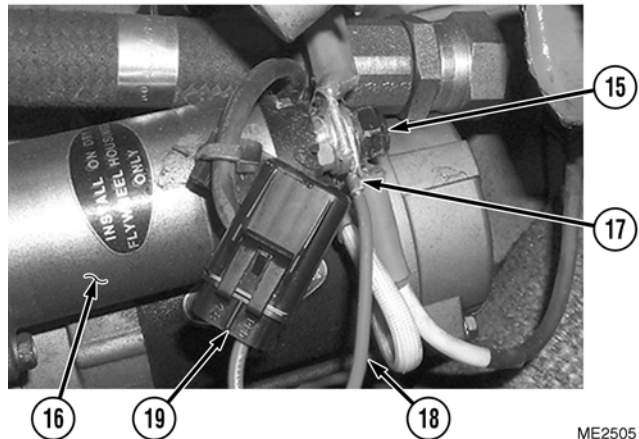
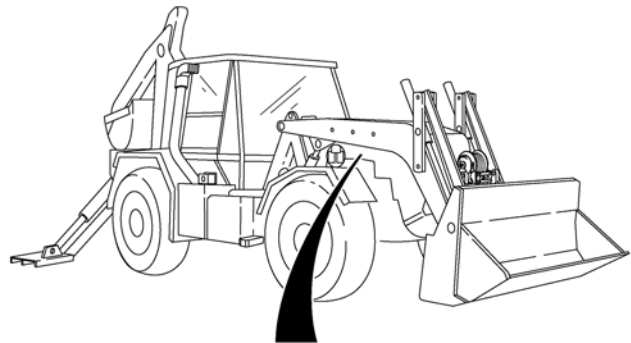


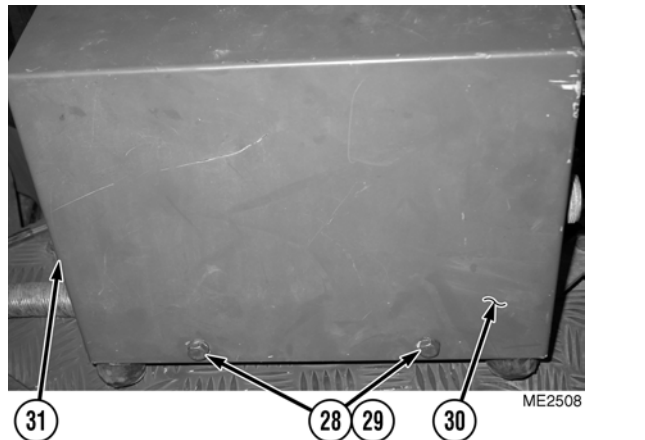
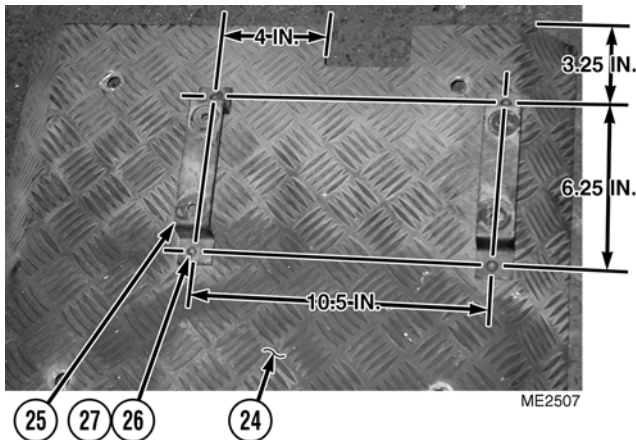
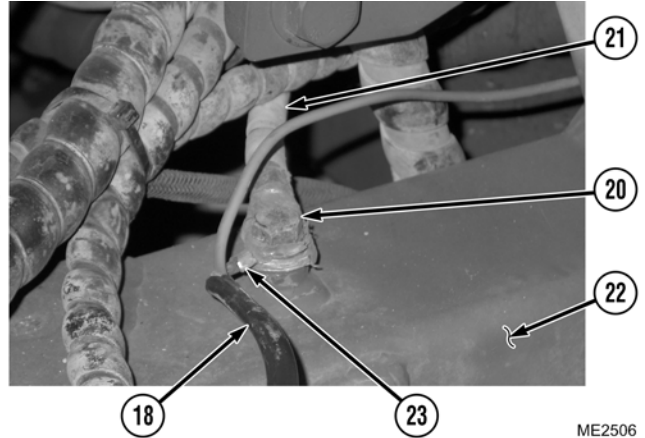
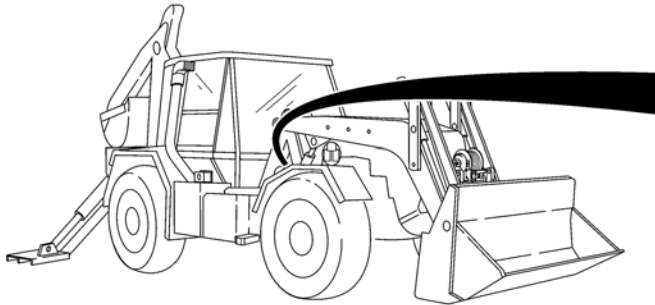
**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.



- (1) Remove plug (1) from fuel tank (2). Discard plug.
- (2) Install fitting (3) on fuel tank (2).
- (3) Measure, mark, and cut fuel pick-up tube (4) to 20 in. (508 mm) long. Discard excess tubing.
- (4) Install fuel pick-up tube (4) in fitting (3).
- (5) Install hose (5) on fuel pick-up tube (4) with hose connection (6) and two clamps (7).
- (6) Install hose (5) on fuel pump (8) with hose connection (9) and two clamps (10).
- (7) Install fuel pump bracket (11) on fuel pump (8).
- (8) Install hose (12) on fuel pump (8) with hose connection (13) and two clamps (14).
- (9) Remove nut (15) from starter solenoid (16), install red wire connector (17) of harness (18) on starter solenoid, and reinstall nut.
- (10) Secure fuse (19) of harness (18) with a cable tie.



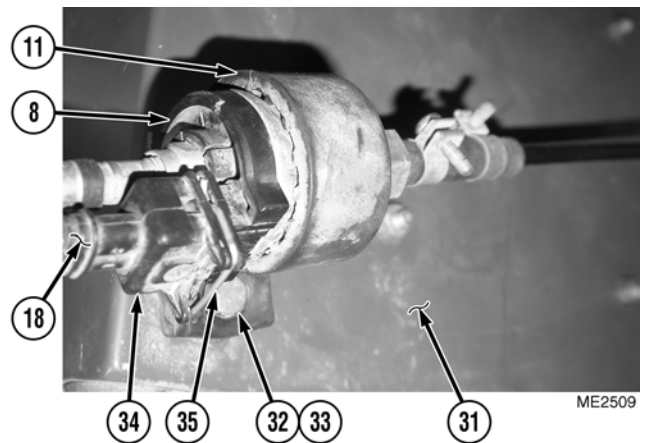


- (11) Remove screw (20) and cable (21) from frame (22).
- (12) Install black wire connector (23) of harness (18) and cable (21) on frame (22) with screw (20).
- (13) Measure and mark four hole positions on fuel step plate (24).
- (14) Using a 17/64-in. drill bit, drill four holes in fuel step plate (24).
- (15) Install two heater mount brackets (25) on fuel step plate (24) with four screws (26) and nuts (27).
- (16) Install fuel tank step plate (24) (Para 13-14).
- (17) Remove two screws (28), washers (29), and cover (30) from arctic heater box (31).

**CAUTION**

Fuel pump must be mounted at a 15 degree minimum angle from horizontal in order to prevent air or vapor blockage in pump. Failure to comply may result in damage to equipment.

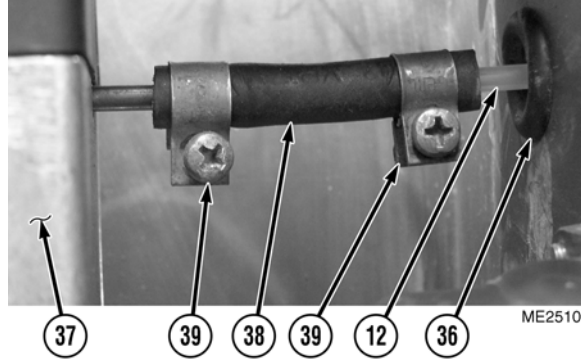
- (18) Install fuel pump mounting bracket (11) on back of arctic heater box (31) with screw (32) and nut (33), ensuring fuel pump is at a 15 degree minimum angle from horizontal.
- (19) Connect fuel pump connector (34) of wire harness (18) to fuel pump (8) with clip (35).



- (20) Route hose (12) through grommet (36) and install hose on arctic heater (37) with hose connection (38) and two clamps (39).

**WARNING**

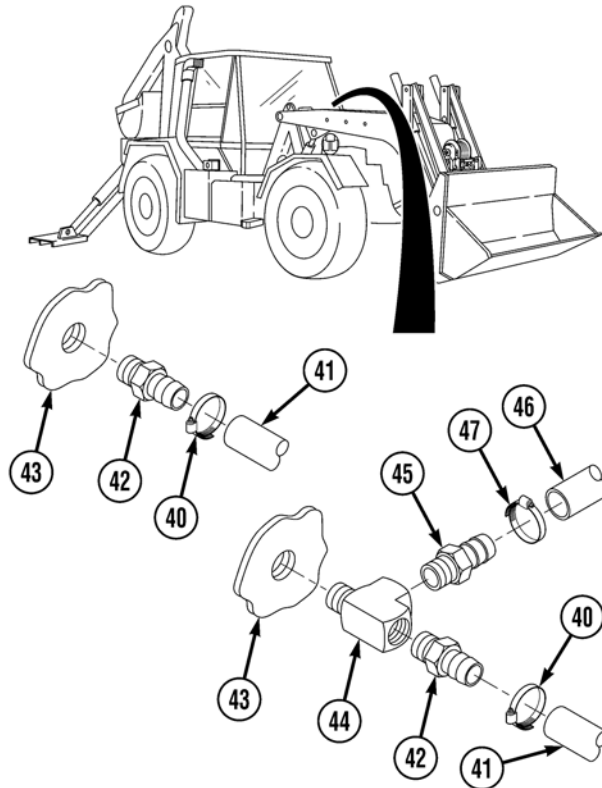
Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.



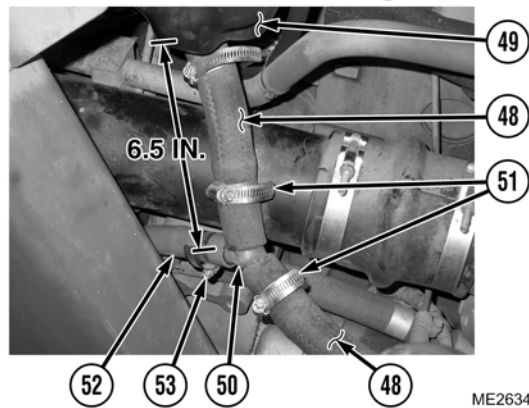
- (21) Loosen clamp (40) and remove hose (41) from fitting (42).
- (22) Remove fitting (42) from engine block (43).
- (23) Apply Loctite 567 on T-fitting (44), fitting (42), and fitting (45).
- (24) Install fittings (42) and (45) on T-fitting (44).

**NOTE**

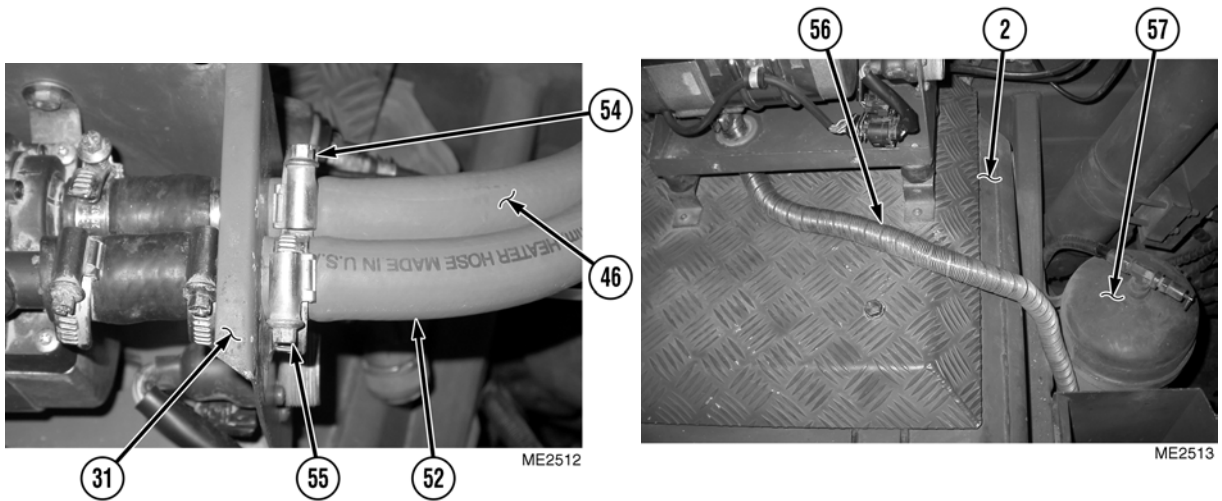
Ensure T-fitting is positioned toward RH side of vehicle.



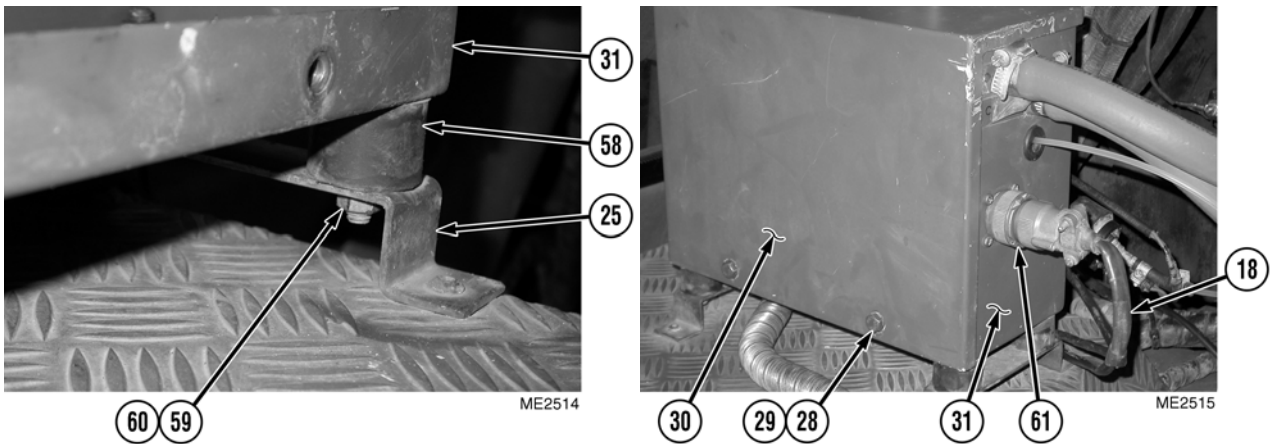
- (25) Install T-fitting (44) on engine block (43).
- (26) Install hose (41) on fitting (42) with clamp (40).
- (27) Install hose (46) on fitting (45) with clamp (47).
- (28) Cut and remove 1 in. (25 mm) from hose (48), approximately 6.5 in. (165 mm) below coolant reservoir (49). Discard removed section of hose.
- (29) Install new ends of hose (48) on Y-fitting (50) with two clamps (51).
- (30) Install hose (52) on Y-fitting (50) with clamp (53).







- (31) Install hose (46) on side marked COOLANT IN of arctic heater box (31) with clamp (54).
- (32) Install hose (52) on side marked OUT of arctic heater box (31) with clamp (55).
- (33) Route heater exhaust pipe (56) so that outlet of pipe is between air dryer bracket (57) and fuel tank (2).

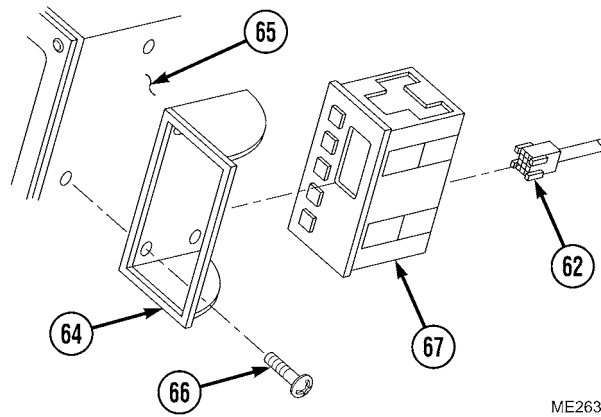


- (34) Secure arctic heater box (31) on heater mount brackets (25) with four isolators (58), eight washers (59), and nuts (60).
- (35) Install cannon plug (61) of wire harness (18) on arctic heater box (31).
- (36) Install cover (30) on arctic heater box (31) with two washers (29) and screws (28).



ME2516

(37) Route timer connector (62) of wire harness (18) through opening in bottom of cab (63).



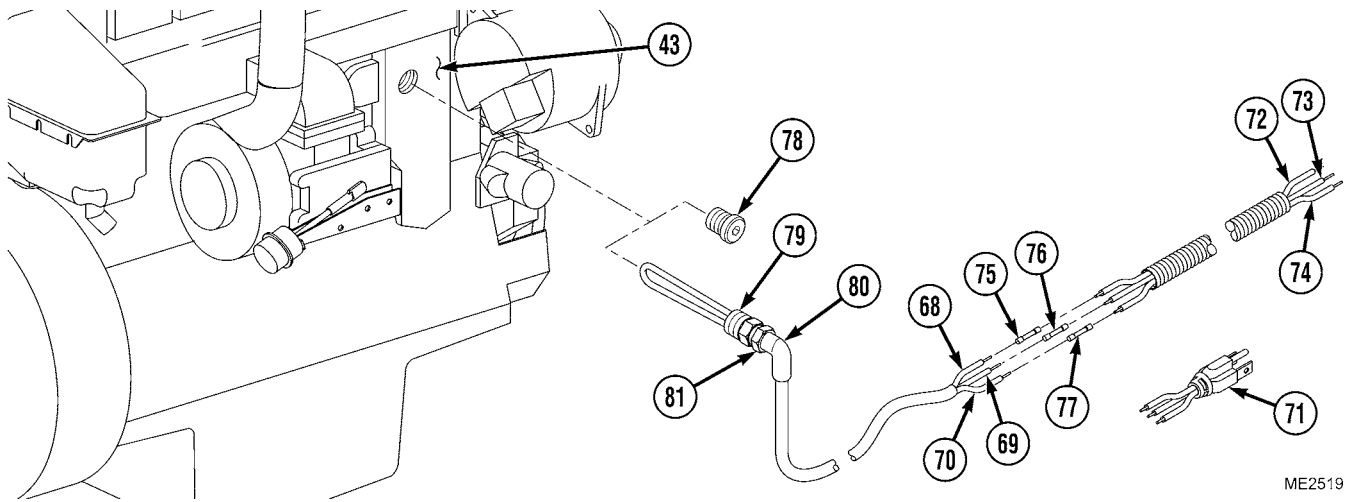
ME2635

**NOTE**

Mark upper-left hole and lower-right hole of timer bracket to ensure best mounting.

- (38) Position timer bracket (64) on upper right side of dash console (65), and mark dash console with locations of two holes in timer bracket.
- (39) Using a 5/32-in. drill bit, drill two holes at locations marked on dash console (65).
- (40) Install timer bracket (64) on dash console (65) with two self-tapping screws (66).
- (41) Install 7-day timer (67) in timer bracket (64).
- (42) Connect timer connector (62) to 7-day timer (67).

**b. Block Heater**



**NOTE**

Cut as close to electrical outlet plug as possible.

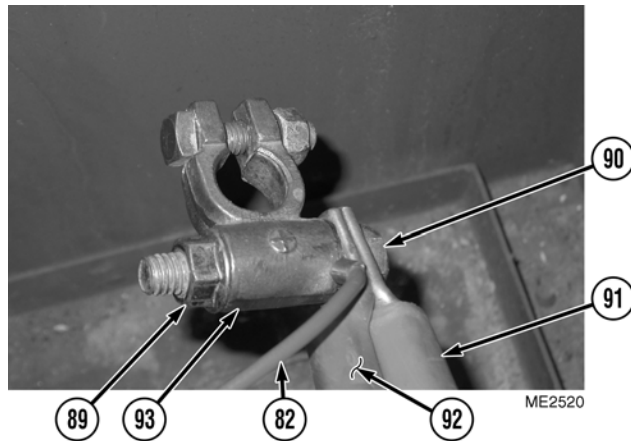
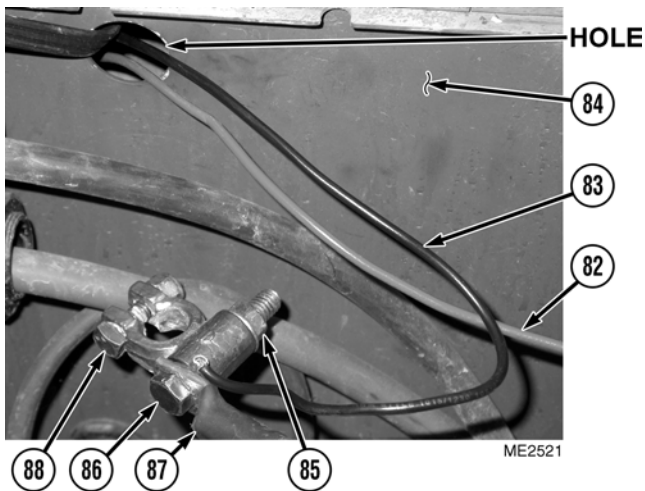
- (1) Cut three block heater wires (68), (69), and (70) as close as possible to electrical outlet plug (71). Discard electrical outlet plug.
- (2) Remove 0.25 in. (6 mm) of insulation from end of three block heater wires (68), (69), and (70).
- (3) Remove 0.25 in. (6 mm) of insulation from both ends of three 6-ft. (1.83 m) bulk wires (72), (73), and (74).
- (4) Connect end of ridged block heater wire (68) with end of black bulk wire (72) using wire connector (75).
- (5) Connect end of green block heater wire (69) with end of green bulk wire (73) using wire connector (76).
- (6) Connect end of smooth block heater wire (70) with end of white bulk wire (74) using wire connector (77).
- (7) Remove plug (78) from engine block (43). Discard plug.
- (8) Install block heater (79) in engine block (43).
- (9) Connect block heater plug (80) to block heater (79) and tighten nut (81).



Use care when routing wires to ensure wires avoid hot or moving components. Failure to comply will result in damage to equipment.

- (10) Route wires (72), (73), and (74) to LH side of engine. Do not secure wires with cable ties at this time.

**c. Trickle Charger**



- (1) Route red trickle charger wire (82) and black trickle charger wire (83) through hole in battery box (84).

**NOTE**

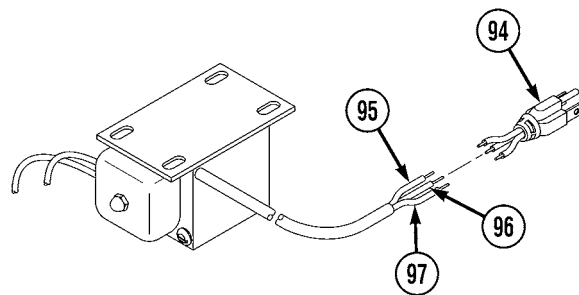
- Cables removed and installed in Steps (2) through (5) are battery-to-electrical master switch, battery-to-NATO slave receptacle, and battery-to-starter solenoid cables.
- Tag all cables and note their positions before removal. Ensure all cables are reconnected to positions noted prior to removal.

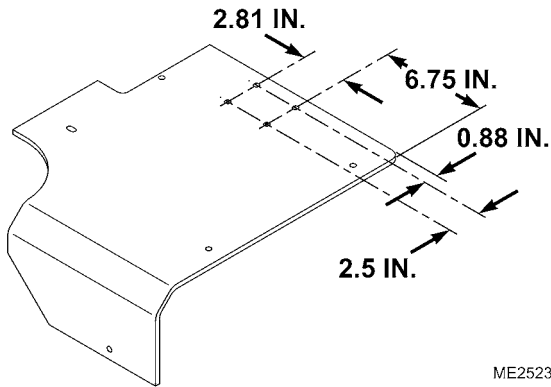
- (2) Remove nut (85), screw (86), and cable (87) from negative (-) terminal (88).
- (3) Install cable (87) and black trickle charger wire (83) on negative (-) terminal (88) with screw (86) and nut (85).
- (4) Remove nut (89), screw (90), cable (91), and cable (92) from positive (+) terminal (93).
- (5) Install cable (92), cable (91), and red trickle charger wire (82) on positive (+) terminal (93) with screw (90) and nut (89).

**NOTE**

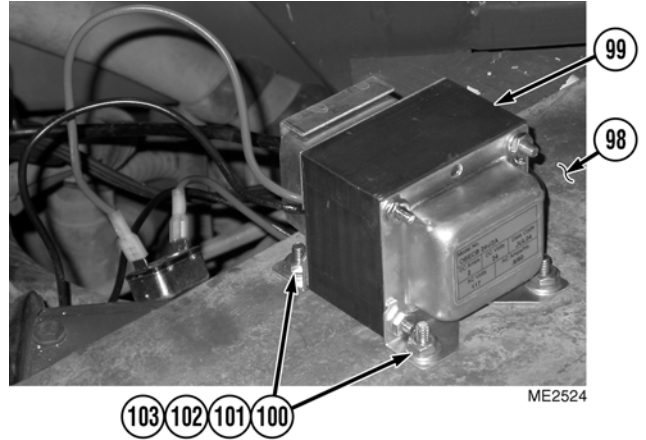
Cut as close to electrical outlet plug as possible.

- (6) Cut electrical outlet plug (94) from three trickle charger wires (95), (96), and (97). Discard electrical outlet plug.
- (7) Remove 0.25 in. (6 mm) of insulation from end of three trickle charger wires (95), (96), and (97).





ME2523

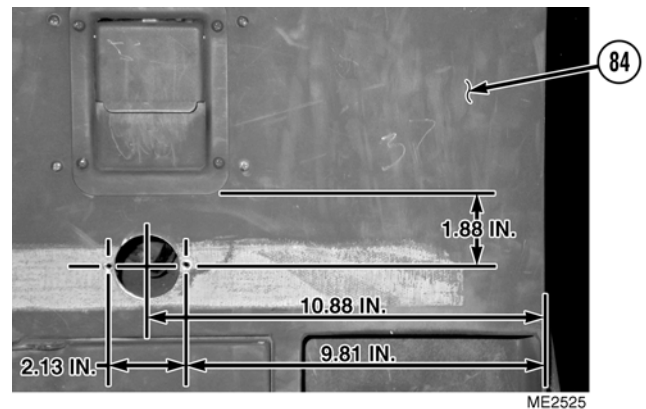


ME2524

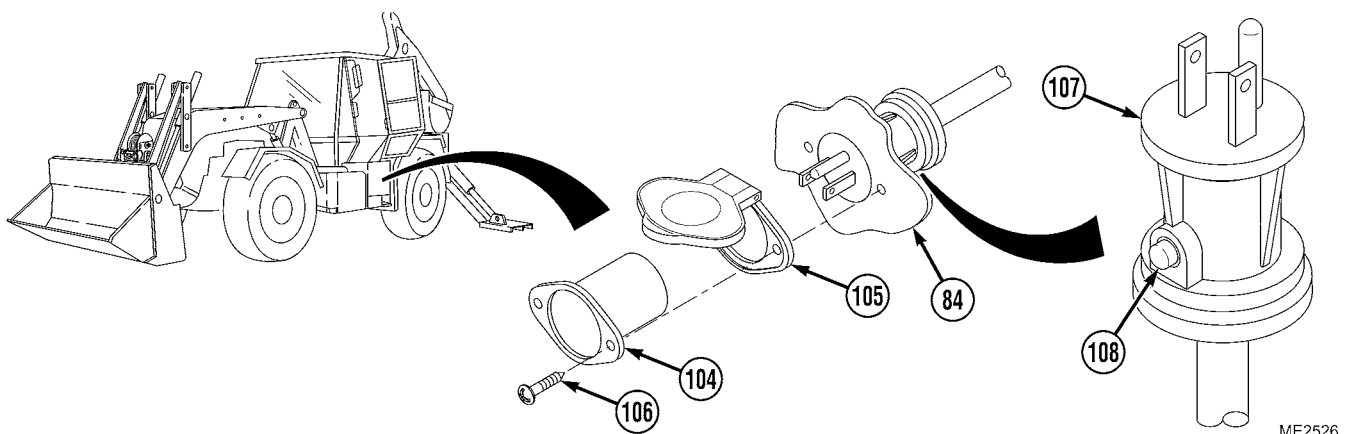
- (8) Measure and mark four hole positions on hydraulic step plate (98).
- (9) Using 13/64-in. drill bit, drill four holes in hydraulic step plate (98).
- (10) Install trickle charger (99) on bottom side of hydraulic step plate (98) with four screws (100), washers (101), lockwashers (102), and nuts (103).

**d. Electrical Outlet**

- (1) Measure and mark three hole positions on battery box (84).
- (2) Using 1.75-in. hole saw, cut hole in battery box (84).
- (3) Using 5/32-in. drill bit, drill two holes in battery box (84).



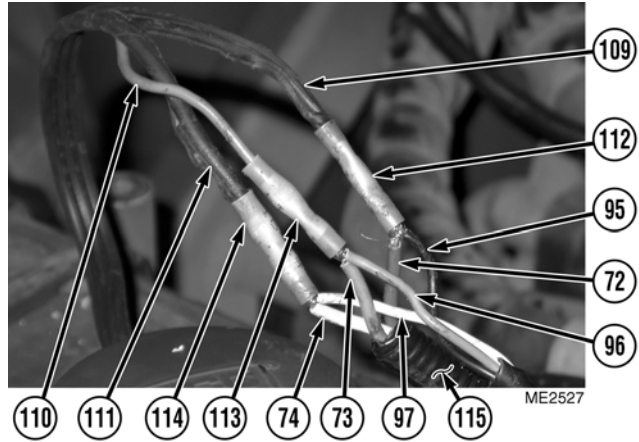
ME2525



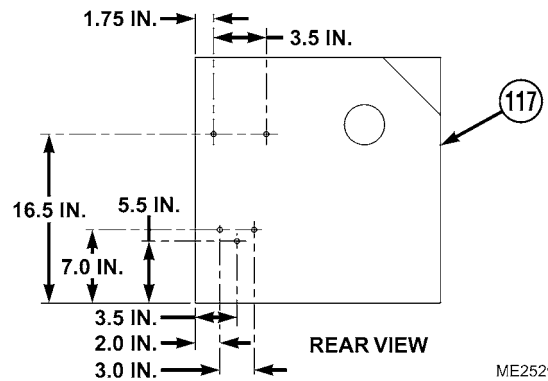
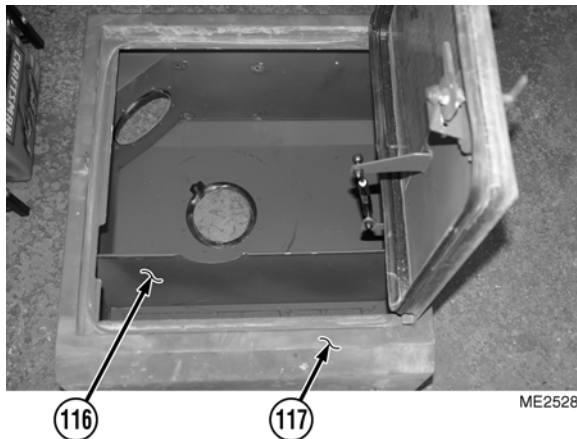
ME2526

- (4) Install plug holder (104) on cover (105).
- (5) Install cover (105) and plug holder (104) on battery box (84) with two self-tapping screws (106).
- (6) Install plug (107) in plug holder (104) until detent ball (108) locks into hole of plug holder (104).

- (7) Remove 0.25 in. (6 mm) of insulation from end of three electrical outlet wires (109), (110), and (111).
- (8) Connect end of ridged electrical outlet wire (109) with ends of black bulk wire (72) and black trickle charger wire (95) using wire connector (112).
- (9) Connect end of green electrical outlet wire (110) with ends of green bulk wire (73) and green trickle charger wire (96) using wire connector (113).
- (10) Connect end of smooth electrical outlet wire (111) with ends of white bulk wire (74) and white trickle charger wire (97) using wire connector (114).
- (11) Install electrical tape on connections.
- (12) Cover bulk wires (72), (73), and (74) with wire sleeving (115), and secure as necessary with cable ties.
- (13) Install hydraulic step plate (98) (Para 13-15).



e. *Ether Start*



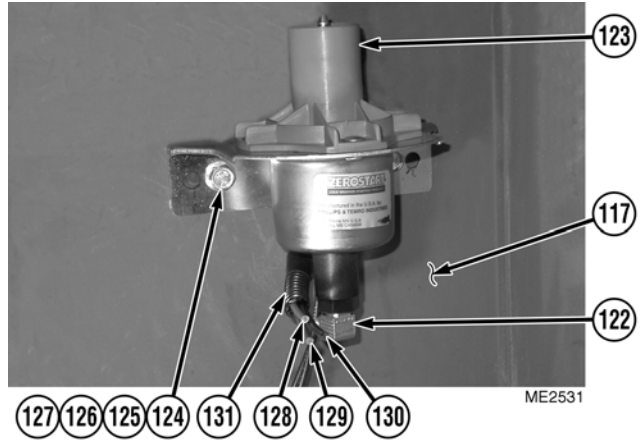
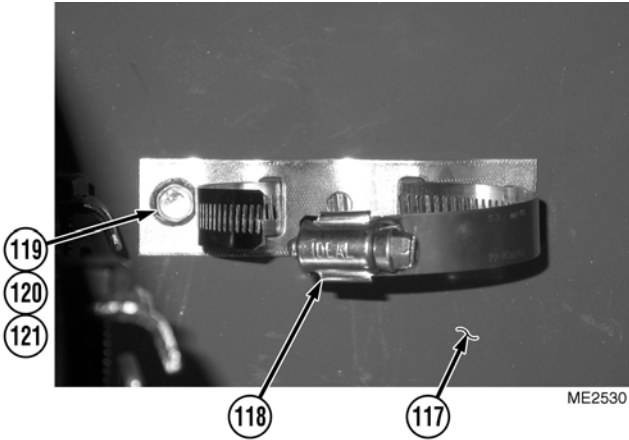
**WARNING**

- CARC paint contains isocyanate (HDI) which is highly irritating to skin and respiratory system. High concentrations of HDI can produce symptoms of itching and reddening of skin, a burning sensation in throat and nose, and watering of the eyes. In extreme concentrations, HDI can cause cough, shortness of breath, pain during respiration, increased sputum production, and chest tightness. The following precautions must be taken whenever using CARC paint:
- ALWAYS use air line respirators when using CARC paint unless air sampling shows exposure to be below standards. Use chemical cartridge respirator if air sampling is below standards.
- DO NOT let skin or eyes come in contact with CARC paint. Always wear protective equipment (gloves, ventilation mask, safety goggles, etc.). DO NOT use CARC paint without adequate ventilation.
- NEVER weld or cut CARC-coated materials.
- DO NOT grind or sand painted equipment without high-efficiency, air-purifying respirators in use.
- BE AWARE of CARC paint exposure symptoms; symptoms can occur a few days after initial exposure. Seek medical help immediately if symptoms are detected.

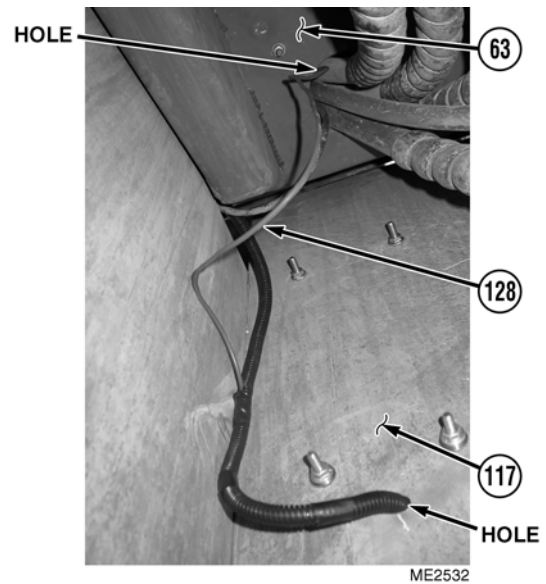
**WARNING**

Ensure all welds are ground completely smooth. Failure to comply may result in injury to personnel or damage to equipment.

- (1) Using a grinder, grind welds of shelf (116) and remove shelf from stowage box (117). Discard shelf.
- (2) Measure and mark five hole positions on rear of stowage box (117).
- (3) Using a 7-mm drill bit, drill four holes in stowage box (117).
- (4) Using a 10-mm drill bit, drill hole in stowage box (117).
- (5) Prime and paint inside of stowage box (117) (TM 43-0139).
- (6) Install stowage box (117) (Para 13-29).



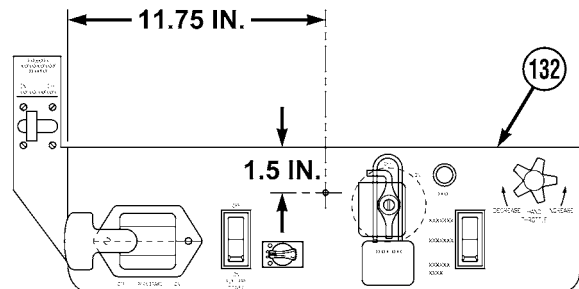
- (7) Install cylinder clamp (118) on stowage box (117) with two screws (119), lockwashers (120), and nuts (121).
- (8) Install valve fitting (122) on valve assembly (123).
- (9) Install valve assembly (123) on stowage box (117) with two screws (124), washers (125), lockwashers (126), and nuts (127).
- (10) Cover 8.5 ft. wire (128), 9.5 ft. wire (129) and 8 ft. tube (130) with 9.5 ft. wire sleeving (131).
- (11) Route wire (128), wire (129), and tube (130) through hole in stowage box (117).
- (12) Route wire (128) through opening in bottom of cab (63).
- (13) Measure and mark hole position on side instrument panel (132).



**CAUTION**

Use care when drilling through side instrument panel. Ensure drill does not contact any wires or components. Failure to comply will result in damage to equipment.

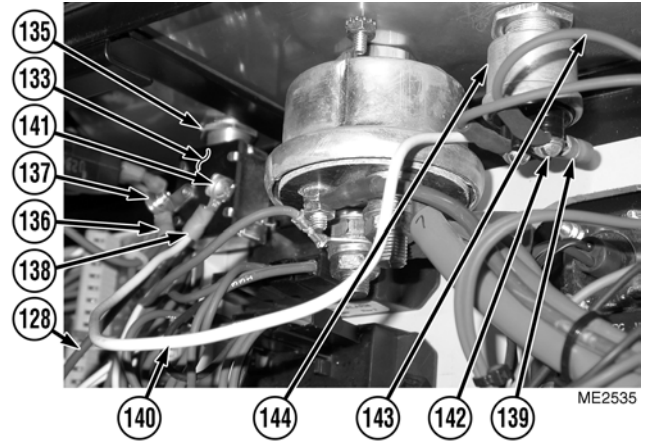
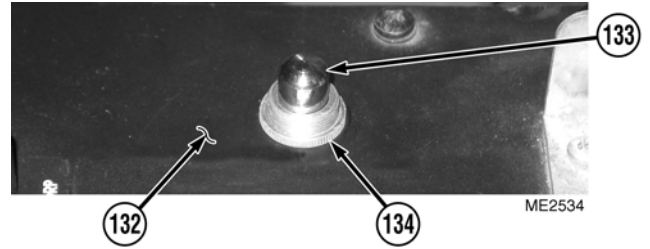
- (14) Using a 5/8-in. drill bit, drill hole on side instrument panel (132).



ME2533



- (15) Install ether start pushbutton (133) on side instrument panel (132) with nuts (134) and (135).
- (16) Install terminal connector (136) to wire (128).
- (17) Install terminal connector (136) on ether start pushbutton (133) with screw (137).
- (18) Install terminal connector (138) and (139) to jumper wire (140).
- (19) Install terminal connector (138) on ether start pushbutton (133) with screw (141).
- (20) Remove screw (142) and wire (143) from starter button (144).
- (21) Install terminal connector (138) and wire (143) on starter button (144) with screw (142).



**NOTE**

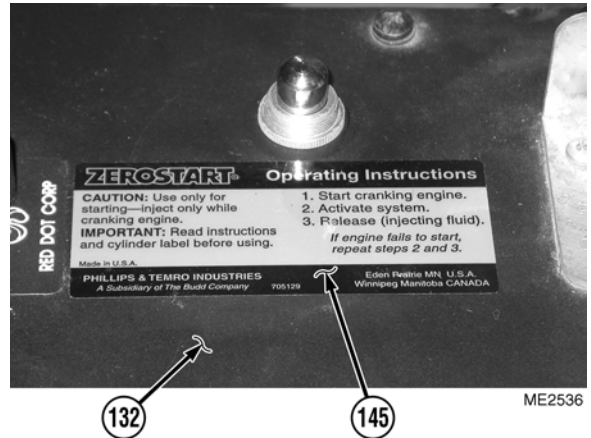
Ensure decal is positioned near ether start pushbutton on side instrument panel, and not covering other decals.

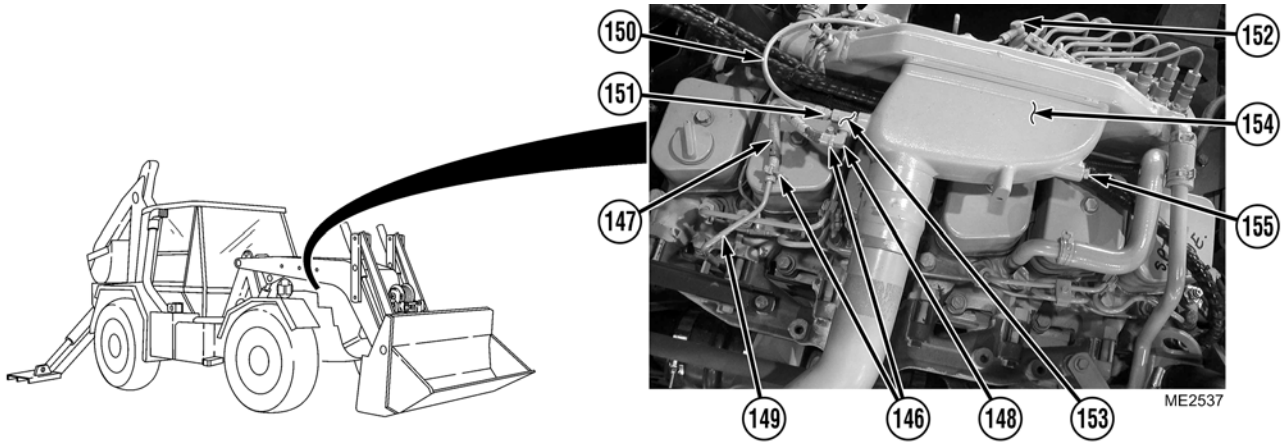
- (22) Install decal (145) on side instrument panel (132).



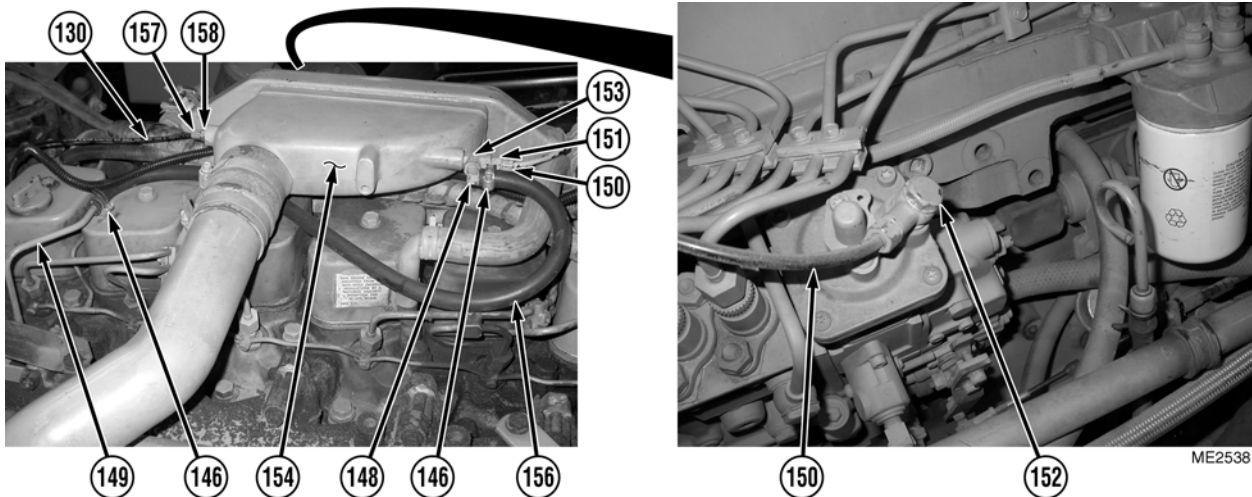
Use care when routing wires to ensure wires avoid hot or moving components. Failure to comply will result in damage to equipment.

- (23) Route wire (129) and tube (130) to engine and secure with cable ties.

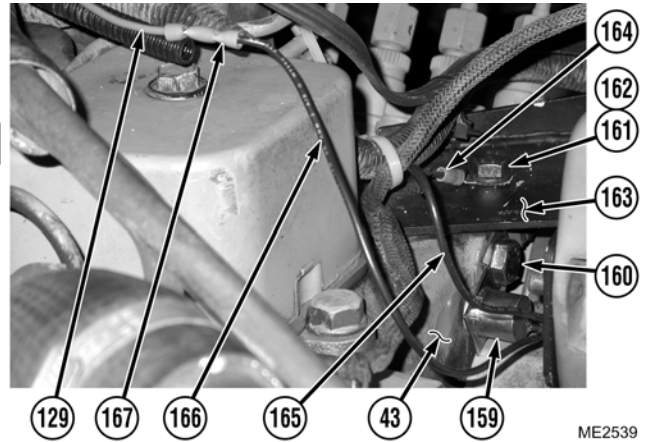
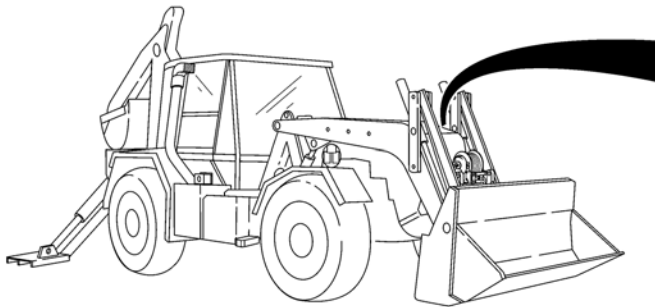




- (24) Loosen two clamps (146) and remove hose (147) from elbow (148) and tube (149). Discard hose.
- (25) Disconnect tube (150) from fitting (151) and loosen screw (152).
- (26) Remove T-fitting (153) from rear side of air cross connection (154).
- (27) Remove plug (155) from front side of air cross connection (154).



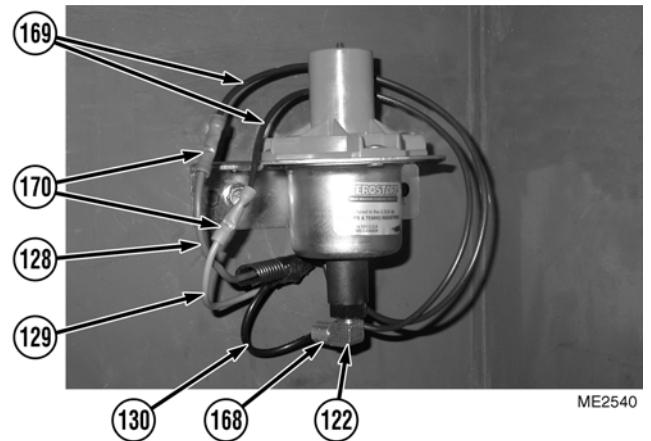
- (28) Install T-fitting (153) in front side of air cross connection (154).
- (29) Connect tube (150) on fitting (151) and tighten screw (152).
- (30) Install 18-in. (457 mm) hose (156) on tube (149) and elbow (148) with two clamps (146).
- (31) Remove tube fitting (157) from atomizer (158).
- (32) Install atomizer (158) on rear side of air cross connection (154).
- (33) Install tube (130) on atomizer (158) with tube fitting (157). Tighten tube fitting approximately one turn after it is finger tight.



ME2539

- (34) Install thermostat (159) on engine block (43) with screw (160).
- (35) Remove screw (161) and lockwasher (162) from washer bottle bracket (163). Discard lockwasher.
- (36) Install terminal connector (164) on wire (165).
- (37) Install terminal connector (164) on washer bottle bracket (163) with new lockwasher (162) and screw (161).
- (38) Install bulk wire (129) on thermostat wire (166) with wire connector (167).

- (39) Remove tube fitting (168) from valve fitting (122).
- (40) Install tubing (130) on valve fitting (122) with tube fitting (168). Tighten tube fitting approximately one turn after it is finger tight.
- (41) Connect bulk wires (128) and (129) to two valve assembly wires (169) using two wire connectors (170).



ME2540

**f. Follow-On Maintenance.**

- (1) Install batteries (Para 12-6).
- (2) Fill cooling system (Para 9-4).
- (3) Install starting fluid cylinder (Para 20-15).
- (4) Start engine and functionally test cold weather equipment (TM 5-2420-230-10).
- (5) Check all hoses and tubes for leaks.
- (6) Shut OFF engine (TM 5-2420-230-10).

**END OF TASK**

**20-5. ARCTIC HEATER ASSEMBLY MAINTENANCE.**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Pan, drain, Item 29, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.

*Materials/Parts*  
Antifreeze, Item 3, Appendix C  
Cap and plug set, Item 4, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 207

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

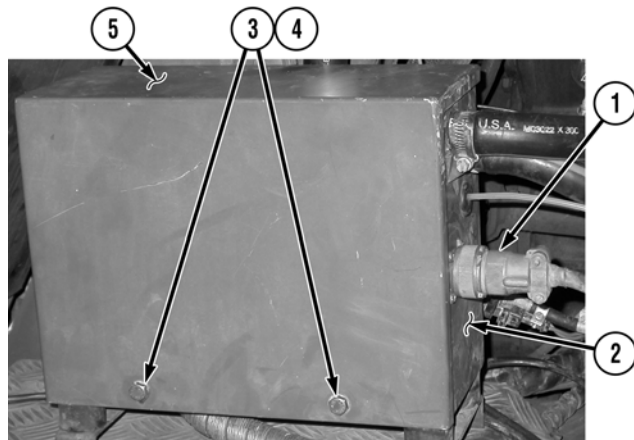
**a. Removal.**

**WARNING**

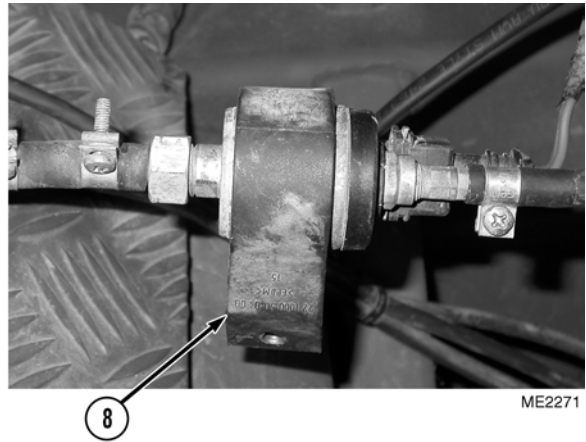
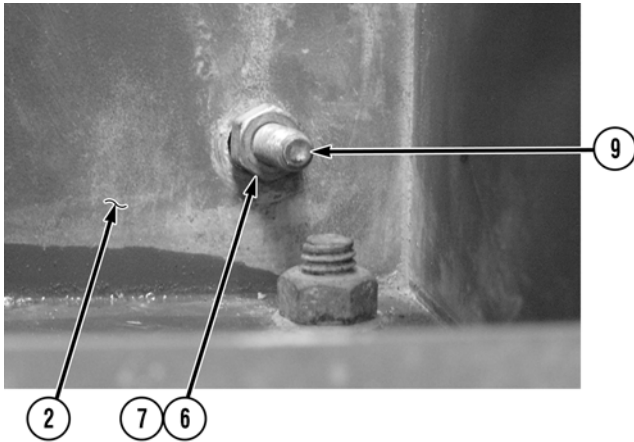
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

**NOTE**

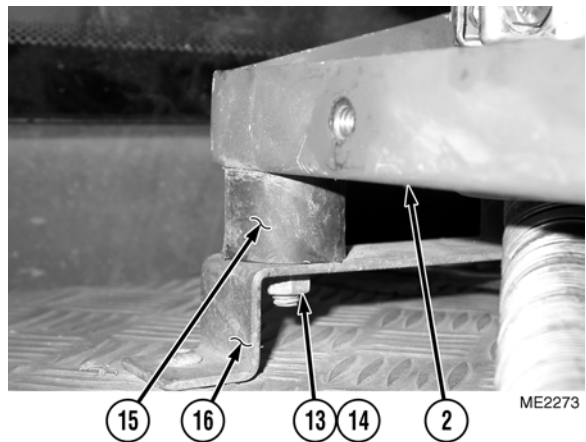
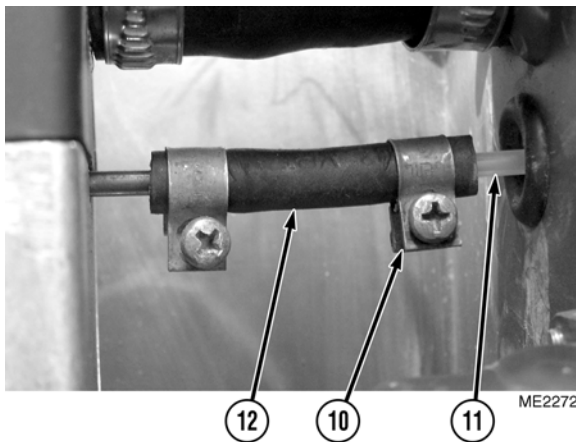
- Tag all hoses, wires, and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
  - Remove cable ties as necessary.
- (1) Disconnect electrical connector (1) from arctic heater box (2).
  - (2) Remove two screws (3), washers (4) and arctic heater cover (5) from arctic heater box (2).



ME2270



(3) Remove nut (6), washer (7), fuel pump mounting bracket (8), and screw (9) from arctic heater box (2).



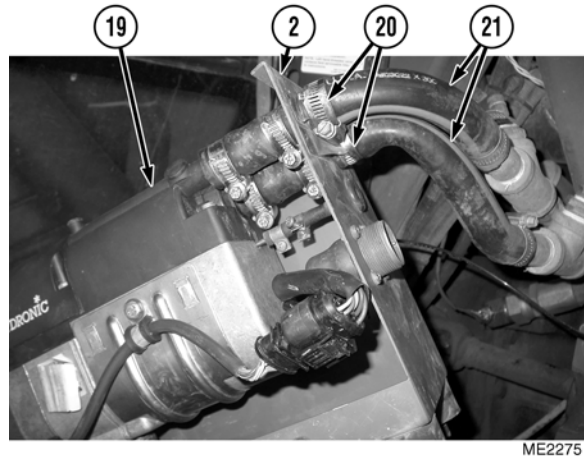
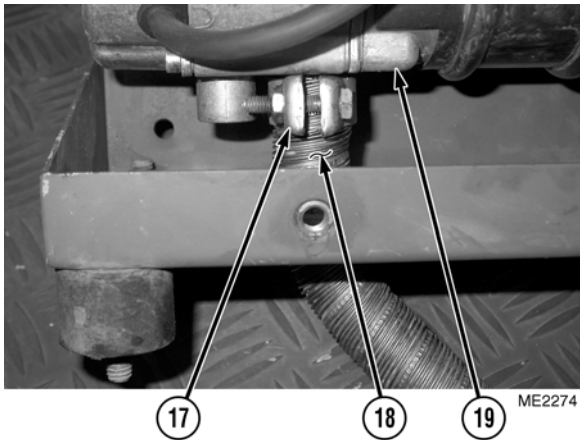
**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

(4) Loosen clamp (10) and remove fuel hose (11) from hose connector (12).

(5) Remove four nuts (13) and washers (14) from isolators (15).

(6) Remove arctic heater box (2) from box mounting brackets (16).

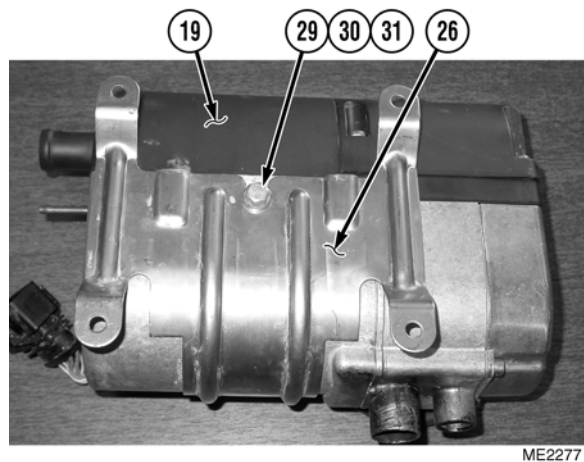
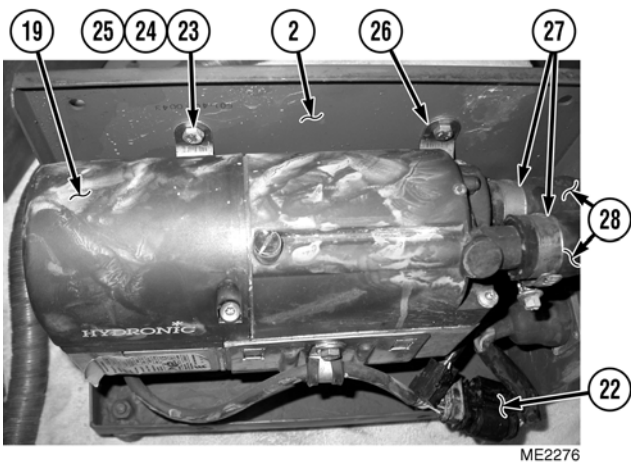


**WARNING**

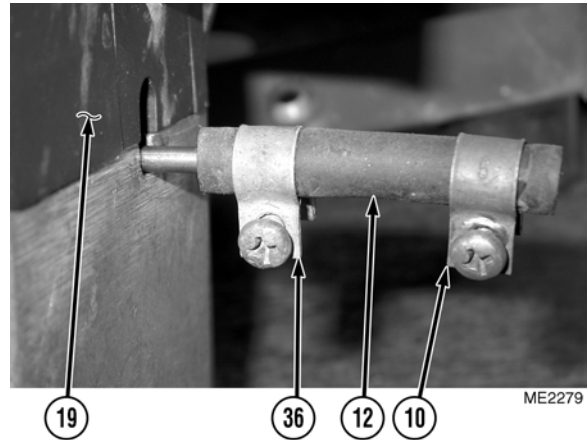
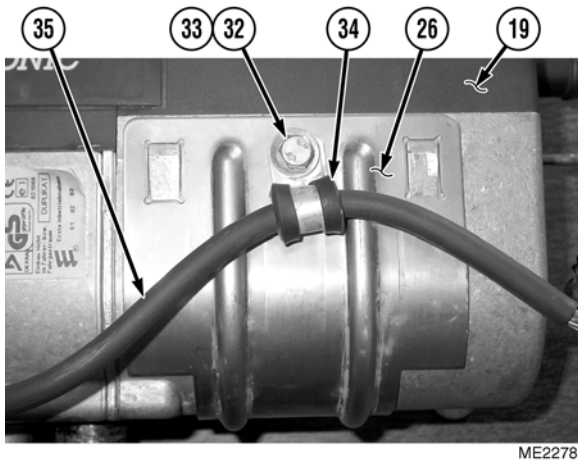
- Hot parts and fluids can burn personnel. If vehicle has been operating, let engine cool before starting work. Avoid contact with hot fluid when removing hoses or fittings. Failure to comply may result in serious injury or death to personnel.
- Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.

- (7) Loosen clamp (17) and remove exhaust pipe (18) from arctic heater (19).
- (8) Place drain pan, loosen two clamps (20), and remove two coolant hoses (21) from arctic heater box (2).
- (9) Drain remaining coolant from arctic heater (19). Wipe excess coolant from arctic heater with a clean cloth.

**b. Disassembly**



- (1) Unplug connector (22).
- (2) Remove four nuts (23), washers (24), screws (25), and heater mounting bracket (26) from arctic heater box (2).
- (3) Loosen two clamps (27) and remove arctic heater (19) from two coolant hoses (28).
- (4) Remove screw (29), washer (30), and spacer (31) from heater mounting bracket (26) and arctic heater (19).

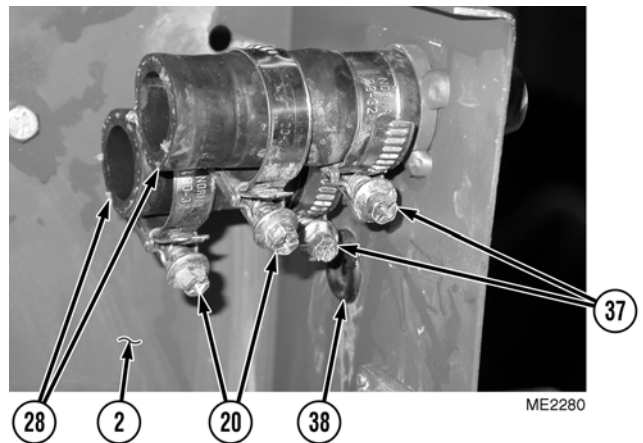


- (5) Remove screw (32), washer (33), and clamp (34) from heater mounting bracket (26) and arctic heater (19).
- (6) Remove heater mounting bracket (26) from locking tabs of arctic heater (19).
- (7) Remove clamp (34) from cable (35).
- (8) Loosen clamp (36) and remove hose connector (12) from arctic heater (19).
- (9) Remove two clamps (10) and (36) from hose connector (12).

**NOTE**

Perform Steps (10) through (16) only if required.

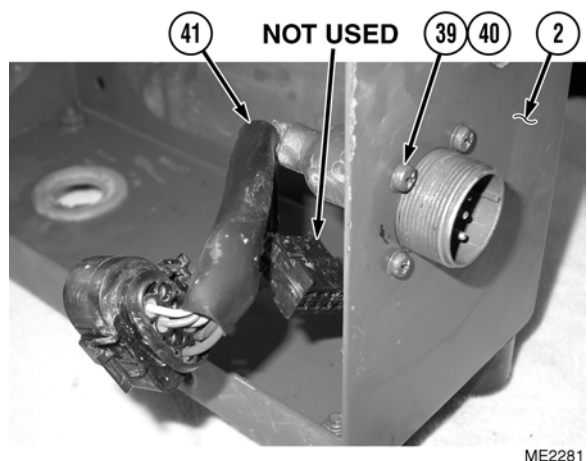
- (10) Loosen two clamps (37) and remove two coolant hoses (28) from arctic heater box (2).
- (11) Remove four clamps (20) and (37) from two coolant hoses (28).
- (12) Remove grommet (38) from arctic heater box (2).

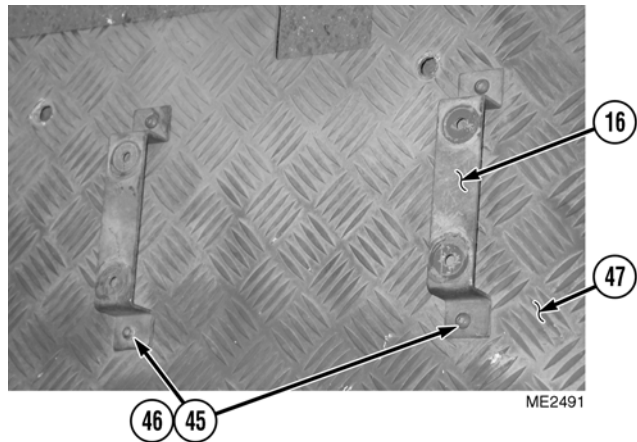
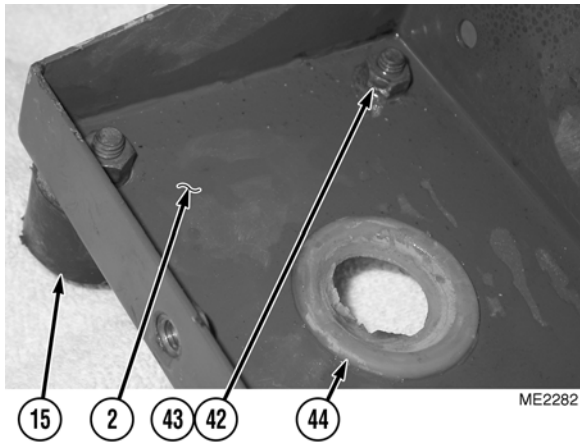


**NOTE**

Auxiliary connector on harness is not used.

- (13) Remove four screws (39), washers (40), and wire harness (41) from arctic heater box (2).





(14) Remove four nuts (42), washers (43) and isolators (15) from arctic heater box (2).

(15) Remove grommet (44) from arctic heater box (2).

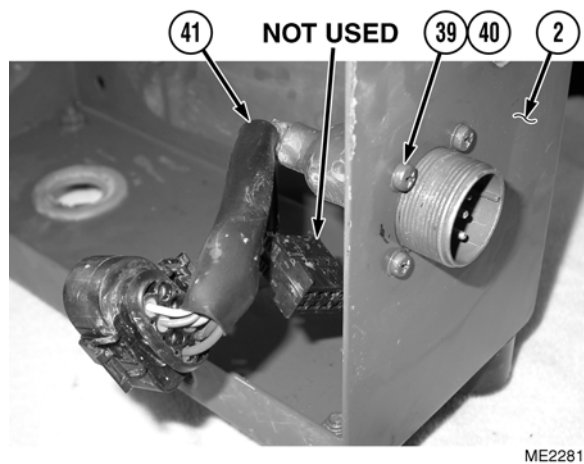
(16) Remove four nuts (45), screws (46), and two box mounting brackets (16) from fuel step plate (47).

**c. Assembly.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Perform Steps (1) through (7) as necessary for parts removed in disassembly.

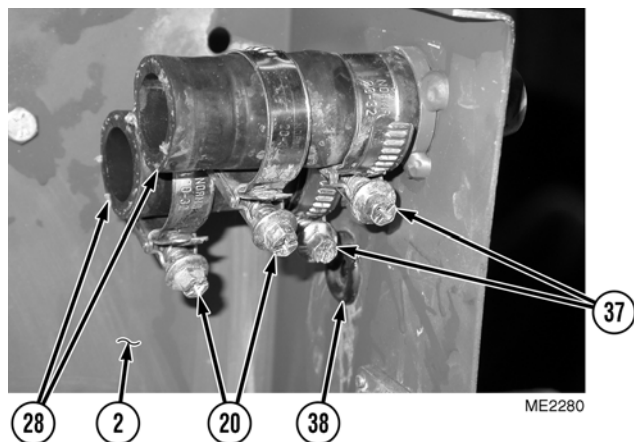
- (1) Install two box mounting brackets (16) on fuel step plate (47) with four screws (46) and nuts (45).
- (2) Install grommet (44) on arctic heater box (2).
- (3) Install isolators (15) on arctic heater box (2) with four washers (43) and nuts (42).



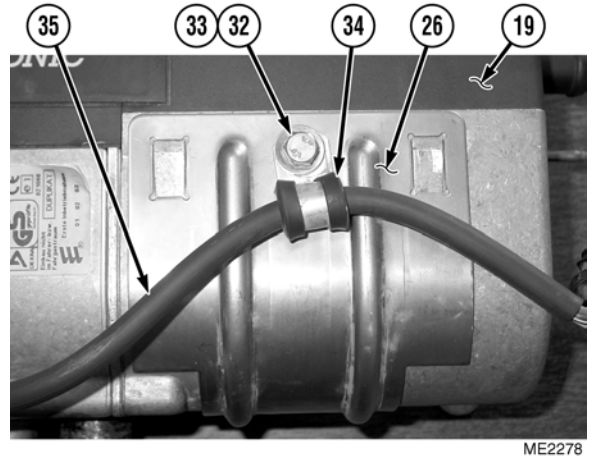
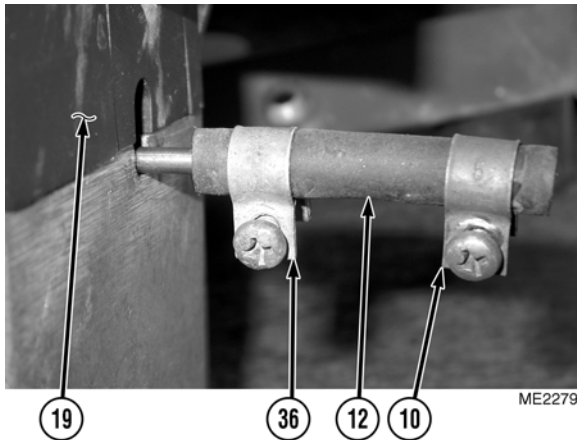
**NOTE**

Auxiliary connector on harness is not used.

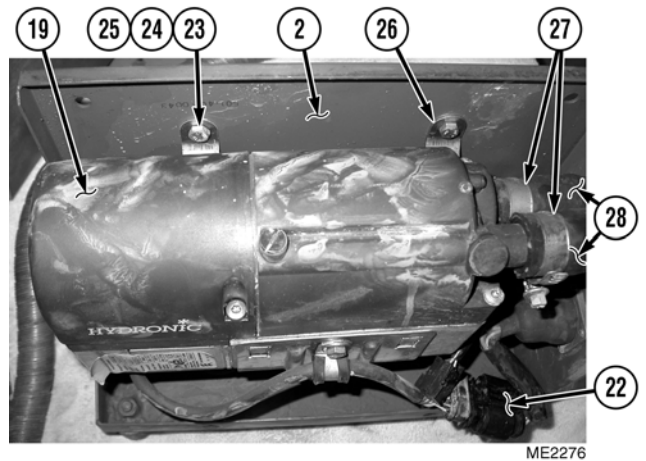
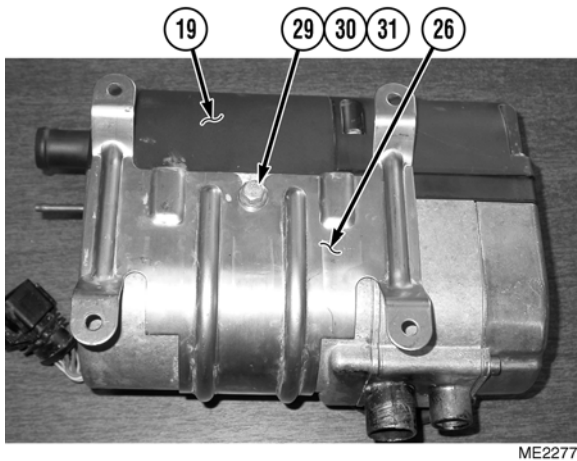
- (4) Install wire harness (41) on arctic heater box (2) with four washers (40) and screws (39).
- (5) Install grommet (38) on arctic heater box (2).
- (6) Position four clamps (20) and (37) on two coolant hoses (28).
- (7) Install two coolant hoses (28) on arctic heater box (2) with clamps (37).





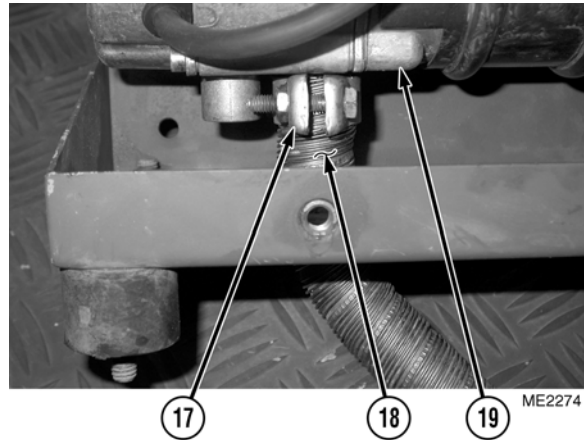
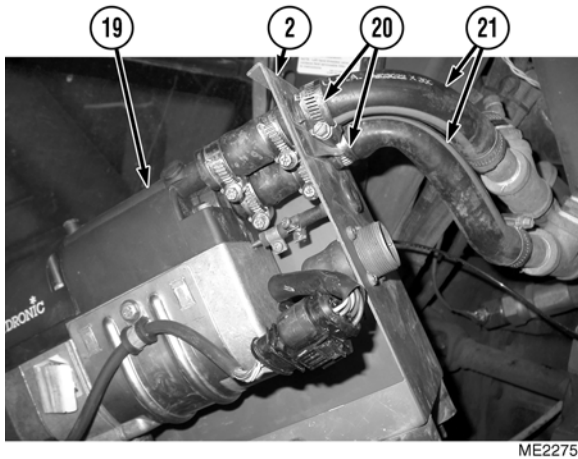


- (8) Position two clamps (36) and (10) on hose connector (12).
- (9) Install hose connector (12) on arctic heater (19) with clamp (36).
- (10) Position clamp (10) on hose connector (12).
- (11) Position clamp (34) on cable (35).
- (12) Install heater mounting bracket (26) on locking tabs of arctic heater (19).
- (13) Install clamp (34) on heater mounting bracket (26) and arctic heater (19) with washer (33) and screw (32).



- (14) Install spacer (31), washer (30), and screw (29) on heater mounting bracket (26) and arctic heater (19).
- (15) Install arctic heater (19) on two coolant hoses (28) with two clamps (27).
- (16) Install heater mounting bracket (26) on arctic heater box (2) with four screws (25), washers (24), and nuts (23).
- (17) Plug in connector (22).

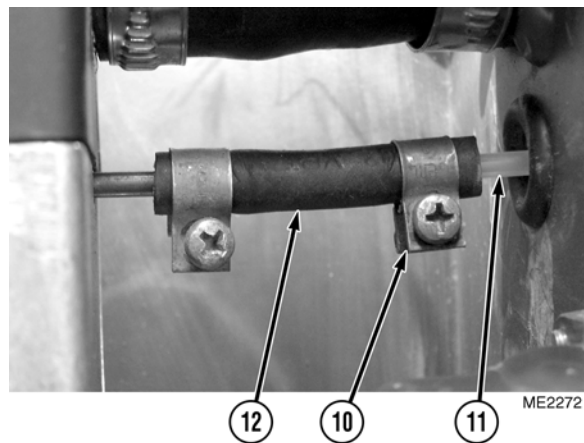
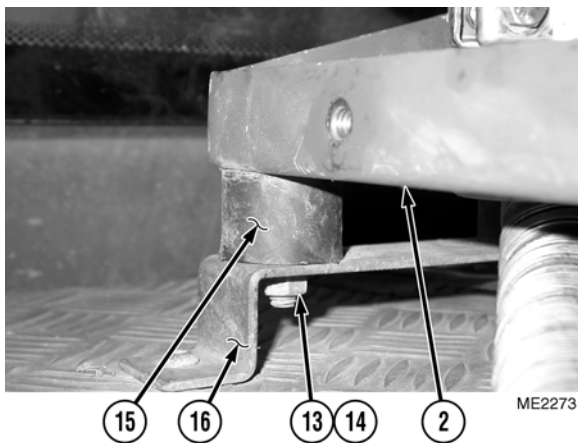
**d. Installation**



**WARNING**

Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.

- (1) Install two coolant hoses (21) on arctic heater box (2) with two clamps (20).
- (2) Install exhaust pipe (18) on arctic heater (19) with clamp (17).

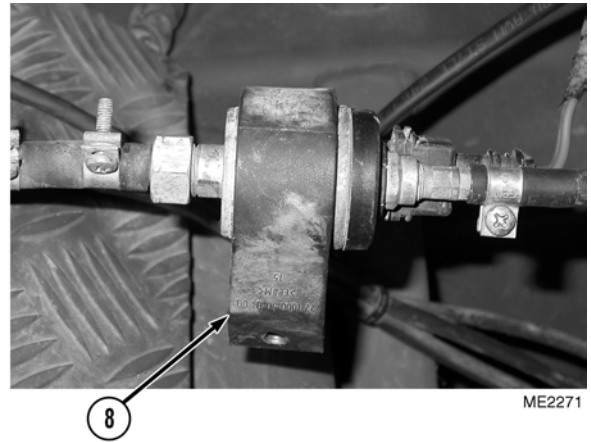
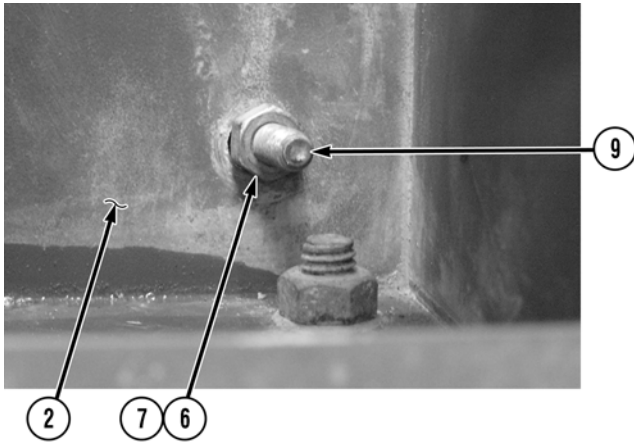


- (3) Install arctic heater box (2) on box mounting brackets (16) with four isolators (15), washers (14), and nuts (13).

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

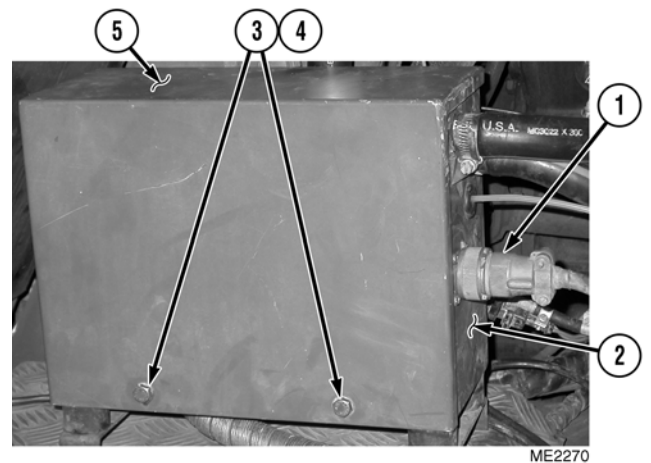
- (4) Install fuel hose (11) on hose connector (12) with clamp (10).



- (5) Install fuel pump mounting bracket (8) on arctic heater box (2) with screw (9), washer (7), and nut (6).
- (6) Install arctic heater cover (5) on arctic heater box (2) with two washers (4) and screws (3).

**WARNING**

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



- (7) Connect electrical connector (1) on arctic heater box (2).

**e. Follow-On Maintenance.**

- (1) Fill cooling system (Para 9-4).
- (2) Start engine and functionally test arctic heater (TM 5-2420-230-10).
- (3) Check all hoses for leaks.
- (4) Shut OFF engine (TM 5-2420-230-10).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

## 20-6. COMBUSTION AIR BLOWER REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

Tool kit, electrical contact, Item 37, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 20-10	Glow pin removed.

*Materials/Parts*

Cloth, lint-free, Item 10, Appendix C  
 Seal and gasket set, Item 234.1, Appendix D  
 Tags, identification, Item 63, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 207

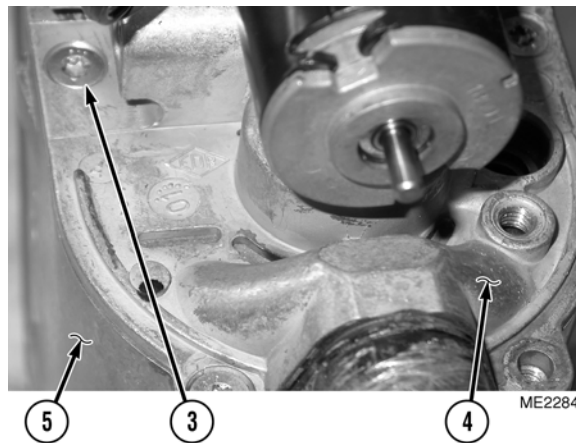
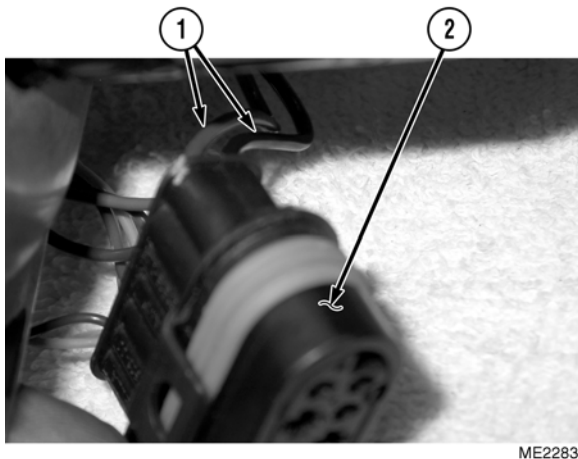
*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

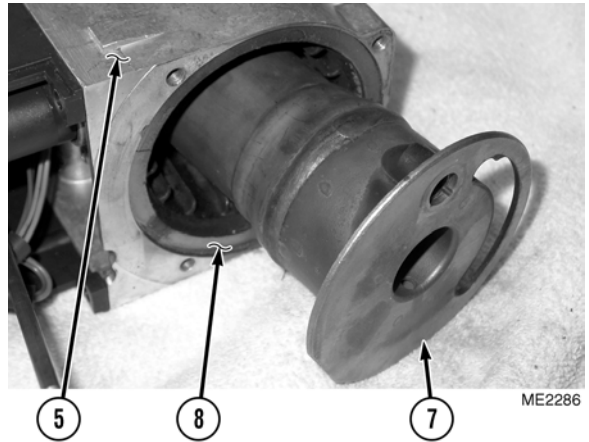
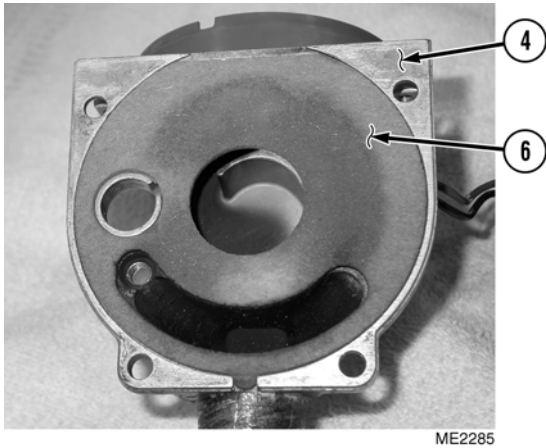
### a. Removal.



### NOTE

Tag all wires and note their positions before removal.

- (1) Remove two wires (1) from connector (2).
- (2) Remove three screws (3) and air blower (4) from heat exchanger outer casing (5).



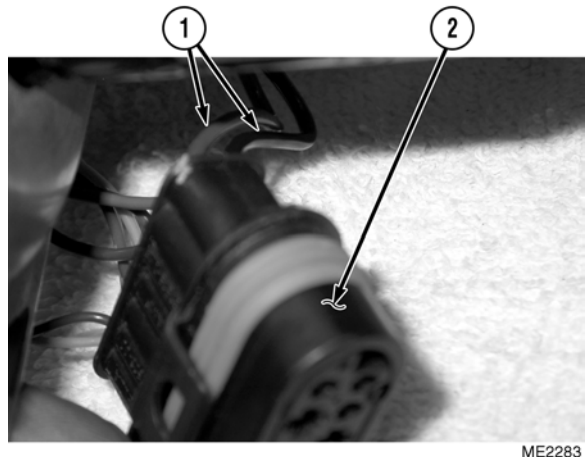
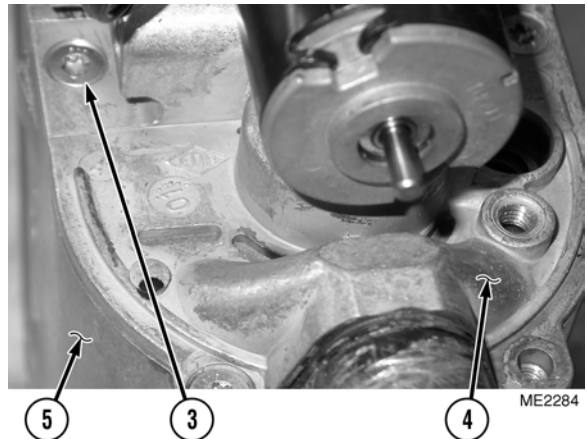
- (3) Remove gasket (6) from air blower (4). Discard gasket.
- (4) Remove burner (7) and seal (8) from heat exchanger outer casing (5).
- (5) Remove seal (8) from burner (7). Discard seal.

**b. Installation.**

**NOTE**

Ensure all wires are reconnected to positions noted prior to removal.

- (1) Install new seal (8) on burner (7).
- (2) Install seal (8) and burner (7) on heat exchanger outer casing (5).
- (3) Install new gasket (6) on air blower (4).
- (4) Install air blower (4) on heat exchanger outer casing (5) with three screws (3).
- (5) Install two wires (1) on connector (2).



**c. Follow-On Maintenance.**

Install glow pin (Para 20-10).

**END OF TASK**

**20-7. CONTROL UNIT REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para* Para 20-5  
*Condition Description* Arctic heater removed.

*Materials/Parts*  
Tags, identification, Item 63, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 207

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

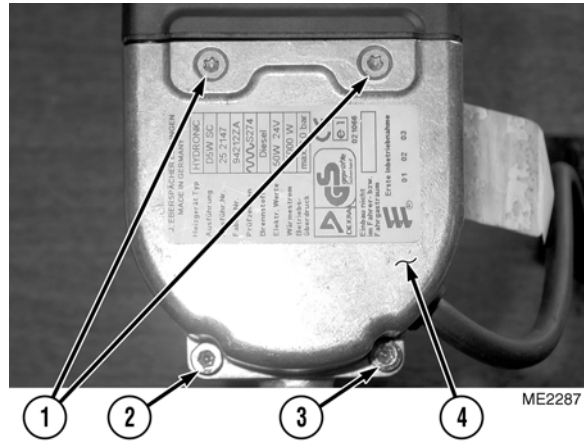
*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

**NOTE**

Tag all wires and note their positions before removal.

- (1) Remove two screws (1), screw (2), screw (3), control unit (4) and grommet (5) from arctic heater (6).
- (2) Unplug connector (7).

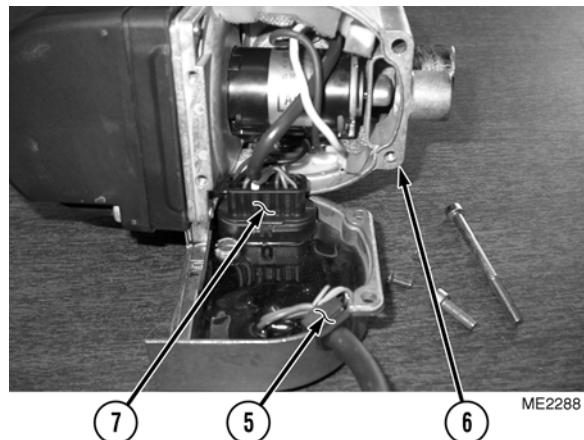


**b. Installation**

**NOTE**

Ensure all wires are reconnected to positions noted prior to removal.

- (1) Plug in connector (7).
- (2) Position grommet (5) on control unit (4).
- (3) Install control unit (4) on arctic heater (6) with screw (3), screw (2), and two screws (1).



**c. Follow-On Maintenance.**

Install arctic heater (Para 20-5).

**END OF TASK**

**20-8. FLAME SENSOR REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool, electrical contact, Item 27.1, Appendix B  
Tool, electrical contact, Item 27.2, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*                      *Condition Description*  
Para 20-7                              Control unit removed.

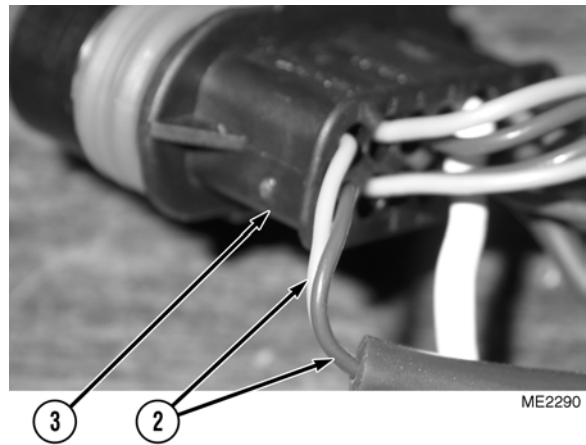
*Materials/Parts*  
Tags, identification, Item 63, Appendix C

*Drawings Required*  
TM 5-2420-230-24P    Figure 207

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

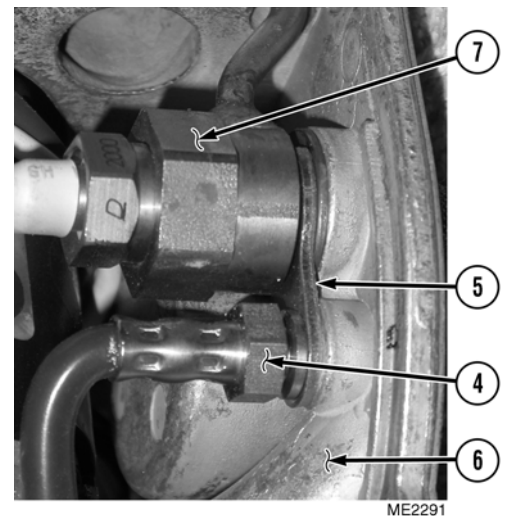
**a. Removal.**



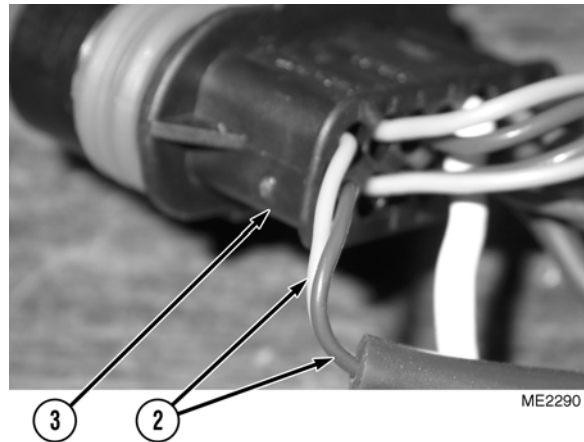
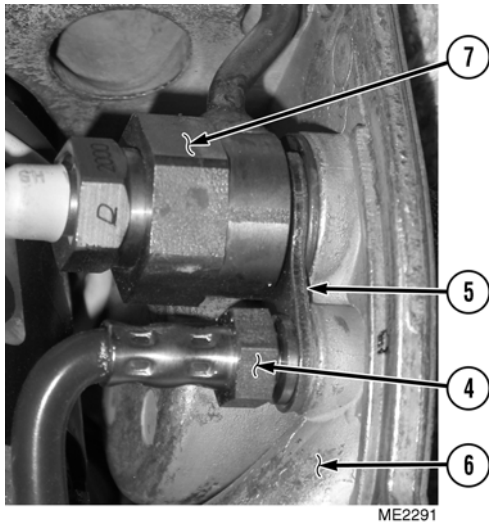
**NOTE**

- Tag all wires and note their positions before removal.
- Note position of holder prior to removal.

- (1) Remove exhaust cover (1).
- (2) Using an electrical contact tool, remove two wires (2) from connector (3).
- (3) Remove flame sensor (4) from holder (5) and air blower (6).
- (4) Remove holder (5) from glow pin (7).



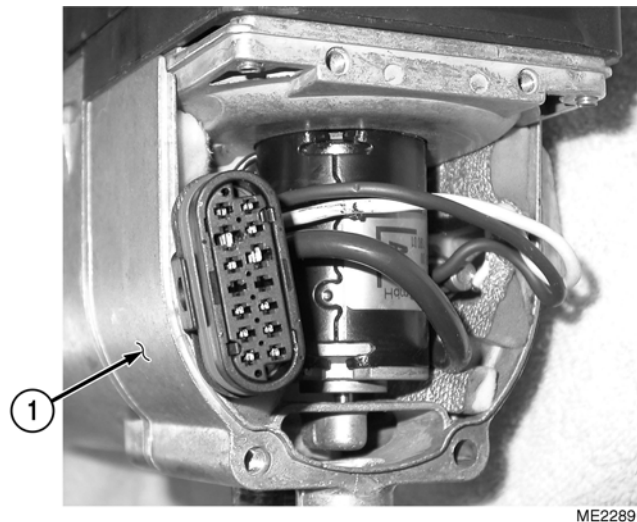
**b. Installation.**



**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Position holder as noted prior to removal.

- (1) Position holder (5) on glow pin (7).
- (2) Install holder (5) on air blower (6) with flame sensor (4).
- (3) Using an electrical contact tool, install two wires (2) on connector (3).
- (4) Install exhaust cover (1).



**c. Follow-On Maintenance.**

Install control unit (Para 20-7).

**END OF TASK**



**20-9. FUEL METERING PUMP REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Bleeding and Testing
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Equipment Conditions*  
*TM or Para*  
TM 5-2420-230-10

*Condition Description*  
Vehicle positioned on level ground.  
Parking brake applied.  
Engine shut OFF.  
Electrical master switch OFF.  
“Do Not Operate” tag attached to ignition switch.

*Tools and Special Tools*  
Cylinder, graduated, Item 20.1, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10  
TM 5-2420-230-10  
TM 5-2420-230-10  
TM 5-2420-230-10

*Materials/Parts*  
Tags, identification, Item 63, Appendix C

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Drawings Required*  
TM 5-2420-230-24P Figure 207

*References*  
None

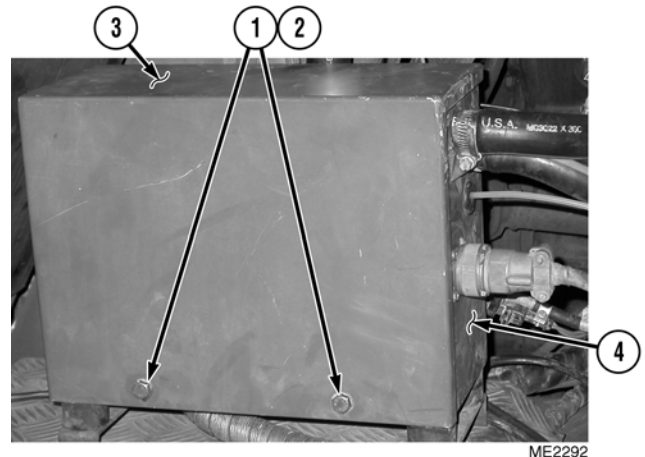
*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

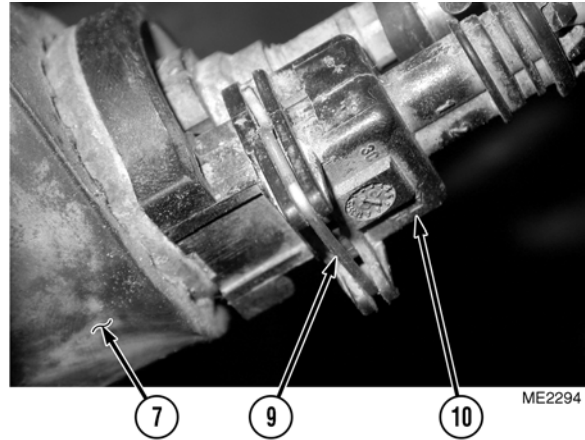
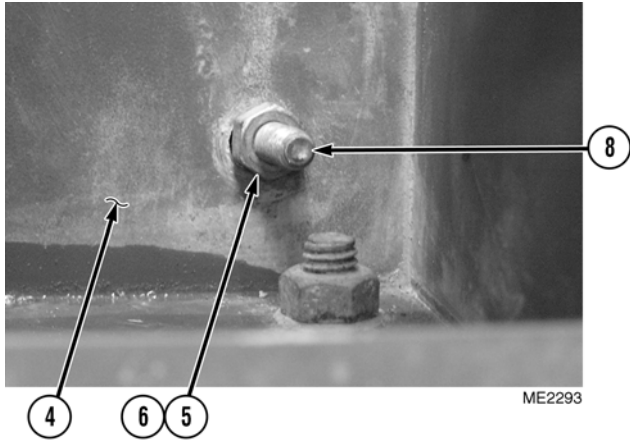
**NOTE**

Tag all wires and tubes and note their positions before removal.

- (1) Remove two screws (1), washers (2), and arctic heater cover (3) from arctic heater box (4).



ME2292



- (2) Remove nut (5), washer (6), pump bracket (7), and screw (8) from arctic heater box (4).

**WARNING**

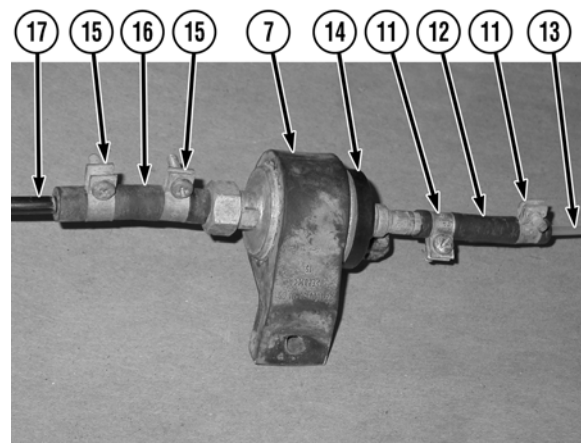
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

- (3) Remove retaining clip (9) and unplug connector (10).

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

- (4) Loosen two clamps (11) and remove hose connector (12) from hose (13) and fuel pump (14).
- (5) Loosen two clamps (15) and remove hose connector (16) from fuel pump (14) and hose (17).
- (6) Remove pump bracket (7) from fuel pump (14).

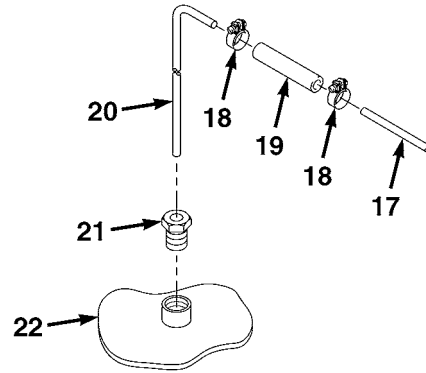


ME2494

**NOTE**

Perform Steps (7) through (10) only if required.

- (7) Remove fuel tank step plate (Para 13-14).
- (8) Loosen two clamps (18) and remove hose connector (19) from hose (17) and fuel pick-up (20).



ME2495

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

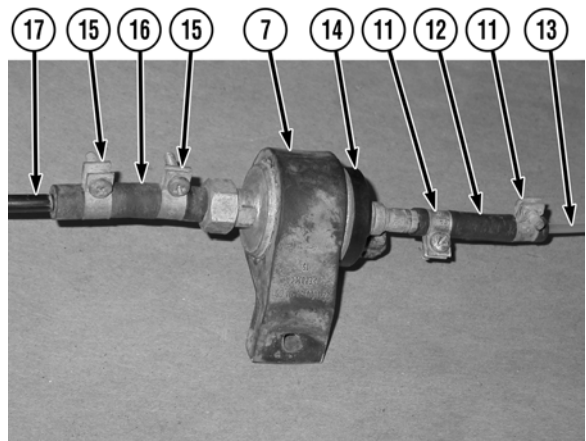
- (9) Remove fitting (21) and fuel pick-up (20) from fuel tank (22).
- (10) Remove fitting (21) from fuel pick-up (20).

**b. Installation.**

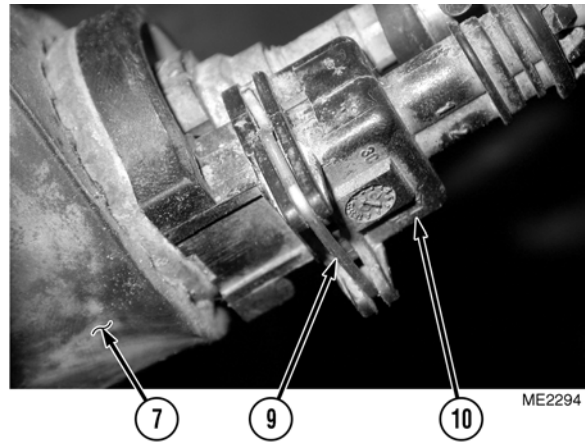
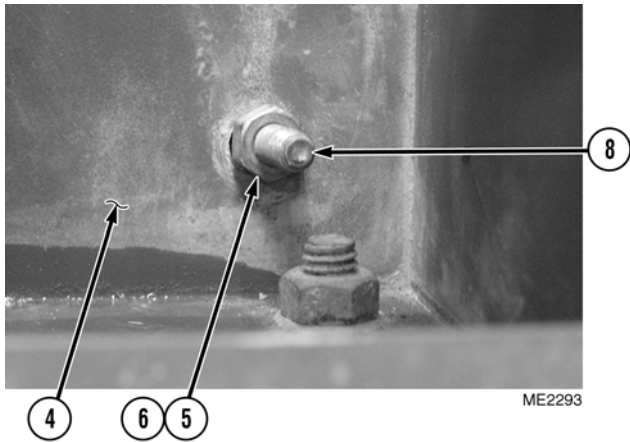
**NOTE**

- Ensure all wires and tubes are reconnected to positions noted prior to removal.
- Perform Steps (1) through (4) only if parts were removed.

- (1) Install fitting (21) on fuel pick-up (20).
- (2) Install fuel pick-up (20) on fuel tank (22) with fitting (21).
- (3) Install hose (17) on fuel pick-up (20) with hose connector (19) and two clamps (18).
- (4) Install fuel tank step plate (Para 13-14).
- (5) Install pump bracket (7) on fuel pump (14).
- (6) Install hose (17) on fuel pump (14) with hose connector (16) and two clamps (15).
- (7) Install hose (13) on fuel pump (14) with hose connector (12) and two clamps (11).



ME2494



**WARNING**

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

- (8) Connect connector (10) with retaining clip (9).

**CAUTION**

Fuel pump needs to be mounted at a 15 degree minimum angle from horizontal in order to prevent air or vapor blockage in pump. Failure to comply will result in damage to equipment.

- (9) Install pump bracket (7) on arctic heater base (4) with screw (8), washer (6), and nut (5), ensuring that fuel pump (14) is at a 15 degree minimum angle from horizontal.
- (10) Bleed arctic heater fuel system.

**c. Bleeding and Testing.**

- (1) If not already removed, remove three screws (23) and cover (24) from arctic heater (25).

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

- (2) Remove cable tie (26) and hose (27) from glow pin connection (28).

**NOTE**

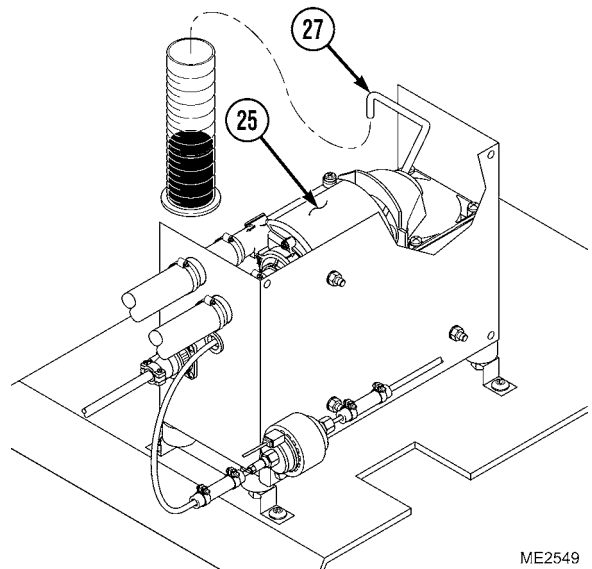
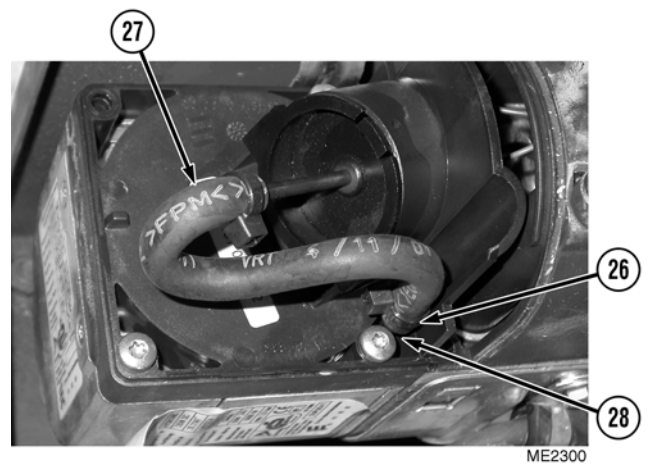
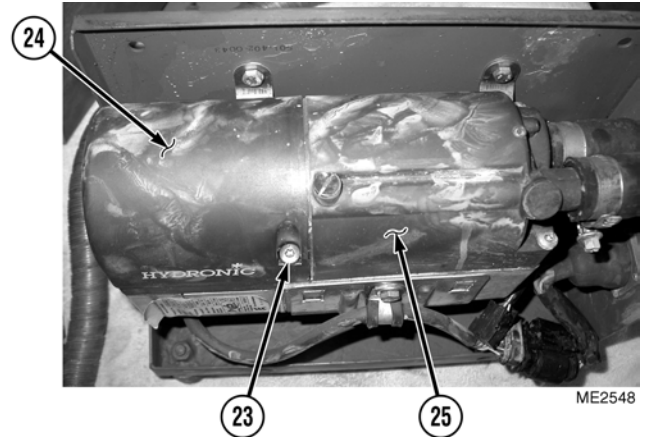
Ensure battery is charged prior to performing bleeding arctic heater fuel system.

- (3) Insert hose (27) into graduated cylinder.
- (4) Turn on arctic heater (25) (TM 5-2420-230-10).
- (5) Allow arctic heater (25) to operate until fuel is uniform, approximately 40-60 sec. after turning on arctic heater.
- (6) Shut off arctic heater (25) (TM 5-2420-230-10).
- (7) Empty graduated cylinder.

**NOTE**

- If bleeding arctic heater fuel system, go to Step (13). If testing fuel pump, proceed to Step (8).
- Ensure graduated cylinder is held at the glow pin height during measurement.

- (8) Reinsert hose (27) into graduated cylinder.
- (9) Turn on arctic heater (25) (TM 5-2420-230-10).



**NOTE**

Fuel delivery will shut off after flowing for 90 sec.

- (10) Allow arctic heater (25) to operate until fuel delivery shuts off.
- (11) Shut off arctic heater (25) (TM 5-2420-230-10).

**NOTE**

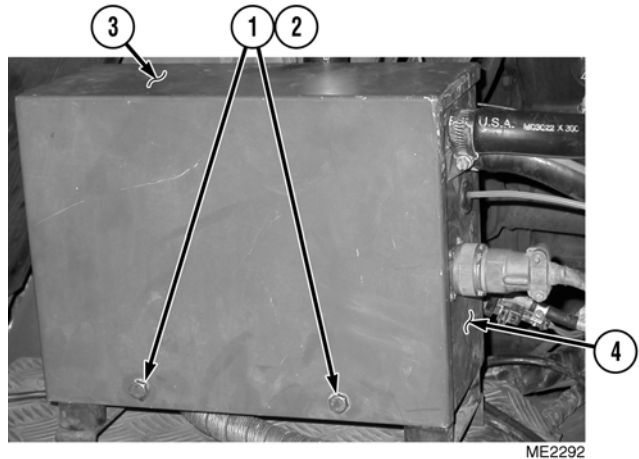
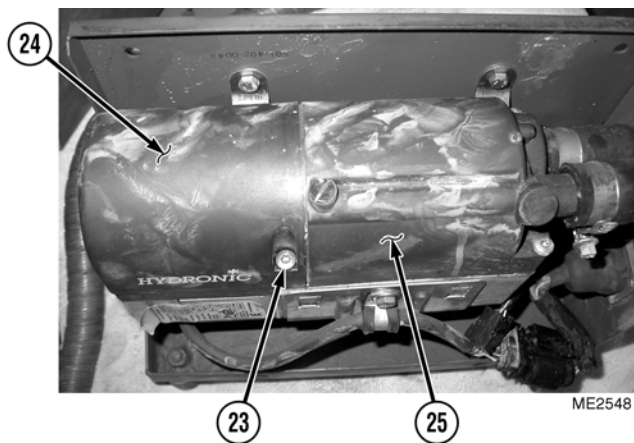
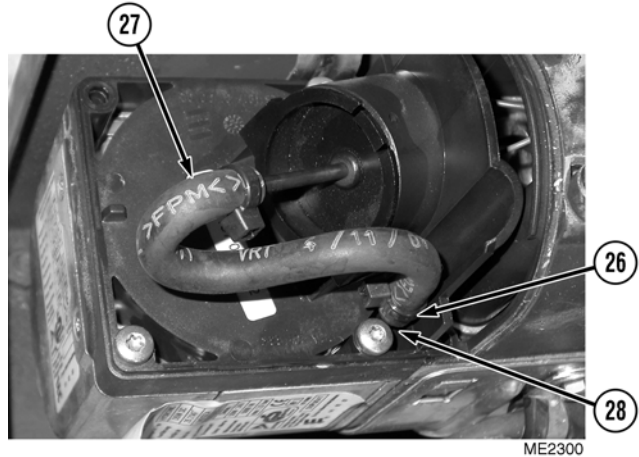
Fuel measurement should be between 0.25 fl.oz. (7.5 ml) and 0.29 fl.oz. (8.6 ml).

- (12) Read quantity of fuel in graduated cylinder. If fuel measured is not between 0.25 fl.oz. (7.5 ml) and 0.29 fl.oz. (8.6 ml), replace fuel pump.

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

- (13) Install hose (27) on glow pin connection (28) with cable tie (26).
- (14) Install cover (24) on arctic heater (25) with three screws (23).
- (15) Install arctic heater cover (3) on arctic heater box (4) with two washers (2) and screws (3).



**d. Follow-On Maintenance.**

- (1) Operate arctic heater (TM 5-2420-230-10) and check for leaks.
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**20-10. GLOW PIN REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

- Tool, electrical contact, Item 27.1, Appendix B
- Tool, electrical contact, Item 27.2, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 20-7	Control unit removed.

*Materials/Parts*

- Lining and O-rings, Item 97.1, Appendix D
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 207

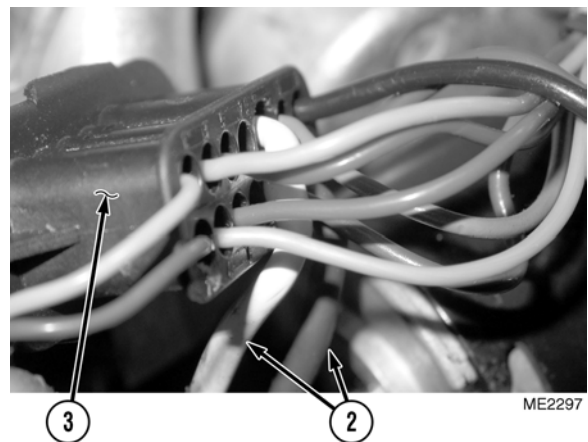
*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

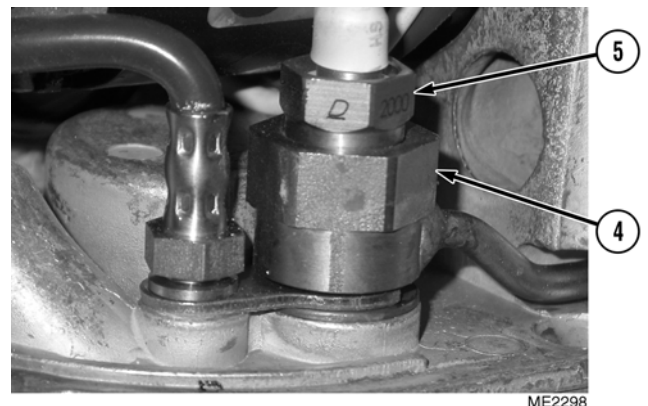
**a. Removal.**



**NOTE**

- Tag all hoses and wires and note their positions before removal.
- Remove cable ties as necessary.

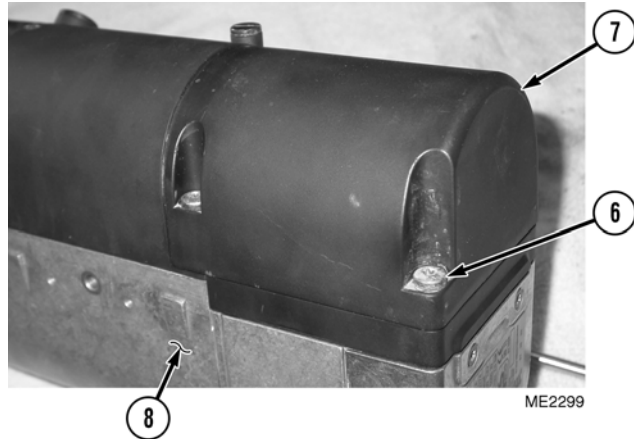
- (1) Remove exhaust cover (1).
- (2) Using an electrical contact tool, remove two wires (2) from connector (3).
- (3) Hold glow pin connection (4) and remove glow pin (5) from glow pin connection.
- (4) Remove flame sensor (Para 20-8).



- (5) Remove three screws (6) and cover (7) from arctic heater (8).

**WARNING**

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.



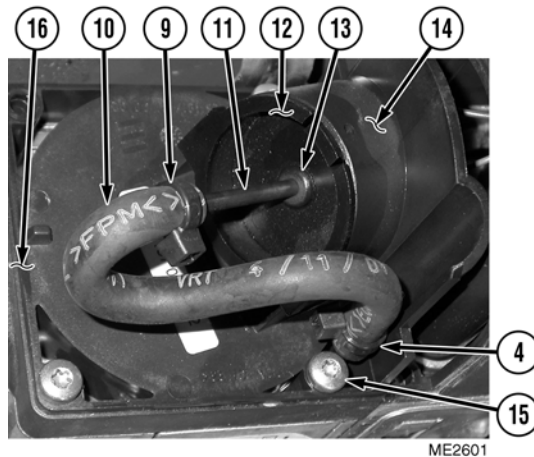
- (6) Remove two cable ties (9) and hose (10) from glow pin connection (4) and fuel line (11).

- (7) Remove cap (12) and grommet (13) from air blower cover (14) and fuel line (11).

- (8) Remove three screws (15) and air blower cover (14) from air blower (16).

- (9) Remove glow pin connection (4) from air blower (16).

- (10) Remove O-ring (17), liner (18), and O-ring (19) from glow pin connection (4). Discard liner and O-rings.



**b. Installation.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

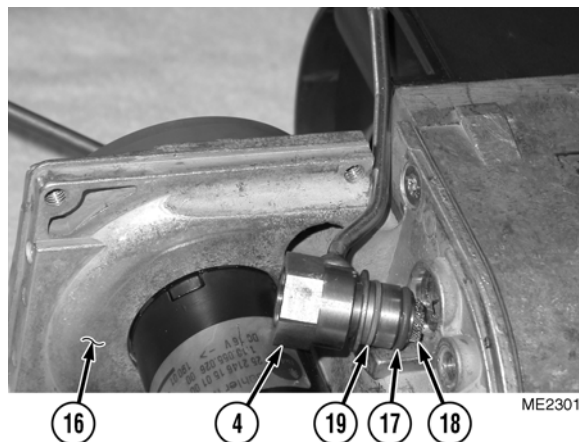
- (1) Install new O-ring (19), new liner (18), and new O-ring (17) on glow pin connection (4).

- (2) Install glow pin connection (4) on air blower (16).

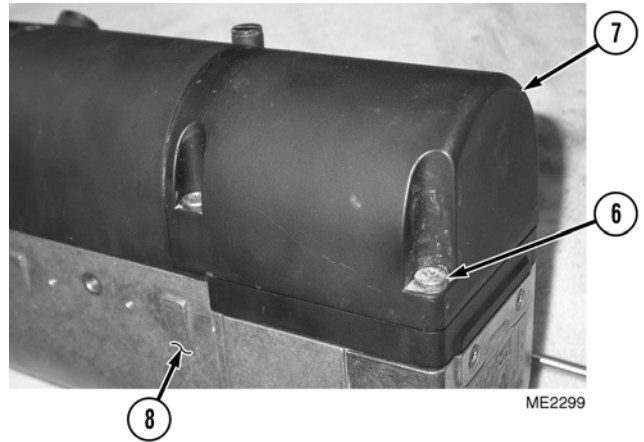
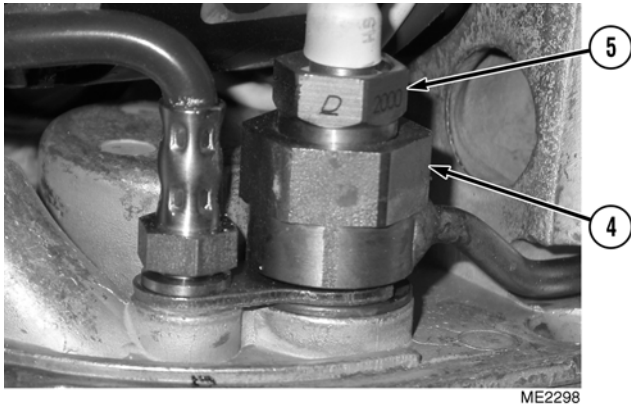
- (3) Install air blower cover (14) on air blower (16) with three screws (15).

- (4) Install grommet (13) and cap (12) on fuel line (11) and air blower cover (14).

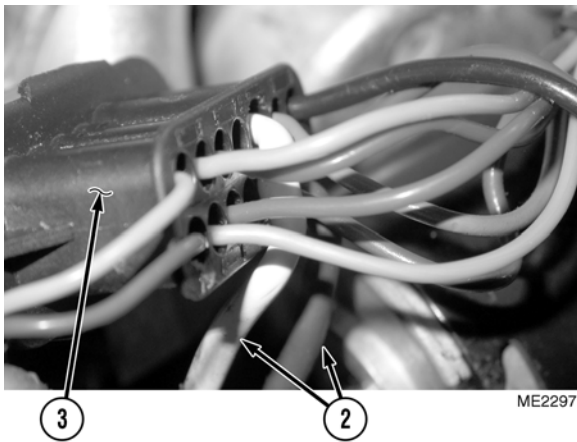
- (5) Install hose (10) on fuel line (11) and glow pin connection (4) with two cable ties (9).







- (6) Install cover (7) on arctic heater (8) with three screws (6).
- (7) Install flame sensor (Para 20-8).
- (8) While holding glow pin connection (4) in place, install glow pin (5) in glow pin connection.



- (9) Using an electrical contact tool, install two wires (2) in connector (3).
- (10) Install cover (1).

**c. Follow-On Maintenance.**

Install control unit (Para 20-7).

**END OF TASK**

## 20-11. OVERHEAT AND TEMPERATURE SENSORS REPLACEMENT.

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

### INITIAL SETUP

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
 Tool, electrical contact, Item 27.1, Appendix B  
 Tool, electrical contact, Item 27.2, Appendix B  
 Tool kit, common no. 2, Item 36, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 20-7	Control unit removed.
Para 20-12	Water pump removed.

*Materials/Parts*  
 O-ring, Item 132.2, Appendix D (2)  
 Tags, identification, Item 63, Appendix C  
 Ties, cable, Item 68, Appendix C

*Drawings Required*  
 TM 5-2420-230-24P Figure 207

*Personnel Required*  
 MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
 Refer to MAC in Appendix B

#### a. Removal.

#### NOTE

- Tag all hoses and wires and note their positions before removal.
- Remove cable ties as necessary.

(1) Remove exhaust cover (1).

#### WARNING

- No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Fuel and oil are slippery and can cause falls. To avoid injury, wipe up spilled fuel or oil with rags.
- To prevent possible injury, wear gloves and protective eye equipment when handling fuel. Failure to comply may result in injury or death to personnel.

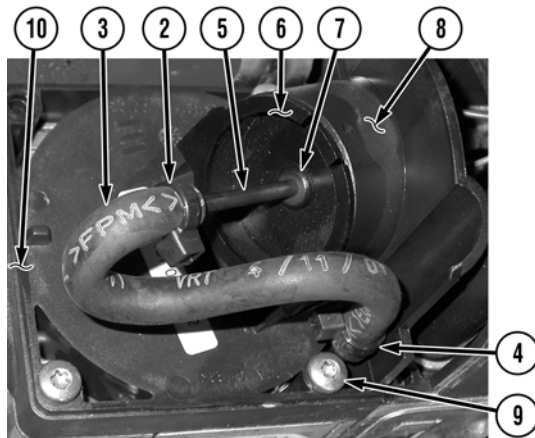
(2) Remove two cable ties (2) and hose (3) from glow pin connection (4) and fuel line (5).

(3) Remove cap (6) and grommet (7) from air blower cover (8) and fuel line (5).

(4) Remove three screws (9) and air blower cover (8) from air blower (10).



ME2304

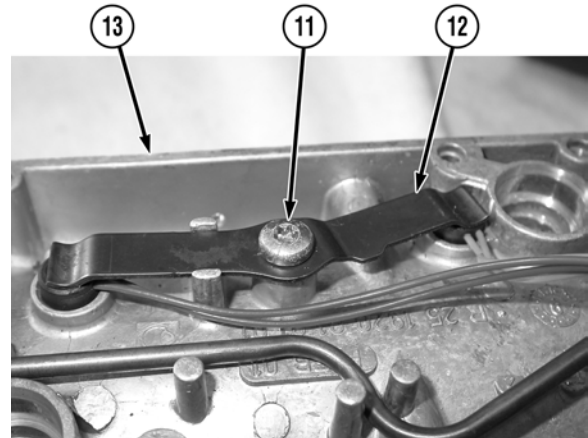


ME2305

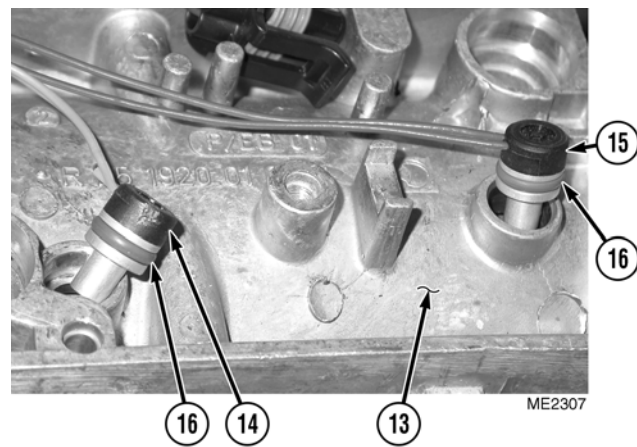
**NOTE**

Note position of bracket prior to removal.

- (5) Remove screw (11) and spring leaf (12) from heat exchanger outer casing (13).
- (6) Remove temperature sensor (14) and overheat sensor (15) from heat exchanger outer casing (13).
- (7) Remove O-rings (16) from temperature sensor (14) and overheat sensor (15). Discard O-rings.
- (8) Using an electrical contact tool, remove four wires (17) from connector (18).



ME2306



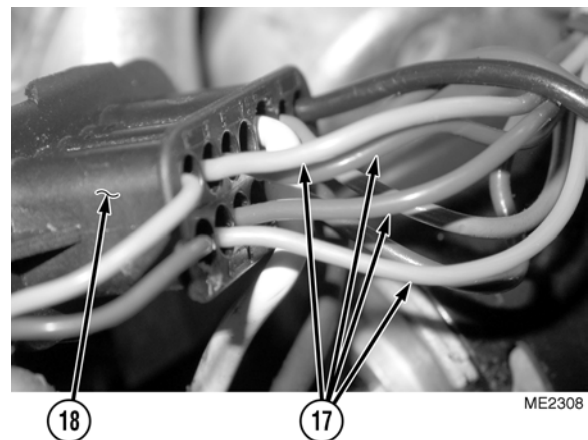
ME2307

**b. Installation.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Using an electrical contact tool, install four wires (17) on connector (18).
- (2) Install new O-rings (16) on overheat sensor (15) and temperature sensor (14).
- (3) Install overheat sensor (15) and temperature sensor (14) in heat exchanger outer casing (13).

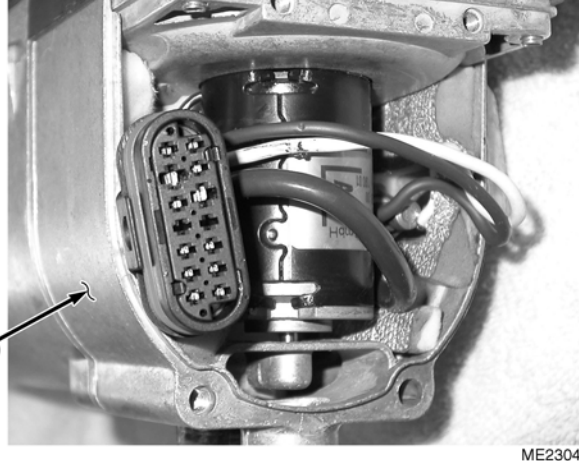
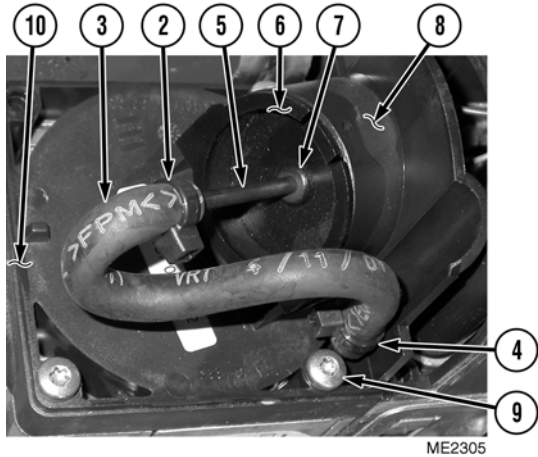


ME2308

**NOTE**

Position bracket as noted prior to removal.

- (4) Install spring leaf (12) on heat exchanger outer casing (13) with screw (11).



- (5) Install air blower cover (8) on air blower (10) with three screws (9).
- (6) Install grommet (7) and cap (6) on fuel line (5) and air blower cover (8).
- (7) Install hose (3) on fuel line (5) and glow pin connection (4) with two cable ties (2).
- (8) Install exhaust cover (1).

**c. Follow-On Maintenance.**

- (1) Install water pump (Para 20-12).
- (2) Install control unit (Para 20-7).

**END OF TASK**

**20-12. WATER PUMP REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

- |                   |                              |
|-------------------|------------------------------|
| <i>TM or Para</i> | <i>Condition Description</i> |
| Para 20-5         | Arctic heater removed.       |

*Materials/Parts*

- O-ring, Item 132.3, Appendix D (2)
- O-ring, Item 153.1, Appendix D
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 207

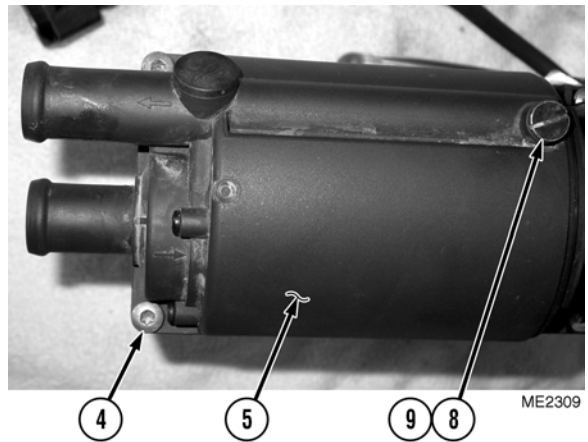
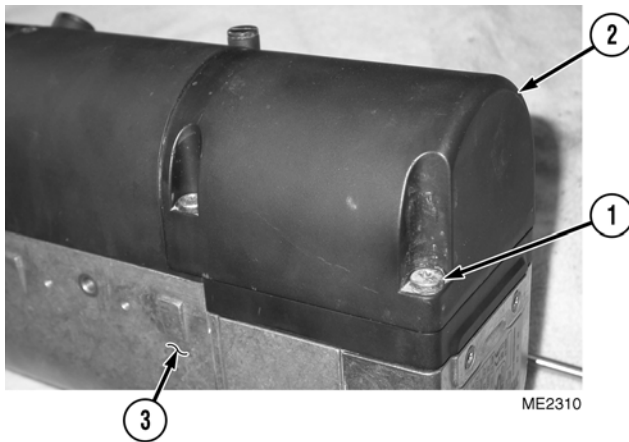
*Estimated Time to Complete Task*

Refer to MAC in Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

**a. Removal.**



**NOTE**

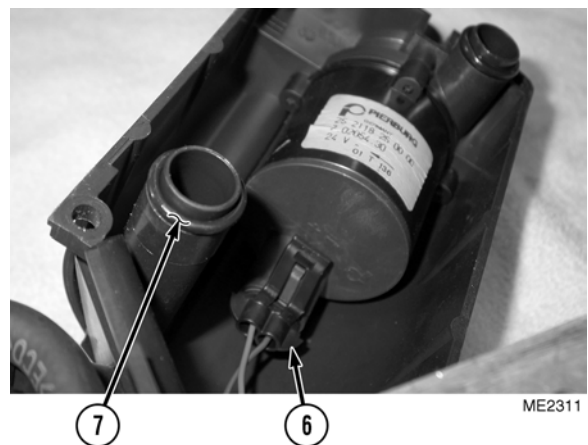
Tag all wires and note their positions before removal

- (1) Remove three screws (1) and cover (2) from arctic heater (3).
- (2) Remove two screws (4) and water pump (5) from arctic heater (3).
- (3) Disconnect connector (6).

**NOTE**

Perform Steps (4) and (5) only if required.

- (4) Remove two O-rings (7) from water pump (5). Discard O-rings.
- (5) Remove bleed screw (8) and O-ring (9) from water pump (5). Discard O-ring.



**b. Installation.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
- Perform Steps (1) and (2) only if parts were removed.

- (1) Install new O-ring (9) and bleed screw (8) on water pump (5).
- (2) Install two new O-rings (7) on water pump (5).
- (3) Connect connector (6).
- (4) Install water pump (5) from arctic heater (3) with two screws (4).
- (5) Install cover (2) on arctic heater (3) with three screws (1).

**c. Follow-On Maintenance.**

Install arctic heater (Para 20-5).

**END OF TASK**

**20-13. ETHER START ASSEMBLY REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Hood raised.
TM 5-2420-230-10	R/S front belly plate removed.
Para 20-15	Starting fluid cylinder removed.

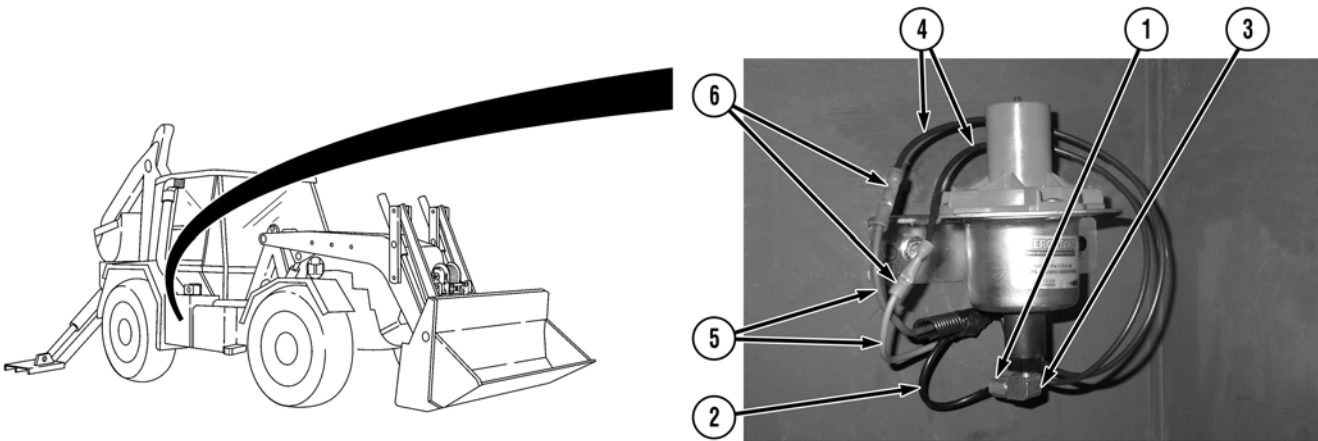
*Materials/Parts*  
Connector, wire, Item 39.1, Appendix D  
Tags, identification, Item 63, Appendix C  
Ties, cable, Item 68, Appendix C  
Washer, lock, Item 283.1, Appendix D (4)

*Drawings Required*  
TM 5-2420-230-24P Figure 207

*Personnel Required*  
MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**



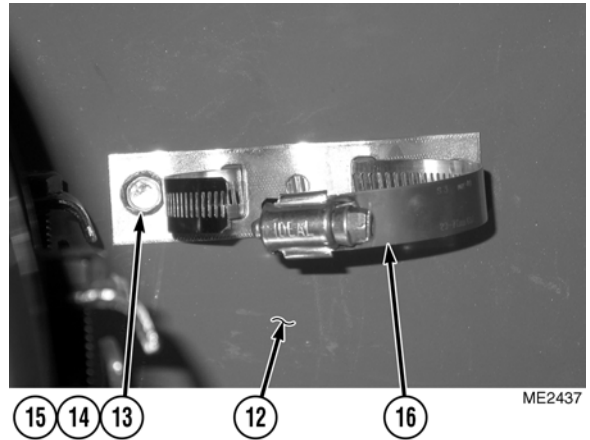
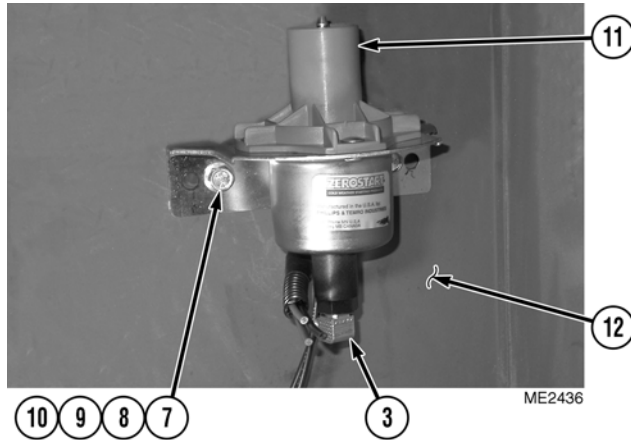
ME2443

**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- Ensure starting fluid cylinder is removed prior to working with valve assembly wires. Failure to comply may result in injury or death to personnel and/or damage to equipment.

**NOTE**

- Tag all hoses, wires, and tubes and note their positions before removal.
  - Remove cable ties as necessary.
  - Cut as close to wire connectors as possible.
- (1) Loosen tube fitting (1) and disconnect tubing (2) from valve fitting (3).
  - (2) Cut four wires (4) and (5) from two wire connectors (6). Discard wire connectors.

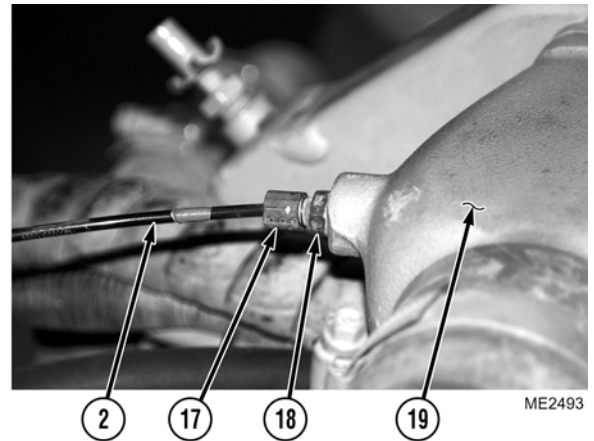
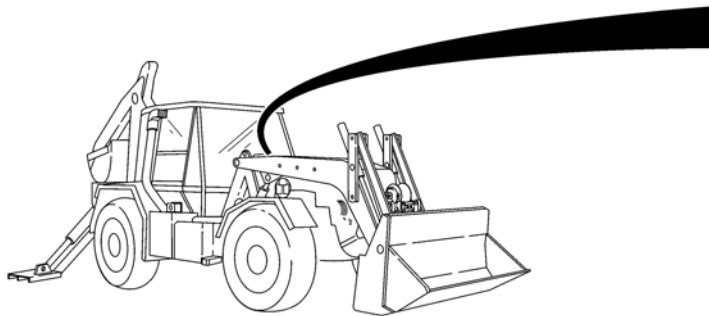


- (3) Remove two nuts (7), lockwashers (8), washers (9), screws (10), and valve assembly (11) from stowage box (12). Discard lockwashers.
- (4) Remove valve fitting (3) from valve assembly (11).

**NOTE**

Perform Steps (5) through (7) as necessary for any components that need to be replaced.

- (5) Remove two nuts (13), lockwashers (14), screws (15) and cylinder clamp (16) from stowage box (12). Discard lockwashers.



- (6) Loosen tube fitting (17), and remove tubing (2) and tube fitting from atomizer (18).
- (7) Remove atomizer (18) from air cross connection (19).

**b. Installation.**

**NOTE**

- Ensure all hoses, wires, and tubes are reconnected to positions noted prior to removal.
  - Install cable ties as necessary.
  - Perform Steps (1) through (3) as necessary for any parts that were removed.
- (1) Install atomizer (18) in air cross connection (19).
  - (2) Place tube fitting (17) on tubing (2), and install tubing on atomizer (18) with tube fitting. Tighten tube fitting approximately one turn after it is finger tight.

- (3) Install cylinder clamp (16) on stowage box (12) with two screws (15), new lockwashers (14), and nuts (13).
- (4) Install valve fitting (3) on valve assembly (11).
- (5) Install valve assembly (11) on stowage box (12) with two screws (10), washers (9), new lockwashers (8), and nuts (7).

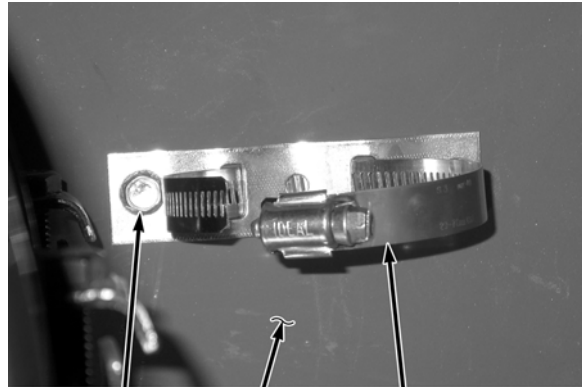
**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- Ensure starting fluid cylinder is removed prior to working with valve assembly wires. Failure to comply may result in injury or death to personnel and/or damage to equipment.

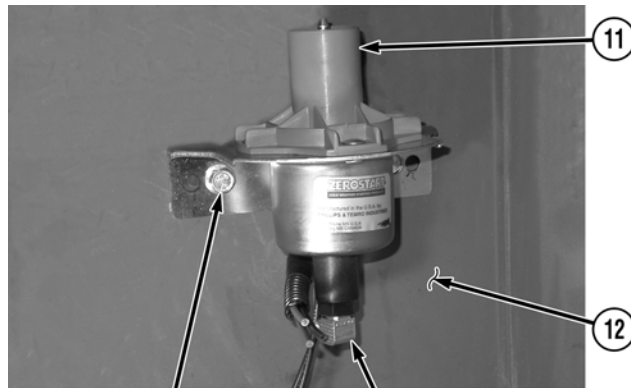
- (6) Connect four wires (5) and (4) with two new wire connectors (6).
- (7) Place tube fitting (1) on tubing (2), and install tubing on valve fitting (3) with tube fitting. Tighten tube fitting approximately one turn after it is finger tight.

**c. Follow-On Maintenance.**

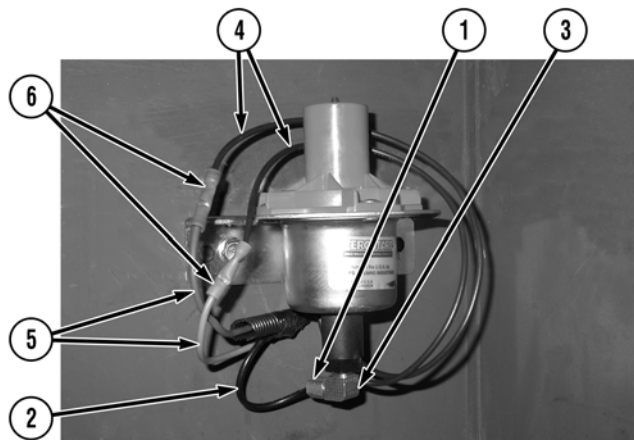
- (1) Close engine hood and secure clips (TM 5-2420-230-10).
- (2) Install starting fluid cylinder (Para 20-15).
- (3) Install R/S front belly plate (TM 5-2420-230-10).



ME2437



ME2436



ME2435

**END OF TASK**



**20-14. ETHER START PUSHBUTTON REPLACEMENT.**

This Task Covers:

a. Removal

b. Installation

c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Equipment Conditions*

TM or Para

*Condition Description*

Vehicle positioned on level ground.

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

TM 5-2420-230-10

Electrical master switch OFF.

*Materials/Parts*

Tags, identification, Item 63, Appendix C

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

Ties, cable, Item 68, Appendix C

TM 5-2420-230-10

PDP door opened.

TM 5-2420-230-10

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Drawings Required*

TM 5-2420-230-24P Figure 207

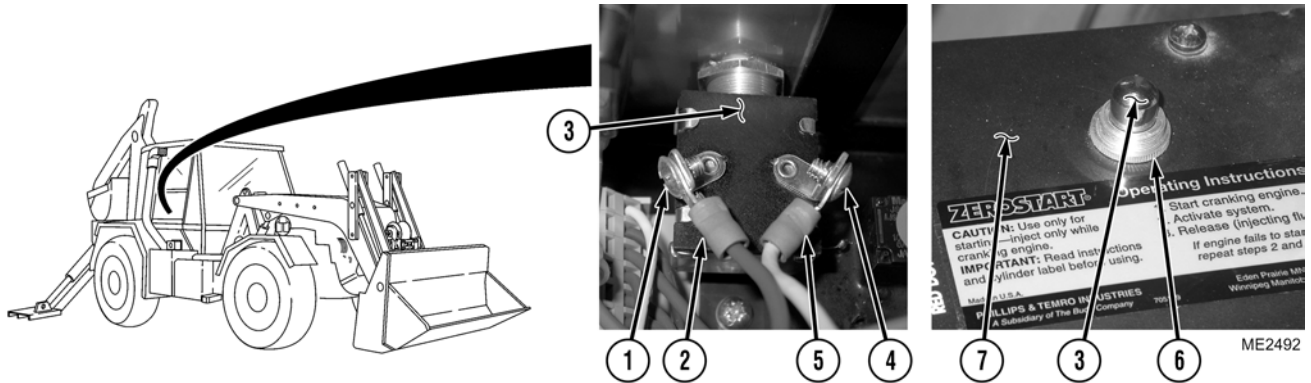
*References*

None

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**



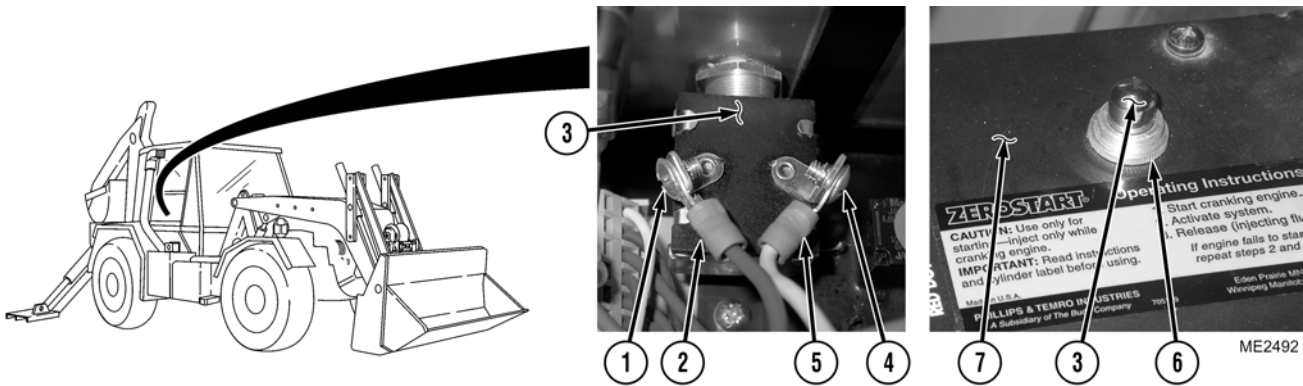
**WARNING**

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

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
- (1) Remove screw (1) and wire (2) from switch (3).
  - (2) Remove screw (4) and wire (5) from switch (3).
  - (3) Remove nut (6) and switch (3) from side instrument panel (7).

**b. Installation.**



**WARNING**

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

**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.

- (1) Install switch (3) on side instrument panel (7) with nut (6).
- (2) Install wire (5) on switch (3) with screw (4).
- (3) Install wire (2) on switch (3) with screw (1).

**c. Follow-On Maintenance.**

Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**20-15. STARTING FLUID (ETHER) CYLINDER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Testing
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

Scale, capable of measuring 0 to 72 oz. (0 to 2 000 g)

*Equipment Conditions*

TM or Para

TM 5-2420-230-10

*Condition Description*

Vehicle positioned on level ground.

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

TM 5-2420-230-10

Parking brake applied.

TM 5-2420-230-10

Engine shut OFF.

*Materials/Parts*

Cloth, lint-free, Item 10, Appendix C

TM 5-2420-230-10

Electrical master switch OFF.

Oil, mineral, light, Item 47, Appendix C

TM 5-2420-230-10

“Do Not Operate” tag attached to ignition switch.

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Drawings Required*

TM 5-2420-230-24P Figure 207

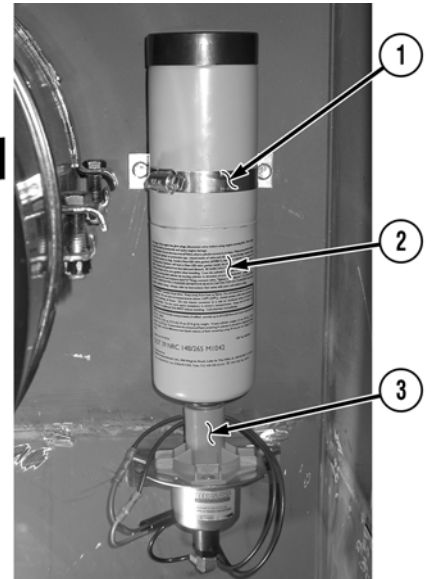
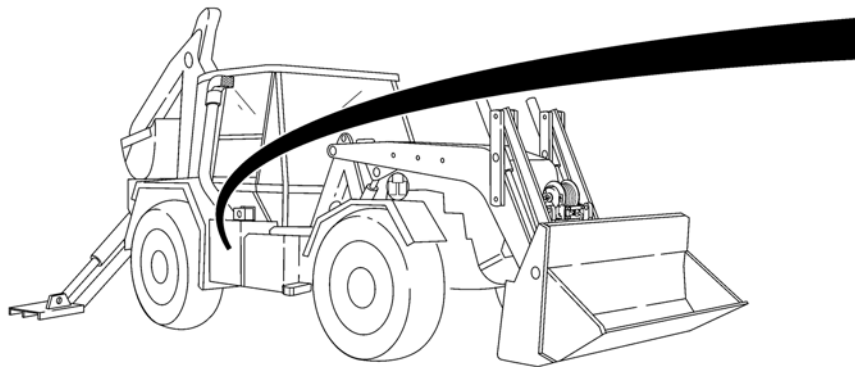
*References*

None

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.**



ME2440

- (1) Using a clean cloth, wipe down cylinder clamp (1), starting fluid cylinder (2), and valve assembly (3).
- (2) Loosen cylinder clamp (1).

**WARNING**

- Starting fluid contains ethyl ether and is extremely flammable. Do not smoke when replacing starting fluid cylinder. No smoking, flames, sparks, or glowing or hot objects are allowed within 50 ft. (15 m) of vehicle. Fire or explosion may cause personal injury or death.
- Starting fluid contains ethyl ether and is TOXIC. It can be harmful or fatal if swallowed. Avoid contact with skin or eyes, or breathing fumes. Make sure you are in a well-ventilated area. To prevent possible injury, wear gloves and protective eye equipment when handling starting fluid cylinder. If fluid enters the eyes or if fumes irritate the eyes, they should be washed with large quantities of clean water for 15 minutes. A physician, preferably an eye specialist, must be contacted. If swallowed, **DO NOT INDUCE VOMITING**. Call a physician immediately. Failure to comply may result in injury or death to personnel.
- Contents of starting fluid cylinder are under pressure. Store in a cool dry area. Do not incinerate, puncture, or attempt to remove cores from cylinder. Failure to comply may result in injury or death to personnel.

- (3) Remove starting fluid cylinder (2) from valve assembly (3) by turning cylinder counterclockwise.
- (4) If necessary, test starting fluid cylinder (2) per Step b to determine if it is empty.

**b. Testing.**

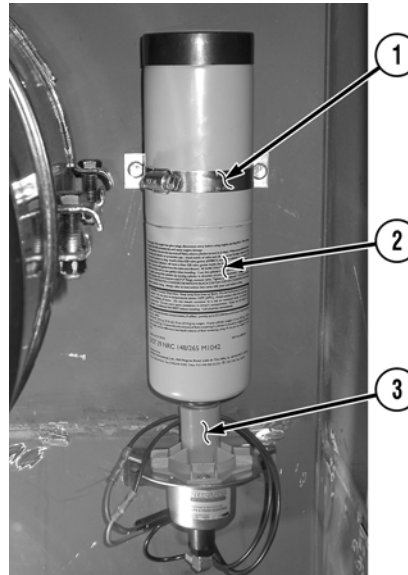
**NOTE**

- A full starting fluid cylinder weighs 33 oz. (935 g); an empty starting fluid cylinder weighs 15 oz. (425 g).
- A typical starting fluid cylinder will last approximately one year under average use.
- Dispose of used starting fluid cylinders in accordance with Unit SOP.

Weigh starting fluid cylinder (2). Replace starting fluid cylinder if it weighs less than 16 oz. (450 g).

**c. Installation.**

- (1) Coat threads of starting fluid cylinder (2) with clean oil.



ME2602

**CAUTION**

Do not overtighten cylinder. Failure to comply will result in damage to equipment.

- (2) Install starting fluid cylinder (2) on valve assembly (3) by turning cylinder clockwise until it bottoms out.
- (3) Tighten cylinder clamp (1).

**d. Follow-On Maintenance.**



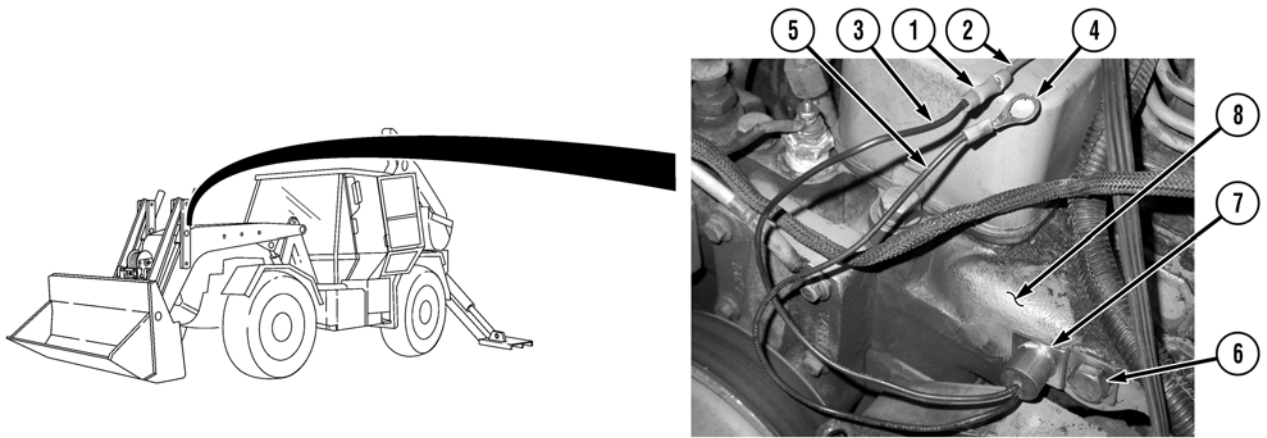
Starting fluid cylinders are typically stored with the threaded end up, which is opposite of its installed position. Therefore, when a new cylinder is first installed, allow the contents to settle for approximately 15 to 20 min. Failure to comply may result in damage to equipment.

- (1) Functionally test ether start while starting engine (TM 5-2420-230-10).
- (2) Shut OFF engine (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>20-16. ETHER START THERMOSTAT REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> Para 12-31 <i>Condition Description</i> Remove washer bottle.	
<i>Materials/Parts</i> Connector, wire, Item 39.1, Appendix D Tags, identification, Item 63, Appendix C Terminal, Item 267.1, Appendix D Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 207  <i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer		

**a. Removal.**



ME2420

**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- Hot parts can burn personnel. Let hot parts cool before starting work.

**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
  - Cut as close to wire connector as possible.
- (1) Cut wire connector (1) from wires (2) and (3). Discard wire connector.
  - (2) Cut terminal (4) from wire (5). Discard terminal.
  - (3) Remove screw (6) and thermostat (7) from engine block (8).

**b. Installation.**

- (1) Install thermostat (7) on engine block (8) with screw (6).
- (2) Install new terminal (4) on wire (5).
- (3) Connect wires (3) and (2) with new wire connector (1).

**c. Follow-On Maintenance.**

- (1) Close engine hood and secure clips (TM 5-2420-230-10).
- (2) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**20-17. ENGINE BLOCK HEATER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

TM or Para	Condition Description
TM 5-2420-230-10	Hood raised.
TM 5-2420-230-10	Electrical outlet unplugged.
Para 9-4	Cooling system drained.

*Materials/Parts*  
Connector, wire, Item 39.2, Appendix D (3)  
Tags, identification, Item 63, Appendix C  
Tape, electrical, Item 65, Appendix C  
Ties, cable, Item 68, Appendix C

*Drawings Required*  
TM 5-2420-230-24P Figure 207

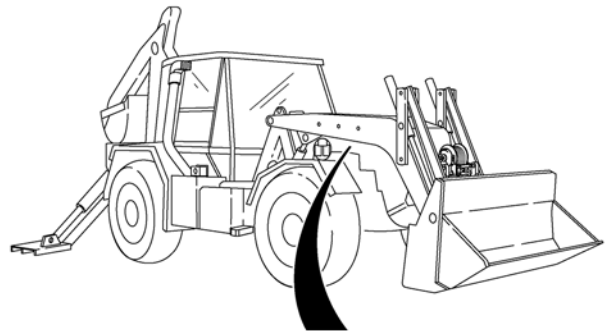
*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

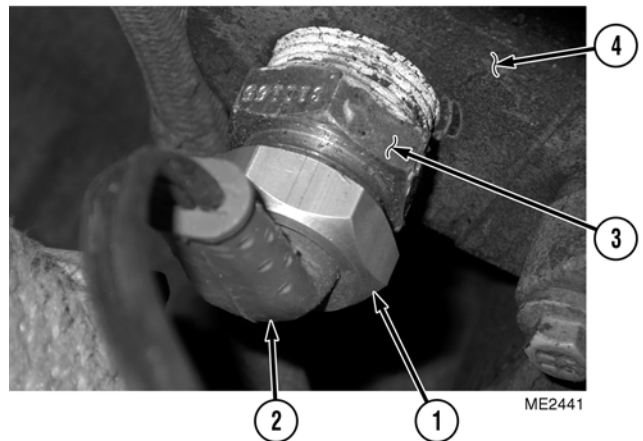
**WARNING**

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.
- Hot parts and fluids can burn personnel. If vehicle has been operating, let engine cool before starting work. Avoid contact with hot fluid when removing hoses or fittings. Failure to comply may result in serious injury or death to personnel.
- Coolant may damage the skin. Wear protective equipment and avoid skin contact when handling coolant.



**NOTE**

- Tag all wires and note their positions before removal.
  - Remove cable ties as necessary.
- (1) Loosen nut (1) and disconnect block heater plug (2) from block heater (3).
  - (2) Remove block heater (3) from engine (4).
  - (3) Remove electrical tape from connections.



ME2441

**WARNING**

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

**NOTE**

Cut as close to wire connectors as possible.

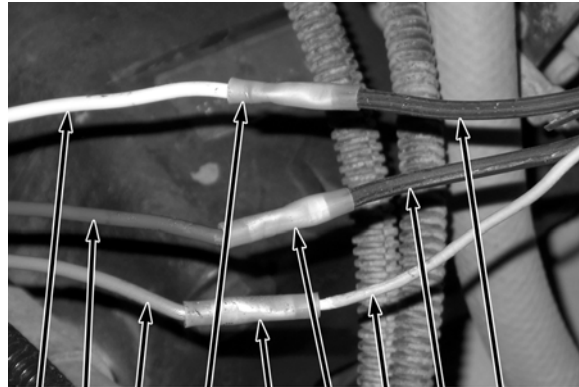
- (4) Cut wire connector (5) from ridged block heater wire (6) and black bulk wire (7). Discard wire connector.
- (5) Cut wire connector (8) from green block heater wire (9) and green bulk wire (10). Discard wire connector.
- (6) Cut wire connector (11) from smooth block heater wire (12) and white bulk wire (13). Discard wire connector.

**b. Installation.**

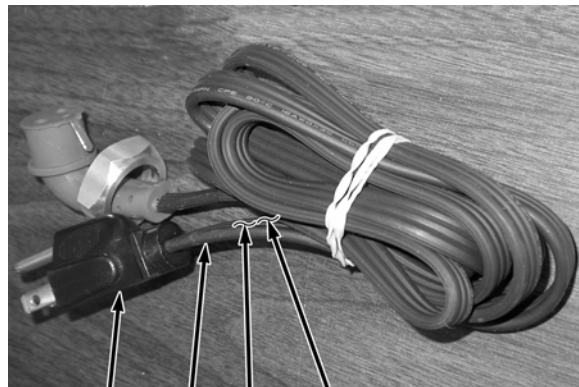
**NOTE**

- Ensure all wires are reconnected to positions noted prior to removal.
- Install cable ties as necessary.
- Cut as close to electrical outlet plug as possible.

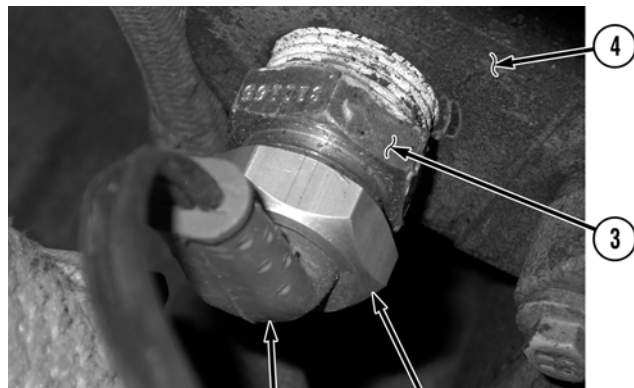
- (1) If replacing block heater (3), cut electrical outlet plug (14) from three new block heater wires (6), (9), and (12).
- (2) Remove 0.25 in. (6 mm) of insulation from end of three block heater wires (6), (9), and (12).
- (3) Remove 0.25 in. (6 mm) of insulation from both ends of three bulk wires (7), (10), and (13).
- (4) Connect end of smooth block heater wire (12) with end of white bulk wire (13) with new wire connector (11).
- (5) Connect end of green block heater wire (9) with end of green bulk wire (10) with new wire connector (8).
- (6) Connect end of ridged block heater wire (6) with end of black bulk wire (7) with new wire connector (5).
- (7) Install electrical tape on connections.
- (8) Install block heater (3) in engine block (4).
- (9) Connect block heater plug (2) to block heater (3) and tighten nut (1).



ME2428



ME2430



ME2427



**c. Follow-On Maintenance.**

- (1) Close engine hood and secure clips (TM 5-2420-230-10).
- (2) Start engine and check for leaks (TM 5-2420-230-10).
- (3) Shut OFF engine (TM 5-2420-230-10).
- (4) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

<b>20-18. BATTERY TRICKLE CHARGER REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 TM 5-2420-230-10 Para 13-15	
<i>Materials/Parts</i> Connector, wire, Item 39.2, Appendix D (3) Tags, identification, Item 63, Appendix C Tape, electrical, Item 65, Appendix C Ties, cable, Item 68, Appendix C Washer, lock, Item 268.1, Appendix D (4)	<i>Condition Description</i> Battery box opened. Electrical outlet unplugged. Hydraulic reservoir step plate removed.	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P Figure 207	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

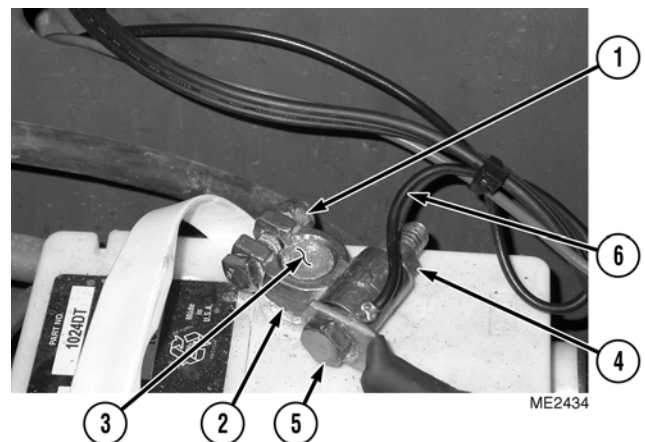
**a. Removal.**

**WARNING**

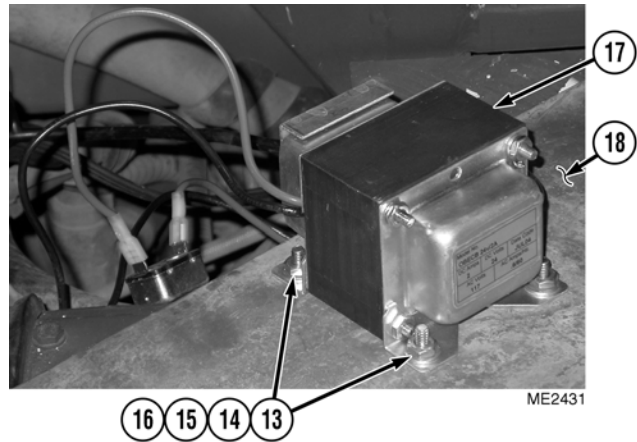
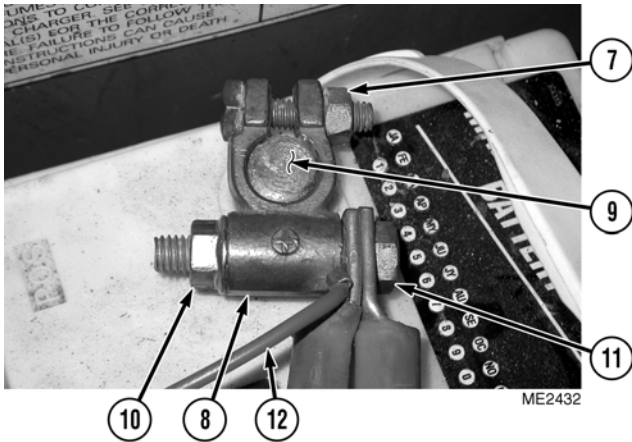
Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or tools contact positive electrical circuits, a direct short may result. Damage to equipment and injury or death to personnel may occur.

**NOTE**

- Tag all wires and note their positions before removal.
- Remove negative (-) cable before removing positive (+) cable.
- Remove cable ties as necessary.



- (1) Loosen nut (1) and remove negative (-) terminal (2) from negative (-) terminal post (3).
- (2) Remove nut (4), screw (5), and wire (6) from negative (-) terminal (2).

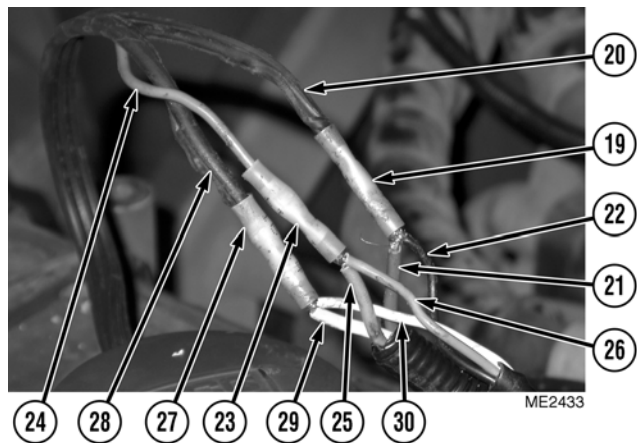


- (3) Loosen nut (7) and remove positive (+) terminal (8) from positive (+) terminal post (9).
- (4) Remove nut (10), screw (11), and wire (12) from positive (+) terminal (8).
- (5) Remove four nuts (13), lockwashers (14), washers (15), screws (16), and trickle charger (17) from hydraulic reservoir step plate (18). Discard lockwashers.

**NOTE**

Cut as close to wire connectors as possible.

- (6) Remove electrical tape from connections.
- (7) Cut wire connector (19) from ridged electrical outlet wire (20), black block heater wire (21) and black trickle charger wire (22). Discard wire connector.
- (8) Cut wire connector (23) from green electrical outlet wire (24), green block heater wire (25) and green trickle charger wire (26). Discard wire connector.
- (9) Cut wire connector (27) from smooth electrical outlet wire (28), white block heater wire (29) and white trickle charger wire (30). Discard wire connector.

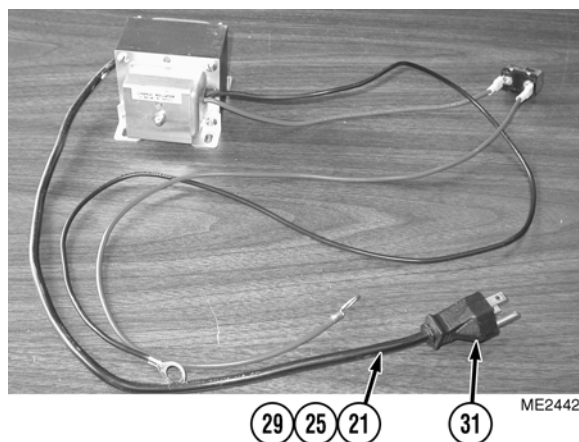


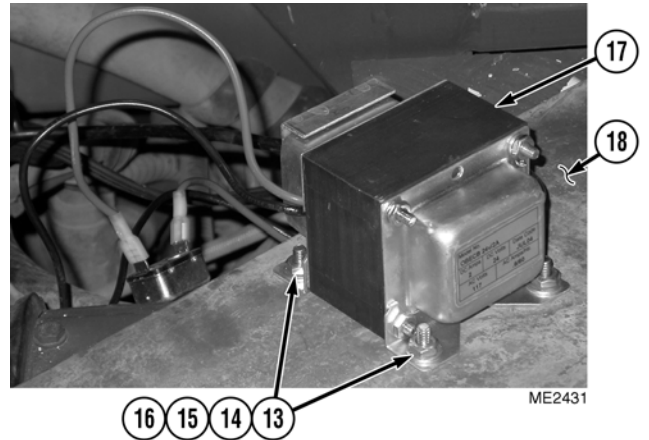
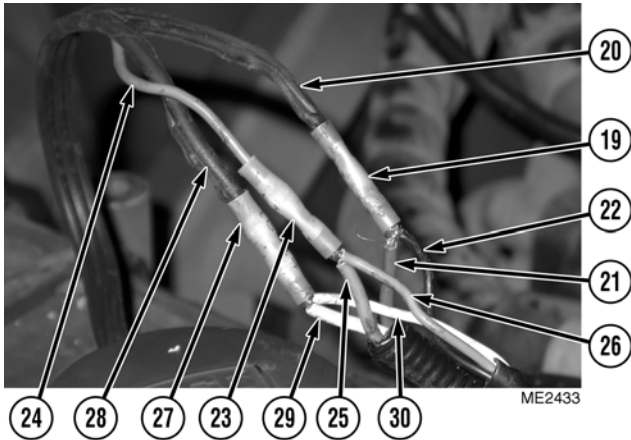
**b. Installation.**

**NOTE**

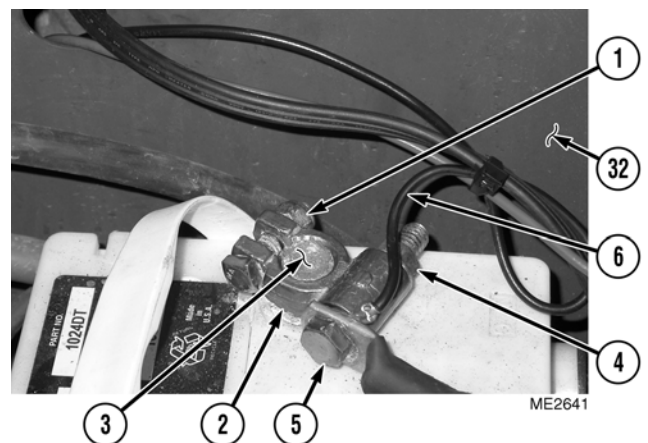
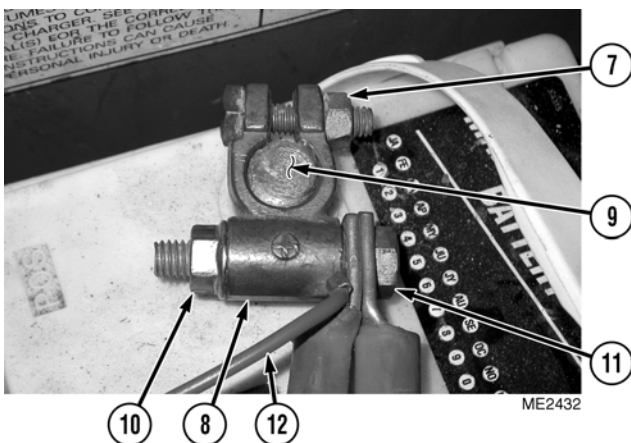
- Ensure all wires are reconnected to positions noted prior to removal.
- Install positive (+) cable before installing negative (-) cable.
- Install cable ties as necessary.
- Cut as close to electrical outlet plug as possible.

- (1) If replacing trickle charger (17), cut electrical outlet plug (31) from three new block heater wires (21), (25), and (29).





- (2) Remove 0.25 in. (6 mm) of insulation from end of three trickle charger wires (22), (26), and (30).
- (3) Remove 0.25 in. (6 mm) of insulation from end of three block heater wires (21), (25), and (29).
- (4) Remove 0.25 in. (6 mm) of insulation from end of three electrical outlet wires (20), (24), and (28).
- (5) Connect ends of white trickle charger wire (30), white block heater wire (29), and smooth electrical outlet wire (28) with wire connector (27).
- (6) Connect ends of green trickle charger wire (26), green block heater wire (25), and green electrical outlet wire (24) with wire connector (23).
- (7) Connect ends of black trickle charger wire (22), black block heater wire (21), and ridged electrical outlet wire (20) with wire connector (19).
- (8) Install electrical tape on connections.
- (9) Install trickle charger (17) on bottom side of hydraulic reservoir step plate (18) with four screws (16), washers (15), new lockwashers (14), and nuts (13).



- (10) Route wires (6) and (12) through back of battery box (32).
- (11) Install wire (12) on positive (+) terminal (8) with screw (11) and nut (10).
- (12) Install positive (+) terminal (8) on positive (+) terminal post (9) and tighten nut (7).
- (13) Install wire (6) on negative (-) terminal (3) with screw (5) and nut (4).
- (14) Install negative (-) terminal (2) on negative (-) terminal post (3) and tighten nut (1).

**c. Follow-On Maintenance.**

- (1) Install hydraulic reservoir step plate (Para 13-15).
- (2) Close battery box (TM 5-2420-230-10).
- (3) Plug in electrical outlet and ensure battery trickle charger and block heater are operating properly (TM 5-2420-230-10).
- (4) Unplug electrical outlet if ambient temperature does not require its use (TM 5-2420-230-10).

**END OF TASK**

<b>20-19. ELECTRICAL OUTLET REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>References</i> None	
<i>Tools and Special Tools</i> Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10 Battery box opened. TM 5-2420-230-10 Electrical outlet unplugged. Para 13-15 Hydraulic reservoir step plate removed.	
<i>Materials/Parts</i> Connector, wire, Item 39.2, Appendix D (3) Tags, identification, Item 63, Appendix C Tape, electrical, Item 65, Appendix C Ties, cable, Item 68, Appendix C	<i>Drawings Required</i> TM 5-2420-230-24P Figure 207	
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

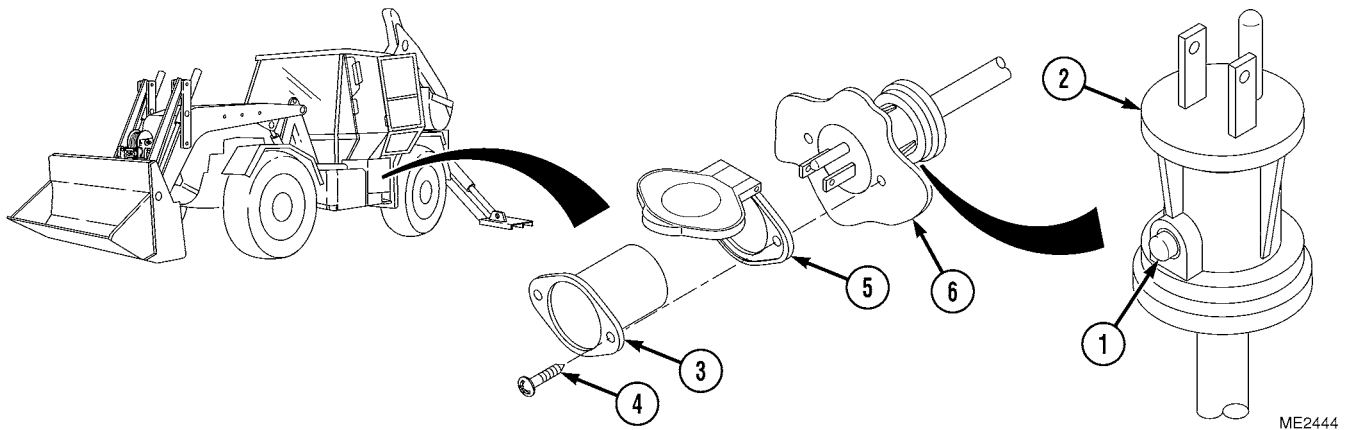
**a. Removal.**

**WARNING**

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

**NOTE**

- Tag all wires and note their positions before removal.
- Remove cable ties as necessary.

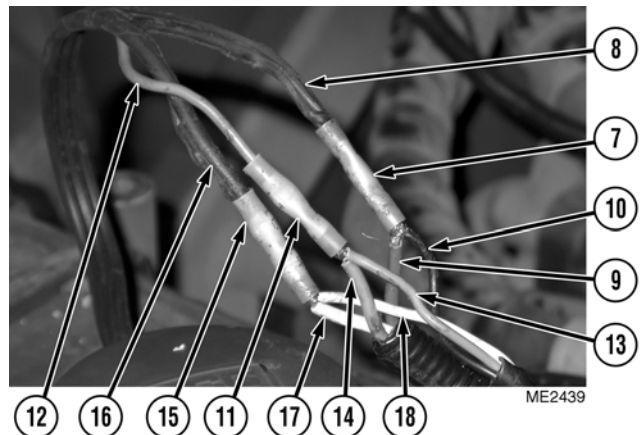


- (1) Push in detent ball (1) and remove plug (2) from plug holder (3).
- (2) Remove two screws (4), plug holder (3), and cover (5) from battery box (6).
- (3) Remove plug holder (3) from cover (5).
- (4) Remove electrical tape from connections.

**NOTE**

Cut as close to wire connectors as possible.

- (5) Cut wire connector (7) from ridged electrical outlet wire (8), black block heater wire (9) and black trickle charger wire (10).
- (6) Cut wire connector (11) from green electrical outlet wire (12), green block heater wire (13) and green trickle charger wire (14).
- (7) Cut wire connector (15) from smooth electrical outlet wire (16), white block heater wire (17) and white trickle charger wire (18).



**b. Installation.**

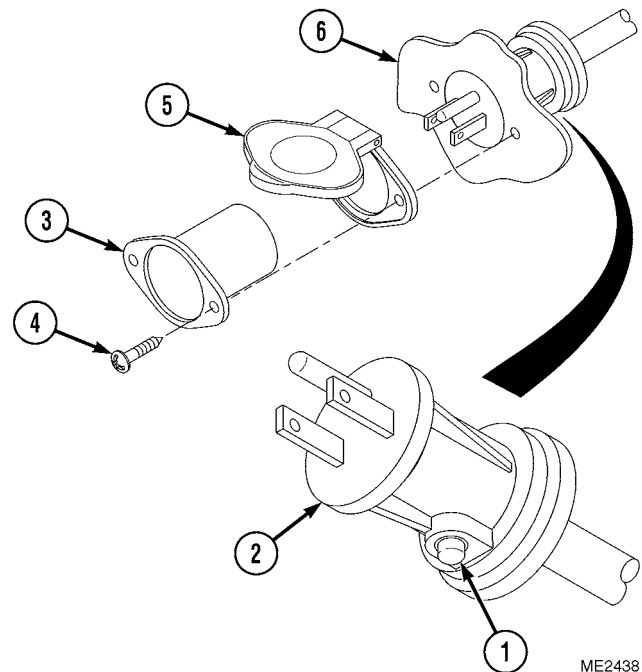
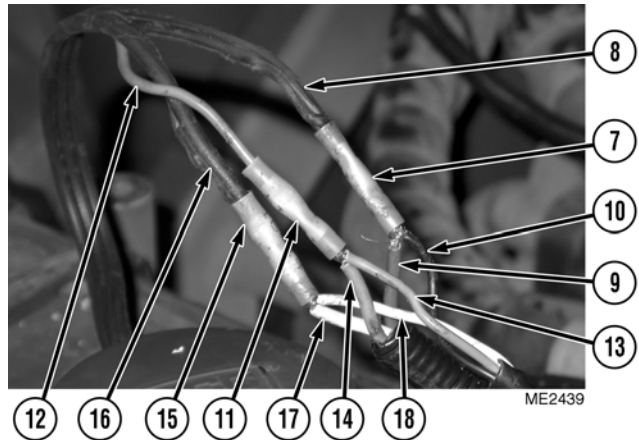
**WARNING**

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

**NOTE**

Ensure all wires are reconnected to positions noted prior to removal.

- (1) Remove 0.25 in. (6 mm) of insulation from end of three trickle charger wires (10), (14), and (18).
- (2) Remove 0.25 in. (6 mm) of insulation from end of three block heater wires (9), (13), and (17).
- (3) Remove 0.25 in. (6 mm) of insulation from end of three electrical outlet wires (8), (12), and (16).
- (4) Connect ends of white trickle charger wire (18), white block heater wire (17), and smooth electrical outlet wire (16) with wire connector (15).
- (5) Connect ends of green trickle charger wire (14), green block heater wire (13), and green electrical outlet wire (12) with wire connector (11).
- (6) Connect ends of black trickle charger wire (10), black block heater wire (9), and ridged electrical outlet wire (8) with wire connector (7).
- (7) Install electrical tape on connections.
- (8) Install cover (5) on plug holder (3) and install on battery box (6) with two screws (4).
- (9) Install plug (2) in plug holder (3) until detent ball (1) locks into hole of plug holder (3).



**c. Follow-On Maintenance.**

- (1) Install hydraulic reservoir step plate (Para 13-15).
- (2) Close battery box (TM 5-2420-230-10).
- (3) Plug in electrical outlet and ensure battery trickle charger and block heater are operating properly (TM 5-2420-230-10).
- (4) Unplug electrical outlet if ambient temperature does not require its use (TM 5-2420-230-10).

**END OF TASK**

## APPENDIX A

### References

#### A-1. SCOPE.

This appendix lists forms, field manuals, technical manuals, and other publications either referenced in this manual or which apply to the operation and maintenance of the Interim High-Mobility Engineer Excavator (IHMEE). Web sites which may be useful are also included in this appendix.

#### A-2. REGULATIONS.

AR 25-30	The Army Publishing Program
AR 700-138	Army Logistics Readiness and Sustainability
AR 750-1	Army Materiel Maintenance Policy and Retail Maintenance Operations

#### A-3. FIELD MANUALS.

FM 4-25.11	First Aid
FM 9-207	Operation and Maintenance of Ordnance Material in Cold Weather
FM 10-20	Organizational Maintenance of Military Petroleum Pipelines, Tanks, and Related Equipment
FM 11-60	Direct Current
FM 11-61	Alternating Current

#### A-4. PAMPHLETS.

DA PAM 40-501	Hearing Conservation Program
DA PAM 310-1	Consolidated Index of Army Publications and Forms
DA PAM 738-750	Functional User's Manual for The Army Maintenance Management System (TAMMS)

#### A-5. FORMS.

DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2408-9	Equipment Control Record
SF 368	Product Quality Deficiency Report

#### A-6. TECHNICAL BULLETINS.

TB 5-2420-230-14	Warranty Information for the Interim High-Mobility Engineer Excavator
TB 9-2300-281-35	Standards for Oversea Shipment or Domestic Issue of Special Purpose Vehicles, Combat, Tactical, Construction, and Selected Industrial and Troop Support Us Army Tank-automotive Materiel Readiness Command Managed Items
TB 9-2300-422-20	Security of Tactical Wheeled Vehicles
TB 43-0001-39	Equipment Improvement Report and Maintenance Digest for Tank and Automotive Equipment
TB 43-0211	Army Oil Analysis Program (AOAP)
TB 43-0212	Purging, Cleaning, and Coating Interior Ferrous and Terne Sheet; Vehicle Fuel Tanks
TB 750-651	Use of Antifreeze Solutions, Antifreeze Extender, Cleaning Compounds, and Test Kit in Engine Cooling Systems

**A-7. TECHNICAL MANUALS.**

TM 5-2420-230-10	Operator's Manual for the Interim High-Mobility Engineer Excavator (IHMEE)
TM 5-2420-230-24P	Unit, Direct Support, and General Support Maintenance Repair Parts and Special Tools List for Interim High-Mobility Engineer Excavator (IHMEE)
TM 9-214	Inspection, Care, and Maintenance of Antifriction Bearings
TM 9-247	Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Material and Related Materials Including Chemicals
TM 9-2610-200-14	Operator's, Unit, Direct Support, and General Support Maintenance for Care, Maintenance, Repair, and Inspection of Pneumatic Tires and Inner Tubes
TM 9-6140-200-14	Lead Acid Storage Batteries
TM 38-450	U.S. Army War Reserve Support Command Shelf-Life Management Policy
TM 43-0158	General Shop Practice Requirements for Repair, Maintenance, and Test of Electronic Equipment
TM 43-0209	Painting Instructions for Field Use, Color, Marking, and Camouflage Painting of Military Vehicles
TM 43-1043	Equipment Improvement Report and Maintenance Summary (EIR MS) for TACOM Equipment
TM 750-244-6	Procedures for Destruction of Tank Automotive Equipment to Prevent Enemy Use (U.S. Army Tank-automotive Command)
TM 750-254	Cooling Systems: Tactical Vehicles

**A-8. MISCELLANEOUS.**

OSHA 1926.1001	Minimum Performance Criteria for Roll-Over Protective Structures for Designated Scrapers, Loaders, Dozers, Graders, and Crawler Tractors
TC 9-237	Operator's Circular for Welding Theory and Application

**A-9. ARMY PUBLICATIONS WEB SITES.**

<a href="http://aeprs.ria.army.mil">aeprs.ria.army.mil</a>	<b>Army Materiel Command Army Electronic Product Support</b> - Used for reporting errors and recommending improvements to this publication.
<a href="http://www.apd.army.mil">www.apd.army.mil</a>	<b>Army Publishing Directorate</b> - Can be used to obtain administrative departmental publications and forms, including the regulations, pamphlets, and forms listed above.
<a href="http://www.army.mil">www.army.mil</a>	<b>Army Home Page (AHP)</b> - Can be used to obtain all unrestricted departmental publications.
<a href="http://www.army.mil/ako">www.army.mil/ako</a>	<b>Army Knowledge Online (AKO)</b> - Can be used to obtain all departmental publications, including distribution-restricted items.
<a href="http://www.logsa.army.mil">www.logsa.army.mil</a>	<b>Army Logistics Support Activity</b> - Can be used to obtain Army technical and equipment publications (except for engineering and medical publications), including the technical manuals listed above.
<a href="http://www.train.army.mil">www.train.army.mil</a>	<b>Army Training Support Center</b> - Can be used to obtain army doctrinal and training publications (except for engineering and medical publications), including the field manuals listed above.
<a href="http://www.usace.army.mil/usace-docs">www.usace.army.mil/usace-docs</a>	<b>Army Corps of Engineers</b> - Can be used to obtain Army engineering publications (except for administrative publications), including technical and field manuals.



## APPENDIX B

### Maintenance Allocation Chart (MAC)

#### Section I. Introduction.

##### B-1. THE ARMY MAINTENANCE SYSTEM MAC.

- a. Section I, Introduction..** This introduction provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.
- b. Section II, MAC for IHMEE..** This MAC (immediately following the introduction) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component levels, which are shown on the MAC in column (4) as:
- Field – includes two columns, Unit maintenance and Direct Support maintenance. The Unit maintenance column is divided again into two more subcolumns, C for Operator or Crew and O for Unit maintenance.
  - Sustainment – includes two subcolumns, General Support (H) and Depot (D).
- c. Section III, Tools and Test Equipment for IHMEE..** The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.
- d. Section IV, Remarks for IHMEE..** The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

##### B-2. MAINTENANCE FUNCTIONS.

Maintenance functions are limited to and defined as follows:

- a. Inspect.** To determine, through examination (e.g., by sight, sound, or feel), the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards.
- b. Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.
- c. Service.** Operations required periodically to keep an item of equipment in proper operating condition; e.g., to clean (including decontamination, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.
- d. Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.
- e. Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.
- f. Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

- g. Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of placing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of the equipment or system.
- h. Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and the assigned maintenance level is shown as the third position code of the SMR code.
- i. Repair.** The application of maintenance services including fault location/troubleshooting, removal/installation and disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

### NOTE

The following definitions are applicable to the "repair" maintenance function:

- Services - Inspect, test, service, adjust, align, calibrate, and/or replace.
  - Fault location/Troubleshooting - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).
  - Disassembly/Assembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).
  - Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.
- j. Overhaul.** That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., NMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.
  - k. Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours, miles, etc.) considered in classifying Army equipment/components.

## B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

- a. Column (1), Group Code.** Column (1) lists functional group code letters, the purpose of which is to group maintenance significant components, assemblies, subassemblies, and modules. These codes also serve as a reference to help locate the maintenance significant items in TM 5-2420-230-24P.
- b. Column (2), Component/Assembly.** Column (2) contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.
- c. Column (3), Maintenance Function.** Column (3) lists functions to be performed on the item listed in Column 2. (For a detailed explanation of these functions, see paragraph B-2.)
- d. Column (4), Maintenance Level.** Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work

time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field:

- C ..... Operator or crew maintenance
- O ..... Unit maintenance
- F ..... Direct Support maintenance

Sustainment:

- H ..... General Support maintenance
- D ..... Depot maintenance

**NOTE**

The “L” maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the “H” column of column (4), and an associated reference code is used in the Remarks Code column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

- e. **Column (5), Tools and Equipment Ref Code.** Column (5) specifies, by code, those common tool kits (not individual tools), common Test, Measurement, and Diagnostic Equipment (TMDE), special tools, special TMDE, and special support equipment required to perform the designated function. Codes are keyed to tools and test equipment in Section III.
- f. **Column (6), Remarks Code.** When applicable, this column contains a letter keyed to the remarks contained in Section IV.

**B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.**

- a. **Column (1), Tool or Test Equipment Reference Code.** The code correlates with a code used in the MAC, Section II, Column (5).
- b. **Column (2), Maintenance Level.** Lowest maintenance level authorized to use tool/equipment.
- c. **Column (3), Nomenclature.** Name or identification of the tool or test equipment.
- d. **Column (4), National Stock Number (NSN).** National Stock Number of the tool or test equipment.
- e. **Column (5), Tool Number.** The manufacturer's part number, model number, or type number.

**B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.**

- a. **Column (1), Remarks Code.** The code recorded in column 6, Section II.
- b. **Column (2), Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAC for IHMEE.

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code	
			Field			Sustainment				
			Unit		Direct Support	General Support	Depot			
			C	O	F	H	D			
AA	Power Pack	Inspect	0.1	0.1	0.1				B	
		Replace			46.5			23,29,34,36,38		
		Repair			5.6			2,23,34,36,38	C	
	AA	Engine	Inspect	0.1						B
			Test		2.5				36,38	
			Adjust		0.3				38	
			Service	0.2	1.2				36,38	A,B
Replace					4.0			2,23,34,36,38	G	
		Repair				40.0	2,3,20,21,22,23,24,30,36,38,27,41	C		
AA	Cylinder Block	Inspect				2.0	23			
Service					0.5	38				
Repair					4.0	21,23,36,38				
AA	Crankshaft	Inspect				0.1				
Service					0.3					
Adjust					0.3					
Replace					2.0	23,36,38,41				
AA	Front Seal and Sleeve Bearing	Replace			1.0		41			
AA	Flywheel Housing	Inspect			0.1					
Replace				1.0		36,38				
AA	Flywheel	Inspect			0.1					
Replace				0.5		36,38				
AA	Pistons, Rings, Connecting Rods, and Bearings	Replace				2.0	20,23,36,38			
AA	Camshaft and Valve Tappets	Inspect				0.1				
Service						0.3				
Adjust					0.3					
Replace						0.5	23,36,38			

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AA	Drive Belt	Inspect Replace	0.1	0.3				38	B
AA	Cylinder Head	Inspect Service Adjust Replace Repair			0.2 0.2 1.2 4.3			3,23,36,38 36,38 3,21,24,36,38	C
AA	Exhaust Manifold	Inspect Replace		0.1 2.4				36,38	B
AA	Oil Pump	Inspect Service Replace			0.1 0.2 1.0			23,36,38	
AA	Engine Oil Filter	Inspect Replace		0.1 0.5				29, 36, 38	B
AA	Secondary Fuel Filter	Inspect Replace		0.1 0.5				29,38	B B
AA	Valve Covers and Gasket	Inspect Replace		0.1 1.0				36,38	B
AA	Suction Tube	Replace			0.2			36,38	
AA	Oil Pan	Inspect Replace		0.1		1.0		36,38	B
AA	Engine Mount	Replace		1.0				36,38	
AB	Radiator Hose, Top	Inspect Replace	0.1	0.1 0.5				29,36,38	B
AB	Engine Hose, Top	Inspect Replace	0.1	0.1 0.5				29,36,38	B
AB	Air-Conditioning Condenser	Replace			0.5			38,39	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AB	Hydraulic Oil Cooler	Inspect	0.1						B
		Replace		1.5			29,38		
AB	Radiator	Inspect	0.2						B
		Test		0.5					
		Service		0.5			29,38		
		Replace		1.6			29,36,38		
AB	Fan Shroud (Cowl)	Replace		1.0			38		
AB	Radiator Hose, Bottom	Inspect	0.1	0.1					B
		Replace		1.0			29,36,38		
AB	Coolant Reservoir	Inspect	0.2						B
		Service	0.1	0.1					A,B
		Replace		0.5			29,38		
AB	Fan	Inspect	0.1						B
		Replace		1.7			29,36,38		
AB	Fan Hydraulic Motor	Inspect		0.1					
		Test		0.2			40.1		J
		Replace		0.8			29,36,38		
		Repair		0.5			29,36,38		C
AB	Thermostat	Inspect		0.1					
		Test		0.5					
		Replace		2.0			36,38		
AB	Water Pump	Inspect		0.1					
		Replace		0.5			36,38		
AB	Engine Oil Cooler	Inspect		0.1					
		Service		0.5					
		Replace		1.0			36,38		
		Repair		0.5			36,38		C
AB	Transmission Oil Cooler	Inspect	0.1						B
		Service		0.5					
		Replace		1.3			29,38		

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AC	Muffler Assembly	Inspect	0.1	0.1					B
		Replace		0.5				38	
AC	Muffler Heat Shield	Replace		0.2				38	
AC	Exhaust Pipes	Inspect	0.1	0.1					B
		Replace		3.0				38	
AD	Fuel System	Inspect	0.1	0.1					B
		Service		0.5				29,38	
AD	Fuel Tank	Inspect	0.1	0.1					B
		Service	0.1	0.1					A
		Replace		1.0				29,38	
		Repair		0.5				38	C
AD	Fuel Sending Unit	Replace		0.3				29,38	
AD	Fuel Tank Breather	Service		0.2					
		Replace		0.5				38	
AD	Primary Fuel Filter (Fuel/ Water Separator)	Inspect	0.1	0.1					B
		Service	0.1	0.1					B,D
		Replace		0.5				29,38	B
AD	Fuel/Water Separator Housing	Replace		0.5				38	
AD	Fuel Transfer Pump	Inspect		0.1					
		Service		0.2					
		Replace		0.5				29,36,38	
AD	Injection Pump	Adjust		0.3	2.9			23	
		Replace			1.0			2,23,36,38	
		Repair					15.0		E
AD	Injector Nozzle	Replace			0.8			30,36,38	
AD	Fuel Shut-Off Valve	Replace		0.5				38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AD	Turbocharger	Inspect	0.1	0.2					
		Service		1.5			36		
		Replace		2.9			36,38		
AD	Aftercooler	Inspect		0.1					
		Service		0.2					
		Test		0.5					
		Replace		1.0			36,38		
AD	Air Cleaner Intake Tube	Inspect		0.1				B	
		Replace		1.0			38		
AD	Air Cleaner Housing	Inspect	0.1					B	
		Service	0.1					B	
		Replace		0.3			38		
AD	Air Cleaner Filter	Inspect		0.1				B	
		Replace		0.2				B	
AD	Body	Inspect	0.1	0.1				B	
		Repair		1.0			38,40		
AD	Accelerator Pedal	Inspect	0.1	0.1				B	
		Replace		0.3			38		
AD	Hand Throttle	Inspect	0.1					B	
		Replace		0.5			38		
AE	NATO Slave Receptacle	Service		0.1				B	
		Replace		0.3			38		
AE	Electrical Master Switch	Test		0.2					
		Replace		0.5			38		
AE	Battery	Inspect	0.1	0.3				B	
		Test		0.8			28,36,38		
		Replace		0.5			38		
AE	Battery Cables	Inspect	0.1					B	
		Replace		0.5			38		



(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AE	Battery Stowage Box	Inspect		0.1					B
		Replace		0.5				36,38	
		Repair		1.0				38	C
AE	PDP-Engine Wiring Harness	Inspect		0.5					B
		Replace		3.0				38	
		Repair		0.5				26,36,37,38	H
AE	Vehicle Horn	Inspect	0.1						B
AE	S24 Park Brake Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	S25 Brake Switch Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	S33 Primary Brake Pressure Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	S34 Secondary Brake Pressure Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	S28 EGS Throttle Switch Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	ECM-Backhoe Valve Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	ECM-FEL Valve Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Direct Support	Sustainment			
			Unit		Support	General Support	Depot		
			C	O	F	H	D		
AE	ECM-PDP Hydraulic Wiring Harness	Inspect		0.1					B
		Replace		0.3				38	
		Repair		0.5				26,36,37,38	H
AE	PDP-Loader Arms Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	Starter Button	Replace		0.5				38	
AE	Ignition Switch	Replace		0.5				38	
AE	Wiper Intermittent Relay	Replace		0.5				38	
AE	Auxiliary Defroster Switch	Replace		0.5				38	
AE	Alarm Module	Adjust		0.5				32.1,38	
		Replace		0.5				38	
AE	Starter Solenoid	Replace		0.5				38	
AE	Charge Equalizer	Test		0.5				28,36,38	
		Replace		0.5				38	
AE	Power Distribution Panel (PDP) Assembly	Replace		2.0				38	
		Repair		4.0				38	C
AE	Fire Extinguisher	Inspect	0.1						B
		Replace	0.1						
AE	Fire Extinguisher Bracket	Replace		0.4				38	
AE	Starter Motor	Inspect		0.1					B
		Test		0.5				36	
		Replace		1.4				36,38	
AE	Alternator	Inspect		0.1					B
		Test		0.4				28,38	
		Replace		0.6				36,38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AE	Headlight Wiring Harness, Left-Hand	Inspect		0.1					B
		Replace		0.3				38	
		Repair		0.5				26,36,37,38	H
AE	Headlight Wiring Harness, Right-Hand	Inspect		0.1					B
		Replace		0.3				38	
		Repair		0.5				26,36,37,38	H
AE	Headlight Assembly	Repair		0.5				38	
AE	Lights	Inspect	0.1						B
		Replace		0.5				38	
AE	Light Bulbs	Inspect	0.1						B
		Replace		0.5				38	
AE	Reverse Alarm	Inspect	0.1						B
		Replace		0.2				38	
AE	Cab Wiring Harness	Replace		1.0				38	
		Repair		0.5				26,36,37,38	H
AE	Wiper Motor, Front	Inspect	0.1						B
		Replace		0.6				38	
AE	Wiper Blade and Arm, Front	Inspect	0.1	0.1					B
		Replace		0.2				38	
AE	Wiper Motor, Rear	Inspect	0.1						B
		Replace		0.6				38	
AE	Wiper Blade and Arm, Rear	Inspect	0.1	0.1					B
		Replace		0.2				38	
AE	Washer Bottle Assembly	Service	0.1						B
		Replace		0.2				38	
AE	PDP-Dash Panel Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AE	Dash Panel Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	Dimmer Wiring Harness	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	Electronic Control Unit	Calibrate		0.5					
		Replace		0.5				38	
		Repair					4.0		E
AE	Electronic Gear Shift	Test		1.0					
		Replace		0.3				38	
AE	Indicator Arm	Replace		0.3				38	
AE	Left Dash Panel and Gauges	Inspect	0.2	0.1					B
		Test		0.5					
		Replace		1.3				38	
		Repair		0.6				38	C
AE	Center Dash Panel and Gauges	Inspect	0.2	0.1					B
		Test		0.5					
		Replace		1.3				38	
		Repair		0.5				38	C
AE	Inclinometer	Inspect	0.1						B
		Replace		0.2				38	
AE	Hand Controls Wiring Harness Assembly	Inspect		0.1					B
		Replace		0.5				38	
		Repair		0.5				26,36,37,38	H
AE	Right Dash Panel and Gauges	Inspect	2.0	0.1					B
		Test		0.5					
		Replace		1.3				38	
		Repair		1.0				38	C

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AE	Master Light Switch	Replace		0.5				38	
AF	Transmission	Inspect	0.1	0.1					B
		Test		0.8	13.0				
		Service	0.1	1.0				29,36,38	A,B
		Replace			4.0			2,23,34,36,38	G
		Repair				34.2		36,38	C
AF	Remote Shift Valve	Replace		1.0				29,36,38	
		Repair			0.5			36,38	C
AF	Remote Shift Solenoid Coil	Replace		0.5				38	
AF	Charging Pump	Replace			1.0			29,36,38	
AF	2/4WD Control Cylinder	Replace		1.0				38	
AF	High/Low Control Cylinder	Replace		1.0				38	
AF	Transmission Mount	Replace		2.0				29,36,38	
AF	Front Differential	Inspect	0.1	0.1					B
		Adjust				1.5		36,38	
		Service	0.1	0.4				29,36,38	A,B,D
		Repair				2.5		36,38	C
AF	Front Axle Housing Breather	Service		0.1					B
		Replace		0.5				38	
AF	Rear Differential	Inspect	0.1	0.1					B
		Adjust				1.5		36,38	
		Service	0.1	0.4				29,36,38	A,B,D
		Repair				2.5		36,38	C
AF	Rear Axle Housing Breather	Service		0.1					B
		Replace		0.5				38	

TM 5-2420-230-24-1

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AF	Front Axle Assembly	Inspect	0.1	0.1					B,D
		Service	0.3	0.5					A,B,D
		Align		0.8				36,38	
		Replace			2.0			36,38	
		Repair			1.5	12.0		23,29,36,38	C,F
AF	Wheel Hub Breather	Service		0.5					B
		Replace		0.2				38	
AF	Front Wheel Hub	Inspect	0.1	0.7					B,D
		Service	0.3	0.5				29,36,38	A,B
		Repair			2.5			23,29,36,38,42	C
AF	Front Slack Adjuster	Inspect		0.1					B
		Service	0.1	0.1					B,D
		Replace		0.5				38	
AF	Front Brake Drum	Inspect		0.7					B
		Service		0.1				36,38	B
		Test		0.1				36	
		Replace		2.0				36,38	
AF	Rear Axle Assembly	Inspect	0.1	0.1					B,D
		Service	0.1	0.5					A,B,D
		Replace			3.5			36,38	
		Repair			1.5	16.0		23,29,36,38	C,F
AF	Rear Wheel Hub	Inspect	0.1	0.7					B,D
		Service	0.3	0.5				29,36,38	A,B
		Repair			2.5			23,29,36,38,42	C
AF	Rear Brake Drum	Inspect		0.7					B
		Service		0.1				36,38	B
		Test		0.1				36	
		Replace		2.0				36,38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AF	Wheel and Tire Assembly	Inspect	0.1	0.1					B,D
		Service	0.1						B,D
		Remove/Install	1.0						D
		Replace Repair		0.5			2.0	36,38	E
AF	Drive Shaft, Front	Inspect	0.1	0.5					B
		Service	0.1						B,D
		Replace		1.3				36,38	
		Repair						36,38	
AF	Drive Shaft, Rear	Inspect	0.1	0.5					B
		Service	0.1						B,D
		Replace		1.3				36,38	
		Repair						36,38	
AF	Transmission Oil Filters	Replace		0.5				29,36,38	
AG	Steering Wheel	Replace		0.3				38	
AG	Steering Column	Inspect		0.1					B
		Replace		0.5				38	
AG	Power Steering Gear Box	Inspect	0.1	0.1					B
		Adjust		0.2				38	
		Service	0.1	1.0				29	B,D
		Replace		1.0				29,36,38	
		Repair				1.5			E
AG	Pitman Arm	Inspect	0.1	0.1					B
		Service	0.1						B,D
		Replace		1.0				31,36,38	
AG	Steering Miter Box	Service	0.2						B,D
		Replace		0.5				38	
AG	Power Steering Pump	Inspect		0.1					B
		Test		1.0				29,36,38,40.1	
		Replace		1.0				29,36,38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AG	Power Steering Reservoir	Inspect	0.1	0.1				29,38	B
		Service	0.1	0.5					A,B
		Replace		0.5					
AG	Power Steering Oil Filter	Replace		0.5			29,36,38	B	
AG	Steering Lines and Hoses	Replace		0.9			29,38		
AG	Drag Link Assembly	Inspect	0.1	0.1				36,38	B
		Service	0.1						B,D
		Replace		1.0					
AG	Steering Shaft, Rear	Inspect	0.1	0.1				36,38	B
		Service	0.1						B,D
		Replace		1.5					
AG	Steering Shaft, Front	Inspect	0.1	0.1				36,38	B
		Service	0.1						B,D
		Replace		1.0					
AG	U-Joint	Inspect		0.1				36,38	B
		Service	0.1						B,D
		Replace		1.0					
AG	Carrier Bearing	Service	0.1					B,D	
AG	Steering Damper	Replace		0.5			38		
AH	Check Straps	Inspect	0.1	0.1				36,38	B
		Replace		0.5					
AH	Shock Absorber	Inspect	0.1					36,38	B
		Replace		0.5					
AH	Airbags	Inspect	0.1					38	B
		Replace		1.3					
AH	Bump Stop	Replace		0.2			36,38		



(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level				(5) Tools and Equipment Ref Code	(6) Remarks Code	
			Field		Sustainment				
			Unit		Direct Support	General Support			Depot
			C	O	F	H			D
AH	Ride Level Valve	Inspect		0.5					
		Adjust		0.8			38		
		Replace		0.2			36,38		
AH	Control Arms	Inspect	0.1					B	
		Replace		0.5			36,38		
AH	Sway Bar	Inspect		0.1					
		Replace		1.7			36,38		
AH	Tie Rod Ends	Inspect	0.1	0.1				B	
		Service	0.1					B,D	
		Adjust		0.5			36,38		
		Replace		0.5			38		
AH	Panhard Rods	Adjust		0.2					
		Replace		1.0			36,38		
AJ	Air Compressor	Inspect	0.1	0.1				B	
		Replace		1.0			29,36,38		
		Repair				1.0		C	
AJ	Air Governor	Inspect		0.1				B	
		Adjust		0.3					
		Replace		0.3			38		
AJ	Pressure Protection Valve	Test		0.8					
		Replace		0.5			38		
AJ	Single Check Valve	Test		0.5					
		Replace		0.5			38		
AJ	Brake Modulation Valve	Test		0.8					
		Replace		0.5			38		
AJ	Double Check Valve	Test		0.5					
		Replace		0.5			38		
AJ	Auxiliary Air Tank (9.7 liter)	Inspect		0.1				B	
		Replace		0.5			38		

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Direct Support	Sustainment			
			Unit		Support	General Support	Depot		
			C	O	F	H	D		
AJ	Front Brake Air Tank (20 liter)	Inspect		0.1					B
		Service		0.5					B
		Replace		0.5			38		
AJ	Rear Brakes and Park Brakes Air Tank (28 liter)	Inspect		0.1					B
		Service		0.1					B
		Replace		0.5			38		
AJ	Front Brake Air Tank (16.8 liter)	Inspect		0.1					B
		Service		0.1					B
		Replace		0.5			38		
AJ	Park Brake Air Tank (13.8 liter)	Inspect		0.1					B
		Service		0.1					B
		Replace		0.5			38		
AJ	Air Drier	Inspect		0.1					B
		Service		0.1					B
		Replace		1.0			38		
AJ	Air Drier Desiccant	Inspect		0.1					B
		Replace		0.5			38		
AJ	Brake Pedal and Foot Treadle Valve	Inspect	0.1	0.1					B
		Test		0.3					
		Replace		0.7			38		
AJ	Brake Assembly, Front	Inspect		0.1					B
		Repair		3.0			23,36,38		
AJ	Brake Cam	Service	0.1						B,D
AJ	Brake Shoe Assembly, Front	Replace			0.5			36,38	
		Inspect		0.1					B
		Adjust		0.2			36,38		
AJ	Spring Brake Chamber, Front	Replace			1.0			23,36,38	
		Replace		0.7			36,38		

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AJ	Brake Assembly, Rear	Inspect Repair		0.1 3.0				23,36,38	B
AJ	Rear Slack Adjuster	Inspect Service Replace	0.1	0.1 0.5				38	B B,D
AJ	Brake Shoe Assembly, Rear	Inspect Adjust Replace		0.1 0.2	1.0			36,38 23,36,38	B
AJ	Spring Brake Chamber, Rear	Replace		0.7				36,38	
AJ	Quick-Release Valve	Test Replace		0.8 0.5				38	
AJ	Pressure Ratio Valve	Test Replace		0.5 0.5				38	
AJ	Pneumatic Solenoid Valve	Test Replace		0.5 0.5				38	
AJ	Valve Island	Test Replace		0.3 0.3				38	
AJ	Parking Brake Control	Inspect Replace	0.1					38	B
AK	Nose Cone	Replace Repair		0.6 0.5				38 36	
AK	Engine Hood	Replace Repair		0.3 0.3				38 38	C
AK	Engine Hood Gas Strut	Replace		0.2				38	
AK	Engine Access Panel	Remove/Install Replace	0.1					38	D
AK	Center Belly Plates	Remove/Install Replace	0.5					38	D

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AK	Hydraulic Reservoir Step Plate	Replace		0.2				38	
AK	Front Fender	Replace		1.0				38	
AK	Rear Fender Assembly, LH	Replace		1.5				38	
		Repair		0.7				38	C
AK	Rear Fender Assembly, RH	Replace		1.5				38	
AK	Mudflap Assembly	Replace		0.2				38	
AL	Hydraulic System	Inspect		0.2					B
		Service		0.5				29,38	D
AL	Hydraulic Oil Pump	Test		0.5				40.1	J
		Replace		3.5				29,36,38	
		Repair					1.0		E
AL	Hydraulic Oil Filter	Replace		0.5				29,38	
AL	Hydraulic Reservoir, Pipes, and Fittings	Inspect	0.1	0.1					A,B
		Service		0.5				29,38	
		Replace		1.3				29,38	
		Repair		0.5				38	C
AL	Hydraulic Reservoir Sight Glass	Replace		0.5				29,38	
AL	4-in-1 Bucket Cylinder	Inspect	0.1						B
		Service		0.2					B,D
		Replace		0.5				29,38	
		Repair			2.0			1.1,22.1,38	C
AL	FEL Lift Cylinder	Inspect	0.1						B
		Service	0.1						B,D
		Replace		1.0				23,29,38	
		Repair			2.0			1.1,22.1,38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AL	Tilt Cylinder	Inspect	0.1						B
		Service	0.1						B,D
		Replace		1.7				23,29,38	
		Repair			2.0			1.1,22.1,38	
AL	Engine, Transmission, and Hydraulic Oil Sampling Valves	Replace		0.5				29,38	
AM	FEL Arms	Inspect	0.1	0.3					B
		Service	0.1						B,D
		Replace		2.8				1,23,29,36,38	
		Repair						23,29,36,38	
AM	Tilt Linkages	Replace		1.5				23,38	
AM	Tilt Position Potentiometer	Replace		0.5				38	
AM	FEL Arm Lift Potentiometer	Replace		0.5				38	
AM	4-in-1 Bucket	Inspect	0.1						B
		Service	0.1						B,D
		Remove/Install	0.3						
		Replace		0.3					
AM	Cutting Edge	Repair		1.5				23,38	C
		Replace		0.5				38	
AM	FEL Tooth	Replace	0.1						D
AM	Ripper Tooth	Replace	0.1						D
AM	FEL Bushings	Service	0.1						B,D
		Replace		0.5				36,38	
AM	FEL Valve Block	Inspect	0.1						B
		Service		0.3					B,D
		Test		0.7					
		Replace		1.7				23,29,38	
		Repair			3.0			23,38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AM	FEL Hydraulic Solenoid Valve	Replace		0.5				38	D
AN	Stabilizer Arm	Replace		0.5				23,36,38	C
		Repair		0.5				23,36,38	
AN	Backhoe Bushings	Service	0.1						B,D
		Replace			0.5			36,38	
AN	Boom Lock Pedal and Cable	Inspect	0.1						B B,D
		Service	0.1					38	
		Adjust		0.2				38	
		Replace		1.0				38	
AN	Swing Cylinder	Inspect	0.1						B B,D
		Service	0.1						
		Replace		2.0				23,29,38	
		Repair			2.0			1.1,22.1,38	
AN	Swing Tower	Inspect	0.1						B B,D
		Service	0.1						
		Replace			1.5			23,36,38	
AN	Stabilizer Cylinder	Inspect	0.1						B B,D
		Service	0.1						
		Replace		1.0				23,29,38	
		Repair			2.0			1.1,22.1,38	
AN	Boom Cylinder	Inspect	0.1						B B,D
		Service	0.1						
		Replace		1.0				23,29,38	
		Repair			2.0			1.1,22.1,38	
AN	Dipper Cylinder	Inspect	0.1						B B,D
		Service	0.1						
		Replace		0.5				23,29,38	
		Repair			2.0			1.1,22.1,38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AN	Boom	Inspect	0.1					23,36,38	B
		Service	0.1						B,D
		Replace			3.0				D
AN	Dipper	Inspect	0.1					23,36,38	B
		Service	0.1						B,D
		Replace		3.0					D
AN	Backhoe Assembly	Inspect	0.1						B
		Service	0.1						B
AN	Backhoe Bucket	Inspect	0.1					38	B
		Service	0.1						B,D
		Remove/Install	0.2						D
		Replace		0.2					
AN	Backhoe Tooth	Replace	0.1						D
AN	Bucket Cylinder	Inspect	0.1					23,29,38 1.1,22.1,38	B
		Service	0.1						B,D
		Replace		0.5					
		Repair			2.0				
AN	Backhoe Valve Block	Inspect	0.1					40.1 23,29,38 23,38	B
		Service		0.3					B,D
		Test		0.7					J
		Replace		1.7					
		Repair			3.0				
AN	Backhoe Hydraulic Solenoid Valve	Replace		0.5				38	D
AP	Spare Wheel Carrier	Inspect	0.1					38	B
		Remove/Install	0.3						D
		Replace		0.3					
AP	Hitch Assembly	Replace		0.5				23,38	D

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Direct Support	Sustainment			
			Unit		Support	General Support	Depot		
			C	O	F	H	D		
AP	Tow Pintle	Service	0.1					38	B,D
		Remove/Install	0.2						
		Replace		0.2					
AP	LH and RH Belly Plates	Remove/Install	0.5				38	D	
		Replace		0.5					
AP	Forklift Attachment	Inspect	0.1				36,38	B B,D	
		Service	0.1						
		Remove/Install	0.3						
AP	Forklift Tines	Replace		0.2				D	
AP	Chassis Assembly	Inspect	0.2	0.2				B	
AP	Rifle Rack and Mount	Replace		0.5					
AP	Hose Reel Assembly	Inspect	0.1				23,38 23,38	B	
		Replace		0.5					
		Repair		2.0					
AP	Hose Reel Roller	Replace		0.5			38		
AP	Hose Reel Spring Motor	Replace		0.5			38		
AP	Hose Reel Switch	Replace		0.5			38		
AP	Hose Reel Valve Assembly	Replace		0.5			38		
AP	Hose Reel Hose Assembly	Replace		1.0			38		
AQ	Operator's Seat	Inspect	0.1				38 38	B C	
		Replace		1.0					
		Repair		1.0					
AQ	Operator's Seat Anchor	Inspect	0.1				38	B	
		Replace		0.5					
AQ	Operator's Seat Belt Assembly	Inspect	0.1	0.1			38	B	
		Replace		1.0					



(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AQ	Hand Control Pod Assembly	Replace			2.0			38	
AQ	Joystick	Replace		0.5				38	
AQ	Main Hydraulic Master Switch	Replace		0.5				38	
AQ	A/C Precleaner	Service Replace	0.1	0.3				38	B
AQ	A/C Pressurizer	Replace		0.2				38	
AQ	A/C Filter	Replace		0.2					B
AQ	Windshield Defrost Cover	Replace		1.0				38	
AQ	A/C Cover	Replace		1.0				38	
AQ	A/C Compressor	Replace			2.0			36,38	
AQ	A/C Receiver-Drier	Replace			0.3			38	
AQ	HVAC System	Inspect	0.1						B
AQ	A/C Evaporator Assembly	Replace Repair			1.0 1.0			29,38 38	 C
AQ	Auxiliary Defroster Heater	Inspect Replace Repair	0.1	1.0 1.0				29,38 38	 C
AQ	Auxiliary Defroster Ducting	Replace		1.0				38	
AQ	Window Assemblies	Inspect	0.2	0.2					B
AQ	Windshield, Bottom, RH	Replace		1.5				38	
AQ	Windshield, Bottom, LH	Replace		1.5				38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Direct Support	Sustainment			
			Unit		Support	General Support	Depot		
			C	O	F	H	D		
AQ	Glass, Top, Front, LH	Replace		1.5				38	
AQ	Glass, Bottom, Front, LH	Replace		1.5				38	
AQ	Glass, Door, Bottom	Replace		1.5				38	
AQ	Glass, Middle, LH	Replace		1.5				38	
AQ	Glass, Rear, LH	Replace		1.5				38	
AQ	Glass, Rear, RH	Replace		1.5				38	
AQ	Glass Bottom, RH	Replace		1.5				38	
AQ	Glass, Top, Front, RH	Replace		1.5				38	
AQ	Glass, Bottom, Front, RH	Replace		1.5				38	
AQ	Window, Framed, LH	Replace		1.5				38	
AQ	Window, Framed, RH	Replace		1.5				38	
AQ	Window, Rear	Replace		1.5				38	
AQ	Windshield, Mid, RH	Replace		1.5				38	
AQ	Windshield, Mid, LH	Replace		1.5				38	
AQ	Windshield, Top	Replace		1.5				38	
AQ	Glass, Middle, RH	Replace		1.5				38	
AQ	Door Assembly	Replace		1.0				38	
AQ	Door Hinge	Replace		1.0				38	
AQ	Door Handle	Replace		1.0				38	
AQ	Door Gas Strut	Replace		0.5				38	

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AQ	Mirrors and Brackets	Inspect	0.1					B	
		Replace		0.5			38		
AQ	Sun Visor	Replace		0.5			38		
AQ	Firewall Assembly	Remove/Install	0.3					D	
		Replace		0.3			38		
AQ	Air Cleaner/Stowage Box	Replace		0.3			38		
		Repair		1.0			38	C	
AQ	Fuel Tank Step Plate	Replace		0.1			38		
AQ	Radio Mount	Replace		0.3			38		
AR	Data Plates and Decals	Inspect	0.1					B	
		Replace		0.1			36,38		
AR	MLC Placard	Replace		0.1			38		
AU	Cold Weather Kit	Install		8.0			2.1,29,36,38		
AU	Arctic Heater Assembly	Inspect	0.5	0.5				B	
		Replace		0.5			29,38		
		Repair		0.3			38		
AU	Combustion Air Blower	Replace		0.4			27.1,27.2, 36,38		
AU	Control Unit	Replace		0.1			36,38		
AU	Flame Sensor	Replace		1.5			27.1,27.2, 36,38		
AU	Fuel Metering Pump	Test		0.3			20.1,38		
		Replace		0.5			38		
AU	Glow Pin	Replace		0.3			27.1,27.2, 36,38		
AU	Overheat and Temperature Sensors	Replace		0.2			27.1,27.2, 36,38		

(1) Group Code	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field		Sustainment				
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
AU	Water Pump	Replace		0.4				36,38	
AU	Ether Start Assembly	Replace		0.4				38	
AU	Ether Start Pushbutton	Replace		0.5				38	
AU	Starting Fluid (Ether) Cylinder	Test Replace		0.1 0.1				38	
AU	Ether Start Thermostat	Replace		0.2				36,38	
AU	Engine Block Heater	Replace		0.5				36,38	
AU	Battery Trickle Charger	Replace		0.8				36,38	
AU	Electrical Outlet	Replace		0.5				36,38	

**Section III. Tools and Test Equipment for IHMEE.**

<b>Tool or Test Equipment Reference Code</b>	<b>Maintenance Level</b>	<b>Nomenclature</b>	<b>National Stock Number</b>	<b>Tool Number</b>
1	O,F	Adapter, Pivot Pin	5120-01-522-4287	3HA261
1.1	F	Bar, Cylinder Cap		NPN-PTE1
2	F,H	Barring Tool, Gear	5120-01-285-5193	3824591
2.1	O	Blade Kit, Hole Saw (or equivalent)	5130-01-473-9803	9493
3	F,H	Brush, Injector Cleaning	7920-01-381-6132	3822509
4		Deleted		
5		Deleted		
6		Deleted		
7		Deleted		
8		Deleted		
9		Deleted		
10		Deleted		
11		Deleted		
12		Deleted		
13		Deleted		
14		Deleted		
15		Deleted		
16		Deleted		
17		Deleted		
18		Deleted		
19		Deleted		
20	H	Compressor, Piston Ring (available in SC 4940-05-B02)	5120-00-116-7676	ST755
20.1	O	Cylinder, Graduated, Laboratory (or equivalent)	6640-00-988-8925	8-571
21	H	Driver, Cup Plug	5120-01-522-4288	3823520
22	H	Driver, Cup Plug	5120-01-516-2833	3823524
22.1	F	Field Maintenance, Artillery	4933-00-754-0704	SC4933-95CLA12
23	O,F,H	Field Maintenance, Basic	4910-00-754-0705	SC4910-95CLA31

**TM 5-2420-230-24-1**

<b>Tool or Test Equipment Reference Code</b>	<b>Maintenance Level</b>	<b>Nomenclature</b>	<b>National Stock Number</b>	<b>Tool Number</b>
24	H	Gauge, Depth, Dial Indicating (available in SC 4940-05-B02)	5210-01-157-3091	3823495
25		Deleted		
26	O	Insertor, Electrical Contact	5120-01-374-8968	CIT-SS-10
27	F	Insertor, Seal	5120-01-476-1516	3824498
27.1	F	Insertion/Extraction Tool, Electrical Contact (00779)		4-1579007-3
27.2	F	Insertion/Extraction Tool, Electrical Contact (00779)		539960-1
28	O	Multimeter	6625-01-265-6000	27 W/ACCE
29	O,F	Pan, Drain	4920-01-446-7583	3D25557G01
30	F,H	Puller, Injector	5120-01-389-5917	3823276
31	O	Puller, Pitman Arm	5120-01-522-4285	ZTSE4439
32	O,F	Reclaimer, Refrigerant	4250-01-359-0393	EEAC304D
32.1	O	Resistor, Variable		NPN-ADI1
33		Deleted		
34	F,H	Stand, Powerpack Rebuild	4910-66-152-5125	LTA-G08-0001-01
35		Deleted		
36	O,F,H	Tool Kit, Automotive Maintenance, Common No. 2 (4910-95-A72)	4910-00-754-0650	SC4910-95CLA72
36	O,F,H	M7 Forward Repair System (FRS) (4940-98-E41)	4940-01-463-7940	RIA149000
37	O	Tool Kit, Electrical Contact	5180-00-876-9336	7550526
38	O,F,H	Tool Kit, General Mechanic's: Automotive	5180-01-481-8389	DFP389J
39	F,O	Tool Kit, Refrigeration Equipment (available in SC 5180-95-N18)	5180-00-596-1474	SC5180-90-CL-N18
40	O,F,H	Tool Kit, Welder's	5180-00-754-0661	SC5180-90-N39
40.1	O	Tool Outfit, Hydraulic Systems Test and Repair (HSTRU)	4940-01-036-5784	13221E6850
41	H	Tool, Wear Sleeve Installation	5120-01-522-4286	3824500
42	F	Wrench, Hub Bearing Nut	5120-66-152-5118	MISC-1-B13229E

**Section IV. Remarks for IHMEE.**

<b>(1) Remarks Code</b>	<b>(2) Remarks</b>
A	Operator adds lubricant only. Unit maintenance drains and fills assembly.
B	Preventive Maintenance Checks and Services (PMCS).
C	Repair by replacement of components.
D	Task requires use of BIL.
E	Repair is performed by a Contractor Repair Facility.
F	DS is lowest level authorized to replace pinion seal.
G	Engine and transmission replacement require power pack removal.
H	Only minor wiring harness repairs are authorized.
J	Testing requires gage 4940-01-086-8756 and fitting (1KPD5) 5-1/8 F5OG-S, or equivalent.





## APPENDIX C

### Expendable/Durables List

#### Section I. INTRODUCTION

##### C-1. SCOPE.

This appendix lists expendable/durable supplies and materials needed to operate and maintain the Interim High-Mobility Engineer Excavator (IHMEE). This listing is for informative purposes only and is not an authority to requisition listed items. These items are authorized to be used by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

##### C-2. EXPLANATION OF COLUMNS.

- a. Column (1), Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., “Use antiseize compound, (Item , Appendix C)”).
- b. Column (2), Level.** This column identifies the Federal item name (in all capital letters), followed by a minimum description when needed.
  - C - Operator/Crew
  - O - Unit maintenance
  - F - Direct Support maintenance
  - H - General Support maintenance
- c. Column (3), National Stock Number (NSN).** This is the National Stock Number assigned to the item; use it to request or requisition the item.
- d. Column (4), Description.** Indicates the Federal item name, and, if required, a description to identify the item.
- e. Column (5), Unit of Measure (U/M).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by two-character alphabetical abbreviations (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue to satisfy required measures.

**Section II. EXPENDABLE AND DURABLE ITEMS.**

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	O		Adhesive, (OPMN0) Sikaflex 255FC	tu
2	O		Alcohol, Isopropyl, (TT-I-735A)	
		6810-01-075-5546	4-ounce bottle	oz
		6810-01-190-2538	9-ounce can	oz
		6810-01-454-9527	16-ounce bottle	oz
		6810-00-286-5435	1-gallon can	gal
3	C		Antifreeze, Multi-Engine Type, (A-A-52624)	
		6850-01-441-3218	Type I (EGAF), 1-gallon can	gal
		6850-01-441-3221	Type I (EGAF), 5-gallon can	gal
		6850-01-441-3223	Type I (EGAF), 55-gallon drum	gal
		6850-01-441-3234	Type IP (60% EGAF), 1-gallon can	gal
		6850-01-441-3240	Type IP (60% EGAF), 5-gallon can	gal
		6850-01-441-3248	Type IP (60% EGAF), 55-gallon drum	gal
4	O, F	5340-00-450-5718	Cap and Plug Set, Protective, Dust and Moisture Seal, (10935405)	ea
5	O	9310-00-045-4395	Cardboard, (81348) UUC190	ea
6	O	7510-00-223-6706	Chalk, (78520) 314-005	ea
7	O	2540-00-678-3469	Chock, Wheel	ea
8	O		Cleaner, (OPMN0) Sikaflex 205	tu
8.1	F	5350-00-089-9378	Cloth, Abrasive	ea
9	O	5350-00-221-0872	Cloth, Crocus, (81348) P-C-458	sh
10	O	5330-01-083-0081	Cloth, Lint-Free	ea
11	O	6850-00-105-0586	Coating, Copper, (15114) OXIBAN40	ea
12	O	8030-00-597-5367	Compound, Antiseize, High Temperature, (MIL-PRF-907E), 2.5-pound can	lb
13	O	7930-01-423-0117	Compound, Cleaning, Solvent-Detergent, (Loctite 7070) (05972), 20162	tu
14	C	6850-00-926-2275	Compound, Cleaning, Windshield, (OFTT5) 0854-000	gal
15	O	8030-00-231-2352	Compound, Corrosion Preventive, (MIL-C-11796C), 400-pound drum	lb
16	O		Compound, Corrosion Preventive, (MIL-PRF-16173E)	
		8030-01-396-5731	1-pint can	pt
		8031-01-396-5732	1-gallon can	gal
		8030-01-347-0970	5-gallon pail	gal
		8030-01-396-5237	55-gallon drum	gal
17	F	5350-01-157-6916	Compound. Lapping and Grinding, J3179-5	ea

TM 5-2420-230-24-1

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
18	O		Compound, Retaining (Loctite 638), (05972) 21447, 10-ml bottle 21448, 50-ml bottle 21449, 250-ml bottle	ml ml ml
19	C	8030-01-104-5392 8030-01-014-5869 8030-01-025-1692	Compound, Sealing (Loctite 242), MIL-S-46163A, Type 2, Grade N 10-ml bottle 50-ml bottle 250-ml bottle	ml ml ml
20	O	8030-01-132-9624 8030-01-475-2446 8030-01-475-2444	Compound, Sealing (Loctite 243) 10-ml bottle 50-ml bottle 250-ml bottle	ml ml ml
21	O	8030-01-137-6964 5330-01-172-1895	Compound, Sealing (Loctite 515) 50-ml tube 300-ml cartridge	ml ml
22	O	8030-01-166-0675 8030-01-517-1616	Compound, Sealing (Loctite 567) 50-ml bottle 250-ml bottle	ml ml
23	O	8030-00-339-0310 8030-01-026-1538	Compound, Sealing (Loctite 569) 50-ml bottle 250-ml bottle	ml ml
24	O	8030-00-180-6150 8030-00-180-6222 8030-00-891-8358	Compound, Sealing (Loctite 609) 10-ml bottle 50-ml bottle 250-ml bottle	ml ml ml
24.1	O	8030-01-488-4272	Compound, Sealing (Loctite 641), 50-ml bottle	ml
25	O	8030-00-538-5212	Compound, Sealing, (Silastic 732 RTV), MIL-A-46106B, 3-oz. tube	tu
26	O	8030-01-510-9460	Compound, Threadlocking (Loctite 277), 10-ml bottle	ml
27	C	9150-00-698-2382 9150-01-353-4799 9150-00-657-4959 9150-01-114-9968	Dexron III 1-quart can 1-quart bottle 5-gallon can 55-gallon drum	qt qt gal gal
28	O		Dykem Steel Blue, (1QZC4) 80400	oz
29	F	4930-01-452-1040	Fuel Additive, Injector, (0U7J1) 4T-4A	cn

TM 5-2420-230-24-1

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
30	C	9150-01-197-7688 9150-01-197-7693 9150-01-197-7690 9150-01-197-7689 9150-00-190-0906 9150-01-197-7692 9150-01-197-7691	Grease, Automotive and Artillery (GAA), MIL-PRF-10924 2.25-ounce tube 14-ounce cartridge 1.75-pound can 6.5-pound can 25-pound pail 35-pound can 120-pound can	oz oz lb lb lb lb lb
31	F	9150-01-095-5512	Grease, Ball Bearing, Lithium Base, (73219) 18901	cn
32	O	9150-01-179-1589	Grease, Electrically Conductive, (77068) BEMS 15030	tu
33	O	9150-01-154-1259	Grease, High-Temperature, (81349) DOD-G-85733	qt
34	F	9150-00-076-1587	Grease, Lithium, (73219) LUBRIPLATE110	oz
35	O	5970-01-278-5132	Heat Shrink Tubing, (92194) FIT-221-3	ea
36	O	6850-01-241-0651	Inspection Penetrant Developer, Dry	cn
37	O	6850-00-865-2916 6850-00-368-5233 6850-00-803-4400	Inhibitor, Corrosion, Vapor Barrier, (54527) VPI 260 POWDER 2-ounce can 1-pound can 5-pound can	oz lb lb
38	O	4940-01-387-0948	Leak Detector, Refrigerant Gas, (07295) 16600	cn
39	O	6830-00-292-0732	Nitrogen, Technical	cyl
40	O	9150-00-529-7222	Oil, Lubricating, CRC 5-56, (10136) 05005	cn
41	O	9150-00-836-8641 9150-00-261-8146 9150-00-273-2389 9150-00-458-0075 9150-01-374-2021 9150-00-231-6689 9150-00-231-9045 9150-00-231-9062 9150-00-281-2060	Oil, Lubricating, General Purpose, MIL-PRF-32033 1/2-ounce bottles, box of 12 1-ounce bottle 4-ounce can 16-ounce aerosol 16-ounce sprayer 1-quart can 1-gallon can 5-gallon can 55-gallon drum	oz oz oz oz oz qt gal gal gal
41.1	O	9150-01-500-2190	Oil, Lubricating, Gear	

TM 5-2420-230-24-1

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
42	C	9150-01-035-5390 9150-01-035-5391 9150-01-035-5392 9150-01-313-2191 9150-01-035-5393 9150-01-035-5394 9150-01-035-5395 9150-01-035-5396 9150-01-048-4591	Oil, Lubricating, Gear, Multipurpose, (GO-), MIL-PRF-2105 GO-75, 1-quart can GO-75, 5-gallon can GO-80/90, 1-quart can GO-80/90, 1-gallon can GO-80/90, 5-gallon can GO-80/90, 55-gallon drum GO-85/140, 5-gallon can GO-85/140, 55-gallon drum GO-85/140, 1-quart can	qt gal qt gal gal gal gal gal qt
43	C	9150-00-402-2372 9150-00-491-7197	Oil, Lubricating, I-C Engine, Arctic, (OEA), MIL-PRF-46167 5-gallon can 55-gallon drum	gal gal
44	C	9150-00-189-6727 9150-01-177-3988 9150-00-186-6668 9150-00-191-2772 9150-00-186-6681 9150-01-178-4726 9150-00-188-9858 9150-00-189-6729 9150-00-188-9862 9150-01-152-4117 9150-01-178-4725 9150-01-152-4118 9150-01-152-4119	Oil, Lubricating, I-C Engine, Combat/Tactical Service, (OE/ HDO-), MIL-PRF-2104 OE/HDO-10, 1-quart can OE/HDO-10, 1-quart bottle OE/HDO-10, 5-gallon can OE/HDO-10, 55-gallon drum OE/HDO-30, 1-quart can OE/HDO-30, 1-quart bottle OE/HDO-30, 5-gallon can OE/HDO-30, 55-gallon drum OE/HDO-40, 55-gallon drum OE/HDO-15/40, 1-quart can OE/HDO-15/40, 1-quart bottle OE/HDO-15/40, 5-gallon can OE/HDO-15/40, 55-gallon drum	qt qt gal gal gal qt qt gal gal gal qt qt gal gal
45	F	9150-00-543-7220	Oil, Lubricating, Molybdenum Disulfide, DOD-L-25681	ea
46	O	9150-00-111-3199 9150-00-111-0208 9150-00-111-0209 9150-00-111-0210 9150-01-293-2773 9150-01-293-7697 9150-01-293-7696 9150-01-293-2772	Oil, Lubricating, I-C Engine, Preservation and Break-In, (PE-), MIL-PRF-21260 PE-10 5-gallon can PE-10 55-gallon drum PE-30 5-gallon can PE-30 55-gallon drum PE-40 5-gallon can PE-40 55-gallon drum PE-15W/40 5-gallon can PE-15W/40 55-gallon drum	gal gal gal gal gal gal gal gal
47	O	6505-00-240-6327	Oil, Mineral, Light, NDC00527-0812-28	cn
48	O	9150-00-889-3523 9150-00-985-7293 9150-00-407-0973	Oil, Preservative, Contact and Volatile Corrosion Inhibited, MIL-PRF-46002B Grade 1, 1-quart can Grade 1, 5-gallon can Grade 1, 55-gallon drum	qt gal gal

TM 5-2420-230-24-1

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
49	O	5350-00-578-8378	Paper, Abrasive, Silicon Carbide, Waterproof, P-P-101, 400-grit	sh
50	O	9150-00-250-0931 9150-00-250-0926 9150-00-250-0933	Petrolatum, Technical, VV-P-236A 8-ounce tube 1.75-pound can 7.5-pound can	oz lb lb
51	O		Primer, (OPMN0) Sikaflex 210T	tu
52	O	6830-01-439-0614	Refrigerant, (4V886) R134a	cyl
53	O	5330-01-197-7789	Scotch Brite, (11924) 12000260	ea
54	O		Sealant, Metal, (45152) 1317520	tu
55	O		Sealant, Pipe Plug, 3375066	tu
55.1	O		Sealant, (OPMN0) Sikaflex 221	tu
56	C	7930-00-634-3935	Soap, Laundry, ASTM D 496	dr
57	O	6810-00-264-6618	Sodium, Bicarbonate, (81348) 0-S-576	box
58	C	6850-01-474-2319 6850-01-474-2317 6850-01-378-0698 6850-01-474-2316	Solvent, Degreasing, Type II (81348) MIL-PRF-680 1-gallon can 5-gallon can 15-gallon can 55-gallon drum	gal gal gal gal
59	O	6850-00-508-0076	Solvent, Penetrating, 1064021	tu
60	O	6850-01-246-6544 6850-01-246-6545 6840-01-173-6940 6850-01-167-4789 6849-01-041-0098 6850-01-167-4788	Stabilizer Additive, Diesel Fuel, MIL-S-53021A Single Package, 5-gallon can Single Package, 55-gallon drum Two Package A, 5-gallon can Two Package A, 5-gallon can Two Package B, 55-gallon drum Two Package B, 55-gallon drum	gal gal gal gal gal gal
61	O	5345-01-119-6244	Stone, Finishing, Fine Grit, STONE14X3X2 1/4-C100PV	ea
62			Deleted	
63	O	8135-00-178-9200	Tags, Identification, UU-T-81	pk
64	O	9320-00-171-4369	Tape, Adhesive, Rubber (MIL-T-46114)	ea
65	O	5970-00-547-0966	Tape, Electrical, (19207) GISEALTYPE3	ea
66	O	7510-01-399-5074	Tape, Masking, (0N6J0) P34953A	ea
66.1	O		Tape, Tacky (53309), 933405	ea
67	O		Three Bond 1207-C, 3823494	ea
68	C	4310-01-115-2297	Ties, Cable, (56501) TY525MX	ea.
69	C	9130-01-395-0945	Turbine Fuel, Aviation, Bulk, JP-8	gal
70	O	9505-00-293-4208	Wire, Nonelectrical Lock	lb

## APPENDIX D

### Mandatory Replacement Parts

#### Section I. Introduction.

**D-1. SCOPE.**

This appendix lists all mandatory replacement parts required for performance of Direct Support and General Support Maintenance of the Interim High-Mobility Engineer Excavator (IHMEE). It authorizes the requisitioning, issue, and disposition of consumable repair parts. All consumable repair parts listed in the maintenance tasks are listed here for ease of reference.

**D-2. EXPLANATION OF COLUMNS.**

- a. Column (1) - Replacement Part Reference Code.** This number is assigned to the entry in the listing and is referenced in the narrative task box to identify the part (e.g., Clip, (Item , Appendix D)).
- b. Column (2) - Nomenclature.** Indicates the federal item name and, if required, a description to identify the item.
- c. Column (3) - Part Number.** This is the vendor number assigned to the item.
- d. Column (4) - National Stock Number.** This is the National Stock Number assigned to the item; use it to request or requisition the item.

#### Section II. Mandatory Replacement Parts.

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
1	Deleted		
2	Deleted		
3	Bearing	241539	3110-01-507-7494
4	Deleted		
5	Deleted		
6	Bearing, Ball	999-58028-0400	3110-00-151-9119
6.1	Bearing, Ball, Annula	17898/75	3110-99-830-9833
7	Bearing, Ball, Annula	124608	3110-00-083-5812

TM 5-2420-230-24-1

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
8	Deleted		
9	Deleted		
10	Bearing, Ball, Annula	212XR1A	3110-00-554-2974
11	Bearing, Ball, Annula	3L08L1A	3110-00-554-5675
11.1	Bearing, Ball, Annula	6312C4H	3110-01-192-3388
12	Bearing, Ball, Annula	9108KFS641	3110-00-554-5675
13	Bearing, Ball, Annula	FFB171/03J08B3C	3110-01-052-0058
14	Bearing, Ball, Annula	FFB171/08J08A2E	3110-00-554-5968
15	Bearing, Ball, Annula	P9109KFS179	3110-00-541-9785
15.1	Bearing, Ball, Annula	T759-001-027	3110-01-318-5361
16	Bearing, Impeller	237190	3110-01-506-8219
17	Bearing, Pump Drive	237798	3110-01-506-8225
18	Bearing, Roller	239741	3100-01-408-9312
19	Bearing, Roller	550886	3110-00-923-1246
20	Deleted		
21	Bearing, Roller, Cyli	LP1310UMR026	3110-01-064-4124
22	Bearing, Roller, Tape	231780	3110-01-029-8085
23	Bearing, Roller, Tape	9-114	3110-01-319-4870
24	Bearing Set, Sleeve	3802070	3120-01-297-7502
24.1	Bearing, Sleeve	231871	3120-01-068-3429
25	Deleted		
26	Bearing, Sleeve	3901170	3120-01-193-9475
26.1	Bearing, Sleeve	T759-001-030	3110-01-318-5360
27	Bushing	52.01.1014	3120-66-151-8698
28	Bushing	52.01.4017	
29	Deleted		
30	Bushing	7305/53	3120-99-830-4616
31	Bushing	7607/19	3120-99-830-4612
32	Bushing	R3423/53	2520-99-833-6871
33	Gear, Spur	2S015/23A	3020-995-07-2669



(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
33.1	Bushing, Sleeve	225408	3120-00-469-6800
34	Bushing, Sleeve	237576	3120-01-057-0255
35	Bushing, Sleeve	3940059	3120-01-477-6294
36	Bushing, Sleeve	LTA-A03-0143-01	5365-66-151-5919
37	Cap, Protective	SL1000/76	5340-99-786-2561
38	Clip	231048	5342-01-070-1591
39	Clip	SL194/5	5365-99-910-8205
39.1	Clip, Locking	54.44.0071-A	
39.2	Connector, Splice	1800	
40	Disk, Clutch	106118	2520-00-383-3917
41	Deleted		
42	Disk, Clutch	234109	2520-01-045-8766
43	Disk, Clutch	236989	2520-01-177-8305
44	Disk, Clutch	9-904-103633	2520-01-099-3931
45	Disk, Clutch	N7217	3010-01-104-0361
46	Disk, Clutch, Outer	VZ7498	2520-00-435-8065
47	Element, Filter, Transmission	243622	2940-01-382-6451
47.1	Filter, Element, Flui	20/10332	
48	Filter, Element, Flui	3937145	2910-01-490-5740
48.1	Filter, Element, Intak	PA1884	2910-00-477-6083
48.2	Filter, Element, Intak	SMP10-1052	4140-55-151-5839
48.3	Filter, Element, Hydraulic Oil	D149921	4730-01-507-0214
49	Filter, Fuel, Secondary	3931062	4930-01-471-0654
50	Filter, Fuel, Primary	FS1241B	4930-01-486-7933
51	Deleted		
52	Deleted		
53	Gasket	231606	5330-00-119-8075
54	Gasket	237415	5330-01-311-8600
55	Gasket	241573	5330-01-367-2312
56	Deleted		

TM 5-2420-230-24-1

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
57	Deleted		
58	Deleted		
59	Gasket	249914	5330-01-506-9508
60	Gasket	3283570	5330-01-379-8394
61	Gasket	3284623	5330-01-492-7606
62	Gasket	3901356	5330-01-190-7581
63	Gasket	3903475	5330-01-191-8047
64	Gasket	3906697	5330-01-314-0902
65	Gasket	3906698	5330-01-297-6308
66	Gasket	3915772	5330-01-263-6179
67	Deleted		
68	Gasket	3925449	5330-01-448-6910
69	Gasket	3927154	5330-01-218-1201
70	Gasket	3929751	5330-01-450-6040
71	Gasket	3929791	5330-01-453-7147
72	Gasket	3929792	5330-01-356-9972
73	Gasket	3929795	5330-01-453-7148
74	Gasket	3930426	5330-01-506-9033
75	Gasket	3937072	5330-01-492-5701
76	Gasket	3937706	5330-01-453-7146
77	Gasket	3938152	5330-01-319-8523
78	Gasket	3938156	5330-01-453-7142
79	Gasket	3938157	5330-01-453-7145
80	Gasket	3938159	5330-01-304-7807
81	Deleted		
82	Gasket	393925800	5330-01-467-2130
83	Deleted		
84	Gasket	5188755	5330-00-695-2157
85	Gasket	1233220H1	5330-01-319-7300
86	Gasket	G42	5330-00-250-2156

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
87	Gasket	J923331	5330-01-190-1904
87.1	Gasket	LTA-A05-040-001	5330-66-151-0695
87.2	Gasket	LTA-A05-041-001	5330-66-151-0701
87.3	Gasket	LTA-A09-020-001	5330-66-150-8092
88	Gasket, Pump Hydraulic	LTA-A12-116-001	5330-66-150-8094
89	Grommet	LT1196	5325-66-151-0652
90	Grommet, Blanking	LTA05147	
91	Housing, Seal	7607/26A	5330-09-966-1425
92	Insert, Threaded	26004	5326-66-151-8186
92.1	Insert, Threaded	26005	5325-66-151-8793
92.2	Insulation, Ducting	RD-5-11402-0P	
92.3	Insulation, Ducting	RD-5-11402-1P	
92.4	Insulation, Ducting	RD-5-11402-2P	
93	Key, 1/4 in sq	3911781085	
94	Key, 3/8 in sq	ORB50-KEY	
95	Kit, Hardware, Cylinder Block	3933220	3815-01-508-8155
95.1	Kit, Installation, Fuel Level Sender	366LP-F	6680-01-190-9807
96	Kit, Water Pump	3286275	2930-01-467-6421
96.1	Kit, Seal	131750A2	
96.2	Kit, Seal	182218A1	
96.3	Kit, Seal	191747A1	
96.4	Kit, Seal	234844A1	
97	Deleted		
97.1	Lining and O-Rings	20-1752-99-01-02	
98	Lockplate	R3667/202	5340-99-830-4620
98.1	Nut, Self-Locking	12414315-001	4030-01-579-2976
99	Nut, Self-Locking	231639	5310-01-025-1736
100	Nut, Self-Locking	3902662	5310-01-270-8343
101	Nut, Self-Locking	3910959	5310-01-270-8341
102	Nut, Self-Locking	90240	5310-66-150-7824

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
103	Nut, Self-Locking	90241	5310-66-150-7814
104	Nut, Self-Locking	90242	5310-01-209-0508
105	Nut, Self-Locking	90244	5310-66-150-7826
106	Nut, Self-Locking	90245	5310-66-151-5882
107	Nut, Self-Locking	90260	5310-66-151-0970
108	Nut, Self-Locking	90261	5310-66-150-7797
109	Nut, Self-Locking	90262	5310-66-150-7833
110	Nut, Self-Locking	90263	5310-66-151-1024
111	Nut, Self-Locking	90264	5310-66-150-7796
112	Nut, Self-Locking	90265	5310-66-150-7823
113	Nut, Self-Locking	90266	5310-01-270-8343
114	Nut, Self-Locking	90267	5310-66-151-1153
115	Nut, Self-Locking	90268	5310-66-151-1384
115.1	Nut, Self-Locking	91831A009	5310-01-359-2589
116	Nut, Self-Locking	95401	5310-66-150-7827
117	Deleted		
117.1	Nut, Self-Locking	9904.6100	5310-01-515-4442
117.2	Nut, Self-Locking	NPD209-11-6	5310-99-923-0540
118	Deleted		
119	Nut, Self-Locking	LT1024	5310-66-150-7814
120	Deleted		
121	Nut, Self-Locking	LT1059	5310-66-151-0710
122	Nut, Self-Locking	LT1061	5310-66-150-7821
123	Nut, Self-Locking	LT1068	5310-66-151-8181
124	Deleted		
125	Nut, Self-Locking	LT1213	5310-66-150-7868
126	Nut, Self-Locking	LT1233	5310-66-150-8090
126.1	Nut, Self-Locking	MS21044N08	5310-00-811-3494
126.2	Nut, Self-Locking	SL228-6	5310-99-808-3554
126.3	Nut, Self-Locking	SL200-8	5310-99-139-3451

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
126.4	Nut, Self-Locking	MS21044N10	5310-00-982-6809
126.5	Nut, Self-Locking	SL228-8	
126.6	Nut, Self-Locking	SL228/4	5310-99-923-0537
127	Nut, Self-Locking, Brass	LT1137	
128	Nut, Self-Locking, He	NP/D129/11/6	5310-99-923-0537
129	O-Ring	B1085	5331-00-579-6349
130	O-Ring	746	5331-00-710-2698
131	O-Ring	3931824	5331-01-467-4074
132	O-Ring	3037236	5331-01-331-9293
132.1	O-Ring	320-75-104	
132.2	O-Ring	32075111	5331-01-475-3907
132.3	O-Ring	320-75-119	
133	Deleted		
134	O-Ring	3434485	5331-01-480-9716
135	O-Ring	3921640	5331-01-389-1356
136	O-Ring	3929457	5331-01-453-7141
137	O-Ring	200-214-4460	5331-99-540-6838
138	O-Ring	237-6010	5331-01-303-5376
138.1	O-Ring	238-5223	
139	O-Ring	238-5228	5331-01-426-0828
140	Deleted		
141	O-Ring	25K40030	5331-01-316-5754
141.1	O-Ring	25K40112	
142	O-Ring	25K40400	5331-01-019-2610
143	O-Ring	25K40412	5331-00-580-6588
144	Deleted		
144.1	O-Ring	298922	
145	Deleted		
146	Deleted		
147	O-Ring	60K40026	5331-01-020-0949

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
148	O-Ring	60K40106	5331-01-020-0948
148.1	O-Ring	60K40504	5331-01-506-8221
149	O-Ring	60K40616	5331-01-025-0825
150	O-Ring	6683/149	
150.1	O-Ring	76K-20	5331-01-358-7947
150.2	O-Ring	76K112	
150.3	O-Ring	76K211	
150.4	O-Ring	76K227	
150.5	O-Ring	76K241	
150.6	O-Ring	76K328	
151	Deleted		
152	O-Ring	AS29513-117	5331-00-250-0222
153	O-Ring	BS1806-BS128	5331-99-202-9107
153.1	O-Ring	DR524	
153.2	O-Ring	HUBLICH-0143-33	
154	O-Ring	R3383/149	5331-99-828-7212
155	O-Ring	R4875ML5391	5331-99-828-7212
156	O-Ring	R8802/149	5331-99-540-6837
156.1	O-Ring	RD-5-4017-013	5331-01-520-5438
157	Seal, Oil	R3854/187V	5330-99-828-7211
158	Packing, Preformed	230857	5330-01-018-5222
159	Packing, Preformed	231458	5330-01-018-0054
160	Packing, Preformed	232535	5330-00-145-1509
161	Packing, Preformed	234113	5330-01-101-1518
162	Packing, Preformed	237032	5330-01-101-1517
163	Deleted		
164	Packing, Preformed	3903927	5330-01-291-6537
165	Packing, Preformed	3910260	5330-01-272-1124
166	Packing, Preformed	3912473	5330-01-271-9375
167	Packing, Preformed	3928759	5330-01-450-6038

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
168	Deleted		
168.1	Parts Kit, Air Drier	107796	4440-01-391-8276
168.2	Parts Kit, Seal	157B3999	5330-01-431-3084
168.3	Parts Kit, Seal	157B4997	5330-01-431-3087
169	Deleted		
170	Parts Kit, Universal	5-280X	2520-01-082-8619
170.1	Pin, Cotter	AS1236	5315-66-097-0341
171	Pin, Cotter	LT1060	5315-66-097-0341
172	Pin, Cotter	LT1179	5315-66-151-0949
173	Deleted		
173.1	Pin, Cotter	MS24665-283	5315-00-842-3044
174	Pin, Cotter, Split	SL.251/1	5315-99-433-4061
174.1	Pin, Cotter, Split	SL251/18	5315-99-575-0837
174.2	Pin, Cotter, Split	SL251/101	
175	Piston Ring, Turbine	250089	5330-01-507-1790
176	Plate, Clutch	224774	2520-00-435-8063
177	Plate, Clutch, Revers	236810	2520-01-178-4786
178	Plug, Expansion	3900956	5340-01-190-7424
179	Plug, Expansion	3922072	5340-01-431-8753
180	Plug, Expansion	4429735	5340-01-435-7103
181	Reflector, Rectangular, Amber	LTA30013	9905-66-147-8691
181.1	Retainer, Helical	241917	5340-01-276-1794
182	Retainer, Helical Co	9-904-103568	5340-01-099-1427
182.1	Packing, Retainer	232424	5330-10-506-9480
182.2	Retainer, Packing	72776	5330-00-420-4419
182.3	Retainer, Packing	7607-160	5330-99-830-4614
183	Retainer, Packing	235987	5330-01-312-7223
184	Retainer, Spring	232088	5342-01-018-5221
185	Retainer, Spring	232089	5342-01-019-1948
185.1	Retaining Kit	1790442K	

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
186	Ring, Bearing, Inner	N0231870	3110-01-009-7012
187	Ring, Piston	215183	2520-00-142-5392
188	Ring, Piston	222210	4310-01-312-5194
189	Ring, Piston	224771	2520-00-142-5391
189.1	Ring, Piston	234076	2810-01-131-6056
190	Ring, Piston	249779	2420-00-142-5392
191	Ring, Piston	250215	3040-01-508-2344
191.1	Ring, Retaining	1400-1 1-21N	5365-99-910-8205
192	Ring, Retaining	214953	5342-00-439-8139
193	Ring, Retaining	215190	5325-00-249-6555
194	Ring, Retaining	223854	5325-01-271-5247
195	Ring, Retaining	223874	5325-01-018-5223
196	Ring, Retaining	224009	5325-00-821-2502
197	Ring, Retaining	224026	5325-00-144-6445
197.1	Ring, Retaining	224039	5342-00-434-2005
198	Ring, Retaining	224075	5325-00-584-3575
199	Ring, Retaining	224106	5325-01-018-5449
200	Ring, Retaining	230952	5325-01-018-5447
201	Deleted		
202	Ring, Retaining	234350	5325-01-105-2983
202.1	Ring, Retainer	238705	5325-01-197-1631
203	Deleted		
204	Ring, Retaining	239986	5325-01-506-8716
204.1	Ring, Retaining	243251	
205	Ring, Retaining	243262	5325-01-508-5706
206	Ring, Retaining	245787	5325-01-018-0782
207	Deleted		
208	Deleted		
209	Ring, Retaining	247487	5325-01-508-5710
210	Ring, Retaining	247949	5325-01-398-3628



TM 5-2420-230-24-1

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
211	Deleted		
211.1	Ring, Retaining	3035960	5325-01-284-7966
212	Deleted		
213	Ring, Retaining	9-904-103632	5325-01-101-1634
213.1	Ring, Retaining	MS16624-1196	5325-00-514-0362
214	Ring, Special	223877	5365-01-018-5253
214.1	Ring, Special	223925	5365-01-018-5219
215	Ring, Special	230889	5365-01-018-5220
216	Deleted		
217	Ring, Special	243997	5325-01-508-3715
218	Deleted		
219	Rivet	249894	5320-01-506-4369
220	Rivet	615447	5320-66-151-8696
220.1	Rivet	73ASMG6-4-7	
221	Rivet	LT1170	5320-66-152-0503
222	Rivet	LT1171	
223	Rivet	LT1201	5320-66-151-0678
224	Rivet	LTA05112	5320-01-517-6019
225	Deleted		
226	Deleted		
226.1	Screw, Special	22C714	5305-01-018-5592
227	Seal	3904353	5330-01-191-4513
228	Seal	3909356	5330-01-267-2985
229	Seal	3936876	5330-01-199-6159
230	Seal	9-904-101628	5330-00-397-4622
231	Seal	LTA05090-617	
232	Deleted		
233	Seal	LTA05090-1140	5330-661-151-5763
233.1	Seal	LTA05091-1100	
234	Seal	LTA10047	5330-66-151-0624

TM 5-2420-230-24-1

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
234.1	Seal and Gasket Set	25-1864-99-00-21	
235	Seal Assy, Transmission	60K40100	5330-00-932-8714
236	Seal Ring, Metal	72775	5330-00-439-8094
237	Seal Ring, Metal	209781	5330-00-620-6111
238	Seal, Banjo, Connect	3903380	5330-01-195-5268
239	Deleted		
240	Seal, Oil	7887/32	5330-99-768-3630
241	Seal, Oil	7931/32A	5330-99-747-9752
242	Seal, Oil	7973/107	2530-99-725-6539
243	Seal, Oil	LL-1670-626	5330-01-178-1408
244	Seal, Oil	R3185/187	5330-99-815-9846
245	Seal, Oil	R3854/187V	5330-99-828-7211
246	Seal, Pinchweld	LTA05081	5330-66-151-5755
247	Seal, Plain, Encased	415322R	5330-01-025-1737
248	Seal, Plain, Encased	9-904-103663	5330-01-098-7250
249	Seal, Plain, Encased	850132B1020-011	5330-99-815-9846
250	Seal, Plain, Encased	R8321/187	5330-99-728-5219
251	Shim	231848	5365-01-018-5489
252	Shim	LTA-A03-0153-01	5365-66-151-8719
253	Shim (.007)	231849	5365-01-018-0810
254	Shim (.010)	231850	5365-01-018-0811
255	Shim (.020)	231851	5365-01-018-0812
255.1	Shim (.004)	251442	
255.2	Shim (.007)	251443	
255.3	Shim (.010)	251444	
255.4	Shim (.020)	251445	
256	Deleted		
257	Sleeve, Wear	R3383/41	2530-99-830-4617
258	Spacer	230906	5365-01-018-5254
259	Deleted		

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
259.1	Spacer	239923	3020-01-507-0546
260	Spacer, Gear	241674	5365-01-506-6462
261	Spacer, Plate	230921	5365-01-056-2938
262	Spacer, Sleeve	239230	5365-01-271-3334
263	Spacer, Special	229566	5365-01-018-5218
264	Spring	230822	5360-01-018-0685
265	Spring, Helical	201413	5360-00-358-8994
266	Deleted		
266.1	Spring, Helical	3925009	5360-01-411-8374
267	Strainer Element	231390	4730-01-017-0494
267.1	Terminal, Lug	MS25036-108	5940-00-143-4780
268	Valve Collets	3900250	2815-01-199-0448
268.1	Washer, Lock	10	5310-00-045-3296
269	Deleted		
270	Deleted		
271	Washer, Lock	3221-164	5310-99-202-9108
272	Washer, Lock	4E-5	5310-01-358-8280
273	Washer, Lock	4E-6	5310-01-358-4596
274	Washer, Lock	4E7	5310-01-313-8545
275	Washer, Lock	4E9	5310-01-508-3843
276	Deleted		
277	Washer, Lock	7E8	5310-01-508-3716
278	Deleted		
279	Washer, Lock	91042	5310-66-151-0977
280	Washer, Lock	91043	5310-66-150-7830
281	Washer, Lock	91044	5310-66-150-7804
282	Washer, Lock	91045	5310-66-151-0972
283	Washer, Lock	91047	5310-66-151-7018
283.1	Washer, Lock	92153A426	
284	Washer, Lock	BS1802-5-16TYPEB	5310-99-305-3389

TM 5-2420-230-24-1

(1) Index No.	(2) Nomenclature	(3) Part Number	(4) National Stock Number
284.1	Washer, Lock	J50-09	5310-00-209-0965
285	Washer, Lock	LT1004	5310-66-151-5911
286	Deleted		
286.1	Washer, Lock	LT1157	5310-66-151-1115
287	Washer, Lock	MS35338-7	5310-00-010-3320
288	Washer, Lock	MS35338-11	5310-00-010-3324
289	Washer, Lock	MS35333-76	5310-00-180-0277
289.1	Washer, Lock	MS35338-140	5310-00-974-6623
289.2	Washer, Lock	MS35338-46	5310-00-637-9541
290	Deleted		
290.1	Washer, Lock	RD-5-6971-0M	
290.2	Washer, Lock	SL242/5	5310-99-120-8698
291	Washer, Lock	SL242/6	5310-99-941-6658
292	Deleted		
292.1	Washer, Recessed	SL246/268	5310-99-139-4365
293	Deleted		
294	Washer, Set, Bellevil	247655	5310-01-508-3721

## APPENDIX E

### Torque Limits

#### E-1. SCOPE.

This section provides general torque limits for the screws, hoses, and fittings used on the IHMEE. Special torque limits are listed in the maintenance procedures for applicable components. The general torque limits given in this appendix shall be used when specific torque limits are not indicated in the maintenance procedure. These general torque limits cannot be applied to screws that retain rubber components. The rubber components will be damaged before the torque limit is reached. If a special torque limit is not given in the maintenance instructions, tighten the screw or nut until it touches the metal bracket, then tighten it one more turn.

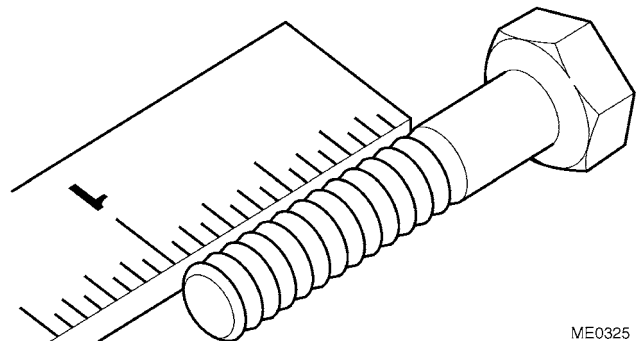
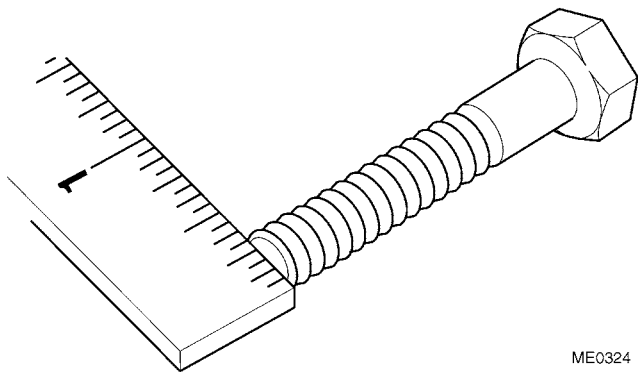
Para E-4. shows torque data provided by ADI for fasteners used on the IHMEE. These torque values must be used whenever applicable.

The material shown in Para E-5. is U.S. Army standard torque values. Ensure that you use the correct torque values for the type and size fastener being tightened.

#### E-2. TORQUE LIMITS.

The tables on the following pages in this appendix may list values for “wet” or “dry” fasteners. Dry torque limits are used on screws that do not have high-pressure lubricants applied to the threads. Wet torque limits are used on screws that have high-pressure lubricants applied to the threads. Torque values are also provided for several styles of hose connections.

#### E-3. HOW TO USE THE TORQUE TABLES.

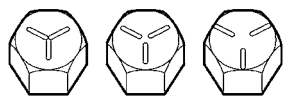
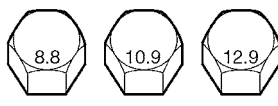


##### a. Screws and Nuts.

- (1) Measure the diameter of the screw you are installing (with a ruler).
- (2) Measure out 1 in. with the ruler and count the number of threads per inch.

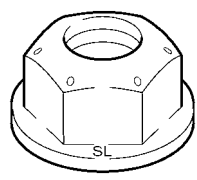
- (3) Under the heading **SIZE**, look down the left-hand column until you find the diameter of the screw you are installing (there will usually be two lines beginning with the same size).
- (4) In the second column under **SIZE**, find the number of threads per inch that matches the number of threads per inch you counted in Step (2)). (Not required for metric screws.)
- (5) To find the grade screw you are installing, match the markings on the head with the correct picture of **CAPSCREW HEAD MARKINGS** on the torque table.
- (6) Look down the column under the picture you found in Step (5) until you find the torque limit (lbf/ft or N·m) for the diameter and threads per inch of the screw you are installing.
- (7) Use wet torque values.

**CAPSCREW HEAD MARKINGS**

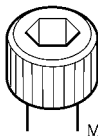
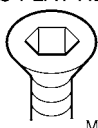
Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).	Metric screws are of four grades: 4.4, 8.8, 10.9, & 12.9. Manufacturer's marks & Grades appear on the screw head.
	
<b>STANDARD</b>	<b>METRIC</b>

ME0326

**Table E-1. Torque Limits for Wet Flange Nuts.**

SPIRALLOCK FLANGE NUT MARKINGS GRADE 8	DIAMETER		THREADS PER INCH	TORQUE	
	IN.	MM		LBF/FT	N·M
 <p>ME0327</p>	1/4	6.35	20	15	20
	5/16	7.94	18	25	34
	3/8	9.53	16	45	61
	1/2	12.70	13	110	149
	5/8	15.87	11	210	285
	3/4	19.05	10	375	508

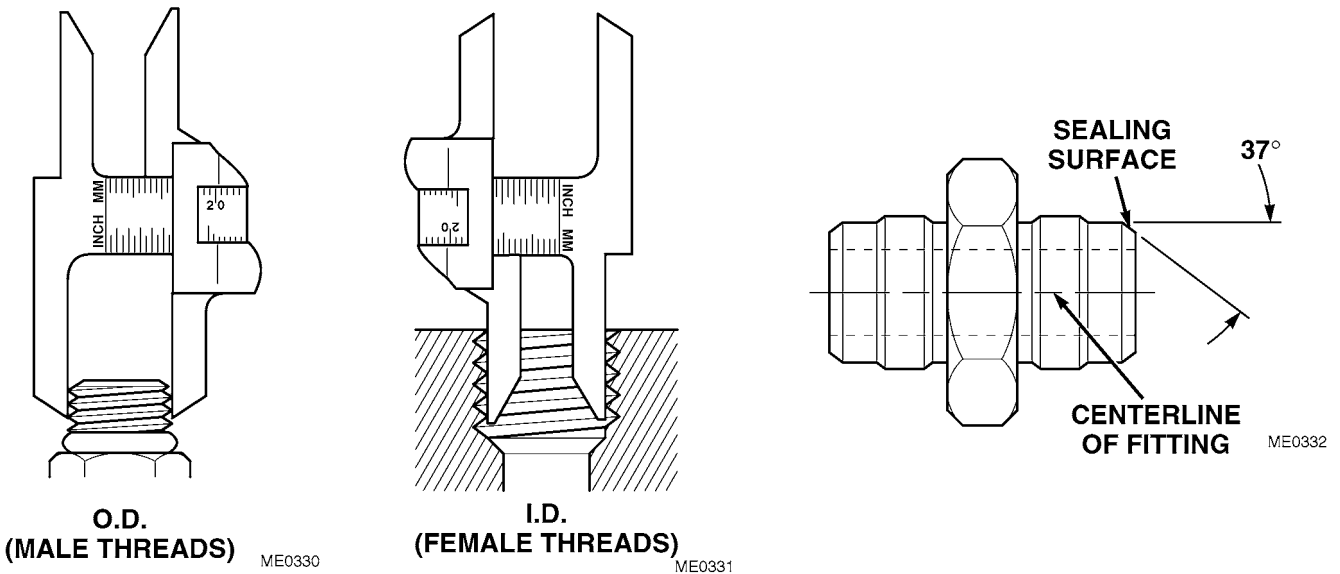
**Table E-1. Torque Limits for Wet Socket Head Capscrews.**

	TORQUE IN LBF/FT (CAPSCREWS) LUBED		
	SIZE	SOC HD OR 12 PT	SOC FLAT HD
SOC HEAD/12 PT.  <p>ME0328</p>	.10–24	55	2.5
	.25–20	12	6
	.31–18	25	12
	.38–16	44	22
	.50–13	70	36
SOC FLAT HEAD  <p>ME0329</p>	.56–12	106	53
	.62–11	212	106
	.75–10	375	187
	1.00–8	781	—

**b. Hoses and Fittings.**

**NOTE**

Most fluid piping system sizes are measured by dash numbers. These are universally used abbreviations for the size of the component expressed as the numerator of the fraction with the denominator always being 16. For example, a -04 port is 4/16 or ¼ inch. Dash numbers are usually nominal (in name only) and are abbreviations that make ordering of components easier.



- (1) Measure the I.D./O.D. diameter with a caliper as shown.
- (2) Under the headings MALE THREAD O.D. and FEMALE THREAD I.D., match the measurements with the row in table to determine proper torque.
- (3) To find the sealing surface angle, use a protractor and measure the sealing surface parallel to the centerline of the fitting.

**E-4. ADI-RECOMMENDED TORQUE TABLES.**

The torque values in this paragraph must be used whenever applicable. If the type or size fastener being used is not listed, refer to Para E-5. . When using the ADI torque specification, note the following:

- a. “The Recommended Assembly Torques” are for plain-finish, uncoated fasteners.
- b. The torque specifications in this paragraph only apply to bolt and nut applications.
- c. When a flexible gasket is used, multiply the value shown by 0.8 to find the correct torque.
- d. Capscrews must have the following thread engagement: 1.5 thread diameters in steel, 2.5 thread diameters in aluminium.

Table E-2. Torque Specification For Grade 4.4 Metric Fasteners

GRADE 4.4 BOLT SIZE (mm)	RECOMMENDED ASSEMBLY TORQUE		GALVANIZED				CADMIUM PLATED			
			DEGREASED		LIGHTLY OILED		DEGREASED		LIGHTLY OILED	
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M
5	1	2	3	4	1	2	1	2	1	1
6	3	4	5	7	3	4	3	4	1	2
8	7	9	13	18	7	9	7	9	4	6
10	13	17	27	36	14	19	13	17	9	12
12	22	30	46	63	24	33	22	30	15	21
16	54	73	113	153	59	80	54	73	38	51
20	105	143	221	300	116	157	105	143	74	100
24	183	248	384	521	201	273	183	248	128	174
30	362	491	760	1031	398	540	362	491	253	344
36	637	864	1338	1814	701	950	637	864	446	605
42	1016	1378	2135	2894	1118	1516	1016	1378	712	965
48	1522	2064	3197	4334	1674	2270	1522	2064	1066	1445
56	2462	3338	5170	7010	2708	3672	2462	3338	1724	2337
64	3710	5030	7791	10563	4081	5533	3710	5030	2597	3521
GRADE 4.4 BOLT SIZE (mm)	ZINC PLATED				PHOSPHATED		STANDARD FINISH			
	DEGREASED		LIGHTLY OILED		OILED		HEAVY GREASE			
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M		
5	1	1	1	2	1	1	1	1		
6	1	2	2	3	1	2	1	2		
8	4	6	6	8	4	6	4	6		
10	9	12	11	15	9	12	9	12		
12	15	21	20	27	15	21	15	21		
16	38	51	49	66	38	51	38	51		
20	74	100	95	129	74	100	74	100		
24	128	174	164	223	128	174	128	174		
30	253	344	326	442	253	344	253	344		
36	446	605	574	778	446	605	446	605		
42	712	965	915	1240	712	965	712	965		
48	1066	1445	1370	1858	1066	1445	1066	1445		
56	1724	2337	2216	3004	1724	2337	1724	2337		
64	2597	3521	3339	4527	2597	3521	2597	3521		



**Table E-3. Torque Specification For Grade 8.8 Metric Fasteners**

GRADE 8.8 BOLT SIZE (mm)	RECOMMENDED ASSEMBLY TORQUE		GALVANIZED				CADMIUM PLATED			
			DEGREASED		LIGHTLY OILED		DEGREASED		LIGHTLY OILED	
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M
5	4	5	8	11	4	6	4	5	3	4
6	7	9	14	19	7	10	7	9	4	6
8	16	22	34	46	18	24	16	22	11	15
10	32	44	68	92	35	48	32	44	23	31
12	57	77	119	162	63	85	57	77	40	54
14	89	120	186	252	97	132	89	120	62	84
16	140	190	294	399	154	209	140	190	98	133
20	274	372	576	781	302	409	274	372	192	260
24	472	640	991	1344	519	704	472	640	330	448
30	970	1314	2035	2759	1066	1445	970	1314	679	920
36	1694	2297	3558	4824	1864	2527	1694	2297	1186	1608
42	2708	3671	5686	7709	2978	4038	2708	3671	1896	2570
48	4057	5500	8519	11550	4462	6050	4057	5500	2840	3850
56	6542	8870	13739	18627	7196	9757	6542	8870	4580	6209
GRADE 8.8 BOLT SIZE (mm)	ZINC PLATED				PHOSPHATED		STANDARD FINISH			
	DEGREASED		LIGHTLY OILED		OILED		HEAVY GREASE			
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M		
5	3	4	4	5	3	4	3	4		
6	4	6	6	8	4	6	4	6		
8	11	15	15	20	11	15	11	15		
10	23	31	30	40	23	31	23	31		
12	40	54	51	69	40	54	40	54		
14	62	84	80	108	62	84	62	84		
16	98	133	126	171	98	133	98	133		
20	192	260	247	335	192	260	192	260		
24	330	448	424	576	330	448	330	448		
30	679	920	873	1183	679	920	679	920		
36	1186	1608	1525	2067	1186	1608	1186	1608		
42	1896	2570	2437	3304	1896	2570	1896	2570		
48	2840	3850	3651	4950	2840	3850	2840	3850		
56	4580	6209	5888	7983	4580	6209	4580	6209		

**Table E-4. Torque Specification For Grade 10.9 Metric Fasteners**

GRADE 10.9 BOLT SIZE (mm)	RECOMMENDED ASSEMBLY TORQUE		GALVANIZED				CADMIUM PLATED			
			DEGREASED		LIGHTLY OILED		DEGREASED		LIGHTLY OILED	
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M
5	6	8	13	17	7	9	6	8	4	6
6	10	13	20	27	10	14	10	13	7	9
8	24	32	49	67	26	35	24	32	16	22
10	46	63	97	132	51	69	46	63	32	44
12	80	109	169	229	89	120	80	109	56	76
16	199	270	418	567	219	297	199	270	140	189
20	389	528	818	1109	429	581	389	528	273	370
24	674	914	1415	1919	741	1005	674	914	472	640
30	1340	1817	2815	3816	1474	1999	1340	1817	938	1272
36	2340	3173	4914	6663	2574	3490	2340	3173	1638	2221
GRADE 10.9 BOLT SIZE (mm)	ZINC PLATED				PHOSPHATED		STANDARD FINISH			
	DEGREASED		LIGHTLY OILED		OILED		HEAVY GREASE			
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M		
5	4	6	5	7	4	6	4	6		
6	7	9	9	12	7	9	7	9		
8	16	22	21	29	16	22	16	22		
10	32	44	42	57	32	44	32	44		
12	56	76	72	98	56	76	56	76		
16	140	189	179	243	140	189	140	189		
20	273	370	350	475	273	370	273	370		
24	472	640	607	823	472	640	472	640		
30	938	1272	1206	1635	938	1272	938	1272		
36	1638	2221	2106	2856	1638	2221	1638	2221		

**Table E-5. Torque Specification For SAE Grade No. 5 Fasteners**

SAE GRADE NO. 5 (IN.)	RECOMMENDED ASSEMBLY TORQUE		GALVANIZED				CADMIUM PLATED			
			DEGREASED		LIGHTLY OILED		DEGREASED		LIGHTLY OILED	
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M
1/4 UNC	5	7	11	15	6	8	5	7	4	5
5/16 UNC	11	15	24	32	13	17	11	15	8	11
3/8 UNC	20	27	42	57	22	30	20	27	14	19
7/16 UNC	32	43	66	90	35	47	32	43	22	30
1/2 UNC	49	66	103	139	54	73	49	66	34	46
5/8 UNC	96	130	201	273	105	143	96	130	67	91
3/4 UNC	169	230	356	483	187	253	169	230	119	161
7/8 UNC	273	370	573	777	300	407	273	370	191	259
1 UNC	413	560	867	1176	454	616	413	560	289	392
SAE GRADE NO. 5 (IN.)	ZINC PLATED				PHOSPHATED		STANDARD FINISH			
	DEGREASED		LIGHTLY OILED		OILED		HEAVY GREASE			
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M		
1/4 UNC	4	5	4	6	4	5	4	5		
5/16 UNC	8	11	10	14	8	11	8	11		
3/8 UNC	14	19	18	24	14	19	14	19		
7/16 UNC	22	30	29	39	22	30	22	30		
1/2 UNC	34	46	44	59	34	46	34	46		
5/8 UNC	67	91	86	117	67	91	67	91		
3/4 UNC	119	161	153	207	119	161	119	161		
7/8 UNC	191	259	246	333	191	259	191	259		
1 UNC	289	392	372	504	289	392	289	392		

**Table E-6. Torque Specification For SAE Grade No. 8 Fasteners**

SAE GRADE NO. 8 (IN.)	RECOMMENDED ASSEMBLY TORQUE		GALVANIZED				CADMIUM PLATED			
			DEGREASED		LIGHTLY OILED		DEGREASED		LIGHTLY OILED	
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M
1/4 UNC	7	10	15	21	8	11	7	10	5	7
5/16 UNC	15	21	32	44	17	23	15	21	11	15
3/8 UNC	28	38	59	80	31	42	28	38	20	27
7/16 UNC	44	60	93	126	49	66	44	60	31	42
1/2 UNC	68	92	142	193	74	101	68	92	47	64
5/8 UNC	135	183	283	384	148	201	135	183	94	128
3/4 UNC	240	325	504	683	264	358	240	325	168	228
7/8 UNC	386	523	810	1098	424	575	386	523	270	366
1 UNC	579	785	1216	1649	637	864	579	785	406	550
SAE GRADE NO. 8 (IN.)	ZINC PLATED				PHOSPHATED		STANDARD FINISH			
	DEGREASED		LIGHTLY OILED		OILED		HEAVY GREASE			
	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M	LBF/FT	N·M		
1/4 UNC	5	7	7	9	5	7	5	7		
5/16 UNC	11	15	14	19	11	15	11	15		
3/8 UNC	20	27	25	34	20	27	20	27		
7/16 UNC	31	42	40	54	31	42	31	42		
1/2 UNC	47	64	61	83	47	64	47	64		
5/8 UNC	94	128	122	165	94	128	94	128		
3/4 UNC	168	228	216	293	168	228	168	228		
7/8 UNC	270	366	347	471	270	366	270	366		
1 UNC	406	550	521	707	406	550	406	550		

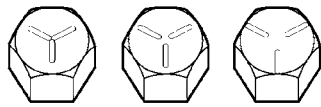
**E-5. U.S. ARMY STANDARD TORQUE TABLES.**

The U.S. Army standard torque values are shown below. Refer to Para E-4. before using the following information.

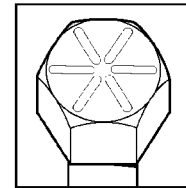
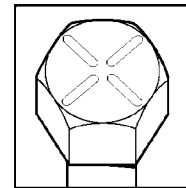
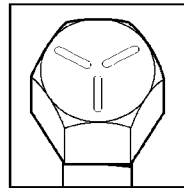
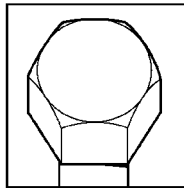
Table E-7. Torque Limits for Dry Standard Fasteners.

SIZE			TORQUE							
			SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 6 or 7		SAE GRADE NO. 8	
Dia. Inches	Threads Per Inch	Millimeters	LBF/FT	N-M	LBF/FT	N-M	LBF/FT	N-M	LBF/FT	N-M
1/4	20	6.35	5	7	8	11	12	14	12	16
1/4	28	6.35	6	9	10	14	12	16	14	19
5/16	18	7.94	11	15	17	23	21	28	25	34
5/16	24	7.49	12	16	19	26	24	33	25	34
3/8	16	9.53	20	27	30	41	40	54	45	61
3/8	24	9.53	23	34	35	47	45	61	50	68
7/16	14	11.11	30	41	50	68	60	81	70	95
7/16	20	—	35	47	55	75	70	95	80	108
1/2	13	12.70	50	68	75	102	95	129	110	149
1/2	20	—	55	75	90	122	100	136	120	163
9/16	12	14.95	65	88	110	149	135	183	150	203
9/16	12	—	75	102	120	163	150	2-3	170	231
5/8	11	15.88	90	122	150	203	190	258	220	298
5/8	18	—	100	136	180	244	210	285	240	325
3/4	10	19.05	160	217	260	353	320	434	380	515
3/4	10	—	180	244	300	407	360	488	420	570
7/8	9	22.23	140	190	400	542	520	7-5	600	814
7/8	14	—	155	210	440	597	580	786	660	895
1	8	25.40	220	298	580	786	800	1085	900	1220
1	12	—	240	325	640	868	860	1166	1000	1356
1-1/8	7	25.58	300	407	800	1085	1120	1519	1280	1736
1-1/8	12	—	340	461	880	1193	1260	1709	1440	1953
1-1/4	7	31.75	420	570	1120	1519	1580	2142	1820	2468
1-1/4	12	—	460	624	1240	1681	1760	2387	2000	2712
1-3/8	6	34.98	560	759	1460	1980	2080	2080	2380	3227
1-3/8	12	—	640	868	1680	2278	2380	3227	2720	3688
1-1/2	6	38.10	740	1003	1940	2631	2780	3770	3160	4285
1-1/2	12	—	840	1139	2200	2983	3100	4204	3560	4827

**CAPSCREW HEAD MARKINGS**



Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).

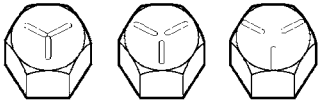


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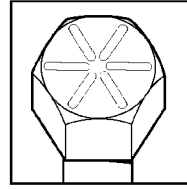
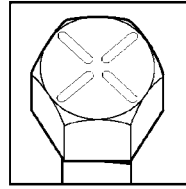
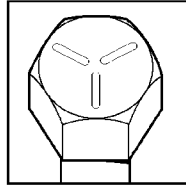
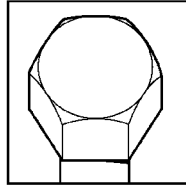
Table E-8. Torque Limits for Wet Standard Fasteners.

SIZE			TORQUE							
			SAE GRADE NO. 2		SAE GRADE NO. 5		SAE GRADE NO. 6 or 7		SAE GRADE NO. 8	
Dia. Inches	Threads Per Inch	Millimeters	LBF/FT	N-M	LBF/FT	N-M	LBF/FT	N-M	LBF/FT	N-M
1/4	20	6.35	4	6	6	8	8	11	9	12
1/4	28	6.35	5	7	7	9	9	12	10	14
5/16	18	7.94	8	11	13	18	16	22	18	24
5/16	24	7.49	9	12	14	19	18	24	20	27
3/8	16	9.53	15	20	23	31	30	41	35	47
3/8	24	9.53	17	23	25	34	30	41	35	47
7/16	14	11.11	24	33	35	47	45	61	55	75
7/16	20	—	25	34	40	54	50	68	60	81
1/2	13	12.70	35	47	55	75	70	95	80	108
1/2	20	—	40	54	65	88	80	108	90	122
9/16	12	14.95	50	68	80	108	100	136	110	149
9/16	12	—	55	75	90	122	110	149	130	176
5/8	11	15.88	70	95	110	149	140	190	170	231
5/8	18	—	80	108	130	176	160	218	180	244
3/4	10	19.05	120	163	200	271	240	325	280	380
3/4	10	—	140	190	220	198	280	380	320	434
7/8	9	22.23	110	149	300	407	400	542	460	624
7/8	14	—	120	163	320	434	440	597	500	678
1	8	25.40	160	217	440	597	600	814	680	922
1	12	—	170	231	480	651	660	895	740	1003
1-1/8	7	25.58	220	298	600	814	840	1139	960	1320
1-1/8	12	—	260	353	660	895	940	1275	1080	1464
1-1/4	7	31.75	320	434	840	1139	1100	1492	1360	1844
1-1/4	12	—	360	488	920	1248	1320	1709	1500	2034
1-3/8	6	34.98	420	570	1100	1560	2115	1780	2414	3227
1-3/8	12	—	460	524	1260	1709	1780	2414	2040	2776
1-1/2	6	38.10	560	760	1460	1980	2080	2820	2360	3200
1-1/2	12	—	620	841	1640	2224	2320	3146	2660	3607

CAPSCREW HEAD MARKINGS

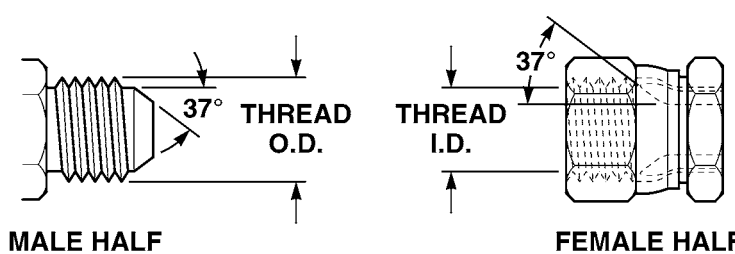


Manufacturer's marks may vary. These are all SAE Grade 5 (3-line).



ME0334

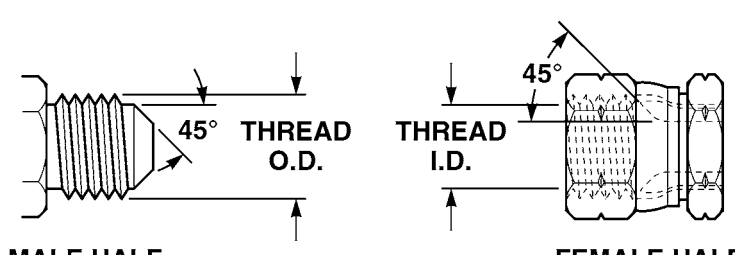
**Table E-9. Torque Limits for 37-Degree Flare Hose Connections.**



The diagram illustrates the male and female halves of a 37-degree flare hose connection. The male half on the left has a 37-degree flare and is labeled 'MALE HALF' and '37° THREAD O.D.'. The female half on the right has a 37-degree flare and is labeled 'FEMALE HALF' and '37° THREAD I.D.'. A reference code 'ME0335' is located to the right of the female half diagram.

INCH SIZE	DASH NO.	THREAD SIZE	TORQUE LBF/FT	TORQUE N·M
1/4	04	7/16-20	11-12	15-16
3/8	06	9/16-18	18-21	24-28
1/2	08	3/4-16	26-39	49-53
5/8	10	7/8-14	57-62	77-84
3/4	12	1-1/16-12	79-87	107-118
7/8	14	1-3/16-12	83-91	113-123
1	16	1-5/16-12	108-113	146-153
1-1/4	20	1-5/8-12	127-133	172-180
1-1/2	24	1-7/8-12	158-167	214-224
2	32	2-1/2-12	245-258	332-350

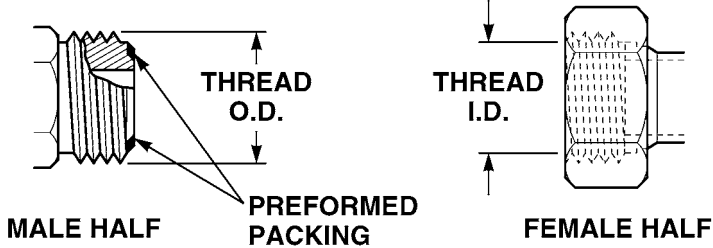
**Table E-10. Torque Limits for 45-Degree Flare Hose Connections.**



The diagram illustrates the male and female halves of a 45-degree flare hose connection. The male half on the left has a 45-degree flare and is labeled 'MALE HALF' and '45° THREAD O.D.'. The female half on the right has a 45-degree flare and is labeled 'FEMALE HALF' and '45° THREAD I.D.'. A reference code 'ME0336' is located to the right of the female half diagram.

INCH SIZE	DASH NO.	THREAD SIZE	TORQUE LBF/FT	TORQUE N·M
1/4	04	7/16-20	8-9	11-12
3/8	06	5/8-18	18-20	24-27
1/2	08	3/4-16	36-38	49-51
5/8	10	7/8-14	52-54	70-73
3/4	12	1-1/16-14	71-74	97-100

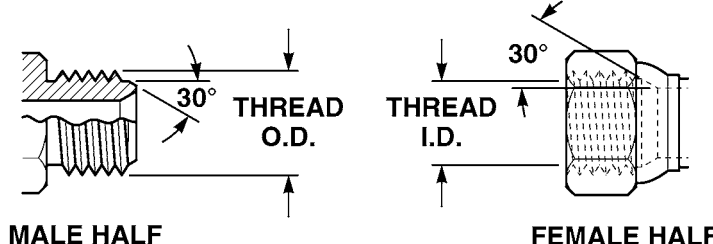
**Table E-11. Torque Limits for ORS Preformed Packing Face Seal Hose Connections.**



The diagram illustrates the components of an ORS Preformed Packing Face Seal Hose Connection. On the left is the 'MALE HALF' with 'PREFORMED PACKING' and 'THREAD O.D.' (Thread Outer Diameter) indicated. On the right is the 'FEMALE HALF' with 'THREAD I.D.' (Thread Inner Diameter) indicated. The diagram is labeled ME0337.

INCH SIZE	DASH NO.	THREAD SIZE	TORQUE LBF/FT	TORQUE N·M
1/4	04	9/16-18	10-12	14-16
3/8	06	11/16-16	18-20	24-27
1/2	08	13/16-16	32-35	43-47
5/8	10	1-14	46-50	62-68
3/4	12	1-3/16-12	65-70	88-95
1	16	1-7/16-12	108-113	146-153
1-1/4	20	1-11/16-12	127-133	172-180
1-1/2	24	2-12	158-167	214-226

**Table E-12. Torque Limits for NPSM Swivel Connections.**



The diagram illustrates the components of an NPSM Swivel Connection. On the left is the 'MALE HALF' with 'THREAD O.D.' (Thread Outer Diameter) and a 30-degree angle indicated. On the right is the 'FEMALE HALF' with 'THREAD I.D.' (Thread Inner Diameter) and a 30-degree angle indicated. The diagram is labeled ME0338.

INCH SIZE	DASH NO.	THREAD SIZE	TORQUE LBF/FT	TORQUE N·M
1/8	02	1/8-27	3-4	4-5
1/4	04	1/4-18	10-11	14-15
3/8	06	3/8-18	16-18	22-24
1/2	08	1/2-14	25-27	34-37
3/4	12	3/4-14	46-48	62-65
1	16	1-1 1/2	80-83	108-113
1-1/4	20	1-1/4-11/2	130-134	176-182
1-1/2	24	1-1/2-11/2	160-164	217-222
2	32	2-11/2	170-174	231-240



# APPENDIX F

## TRANSMISSION SERVICE MANUAL

<b>Contents</b>	<b>Para</b>	<b>Page</b>
Scope.....	F-1	F-1
General.....	F-2	F-1
HR32000 Transmission Repair.....	F-3	F-2
Installation of Non-Metallic Seal Rings.....	F-4	F-4
1st Speed Clutch (Low) Repair.....	F-5	F-5
Reverse and 3rd Clutch Repair.....	F-6	F-6
Forward and 2nd Clutch Repair.....	F-7	F-8
Oil Seal Ring Sleeve Replacement.....	F-8	F-10
Impeller and Baffle Repair.....	F-9	F-12
Turbine and Impeller Cover Repair.....	F-10	F-14
8-Speed Output Repair.....	F-11	F-16
4th Speed Clutch Repair.....	F-12	F-18
Servicing Machine After Transmission Overhaul.....	F-13	F-20
Drive Plate Installation.....	F-14	F-21

### Section I. U.S. Army Supplement to Dana Spicer Clark-Hurth Material.

**F-1. SCOPE.**

This appendix contains information for servicing the transmission. Section I contains U.S. Army supplemental information to the vendor manual. The supplemental information includes initial setup task boxes for all maintenance tasks covered in the vendor manual that apply to the IHMEE. The supplemental information also includes individual task headings and page references to aid in locating the tasks in the vendor manual.

Section II contains the manufacturer’s technical manual. This manual is unedited and covers multiple models of Dana Spicer Clark-Hurth transmissions. This manual also contains parts information for Dana Spicer Clark-Hurth transmissions. Refer to Para F-2 for details on how to use this material.

**F-2. GENERAL.**

To perform a task covered in this appendix, refer to the task box for initial setup information as you would with a normal maintenance procedure. The individual task headings have page references to aid in locating the tasks in the vendor manual. Most pages will also include two different page numbers. The appendix page number will have the appendix letter and a page number like the one at the bottom of this page. This page number will be used in all references made in Section I. The other page number is the vendor material page numbering. It will be used for any references made within the vendor material.

The IHMEE uses the Dana Spicer Clark-Hurth 12.5 LHR 32821-3 transmission with a remote-mounted shift valve, remote-mounted filter, and no brake drum. All information in Section II that does not pertain to the HR 32000 series transmissions and all parts information should be ignored. Refer to TM 5-2420-230-24P for parts information.

**F-3. HR32000 TRANSMISSION REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Solvent, degreasing, Item 58, Appendix C
- Bearing, Item 3, Appendix D
- Bearing, ball, annula, Item 11.1, Appendix D
- Bearing, ball, Item 38, Appendix D
- Bearing, impeller, Item 16, Appendix D
- Bearing, pump drive, Item 17, Appendix D (3)
- Bearing, roller, Item 18, Appendix D
- Bearing, roller, Item 19, Appendix D (2)
- Bearing, roller, tape, Item 23, Appendix D
- Bushing, sleeve, Item 34, Appendix D (2)
- Clip, Item 38, Appendix D (2)
- Cup, bearing, Item 21, Appendix D
- Disk, clutch, Item 40, Appendix D (9)
- Disk, clutch, outer, Item 46, Appendix D (9)
- Gasket, Item 53, Appendix D
- Gasket, Item 54, Appendix D
- Gasket, Item 55, Appendix D
- Gasket, Item 85, Appendix D
- Gasket, Item 86, Appendix D
- Gasket, Item 87.2, Appendix D
- Nut, self-locking, Item 98.1, Appendix D (2)
- Nut, self-locking, Item 99, Appendix D
- Nut, self-locking, Item 111, Appendix D (12)
- O-ring, Item 129, Appendix D
- O-ring, Item 130, Appendix D (2)
- O-ring, Item 141, Appendix D
- O-ring, Item 147, Appendix D
- O-ring, Item 148, Appendix D
- O-ring, Item 148.1, Appendix D
- O-ring, Item 149, Appendix D
- O-ring, Item 150.2, Appendix D
- O-ring, Item 150.3, Appendix D (2)
- O-ring, Item 150.5, Appendix D
- O-ring, Item 150.6, Appendix D (2)
- Packing, preformed, Item 150.4, Appendix D
- Packing, preformed, Item 158, Appendix D
- Packing, preformed, Item 159, Appendix D
- Packing, preformed, Item 160, Appendix D
- Piston ring, turbine, Item 175, Appendix D

*Materials/Parts (Cont.)*

- Retainer, helical, Item 181.1, Appendix D
- Retainer, packing, Item 182.1, Appendix D
- Retainer, packing, Item 182.2, Appendix D
- Retainer, packing, Item 183, Appendix D
- Ring, piston, Item 188, Appendix D
- Ring, piston, Item 189, Appendix D
- Ring, piston, Item 189.1, Appendix D
- Ring, piston, Item 191, Appendix D
- Ring, retainer, Item 192, Appendix D
- Ring, retainer, Item 205, Appendix D
- Ring, retaining, Item 193, Appendix D
- Ring, retaining, Item 198, Appendix D
- Ring, retaining, Item 196, Appendix D
- Ring, retaining, Item 197, Appendix D (2)
- Ring, retaining, Item 197.1, Appendix D
- Ring, retaining, Item 198, Appendix D
- Ring, retaining, Item 200, Appendix D
- Ring, retaining, Item 202.1, Appendix D
- Ring, retaining, Item 204.1, Appendix D
- Ring, retaining, Item 206, Appendix D
- Ring, retaining, Item 211.1, Appendix D
- Ring, special, Item 214.1, Appendix D (3)
- Ring, special, Item 217, Appendix D
- Rivet, blind, Item 219, Appendix D (5)
- Seal assy, transmission, Item 235, Appendix D
- Seal ring, metal, Item 236, Appendix D
- Seal ring, metal, Item 237, Appendix D (4)
- Seal, plain encased, Item 248, Appendix D
- Spacer, Item 259.1, Appendix D
- Spacer, Item 263, Appendix D
- Spacer, gear, Item 260, Appendix D
- Spacer, plate, Item 261, Appendix D
- Strainer, element, Item 267, Appendix D
- Washer, lock, Item 272, Appendix D (7)
- Washer, lock, Item 273, Appendix D (35)
- Washer, lock, Item 274, Appendix D (24)
- Washer, lock, Item 275, Appendix D (4)
- Washer, lock, Item 277, Appendix D (6)
- Washer, lock, Item 281, Appendix D (16)
- Washer, lock, Item 284.1, Appendix D (23)
- Washer, lock, Item 286.1, Appendix D (8)
- Washer, lock, Item 289, Appendix D (5)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

**F-3. HR32000 TRANSMISSION REPAIR. (CONT).**

**INITIAL SETUP (Cont)**

*References*

None

*Drawings Required (Cont.)*

TM 5-2420-230-24P Figure 77  
 TM 5-2420-230-24P Figure 78  
 TM 5-2420-230-24P Figure 79  
 TM 5-2420-230-24P Figure 80  
 TM 5-2420-230-24P Figure 81  
 TM 5-2420-230-24P Figure 84  
 TM 5-2420-230-24P Figure 86  
 TM 5-2420-230-24P Figure 88

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-9	Transmission components removed.
Para 4-10	Transmission separated.

*Drawings Required*

TM 5-2420-230-24P Figure 75  
 TM 5-2420-230-24P Figure 76

*Estimated Time to Complete Task*  
 Refer to MAC in Appendix B

**a. Disassembly.**

**WARNING**

- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.
- Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

Refer to page F-46 for disassembly.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**



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

Refer to page F-83 for assembly.

**d. Follow-On Maintenance.**

- (1) Install transmission components (Para 4-9).
- (2) Connect engine and transmission (Para 4-10).

**END OF TASK**

<b>F-4. INSTALLATION OF NON-METALLIC SEAL RINGS.</b>		
This Task Covers:		
a. Installation		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	Para 4-10	Engine and transmission separated.
<i>Tools and Special Tools</i>	<i>Drawings Required</i>	
Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-24P	Figure 81
<i>Materials/Parts</i>	<i>Estimated Time to Complete Task</i>	
Grease, automotive and artillery, Item 30, Appendix C	Part of Transmission Repair in MAC, Appendix B	
Washer, lock, Item 286.1, Appendix D (8)		
<i>Personnel Required</i>		
MOS 62B, Construction Equipment Repairer		
<i>References</i>		
None		

**a. Installation.**

Refer to page F-124 for installation.

**END OF TASK**

**F-5. 1ST SPEED CLUTCH (LOW) REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Bearing, roller, Item 19, Appendix D  
Bearing, roller, cyli, Item 21, Appendix D  
Disk, clutch, Item 40, Appendix D (9)  
Disk, clutch, outer, Item 46, Appendix D (9)  
O-ring, Item 150.2, Appendix D  
O-ring, Item 150.4, Appendix D  
Packing, preformed, Item 150.4, Appendix D  
Packing, preformed, Item 158, Appendix D  
Retainer, helical, Item 181.1, Appendix D  
Ring, piston, Item 189, Appendix D  
Ring, piston, Item 191, Appendix D  
Ring, retaining, Item 193, Appendix D (2)  
Ring, retaining, Item 197, Appendix D  
Ring, retaining, Item 198, Appendix D  
Ring, retaining, Item 217, Appendix D

*Materials/Parts (Cont.)*  
Shim (0.004), Item 255.1, Appendix D  
Shim (0.007), Item 225.2, Appendix D  
Shim (0.010), Item 225.3, Appendix D  
Shim (0.020), Item 225.4, Appendix D  
Solvent, degreasing, Item 58, Appendix C  
Washer, lock, Item 289, Appendix D (5)

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

<i>Equipment Conditions</i>	
<i>TM or Para</i>	<i>Condition Description</i>
Para F-3	Transmission disassembled.

*Drawings Required*  
TM 5-2420-230-24P Figure 84  
TM 5-2420-230-24P Figure 86

*Estimated Time to Complete Task*  
Part of Transmission Repair in MAC, Appendix B

**a. Disassembly.**

**WARNING**

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

Refer to page F-58 for disassembly.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**



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

Refer to page F-60 for assembly.

**d. Follow-On Maintenance.**

Assemble transmission (Para F-3).

**END OF TASK**

<b>F-6. REVERSE AND 3RD CLUTCH REPAIR.</b>					
This Task Covers:					
a. Disassembly	b. Cleaning/Inspection				
d. Follow-On Maintenance	c. Assembly				
<b>INITIAL SETUP</b>					
<i>Test Equipment</i> None	<i>Materials/Parts (Cont.)</i> Ring, retaining, Item 202, Appendix D (2) Ring, retaining, Item 210, Appendix D (2) Ring, special, Item 214, Appendix D (2) Ring, special, Item 217, Appendix D (2) Solvent, degreasing, Item 58, Appendix C Spacer, Item 258, Appendix D Spacer, sleeve, Item 262, Appendix D Spring, Item 264, Appendix D Washer, set, bellevil, Item 294, Appendix D				
<i>Tools and Special Tools</i> Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer				
<i>Materials/Parts</i> Bearing, ball, annula, Item 7, Appendix D Bearing, ball, annula, Item 12, Appendix D Bearing, ball, annula, Item 13, Appendix D Bearing, ball, annula, Item 15, Appendix D Bearing, ball, annula, Item 15.1, Appendix D Bearing, sleeve, Item 26.1, Appendix D Disk, clutch, Item 43, Appendix D (13) Disk, clutch, outer, Item 46, Appendix D (13) Packing, preformed, Item 158, Appendix D (2) Plate, clutch, Item 176, Appendix D Plate, clutch, revers, Item 177, Appendix D Retainer, spring, Item 184, Appendix D Retainer, spring, Item 185, Appendix D Ring, piston, Item 187, Appendix D (3) Ring, piston, Item 189, Appendix D (2) Ring, retaining, Item 193, Appendix D (2) Ring, retaining, Item 195, Appendix D (2) Ring, retaining, Item 199, Appendix D	<i>References</i> None  <i>Equipment Conditions</i> <table border="0"> <tr> <td><i>TM or Para</i></td> <td><i>Condition Description</i></td> </tr> <tr> <td>Para F-3</td> <td>Transmission disassembled.</td> </tr> </table>  <i>Drawings Required</i> TM 5-2420-230-24P Figure 82  <i>Estimated Time to Complete Task</i> Part of Transmission Repair in MAC, Appendix B	<i>TM or Para</i>	<i>Condition Description</i>	Para F-3	Transmission disassembled.
<i>TM or Para</i>	<i>Condition Description</i>				
Para F-3	Transmission disassembled.				

**a. Disassembly.**

**WARNING**

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

Refer to page F-63 for disassembly.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**

**WARNING**

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

Refer to page F-68 for assembly.

**d. Follow-On Maintenance.**

Assemble transmission (Para F-3).

**END OF TASK**

**F-7. FORWARD AND 2ND CLUTCH REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Bearing, ball, annula, Item 11, Appendix D
- Bearing, ball, annula, Item 13, Appendix D
- Bearing, ball, annula, Item 15.1, Appendix D
- Disk, clutch, Item 43, Appendix D (13)
- Disk, clutch, outer, Item 46, Appendix D (13)
- Packing, preformed, Item 158, Appendix D (2)
- Plate, clutch, Item 176, Appendix D
- Plate, clutch, reverse, Item 177, Appendix D
- Retainer, spring, Item 184, Appendix D
- Retainer, spring, Item 185, Appendix D
- Ring, piston, Item 187, Appendix D (3)
- Ring, piston, Item 189, Appendix D (2)
- Ring, retaining, Item 193, Appendix D (2)
- Ring, retaining, Item 204, Appendix D (2)
- Ring, retaining, Item 209, Appendix D
- Ring, retaining, Item 210, Appendix D (2)

*Materials/Parts (Cont.)*

- Ring, retaining, Item 213.1, Appendix D (3)
- Ring, special, Item 214, Appendix D (2)
- Ring, special, Item 215, Appendix D
- Ring, special, Item 217, Appendix D (2)
- Solvent, degreasing, Item 58, Appendix C
- Spacer, sleeve, Item 262, Appendix D (2)
- Spring, Item 264, Appendix D
- Washer, set, bellevil, Item 294, Appendix D

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para F-3	Transmission disassembled.

*Drawings Required*

TM 5-2420-230-24P Figure 83

*Estimated Time to Complete Task*

Part of Transmission Repair in MAC, Appendix B

**a. Disassembly.**

**WARNING**

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

Refer to page F-73 for disassembly.



**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**

**WARNING**

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

Refer to page F-77 for assembly.

**d. Follow-On Maintenance.**

Assemble transmission (Para F-3).

**END OF TASK**

**F-8. OIL SEAL RING SLEEVE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Cleaning/Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para F-3      Transmission disassembled.

*Materials/Parts*  
Bushing, sleeve, Item 34, Appendix D  
Solvent, degreasing, Item 58, Appendix C  
Washer, lock, Item 272, Appendix D

*Drawings Required*  
TM 5-2420-230-24P    Figure 76

*Estimated Time to Complete Task*  
Part of Transmission Repair in MAC, Appendix B

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

**a. Removal.**

**WARNING**

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

Refer to page F-82 for removal.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

***c. Installation.***

**WARNING**

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

Refer to page F-82 for installation.

***d. Follow-On Maintenance.***

Assemble transmission (Para F-3).

**END OF TASK**

**F-9. IMPELLER AND BAFFLE REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*References*

None

*Materials/Parts*

- Bearing, impeller, Item 16, Appendix D
- O-ring, Item 149, Appendix D
- Ring, retaining, Item 192, Appendix D
- Ring, retaining, Item 205, Appendix D
- Screw, special, Item 226.1, Appendix D (8)
- Spacer, special, Item 263, Appendix D
- Solvent, degreasing, Item 58, Appendix C

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 4-10	Engine and transmission separated.

*Drawings Required*

TM 5-2420-230-24P Figure 79

*Estimated Time to Complete Task*

Part of Transmission Repair in MAC, Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

**a. Disassembly.**

**WARNING**

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

Refer to page F-92 for disassembly.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**

**WARNING**

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

Refer to page F-93 for assembly.

**d. Follow-On Maintenance.**

Connect engine and transmission (Para 4-10).

**END OF TASK**

**F-10. TURBINE AND IMPELLER COVER REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

*TM or Para*

*Condition Description*

Para 4-10

Engine and transmission separated.

*Materials/Parts*

Bearing, impeller, Item 16, Appendix D

O-ring, Item 149, Appendix D

Ring, retaining, Item 192, Appendix D

Ring, retaining, Item 205, Appendix D

Solvent, degreasing, Item 58, Appendix C

Spacer, special, Item 263, Appendix D

*Drawings Required*

TM 5-2420-230-24P Figure 79

*Estimated Time to Complete Task*

Part of Transmission Repair in MAC, Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

**a. Disassembly.**

**WARNING**

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

Refer to page F-95 for disassembly.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**

**WARNING**

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

Refer to page F-96 for assembly.

**d. Follow-On Maintenance.**

Connect engine and transmission (Para 4-10).

**END OF TASK**

**F-11. 8-SPEED OUTPUT REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Bearing, ball, Item 6, Appendix D
- Bearing, ball, annula, Item 10, Appendix D
- Bearing, sleeve, Item 24.1, Appendix D
- Bushing, sleeve, Item 33.7, Appendix D
- O-ring, Item 142, Appendix D
- O-ring, Item 143, Appendix D
- O-ring, Item 152, Appendix D
- Ring, bearing, inner, Item 186, Appendix D (2)
- Ring, retaining, Item 194, Appendix D
- Seal, Item 230, Appendix D
- Seal, oil, Item 243, Appendix D
- Seal, plain encased, Item 247, Appendix D
- Shim, 0.004 in., Item 251, Appendix D
- Shim, 0.007 in., Item 252, Appendix D

*Materials/Parts (Cont.)*

- Shim, 0.010 in., Item 253, Appendix D
- Shim, 0.020 in., Item 254, Appendix D
- Solvent, degreasing, Item 58, Appendix C
- Spring, helical, comp, Item 265, Appendix D
- Washer, lock, Item 288, Appendix D (8)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para F-3	Transmission disassembled.

*Drawings Required*

TM 5-2420-230-24P	Figure 87
TM 5-2420-230-24P	Figure 91

*Estimated Time to Complete Task*

Part of Transmission Repair in MAC, Appendix B

**a. Disassembly.**

**WARNING**

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

Refer to page F-130 for disassembly.



**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**

**WARNING**

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

Refer to page F-131 for assembly.

**d. Follow-On Maintenance.**

Assemble transmission (Para F-3).

**END OF TASK**

**F-12. 4TH SPEED CLUTCH REPAIR.**

This Task Covers:

- a. Disassembly
- b. Cleaning/Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Bearing, ball, annula, Item 12, Appendix D
- Bearing, ball, annula, Item 14, Appendix D
- Disk, clutch, Item 42, Appendix D (8)
- Disk, clutch, Item 44, Appendix D
- Disk, clutch, Item 45, Appendix D (8)
- Packing, Preformed Item 161, Appendix D
- Packing, Preformed Item 162, Appendix D
- Retainer, helical, Item 182, Appendix D
- Ring, piston, Item 190, Appendix D (2)
- Ring, retaining, Item 210, Appendix D
- Ring, retaining, Item 213, Appendix D
- Ring, retaining, Item 213.2, Appendix D

*Materials/Parts (Cont.)*

- Ring, special, Item 215, Appendix D (2)
- Solvent, degreasing, Item 58, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para F-3	Transmission disassembled.

*Drawings Required*

TM 5-2420-230-24P	Figure 82
TM 5-2420-230-24P	Figure 83
TM 5-2420-230-24P	Figure 85

*Estimated Time to Complete Task*

Part of Transmission Repair in MAC, Appendix B

**a. Disassembly.**

**WARNING**

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

Refer to page F-138 for disassembly.

**b. Cleaning/Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page F-111 for cleaning/inspection.

**c. Assembly.**

**WARNING**

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

Refer to page F-141 for assembly.

**d. Follow-On Maintenance.**

Assemble transmission (Para F-3).

**END OF TASK**

**F-13. SERVICING MACHINE AFTER TRANSMISSION OVERHAUL.**

This Task Covers:

- a. Servicing
- b. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p>	<p><i>References</i> None</p>								
<p><i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B</p>	<p><i>Equipment Conditions</i></p> <table border="0"> <tr> <td style="padding-right: 20px;"><i>TM or Para</i></td> <td><i>Condition Description</i></td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Vehicle positioned on level ground.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Engine ON, as required.</td> </tr> <tr> <td>TM 5-2420-230-10</td> <td>Hood raised, as required.</td> </tr> </table>	<i>TM or Para</i>	<i>Condition Description</i>	TM 5-2420-230-10	Vehicle positioned on level ground.	TM 5-2420-230-10	Engine ON, as required.	TM 5-2420-230-10	Hood raised, as required.
<i>TM or Para</i>	<i>Condition Description</i>								
TM 5-2420-230-10	Vehicle positioned on level ground.								
TM 5-2420-230-10	Engine ON, as required.								
TM 5-2420-230-10	Hood raised, as required.								
<p><i>Materials/Parts</i> Oil, lubricating OE/HDO-10, Item 44, Appendix C</p>	<p><i>Drawings Required</i> None</p>								
<p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p>	<p><i>Estimated Time to Complete Task</i> Part of Transmission Repair in MAC, Appendix B</p>								

**a. Servicing.**

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

Refer to page F-101 for servicing.

**b. Follow-On Maintenance**

- (1) Shut OFF engine (TM 5-2420-230-10).
- (2) Lower hood (TM 5-2420-230-10).

**END OF TASK**

**F-14. DRIVE PLATE INSTALLATION.**

This Task Covers:

- a. Installation

**INITIAL SETUP**

*Test Equipment*

None

*Equipment Conditions*

*TM or Para*

*Condition Description*

Para 4-10

Engine and transmission separated.

*Tools and Special Tools*

Tool kit, general mechanics, Item 38, Appendix B

*Drawings Required*

TM 5-2420-230-24P Figure 81

*Materials/Parts*

Washer, lock, Item 286.1, Appendix D (8)

*Estimated Time to Complete Task*

Part of Transmission Repair in MAC, Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

**a. Installation.**

Refer to page F-144 for installation.

**END OF TASK**

## **Section II. Vendor Service Manual.**

This section contains information for servicing the transmission in the form of the manufacturer's technical manual which follows this page. Section I contains U.S. Army supplemental information to the vendor manuals.

# Maintenance/Service Manual Model 32000

R & HR Model / 3, 6 & 8 Speed  
Long Drop  
(with Range Shift)



**SPICER OFF-HIGHWAY COMPONENTS**



## FOREWORD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the DANA Spicer Off-Highway product.

Extreme care has been exercised in the design, selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, its principle of operation, trouble shooting and adjustments, it is urged that the mechanic studies the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only Dana Spicer - approved parts as listed in the applicable parts manual should be used. Use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment, Dana Spicer Off-Highway does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by Dana Spicer Off-Highway

**IMPORTANT: Always furnish the Distributor with the serial and model number when ordering parts.**



**TABLE OF CONTENTS**

**HOW THE UNITS OPERATE**

**SECTIONAL VIEWS AND PARTS IDENTIFICATION**

Basic Design Silhouette ..... Fig.A

Converter Group..... Fig.B

Converter and Transmission Case Group ..... Fig. C

Reverse and 3rd and Forward and 2nd Clutch Group ..... Fig. D

Low (1stClutch) and Output Group ..... Fig.E

Regulating Valve, Charging Pump and Filter Group.....Fig. F

Control Valve Assembly ..... Fig. G

Axle Disconnect and Mechanical Parking Brake ..... Fig. H

Assembly Instruction Illustration .....Fig. I

HR320003 Speed Typical Cross Section .....Fig. J

DISASSEMBLY OF TRANSMISSION ..... 1

REASSEMBLY OF TRANSMISSION ..... 38

SERVICING MACHINE AFTER TRANSMISSION OVERHAUL ..... 56

SPECIFICATIONS AND SERVICE DATA..... 57

LUBRICATION ..... 57

TROUBLE SHOOTING GUIDE..... 58

16 SCREW RING GEAR INSTALLATION ..... 60-61

TYPICAL THREE SPEED POWER FLOW..... 62-63

HR EXTERNAL PLUMBING DIAGRAM..... 65

CLEANING AND INSPECTION ..... 66

SPEED SENSOR BUSHING INSTALLATION ..... 67

32 SCREW RING GEAR INSTALLATION ..... 68-69

R-MODEL SECTION..... 70

6 SPEED SECTION ..... 80

DRIVEPLATE INSTALLATION ..... 90

NOTE: Metric Dimensions Shown in Brackets [ ],

## TRANSMISSION ASSEMBLY

The transmission and hydraulic torque portion of the power train enacts an important role in transmitting engine power to the driving wheels. In order to properly maintain and service these units it is important to first understand their function and how they operate.

The transmission and torque converter function together and operate through a common hydraulic system. It is necessary to consider both units in the study of their function and operation.

To supplement the text below and for reference use therewith, the following illustrations are provided:

- Basic Design Silhouette
- Converter Group
- Converter and Transmission Case Group
- Reverse and 3rd, Forward and 2nd Clutch Group
- Low (1st) Clutch and Output Group
- Regulating Valve, Charging Pump and Filter Group
- Control Valve Assembly
- Axle Disconnect and Mechanical Parking Brake
- Assembly Instruction
- Ring Gear Installation
- Clutch and Gear Arrangement
- Three Speed Power Flow
- External Plumbing

The R, HR, and MHR Model Transmissions are of three basic designs.

The R Model consists of a separate torque converter, mounted to the engine with the powershift transmission remotely mounted and connected to the torque converter with a drive shaft.

The HR Model consists of a torque converter and powershifted transmission in one package mounted directly to the engine.

The MHR version is a mid-mount torque converter and transmission assembly connected to the engine by means of a drive shaft, (See Fig. A for basic design silhouette.)

The shift control valve assembly may be mounted directly on the side of the converter housing or front transmission cover, or remote mounted and connected to the transmission by means of flexible hoses. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutch, A provision is made on certain models to neutralize the transmission when the brakes are applied. This is accomplished through use of a brake actuated shutoff valve. The speed and direction clutch assemblies are mounted inside the transmission case and are connected to the output shaft of the converter either by direct gearing or drive shaft. The purpose of the speed or directional clutches is to direct the power flow through the gear train to provide the desired speed range and direction.

An axle disconnect is optional and is located on the output shaft, The drive to the front or rear axle can be disconnected or connected by manual shifting.

### HOW THE UNITS OPERATE

With the engine running, the converter charging pump draws oil from the transmission sump through the removable oil suction screen and directs it through the pressure regulating valve and oil filter.

The pressure regulating valve maintains pressure to the transmission control cover for actuating the direction and speed clutches, This requires a small portion of the total volume of oil used in the system. The remaining volume of oil is directed through the torque converter circuit to the oil cooler and returns to the transmission for positive lubrication, This regulator valve consists of a hardened valve spool operating in a closely fitted bore, The valve spool is spring loaded to hold the valve in a closed position, When a specific pressure is achieved, the valve spool works against the spring until a port is exposed along the side of the bore, This sequence of events provides the proper system pressure.

After entering the converter housing the oil is directed through the stator support to the converter blade cavity and exits in the passage between the turbine shaft and converter support. The oil then flows out of the converter to the oil cooler, After leaving the cooler, the oil is directed to a fitting on the transmission. Then through a series of tubes and passages lubricates the transmission bearings and clutches. The oil then gravity drains to the transmission sump.

The hydraulic torque converter consists basically of three elements and their related parts to multiply engine torque, The engine power is transmitted from the engine flywheel to the impeller element through the impeller cover, This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump in that it picks up fluid at its center and discharges at its outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the output shaft of the torque converter. This element receives fluid at its outer diameter and discharges at its center. Fluid directed by the impeller out into the particular design of blading in the turbine and reaction member is the means by which the hydraulic torque converter multiplies torque.

The reaction member of the torque converter is located between and at the center or inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element.

The torque converter will multiply engine torque to its designed maximum multiplication ratio when the output shaft is at zero RPM, Therefore, we can say that as the output shaft is decreasing in speed the torque multiplication is increasing.

The shift control valve assembly consists of a valve body with selector valve spools. A detent ball and spring in the selector spool provides one position for each speed range. A detent ball and spring in the direction spool provides three positions, one each for forward, neutral and reverse.

With the engine running and the directional control lever in neutral position, oil pressure from the regulating valve is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction clutch as desired.

When either directional clutch is selected the opposite clutch is relieved of pressure and vents back through the direction selector spool. The same procedure is used in the speed selector.

The direction or speed clutch assembly consists of a drum with internal splines and a bore to receive a hydraulically actuated piston. The piston is "oil tight" by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc with splines at the inner diameter is inserted. Discs are alternated until the required total is achieved. A heavy back-up plate is then inserted and secured with a snap ring. A Hub with O.D. splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control valve, through a tube, to a chosen clutch shaft. This shaft has a drilled passageway for oil under pressure to enter the shaft. Oil pressure sealing rings are located on the clutch shaft. These rings direct oil under pressure to a desired clutch. Pressure of the oil forces the piston and discs against the heavy back-up plate. The discs, with teeth on the outer diameter, clamping against discs with teeth on the inner diameter, enables the hub and clutch shaft to be locked together and allows them to drive as a unit.

There are bleed balls in the clutch piston which allow quick escape for oil when the pressure to the piston is released.

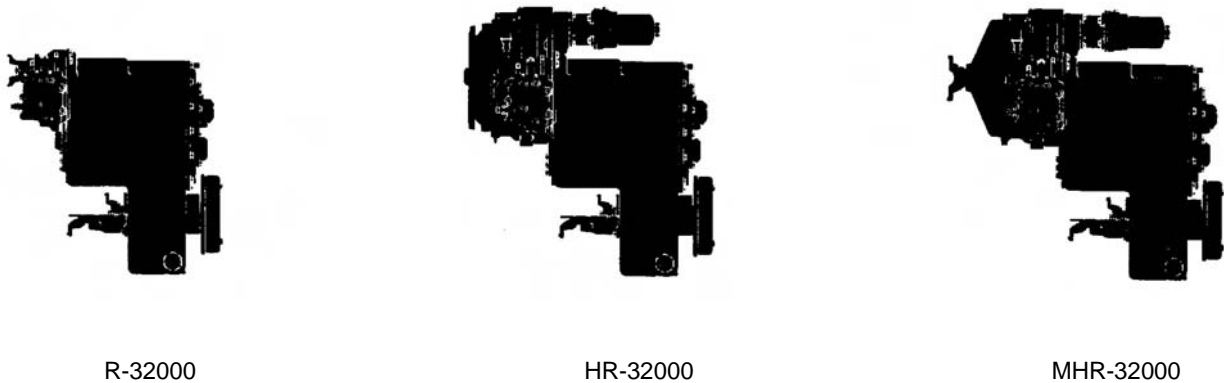


FIG. A

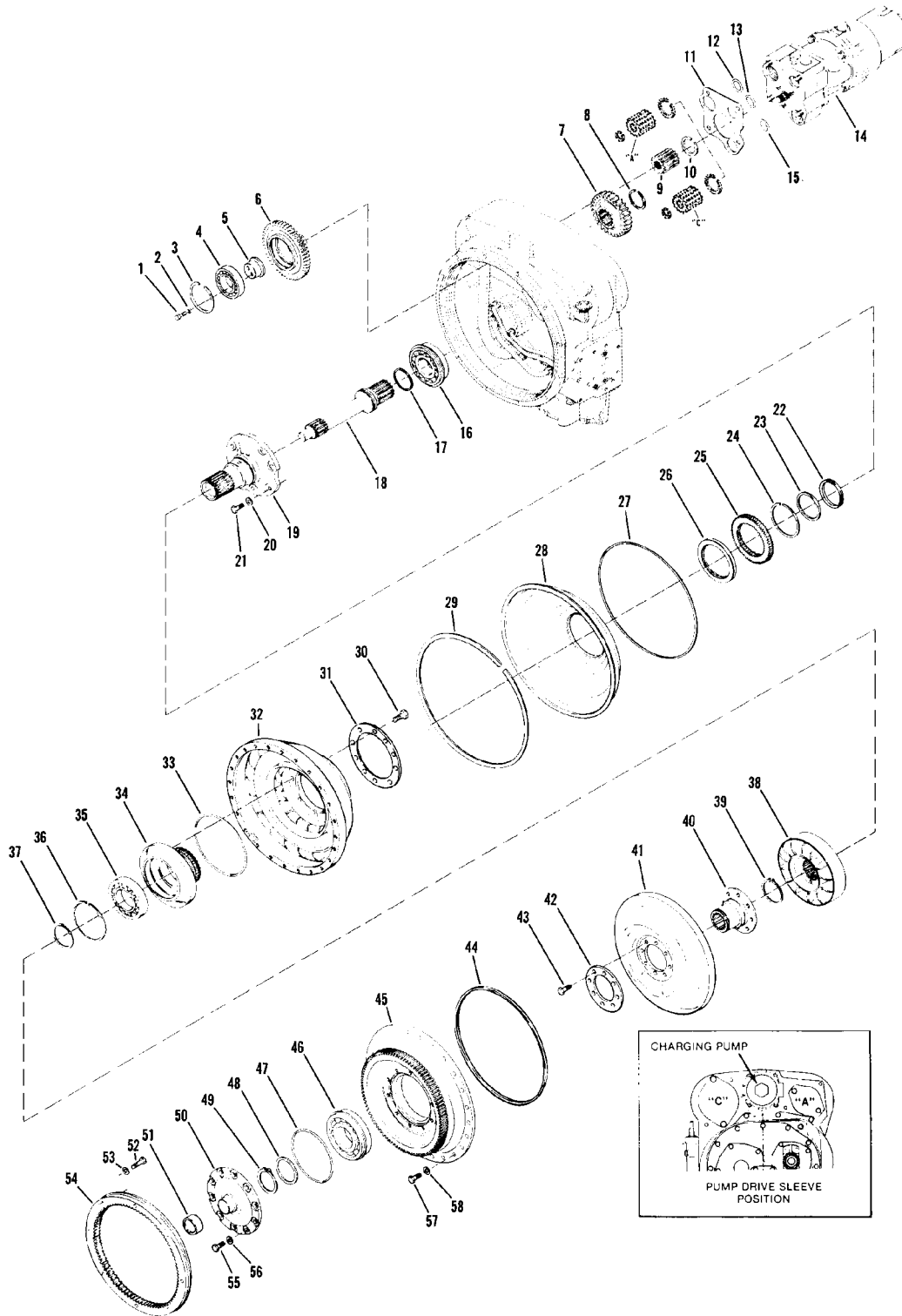


Figure B

HR32000 CONVERTER GROUP

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Bearing Support Screw . . . . .	6	30	Hub to Impeller Screw . . . . .	12
2	Bearing Support Screw Lockwasher . . . . .	6	31	Impeller Hub Screw Backing Ring . . . . .	1
3	Drive Gear Snap Ring . . . . .	3	32	Impeller . . . . .	1
4	Pump Drive Gear Bearing . . . . .	3	33	Impeller Hub "O" Ring . . . . .	1
5	Pump Drive Bearing Support . . . . .	3	34	Impeller Hub . . . . .	1
6	Pump Drive Gear . . . . .	3	35	Impeller Hub Bearing . . . . .	1
7	Turbine Shaft Gear . . . . .	1	36	Bearing Snap Ring . . . . .	1
8	Turbine Shaft Gear Snap Ring . . . . .	1	37	Reaction Member Spacer . . . . .	1
9	Charging Pump Drive Sleeve . . . . .	1	38	Reaction Member . . . . .	1
10	Pump Sleeve Snap Ring . . . . .	1	39	Reaction Member Snap Ring . . . . .	1
11	Valve to Housing Gasket . . . . .	1	40	Turbine Hub . . . . .	1
12	Valve Body "O" Ring . . . . .	1	41	Turbine . . . . .	1
13	Valve Body "O" Ring . . . . .	1	42	Turbine Hub Backing Ring . . . . .	1
14	Charging Pump & Oil Filter Assembly . . . . .	1	43	Turbine Hub Screw . . . . .	8
15	Valve Body "O" Ring . . . . .	1	44	Impeller to Cover "O" Ring . . . . .	1
16	Turbine Shaft Bearing . . . . .	1	45	Impeller Cover . . . . .	1
17	Turbine Shaft Piston Ring . . . . .	1	46	Impeller Cover Bearing . . . . .	1
18	Turbine Shaft . . . . .	1	47	Bearing Cap to Impeller Cover "O" Ring . . . . .	1
19	Stator Support . . . . .	1	48	Bearing Washer . . . . .	1
20	Stator Support Screw Lockwasher . . . . .	6	49	Bearing Snap Ring . . . . .	1
21	Stator Support Screw . . . . .	6	50	Impeller Cover Bearing Cap . . . . .	1
22	Piston Ring . . . . .	1	51	Impeller Cover Sleeve . . . . .	1
23	Piston Ring Expander Spring . . . . .	1	52	Ring Gear Screw . . . . .	16
24	Impeller Hub Gear Snap Ring . . . . .	1	53	Plain Washer . . . . .	16
25	Impeller Hub Gear . . . . .	1	54	Flywheel Ring Gear . . . . .	1
26	Oil Baffle Oil Seal . . . . .	1	55	Bearing Cap to Impeller Cover Screw . . . . .	10
27	Oil Baffle Seal Ring . . . . .	1	56	Bearing Cap to Impeller Cover Screw Lockwasher . . . . .	10
28	Oil Baffle . . . . .	1	57	Impeller to Cover Screw . . . . .	24
29	Oil Baffle Retainer Ring . . . . .	1	58	Impeller to Cover Screw Lockwasher . . . . .	24

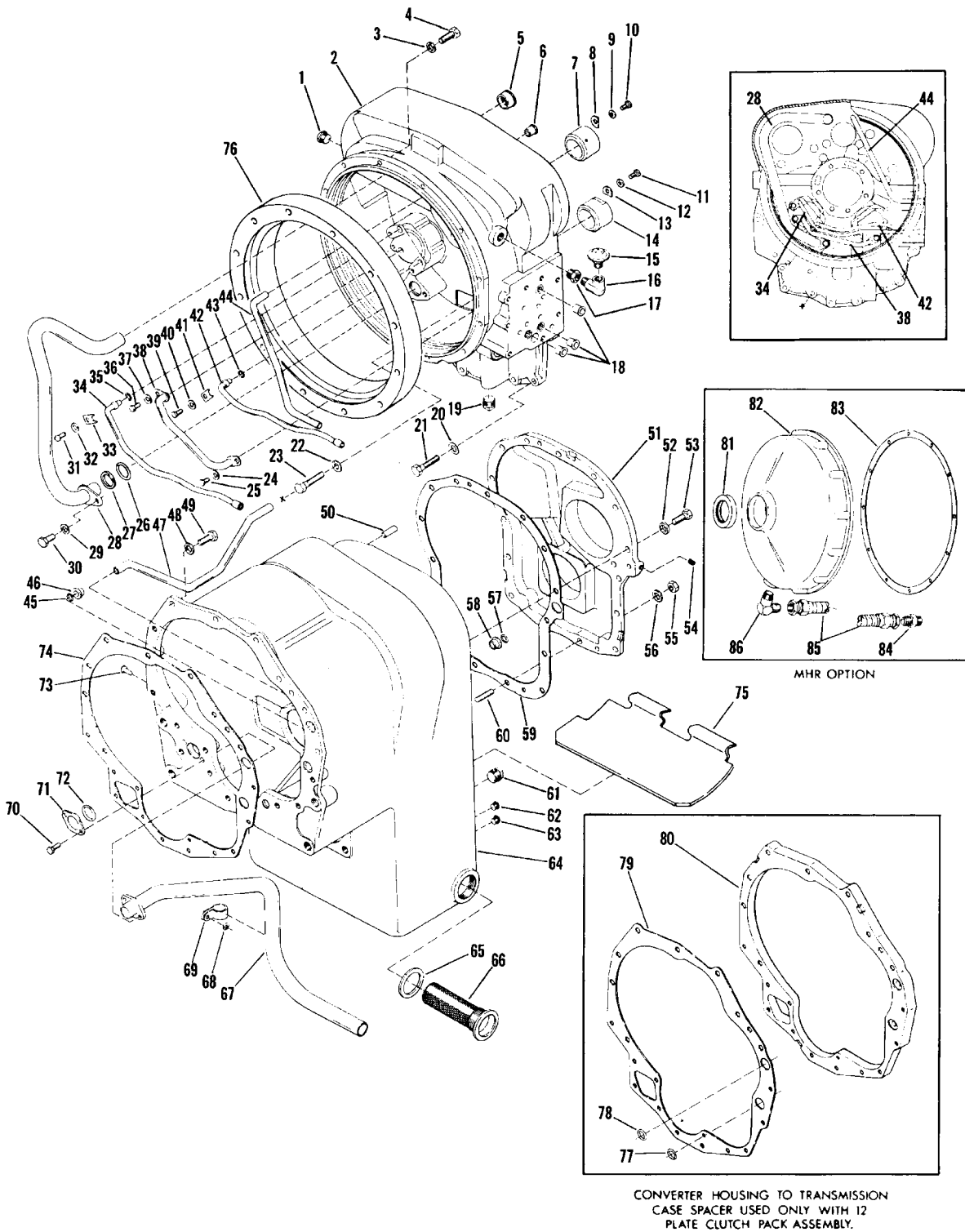


Figure C

HR32000 CONVERTER & TRANSMISSION CASE GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Pipe Plug .....	1	45	Clutch Pressure Tube "0" Ring.....	1
2	Converter Housing Assembly .....	1	46	Tube Sleeve .....	1
3	Converter Housing to Front Cover Screw Lockwasher .....	12	47	Low Speed Clutch Pressure Tube .....	1
4	Converter Housing to Front Cover Screw .....	12	48	Transmission Case to Converter Housing Screw Lockwasher .....	10
5	Tube Sleeve .....	1	49	Transmission Case to Converter Housing Screw .....	10
6	Tube Sleeve .....	1	50	Rear Cover Dowel Pin .....	2
7	Converter Housing Sleeve .....	1	51	Rear Cover .....	1
8	Converter Housing Sleeve Lock .....	1	52	Rear Cover to Transmission Case Screw Lockwasher .....	13
9	Converter Housing Sleeve Screw Lockwasher .....	1	53	Rear Cover to Transmission Case Screw .....	13
10	Converter Housing Sleeve Screw .....	1	54	Rear Cover Pipe Plug.....	1
11	Converter Housing Sleeve Screw .....	1	55	Rear Cover to Case Stud Nut.....	2
12	Converter Housing Sleeve Screw Lockwasher .....	1	56	Rear Cover to Case Stud Lockwasher .....	2
13	Converter Housing Sleeve Lock .....	1	57	ClutchPressureTube"0"Ring .....	1
14	Converter Housing Sleeve .....	1	58	Tube Sleeve .....	1
15	Breather .....	1	59	Rear Cover to Transmission Case Gasket .....	1
16	Street E II .....	1	60	Rear Cover to Case Stud .....	2
17	Breather Reducing Bushing .....	1	61	Magnetic Drain Plug .....	1
18	Tube Sleeve .....	3	62	Oil Level Plug.....	1
19	Pipe Plug .....	1	63	Oil Level Plug.....	1
20	Converter Housing to Transmission Housing Screw Lockwasher .....	4	64	Transmission Case Assembly .....	1
21	Converter Housing to Transmission Housing Screw .....	4	65	Screen Assembly Gasket.....	1
22	Converter Housing to Transmission Housing Lockwasher.....	4	66	Screen Assembly .....	1
23	Converter Housing to Transmission Housing Screw .....	4	67	Suction Tube .....	1
24	Lube Tube Retaining Screw Lockwasher .....	1	68	Suction Tube Clip Washer .....	1
25	Lube Tube Retaining Screw .....	1	69	Suction Tube Clip .....	1
26	Suction Tube "0" Ring .....	1	70	Suction Line Screw.....	2
27	Suction Tube Spacer Ring.....	1	71	Suction Line Washer .....	1
28	Suction Tube Assembly.....	1	72	Suction Line "0" Ring .....	1
29	Suction Tube Retainer Screw Lockwasher .....	1	73	Suction Tube Clip Rivet .....	1
30	Suction Tube Retainer Screw .....	1	74	Converter Housing to Transmission Case Gasket .....	1
31	Tube Clip Screw .....	1	75	Oil Baffle.....	1
32	Tube Clip Screw Lockwasher .....	1	76	Converter Housing Adaptor Ring.....	1
33	Tube Clip.....	1	77	4 <sup>th</sup> Speed Pressure Tube "0" Ring .....	1
34	ReverseTube Assembly .....	1	78	Low Speed Pressure Tube "0" Ring.....	1
35	Reverse Tube "0" Ring.....	1	79	Converter Housing to Transmission Case Gasket .....	1
36	Lube Tube Retainer Screw.....	1	80	Converter Housing to Transmission Case Spacer (12 plate clutch pack only) .....	1
37	Lube Tube Retainer Screw Lockwasher.....	1	81	Front Cover Oil Seal.....	1
38	Lube Tube Assembly .....	1	82	Converter Housing Front Cover .....	1
39	Tube Clip Screw .....	1	83	Converter Housing Front Cover Gasket.....	1
40	Tube Clip Screw Lockwasher .....	1	84	Hose Fitting .....	1
41	Tube Clip.....	1	85	Hose Assembly .....	1
42	3 <sup>rd</sup> Speed Tube .....	1	86	Hose Fitting .....	1
43	3 <sup>rd</sup> Speed Tube "0" Ring .....	1			
44	Valve Oil Supply Tube .....	1			

ITEMS 81 THRU 86 FOR MHR ONLY.



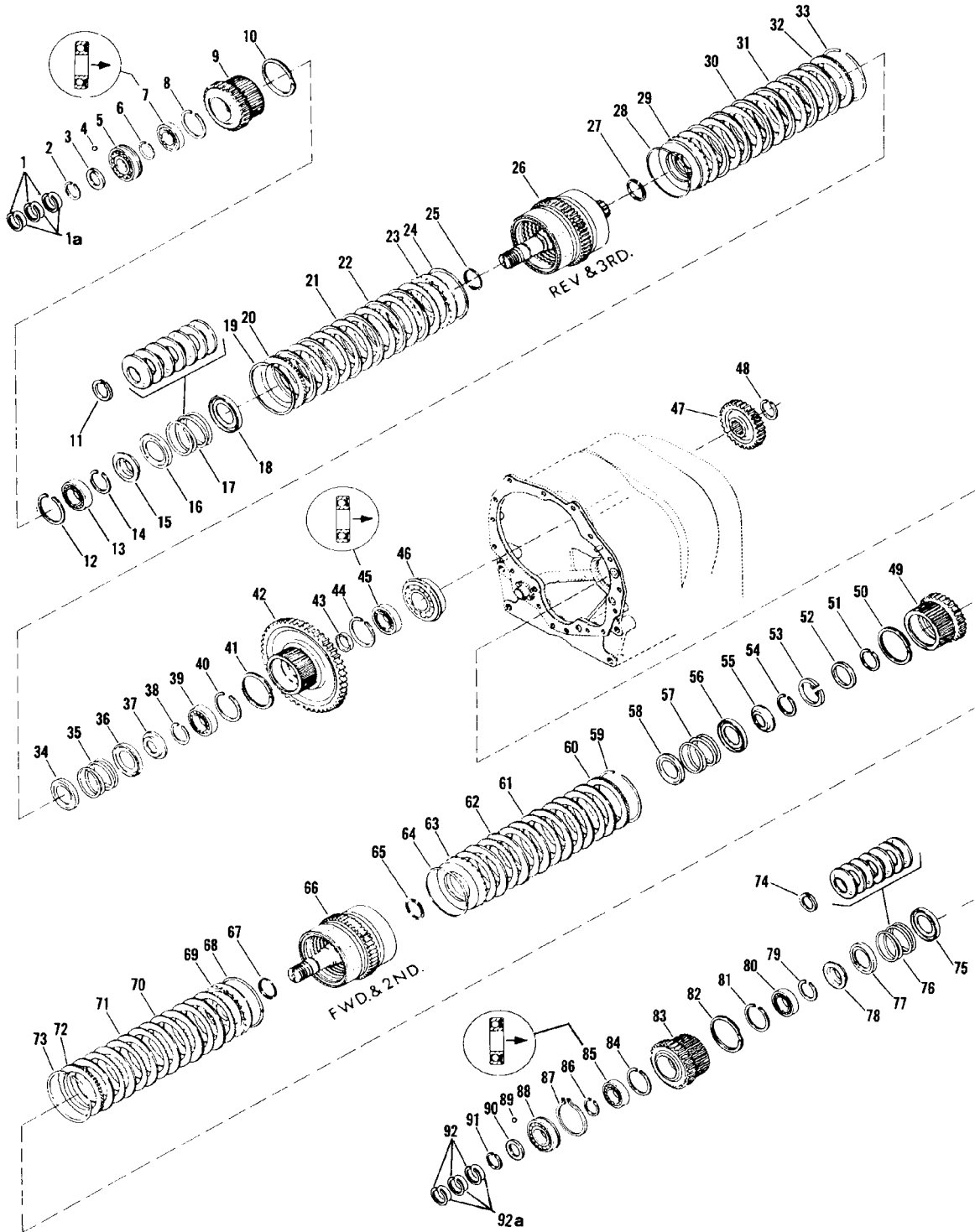


Figure D

R OR H R32000

REVERSE & 3RD & FORWARD & 2ND CLUTCH GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Reverse & 3rd Clutch Shaft Piston Ring .....	3	47	Low Clutch Drive Gear .....	1
1A	Piston Ring Expander Springs .....	3	48	Gear Retaining Ring .....	1
2	Front Bearing Retainer Ring .....	1	49	2nd Gear .....	1
3	Reverse & 3rd Shaft Front Bearing End Plate .....	1	50	Clutch Hub Oil Baffle Ring .....	1
4	Reverse & 3rd Shaft Bearing End Plate Ball .....	1	51	2nd Gear Retainer Ring .....	1
5	Reverse & 3rd Shaft Front Bearing .....	1	52	2nd Gear Retainer Ring Retainer .....	1
6	Front Bearing Retainer Ring .....	1	53	2nd Gear Retainer Ring Retainer Snap Ring .....	1
7	Clutch Driven Gear Bearing -Shield In .....	1	54	Spring Retainer Snap Ring .....	1
8	Clutch Driven Gear Bearing Snap Ring .....	1	55	Spring Retainer Snap Ring Retainer .....	1
9	Clutch Driven Gear .....	1	56	Spring Retainer .....	1
10	Clutch Hub Oil Baffle Ring .....	1	57	Piston Return Spring .....	1
11	Spring Retainer Snap Ring .....	1	58	Spring Retainer .....	1
12	Clutch Driven Gear Bearing Snap Ring .....	1	59	End Plate Retainer Ring .....	1
13	Clutch Driven Gear Bearing .....	1	60	End Plate-2ndClutch .....	1
14	Spring Retainer Snap Ring .....	1	61	Clutch Outer Disc -2nd Clutch .....	6
15	Spring Retainer Snap Ring Retainer .....	1	62	Clutch Inner Disc -2nd Clutch .....	6
16	Spring Retainer .....	1	63	Clutch Piston Assembly -2nd Clutch .....	1
17	Piston Return Spring .....	1	64	Clutch Piston Outer Seal .....	1
18	Spring Retainer .....	1	65	Clutch Piston Inner Seal .....	1
19	End Plate Retainer Ring .....	1	66	Forward & 2nd Clutch Drum .....	1
20	End Plate -Reverse Clutch .....	1	67	Clutch Piston Inner Seal .....	1
21	Clutch Outer Disc -Reverse Clutch .....	6	68	Clutch Piston Outer Seal .....	1
22	Clutch Inner Disc -Reverse Clutch .....	6	69	Clutch Piston Assembly -Forward Clutch .....	1
23	Clutch Piston Assembly -Reverse Clutch .....	1	70	Clutch Outer Disc -Forward Clutch .....	6
24	Clutch Piston Outer Seal .....	1	71	Clutch Inner Disc -Forward Clutch .....	6
25	Clutch Piston Inner Seal .....	1	72	End Plate-Forward Clutch .....	1
26	Reverse & 3rd Clutch Drum .....	1	73	End Plate Retainer Ring .....	1
27	Clutch Piston Inner Seal .....	1	74	Spring Retainer Snap Ring .....	1
28	Clutch Piston Outer Seal .....	1	75	Spring Retainer .....	1
29	Clutch Piston -3rd Clutch .....	1	76	Piston Return Spring .....	1
30	Clutch Inner Disc -3rd Clutch .....	6	77	Spring Retainer .....	1
31	Clutch Outer Disc -3rd Clutch .....	6	78	Spring Retainer Snap Ring Retainer .....	1
32	End Plate -3rd Clutch .....	1	79	Spring Retainer Snap Ring .....	1
33	End Plate Retainer Ring .....	1	80	Clutch Driven Gear Bearing .....	1
34	Spring Retainer .....	1	81	Clutch Driven Gear Bearing Snap Ring .....	1
35	Piston Return Spring .....	1	82	Clutch Hub Oil Baffle Ring .....	1
36	Spring Retainer .....	1	83	Forward Clutch Driven Gear .....	1
37	Spring Retainer Snap Ring Retainer .....	1	84	Clutch Driven Gear Bearing Snap Ring .....	1
38	Spring Retainer Snap Ring .....	1	85	Clutch Driven Gear Bearing -Shield In .....	1
39	3rd Gear Bearing .....	1	86	Front Bearing Retainer Ring .....	1
40	3rd Gear Bearing Snap Ring .....	1	87	Front Bearing Locating Ring .....	1
41	Clutch Hub Oil Baffle Ring .....	1	88	Forward & 2nd Shaft Front Bearing .....	1
42	3rd Gear .....	1	89	Forward & 2nd Shaft Bearing End Plate Ball .....	1
43	3rd Gear Bearing Spacer .....	1	90	Forward & 2nd Shaft Front Bearing End Plate .....	1
44	3rd Gear Bearing Snap Ring .....	1	91	Front Bearing Retainer Ring .....	1
45	3rd Gear Bearing -Shield Out .....	1	92	Forward & 2nd Shaft Piston Ring .....	3
46	Reverse & 3rd Shaft Rear Bearing .....	1	92A	Piston Ring Expander Springs .....	3

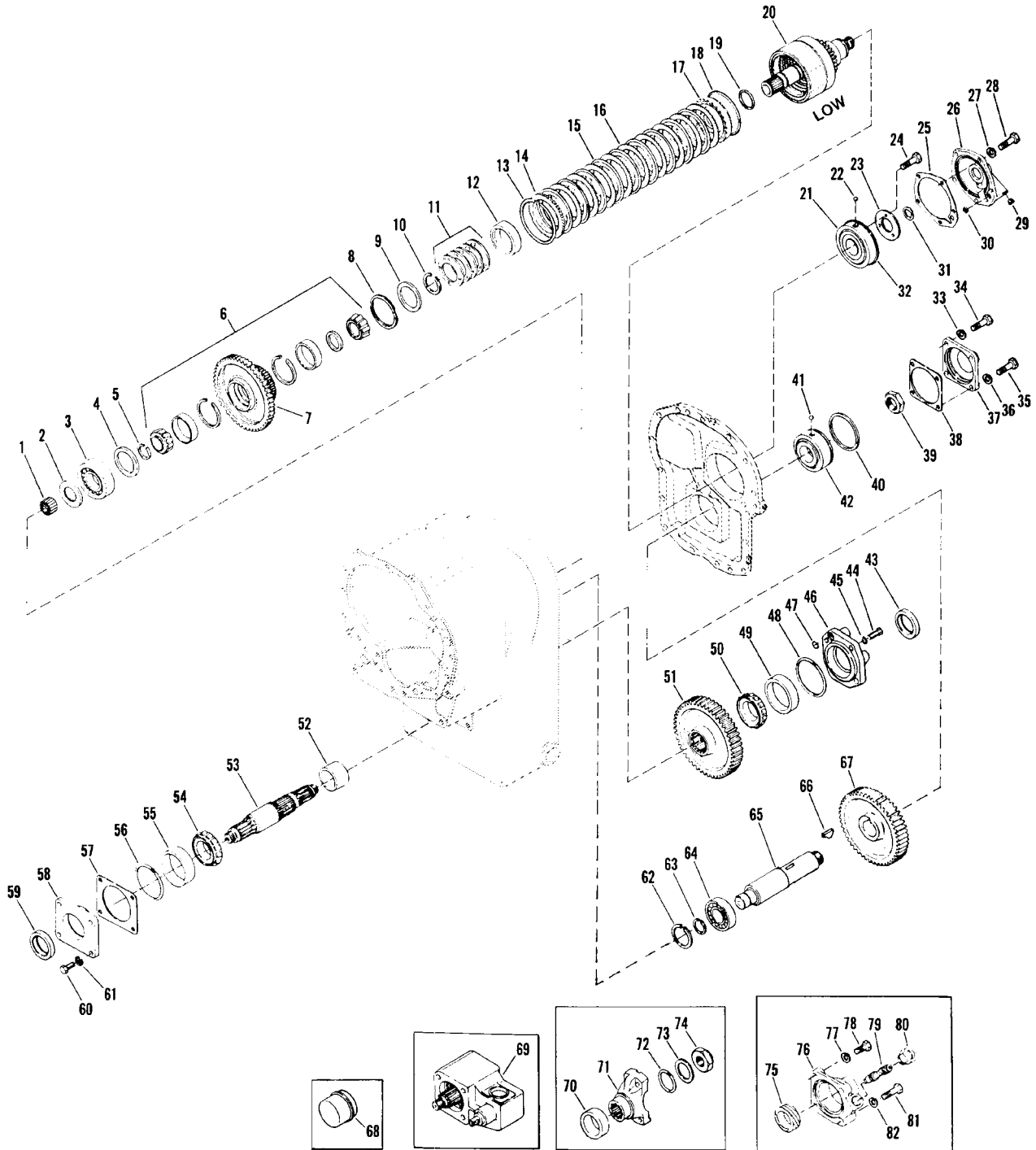


Figure E

R OR HR32000 LOW (1ST) CLUTCH & OUTPUT GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Low Speed Clutch Shaft Pilot Bearing .....	1	42	Idler Shaft Rear Bearing .....	1
2	2nd Gear Bearing End Plate .....	1	43	Rear Bearing Cap Oil Seal.....	1
3	2nd Gear Bearing .....	1	44	Rear Bearing Cap Screw .....	4
4	Bearing Retaining Ring Retainer .....	1	45	Rear Bearing Cap Screw Lockwasher .....	4
5	Low Speed Gear Bearing Retainer Ring .....	1	46	Rear Bearing Cap.....	1
6	Low Speed Gear Bearing Assembly.....	1	47	Rear Bearing Cap "0" Ring .....	1
7	Low Speed Gear .....	1	48	Rear Bearing Cap "0" Ring .....	1
8	Clutch Hub Oil Baffle Ring .....	1	49	Rear Bearing Cup.....	1
9	Spring Retaining Ring Retainer .....	1	50	Rear Bearing Cone.....	1
10	Spring Retaining Ring .....	1	51	Output Shaft Gear .....	1
11	Piston Return Disc Springs .....	5	52	Output Shaft Gear Spacer.....	1
12	Piston to Piston Return Disc Springs Spacer .....	1	53	Output Shaft.....	1
13	End Plate Retainer Ring .....	1	54	Front Bearing Cone .....	1
14	End Plate .....	1	55	Front Bearing Cup .....	1
15	Clutch Inner Disc .....	9	56	Front Bearing Cap "0" Ring .....	1
16	Clutch Outer Disc .....	9	57	Bearing Cap Shim .....	AR
17	Clutch Piston .....	1	58	Front Bearing Cap .....	1
18	Clutch Piston Outer Seal.....	1	59	Front Bearing Cap Oil Seal.....	1
19	Clutch Piston Inner Seal .....	1	60	Front Bearing Cap Screw.....	4
20	Low Speed Clutch Drum .....	1	61	Front Bearing Cap Screw Lockwasher .....	4
21	Low Speed Shaft Rear Bearing .....	1	62	Bearing Retainer Ring .....	1
22	Bearing Lockball.....	1	63	Bearing Locating Ring .....	1
23	Rear Bearing Retainer Plate .....	1	64	Idler Shaft Front Bearing .....	1
24	Rear Bearing Retainer Plate Screw .....	3	65	Idler Shaft .....	1
25	Rear Bearing Cap Gasket .....	1	66	Idler Shaft Gear Key .....	1
26	Rear Bearing Cap .....	1	67	Idler Shaft Gear.....	1
27	Rear Bearing Cap Screw Lockwasher .....	5	68	Bore Plug (optional) .....	1
28	Rear Bearing Cap Screw.....	5	69	Disconnect Assembly (optional) .....	1
29	Rear Bearing Cap Plug .....	1	70	Oil Seal.....	1
30	Rear Bearing Cap "0" Ring.....	1	71	Output Flange .....	1
31	Clutch Shaft Piston Plug .....	1	72	Output Flange "0" Ring .....	1
32	Low Speed Shaft Rear Bearing Locating Ring.....	1	73	Output Flange Washer.....	1
33	Bearing Cap Screw Lockwasher.....	2	74	Output Flange Nut .....	1
34	Bearing Cap Screw.....	2	75	Speedo Drive Gear.....	1
35	Bearing Cap Screw.....	2	76	Rear Bearing Cap.....	1
36	Bearing Cap Screw Lockwasher.....	2	77	Rear Bearing Cap Screw Lockwasher .....	3
37	Idler Shaft Bearing Cap.....	1	78	Rear Bearing Cap Screw .....	3
38	Idler Shaft Bearing Cap Gasket.....	1	79	Speedo Driven Gear .....	1
39	Idler Shaft Nut .....	1	80	Speedo Tube Nut .....	1
40	Rear Bearing Locating Ring .....	1	81	Rear Bearing Cap Screw .....	1
41	Idler Shaft Rear Bearing Lockball.....	1	82	Rear Bearing Cap Screw Lockwasher .....	1

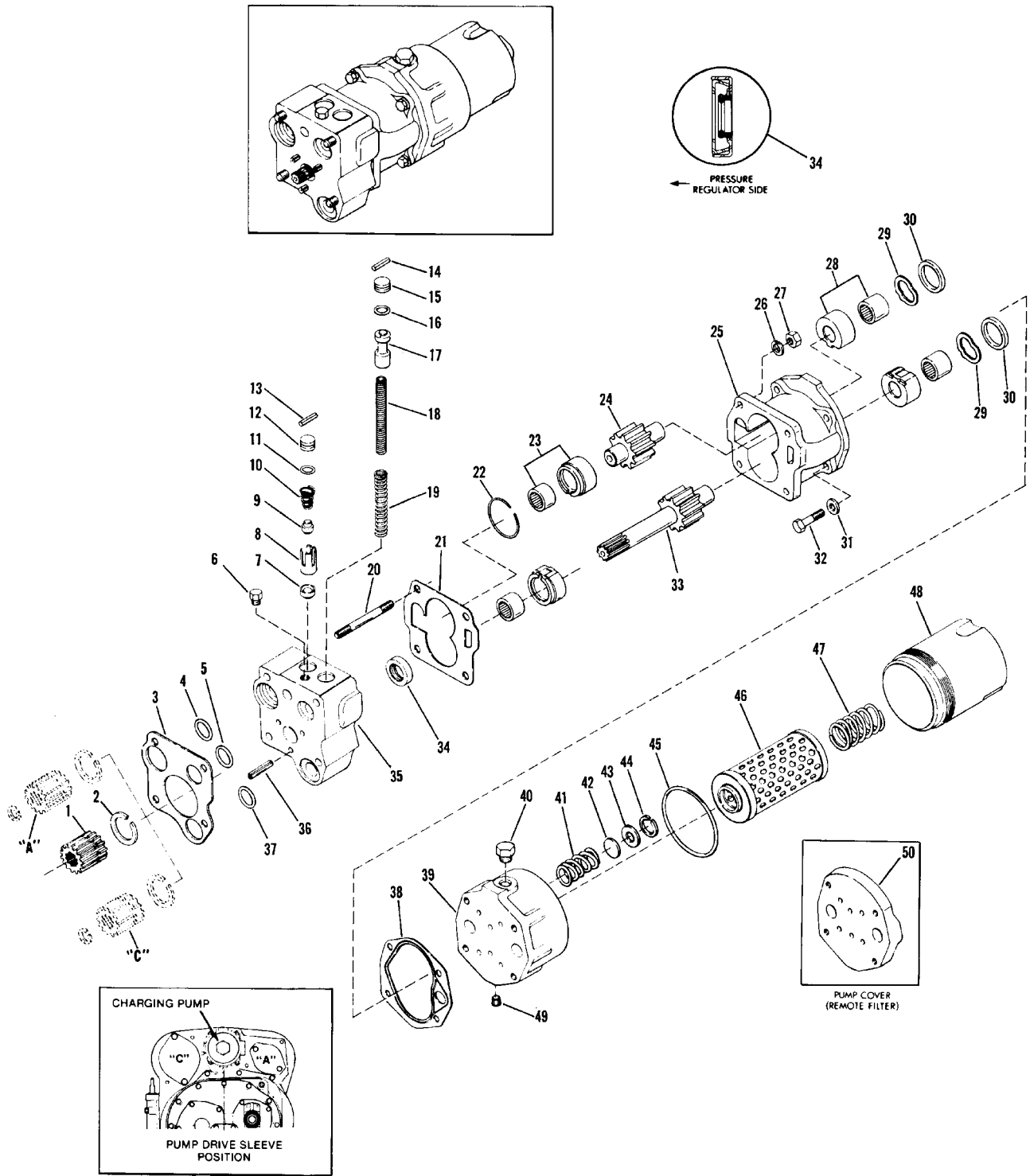


Figure F

**PRESSURE REGULATOR VALVE, CHARGING PUMP & OIL FILTER GROUP**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Charging Pump Drive Sleeve . . . . .	1	26	Valve to Housing Stud Lockwasher . . .	4
2	Pump Sleeve Snap Ring . . . . .	1	27	Valve to Housing Stud Nut . . . . .	4
3	Valve to Housing Gasket . . . . .	1	28	Thrust Plate & Bearing Assembly . . . .	2
4	Valve Body "O" Ring . . . . .	1	29	Wave Spring . . . . .	2
5	Valve Body "O" Ring . . . . .	1	30	Pump Shaft Seal . . . . .	2
6	Pipe Plug . . . . .	1	31	Pump to Filter Adaptor Screw Lockwasher . . . . .	4
7	Safety Valve Seat . . . . .	1	32	Pump to Filter Adaptor Screw . . . . .	4
8	Safety Valve Spacer . . . . .	1	33	Pump Drive Shaft Assembly . . . . .	1
9	Safety Valve Plunger . . . . .	1	34	Pump Drive Shaft Oil Seal . . . . .	1
10	Safety Valve Spring . . . . .	1	35	Pressure Regulator Valve . . . . .	1
11	Valve Stop "O" Ring . . . . .	1	36	Valve Body Roll Pin . . . . .	3
12	Valve Stop . . . . .	1	37	Valve Body "O" Ring . . . . .	1
13	Valve Stop Roll Pin . . . . .	1	38	Pump to Filter Gasket . . . . .	1
14	Valve Stop Roll Pin . . . . .	1	39	Filter Adaptor . . . . .	1
15	Valve Stop . . . . .	1	40	Filter Adaptor Plug . . . . .	1
16	Valve Stop "O" Ring . . . . .	1	41	By-Pass Filter Disc Spring . . . . .	1
17	Valve Piston . . . . .	1	42	By-Pass Filter Disc . . . . .	1
18	Valve Spring - Inner . . . . .	1	43	By-Pass Filter Disc Seat . . . . .	1
19	Valve Spring - Outer . . . . .	1	44	Filter Seat Retainer Ring . . . . .	1
20	Valve to Converter Housing Stud . . . . .	4	45	Filter Housing "O" Ring . . . . .	1
21	Valve Body to Pump Gasket . . . . .	1	46	Oil Filter Element Assembly . . . . .	1
22	Pump Body Snap Ring . . . . .	1	47	Oil Filter Element Spring . . . . .	1
23	Thrust Plate & Bearing Assembly . . . . .	2	48	Filter Housing . . . . .	1
24	Pump Driven Shaft Assembly . . . . .	1	49	Pipe Plug . . . . .	1
25	Charging Pump Housing . . . . .	1	50	Optional Adaptor for Remote Filter . . .	1

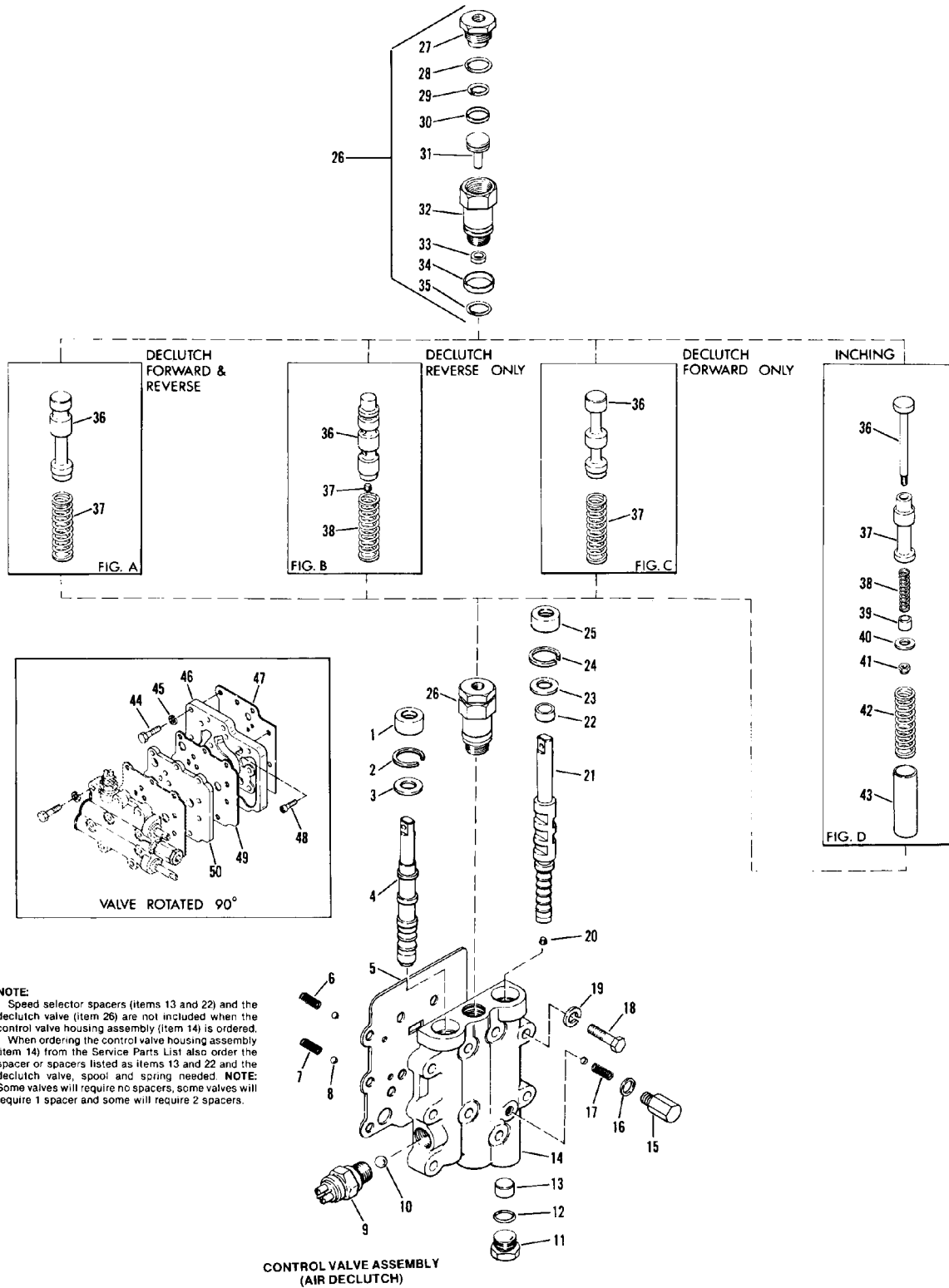


Figure G

**CONTROL VALVE ASSEMBLY**

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Oil Seal . . . . .	1	22	Overshift Spacer (Not on all models) . .	1
2	Oil Seal Retainer Ring . . . . .	1	23	Oil Seal Retainer Washer . . . . .	1
3	Oil Seal Retainer Washer . . . . .	1	24	Oil Seal Retainer Ring . . . . .	1
4	Forward & Reverse Valve Spool . . . . .	1	25	Oil Seal . . . . .	1
5	Control Valve Gasket . . . . .	1	26	Piston Housing Assembly . . . . .	1
6	Detent Spring . . . . .	1	27	Stop Plug . . . . .	1
7	Detent Spring . . . . .	1	28	Plug "O" Ring . . . . .	1
8	Detent Ball . . . . .	3	29	Piston "O" Ring . . . . .	1
9	Neutral Switch . . . . .	1	30	Glyd Ring . . . . .	1
10	Detent Ball . . . . .	1	31	Piston . . . . .	1
11	Valve Housing Plug . . . . .	1	32	Piston Housing . . . . .	1
12	Valve Housing Plug "O" Ring . . . . .	1	33	Oil Seal . . . . .	1
13	Overshift Spacer (Not on all models) . .	1	34	Band Seal . . . . .	1
14	Control Valve Housing . . . . .	1	35	"O" Ring . . . . .	1
15	Detent Spring Plug . . . . .	1	<b>Figures A-B-C &amp; D are various declutch options.</b>		
16	Detent Spring Plug Washer . . . . .	1	44	Adaptor Screw . . . . .	4
17	Detent Spring . . . . .	1	45	Adaptor Screw Lockwasher . . . . .	4
18	Valve to Adaptor Housing Screw . . . . .	9	46	Valve Adaptor . . . . .	1
19	Valve to Adaptor Housing Screw Lockwasher . . . . .	9	47	Valve Adaptor Gasket . . . . .	1
20	Speed Selector Spool Plug . . . . .	1	48	Adaptor Screw . . . . .	5
21	Speed Selector Spool . . . . .	1	49	Adaptor to Plate Gasket . . . . .	1
			50	Valve Adaptor Plate . . . . .	1



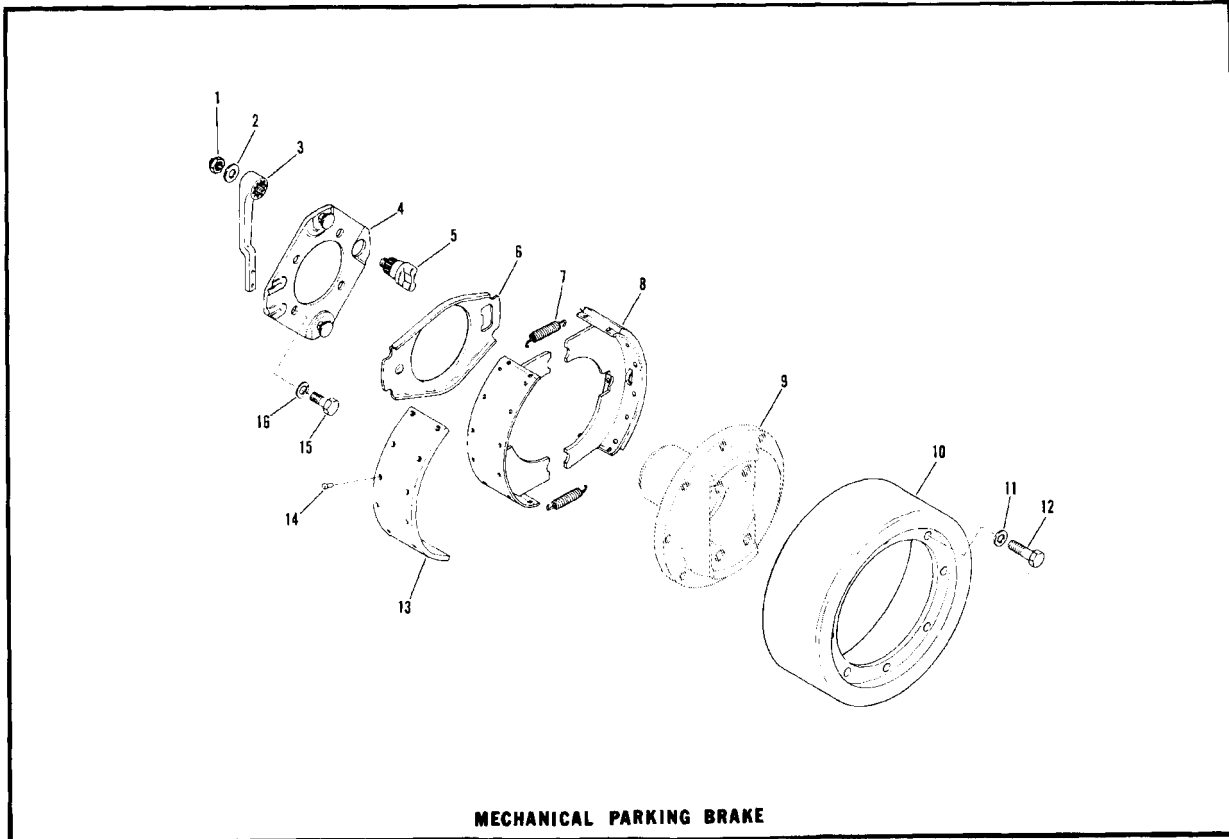
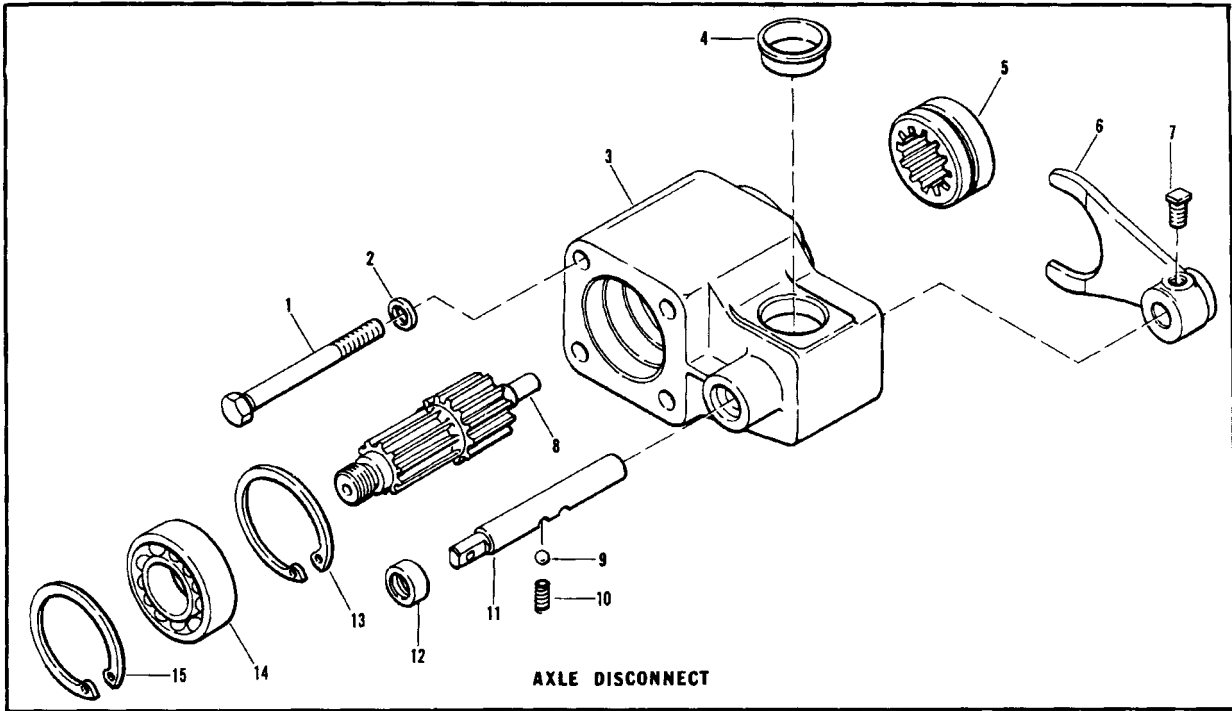


Figure H

**AXLE DISCONNECT**

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Disconnect Housing Capscrew .....	4	9	Detent Ball .....	1
2	Disconnect Housing Capscrew Lockwasher .....	4	10	Detent Spring .....	1
3	Disconnect Housing .....	1	11	Shift Rail .....	1
4	Disconnect Housing Plug .....	1	12	Shift Rail Oil Seal .....	1
5	Shift Hub .....	1	13	Bearing Retainer Ring .....	1
6	Shift Fork .....	1	14	Bearing .....	1
7	Shift Fork Lockscrew .....	1	15	Bearing Retainer Ring .....	1
8	Disconnect Shaft .....	1			

**PARKING BRAKE GROUP  
10 X 3 BRAKE**

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Lock Nut.....	1	9	Brake Flange .....	1
2	Washer.....	1	10	Brake Drum.....	1
3	Operating Lever.....	1	11	Brake Drum Screw Lockwasher .....	1
4	Backing Plate .....	1	12	Brake Drum Screw .....	6
5	Cam Shaft .....	1	13	Brake Lining.....	1
6	Strut Assembly .....	1	14	Rivet Kit.....	24
7	Return Spring .....	1	15	Backing Plate Screw .....	4
8	Brake Shoe, Lining & Rivet .....	1	16	Backing Plate Screw Lockwasher .....	4

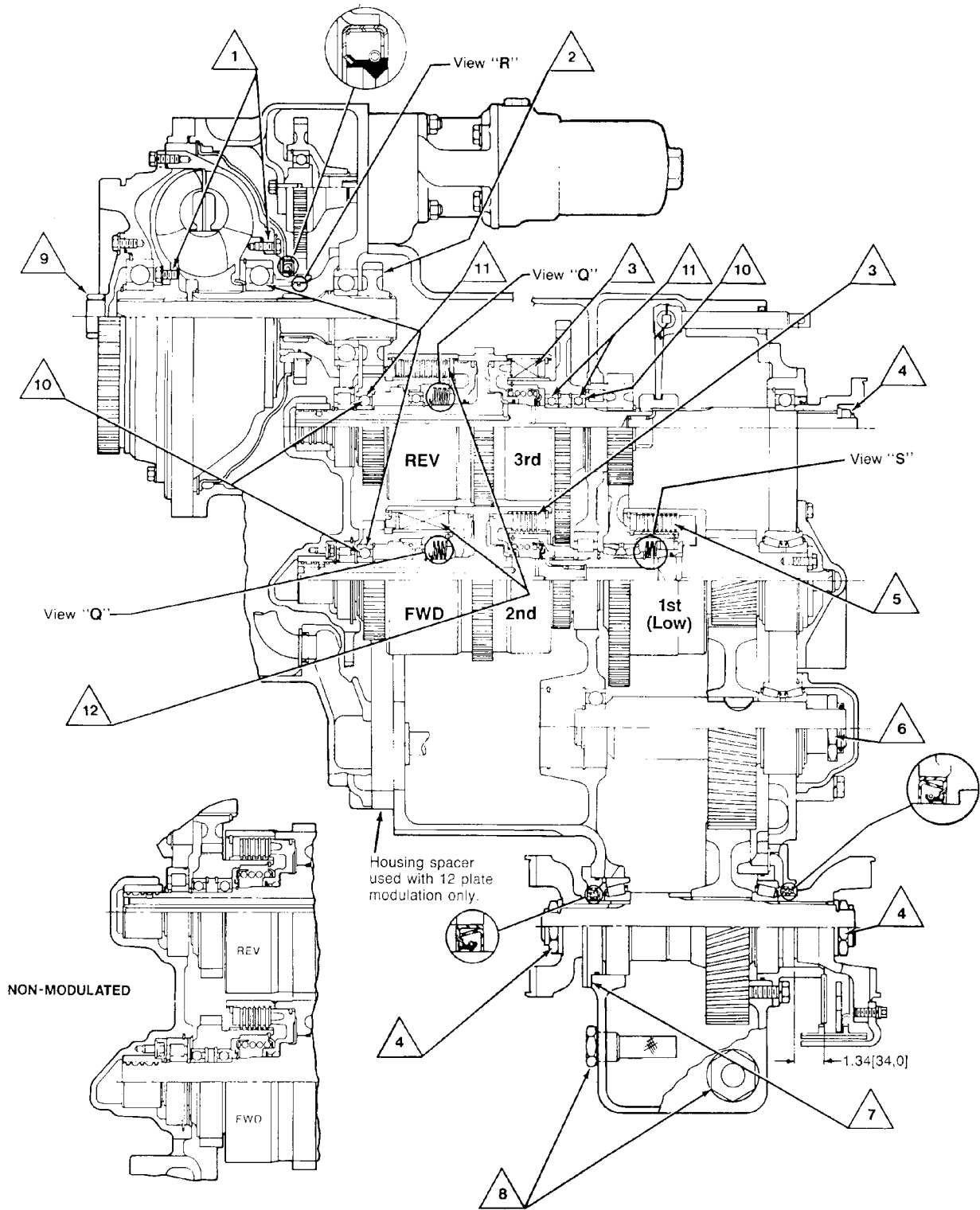


Figure I

- △ Impeller Hub and Turbine Hub Assembly with Backing Ring and Special Self Locking Screws.
  1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry & clean.
  2. Install backing ring and special self locking screws.
 Tighten screws 40 to 45 Lbs. Ft. [54,3-61,0 N·m]  
 Note: Assembly of hub must be complete within a fifteen minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The epoxy left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.
- △ Gear to be assembled with long hub length to this side.
- △ Three clutches, 6-outer steel plates, 6-inner friction plates. Assemble alternately, starting with outer steel plate.
- △ See Elastic Stop Nut Torque Chart
- △ Low clutch, 9-outer steel plates, 9-inner friction plates. Assemble alternately, starting with outer steel plate.
- △ See Elastic Stop Nut Torque Chart
- △ Shim output shaft bearings to produce 6 to 8 Lbs.-In. [0,68-0,90 N·m] preload.
- △ Tighten oil screen ass'y. 10 to 15 Lbs. Ft. [13,6-20,0 N·m]

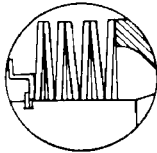
- △ Heat nose bushing to 200° F° (93°C) before ass'y. of bushing to cover.
- △ Bearing shield **OUT** on 3rd speed clutch. Bearing shield **IN** on Fwd. & Rev. clutch.
- △ Must be loose internal fit bearings, No. "3" etched on bearing.
- △ (12 Plate Modulation) Two clutches, 12-outer steel plates, 12-inner friction plates. Assemble alternately, starting with outer steel plate.

Notes

- A. - Use Permatex & Crane Sealer only where specified.
- B. - All lead in chamfers for oil seals, piston rings & "O" rings must be smooth & free from burrs. Inspect at ass'y.
- C. - Lubricate all piston ring grooves & "O" rings with oil before ass'y.
- D. - Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
- E. - After assembly of parts using Permatex or Crane sealer, there must not be any free or excess material that could enter the oil circuit.
- F. - Apply light coat of Crane Sealer to all pipe plugs.
- G. - Apply a thin coating of grease between seal lips on lip type seals prior to ass'y.
- H. - Apply light coat of Permatex No. 2 to all thru hole stud threads.

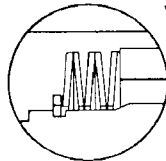
NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc.

View "Q" 2 Places Modulation only



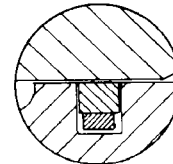
Low Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining four springs to be stacked alternately reversed as shown.

View "S"



Forward & Reverse Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining six springs of each clutch to be stacked alternately reversed as shown. See note on page 77.

View "R"



Enlarged view of Piston Ring & Expander Note: Expander gap to be approx. 180° from ring hook joint to aid ring assembly.

NOTE: Metric dimensions shown in brackets [ ].

ELASTIC STOP NUT TORQUE

THREAD SIZE	LB.-FT.	[N·m]
1" - 20	150 - 200	[203,4 - 271,1]
1 1/4" - 18	200 - 250	[271,2 - 338,9]
1 1/2" - 18	300 - 350	[406,8 - 474,5]
1 3/4" - 12	400 - 450	[542,4 - 610,1]

Grade 5

Torque Specification for Lubricated or Plated Screw Threads

Grade 8

NOM SIZE	FINE THREAD		COARSE THREAD		LB-FT	FINE THREAD		COARSE THREAD	
	LB-FT	[N·M]	LB-FT	[N·M]		LB-FT	[N·M]	LB-FT	[N·M]
5625	91 - 100	[123,4 - 135,5]	82 - 90	[111,2 - 122,0]	128 - 141	[173,6 - 191,1]	115 - 127	[156,0 - 172,2]	
5000	64 - 70	[86,8 - 94,9]	57 - 63	[77,3 - 85,4]	90 - 99	[122,1 - 134,2]	80 - 88	[108,5 - 119,3]	
4375	41 - 45	[55,6 - 61,0]	37 - 41	[50,2 - 55,5]	58 - 64	[78,7 - 86,7]	52 - 57	[70,6 - 77,2]	
3750	26 - 29	[35,3 - 39,3]	23 - 25	[31,2 - 33,8]	37 - 41	[50,2 - 55,5]	33 - 36	[44,8 - 48,8]	
3125	16 - 20	[21,7 - 27,1]	12 - 16	[16,3 - 21,6]	28 - 32	[38,0 - 43,3]	26 - 30	[35,3 - 40,6]	
2500	9 - 11	[12,3 - 14,9]	8 - 10	[10,9 - 13,5]	11 - 13	[15,0 - 17,6]	9 - 11	[12,3 - 14,9]	

Figure I

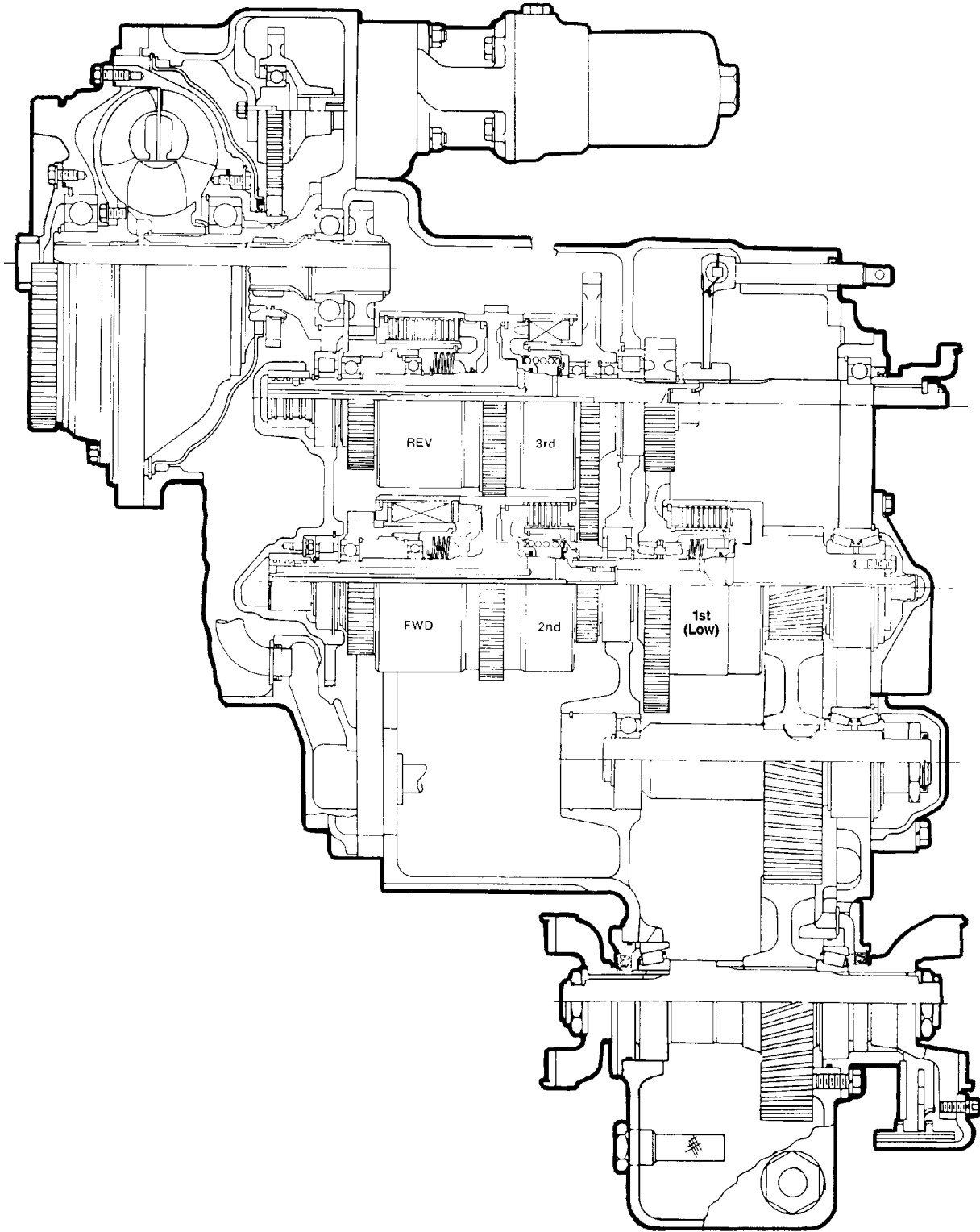


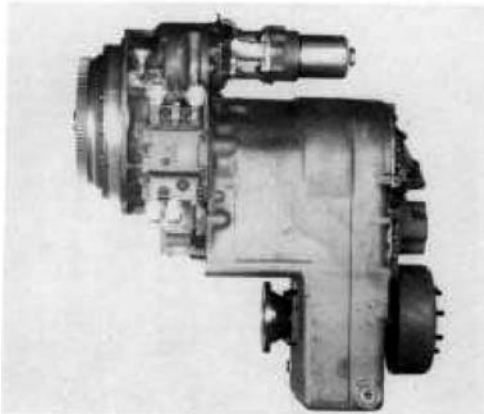
Figure J

**MAINTENANCE AND SERVICE**

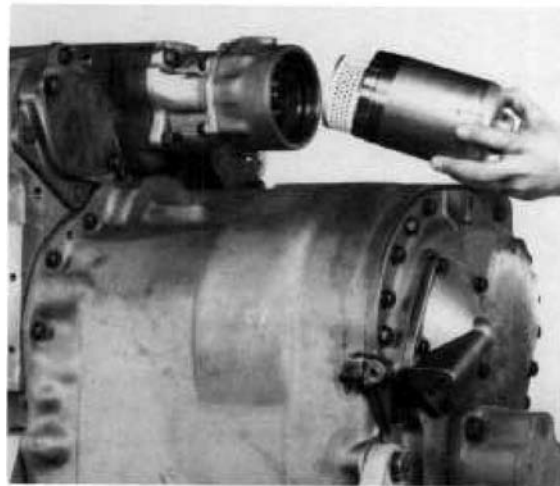
The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled. It must also be understood that this is a basic HR32000 3 speed long drop transmission with many options. Companion flanges and output

shafts with and without disconnect assemblies may vary on specific models. The units are very similar to trouble shoot, disassemble, repair, and reassemble. Drain as much oil as possible before disassembly. See page 70 for R-Model (remote mounted) transmission front cover section.

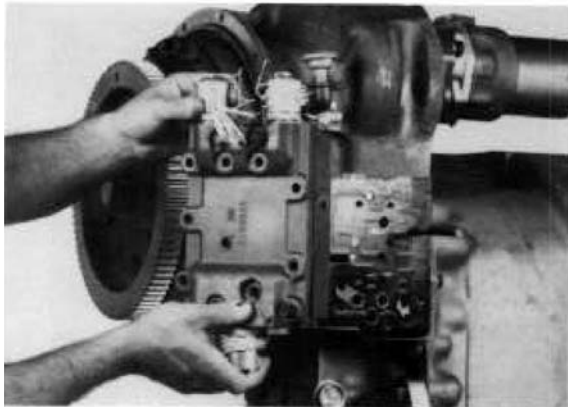
**DISASSEMBLY**



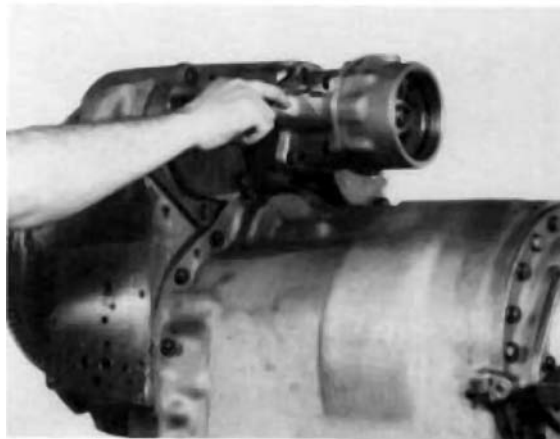
**Figure 1**  
Side view of 3 speed HR32000 long drop transmission.



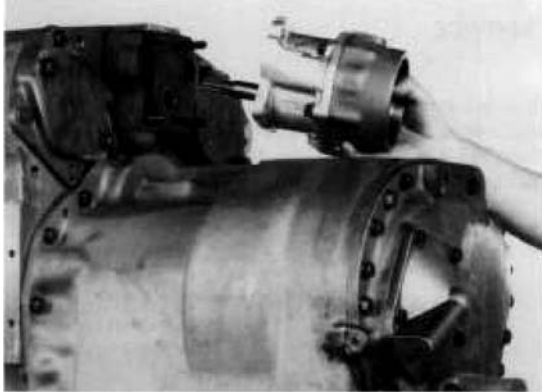
**Figure 3**  
Remove filter element housing and element. **NOTE:** It is recommended a small pan be used to catch remaining oil in element housing.



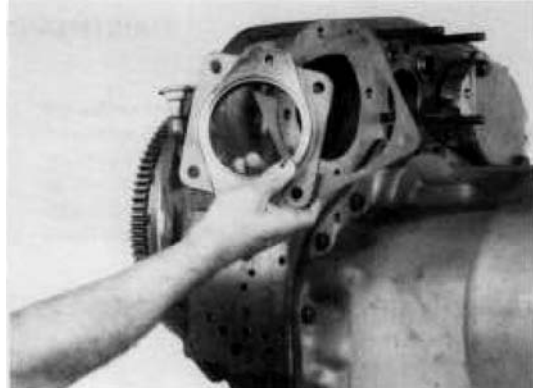
**Figure 2**  
Remove two valve to converter housing cap screws. Install two aligning studs as shown. Remove remaining cap screws. Remove control valve and gasket.



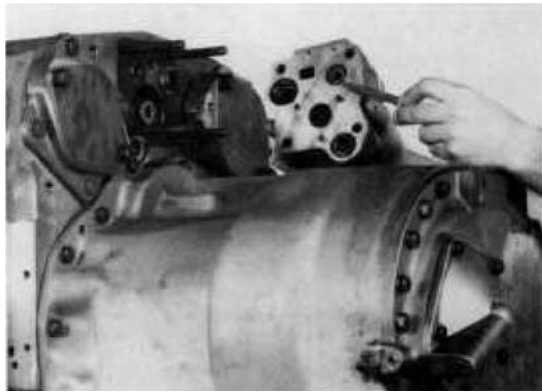
**Figure 4**  
Remove charging pump to pressure regulating valve stud nuts.



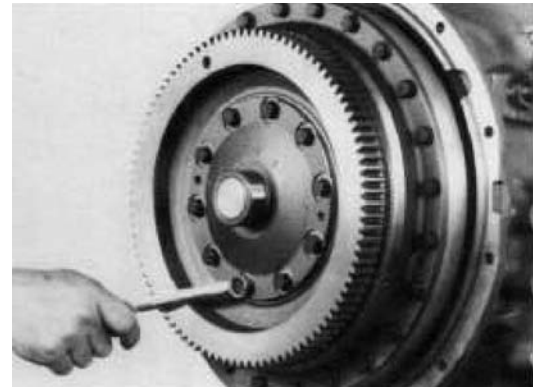
**Figure 5**  
Remove charging pump and filter adaptor assembly.



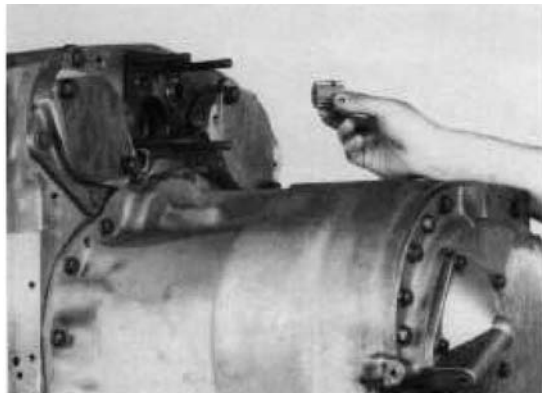
**Figure 8**  
Remove pump adaptor bolts, adaptor and gasket.



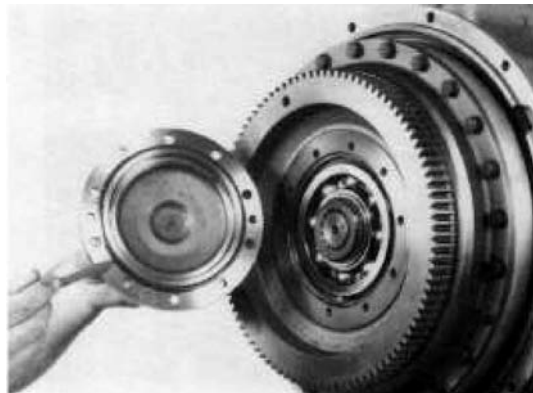
**Figure 6**  
Remove pressure regulating valve assembly and "O" rings.



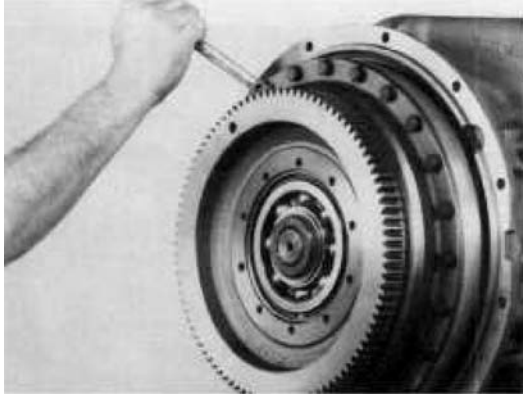
**Figure 9**  
Remove impeller cover bearing cap bolts.



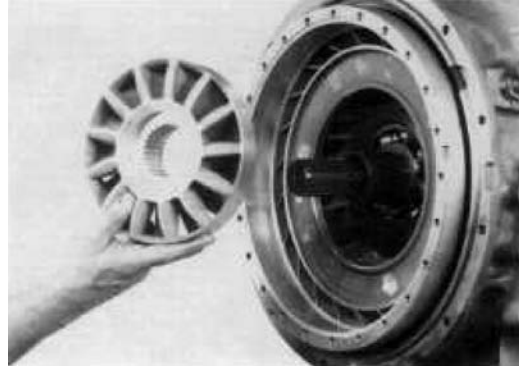
**Figure 7**  
Remove pump drive sleeve and gasket.



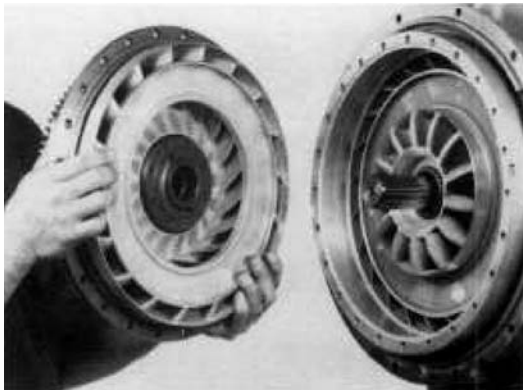
**Figure 10**  
Remove bearing cap and "O" ring.



**Figure 11**  
Remove impeller cover to impeller bolts.



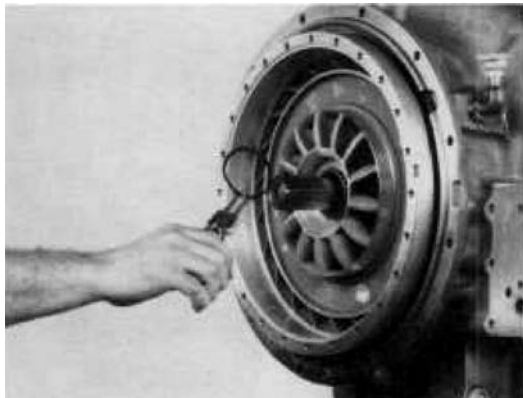
**Figure 14**  
Remove reaction member.



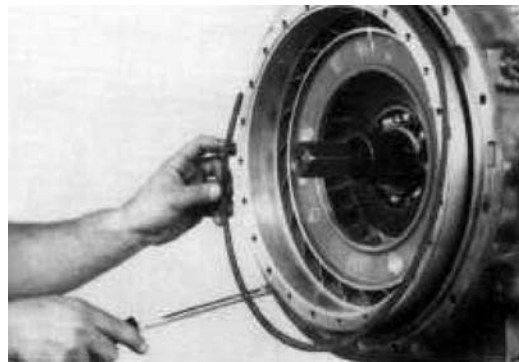
**Figure 12**  
Remove impeller cover and turbine as an assembly.



**Figure 15**  
Remove reaction member spacer.

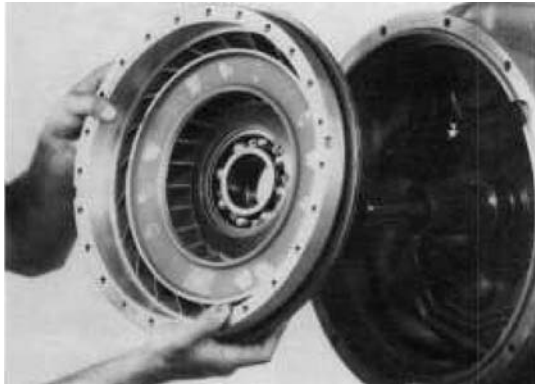


**Figure 13**  
Remove reaction member retainer ring.

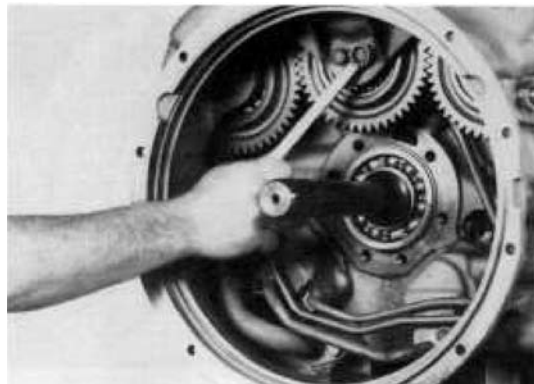


**Figure 16**  
Remove oil baffle retainer ring. Using pry slots in converter housing pry oil baffle and impeller from housing. **NOTE:** Impeller, oil baffle and impeller hub gear are removed as an assembly.

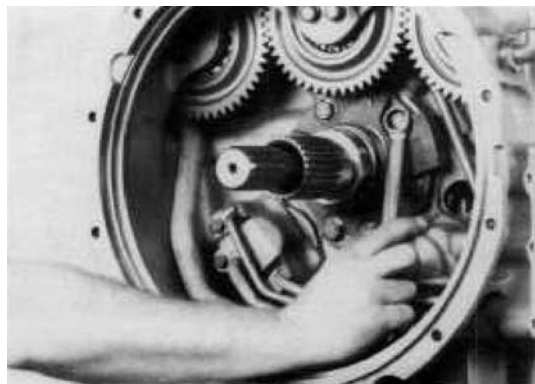




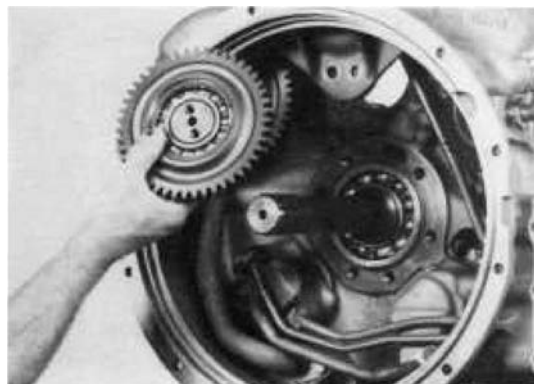
**Figure 17**  
Remove impeller assembly.



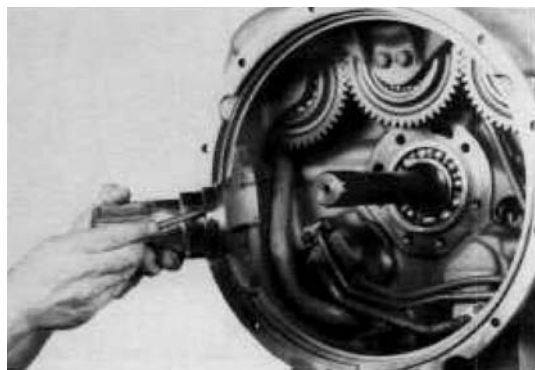
**Figure 20**  
Remove pump drive gear support bolts.



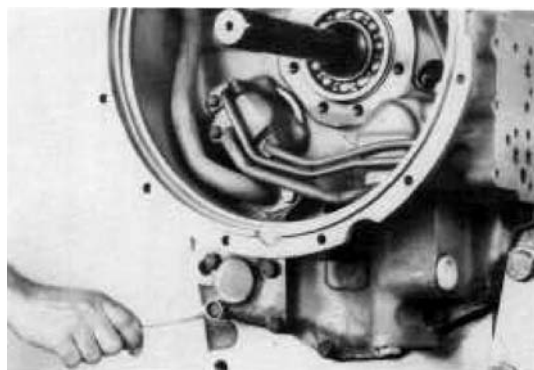
**Figure 18**  
Remove stator support to housing bolts.



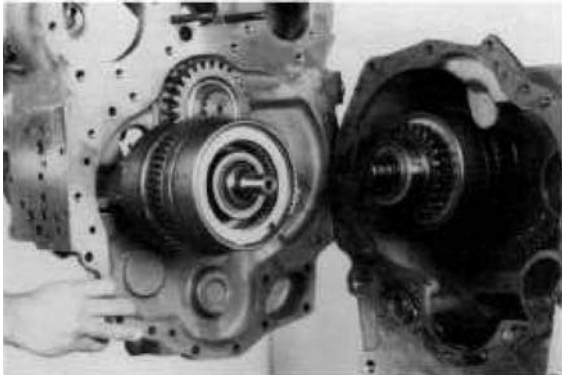
**Figure 21**  
Remove pump drive gear and bearing assemblies.



**Figure 19**  
Remove stator support. **NOTE:** Support must be turned to clear pump drive gear.

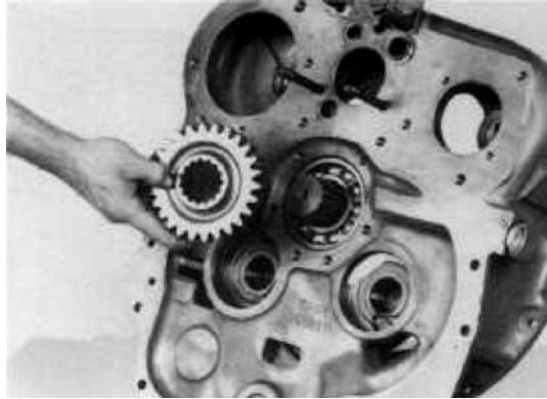


**Figure 22**  
Support converter housing with a chain fall. Remove converter housing to transmission housing bolts.



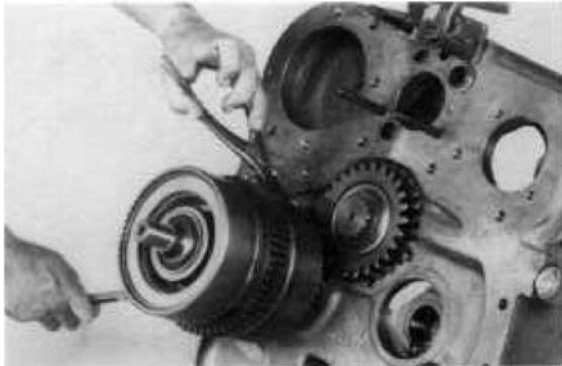
**Figure 23**

Separate the converter housing from the transmission housing. Remove gasket. **NOTE:** Forward and 2nd clutch will remain in converter housing.



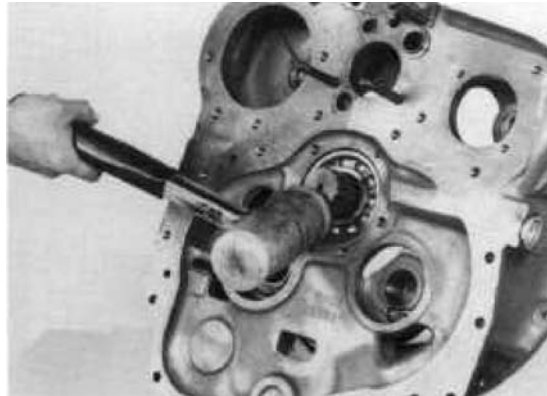
**Figure 26**

Remove turbine shaft gear.



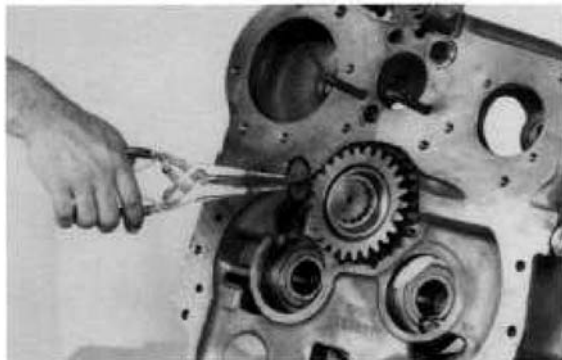
**Figure 24**

Use a spreading type snap ring pliers to spread the ears on forward clutch front bearing retainer ring. Remove forward clutch with pry bar.



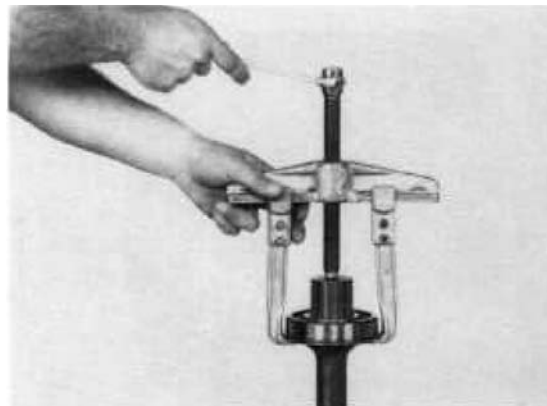
**Figure 27**

Tap turbine shaft and bearing from converter housing.



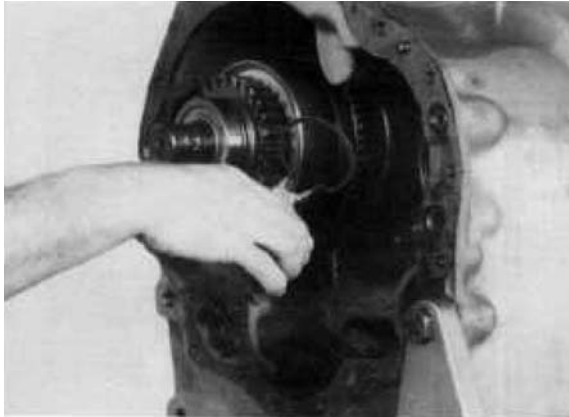
**Figure 25**

Remove turbine shaft gear retainer ring.

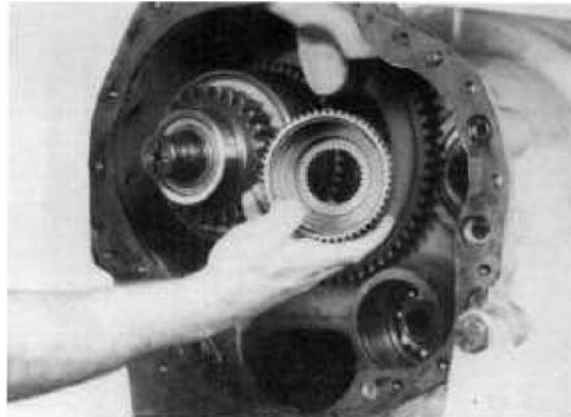


**Figure 28**

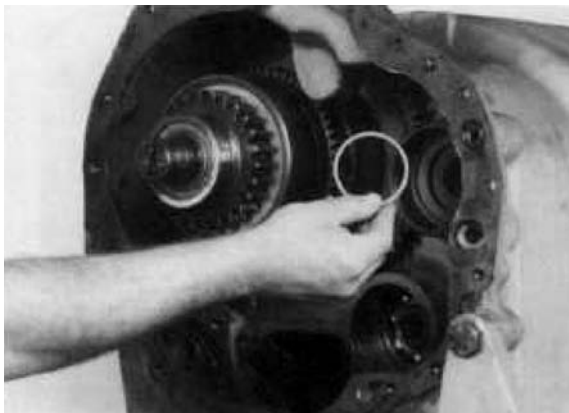
Remove bearing from turbine shaft.



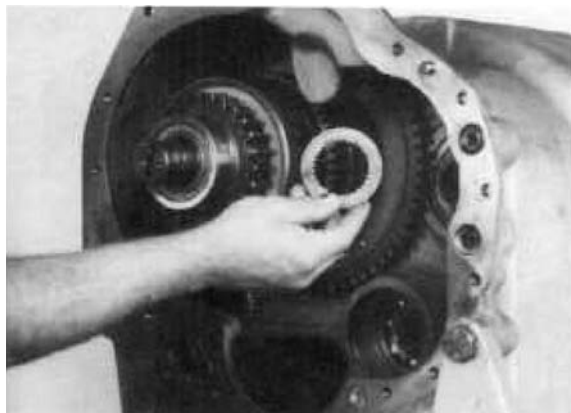
**Figure 29**  
Remove 2nd clutch disc hub retainer ring retainer.



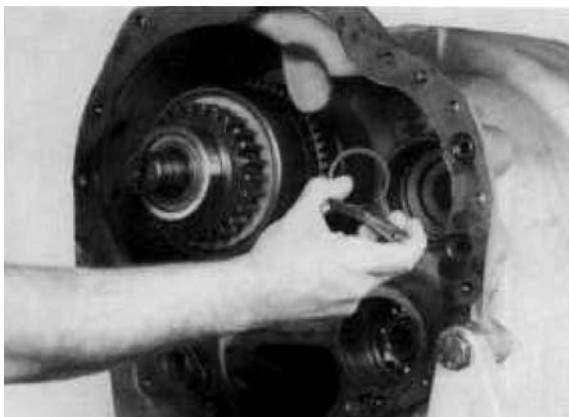
**Figure 32**  
Remove disc hub.



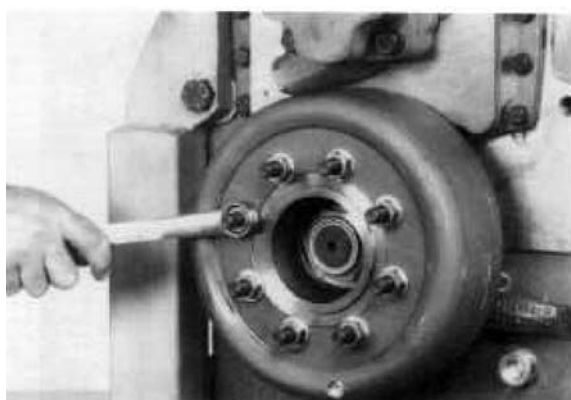
**Figure 30**  
Remove disc hub ring retainer.



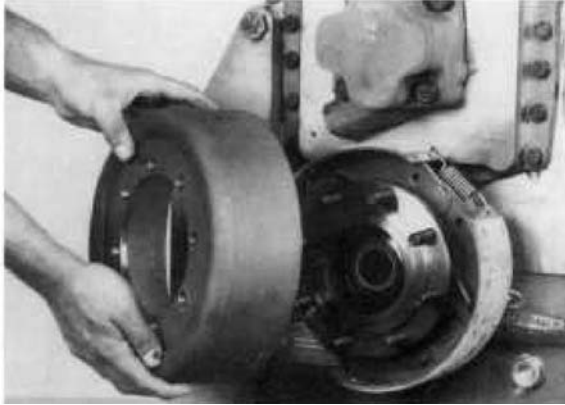
**Figure 33**  
Remove bearing and plate.



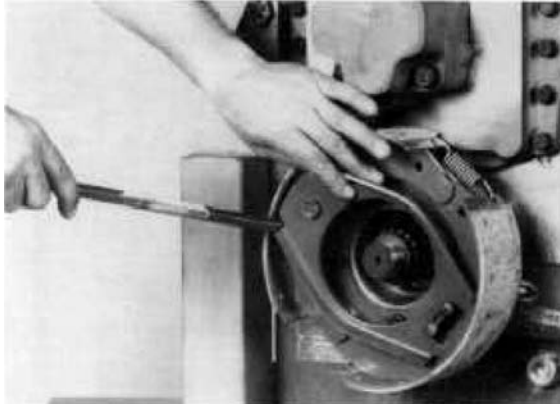
**Figure 31**  
Remove disc hub retainer ring.



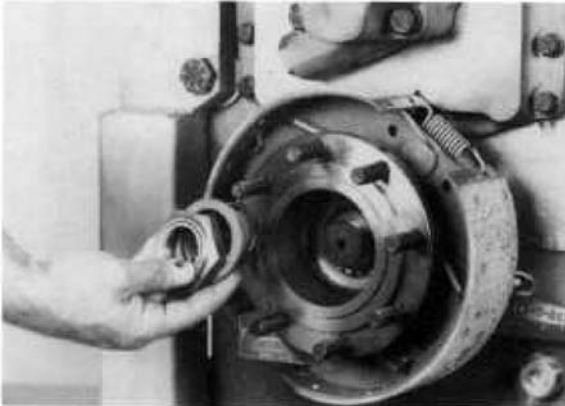
**Figure 34**  
Remove brake drum stud nuts fused to hold drum in place after drive shaft was removed.



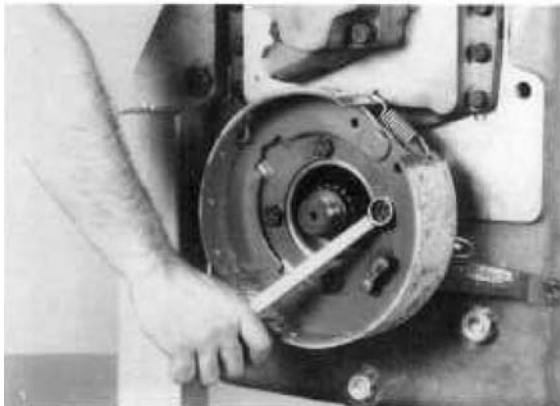
**Figure 35**  
Remove brake drum.



**Figure 38**  
Pry brake strut from brake bands.



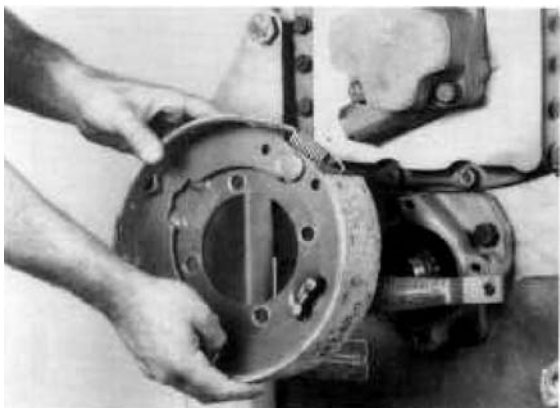
**Figure 36**  
Remove output flange nut, washer and "O" ring.



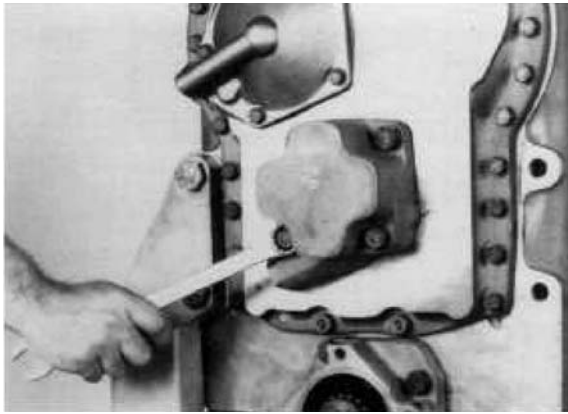
**Figure 39**  
Remove brake backing plate bolts.



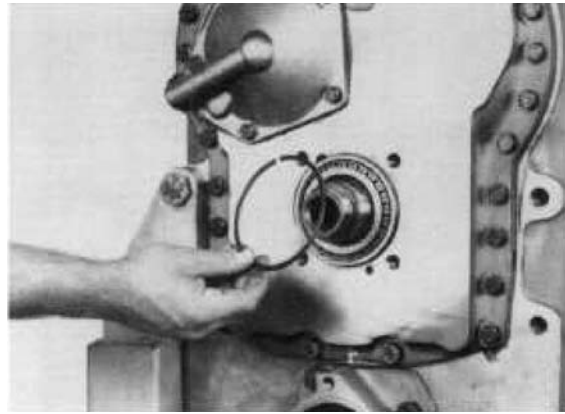
**Figure 37**  
Remove output flange.



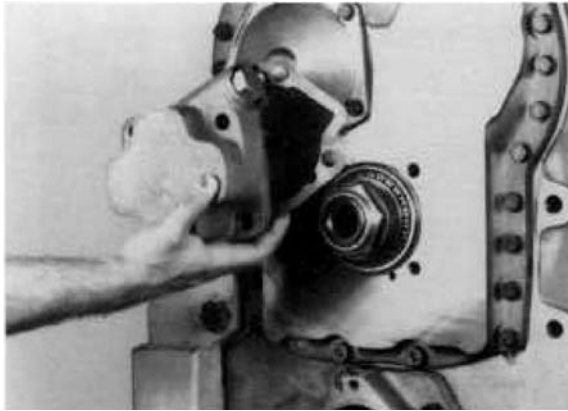
**Figure 40**  
Remove backing plate and brake band assembly.



**Figure 41**  
Remove idler shaft rear bearing cap bolts and washers.



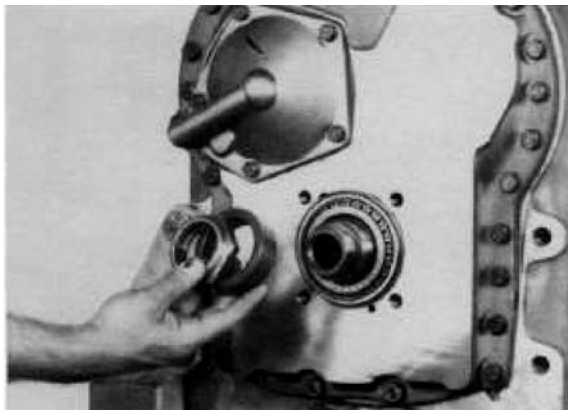
**Figure 44**  
Remove rear bearing locating ring.



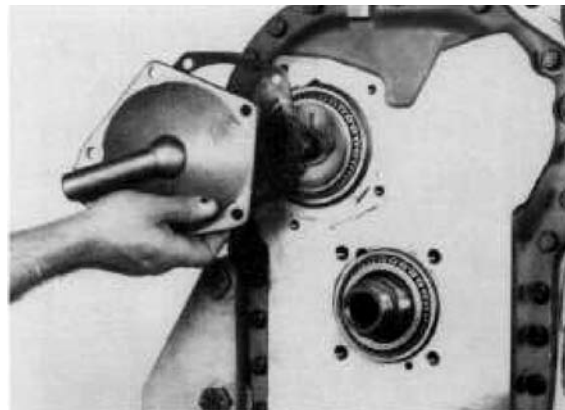
**Figure 42**  
Remove bearing cap and gasket.



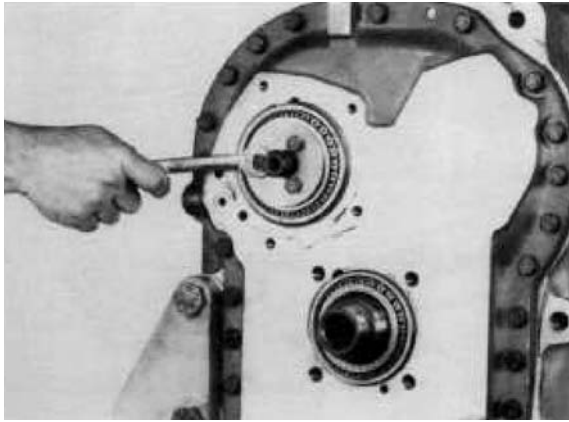
**Figure 45**  
Remove 1st speed clutch (low) rear bearing cap bolts and washers.



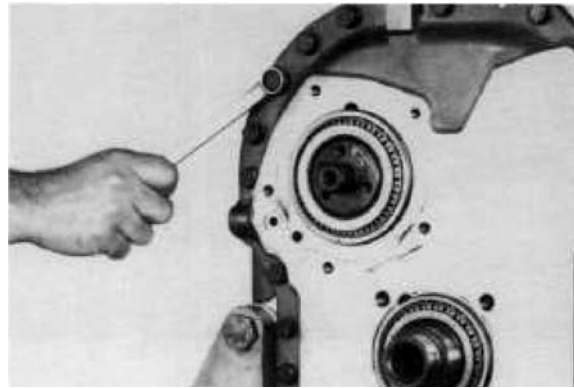
**Figure 43**  
Remove idler shaft rear bearing retainer nut and spacer.



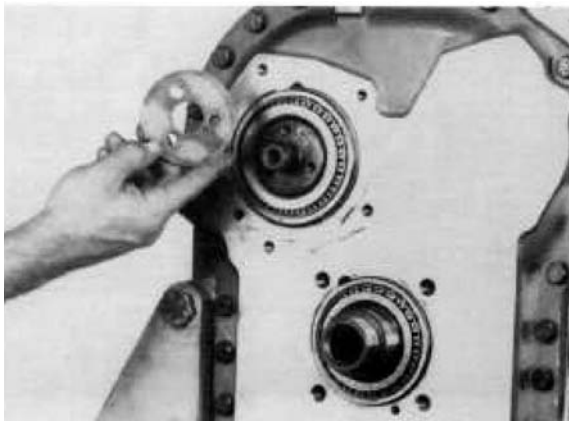
**Figure 46**  
Remove bearing cap and gasket.



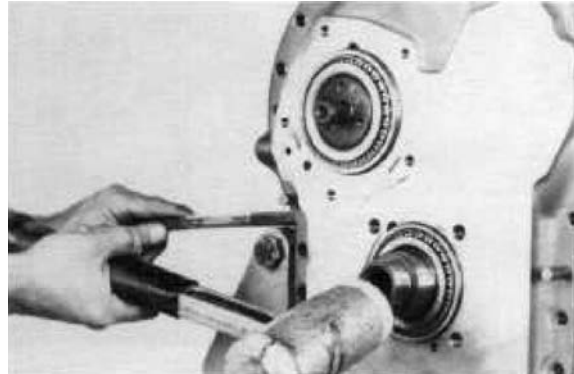
**Figure 47**  
Remove rear bearing retainer plate bolts.



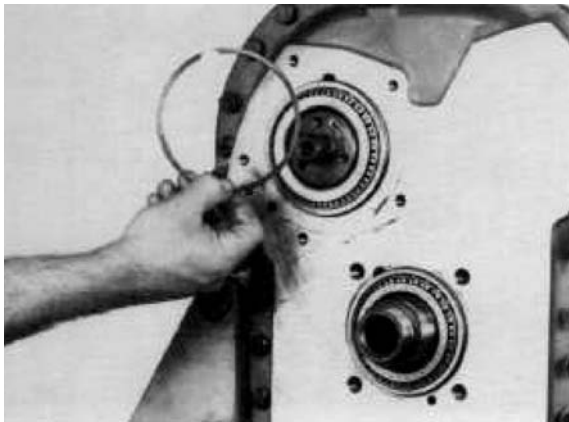
**Figure 50**  
Remove rear cover bolts and washers.



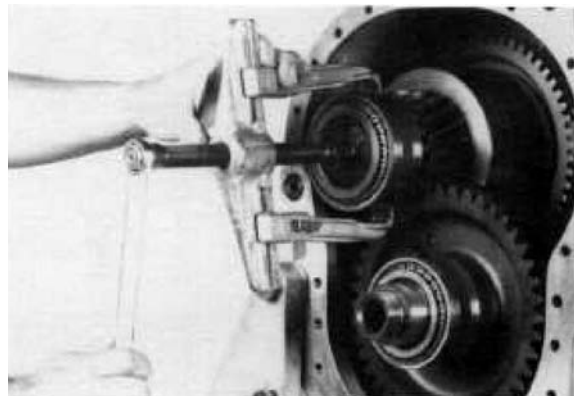
**Figure 48**  
Remove retainer plate.



**Figure 51**  
Using pry slots provided, pry cover from transmission housing tapping on 1st speed clutch and idler shaft to allow cover to be removed without shaft binding. **NOTE:** The use of alignment studs will facilitate cover removal.

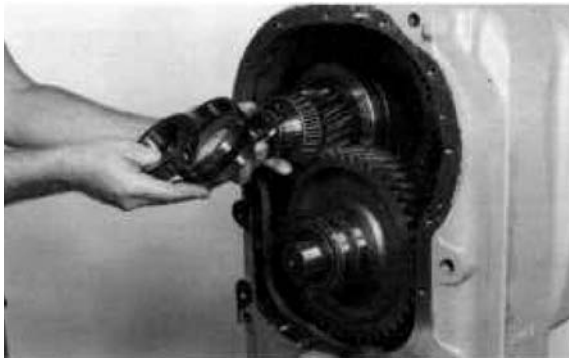


**Figure 49**  
Remove bearing locating ring.



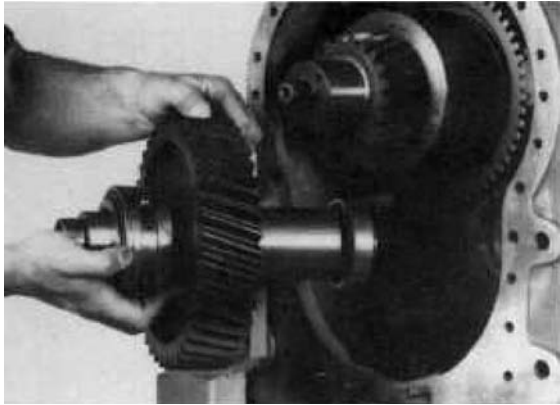
**Figure 52**  
Remove 1st speed clutch double bearing cup, outer taper bearing and spacer.





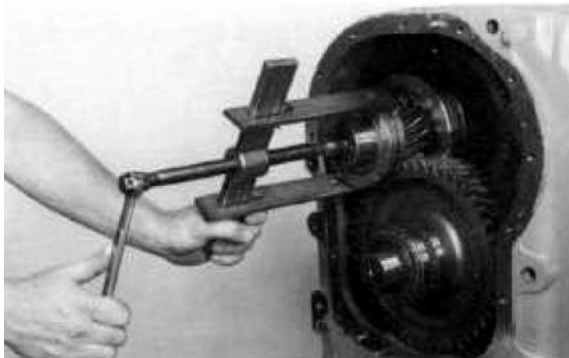
**Figure 53**

**CAUTION:** Outer cone, double bearing cup, spacer and inner bearing cone are replaced as a set.



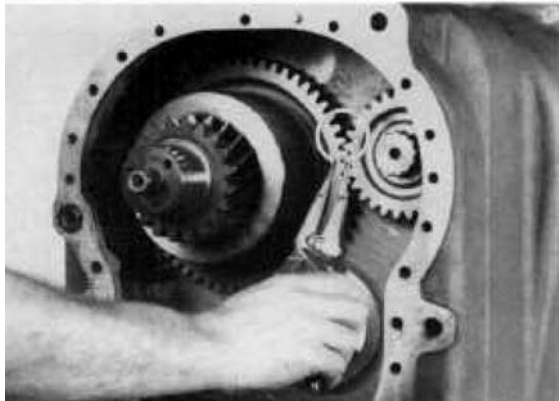
**Figure 55**

Remove idler shaft assembly. **NOTE:** The 6 speed transmission will have two gears and a heavier front bearing.



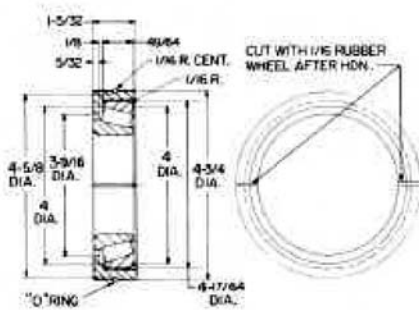
**Figure 54**

Remove low clutch inner bearing cone. **NOTE:** To remove the inner cone bearing without damage; a special bearing puller must be made (see diagram Fig. 54-A1 or the outer cage and rollers may be pulled from the bearing inner race and the inner race can be removed after the low clutch assembly has been removed from the transmission. See caution in Figure 53.



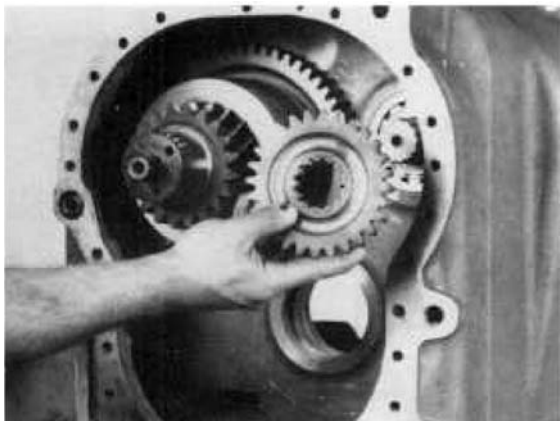
**Figure 56**

Remove 1st speed clutch drive gear retainers.



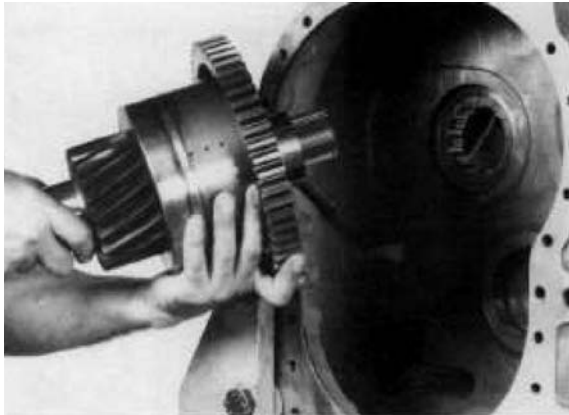
**Figure 54-A**

A timken bearing cup, No. 29520 must be used with the above bearing puller.

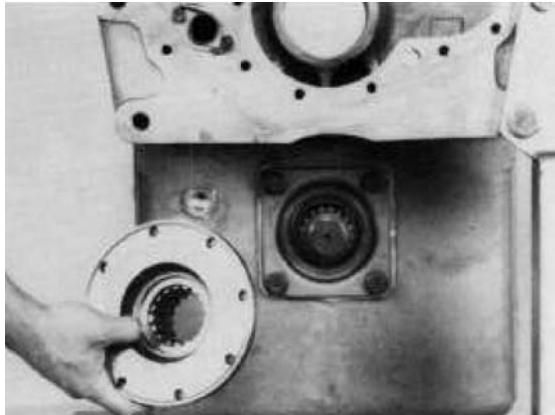


**Figure 57**

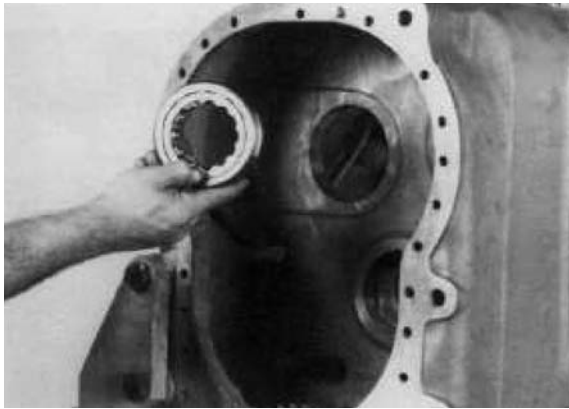
Remove drive gear.



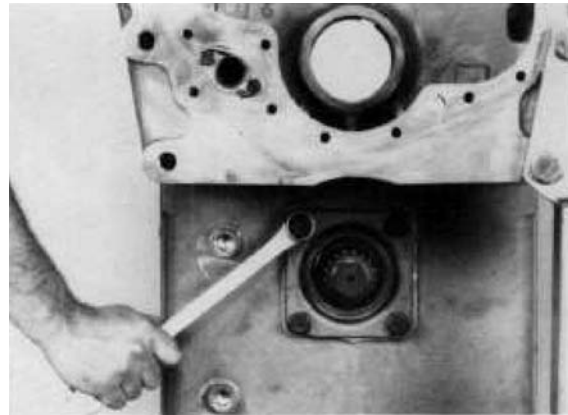
**Figure 58**  
Remove 1st speed clutch assembly.



**Figure 61**  
Remove front output flange nut, washer, "O" ring and flange. See 6 speed section for range shift output shaft removal.



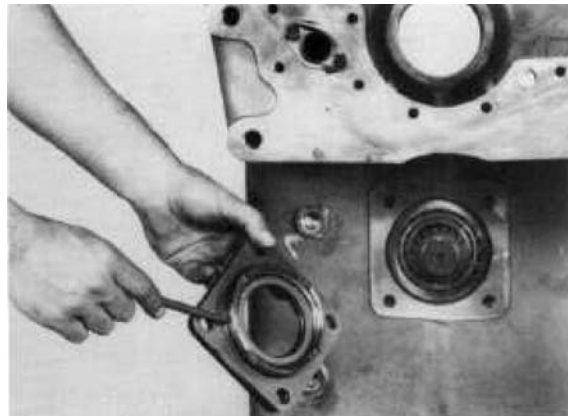
**Figure 59**  
Remove 1st speed front bearing.



**Figure 62**  
Remove output shaft front bearing cap bolts and washers.

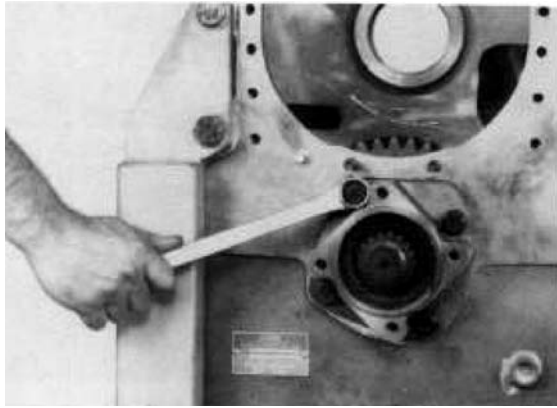


**Figure 60**  
Remove reverse and 3rd clutch assembly.

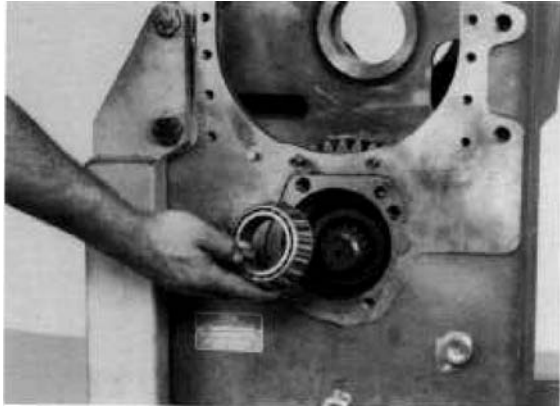


**Figure 63**  
Remove bearing cap, "O" ring and shims.

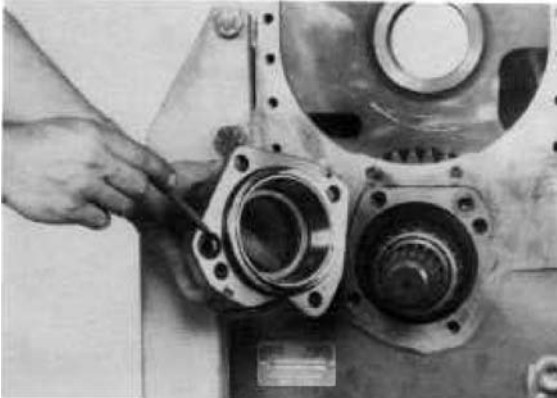




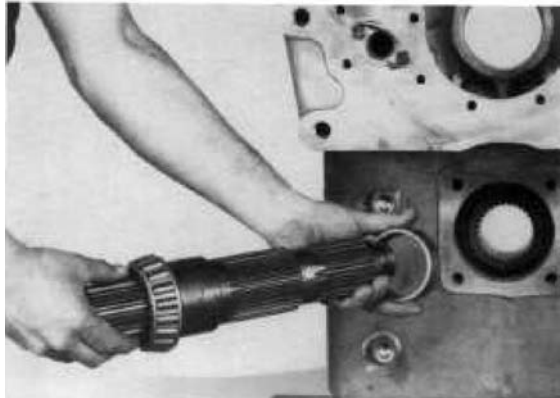
**Figure 64**  
Remove output shaft rear bearing cap bolts and washers.



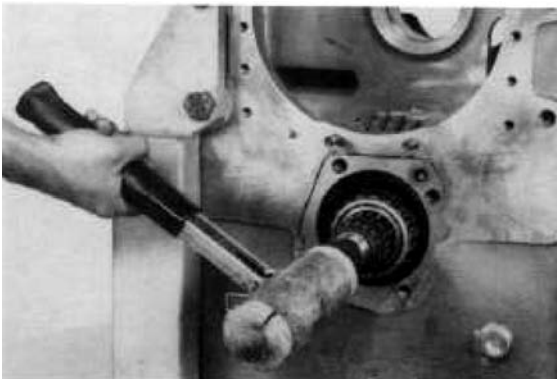
**Figure 67**  
Remove rear taper bearing.



**Figure 65**  
Remove bearing cap and "O" rings.



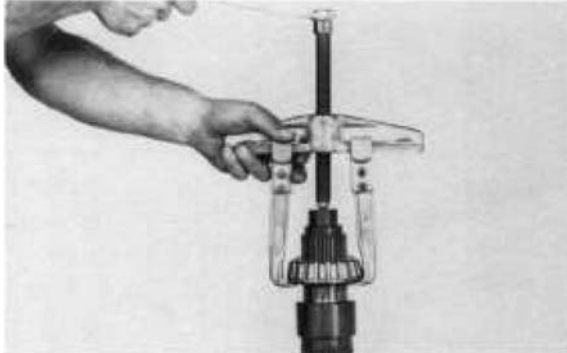
**Figure 68**  
Remove output shaft, gear spacer and front taper bearing.



**Figure 66**  
Block output gear. Push or drive output shaft through taper bearing and output gear.

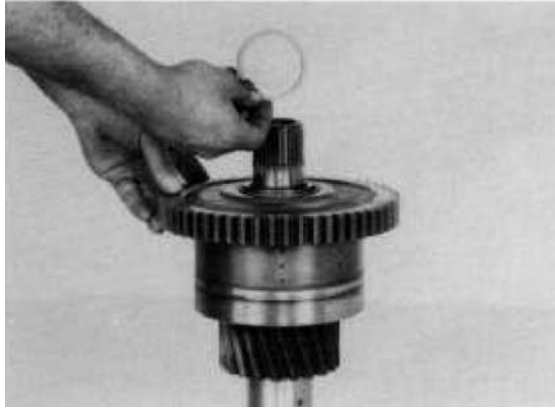


**Figure 69**  
Remove output gear.



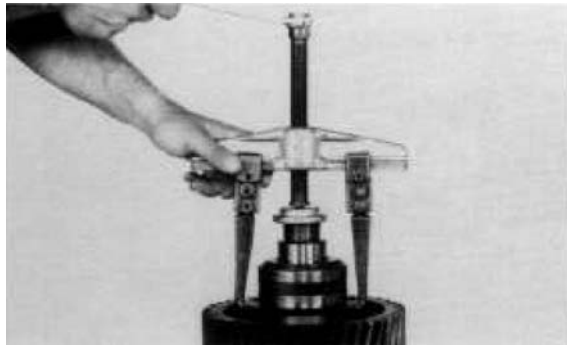
**Figure 70**

Remove front bearing.



**Figure 73**

Remove taper bearing retainer ring retainer.



**Figure 71**

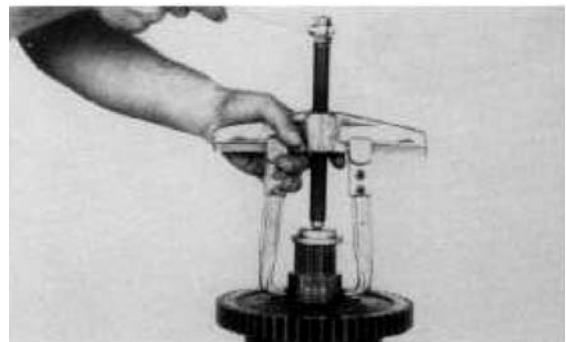
If idler shaft, idler gear or rear bearing are to be replaced, remove bearing and gear. Turn shaft over and remove the front bearing retainer ring and bearing.



**Figure 74**

Remove bearing retainer ring.

**1ST SPEED CLUTCH (LOW)  
DISASSEMBLY AND REASSEMBLY  
DISASSEMBLY**



**Figure 72**

Remove clutch assembly front bearing inner race.



**Figure 75**

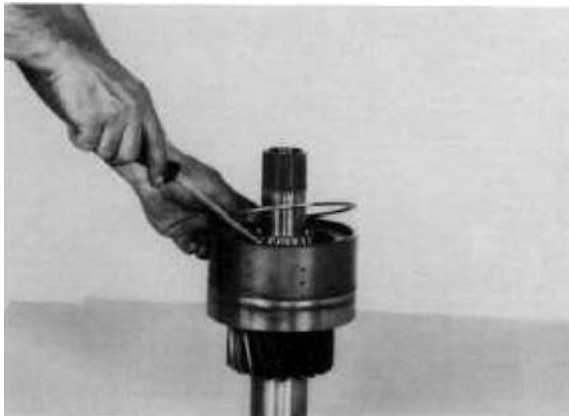
Remove 1st speed gear and outer taper bearing.



**Figure 76**  
Remove taper bearing spacer.



**Figure 79**  
Remove inner and outer clutch discs.



**Figure 77**  
Remove clutch end plate retainer ring.



**Figure 80**  
Remove inner taper bearing.



**Figure 78**  
Remove end plate.



**Figure 81**  
Remove piston return disc spring retainer ring retainer washer.



**Figure 82**  
Remove return disc spring retainer ring.



**Figure 83**  
Remove piston return disc spring. **NOTE:** Disc springs in the low clutch are different than springs in the forward and reverse clutch. Do not mix low clutch springs with forward and reverse springs (see note at top of page). Non modulated units will have return springs in forward & reverse clutches.



**Figure 84**  
Remove return spring to piston spacer. Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

**See cleaning and inspection page.**

**NOTE:** Each disc spring assembly is made up of selected springs to precisely match each part within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this imbalance may adversely affect overall life of springs. The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

**1ST SPEED CLUTCH REASSEMBLY**



**Figure 85**  
Install clutch piston outer seal ring.



**Figure 86**  
Install clutch piston inner seal ring. Install piston into clutch drum. Use caution as not to damage seal rings.



**Figure 87**

Install piston spacer.



**Figure 90**

Position ring retainer over retainer ring.



**Figure 88**

See **NOTE** in figure 83. Install disc springs. First spring with large diameter toward spacer. Alternate (5) five washers. See page 59, Figure C.



**Figure 91**

Install one steel disc.



**Figure 89**

Position return spring retainer ring on clutch shaft. Compress disc springs and install retainer ring.



**Figure 92**

Install one friction disc. **NOTE:** The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.



**Figure 93**

Install clutch disc end plate.



**Figure 96**

Position taper bearing spacer on shaft.



**Figure 94**

Install end plate retainer ring.



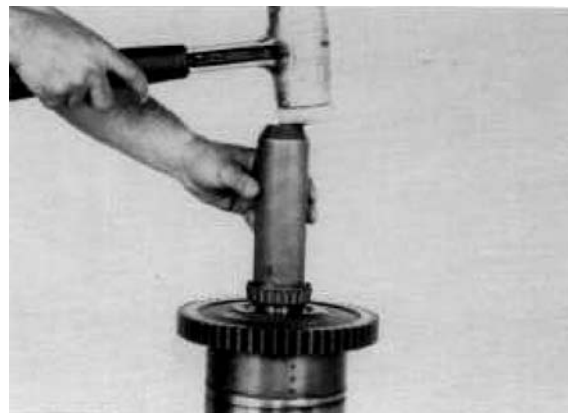
**Figure 97**

Install 1st gear into clutch drum. Align splines on 1st gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.



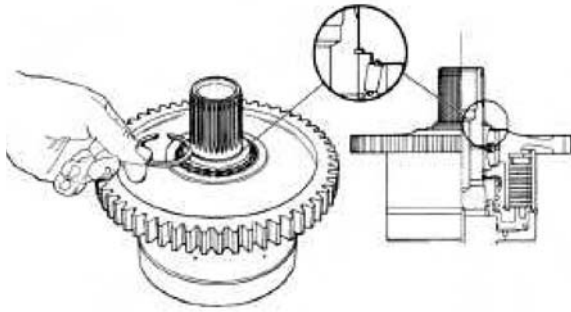
**Figure 95**

Install inner clutch gear taper bearing.



**Figure 98**

Install outer taper bearing.



**Figure 99**

Install low clutch taper bearing retainer ring.

**NOTE:** Retainer ring is selected at assembly for proper thickness. A snap ring kit is available. Select the thickest of the three rings in the kit that can be fitted into the snap ring groove to assure a proper taper bearing tightness. Check ring as shown for tight ring to bearing fit.



**Figure 102**

Position front bearing on clutch shaft inner race. **NOTE:** Bearing could be installed in transmission case before installing clutch.



**Figure 100**

Position ring retainer over retainer ring.



**Figure 101**

Install clutch shaft front bearing inner race with large diameter of race down.

**REVERSE AND 3RD CLUTCH  
DISASSEMBLY AND REASSEMBLY**

**DISASSEMBLY  
(Reverse being disassembled)**



**Figure 103**

Remove clutch shaft piston rings. **NOTE:** Some units will have Teflon piston rings and expander springs, see page 79 for proper piston ring installation.



**Figure 104**  
Remove front bearing retainer ring.



**Figure 107**  
Remove front bearing.



**Figure 105**  
Remove front bearing end plate.



**Figure 108**  
Pry front bearing inner race up far enough to use a bearing puller.



**Figure 106**  
Remove end plate lock ball.

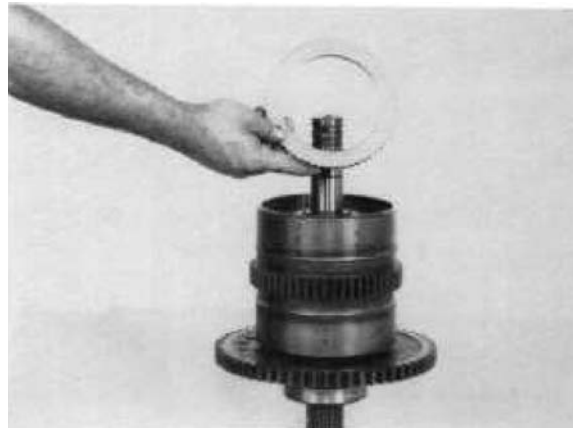


**Figure 109**  
Remove bearing inner race.





**Figure 110**  
Remove clutch driven gear outer bearing retainer ring.



**Figure 113**  
Remove end plate.



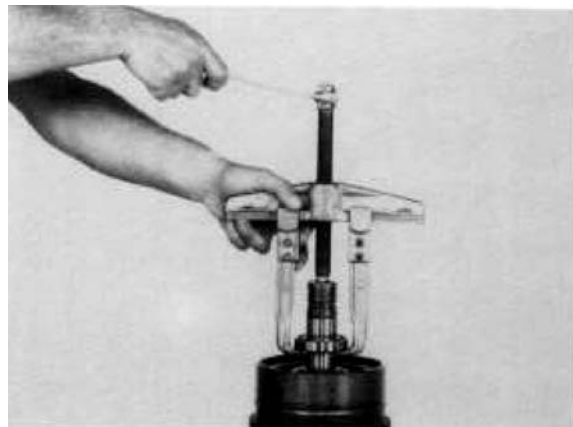
**Figure 111**  
Remove clutch gear and outer bearing.



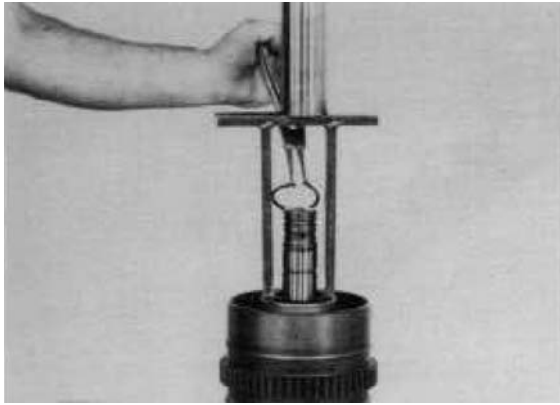
**Figure 114**  
Remove inner and outer clutch discs.



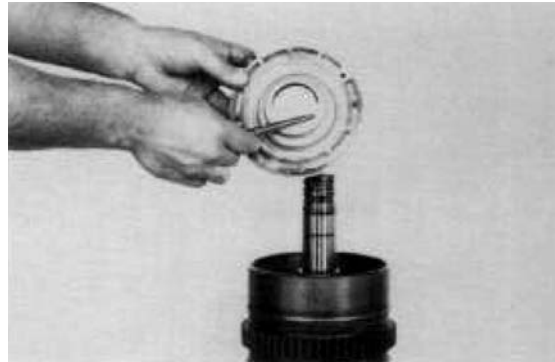
**Figure 112**  
Remove clutch disc end plate retainer ring.



**Figure 115**  
Remove inner bearing.



**Figure 116**  
Compress piston return spring. Remove spring retainer ring.

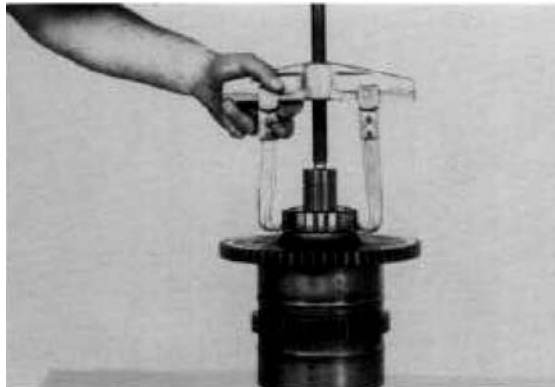


**Figure 119**  
Remove clutch piston.

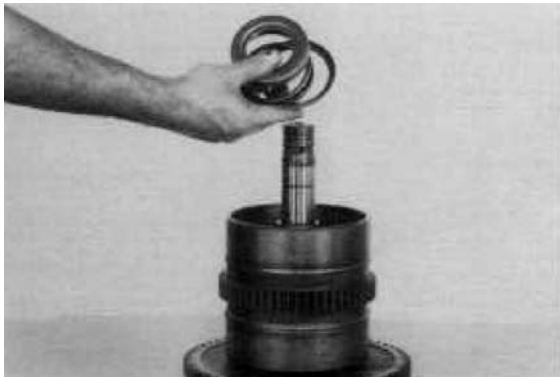
**3RD SPEED CLUTCH DISASSEMBLY**



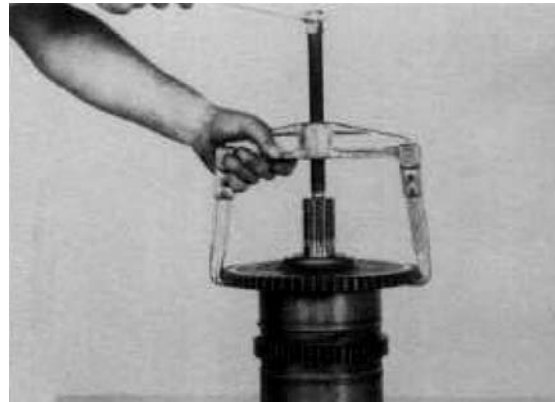
**Figure 117**  
Remove retainer ring retaining washer.



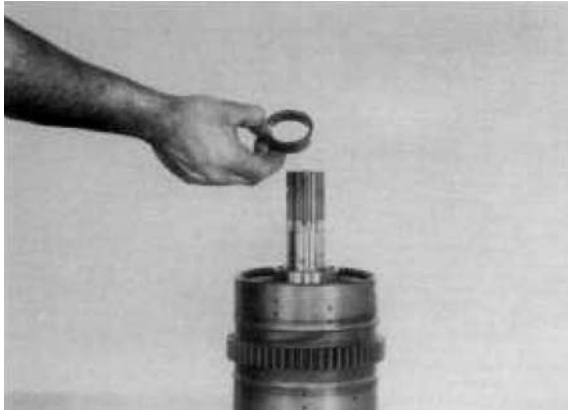
**Figure 120**  
Remove 3rd speed clutch shaft bearing.



**Figure 118**  
Remove piston return spring and retainers. **NOTE:** Modulated forward end reverse clutches will have piston return disc springs. (See note on page 15, Figure 83.)



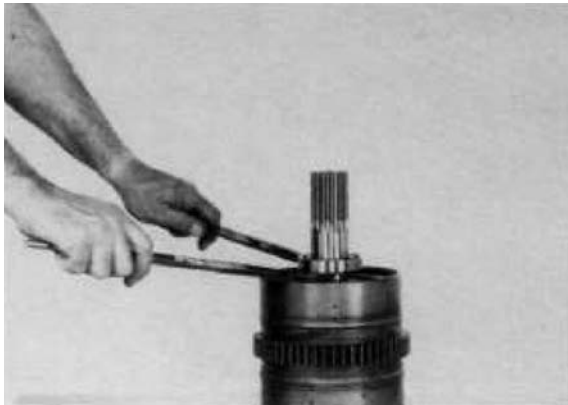
**Figure 121**  
Remove 3rd speed gear and outer bearing.



**Figure 122**  
Remove clutch gear outer and inner bearing spacer.



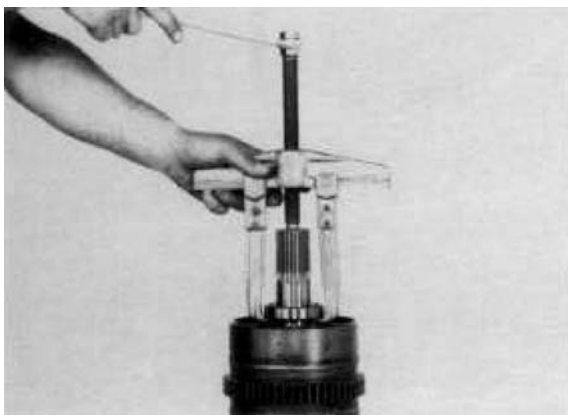
**Figure 125**  
Remove clutch disc end plate retainer ring.



**Figure 123**  
Pry inner bearing up far enough to use a bearing puller.



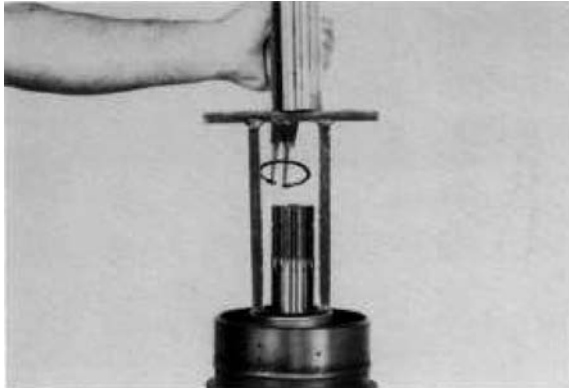
**Figure 126**  
Remove end plate.



**Figure 124**  
Remove inner bearing.



**Figure 127**  
Remove inner and outer clutch discs.



**Figure 128**  
Compress piston return spring. Remove return spring retainer ring.



**Figure 131**  
Remove clutch piston.

**See cleaning and inspection page.**

**3RD SPEED CLUTCH REASSEMBLY**



**Figure 129**  
Remove retainer ring retaining washer.



**Figure 132**  
Install clutch piston inner and outer seal rings. Install clutch piston in clutch drum, use caution as not to damage seal rings.



**Figure 130**  
Remove return spring retainers and spring.



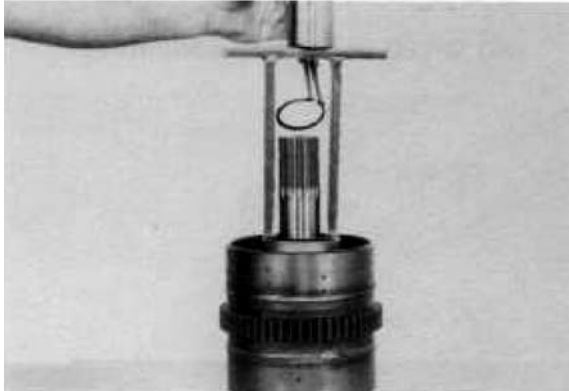
**Figure 133**  
Position the inner return spring retainer, the return spring and the outer spring retainer on clutch shaft.



**Figure 134**  
Position return spring retainer ring retaining washer on clutch shaft.



**Figure 137**  
Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed in friction.



**Figure 135**  
Compress return spring and install retainer ring being certain ring is in full position in retaining washer and ring groove.



**Figure 138**  
Install clutch disc end plate.



**Figure 136**  
Install one steel disc.



**Figure 139**  
Install end plate retainer ring.



**Figure 140**  
Install clutch gear inner bearing. **NOTE:** The inner bearing does not have a bearing shield.



**Figure 143**  
Install clutch gear outer bearing. **NOTE:** Outer bearing has a shield in it, this shield must be up.

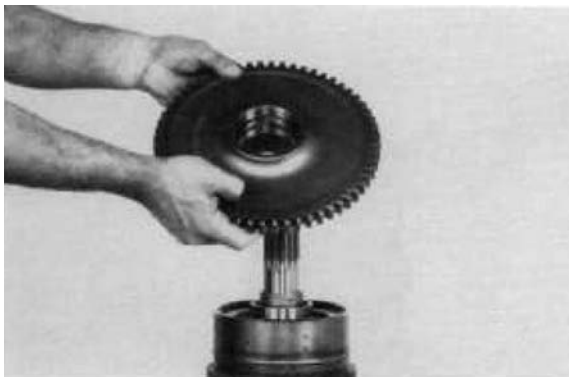


**Figure 141**  
Install clutch gear inner and outer bearing spacer.



**Figure 144**  
Install 3rd speed clutch shaft rear bearing. **NOTE:** Bearing outer diameter locating ring must be down.

**REVERSE CLUTCH REASSEMBLY**



**Figure 142**  
Install clutch gear into clutch drum. Align splines on clutch gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

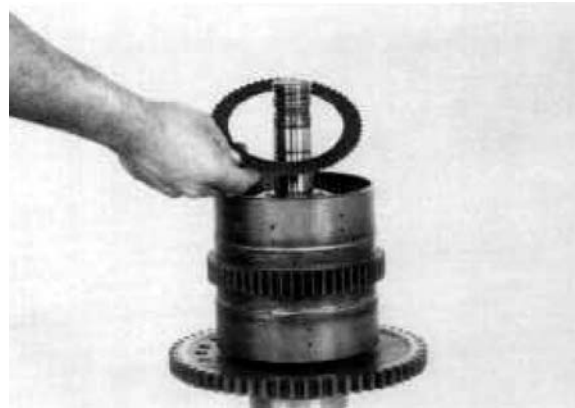


**Figure 145**  
Install clutch piston inner and outer oil seal rings. Install clutch piston in clutch drum, use caution as not to damage seal rings.



**Figure 146**

Position the inner return spring retainer, the return spring and the outer spring retainer. **NOTE:** If reverse and forward clutches are modulated, assemble disc springs as shown in Figure A on page 59.



**Figure 149**

Install one steel disc.



**Figure 147**

Position return spring retainer ring retaining washer on clutch shaft.



**Figure 150**

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.



**Figure 148**

Compress return spring and install retainer ring being certain ring is in full position in retaining washer and ring groove.



**Figure 151**

Install clutch disc end plate.



**Figure 152**  
Install end plate retainer ring.



**Figure 155**  
Install clutch gear outer bearing. **NOTE:** Outer bearing has a shield in it, this shield must be down.



**Figure 153**  
Install clutch gear inner bearing. **NOTE:** This bearing does not have a shield in it.



**Figure 156**  
Install clutch gear outer bearing retainer ring.



**Figure 154**  
Install clutch gear into clutch drum. Align splines on reverse gear with internal teeth of friction discs. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.



**Figure 157**  
Install clutch shaft front bearing inner race with large diameter of race down.





**Figure 158**  
Position front bearing over bearing race.



**Figure 161**  
Install bearing retainer ring.



**Figure 159**  
Position end plate lock ball in clutch shaft.



**Figure 162**  
Install clutch shaft piston rings and expander springs as explained on page 79.

**DISASSEMBLY AND REASSEMBLY  
OF THE FORWARD AND 2ND CLUTCH  
(Forward being disassembled)**



**Figure 160**  
Install bearing end plate, aligning notch in plate with lock ball.



**Figure 163**  
Remove clutch shaft piston rings. (See note in Figure 103.)



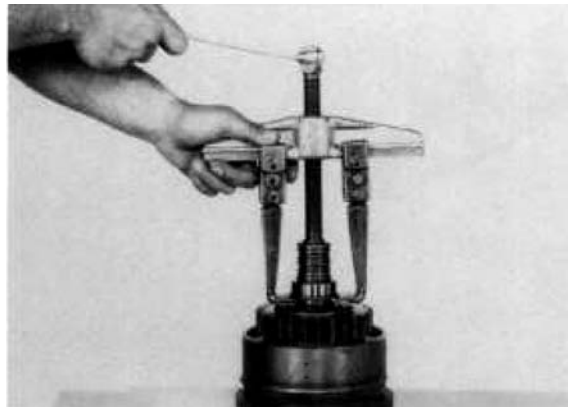
**Figure 164**  
Remove front bearing end plate retainer ring.



**Figure 167**  
Remove bearing end plate lock ball.



**Figure 165**  
Remove end plate.



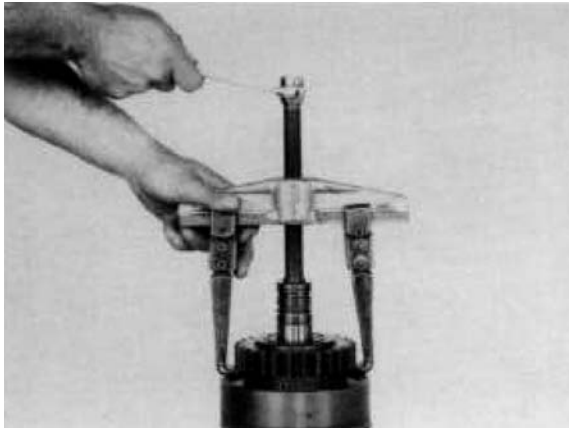
**Figure 168**  
Remove front bearing inner race.



**Figure 166**  
Remove front bearing.



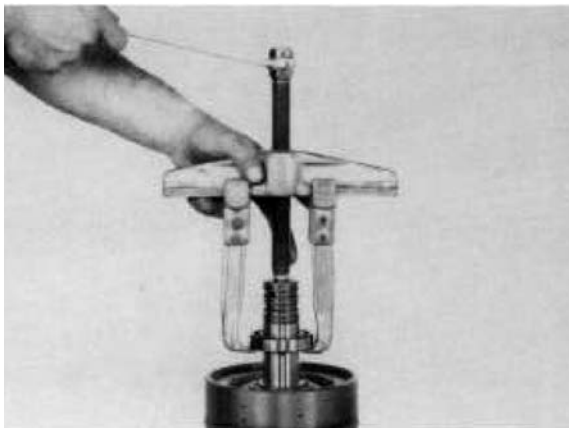
**Figure 169**  
Remove clutch gear outer bearing retainer ring.



**Figure 170**  
Remove clutch gear and outer bearing.



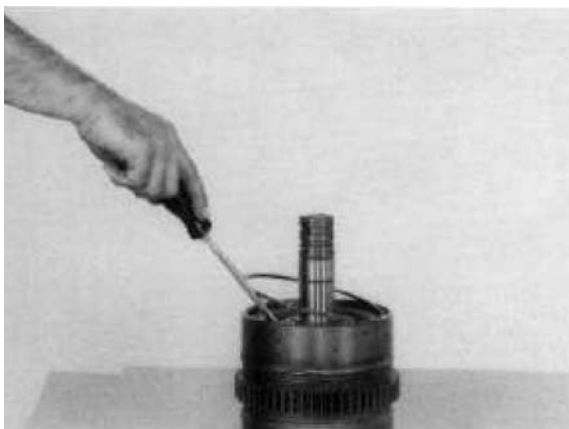
**Figure 173**  
Remove end plate.



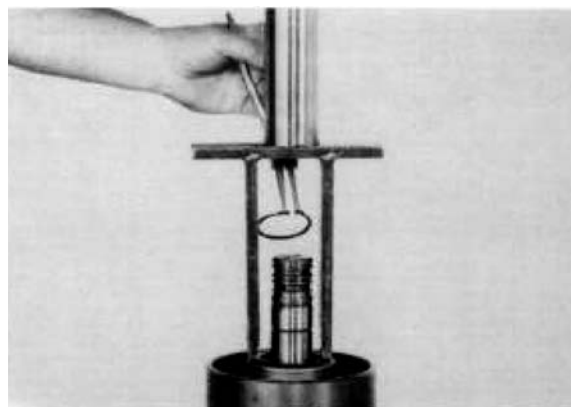
**Figure 171**  
Remove inner bearing.



**Figure 174**  
Remove inner and outer clutch discs.



**Figure 172**  
Remove clutch disc end plate retainer ring.



**Figure 175**  
Compress piston return spring. Remove return spring retainer ring.

**2ND CLUTCH DISASSEMBLY**



**Figure 176**  
Remove retainer ring retaining ring.



**Figure 179**  
Remove clutch disc end plate retainer ring.



**Figure 177**  
Remove piston return spring and retainers. See note in Figure 118.



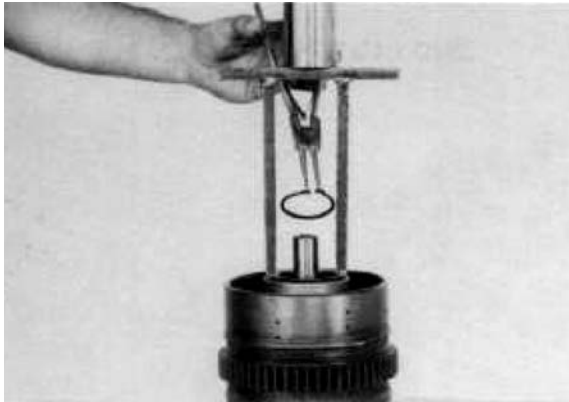
**Figure 180**  
Remove end plate.



**Figure 178**  
Remove clutch piston.



**Figure 181**  
Remove inner and outer clutch discs.



**Figure 182**  
Compress piston return spring. Remove return spring retainer ring.



**Figure 185**  
Remove clutch piston.

See cleaning and inspection page.

**2ND CLUTCH REASSEMBLY**



**Figure 183**  
Remove retainer ring retaining washer.



**Figure 186**  
Install clutch piston inner and outer seal rings. Install clutch piston in clutch drum, use caution as not to damage seal rings.



**Figure 184**  
Remove return spring retainers and spring.



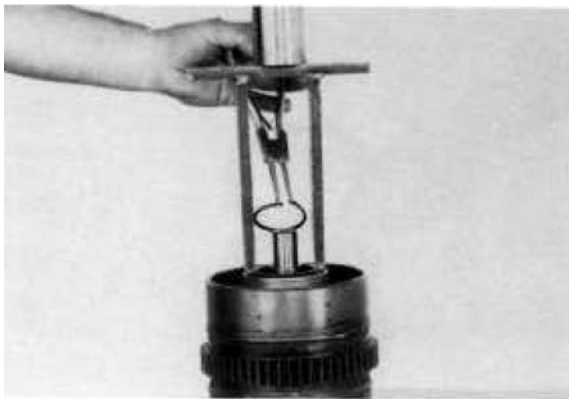
**Figure 187**  
Position the inner return spring retainer, the return spring and outer spring retainer on clutch shaft.



**Figure 188**  
Position return spring retainer ring retaining washer on clutch shaft.



**Figure 191**  
Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction



**Figure 189**  
Compress return spring and install retainer ring, being certain ring is in full position in retaining washer and ring groove.



**Figure 192**  
Install clutch disc end plate.



**Figure 190**  
Install one steel disc.

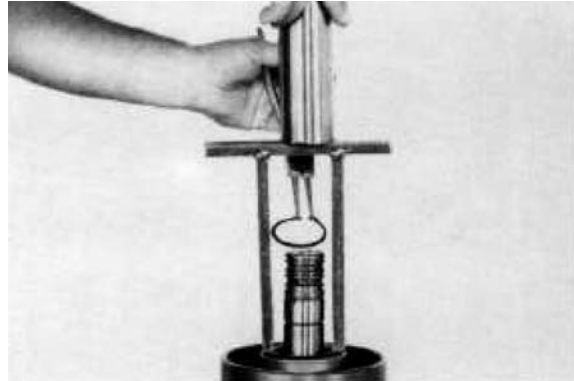


**Figure 193**  
Install end plate retainer ring.

**FORWARD CLUTCH REASSEMBLY**



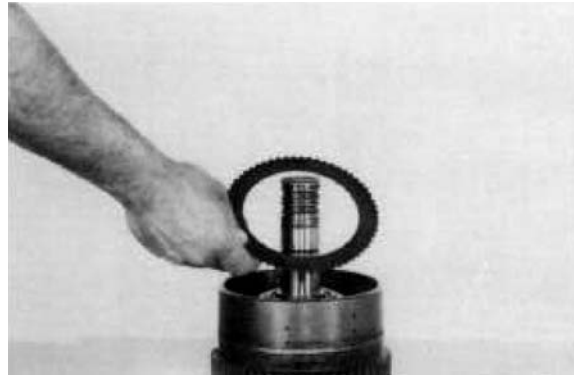
**Figure 194**  
Install clutch piston inner and outer seal rings. Install piston in clutch drum, use caution as not to damage seal rings.



**Figure 197**  
Compress return spring and install retainer ring, being certain ring is in full position in retaining washer and ring groove.



**Figure 195**  
Position the inner return spring retainer, the return spring and outer spring retainer. **NOTE: If forward and reverse clutches are modulated, assemble piston return disc springs as shown in Figure A on page 59**



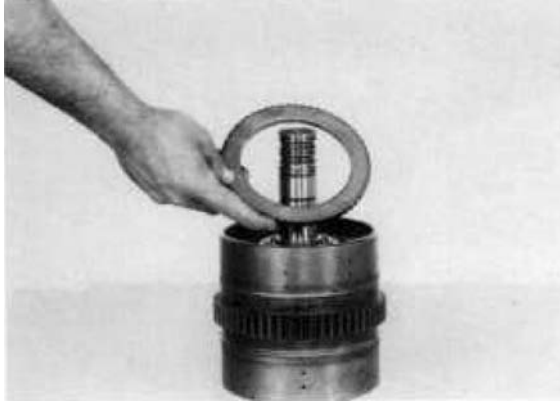
**Figure 198**  
Install one steel disc.



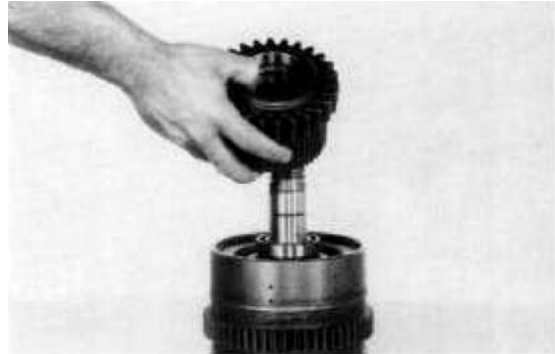
**Figure 196**  
Position return spring retainer ring retaining washer on clutch shaft.



**Figure 199**  
Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.



**Figure 200**  
Install clutch disc end plate.



**Figure 203**  
Install clutch gear into clutch drum. Align splines on clutch gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.



**Figure 201**  
Install end plate retainer ring.



**Figure 204**  
Install clutch gear outer bearing. **NOTE: Outer bearing has a shield in it, this shield must be down.**

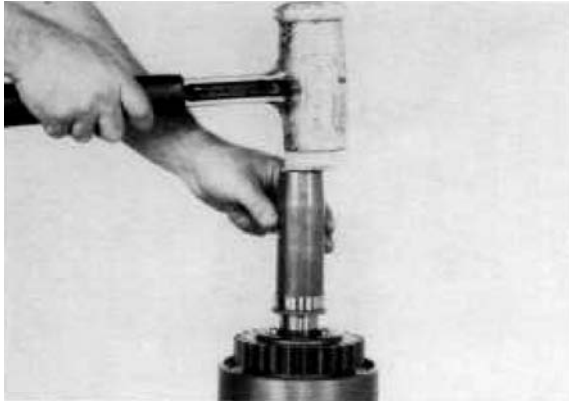


**Figure 202**  
Install clutch gear inner bearing. **NOTE: This bearing does not have a shield in it.**



**Figure 205**  
Install bearing retainer ring.





**Figure 206**

Install clutch shaft front bearing inner race with large diameter of race down.



**Figure 209**

Install bearing end plate, aligning notch in plate with lock ball.



**Figure 207**

Position end plate lock ball in clutch shaft.



**Figure 210**

Install bearing retainer ring.



**Figure 208**

Position front bearing over bearing race.

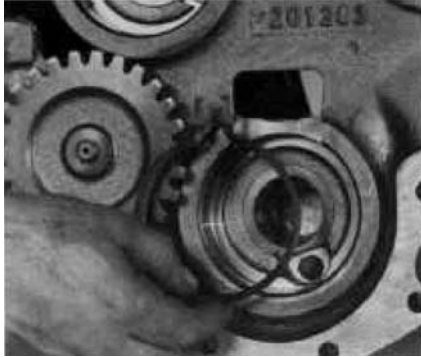


**Figure 211**

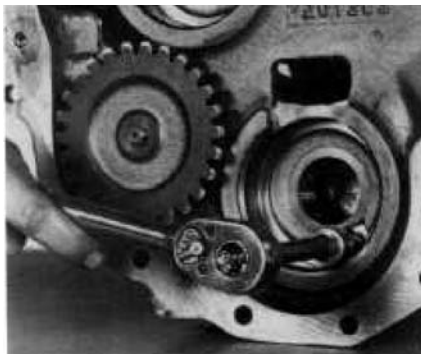
Install clutch shaft piston rings and expander springs as explained on page 79.

**OIL SEALING RING SLEEVE REMOVAL**

**NOTE:** The following photos are not of the HR Converter Housing but the sleeve removal procedure is identical.



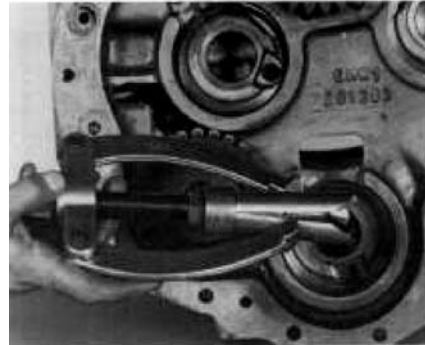
**Figure 212**  
Remove clutch front bearing locating ring.



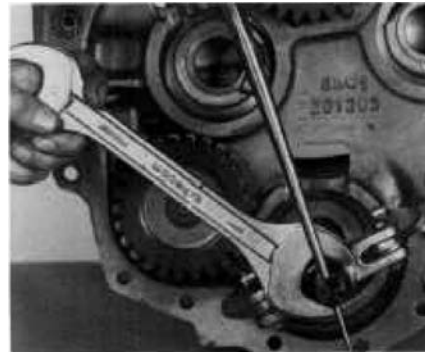
**Figure 213**  
Remove oil sealing ring sleeve retainer screw.



**Figure 214**  
Remove screw and sleeve lock.



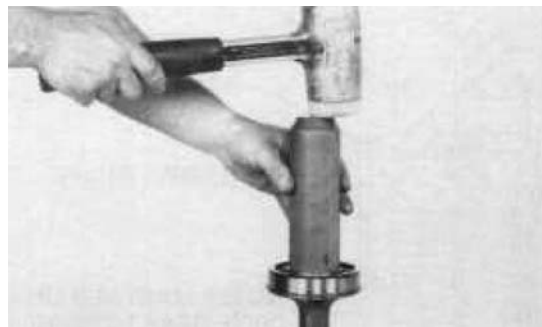
**Figure 215**  
Use a sleeve puller like the one shown.



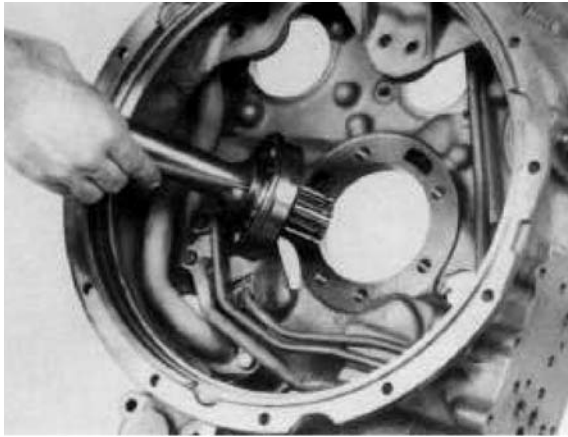
**Figure 216**  
Sleeve being removed.

**See cleaning and inspection page.**

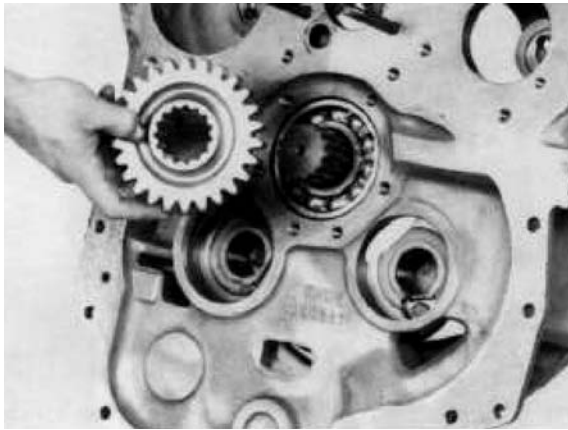
**NOTE:** When installing a new sleeve it is recommended a press or a driver be used to prevent damage to the sleeve and be sure the notch in the sleeve is aligned with sleeve lock notch. Install sleeve lock and capscrew. Tighten screw to specified torque (See torque chart.)



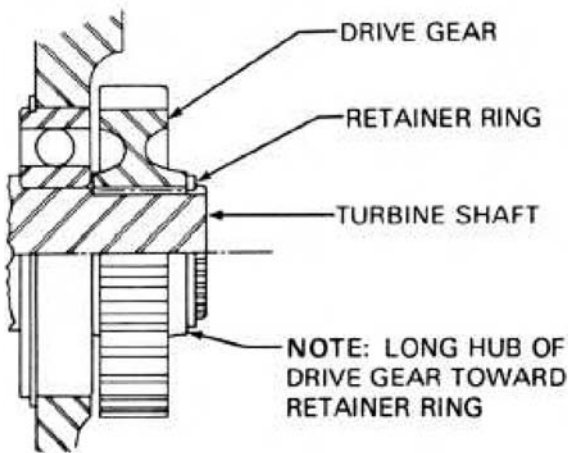
**Figure 217**  
Position new oil sealing ring on turbine shaft. Install turbine shaft bearing on shaft with bearing outer locating ring down.



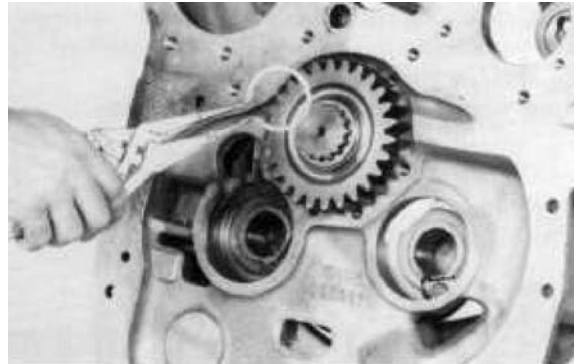
**Figure 218**  
Install turbine shaft and bearing in converter housing.



**Figure 219**  
Install turbine shaft drive gear as shown in Figure 219-A.



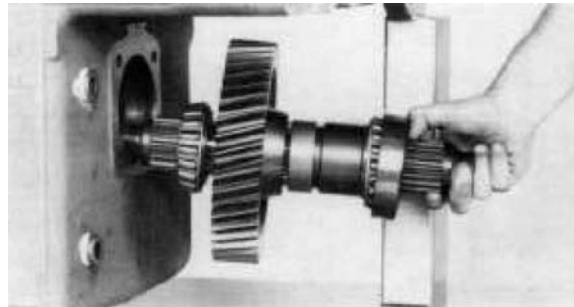
**Figure 219-A**



**Figure 220**  
Install drive gear retainer ring.

**TRANSMISSION REASSEMBLY**

SEE 6 SPEED SECTION FOR RANGE SHIFT OUTPUT SHAFT INSTALLATION.



**Figure 221**  
View of output shaft as it would be positioned in transmission case. **NOTE:** Front cone bearing shouldered on shaft with large diameter of bearing in, and long hub of gear toward gear spacer.

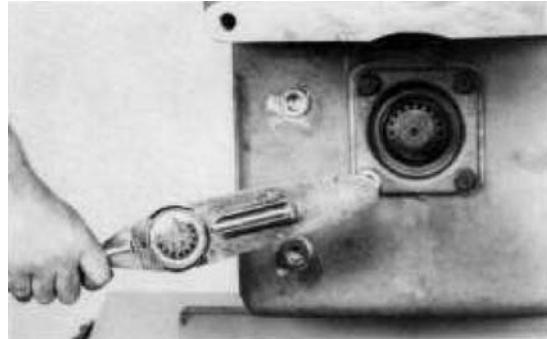


**Figure 222**  
Position output gear in transmission case with protruding hub toward front of case. See Figure 221. Insert output shaft, gear spacer and taper bearing from front of case and through output gear. Install front taper bearing cup. Block output shaft and install rear taper bearing with large diameter in.



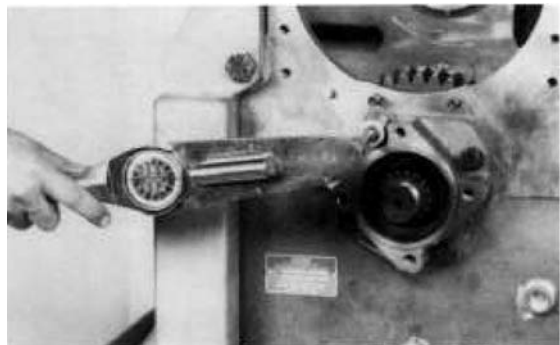
**Figure 223**

coat outer diameter of oil seal with Permatex No. 2 and press seal in bearing cap with lip of seal in. See assembly instruction sheet for seal depth. Using new "O" rings install rear output bearing cap, oil seal and taper bearing cup on transmission case. Lube opening in bearing cap must be aligned with lube opening in case.



**Figure 226**

Install front bearing cap and shims. Tighten bolts to specified torque. Tap output shaft front and rear to seat taper bearings. Loosen front bearing cap bolts.



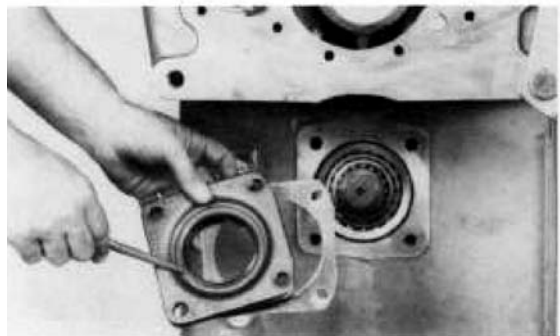
**Figure 224**

Tighten bearing cap bolts to specified torque. (See torque chart.)



**Figure 227**

Using a inch lb. torque wrench, determine the rolling torque of the output shaft and record. Tighten front bearing cap bolts to specified torque. Check rolling torque with bolts tight. Torque must be 6 to 8 inch lbs. [0.7-0.09 N-m] more than when bearing cap bolts were loose. Add or omit shims on the front bearing cap to achieve the proper preload.



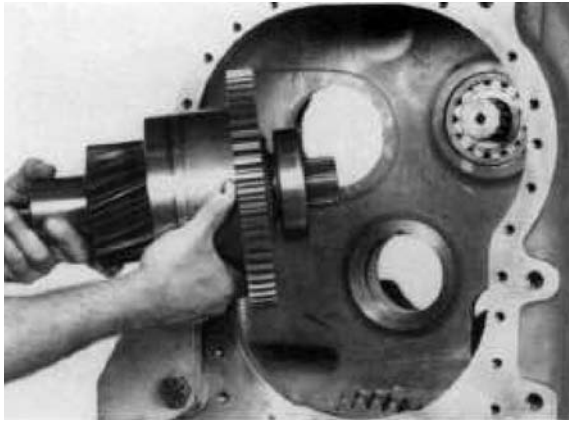
**Figure 225**

Coat outer diameter of front output oil seal with Permatex No. 2. Install seal at bearing cap with lip of seal in.



**Figure 228**

Position reverse and 3rd clutch in transmission housing.



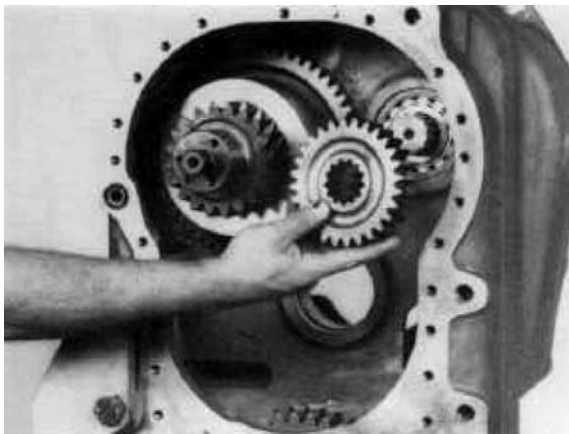
**Figure 229**

From the rear of the transmission case, install the low (1st) clutch.



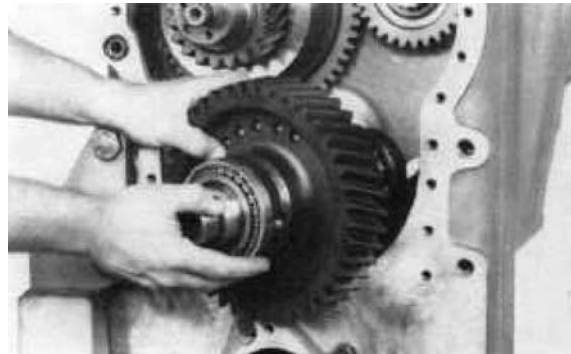
**Figure 232**

If idler shaft was disassembled, install front bearing. Install idler gear on shaft with long hub of gear up. (6 speed will have two gears on the idler shaft). Install rear inner taper bearing with large diameter of taper down. Install bearing spacer and double bearing cup with outer diameter locating ring groove up. Install outer taper bearing with large diameter of taper up. **NOTE:** Double taper bearing must be replaced as an assembly as the bearing spacer is pre-selected at factory.



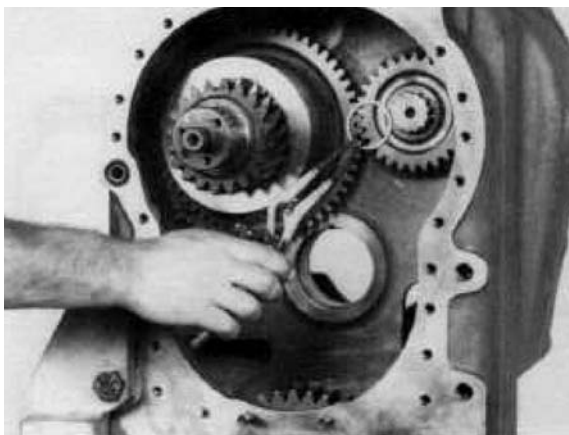
**Figure 230**

Install low (1st) speed drive gear on clutch shaft.



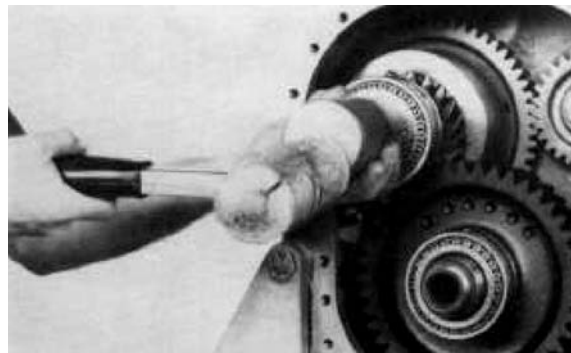
**Figure 233**

Install idler shaft assembly. **NOTE:** Lock ball in bearing cup.



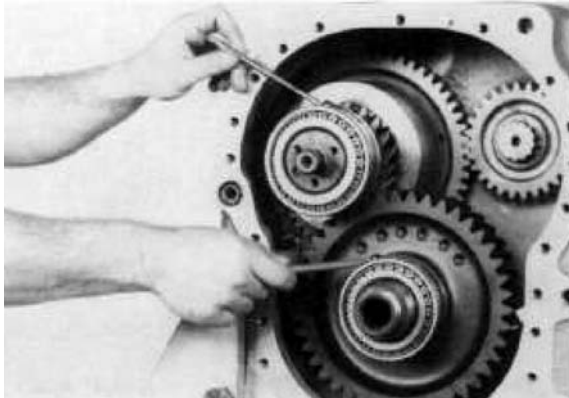
**Figure 231**

Install drive gear retainer ring.



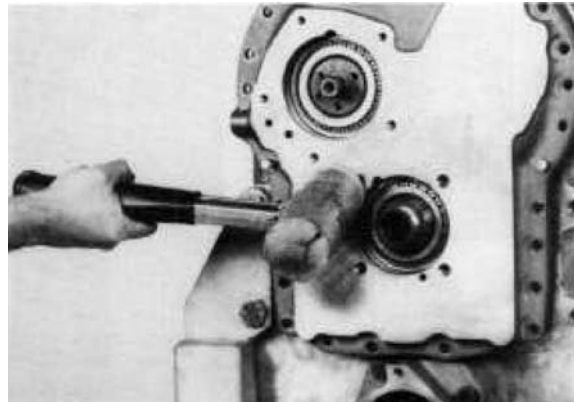
**Figure 234**

Install low (1st) clutch outer double taper bearing. **NOTE:** Locating ring groove in bearing cup to be out (to the rear).



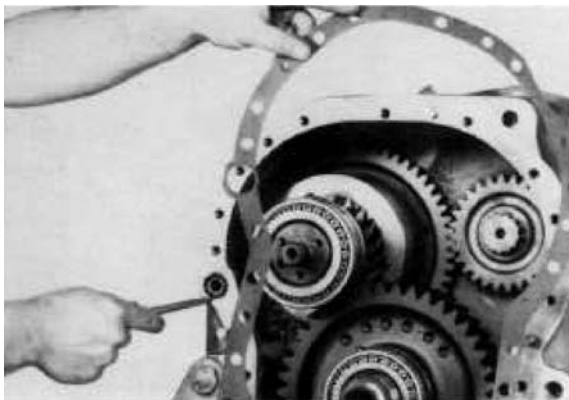
**Figure 235**

Use caution as not to lose low (1st) and idler bearing lock balls. A light coat of grease will hold lock balls in place.



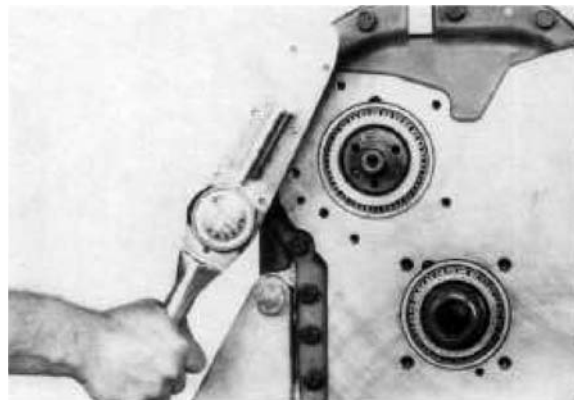
**Figure 238**

Tap cover in place.



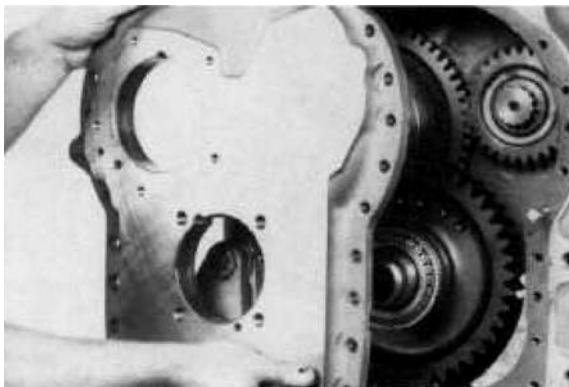
**Figure 236**

The use of saligning studs will facilitate rear cover installation. Position a new gasket and "O" ring on rear of case. A light coat of grease will hold gasket in place.



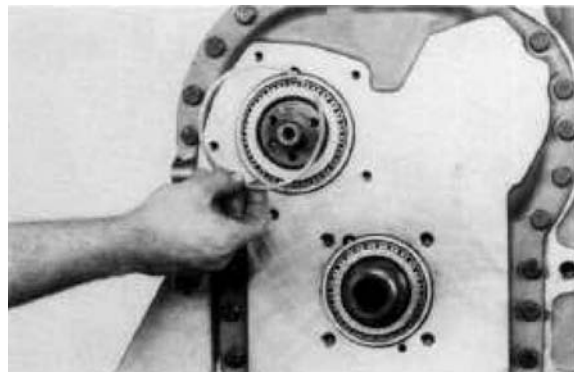
**Figure 239**

Install rear cover bolts and washers, tighten to specified torque. (See torque chart).



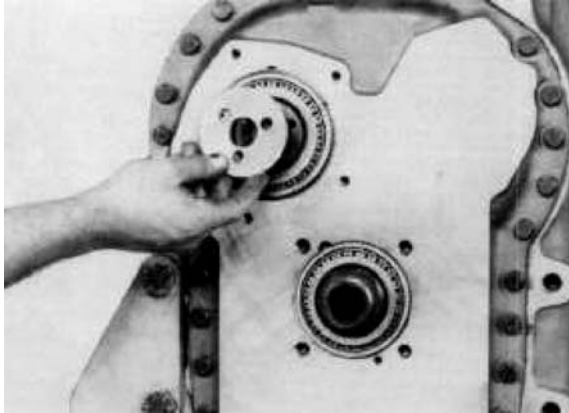
**Figure 237**

Align lock balls in bearing with notches in rear cover.



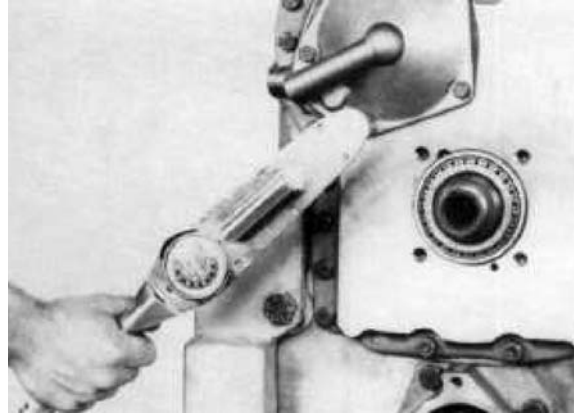
**Figure 240**

From the front, tap the low (1st) clutch and idler shaft to the rear to expose the rear bearing locating ring groove. Install locating ring.



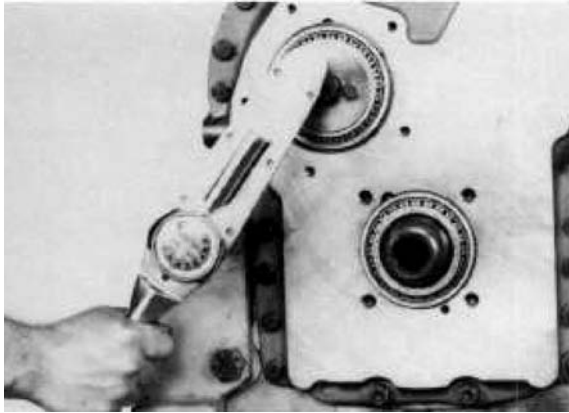
**Figure 241**

Install low (1st) clutch rear bearing retainer plate. **NOTE:** Inner diameter hole chamfer to go toward bearing.



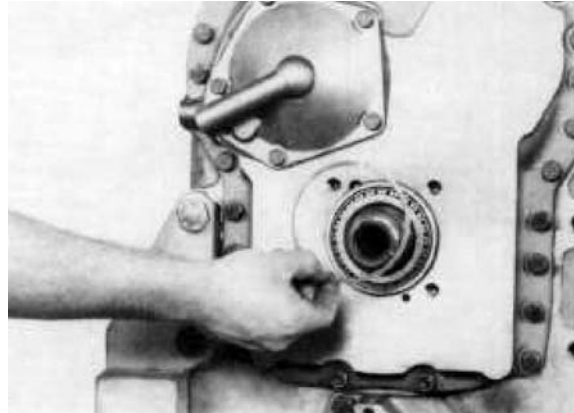
**Figure 244**

Position bearing cap over bearing and install bearing cap bolts. Tighten to specified torque. (See torque chart).



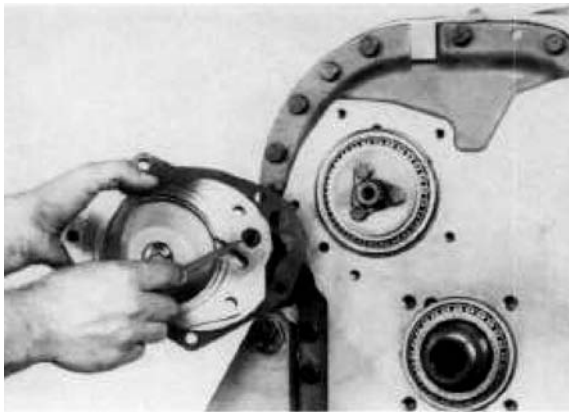
**Figure 242**

Install retainer plate bolts and tighten to specified torque (see torque chart). Lock wire bolts together to prevent loosening.



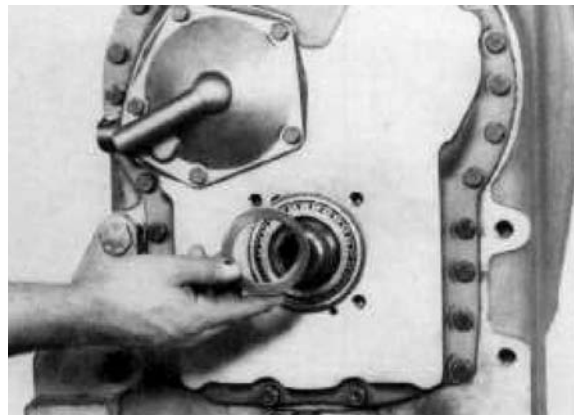
**Figure 245**

Install idler shaft rear bearing locating ring.



**Figure 243**

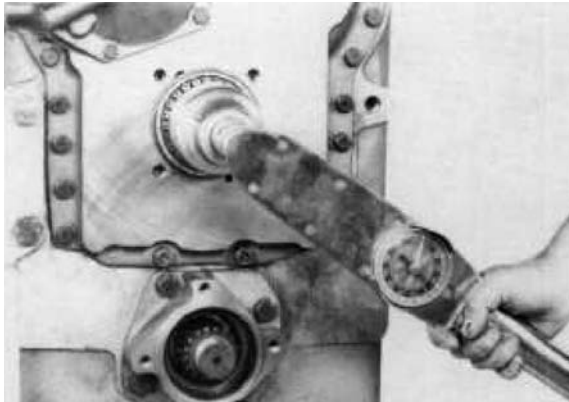
Install new "O" ring and gasket on low (1st) clutch shaft rear bearing cap.



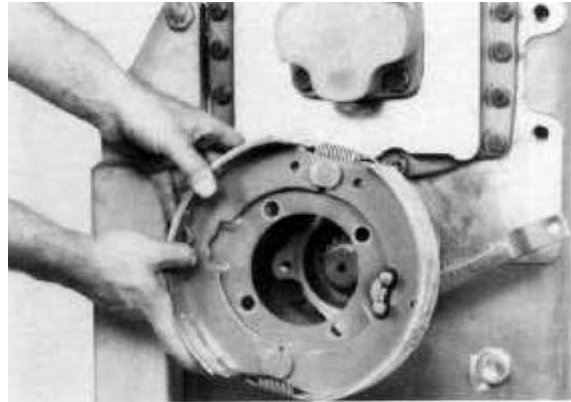
**Figure 246**

Install idler shaft rear bearing spacer.

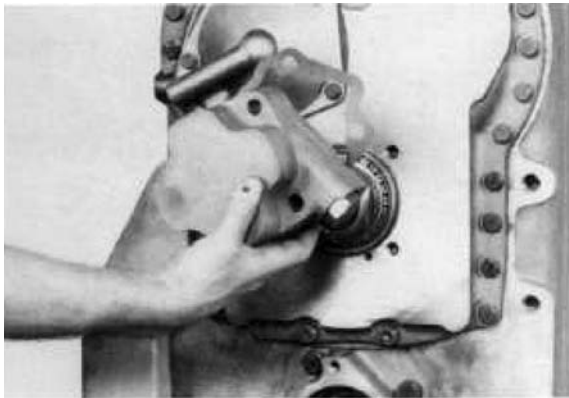




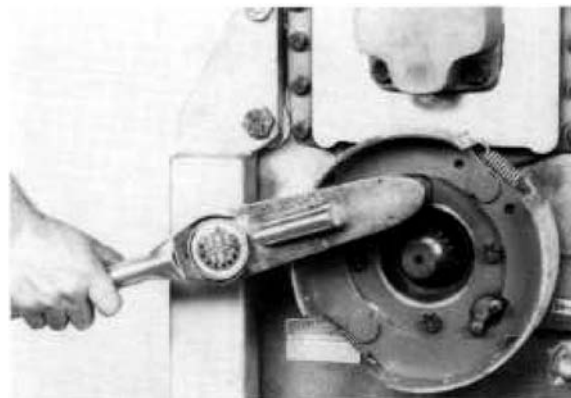
**Figure 247**  
Install idler shaft rear bearing retainer nut. Tighten to specified torque. (See elastic stop nut torque chart).



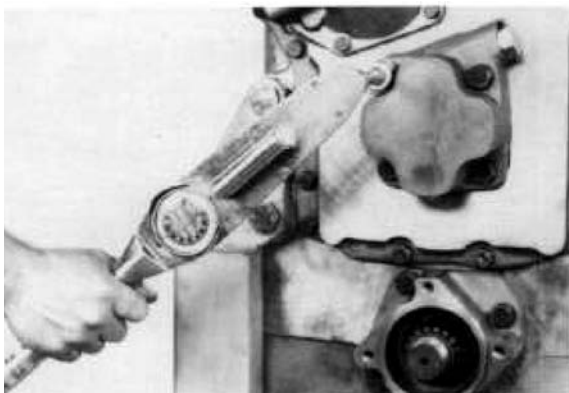
**Figure 250**  
Install brake backing plate and brake band assembly on output bearing cap.



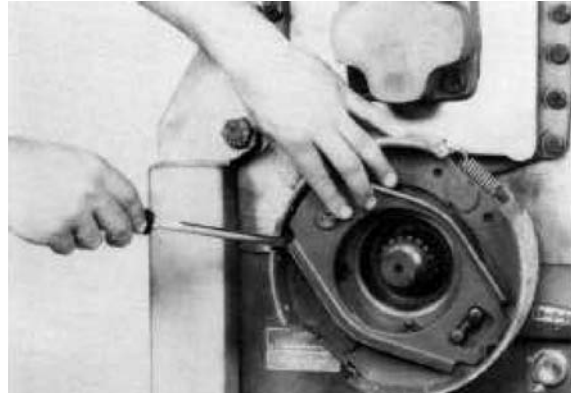
**Figure 248**  
Position a new gasket on the idler shaft rear bearing cap, install bearing cap.



**Figure 251**  
Install backing plate cap screws and tighten to specified torque. (See torque chart).

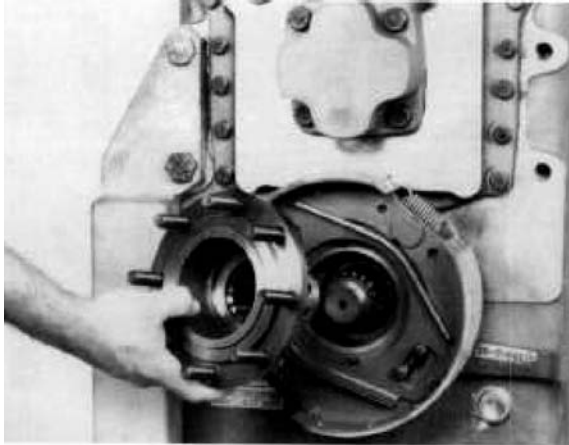


**Figure 249**  
Install cap screws and tighten to specified torque. (See torque chart).

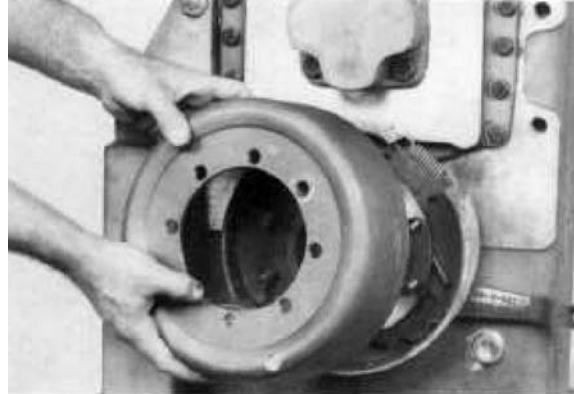


**Figure 252**  
Install brake strut to brake bands.

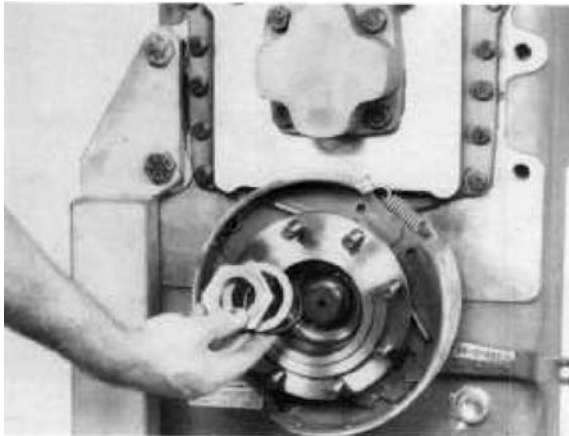




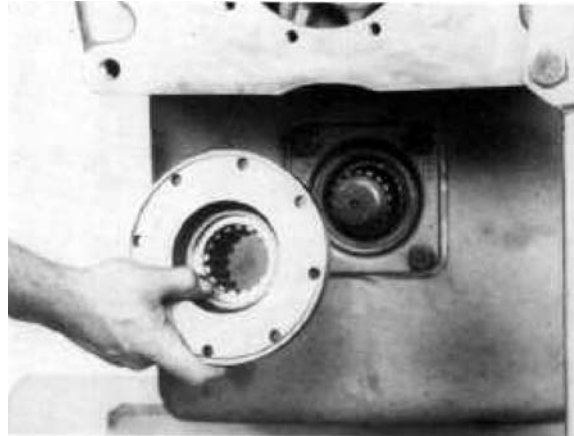
**Figure 253**  
Install rear output flange.



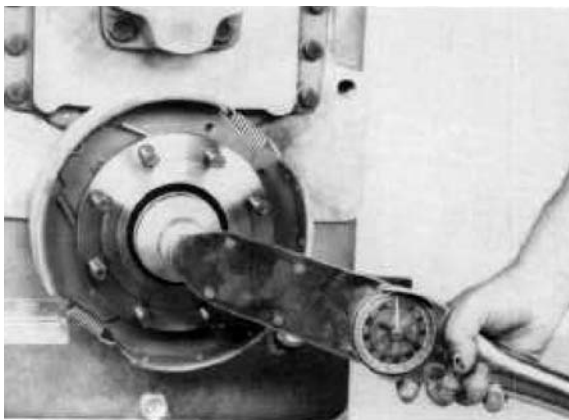
**Figure 256**  
Position brake drum on output flange studs. Install stud nut washers and stud nuts. Tighten stud nuts enough to hold drum in place until drive shaft is installed.



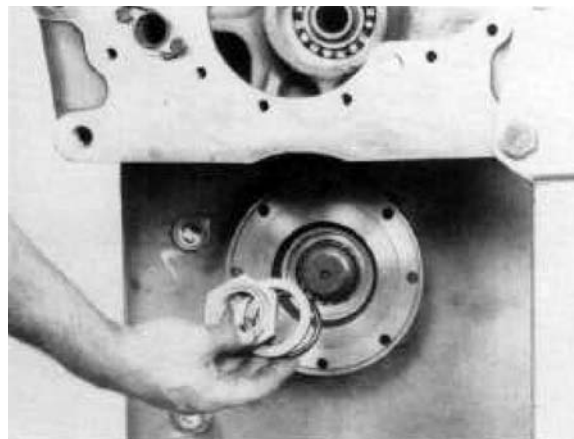
**Figure 254**  
Install flange "O" ring, washer and lock nut.



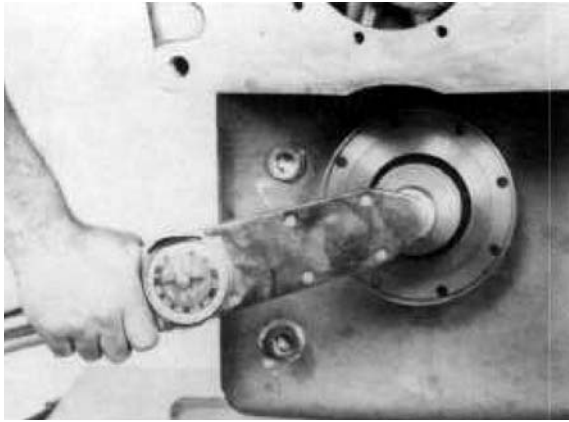
**Figure 257**  
Install front output flange.



**Figure 255**  
Tighten lock nut to specified torque. (See elastic stop nut torque chart).



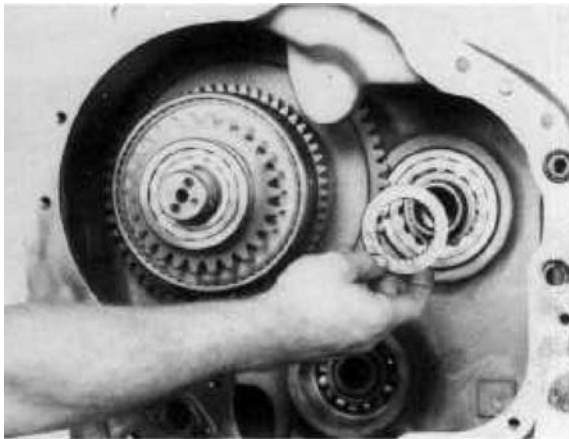
**Figure 258**  
Install new output flange "O" ring, washer and flange nut.



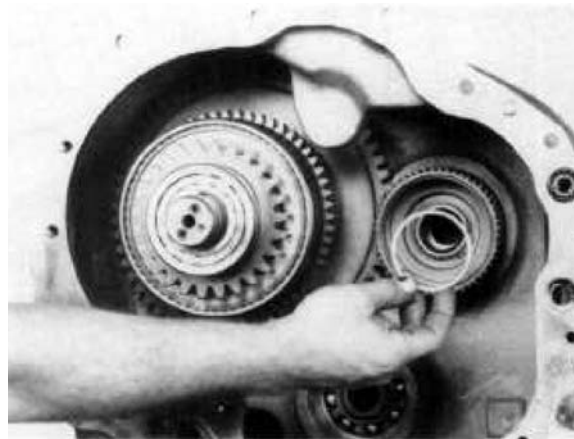
**Figure 259**  
Tighten flange nut to proper specifications. (See elastic stop nut torque chart).



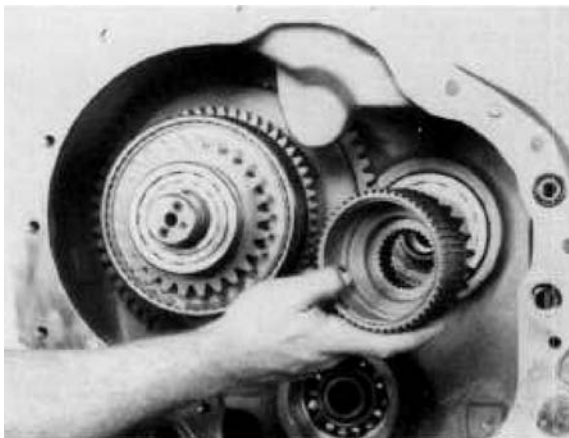
**Figure 262**  
Install disc hub retainer ring.



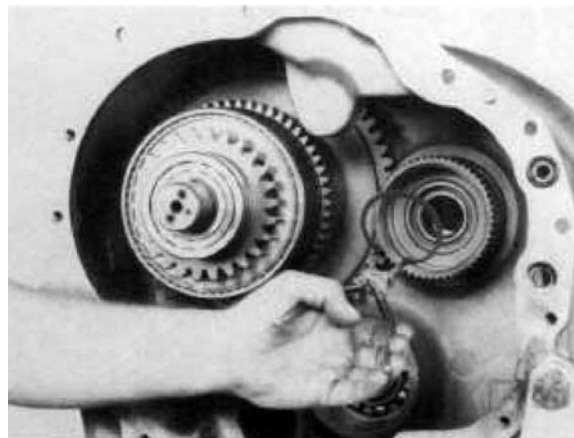
**Figure 260**  
Position 2nd clutch bearing end plate on low (1st) clutch shaft.



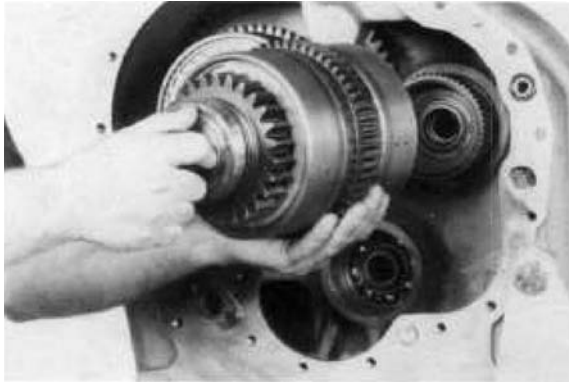
**Figure 263**  
Install disc hub retainer ring retainer.



**Figure 261**  
Position 2nd clutch disc hub on clutch shaft.

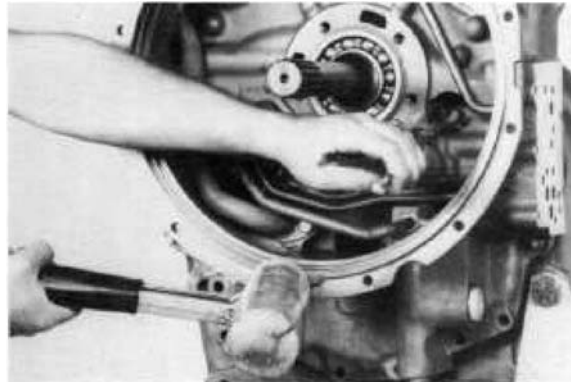


**Figure 264**  
Install disc hub ring retainer retaining ring.



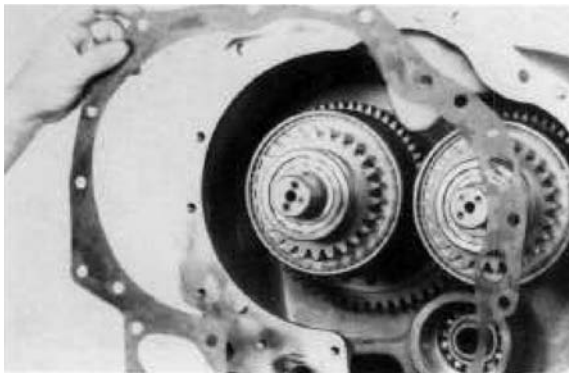
**Figure 265**

Position 2nd speed clutch shaft pilot bearing on clutch shaft. A light coat of grease will hold bearing in place. Install forward and 2nd clutch in clutch disc hub being certain clutch disc hub is in full position in clutch discs.



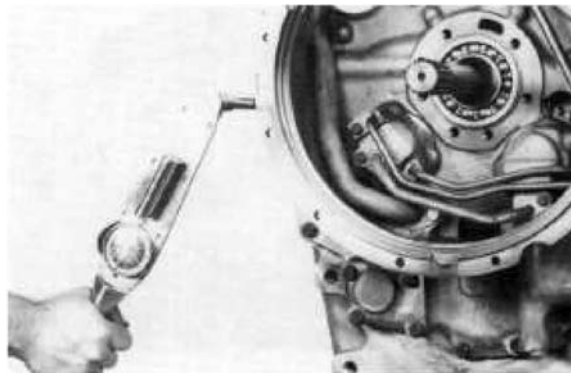
**Figure 268**

Spread forward clutch front bearing locating ring. Position converter housing to transmission housing. Tap housing into place using caution as not to damage clutch shaft oil sealing rings. **Do not force this operation.**



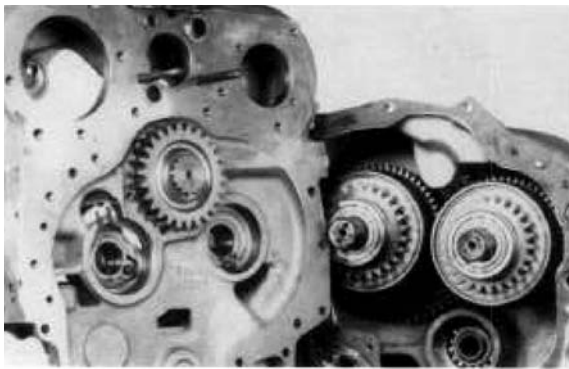
**Figure 266**

Position new gasket and "O" rings on housing. A light coat of grease will hold gasket and "O" rings in place.



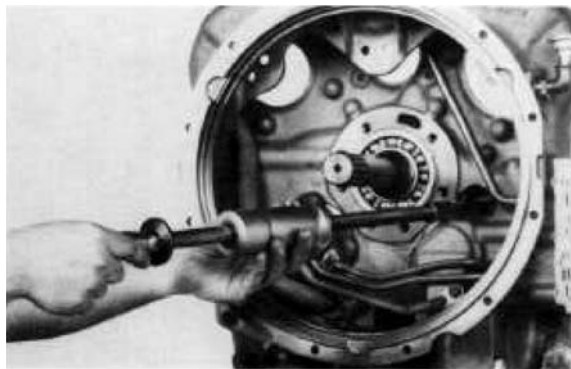
**Figure 269**

Install bolts and washers, tighten to specified torque (see torque chart).



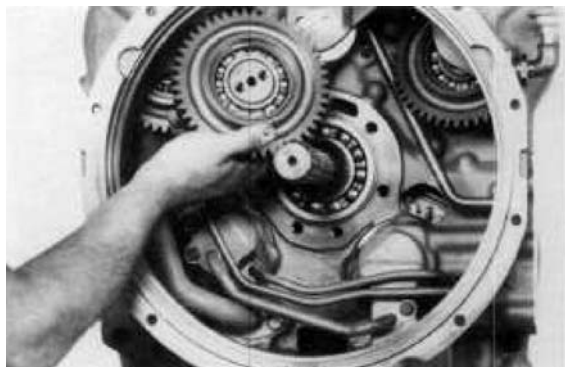
**Figure 267**

Install alignment studs in transmission housing to facilitate converter housing to transmission housing assembly.



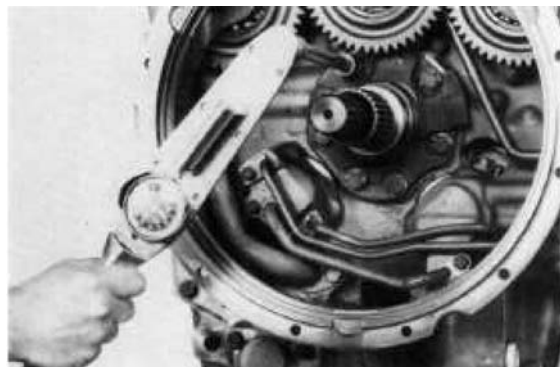
**Figure 270**

Using a hammer puller as shown, pull forward clutch until front bearing locating ring is in full position in ring groove.



**Figure 271**

Install pump drive gears.



**Figure 274**

Install support bolts and tighten to specified torque. (See torque chart).



**Figure 272**

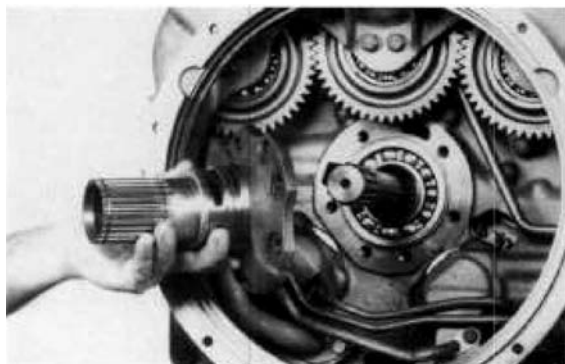
Tighten pump drive gear support bolts to specified torque. (See torque chart).

**DISASSEMBLY AND REASSEMBLY  
OF IMPELLER AND BAFFLE  
DISASSEMBLY**



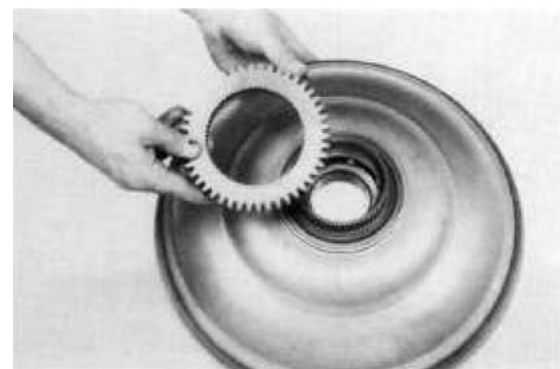
**Figure 275**

Remove pump drive gear retainer ring.



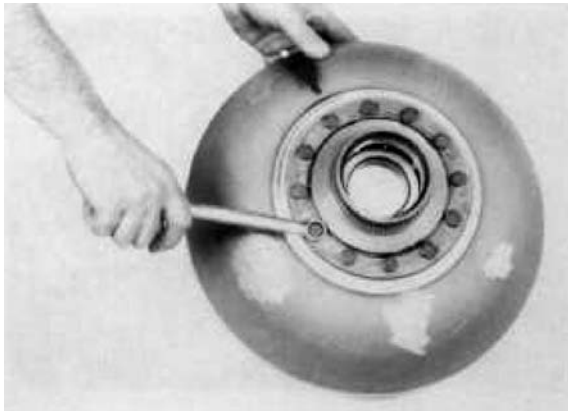
**Figure 273**

Install new sealing ring expander spring and oil sealing ring on support. NOTE: Expander spring gap to be 180° from sealing ring hook joint. Position support on turbine shaft, turn support to clear pump drive gear. Align support holes with converter housing.



**Figure 276**

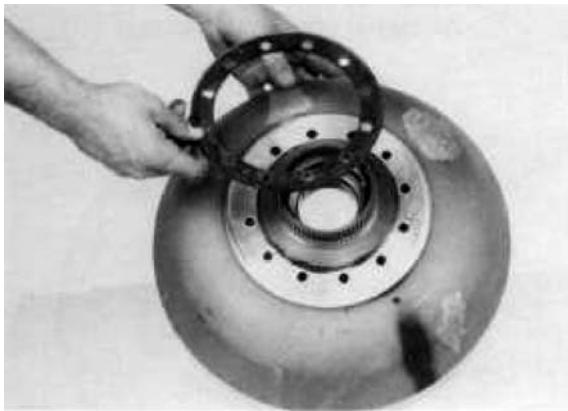
Remove pump drive gear.



**Figure 277**  
Remove impeller hub bolts.



**Figure 280**  
Remove hub bearing retainer ring.



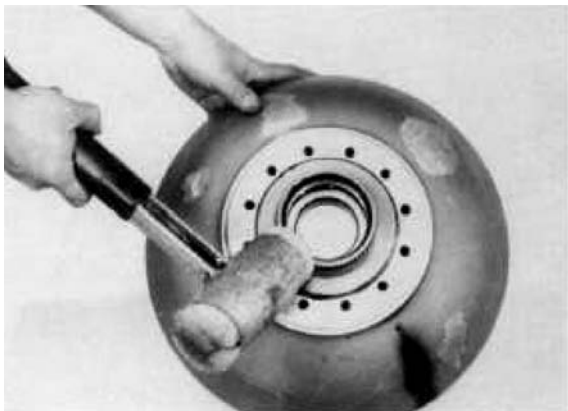
**Figure 278**  
Remove backing ring.



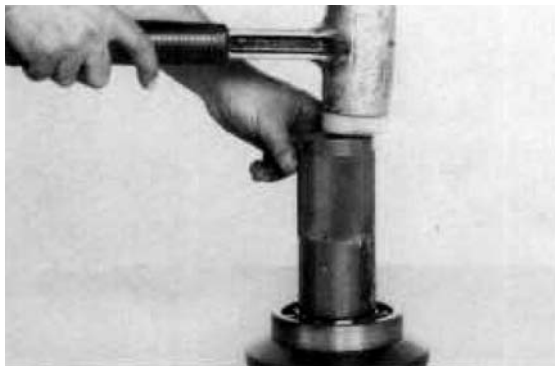
**Figure 281**  
Remove hub bearing.

**See cleaning and inspection page.**

**REASSEMBLY**



**Figure 279**  
Tap impeller hub from impeller.



**Figure 282**  
Install impeller hub bearing in hub.



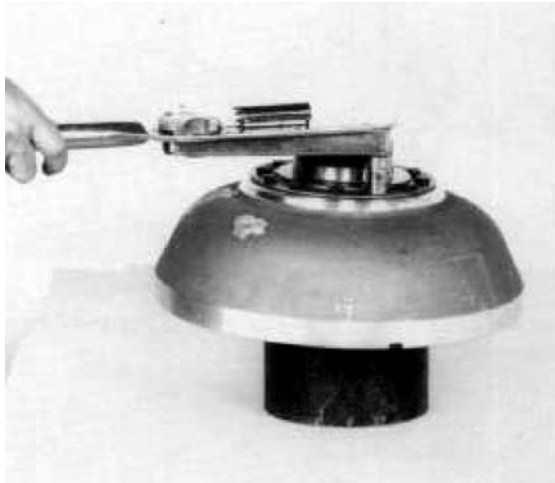
**Figure 283**  
Install bearing retainer ring.



**Figure 286**  
Position backing ring on impeller.



**Figure 284**  
Position new "O" ring on impeller hub.



**Figure 287**  
Install (12) impeller hub special screws to approximately .06 inch (1,5) of seated position. With a calibrated torque wrench, tighten screws to 40-45 lbs. ft. [54,3-61.0 N.m.] torque. **NOTE:** Assembly of impeller to impeller hub must be completed within a fifteen minute period from start of screw installation. The screws are prepared with a coating which begins to harden after installation in the impeller hub holes. If not tightened to proper torque within the fifteen minute period, insufficient screw clamping tension will result. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced.



**Figure 285**  
Align holes in impeller with holes in impeller hub.

The compound left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.





**Figure 288**

Apply a light coat of Permatex No. 2 on the outer diameter of the oil baffle seal. Press seal in oil baffle with lip of seal down.



**Figure 291**

Install pump drive gear retainer ring.

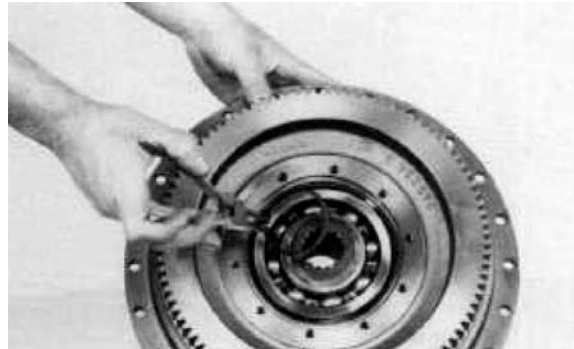
**DISASSEMBLY AND REASSEMBLY OF TURBINE AND IMPELLER COVER**

**DISASSEMBLY**



**Figure 289**

Install new oil baffle seal ring. Position oil baffle on impeller and hub assembly.



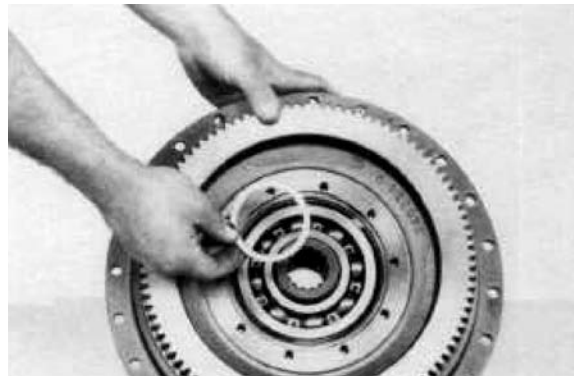
**Figure 292**

Remove turbine hub to impeller cover bearing retainer ring.



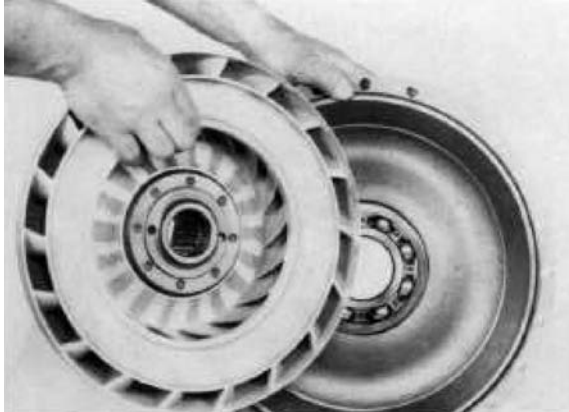
**Figure 290**

Install pump drive gear on impeller hub.



**Figure 293**

Remove retainer ring to bearing washer.

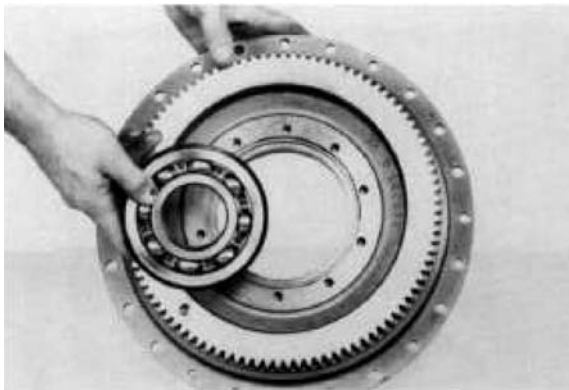


**Figure 294**  
Separate turbine from impeller cover.

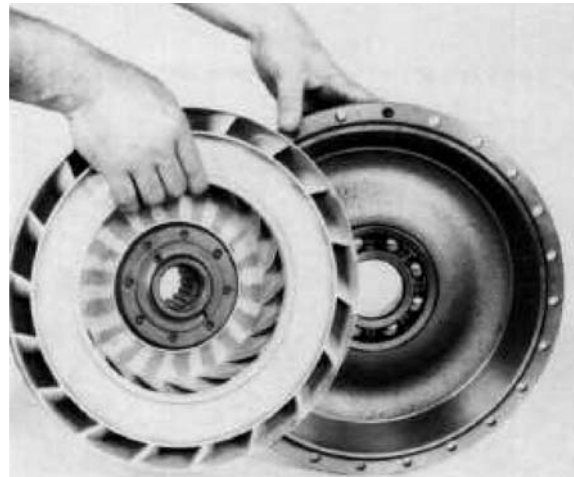
If turbine and hub was disassembled, use the following instructions for reassembly.

1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry and clean.
2. Install backing ring and special self locking screws.

Tighten screws 40 to 45 lbs. ft. (54.3-61.0 N.m.). **NOTE:** Assembly of hub must be complete within a fifteen minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The epoxy left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.



**Figure 295**  
Remove impeller cover bearing.



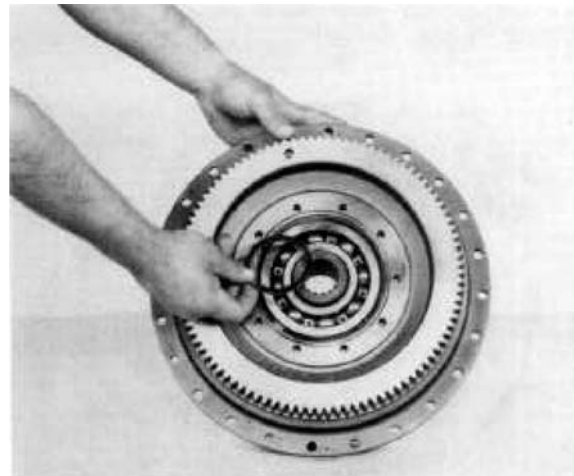
**Figure 297**  
Position turbine and hub assembly in impeller cover assembly.

See cleaning and inspection page.

**REASSEMBLY**

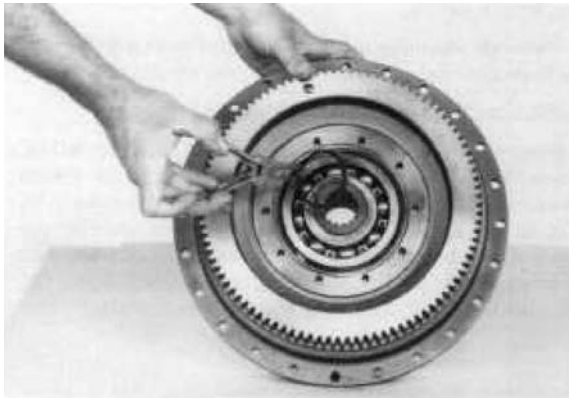


**Figure 296**  
Install impeller cover bearing.

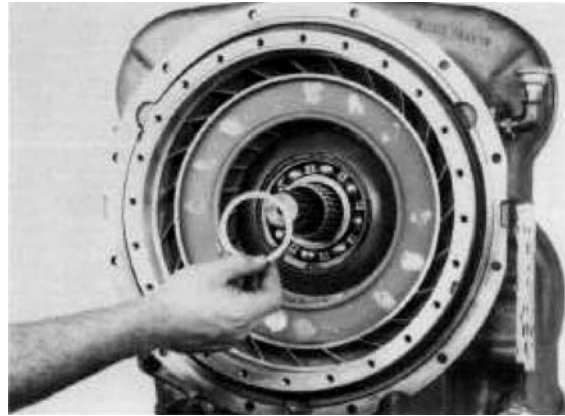


**Figure 298**  
Position bearing washer over turbine hub.

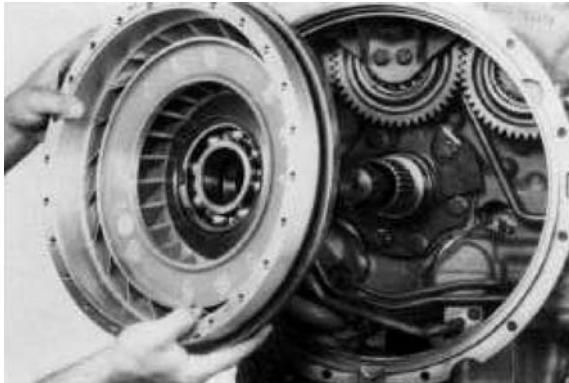




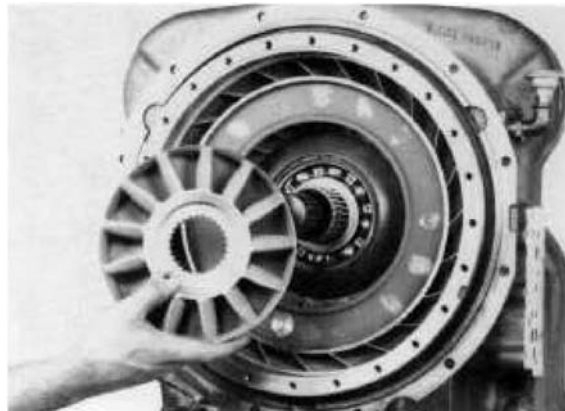
**Figure 299**  
Install turbine hub to impeller cover retainer ring.



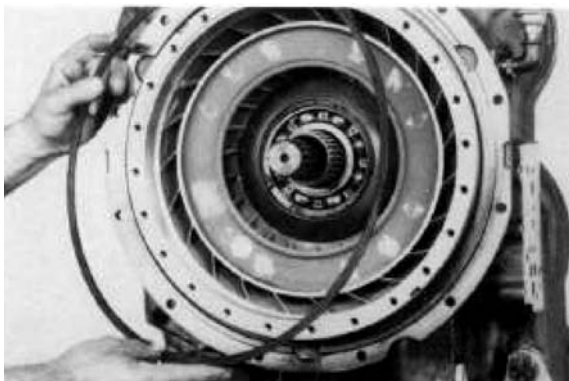
**Figure 302**  
Install reaction member spacer with tang facing out.



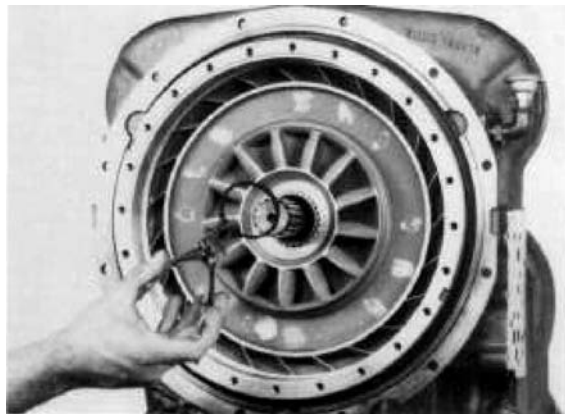
**Figure 300**  
Grease stator support piston ring, oil baffle oil seal and seal ring to facilitate reassembly. Install impeller and oil baffle assembly in converter housing.



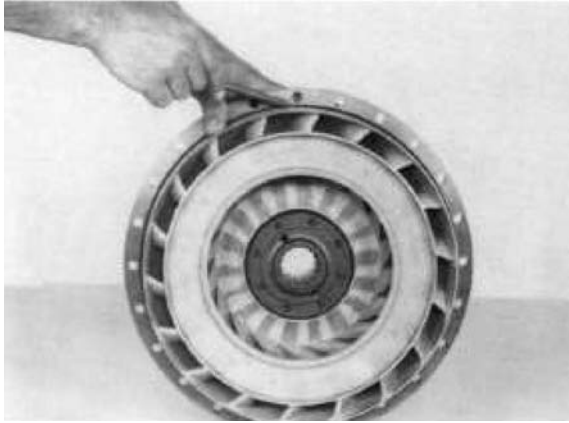
**Figure 303**  
Install reaction member with thick part of blades out.



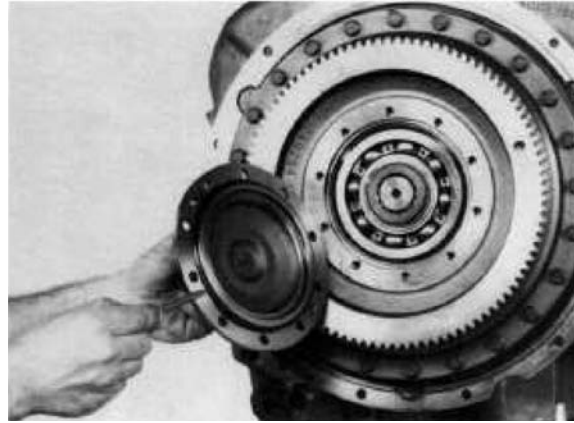
**Figure 301**  
Position oil baffle in housing. Secure with oil baffle retainer ring, being sure ring is in full position in ring groove.



**Figure 304**  
Install reaction member retainer ring.



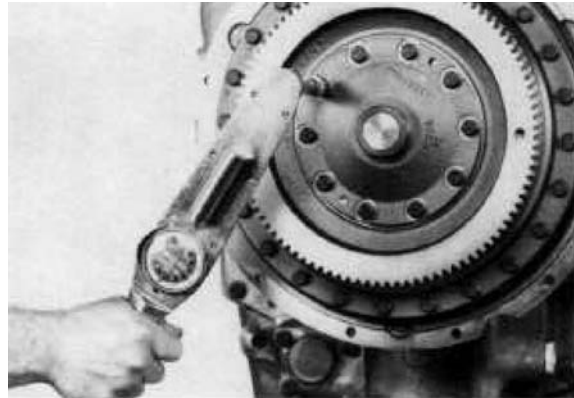
**Figure 305**  
Position a new "O" ring on impeller cover.



**Figure 308**  
Position new "O" ring on impeller cover bearing cap.



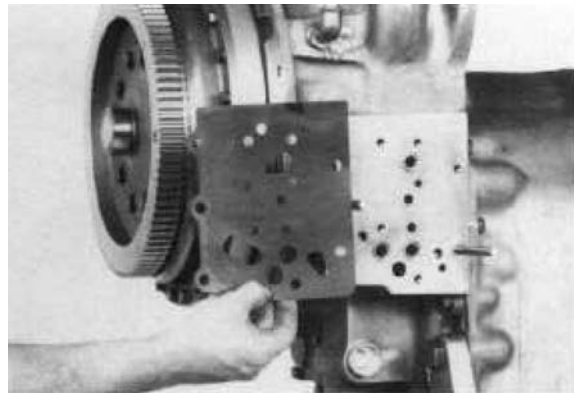
**Figure 306**  
Position turbine and impeller cover on turbine shaft.



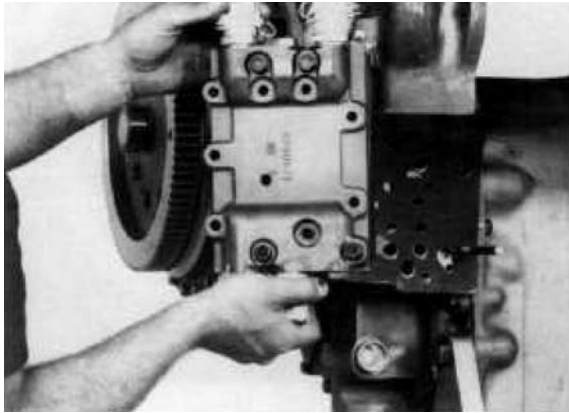
**Figure 309**  
Install bearing cap, bolts and washers, tighten to specified torque. (See torque chart).



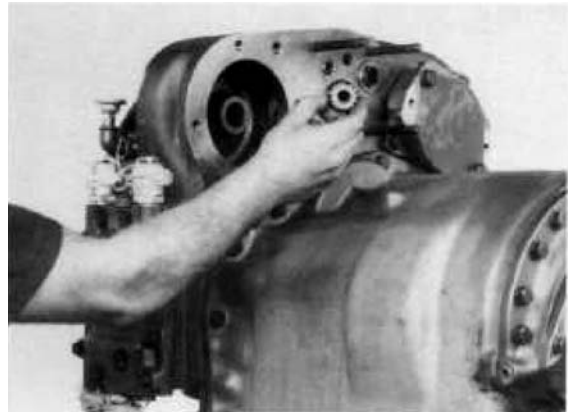
**Figure 307**  
Install impeller cover to impeller bolts and washers. Tighten to specified torque (see torque chart).



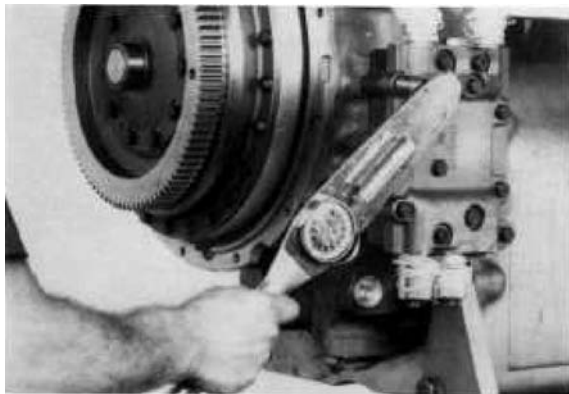
**Figure 310**  
Install aligning studs to facilitate control valve assembly. Install new control valve gasket.



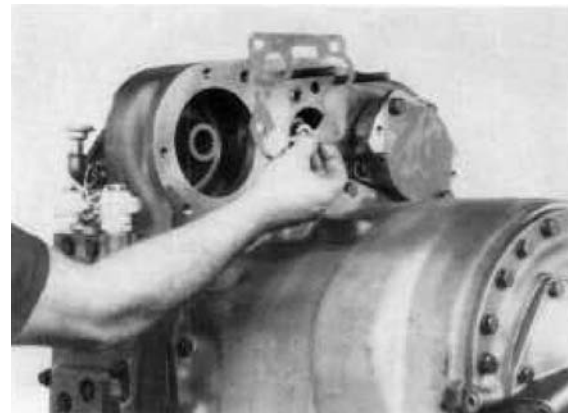
**Figure 311**  
Position control valve assembly on aligning studs.



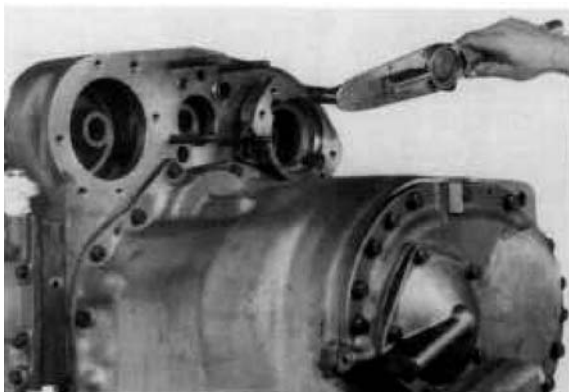
**Figure 314**  
Install charging pump drive sleeve.



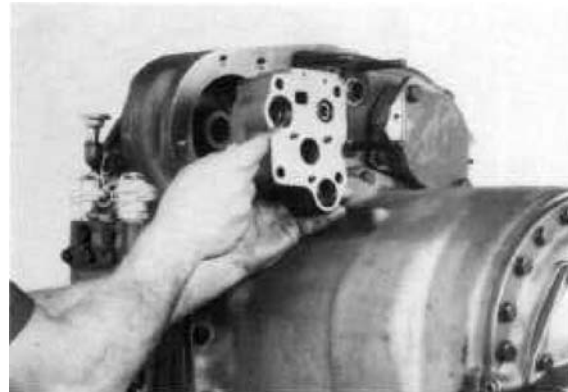
**Figure 312**  
Install control valve bolts and washers and tighten to specified torque. (See torque chart).



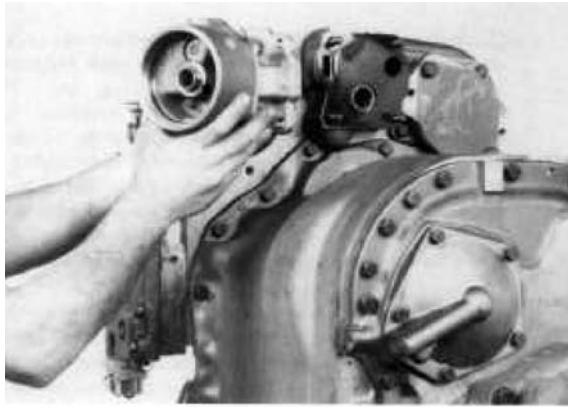
**Figure 315**  
Install new pressure regulating valve gasket.



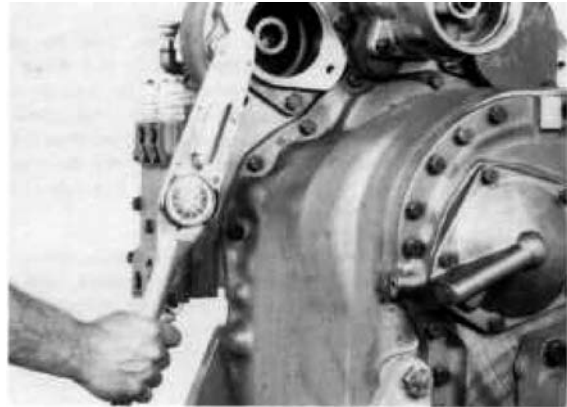
**Figure 313**  
Install pump adaptor, bolts and washers. Tighten to specified torque. (See torque chart).



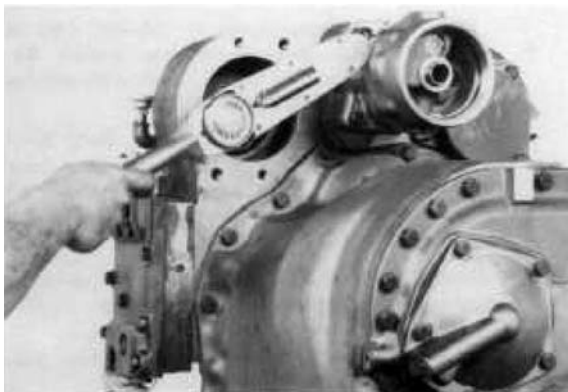
**Figure 316**  
Install new "O" rings on pressure regulating valve. Position valve on studs.



**Figure 317**  
Position new valve to pump gasket on studs. Install charging pump and filter adaptor on studs.



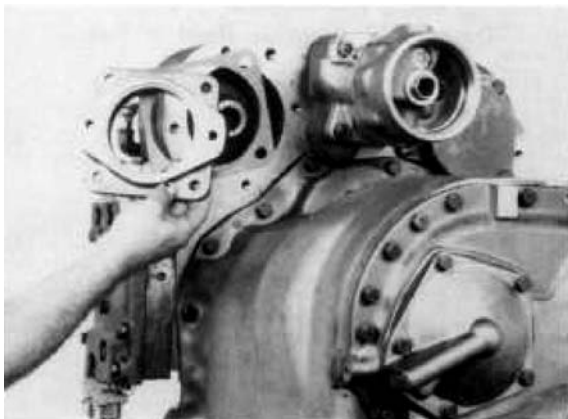
**Figure 320**  
Install bolts and washers. Tighten to specified torque. (See torque chart).



**Figure 318**  
Install washers and nuts, tighten to specified torque. (See torque chart).



**Figure 321**  
Install new filter element and filter housing.



**Figure 319**  
Install new auxiliary pump adaptor gasket and adaptor.

**SERVICING MACHINE AFTER TRANSMISSION OVERHAUL**

The transmission, torque converter, and its allied hydraulic system are important links in the drive line between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other; therefore, wherever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered completed.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgment must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible, hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter elements, cleaning out filter cases thoroughly.
4. The oil cooler must be thoroughly cleaned. The cooler should be "back flushed" with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air and steam cleaner for that purpose. DO NOT use flushing compounds for cleaning purposes.

5. On remote mounted torque converters remove drain plug from torque converter and inspect interior of converter housing, gears, etc. If presence of considerable foreign material is noted, it will be necessary that converter be removed, disassembled and cleaned thoroughly. It is realized this entails extra labor; however, such labor is a minor cost compared to cost of difficulties which can result from presence of such foreign material in the system,

6. Reassemble all components and use only type oil recommended in lubrication section. Fill transmission through filler opening until fluid comes up to LOW mark on transmission dipstick. NOTE: If the dipstick is not accessible oil level check plugs are provided.

Remove LOWER check plug, fill until oil runs from LOWER oil hole, Replace filler and level plug.

Run engine two minutes at 500-600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in transmission with engine running at idle (500-600 RPM).

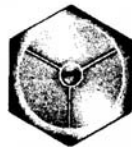
Add quantity necessary to bring fluid level to LOW mark on dipstick or runs freely from LOWER oil level check plug hole. Install oil level plug or dipstick. Recheck with hot oil (180-200° F.) [82,2-93, 3° C].

Bring oil level to FULL mark on dipstick or runs freely from UPPER oil level plug.

7. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

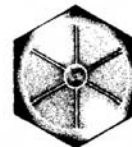
**TORQUE IN (LBS.—FT.)  
BOLTS, CAPSCREWS, STUDS AND NUTS**

**Grade 5 Identification, 3 Radial  
Dashes 120° Apart on Head of Bolt**



**Grade 5**

**Grade 8 Identification, 6 Radial  
Dashes 60° Apart on Head of Bolt**



**Grade 8**

**LUBRICATED OR PLATED**

Nominal Size	Fine Thread Torque Lbs. Ft./N.m.	Course Thread Torque Lbs. Ft./N.m.	Fine Thread Torque Lbs. Ft./N.m.	Course Thread Torque Lbs. Ft./N.m.
.3125	16-20 [21,7-27,1]	12-16 [16,3-21,7]	28-32 [38,0-43,4]	26-30 [35,3-40,7]
.3750	26-29 [35,3-39,3]	23-25 [31,2-33,9]	37-41 [50,2-55,6]	33-36 [44,7-48,8]
.4375	41-45 [55,6-61,0]	37-41 [50,2-55,6]	58-64 [78,6-86,8]	52-57 [70,5-77,3]
.5000	64-70 [86,8-94,9]	57-63 [77,3-85,4]	90-99 [122,0-134,2]	80-88 [108,5-119,3]
.5625	91-100 [123,4-135,6]	82-90 [111,2-122,0]	128-141 [173,5-191,2]	115-127 [156,0-172,2]

**SPECIFICATIONS AND SERVICE DATA-POWER SHIFT TRANSMISSION AND TORQUE CONVERTER**

<p><b>CONVERTER OUT PRESSURE</b></p> <p><b>CONTROLS</b></p> <p><b>CLUTCH TYPE</b></p> <p><b>CLUTCH INNER DISC</b></p> <p><b>CLUTCH OUTER DISC</b></p>	<p>Converter outlet oil temp. 180° - 200° F. [82,3° - 93,3° C].</p> <p>Transmission in <b>NEUTRAL</b>.</p> <p>Operating specifications:</p> <p>25 P.S.I. [172,4 kPa] minimum pressure at 2000 R.P.M. engine speed <b>AND</b> a maximum of 70 P.S.I. [482,6 kPa] outlet pressure with engine operating at no-load governed speed.</p> <p>Forward and Reverse - Manual</p> <p>Speed Selection - Manual</p> <p>Multiple discs, hydraulically actuated, spring released, automatic wear compensation and no adjustment. All clutches oil cooled and lubricated.</p> <p>Friction.</p> <p>Steel.</p>	<p><b>OIL FILTRATION</b></p> <p><b>CLUTCH PRESSURE</b></p>	<p>Full flow oil filter safety by-pass, also strainer screen in sump at bottom of transmission case.</p> <p>240 - 300 psi [1654,8 - 2068,4 kPa] - With parking brake set (see note), oil temperature 180° - 200°F. [82,2° - 93,3°C], engine at idle (400 to 600 RPM), shift thru direction and speed clutches. All clutch pressure must be equal within 5 psi. [34,5 kPa]. If clutch pressure varies in any one clutch more than 5 psi [34,5 kPa] repair clutch.</p> <p><b>NOTE: Never use service brakes while making clutch pressure checks. Units having brake actuated declutching in forward and/or reverse will not give a true reading. ALWAYS USE PARKING BRAKE WHEN MAKING CLUTCH PRESSURE CHECKS.</b></p>
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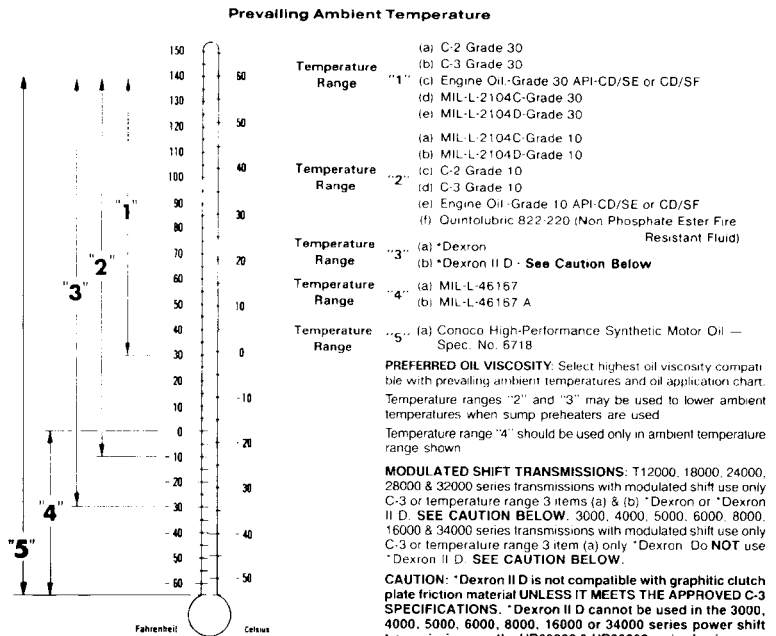
**LUBRICATION**

<p><b>TYPE OF OIL</b></p> <p><b>CAPACITY</b></p> <p><b>CHECK PERIOD</b></p> <p><b>NORMAL * DRAIN PERIOD</b></p>	<p>See Lube Chart.</p> <p>Consult Operator's Manual on applicable machine model for system capacity. Torque Converter, Transmission and allied hydraulic system must be considered as a whole to determine capacity.</p> <p>Check oil level <b>DAILY</b> with engine running at 500-600 RPM and oil at 180° to 200° F. [82,2 - 93,3° C]. Maintain oil level to <b>FULL</b> mark.</p> <p>Every 500 hours, change oil filter element. Every 1000 hours, drain and refill system as follows: Drain with oil at 150° to 200° F. [65,6 - 93,3° C].</p>
---	---

**NOTE: It is recommended that filter elements be changed after 50 and 100 hours of operation on new and rebuilt or repaired units.**

- (a) Drain transmission and remove sump screen. Clean screen thoroughly and replace, using new gaskets.
- (b) Drain oil filters, remove and discard filter elements. Clean filter shells and install new elements.
- (c) Refill transmission to **LOW** mark.
- (d) Run engine at 500-600 RPM to prime converter and lines.
- (e) Recheck level with engine running at 500 - 600 RPM and add oil to bring level to **LOW** mark. When oil temperature is hot (180-200° F.) [82,2-93,3° C] make final oil level check. **BRING OIL LEVEL TO FULL MARK.**

**RECOMMENDED LUBRICANTS FOR CLARK-HURTH COMPONENTS POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS**



\*Dexron is a registered trademark of General Motors Corporation.

**PREFERRED OIL VISCOSITY:** Select highest oil viscosity compatible with prevailing ambient temperatures and oil application chart. Temperature ranges "2" and "3" may be used to lower ambient temperatures when sump preheaters are used. Temperature range "4" should be used only in ambient temperature range shown.

**MODULATED SHIFT TRANSMISSIONS:** T12000, 18000, 24000, 28000 & 32000 series transmissions with modulated shift use only C-3 or temperature range 3 items (a) & (b) \*Dexron or \*Dexron II D. **SEE CAUTION BELOW.** 3000, 4000, 5000, 6000, 8000, 16000 & 34000 series transmissions with modulated shift use only C-3 or temperature range 3 item (a) only \*Dexron. Do NOT use \*Dexron II D. **SEE CAUTION BELOW.**

**CAUTION:** \*Dexron II D is not compatible with graphitic clutch plate friction material **UNLESS IT MEETS THE APPROVED C-3 SPECIFICATIONS.** \*Dexron II D cannot be used in the 3000, 4000, 5000, 6000, 8000, 16000 or 34000 series power shift transmissions, or the HR28000 & HR32000 series having converter lock-up, or the C270 series converter having lock-up **UNLESS IT MEETS THE APPROVED C-3 SPECIFICATIONS.**

Any deviation from this chart must have written approval from the application department of the Clark-Hurth Components Engineering and Marketing Department.

\* Normal drain periods and filter change intervals are for average environmental and duty-cycle conditions. Severe or sustained high operating temperatures or very dusty atmospheric conditions will cause accelerated deterioration and contamination. For extreme conditions judgment must be used to determine the required change intervals.

**TROUBLE SHOOTING GUIDE For The R  
and H R Model. 32000 Transmission**

The following data is presented as an aid to locating the source of difficulty in a malfunctioning unit. It is necessary to consider the torque converter charging pump" transmission, oil cooler" and connecting lines as a complete system when running down the source of trouble since the proper operation of any Unit therein depends greatly on the condition and operations of

the others. By studying the principles of operation together with data in this section, it may be possible to correct any malfunction which may occur in the system.

TROUBLE SHOOTING PROCEDURE BASICALLY CONSISTS OF TWO CLASSIFICATIONS: MECHANICAL AND HYDRAULIC.

**MECHANICAL CHECKS**

Prior to checking any part of the system from a hydraulic standpoint, the following mechanical checks should be made:

1. A check should be made to be sure all control lever linkage is properly connected and adjusted at all connecting points.

2. Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at control valve, if full engagement cannot be obtained, difficulty may be in control cover and valve assembly.

**HYDRAULIC CHECKS**

Before checking on the torque converter, transmission, and allied hydraulic system for pressures and rate of oil flow, it is essential that the following preliminary checks be made:

Check oil level in transmission. This should be done with oil temperatures of 180 to 200° F. [82,2-93,3° C]. DO NOT A TEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification it is necessary to either work the machine or "stall" out

the converter. Where the former means is impractical, the latter means should be employed as follows:

- Engage shift levers in forward and high speed and apply brakes. Accelerate engine half to three-quarter throttle. Hold stall until desired converter outlet temperature is reached. CAUTION: FULL THROTTLE STALL SPEEDS FOR AN EXCESSIVE LENGTH OF TIME WILL OVERHEAT THE CONVERTER.

**LOW CLUTCH PRESSURE**

Cause	Remedy
1. Low oil level.	1. Fill to proper level.
2. Clutch pressure regulating valve spool stuck open.	2. Clean valve spool and housing.
3. Faulty charging pump.	3. Replace pump.
4. Broken or worn clutch shaft or piston sealing rings.	4. Replace sealing rings.
5. Clutch piston bleed valve stuck open,	5. Clean bleed valves thoroughly.

**LOW CONVERTER CHARGING PUMP OUTPUT**

- |  |  |
|--|--|
| 1. Low oil level.  | 1. Fill to proper level.                                 |
| 2. Suction screen plugged.   | 2. Clean suction screen.                                 |
| 3. Air leaks at pump intake hose and connections or collapsed hose. (R-32000 only) | 3. Tighten all connections or replace hose if necessary. |
| 4. Defective oil pump.   | 4. Replace pump.   |

**OVERHEATING**

- |   |   |
|---|---|
| 1. Worn oil sealing rings.                      | 1. Remove" disassemble, and rebuild converter assembly. |
| 2. Worn oil pump.                               | 2. Replace.   |
| 3. Low oil level.                               | 3. Fill to proper level.                                |
| 4. Pump suction line taking air. (R-32000 only) | 4. Check oil line connections and tighten securely.     |

**NOISY CONVERTER**

- |                              |  |
|------------------------------|--|
| 1. Worn coupling gears.      | 1. Replace.  |
| 2. Worn oil pump.            | 2. Replace.  |
| 3. Worn or damaged bearings. | 3. A complete disassembly will be necessary to determine what bearing is faulty. |

**LACK OF POWER**

- |  |  |
|--|--|
| 1. Low engine RPM at converter stall.      | 1. Tune engine check governor.                     |
| 2. See "Overheating" and make same checks. | 2. Make corrections as explained in "Overheating." |

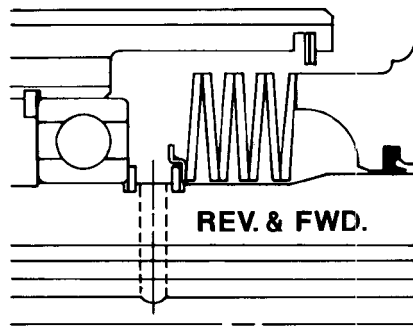
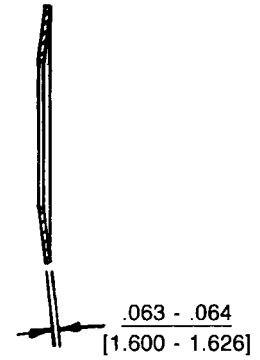


FIG. A



MODULATED FWD.  
& REV. CLUTCHES

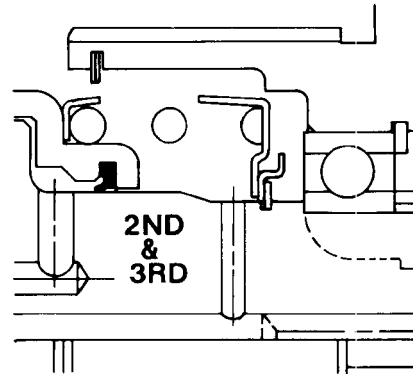


FIG. B

2nd & 3rd & NON-MODULATED FORWARD & REVERSE CLUTCHES

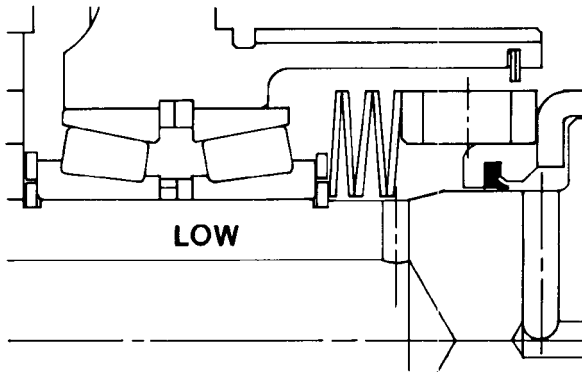
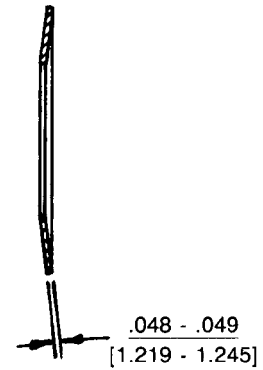


FIG. C



LOW (1st)  
CLUTCH

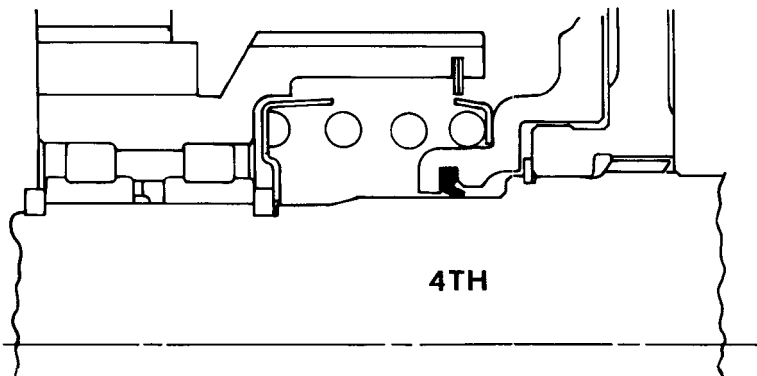
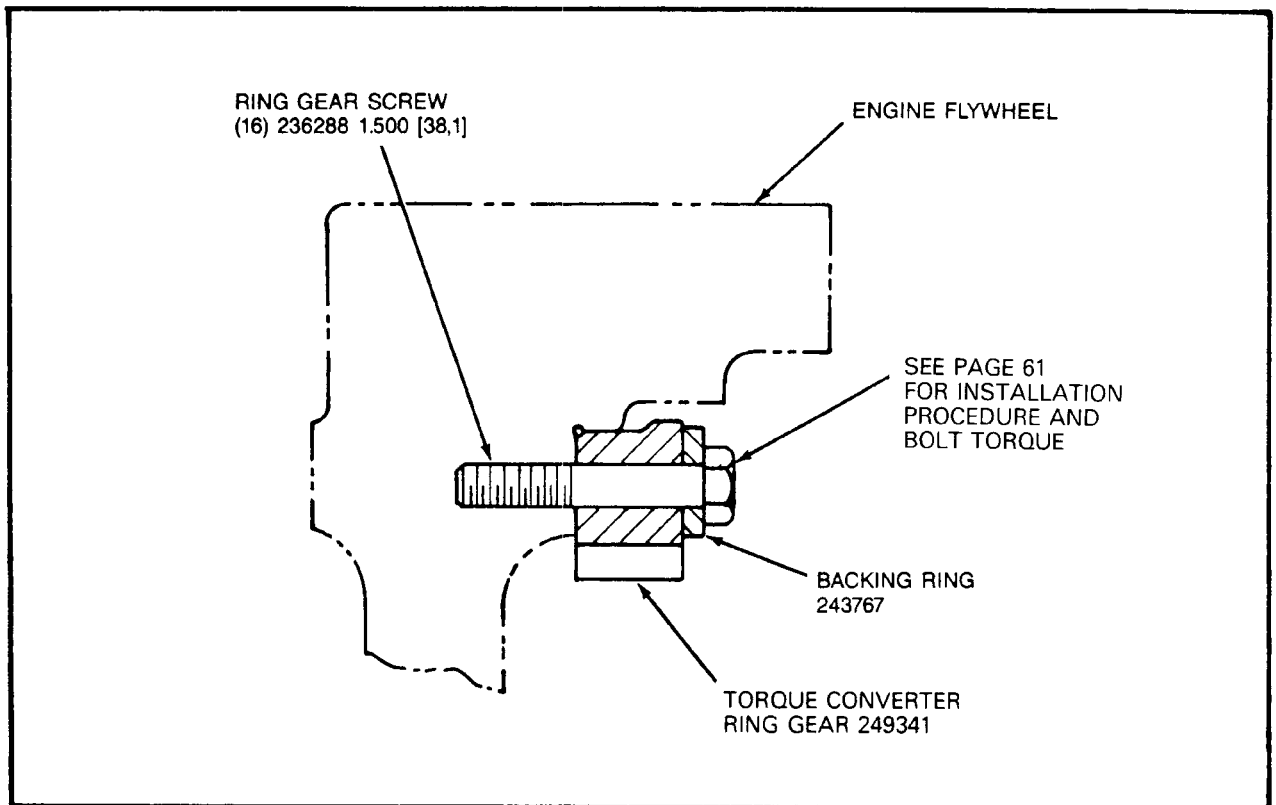
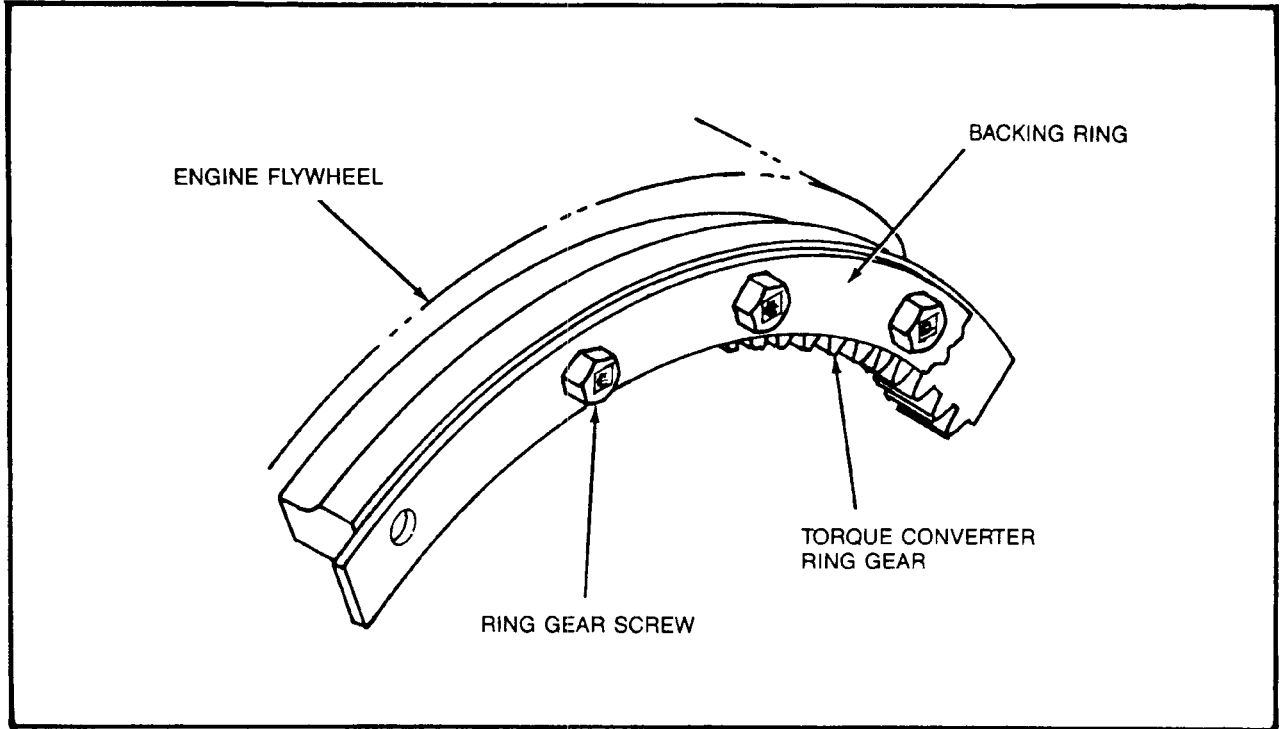


FIG. D  
(4 SPEED ONLY)





**16 SCREW RING GEAR INSTALLATION PROCEDURE  
(Non-Asbestos Ring Gear)**

1. Remove all burrs from flywheel mounting face and pilot bores. Clean the torque converter ring gear flywheel mounting surface and the ring gear screw tapped holes with solvent. Dry thoroughly, being certain ring gear screw holes are dry and clean.
2. Check engine flywheel and housing or housing adaptor for conformance to standard S.AE No 3 -SAE J927 and J1033 tolerance specifications for pilot bores size, pilot bores eccentricities and mounting face deviations. Measure and r
3. Install torque converter ring gear as shown.

NOTE: Assembly of the ring gear must be completed within a fifteen minute period from start of screw installation. The screws are prepared with an epoxy coating which begins to harden after installation in the flywheel mounting holes. If not tightened to proper torque within the fifteen minute period insufficient screw clamping tension will result

4. Install backing ring and sixteen (16) special screws to approximately 06 inch [11,5 mm] of seated position It is permissible to use a power wrench for this installation phase. With a calibrated torque wrench tighten screws 30 to 33 pounds feet of torque [140,7 44,7 N.m].

To obtain maximum effectiveness of the special screw's locking feature, a minimum time period after screw installation of twelve (12) hours is suggested before engine startup

The special screw is to be used for ONE installation only If the screw is removed for any reason it **MUST BE REPLACED** It is recommended that the epoxy left in the flywheel hole be removed with the proper tap and cleaned with solvent Dry hole thoroughly and use a NEW screw for re-installation

5. Assemble torque converter to engine flywheel by sliding converter into position by hand before fastening housing attachment screws. This may require more than one trial to match the drive gear teeth Pulling the converter into position with housing attachment bolts is not recommended.
6. Measure engine crankshaft end play after assembly of torque converter This value must be within one thousandth (001) of an inch [0,0254mm] of end play recorded (in Paragraph #2) before assembly of torque converter

802553 1.5 INCH [38.1] 16 SCREW RING GEAR KIT                      802554 15 INCH 138.1116 SCREW RING GEAR  
KIT

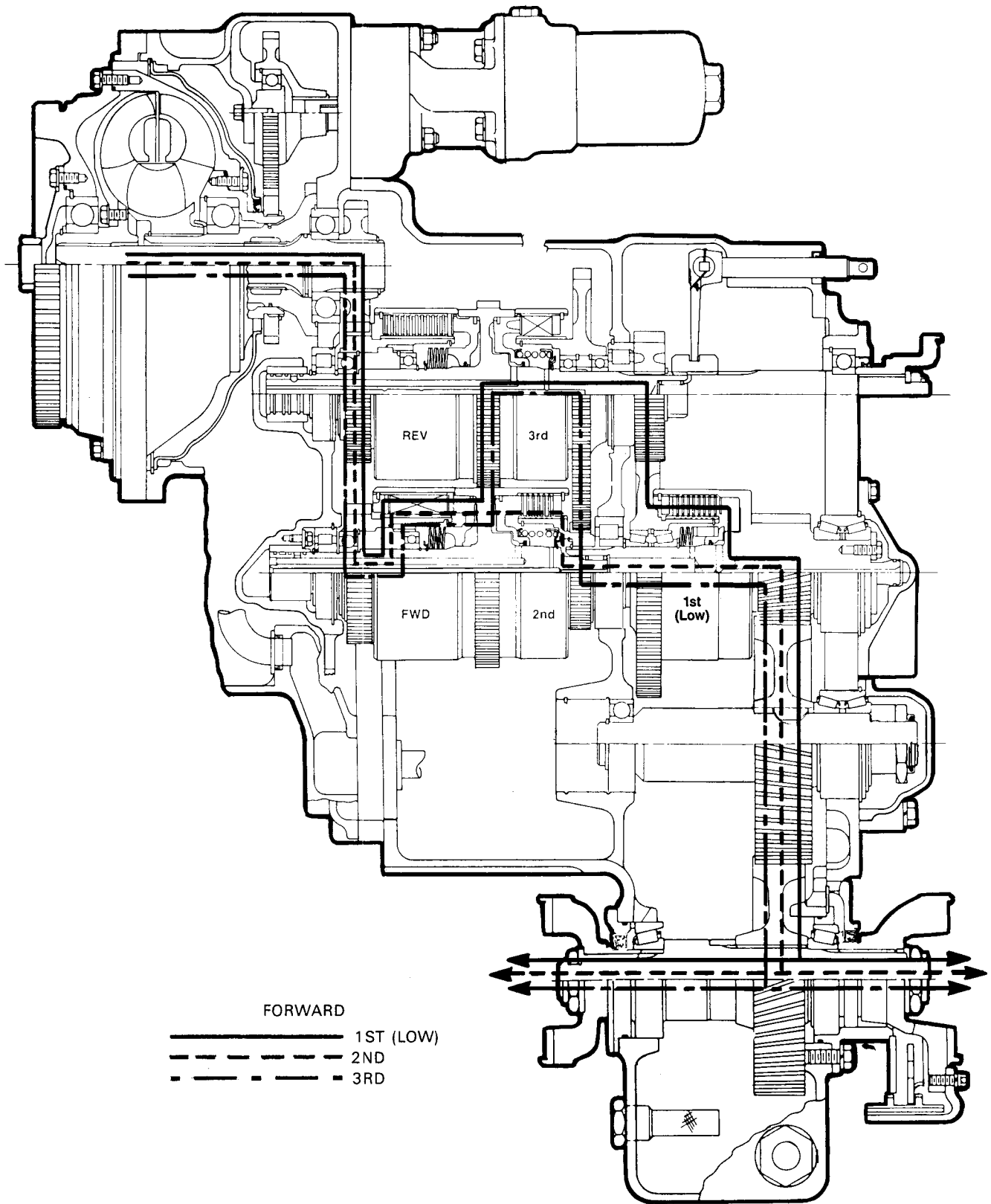
1	249341	Torque Converter Ring Gear	1	249341	Torque Converter Ring Gear
16	236288	Ring Gear Screw 1.5 Inch [38,1]	16	236288	Ring Gear Screw 1,5 Inch[38,1]
1	802555	Installation Instruction Sheet	1	243767	Backing Ring
			1	802555	Installation Instruction Sheet

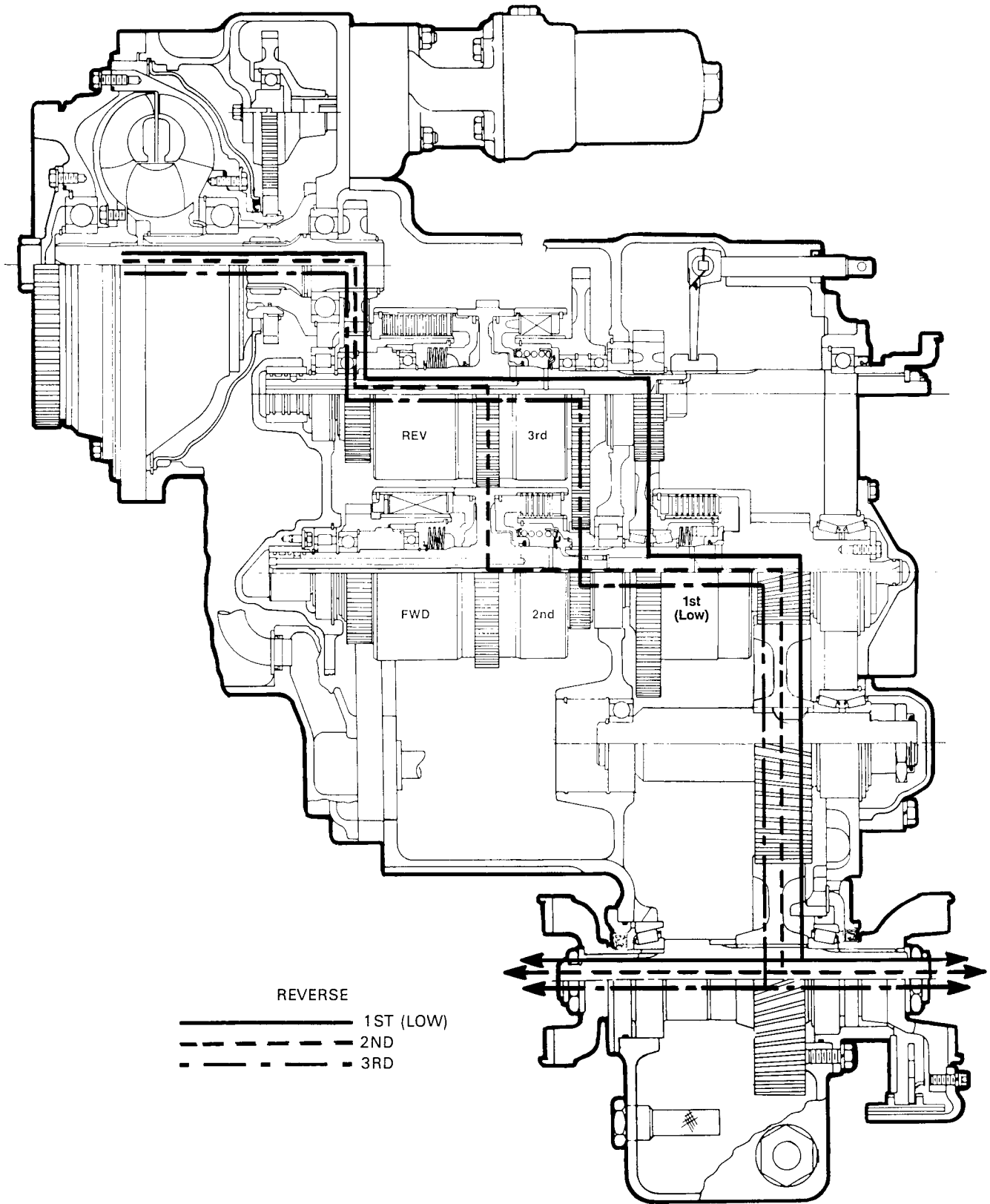
243767 Backing Ring not Included in 802553 Ring Gear Kit Must be Ordered Separately

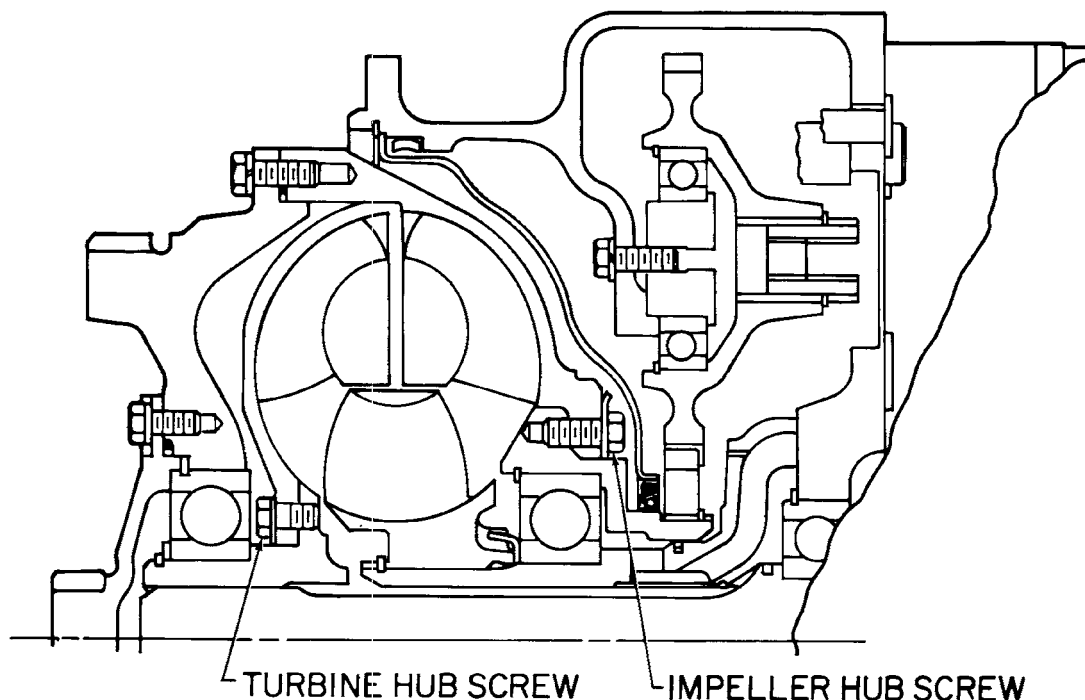
Dimensions are in inches    Dimensions in I I are mm

**SEE PAGE 60 FOR INSTALLATION ILLUSTRATIONS**

**SEE PAGE 69 FOR 32 BOLT INSTALLATION**

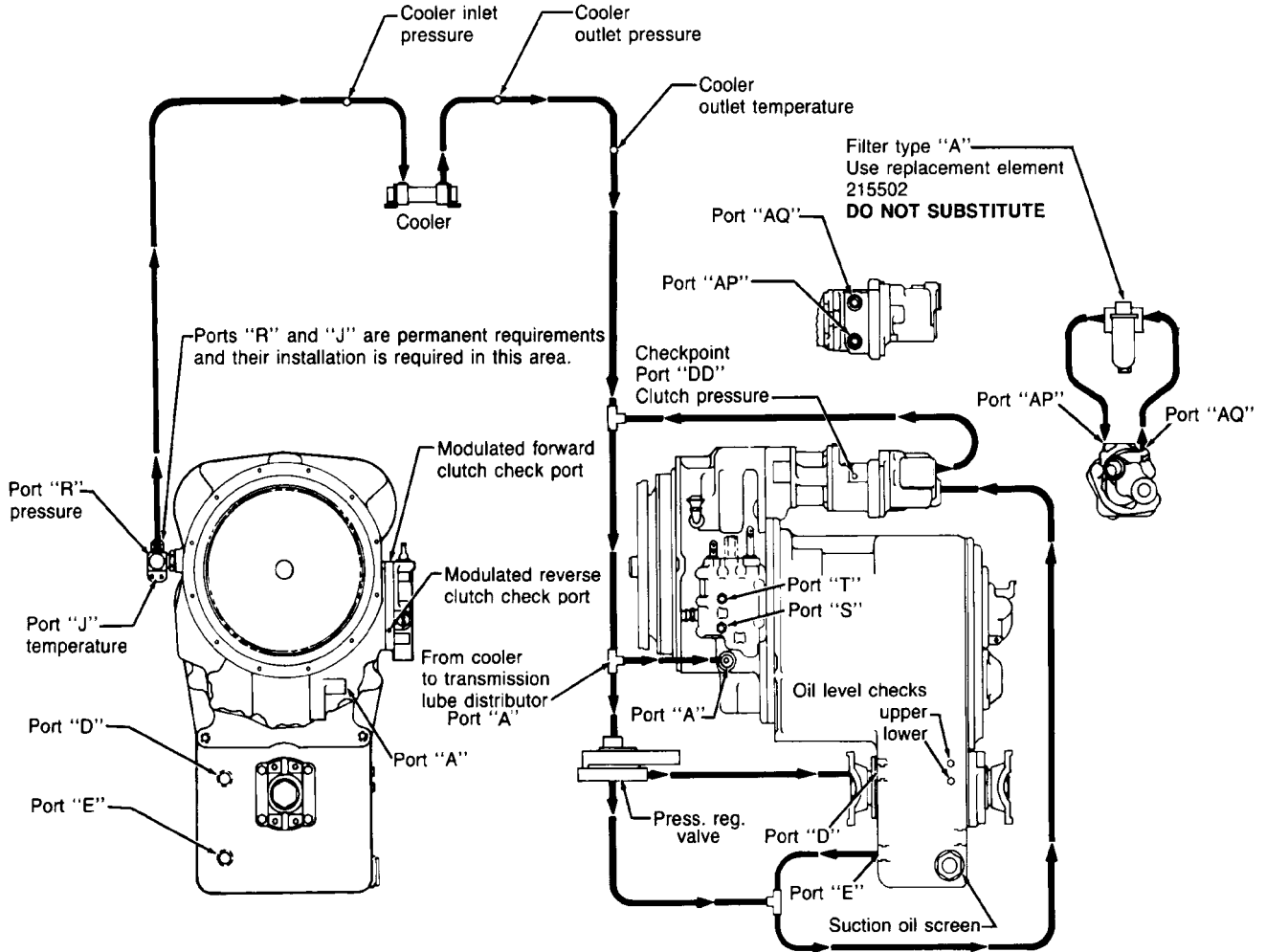






**IMPELLER HUB & TURBINE HUB ASSEMBLY WITH BACKING RING AND SPECIAL SELF LOCKING SCREWS.**

1. CLEAN HUB MOUNTING SURFACE AND TAPPED HOLES WITH SOLVENT. DRY THOROUGHLY BEING CERTAIN TAPPED HOLES ARE DRY AND CLEAN.
2. INSTALL BACKING RING AND SPECIAL SCREWS TO APPROXIMATELY .06 INCH [1,5] OF SEATED POSITION. WITH A CALIBRATED TORQUE WRENCH, TIGHTEN SCREWS 40 TO 45 LBS. FT TORQUE [54,3-61,0 N.m]. NOTE: ASSEMBLY OF IMPELLER OR TURBINE HUB MUST BE COMPLETED WITHIN A FIFTEEN MINUTE PERIOD FROM START OF SCREW INSTALLATION. THE SCREWS ARE PREPARED WITH A COATING WHICH BEGINS TO HARDEN AFTER INSTALLATION IN THE HUB HOLES. IF NOT TIGHTENED TO PROPER TORQUE WITHIN THE FIFTEEN MINUTE PERIOD, INSUFFICIENT SCREW CLAMPING TENSION WILL RESULT. THE SPECIAL SCREW IS TO BE USED FOR ONE INSTALLATION ONLY. IF THE SCREW IS REMOVED FOR ANY REASON IT MUST BE REPLACED. THE COMPOUND LEFT IN THE HUB HOLES MUST BE REMOVED WITH THE PROPER TAP AND CLEANED WITH SOLVENT DRY HOLE THOROUGHLY AND USE A NEW SCREW FOR REINSTALLATION.



Port "J" Converter outlet temperature  
 Port "R" Converter outlet pressure  
 Port "T" Checkpoint transmission forward clutch pressure  
 Port "S" Checkpoint transmission reverse clutch pressure  
 Ports "J", "R", and "DD" Used for field trouble shooting

**PLUMBING DIAGRAM FOR HR 32000  
 W/12 PLATE MODULATION AND  
 AUXILIARY LUBE**

## CLEANING AND INSPECTION

### CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

**CAUTION:** Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

### Bearings

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

### Housings

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

**CAUTION:** Care should be exercised to avoid skin rashes and inhalation of vapors when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

### INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

### Bearings

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in clean light oil and wrap in clean lintless cloth or paper to protect them until installed.

### Oil Seals, Gaskets and Retaining Rings

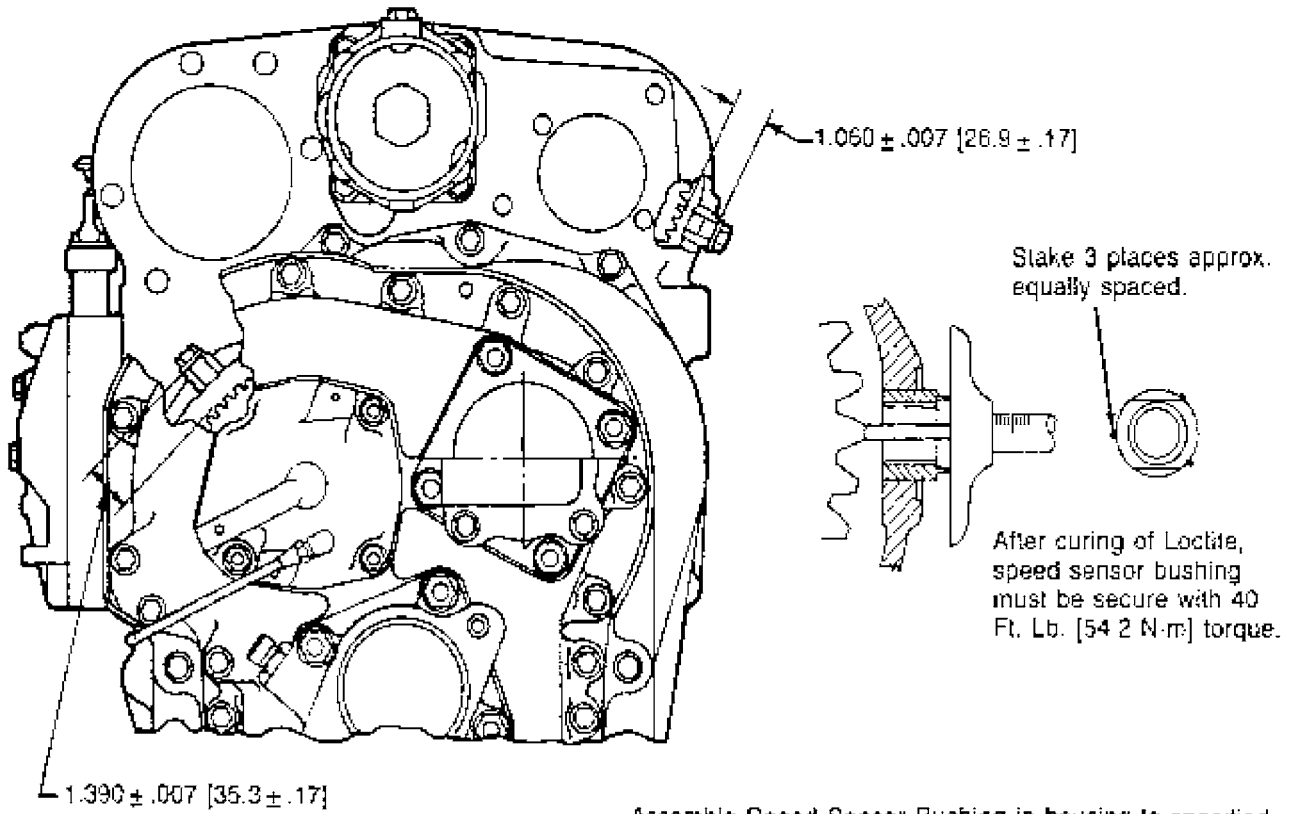
Replacement of spring load oil seals, "O" rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No.2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all "O" rings and seals with recommended type Automatic Transmission Fluid before assembly.

### Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent or splines twisted, and that shafts are true.

### Housing, Covers, etc.

Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

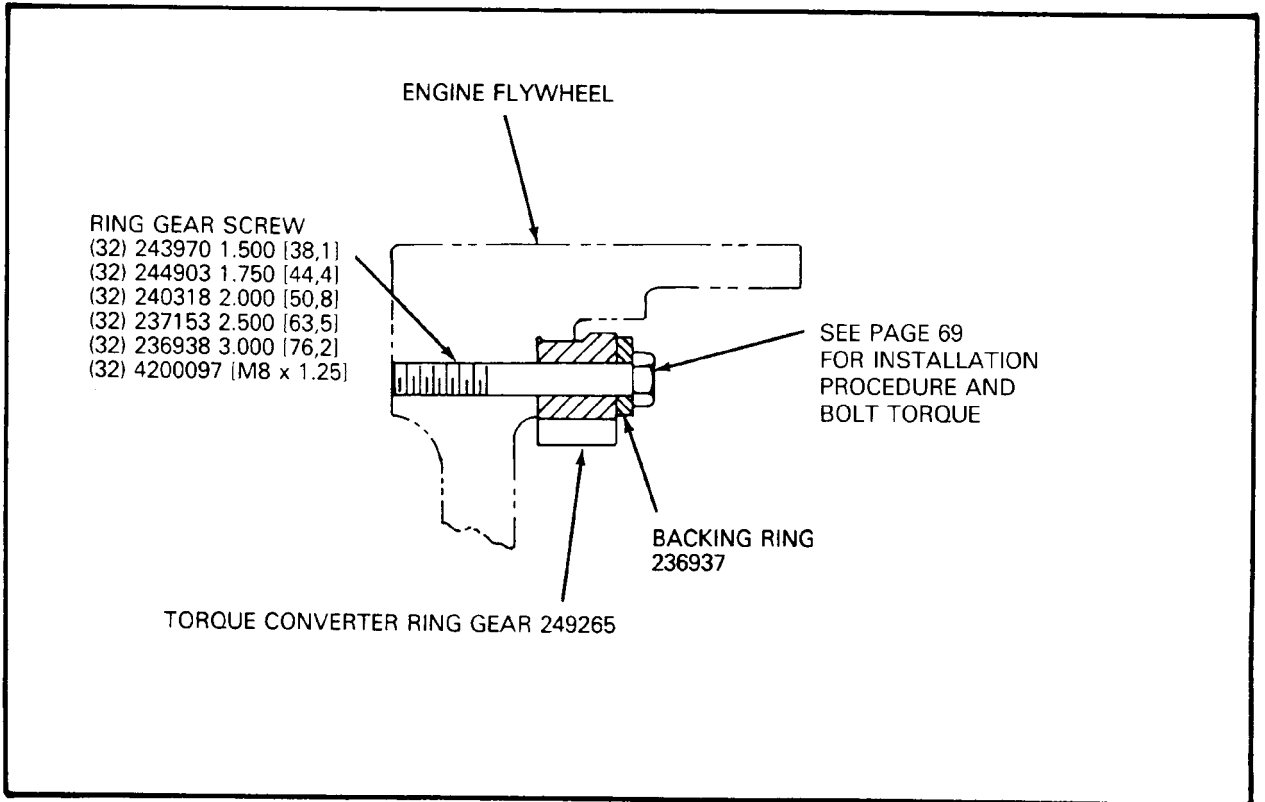
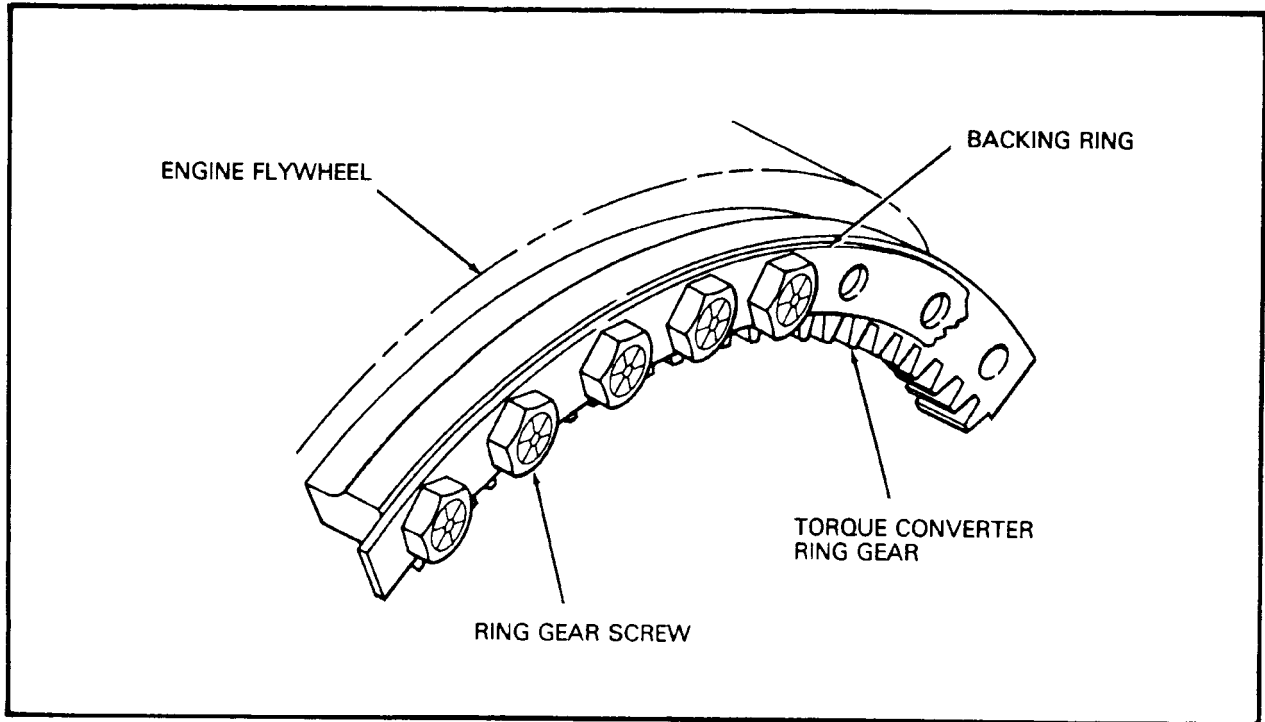


REAR VIEW

Assemble Speed Sensor Bushing in housing to specified dimension with Loctite 262 and stake (3) three places.

**SPEED SENSOR BUSHING INSTALLATION**





**32 SCREW RING GEAR INSTALLATION PROCEDURE  
(Non-Asbestos Ring Gear)**

1. Remove all burrs from flywheel mounting face and pilot bores. Clean the torque converter ring gear flywheel mounting surface and the ring gear screw tapped holes with solvent. Dry thoroughly, being certain ring gear screw holes are dry and clean.
2. Check engine flywheel and housing or housing adaptor for conformance to standard S.A.E. No.3 -SAE J927 and J1033 tolerance specifications for pilot bores size, pilot bores eccentricities and mounting face deviations. Measure and record engine crankshaft end play.
3. Install torque converter ring gear as shown

NOTE: Assembly of the ring gear must be completed within a fifteen minute period from start of screw installation. The screws are prepared with an epoxy coating which begins to harden after installation in the flywheel mounting holes. If not tightened to proper torque within the fifteen minute period insufficient screw clamping tension will result.

4. Install backing ring and thirty-two (32) special screws to approximately .06 inch [1,5 mm] of seated position. It is permissible to use a power wrench for this installation phase. With a calibrated torque wrench tighten screws 23 to 25 pounds feet of torque 131,2 -33,8 N.m].

To obtain maximum effectiveness of the special screw's locking feature, a minimum time period after screw installation of twelve (12) hours is suggested before engine start-up.

The special screw is to be used for ONE installation only. If the screw is removed for any reason it **MUST BE REPLACED**. It is recommended that the epoxy left in the flywheel hole be removed with the proper tap and cleaned with solvent Dry hole thoroughly and use a NEW screw for re-installation.

5. Assemble torque converter to engine flywheel by sliding converter into position by hand before fastening housing attachment screws. This may require more than one trial to match the drive gear teeth. Pulling the converter into position with housing attachment bolts is not recommended.
6. Measure engine crankshaft end play after assembly of torque converter. This value must be within one thousandth (0.001) of an inch (0,0254mm) of end play recorded (in Paragraph #2) before assembly of torque converter.

802544 -15 INCH [38,1] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	243970	Ring Gear Screw 1 5 Inch 138.11
1	802550	Installation Instruction Sheet

802545 1.75 INCH [44,4] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	244903	Ring Gear Screw 1 75 Inch [44,41
1	802550	Installation Instruction Sheet

802546 -2.0 INCH [50,8] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	240318	Ring Gear Screw 20 Inch 150,81
1	802550	Installation Instruction Sheet

802547 -25 INCH [63.51] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	237153	Ring Gear Screw 25 Inch 163,51
1	802550	Installation Instruction Sheet

802548 30 INCH [76.2] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	236938	Ring Gear Screw 30 Inch 176.21
1	802550	Installation Instruction Sheet

802549 M832 SCREW RING GEAR KIT

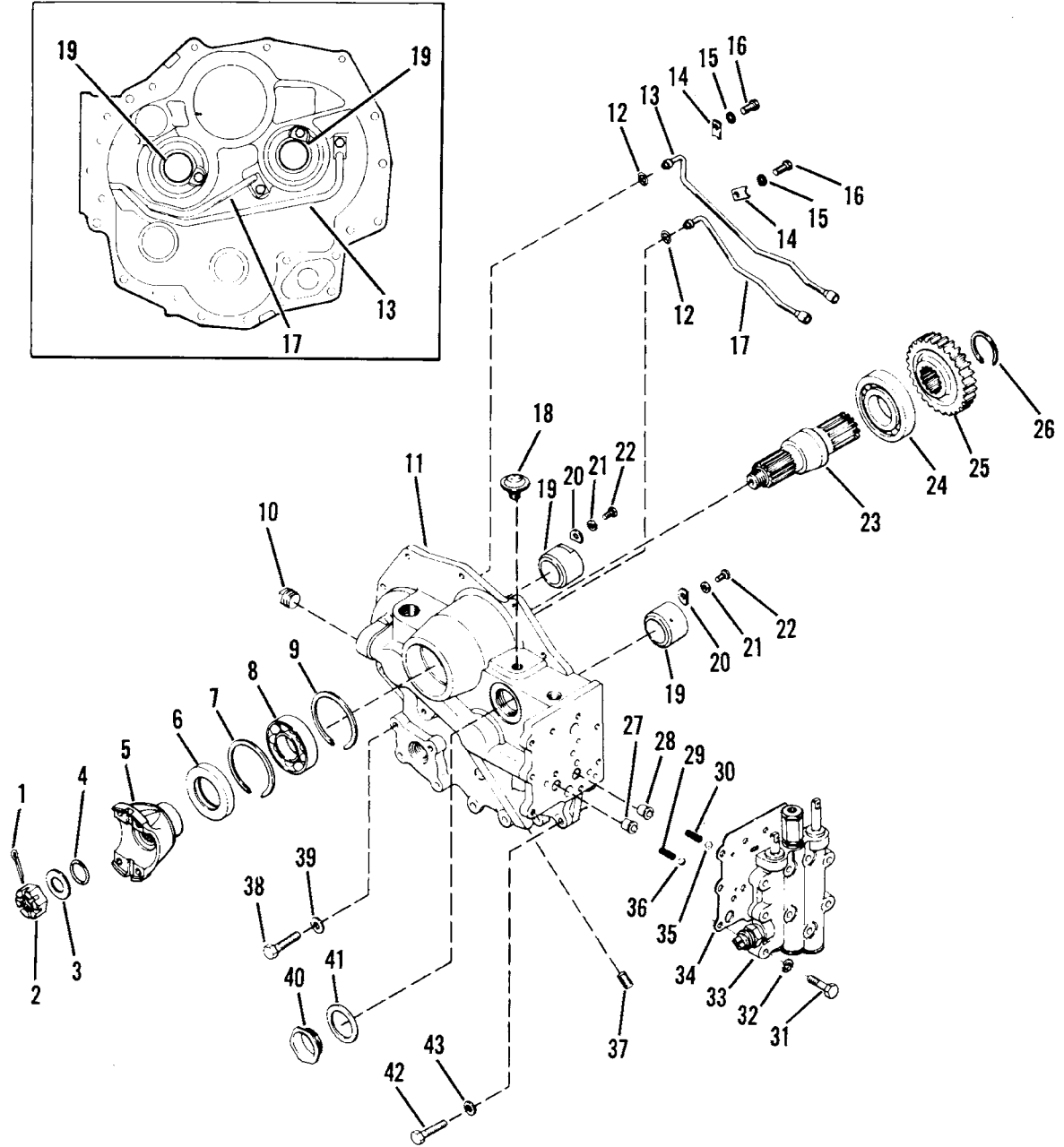
1	249265	Torque Converter Ring Gear
32	4200097	Ring Gear Screw I M8 x 1 251
1	802550	Installation Instruction Sheet

236937 Backing Ring Not Included in Ring Gear Kit Must be Ordered Separately

NOTE: The initial installation drive gear mounting kit includes a converter air breather. This breather is used on C & CL 2701C & CL 320 converters only and is not required for the HR & LHR 280001HR & LHR 32000 applications.

**SEE PAGE 68 FOR INSTALLATION ILLUSTRATIONS**

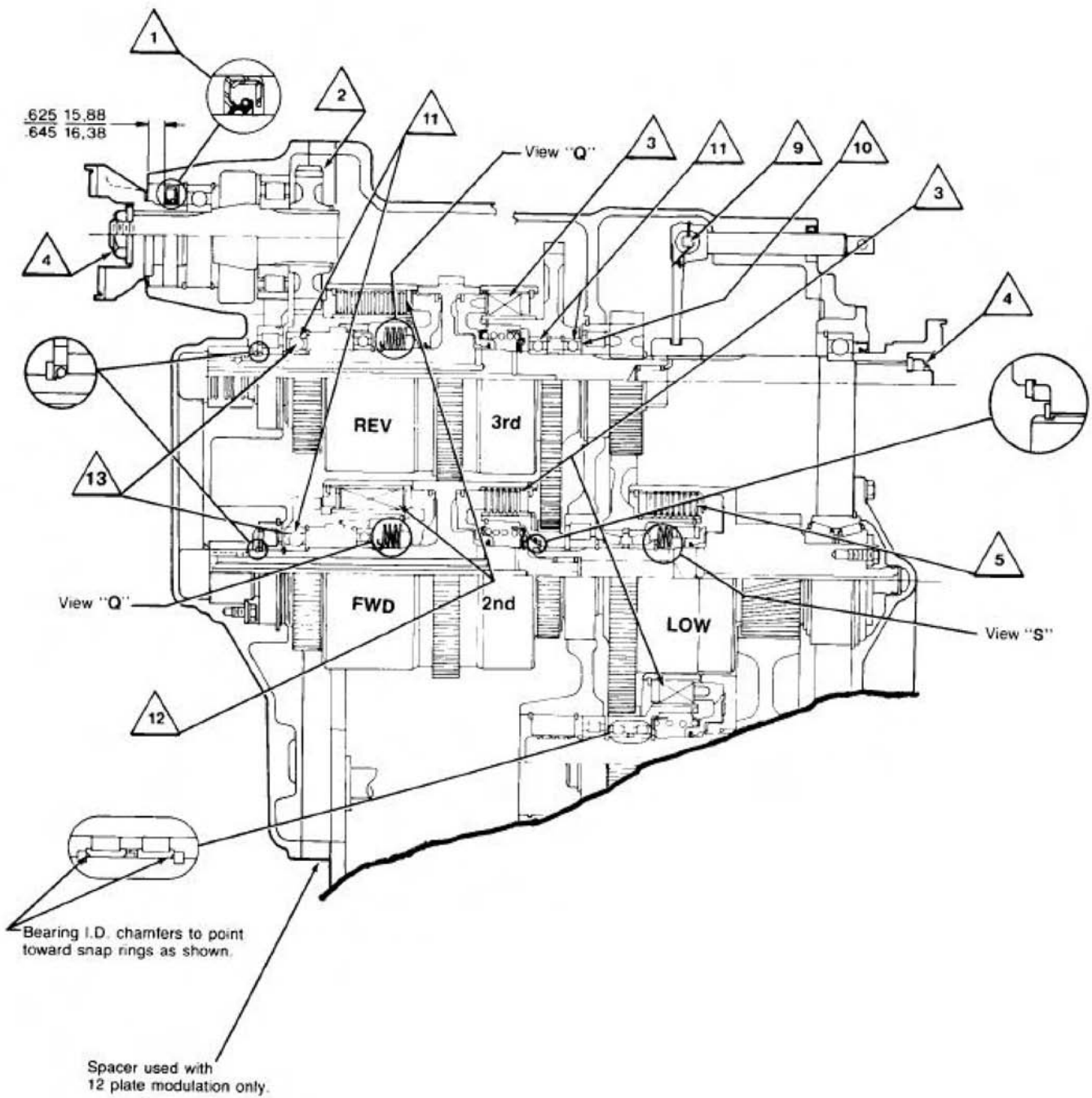
R-MODEL SECTION













**R32000 FRONT COVER GROUP**

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Flange Nut Cotter . . . . .	1	23	Input Shaft . . . . .	1
2	Flange Nut . . . . .	1	24	Input Shaft Rear Bearing . . . . .	1
3	Flange Nut Washer . . . . .	1	25	Input Shaft Gear . . . . .	1
4	Flange "O" Ring . . . . .	1	26	Input Shaft Gear Retaining Ring . . . . .	1
5	Input Flange . . . . .	1	27	Tube Sleeve . . . . .	1
6	Input Flange Oil Seal . . . . .	1	28	Tube Sleeve . . . . .	1
7	Input Shaft Front Bearing Retaining Ring . . . . .	1	29	Detent Spring . . . . .	1
8	Input Shaft Front Bearing . . . . .	1	30	Detent Spring . . . . .	1
9	Input Shaft Front Bearing Retaining Ring . . . . .	1	31	Valve to Converter Housing Screw . . . . .	9
10	Pipe Plug . . . . .	1	32	Valve to Converter Housing Screw Lockwasher . . . . .	9
11	Front Cover & Tube Assembly . . . . .	1	33	Control Valve Assembly . . . . .	1
12	"O" Ring . . . . .	2	34	Control Valve Gasket . . . . .	1
13	3rd Speed Tube Assembly . . . . .	1	35	Detent Ball . . . . .	1
14	Tube Clip . . . . .	2	36	Detent Ball . . . . .	1
15	Tube Clip Screw Lockwasher . . . . .	2	37	Pipe Plug . . . . .	1
16	Tube Clip Screw . . . . .	2	38	Cover to Case Screw . . . . .	4
17	Reverse Tube Assembly . . . . .	1	39	Cover to Case Screw Lockwasher . . . . .	4
18	Breather . . . . .	1	40	Front Cover Plug . . . . .	1
19	Front Cover Sleeve . . . . .	2	41	Front Cover Plug Gasket . . . . .	1
20	Front Cover Sleeve Lock . . . . .	2	42	Cover to Case Screw . . . . .	4
21	Sleeve Lockscrew Lockwasher . . . . .	2	43	Cover to Case Screw Lockwasher . . . . .	4
22	Sleeve Lockscrew . . . . .	2			

R-32000  
ASSEMBLY INSTRUCTION ILLUSTRATION



-  1 Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
-  2 Gear to be assembled with long hub length to this side.
-  3 Three clutches,6-outer steel plates,6-inner friction plates.Assemble alternately, starting with outer steel plate.
-  4 See Elastic Stop Nut Torque Chart
-  5 Low clutch,9-outer steel plates,9-inner friction plates.Assemble alternately, starting with outer steel plate.

-  9 Lockwire to prevent loosening
-  10 Bearing shield out
-  11 Must be loose internal fit bearings, No. "3" etched on bearing.
-  12 (12 Plate Modulation) Two clutches,12-outer steel plates,12-inner friction plates.Assemble alternately, starting with outer steel plate.
-  13 Bearing shield in.

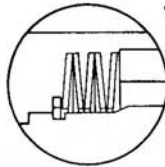
- A. - Use Permatex & Crane Sealer only where specified.
- B. - All lead in chamfers for oil seals, piston rings & "O" rings must be smooth & free from burrs. Inspect at ass'y.
- C. - Lubricate all piston ring grooves & "O" rings with oil before ass'y.
- D. - Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.

Notes

- E. - After assembly of parts using Permatex or Crane sealer, there must not be any free or excess material that could enter the oil circuit.
- F. - Apply light coat of Crane Sealer to all pipe plugs.
- G. - Apply a thin coating of grease between seal lips on lip type seals prior to ass'y.
- H. - Apply light coat of Permatex No. 2 to all thru hole stud threads.

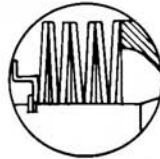
**NOTE:** Metric dimensions shown in brackets [ ].

Low Clutch Return Springs.  
Concave side of first spring to be placed against clutch piston. Remaining four washers to be stacked alternately reversed as shown.



View "S"


View "Q"  
2 Places




Forward & Reverse Clutch Return Springs.  
Concave side of first spring to be placed against clutch piston. Remaining six washers of each clutch to be stacked alternately reversed as shown.

**ELASTIC STOP NUT TORQUE**

THREAD SIZE	LB.-FT.	[N·m]
1" - 20	150 - 200	[203,4 - 271,1]
1 1/4" - 18	200 - 250	[271,2 - 338,9]
1 1/2" - 18	300 - 350	[406,8 - 474,5]
1 3/4" - 12	400 - 450	[542,4 - 610,1]

Grade 5 

Torque Specification for Lubricated or Plated Screw Threads

Grade 8 

NOM SIZE	FINE THREAD		COARSE THREAD		FINE THREAD		COARSE THREAD	
	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]
5625	91 - 100	[123,4 - 135,5]	82 - 90	[111,2 - 122,0]	128 - 141	[173,6 - 191,1]	115 - 127	[156,0 - 172,2]
5000	64 - 70	[86,8 - 94,9]	57 - 63	[77,3 - 85,4]	90 - 99	[122,1 - 134,2]	80 - 88	[108,5 - 119,3]
4375	41 - 45	[55,6 - 61,0]	37 - 41	[50,2 - 55,5]	58 - 64	[78,7 - 86,7]	52 - 57	[70,6 - 77,2]
3750	26 - 29	[35,3 - 39,3]	23 - 25	[31,2 - 33,8]	37 - 41	[50,2 - 55,5]	33 - 36	[44,8 - 48,8]
3125	16 - 20	[21,7 - 27,1]	12 - 16	[16,3 - 21,6]	28 - 32	[38,0 - 43,3]	26 - 30	[35,3 - 40,6]
2500	9 - 11	[12,3 - 14,9]	8 - 10	[10,9 - 13,5]	11 - 13	[15,0 - 17,6]	9 - 11	[12,3 - 14,9]

**MAINTENANCE AND SERVICE**

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled. It must also be understood that this is a basic 32000 transmission with many options. Companion flanges and output shafts with and without disconnect

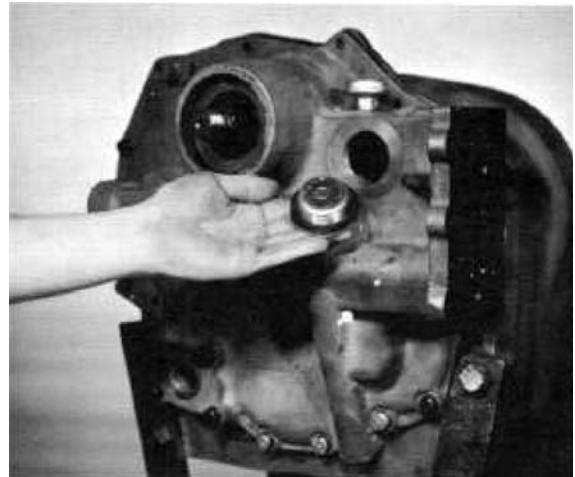
assemblies may vary on specific models. The units are very similar to trouble shoot, disassemble, repair and reassemble.

**CAUTION:** Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

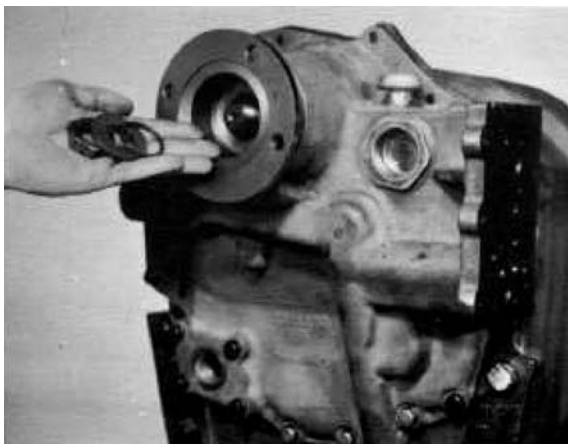
**DISASSEMBLY**



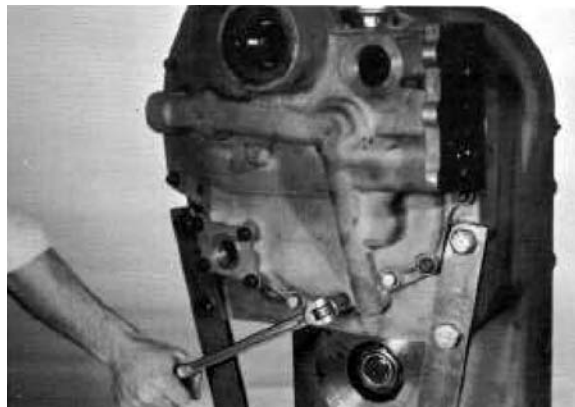
**Figure 1**  
Remove control valve bolts and washers. Remove control valve. Use caution as not to lose detent springs and bolts.



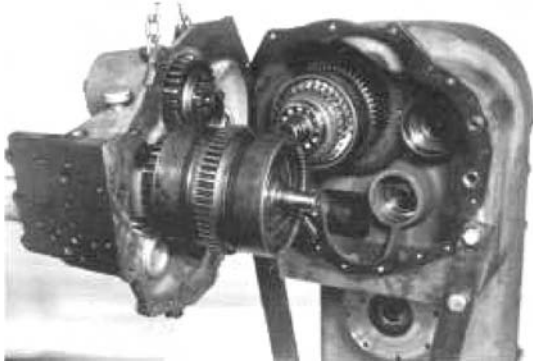
**Figure 3**  
Remove front cover plug.



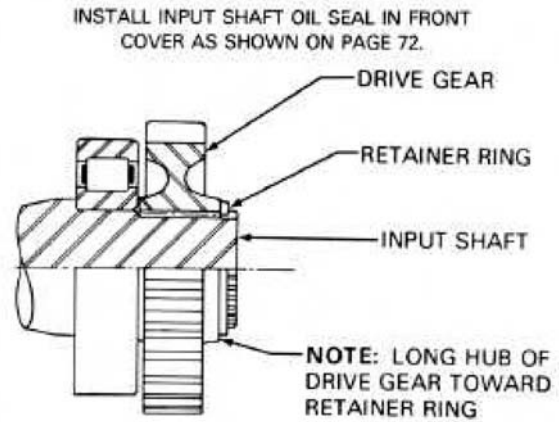
**Figure 2**  
Remove companion flange nut, washer and "O" ring.



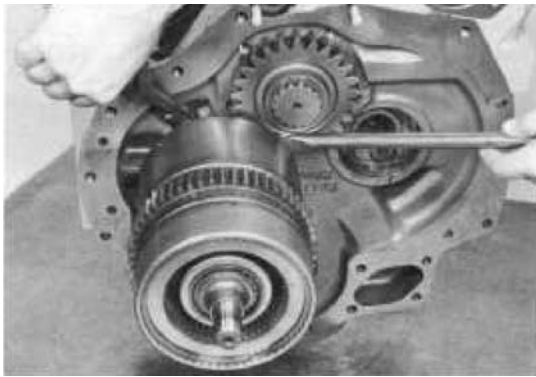
**Figure 4**  
Remove bolts securing front cover to transmission housing.



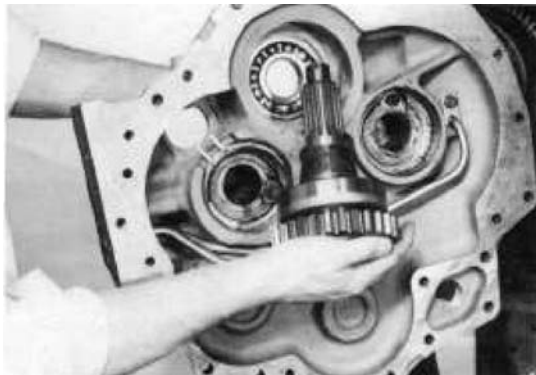
**Figure 5**  
Remove front cover and forward and 2nd clutch.



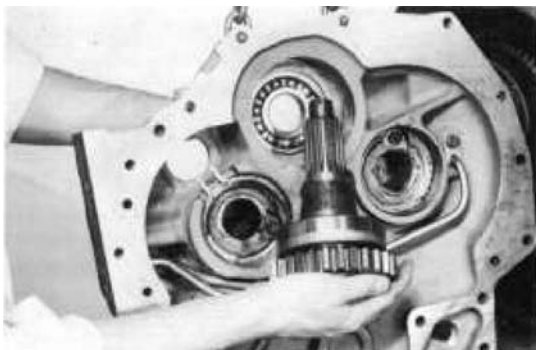
**Figure 8**  
Input shaft, rear bearing, drive gear and snap ring.



**Figure 6**  
Use a spreading type snap ring pliers to spread the ears on forward clutch front bearing retainer ring. Remove forward clutch with pry bar.

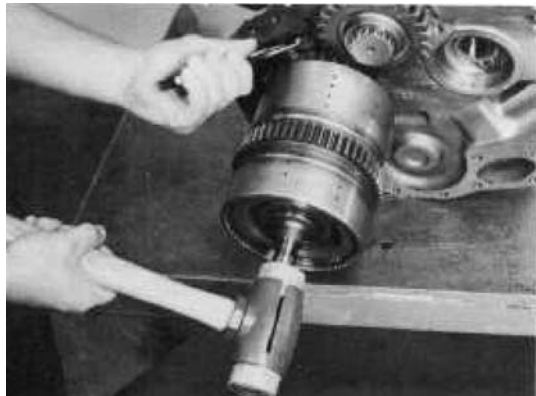


**Figure 9**  
Install input shaft into front bearing.



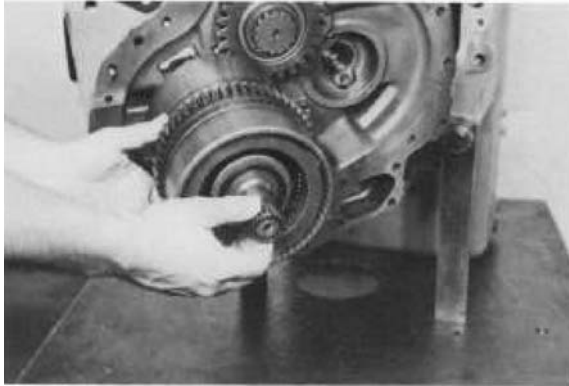
**Figure 7**  
If input shaft is to be removed, tap on threaded end of shaft, remove input shaft, gear and bearing.

See cleaning and inspection page.



**Figure 10**  
Support converter housing with chain fall. Spread forward clutch front bearing retainer ring and tap forward and 2nd clutch assembly into transmission case assembly. Be certain snap ring is in full position in ring groove.

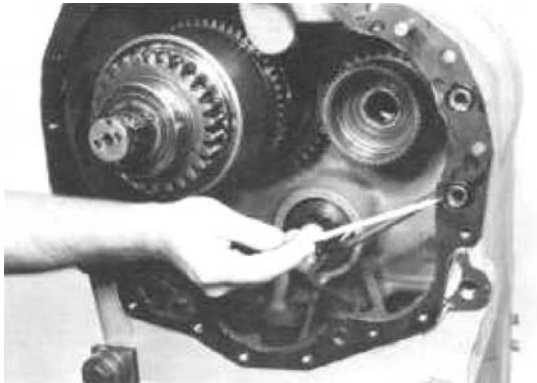




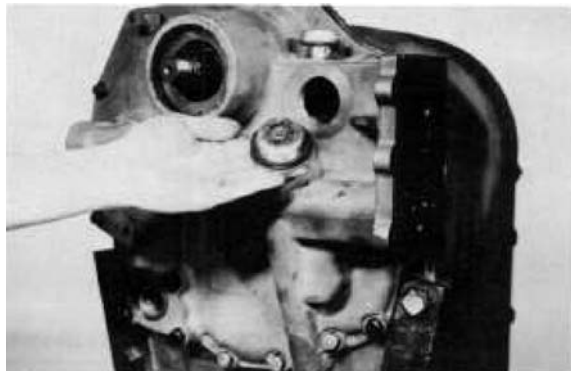
**Figure 11**  
Install 2nd speed clutch pilot bearing.



**Figure 14**  
Support front cover with a chain fall. Install alignment studs in transmission case. Position front cover assembly on aligning studs. Turn output flange to align clutch disc hub in clutch. Do not force this operation. With front cover in position against the transmission case install cover to case bolts. Tighten to specified torque.



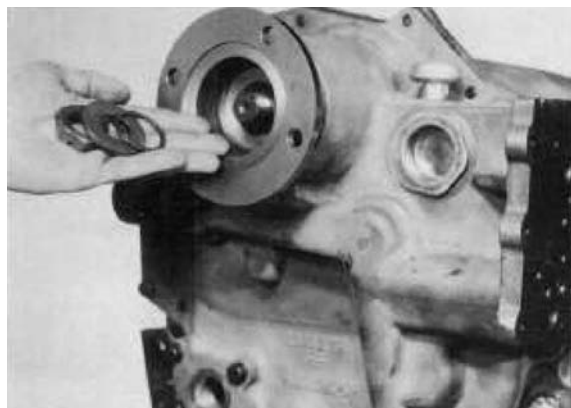
**Figure 12**  
Install transmission case gasket and "O" ring seals.



**Figure 15**  
Install front cover plug.



**Figure 13**  
Install housing spacer, gasket and "O" ring seals. **NOTE:** Housing spacer is used with 12 plate clutch modulation only.



**Figure 16**  
Install companion flange, flange "O" ring, washer and nut. Torque nut to specified torque. (See elastic stop nut torque chart).

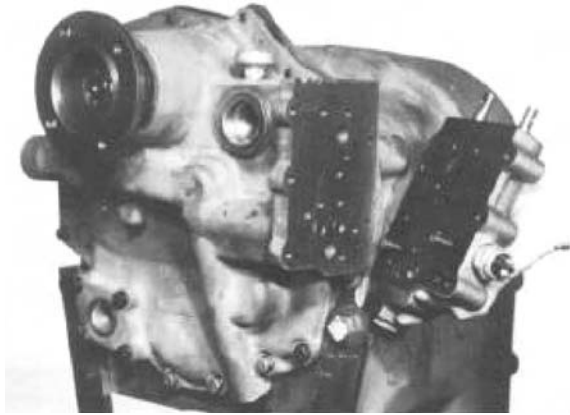


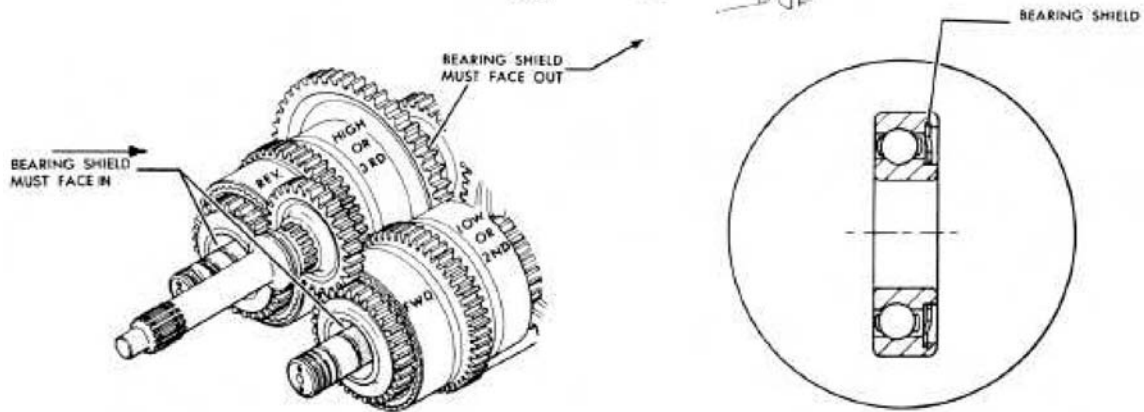
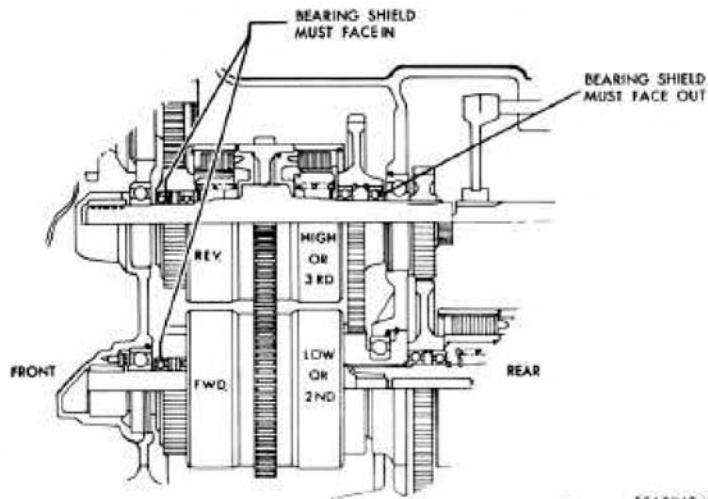
Figure 17

Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.

**NOTE:** The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

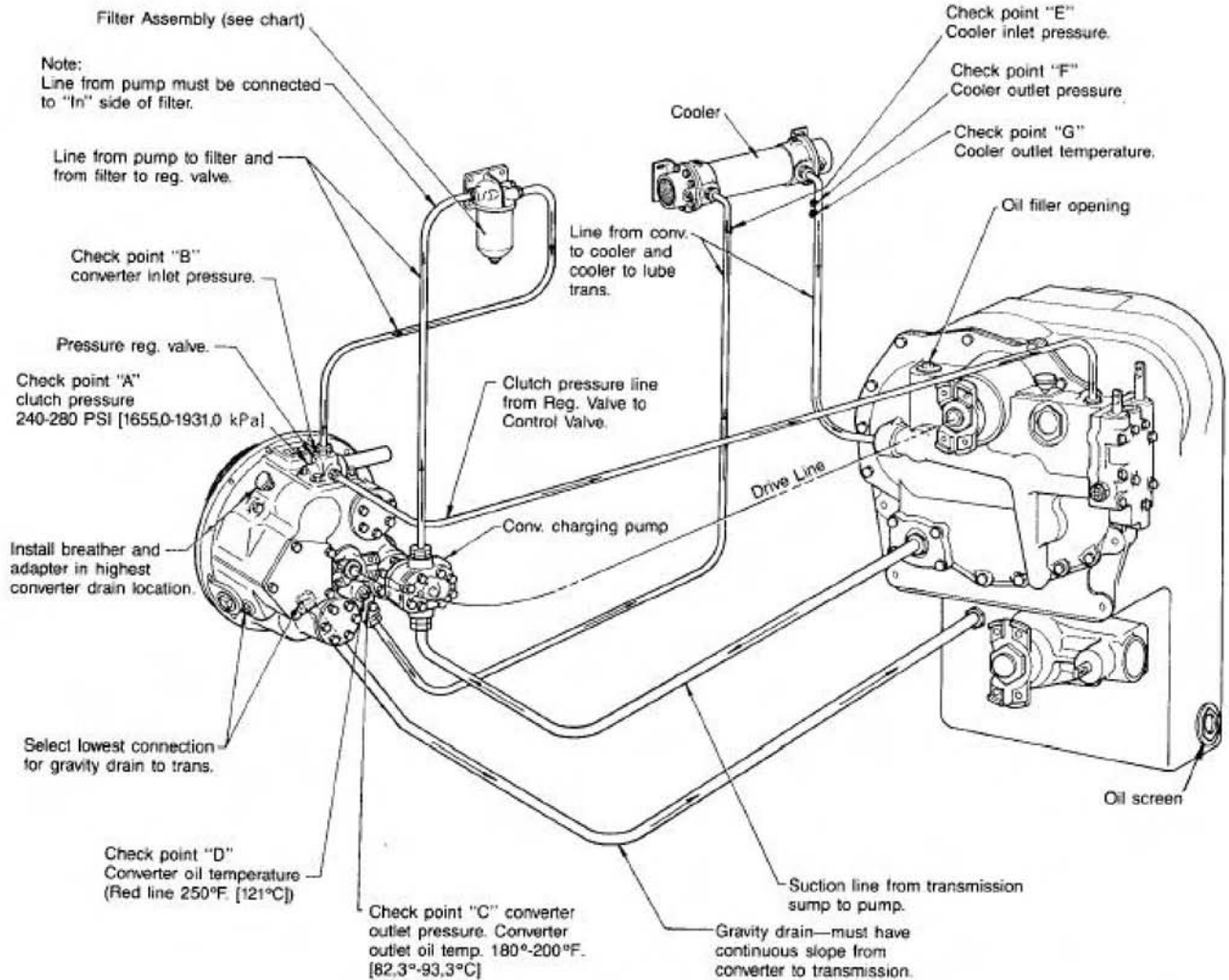
Each disc spring assembly is made up of selected springs to precisely match each part within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this imbalance may adversely affect overall life of springs.

Service replacement assemblies are banded together and must be replaced as assembly.



SHIELDED BEARING INSTALLATION

R32000 -C270/EXTERNAL PLUMBING DIAGRAM



Metric dimensions shown in brackets [ ].

**Note: Do not deviate any line size.**

**Check point "C"** converter outlet pressure. Converter outlet oil temp. 180°-200°F. [82.3°-93.3°C] Transmission in neutral. Operating specifications: 25 PSI [172.0 kPa] minimum pressure at 2000 RPM engine speed and a maximum of 70 PSI [483.0 kPa] outlet pressure with engine operating at no-load governed speed.

- Notes:**  
Hose line operating requirements.
- 1. Pressure Lines**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Must withstand 300 PSI [2068 kPa] continuous pressure with 600 PSI [4137 kPa] intermittent surges. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
  - 2. Suction Line**—To be protected from collapse by interwoven steel wire. Ref. S.A.E. Spec. No. J517,100R4 Hydraulic Hose Specification. Suitable for operation from ambient to 250°F. [121,1°C]. Continuous operating temperature.
  - 3. Gravity Drain Line**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
  - 4. All Hose Lines** used must conform to S.A.E. Spec. No. J1019 Test Procedure for High Temp. Transmission Oil Hose.
  - 5. See Lubrication Specifications.**

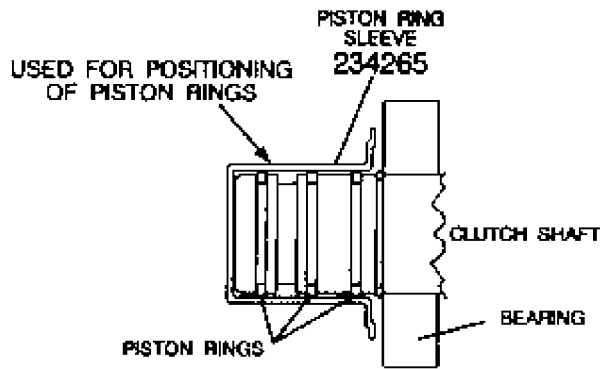
**FILTER ASSEMBLY CHART**

Filter Type	Assembly No.	Cartridge No.	Spin-on Type	
			Assembly No.	Element
A	1533614 Single Can	215502	247055 Single Element	247052
B	234777 Dual Can	215502	246787 Dual Element	243622

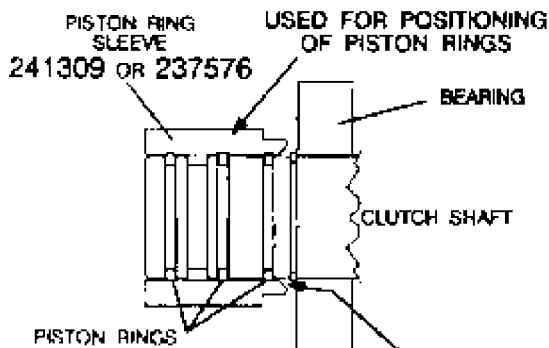
**INSTALLATION INSTRUCTIONS OF NEW NON-METALLIC SEALING RINGS**

Proper oil sealing ring (piston ring) installation procedures. Refer to the appropriate transmission maintenance and service manual for disassembly, cleaning, inspection and reassembly.

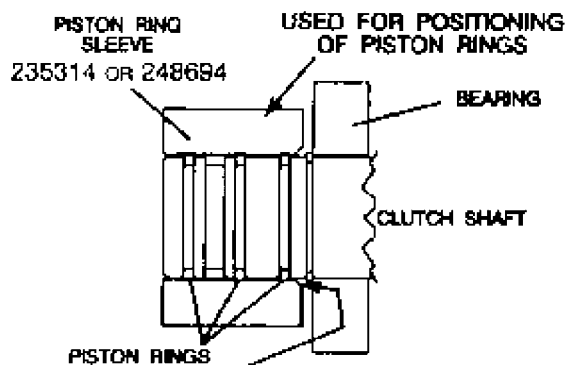
1. Fill the oil sealing ring grooves with a good grade of grease, this will help stabilize the sealing ring in the ring groove for installation.
2. Carefully position the piston ring on the shaft in the inner most ring groove. Hook the piston ring joint.
3. Repeat steps 1, and 2 for the remaining ring or rings making certain all hook joints are fastened securely.
4. Apply a heavy coat of grease to the outer diameter of the rings and shaft. Center the piston rings in the ring groove.
5. When installing the clutch assembly in the transmission case it is recommended a piston ring sleeve P/N's 241309, 237576, 235314 or 248694 be used to center all of the piston rings in their respective ring grooves. Use extreme caution to not damage piston ring when installing the clutch shaft in the transmission case, or when installing the converter housing or front cover on the clutch shafts.



**18000 SERIES**

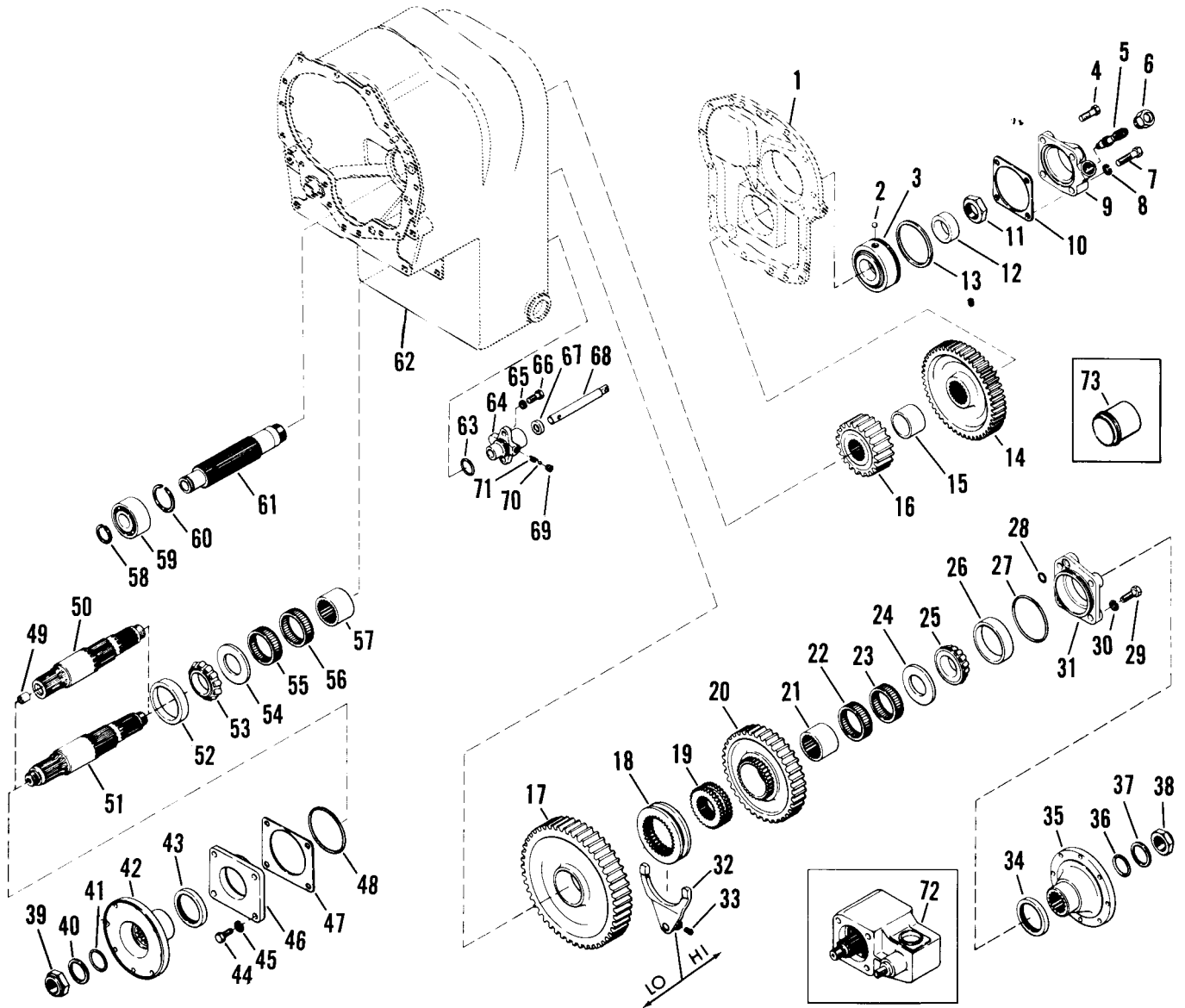


**2420, 24000, 28000, 32000, 33000  
34000, 36000 SERIES**



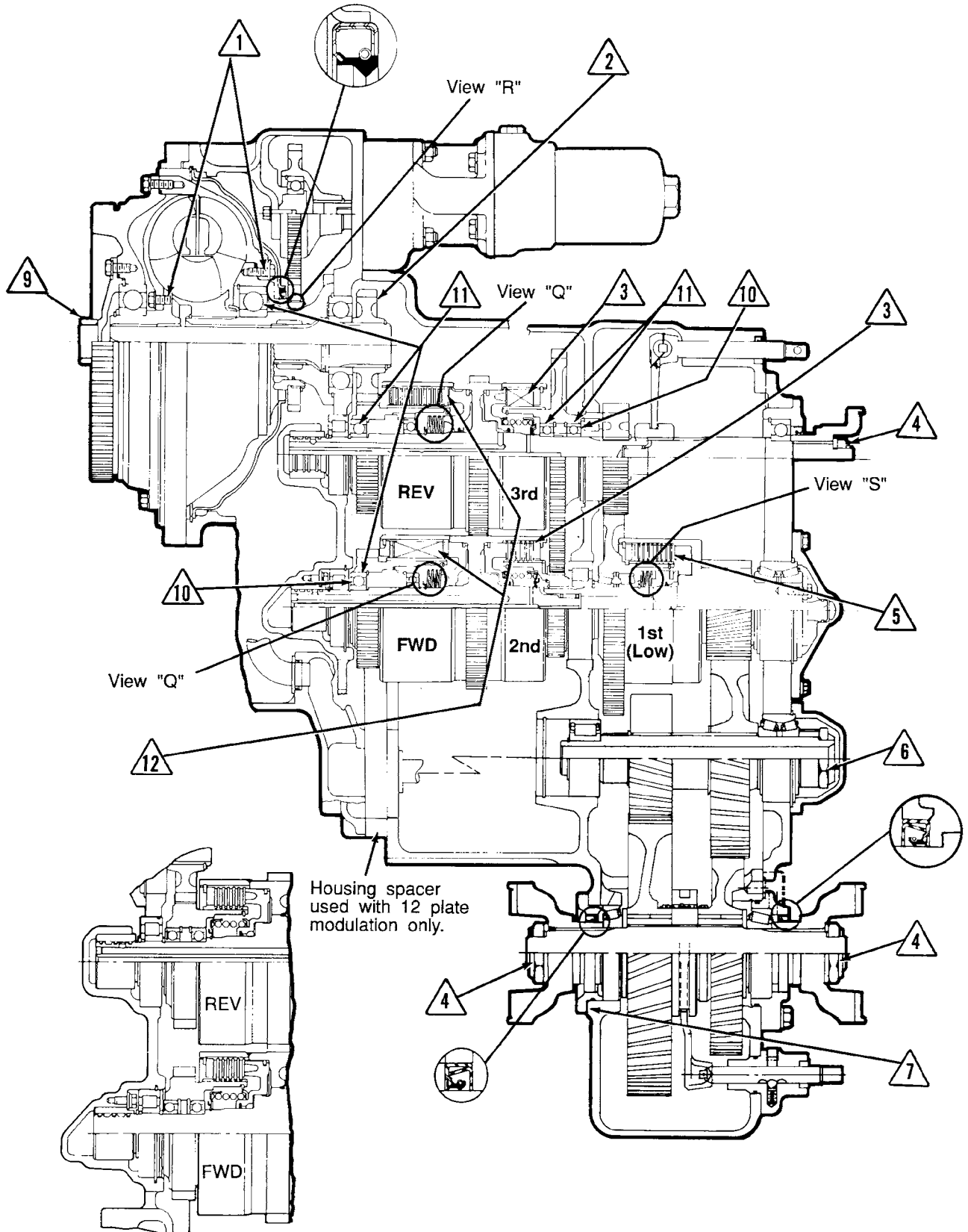
**28000, 32000 SERIES  
4TH CLUTCH SHAFT**

Be sure that lead in chamfer and intersection of lead in chamfer to piston ring bore is free of burrs and nicks.



**32000 6 & 8 SPEED OUTPUT GROUP  
WITH RANGE SHIFT**

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Rear Cover . . . . .	1	38	Output Flange Nut . . . . .	1
2	Idler Shaft Rear Bearing Lock Ball . . . . .	1	39	Output Flange Nut . . . . .	1
3	Idler Shaft Rear Bearing . . . . .	1	40	Output Flange Washer . . . . .	1
4	Idler Shaft Bearing Cap Screw . . . . .	3	41	Output Flange "O" Ring . . . . .	1
5	Speedometer Driven Gear . . . . .	1	42	Output Flange . . . . .	1
6	Speedometer Tube Nut . . . . .	1	43	Output Shaft Front Bearing Cap Oil Seal . .	1
7	Idler Shaft Bearing Capscrew . . . . .	1	44	Output Shaft Front Bearing Cap Screw . . .	4
8	Idler Shaft Bearing Capscrew Lockwasher .	4	45	Output Shaft Front Bearing Cap Lockwasher	4
9	Idler Shaft Bearing Cap . . . . .	1	46	Output Shaft Front Bearing Cap . . . . .	1
10	Idler Shaft Bearing Cap Gasket . . . . .	1	47	Front Bearing Cap Shim . . . . .	AR
11	Idler Shaft Nut . . . . .	1	48	Front Bearing Cap "O" Ring . . . . .	1
12	Speedometer Drive Gear or Bearing Spacer	1	49	Bushing (Used with Disconnect Only) . . . .	1
13	Idler Shaft Rear Bearing Locating Ring . . .	1	50	Output Shaft (Used with Disconnect Only) .	1
14	Idler Shaft Gear . . . . .	1	51	Output Shaft . . . . .	1
15	Idler Shaft Gear Spacer . . . . .	1	52	Output Shaft Front Bearing Cup . . . . .	1
16	Idler Shaft Low Range Gear . . . . .	1	53	Output Shaft Front Bearing Cone . . . . .	1
17	Low Range Gear . . . . .	1	54	Output Gear Thrust Washer . . . . .	1
18	High Low Shift Hub . . . . .	1	55	Output Gear Bearing . . . . .	1
19	Shift Hub Sleeve . . . . .	1	56	Output Gear Bearing . . . . .	1
20	High Range Gear . . . . .	1	57	Output Gear Bearing Inner Race . . . . .	1
21	Output Gear Inner Race . . . . .	1	58	Idler Shaft Front Bearing Retainer Ring . . .	1
22	Output Gear Bearing . . . . .	1	59	Idler Shaft Front Bearing . . . . .	1
23	Output Gear Bearing . . . . .	1	60	Idler Shaft Gear Locating Ring . . . . .	1
24	Output Gear Thrust Washer . . . . .	1	61	Idler Shaft . . . . .	1
25	Output Shaft Rear Bearing Cone . . . . .	1	62	Transmission Case Assembly . . . . .	1
26	Output Shaft Rear Bearing Cup . . . . .	1	63	Range Shift Rail Support "O" Ring . . . . .	1
27	Output Shaft Rear Bearing Cap "O" Ring . .	1	64	Range Shift Rail Support . . . . .	1
28	Output Shaft Rear Bearing Cap "O" Ring . .	1	65	Range Shift Rail Support Screw Lockwasher . . . . .	2
29	Output Shaft Rear Bearing Cap Screw . . . .	4	66	Range Shift Rail Support Screw . . . . .	2
30	Output Shaft Rear Bearing Cap Screw Lockwasher . . . . .	4	67	Range Shift Rail Oil Seal . . . . .	1
31	Output Shaft Rear Bearing Cap . . . . .	1	68	Range Shift Rail . . . . .	1
32	High and Low Range Shift Fork . . . . .	1	69	Range Shift Rail Detent Plug . . . . .	1
33	Shift Fork Lock Screw . . . . .	1	70	Range Shift Rail Detent Ball . . . . .	1
34	Rear Bearing Cap Oil Seal . . . . .	1	71	Range Shift Rail Detent Spring . . . . .	1
35	Rear Output Flange . . . . .	1	72	Disconnect (Optional) . . . . .	1
36	Output Flange "O" Ring . . . . .	1	73	Bearing Cap Bore Plug (Optional) . . . . .	1
37	Output Flange Washer . . . . .	1			



Housing spacer used with 12 plate modulation only.

**NON-MODULATED**

- ⚠ Impeller Hub and Turbine Hub Assembly with Backing Ring and Special Self Locking Screws.
  1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry & clean.
  2. Install backing ring and special self locking screws.
 Tighten screws 40 to 45 Lbs. Ft. [54,3-61,0 N·m]  
 Note: Assembly of hub must be complete within a fifteen minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The epoxy left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.
- ⚠ Gear to be assembled with long hub length to this side.
- ⚠ Three clutches, 6-outer steel plates, 6-inner friction plates. Assemble alternately, starting with outer steel plate.
- ⚠ See Elastic Stop Nut Torque Chart
- ⚠ Low clutch, 9-outer steel plates, 9-inner friction plates. Assemble alternately, starting with outer steel plate.
- ⚠ See Elastic Stop Nut Torque Chart
- ⚠ Shim output shaft bearings to produce 6 to 8 Lbs.-In. [0,68,-0,90 N·m] preload.
- ⚠ Tighten oil screen ass'y. 10 to 15 Lbs. Ft. [13,6-20,0 N·m]

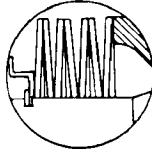
- ⚠ Heat nose bushing to 200° F° (93°C) before ass'y. of bushing to cover.
- ⚠ Bearing shield **OUT** on 3rd speed clutch. Bearing shield **IN** on Fwd. & Rev. clutch.
- ⚠ Must be loose internal fit bearings, No. "3" etched on bearing.
- ⚠ (12 Plate Modulation) Two clutches, 12-outer steel plates, 12-inner friction plates. Assemble alternately, starting with outer steel plate.

Notes

- A. - Use Permatex & Crane Sealer only where specified.
- B. - All lead in chamfers for oil seals, piston rings & "O" rings must be smooth & free from burrs. Inspect at ass'y.
- C. - Lubricate all piston ring grooves & "O" rings with oil before ass'y.
- D. - Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
- E. - After assembly of parts using Permatex or Crane sealer, there must not be any free or excess material that could enter the oil circuit.
- F. - Apply light coat of Crane Sealer to all pipe plugs.
- G. - Apply a thin coating of grease between seal lips on lip type seals prior to ass'y.
- H. - Apply light coat of Permatex No. 2 to all thru hole stud threads.

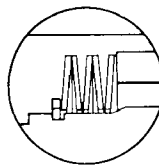
NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc.

View "Q" 2 Places Modulation only

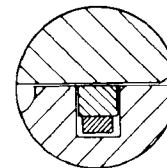


Low Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining four springs to be stacked alternately reversed as shown.

View "S"



View "R"



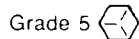
Enlarged view of Piston Ring & Expander  
 Note: Expander gap to be approx. 180° from ring hook joint to aid ring assembly.

Forward & Reverse Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining six springs of each clutch to be stacked alternately reversed as shown. See note on page 77.

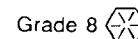
NOTE: Metric dimensions shown in brackets [ ].

ELASTIC STOP NUT TORQUE

THREAD SIZE	LB.-FT.	[N·m]
1" - 20	150 - 200	[203,4 - 271,1]
1¼" - 18	200 - 250	[271,2 - 338,9]
1½" - 18	300 - 350	[406,8 - 474,5]
1¾" - 12	400 - 450	[542,4 - 610,1]

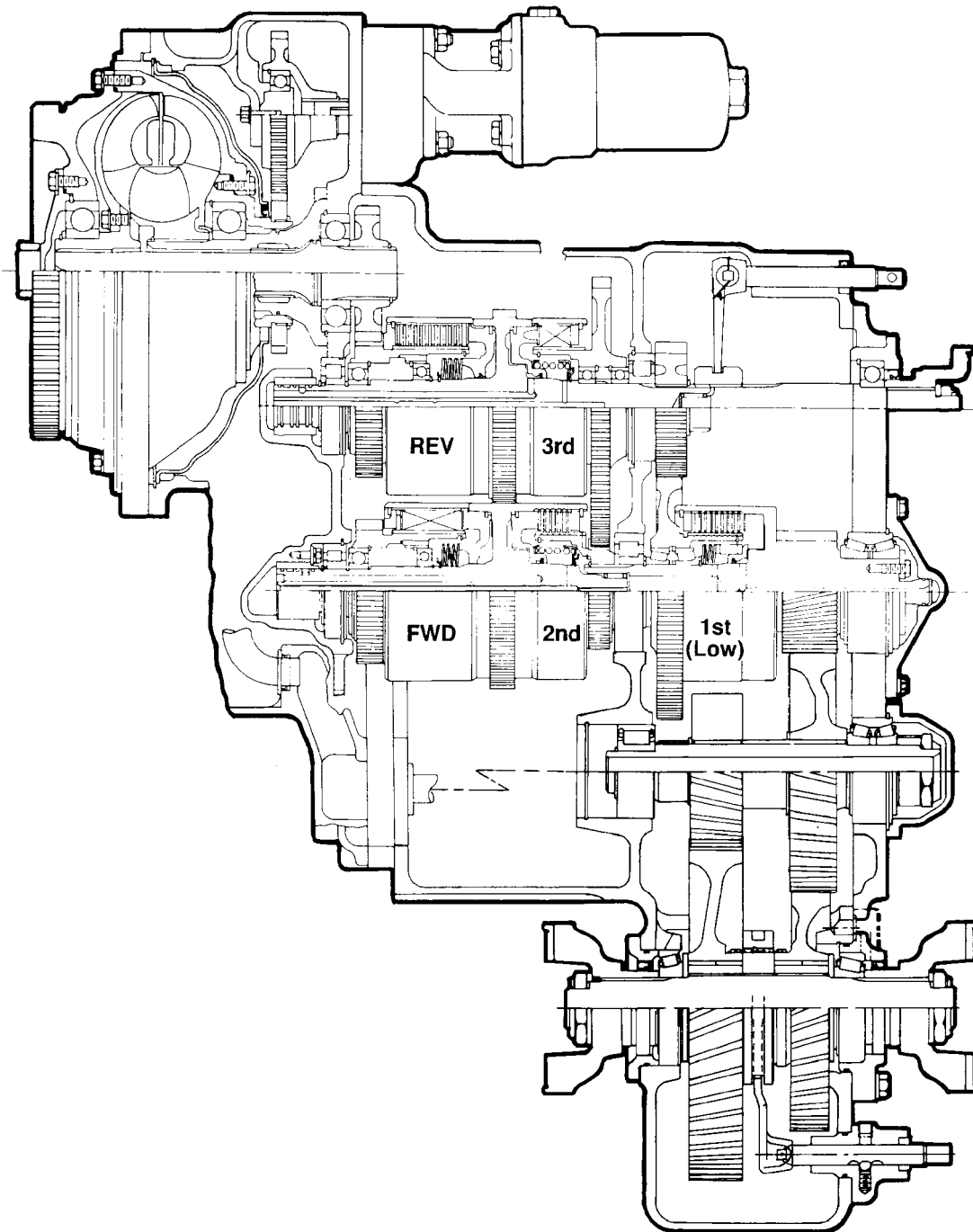


Torque Specification for Lubricated or Plated Screw Threads



NOM. SIZE	FINE THREAD		COARSE THREAD		FINE THREAD		COARSE THREAD	
	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]
5625	91 - 100	[123,4 - 135,5]	82 - 90	[111,2 - 122,0]	128 - 141	[173,6 - 191,1]	115 - 127	[156,0 - 172,2]
5000	64 - 70	[86,8 - 94,9]	57 - 63	[77,3 - 85,4]	90 - 99	[122,1 - 134,2]	80 - 88	[108,5 - 119,3]
4375	41 - 45	[55,6 - 61,0]	37 - 41	[50,2 - 55,5]	58 - 64	[78,7 - 86,7]	52 - 57	[70,6 - 77,2]
3750	26 - 29	[35,3 - 39,3]	23 - 25	[31,2 - 33,8]	37 - 41	[50,2 - 55,5]	33 - 36	[44,8 - 48,8]
3125	16 - 20	[21,7 - 27,1]	12 - 16	[16,3 - 21,6]	28 - 32	[38,0 - 43,3]	26 - 30	[35,3 - 40,6]
2500	9 - 11	[12,3 - 14,9]	8 - 10	[10,9 - 13,5]	11 - 13	[15,0 - 17,6]	9 - 11	[12,3 - 14,9]





**R & HR MODEL 6 & 8 SPEED**

The R & HR 32000 6 speed transmission is the same as the 3 speed R & HR 32000 except the difference being in the idler and output shafts. The 6-speed unit has a gear added to the idler shaft and the output shaft has a high and low range shift.

The 32000 6 speed transmission is the same as the 6 speed except the 8 speed has a 4th speed clutch.

The 6-speed transmission has 3 working range shifts and 3 travel range shifts.

Gear ratio determines working and travel ranges. They are as follows:

1st - 2nd and 4th working range. 3rd - 5th and 6th travel range.

**NOTE: Range shift from low to high must be made with machine stopped.**

The 8-speed transmission has 8 forward speeds and 8 reverse speeds.

The 8-speed transmission has 4 working range shifts and 4 travel range shifts.

Gear ratio determines working and travel ranges. They are as follows:

1st - 2nd -3rd and 5th working ranges 4th - 6th - 7th and 8th travel range.

**NOTE: Range shift from low to high must be made with machine stopped.**

**DISASSEMBLY**

Figure 55 shows the idler shaft with one gear. The 6 speed unit will have two gears and a heavier front bearing. See Figure 55A below:



**Figure 55A**

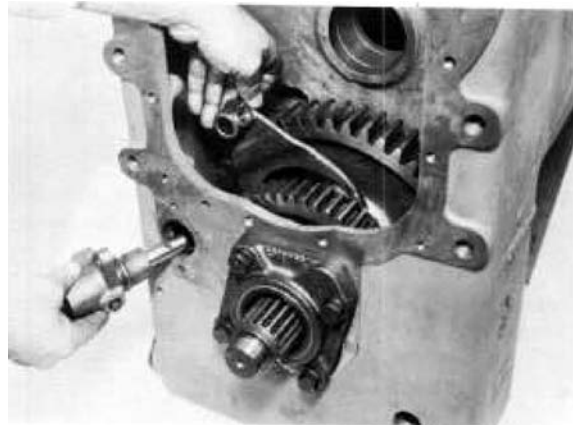
6 & 8 speed idler shaft, gear and bearing assembly. **NOTE: Do not lose rear bearing lock ball.**

**6 & 8 SPEED OUTPUT DISASSEMBLY**



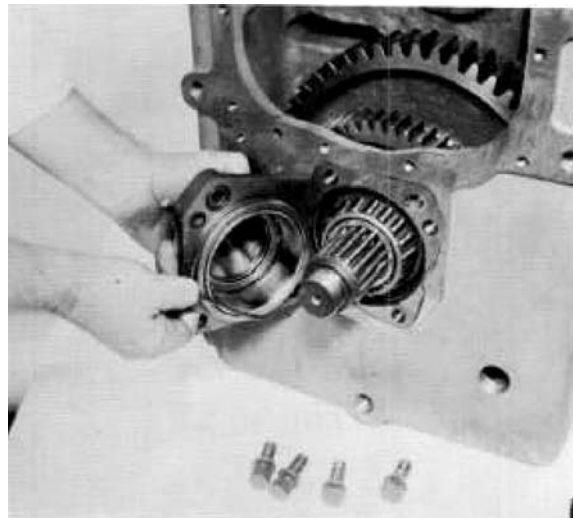
**Figure 1**

With all clutches and shafts removed, cut lockwire on range shift fork lockscrew. Remove fork lockscrew.



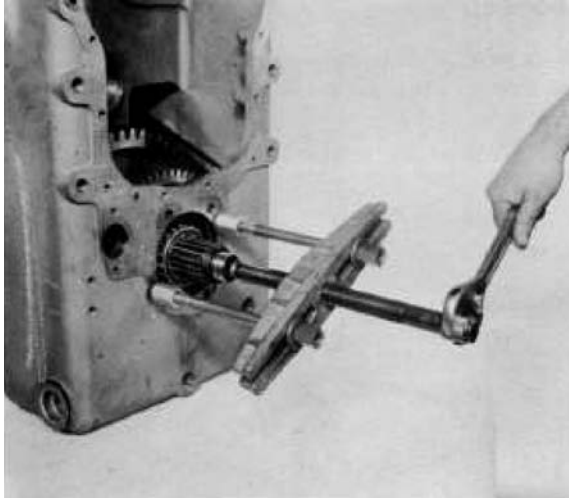
**Figure 2**

Remove range shift rail support bolts. Remove rail support, rail and range shift fork.



**Figure 3**

Remove output shaft rear bearing cap bolts and bearing cap.



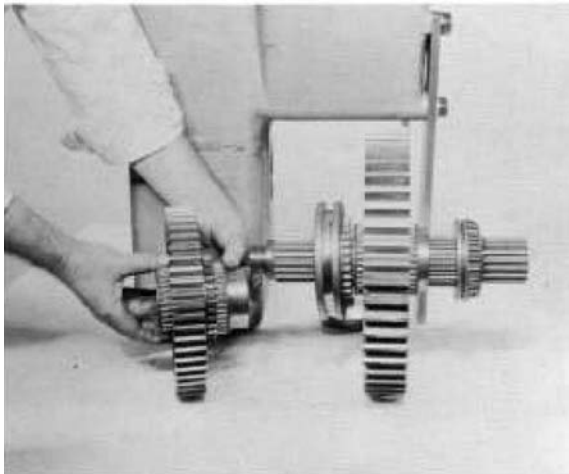
**Figure 4**

Remove front output flange nut, washer, "O" ring, flange and bearing cap from housing. Block output gears. Push output shaft from rear through gears and taper bearing.

Proceed with Figure 72 through 216 in the R & HR 32000 Series 3-Speed Maintenance Section then refer to Figure 5 below.

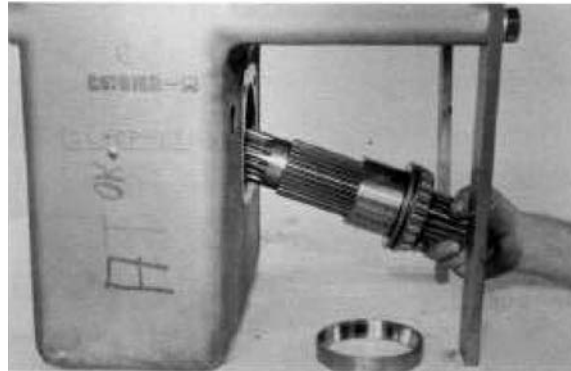
**REASSEMBLY**

(See cleaning and inspection page.)



**Figure 5**

View of output shaft as it would be positioned in transmission case. **NOTE:** Front bearing cone and output gear thrust washer shouldered on shaft with large diameter of bearing in.



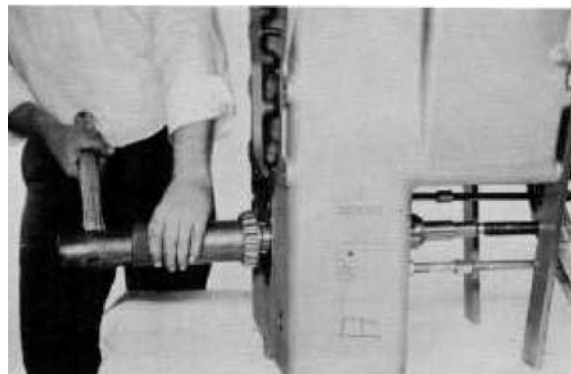
**Figure 6**

Position high and low range gears, shift hub, hub sleeve and needle bearings in transmission case as shown in Figure 5. Insert output shaft, front bearing and thrust washer through output gears. Use caution as not to damage high and low range gear needle bearings.



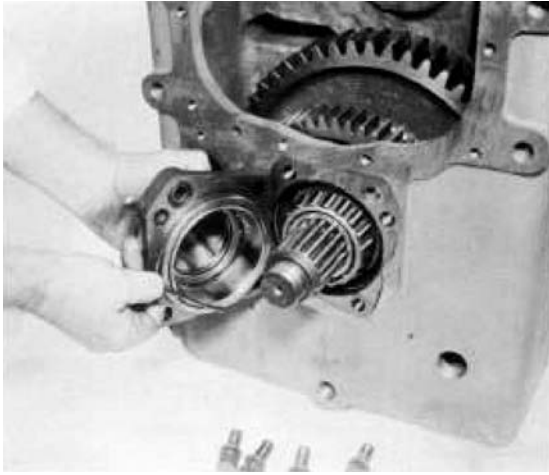
**Figure 7**

Position output gear thrust washer and rear taper bearing on output shaft.



**Figure 8**

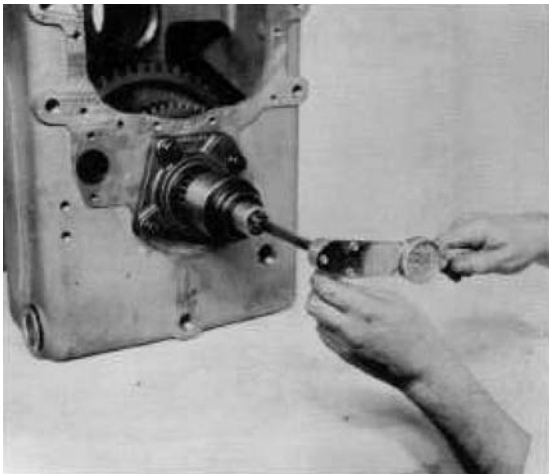
Block output shaft from the front and install rear taper bearing.



**Figure 9**

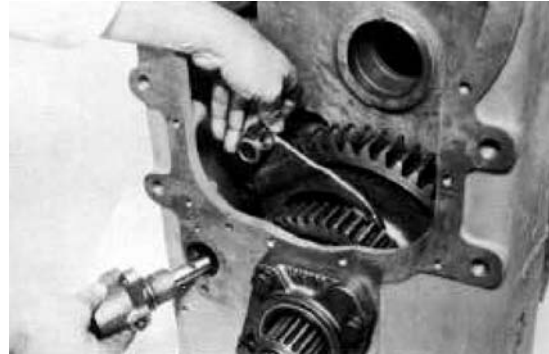
Using new "O" rings install rear output bearing cap and taper bearing cup on transmission case. Lube opening in bearing cap must be aligned with lube opening in case. Tighten bearing cap bolts to specified torque. (See torque chart.)

Install front bearing cap and shims. Tighten bolts to specified torque. Tap output shaft front and rear to seat taper bearings. Loosen front bearing cap bolts.



**Figure 10**

Using a inch lb. torque wrench, determine the rolling torque of the output shaft and record. Tighten front bearing cap bolts to specified torque. Check rolling torque with bolts tight. Torque must be 8 to 8 inch lbs. [0.68 - 0.90 N.m] more than when bearing cap bolts were loose. Add or omit shims on the front bearing cap to achieve the proper preload.



**Figure 11**

Locate high-low range shift fork in shift hub with offset of fork toward gear. Insert rail support and rail into bore in transmission housing and into shift fork.



**Figure 12**

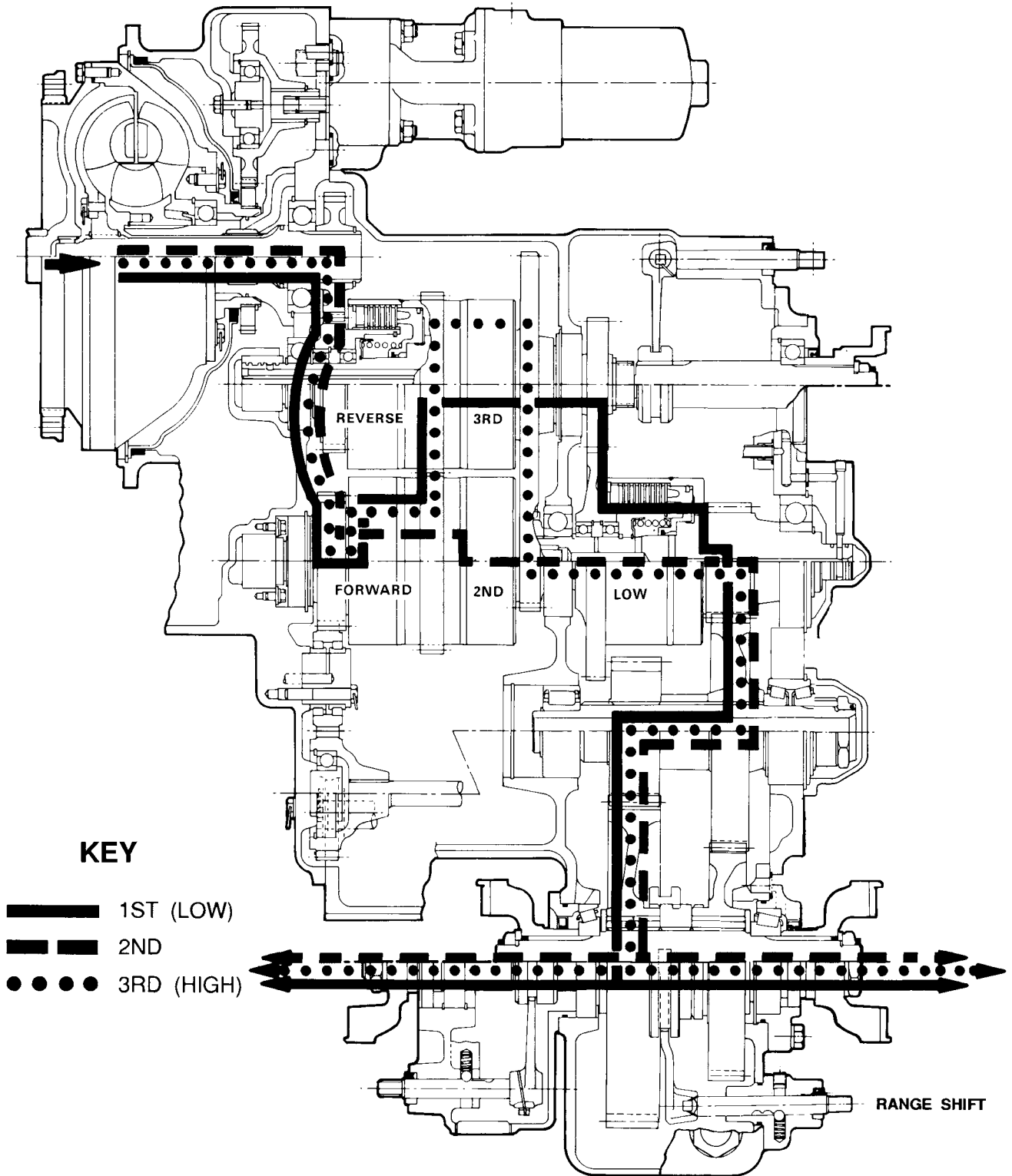
Tighten support bolts to specified torque. (See torque chart.)

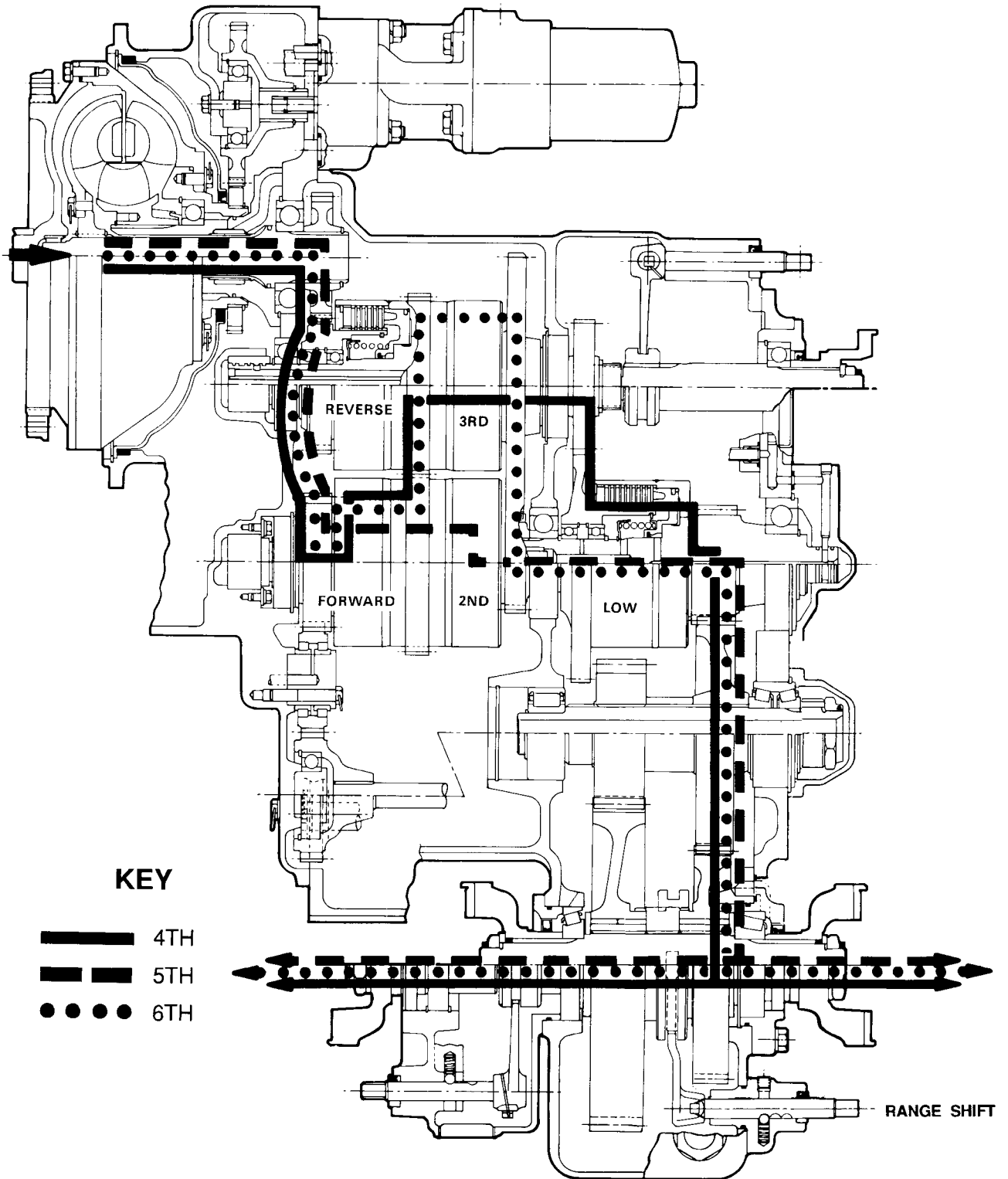


**Figure 13**




Locate lockwire hole in shift rail with hole in shift fork. Install lockwire, tighten securely and lockwire to prevent loosening.

Proceed with Figure 228 in the R & HR 32000 3-Speed Section.

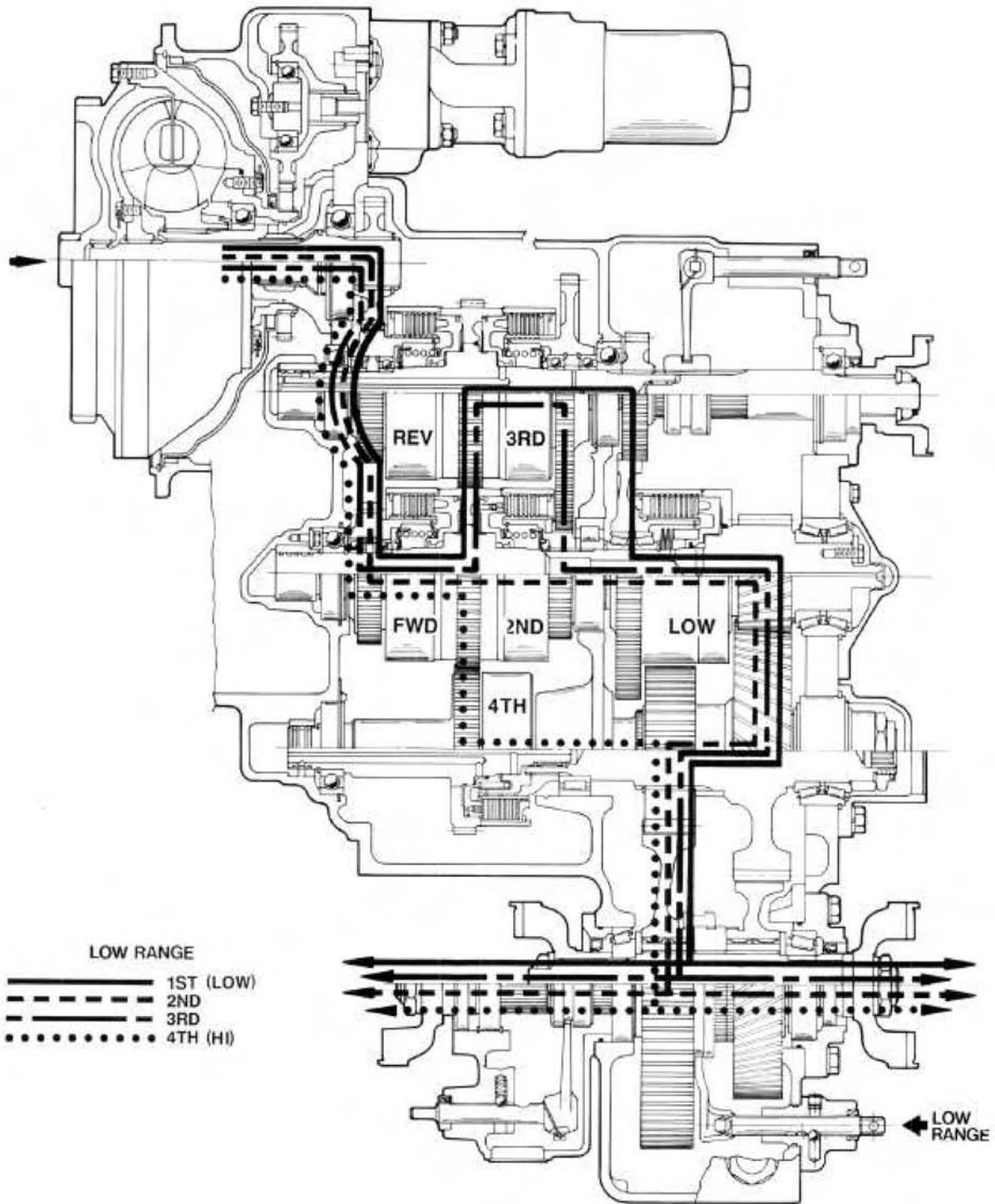




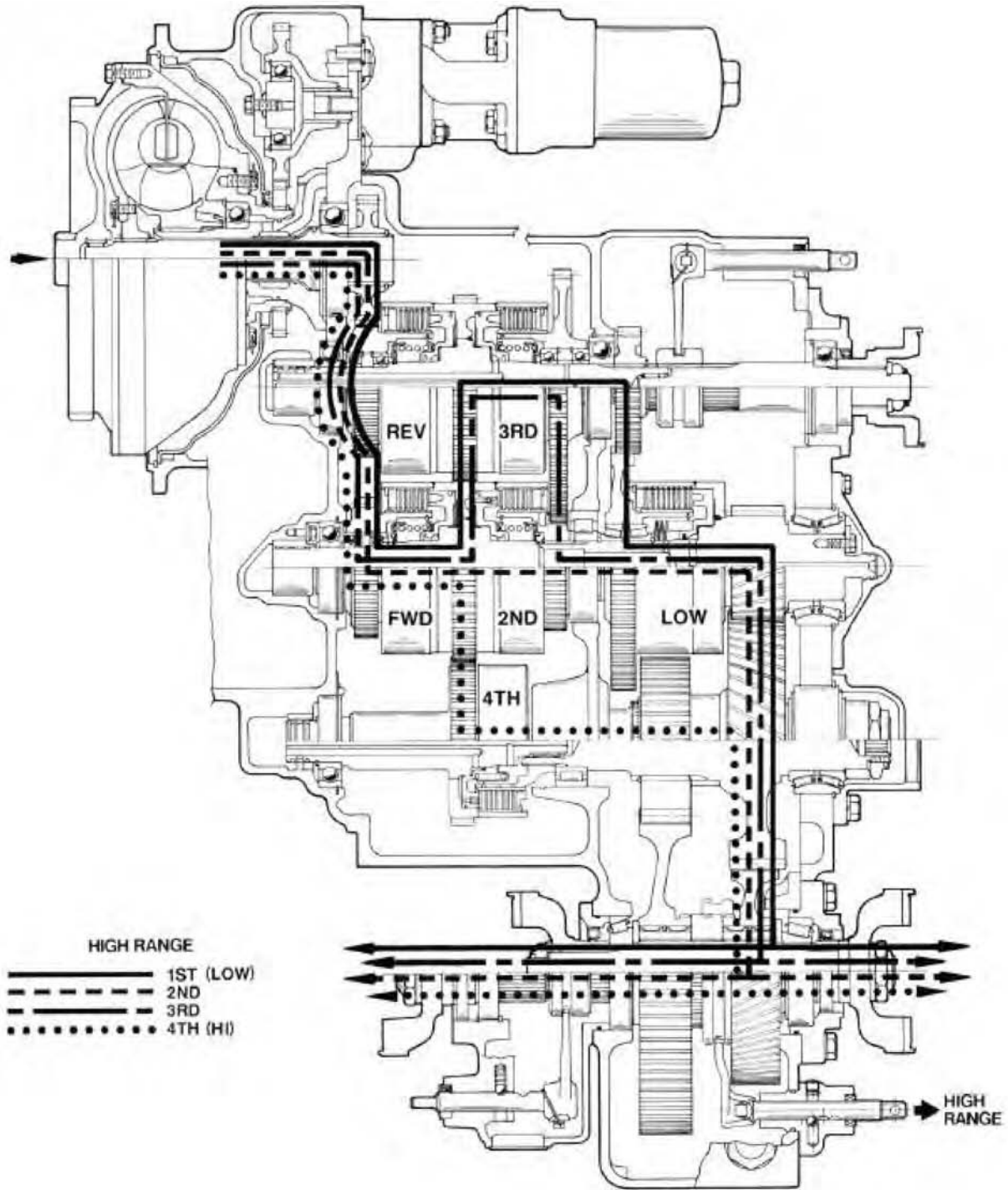
**KEY**

-  4TH
-  5TH
-  6TH

6 SPEED TRANSMISSION HI RANGE



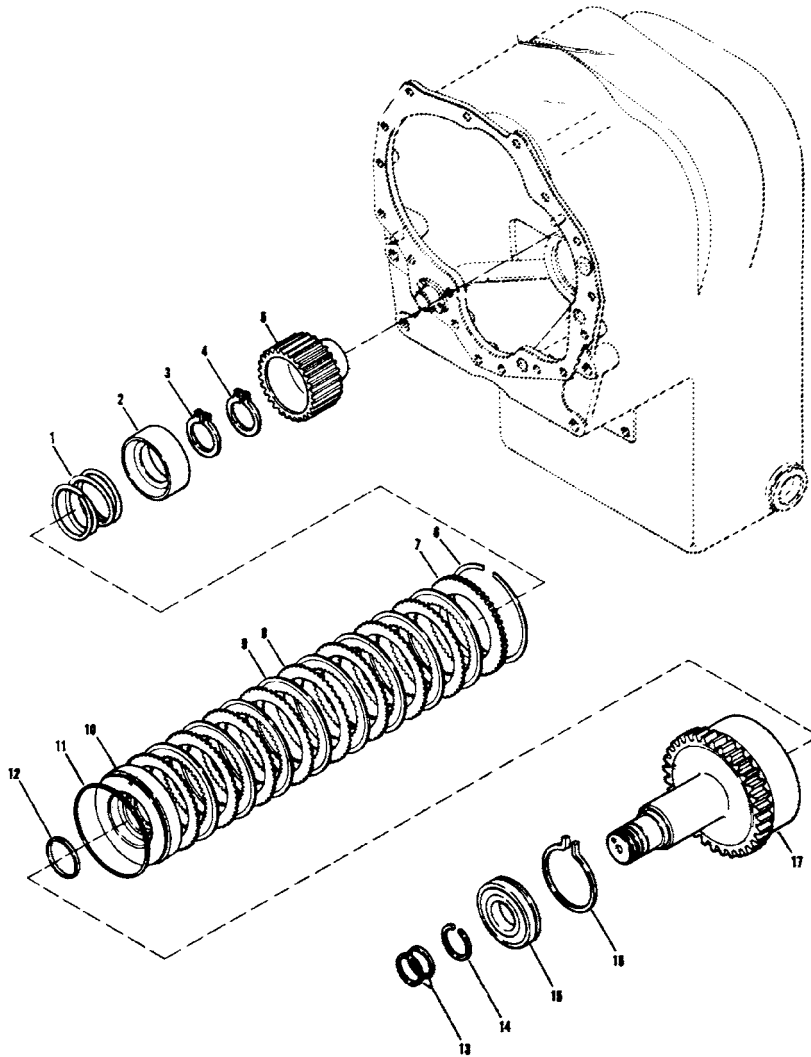
8 SPEED TRANSMISSION LOW RANGE



8 SPEED TRANSMISSION HIGH RANGE



8 SPEED CLUTCH SECTION



4TH SPEED CLUTCH GROUP 8 SPEED TRANSMISSION

ITEM	DESCRIPTION	QTY	ITEM DESCRIPTION	QTY
1	Piston Return Spring .....	1	10 Clutch Piston Assembly.....	1
2	Spring Retainer .....	1	11 Clutch Piston Seal—Outer.....	1
3	Spring Retainer Snap Ring.....	1	12 Clutch Piston Seal Inner.....	1
4	Clutch Hub Snap Ring .....	1	13 4th Sped Shaft Piston Ring.....	2
5	4th Speed Clutch Hub.....	1	14 Front Bearing Retainer Ring.....	1
6	Backing Plate Snap Ring .....	1	15 4th Speed Shaft Front Bearing.....	1
7	Clutch Disc Backing Plate.....	1	16 Front Bearing Snap Ring .....	1
8	Clutch Outer Disc.....	7	17 4th Speed Shaft & Plug Assembly.....	1
9	Clutch Inner Disc.....	8		

**8 SPEED SECTION**

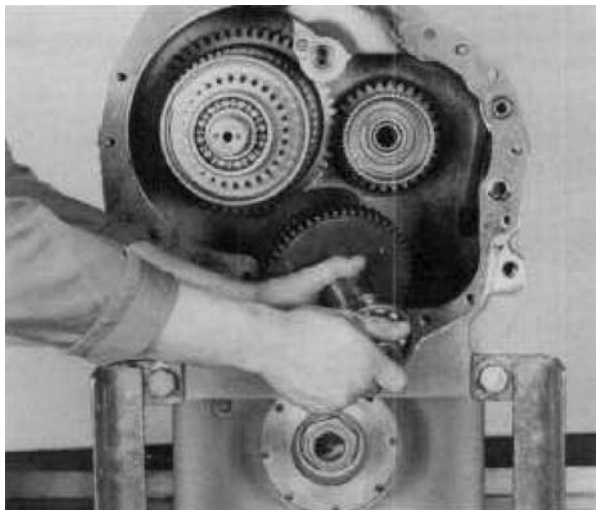
The difference between the 6 speed transmission and the 8 speed is that the 8 speed has an added 4th speed clutch. This section will describe the converter housing removal and the 4th speed clutch repair.

**DISASSEMBLY**



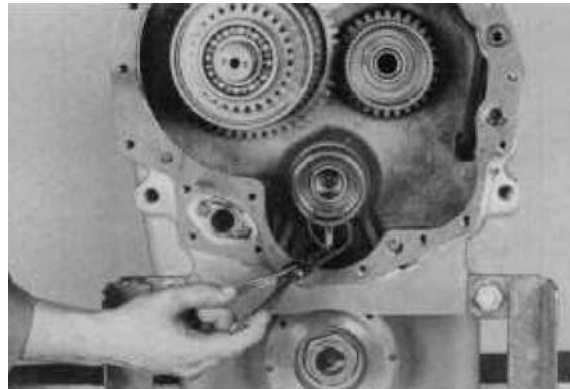
**Figure 1**

Remove bolts securing converter housing to transmission housing. Support converter housing with a chain all. Using spreading type snap ring pliers, spread ears on the fourth speed clutch front bearing retaining ring. Holding snap ring open, tap converter housing from transmission housing. The fourth clutch will remain in the transmission housing.



**Figure 2**

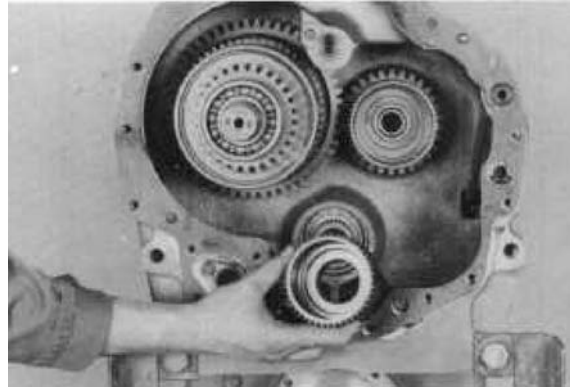
Remove fourth speed clutch assembly from transmission housing.



**Figure 3**

Remove fourth speed clutch disc hub retaining ring.

**Figure**

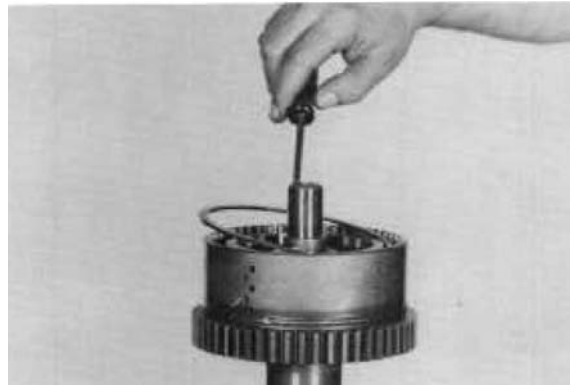


**Figure 4**

Remove fourth speed clutch disc hub.

**4TH SPEED CLUTCH  
DISASSEMBLY**

**(8 speed transmission only)**



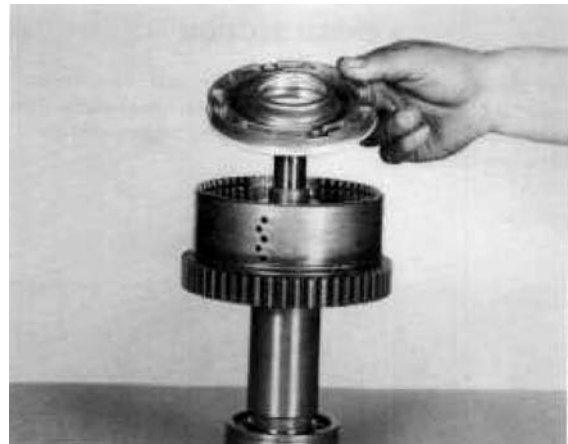
**Figure 5**

Remove end plate retainer.



**Figure 6**

Remove end plate.



**Figure 9**

Remove clutch piston.



**Figure 7**

Remove inner and outer clutch discs.



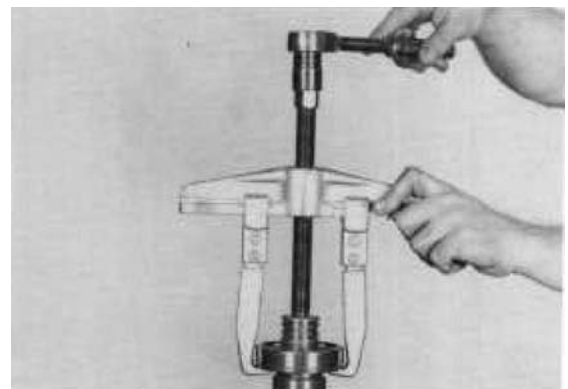
**Figure 10**

Remove clutch shaft piston rings and expander springs. See note in Figure 103.



**Figure 8**

Compress spring retainer washer. Remove spring retainer snap ring. Release tension on spring retainer. Remove snap ring, spring retainer and return spring.



**Figure 11**

Remove clutch shaft bearing retainer ring. Remove shaft bearing. See cleaning and inspection page.



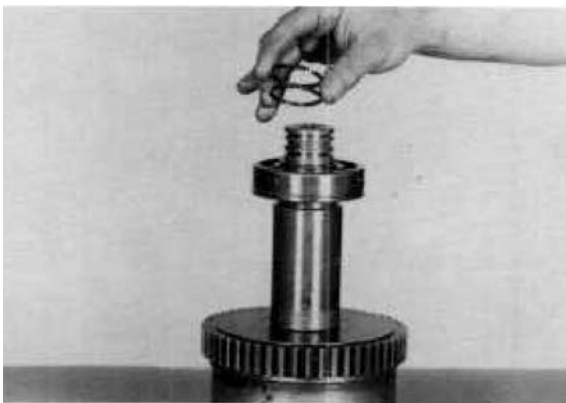
**4TH SPEED CLUTCH  
REASSEMBLY**  
(8 speed transmission only)



**Figure 12**  
Install clutch shaft bearing. **NOTE:** Bearing snap ring groove must be down.



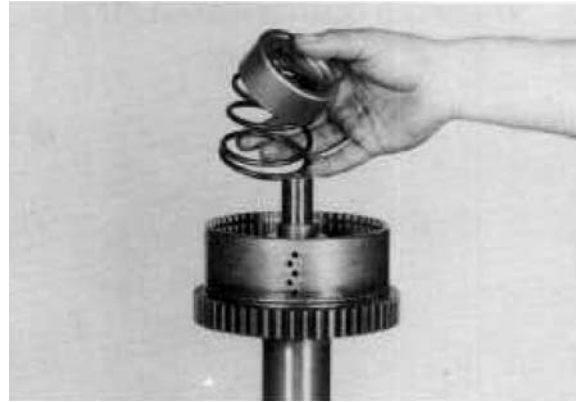
**Figure 13**  
Install bearing retainer ring.



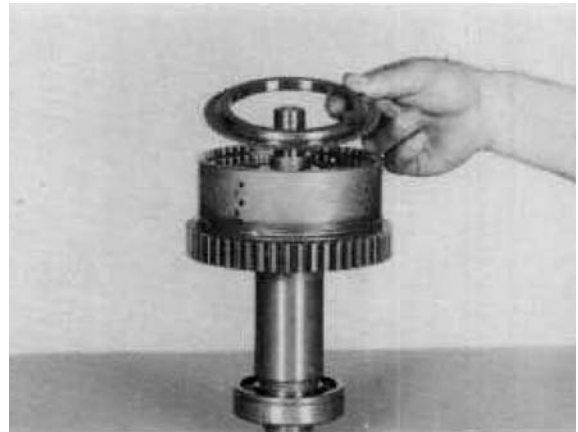
**Figure 14**  
Install piston rings as explained on page 79.



**Figure 15**  
Install new clutch piston inner and outer sealing rings. Insert clutch piston in clutch drum. Use caution as not to damage sealing rings.



**Figure 16**  
Install clutch piston return spring, spring retainer and retainer snap ring. Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to piston is friction, last disc installed is friction. (8 friction - 7 steel).



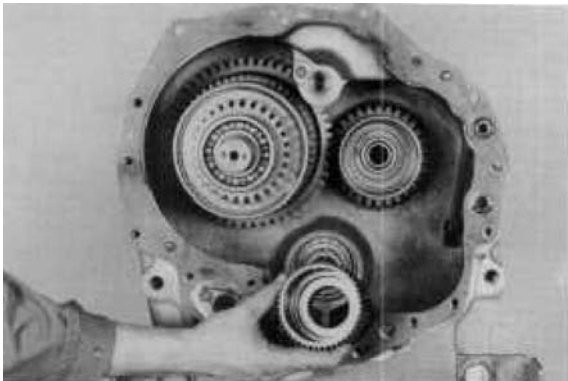
**Figure 17**  
Install end plate.



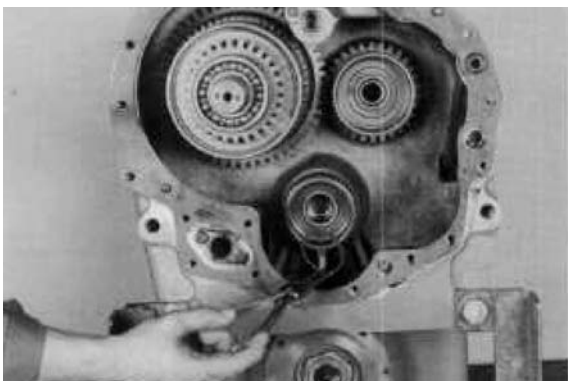
**Figure 18**  
Install end plate retainer ring. See transmission reassembly on page 38.

**4TH SPEED CLUTCH INSTALLATION**

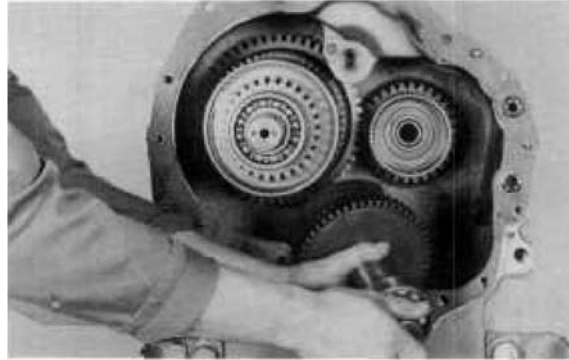
(8 speed only)



**Figure 19**  
Position 4th speed clutch disc hub on idler shaft.

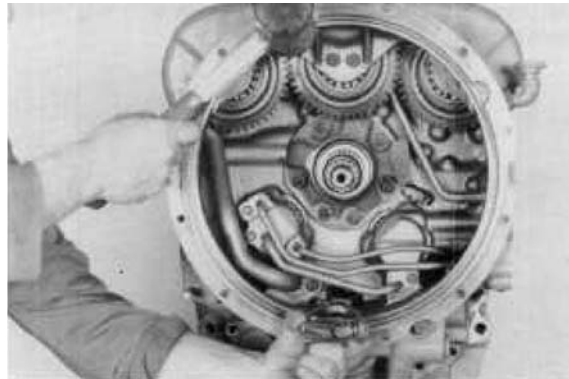


**Figure 20**  
Install disc hub retainer ring.

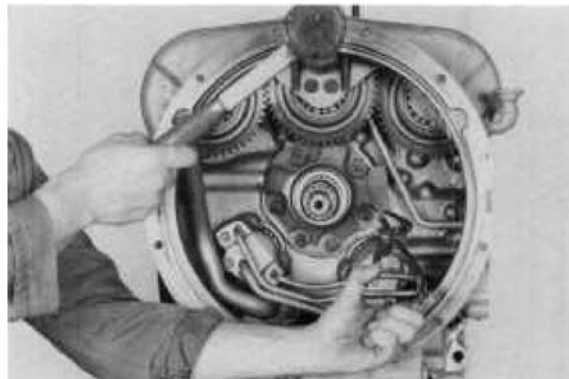


**Figure 21**  
Position pilot bearing on fourth speed clutch shaft. Install fourth clutch on disc hub. Use caution as not to damage the pilot bearing.

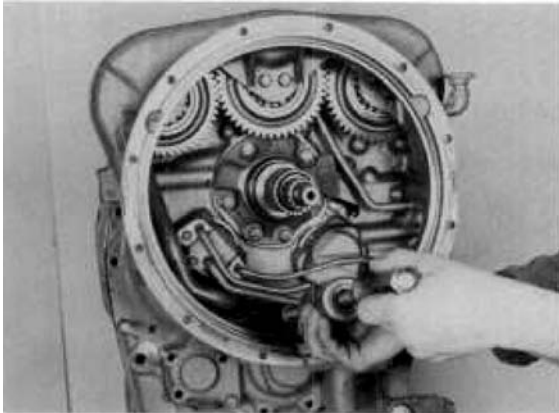
**CONVERTER HOUSING INSTALLATION**



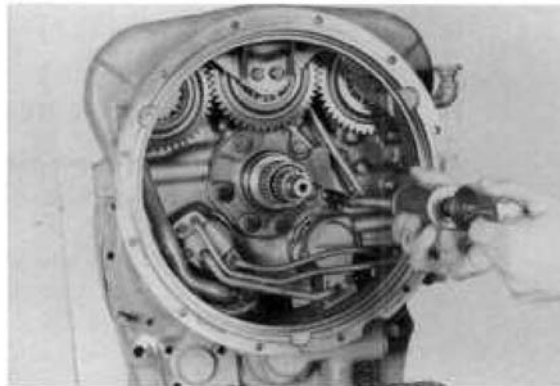
**Figure 22**  
Support converter housing with a chain fall. Spread fourth clutch front bearing retainer ring. Position converter housing to transmission case assembly. Tap housing into place using caution as not to damage any of the clutch shaft piston rings.



**Figure 23**  
Spread forward clutch front bearing retainer ring to allow the converter housing to position properly.

**Figure 24**

A hammer puller was used to pull the fourth clutch bearing forward to engage the front bearing snap ring in the bearing groove.

**Figure 25**

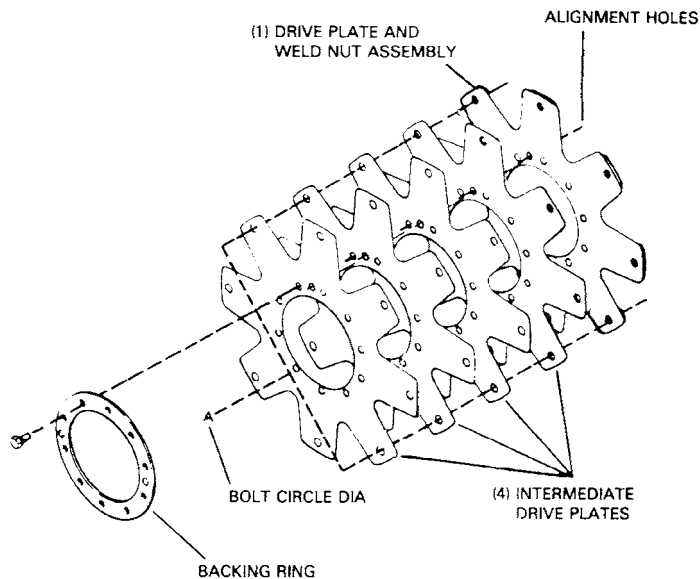
Use the same procedure for the forward clutch as explained in Figure 24. Be certain both snap rings are fully seated in the bearing snap ring grooves. Install converter housing to transmission housing cap screws, tighten to specified torque.

**REFER TO PAGE 46 FOR COMPLETE TRANSMISSION REASSEMBLY.**

**DRIVE PLATE INSTALLATION**

SUBJECT: 28000/32000 Series Transmission and C-270/C-320 Series Converter Drive Plate Kits. REASON FOR BULLETIN: Proper Identification by Bolt Circle Diameter.

Measure the "A" dimension (Bolt Circle diameter) and order Drive Plate Kit listed below.



"A" Dimension (Bolt Circle Diameter)

13.125" [333,375 mm] Diameter

Kit No.802335

13.50" [342,900 mm] Diameter Kit

No.802333

17.00" [431,800 mm] Diameter Kit

No.802454

Each kit will include the following parts:

4 Intermediate Drive Plates

1 Drive Plate and Weld Nut Assembly.

1 Backing Ring.

10 Screw and Lockwasher Assembly.

1 Instruction Sheet.

TO FACILITATE ASSEMBLY, ALIGN SMALL HOLES IN DRIVE PLATES-SEE ILLUSTRATION ABOVE.

Position drive plate and weld nut assembly on impeller cover with weld nuts toward cover. Align intermediate drive plate and backing ring with holes in impeller cover. NOTE: Two dimples 180° apart in backing ring must be out (toward engine flywheel). Install capscrews and washers. Tighten 23 to 25 ft. lbs. torque [31,2-33,8 N.m]

**SEE PAGE 91 FOR TRANSMISSION TO ENGINE  
INSTALLATION PROCEDURE**



**TRANSMISSION TO ENGINE INSTALLATION PROCEDURE**

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.

2. Check engine flywheel and housing for conformance to standard S.A.E. #3 -S.A.E. J-927 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play.

3. Install two 3.50 [88,90 mm] long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.

4. Install a 4.00 [101,60 mm] long drive plate locating stud .3750-24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel drive plate mounting screw hole positioned in step No.3.

5. Locate transmission of flywheel housing aligning drive plate to flywheel and transmission to flywheel housing.

Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.

6. Remove drive plate locating stud.

7. Install drive plate attaching screw and washer. Snug screw but do not tighten. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed torque each one 25 to 30 ft. lbs. torque [33,9 40,6 N.m.]. This will require torquing each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened.

8. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within .001 [0,025 mm] of the end play recorded in step No.2.

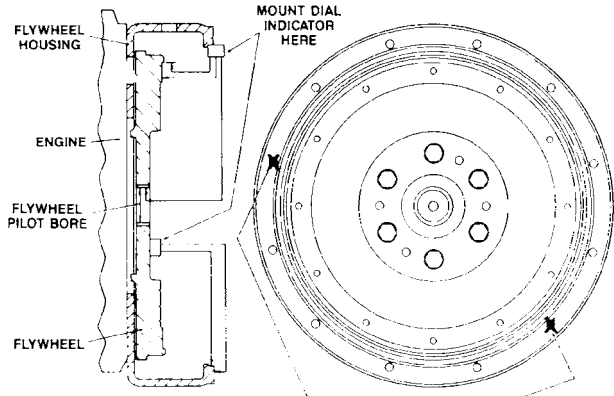


FIG 1

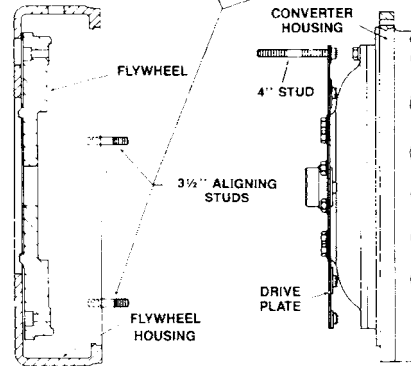


FIG 2

SPECIAL STUD, WASHER AND SELF LOCK NUT FURNISHED BY MACHINE MANUFACTURER.

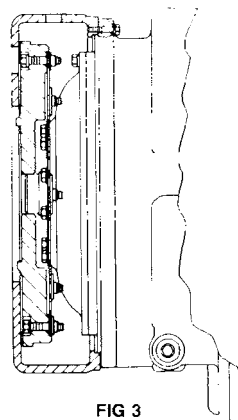


FIG 3

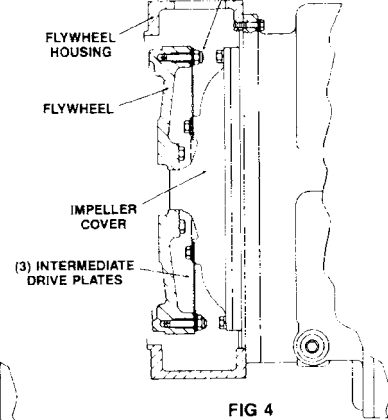
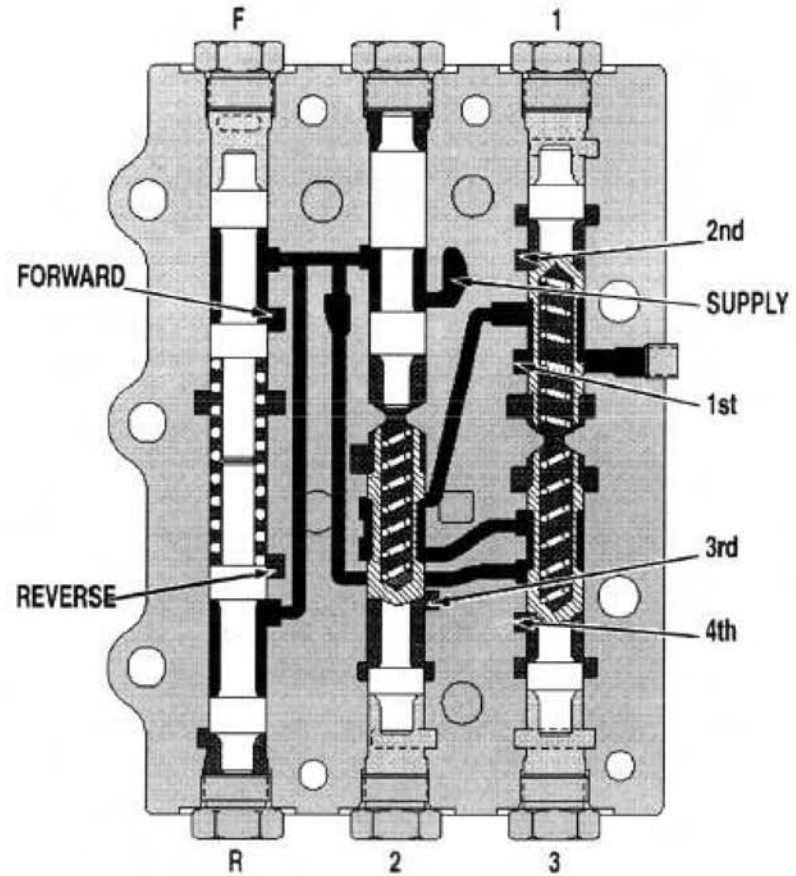
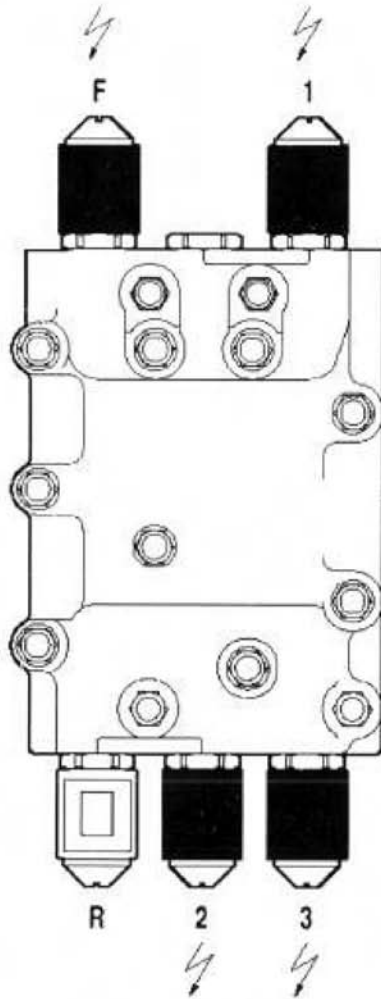
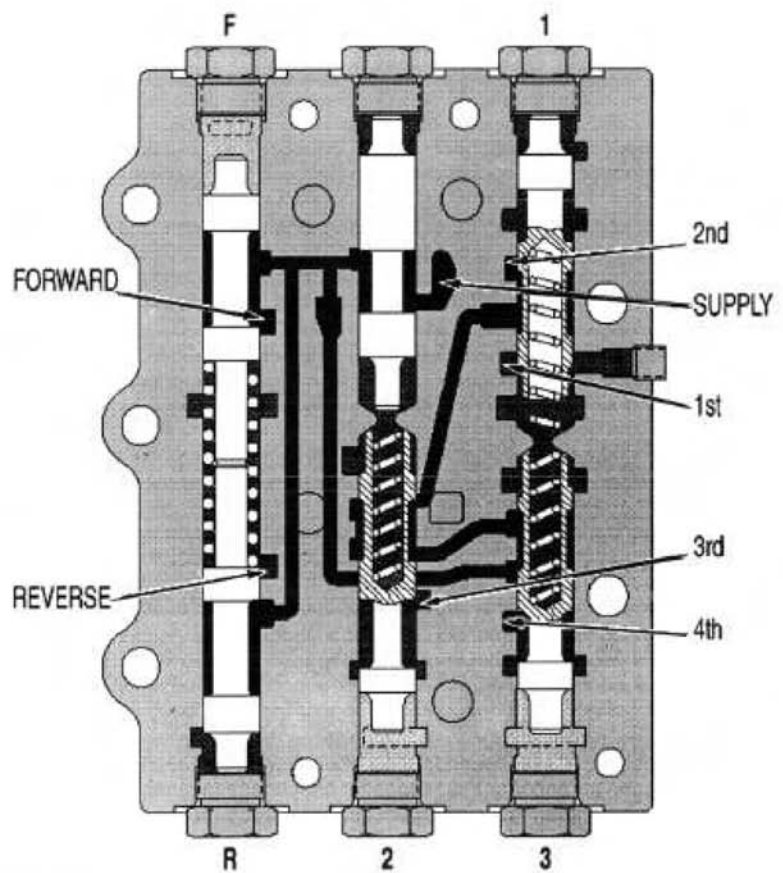
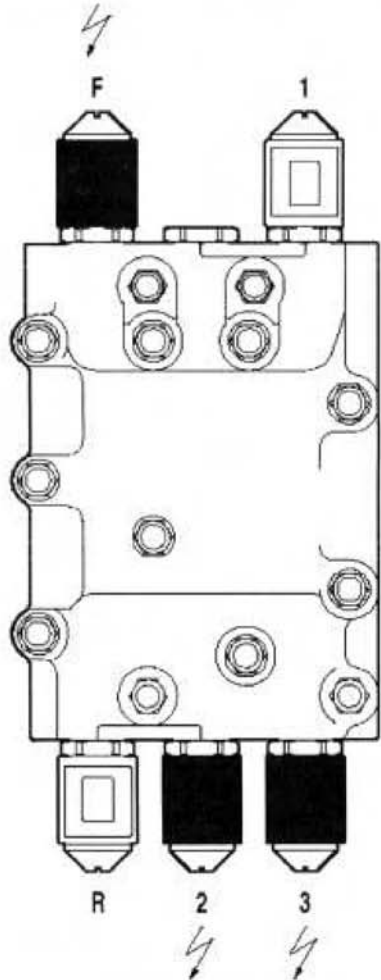


FIG 4

### Control valve function of 28000 / 32000 - 4 speed : forward 1st



### Control valve function of 28000 / 32000 - 4 speed : forward 2nd



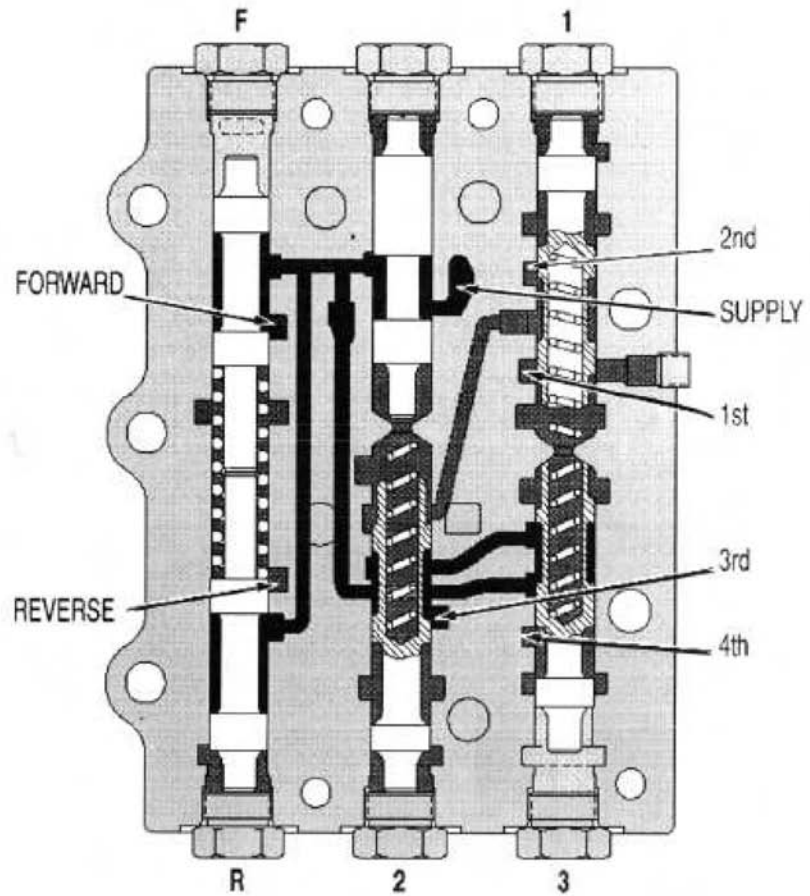
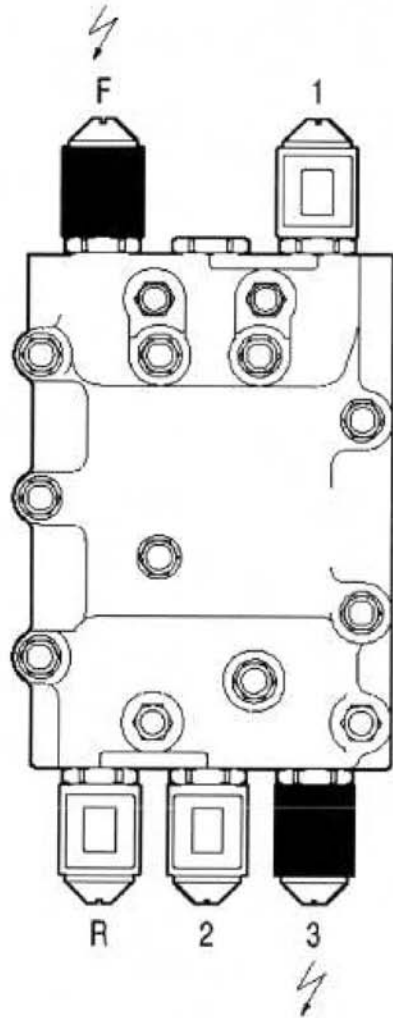
—101—

F-147



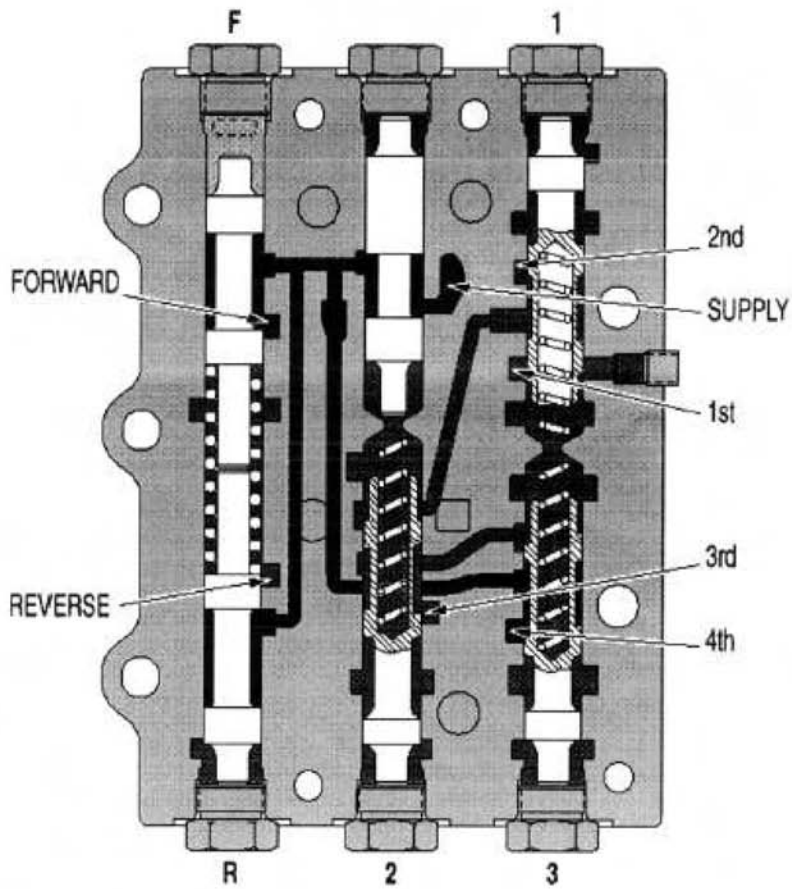
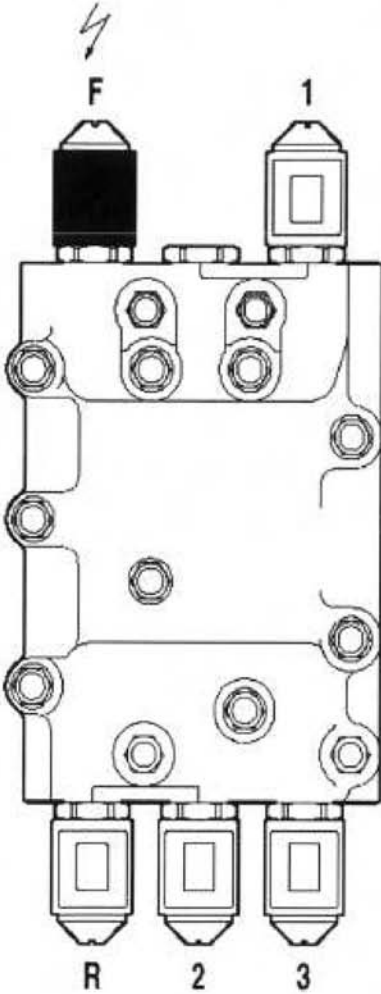
OFF-HIGHWAY COMPONENTS

### Control valve function of 28000 / 32000 - 4 speed : forward 3rd

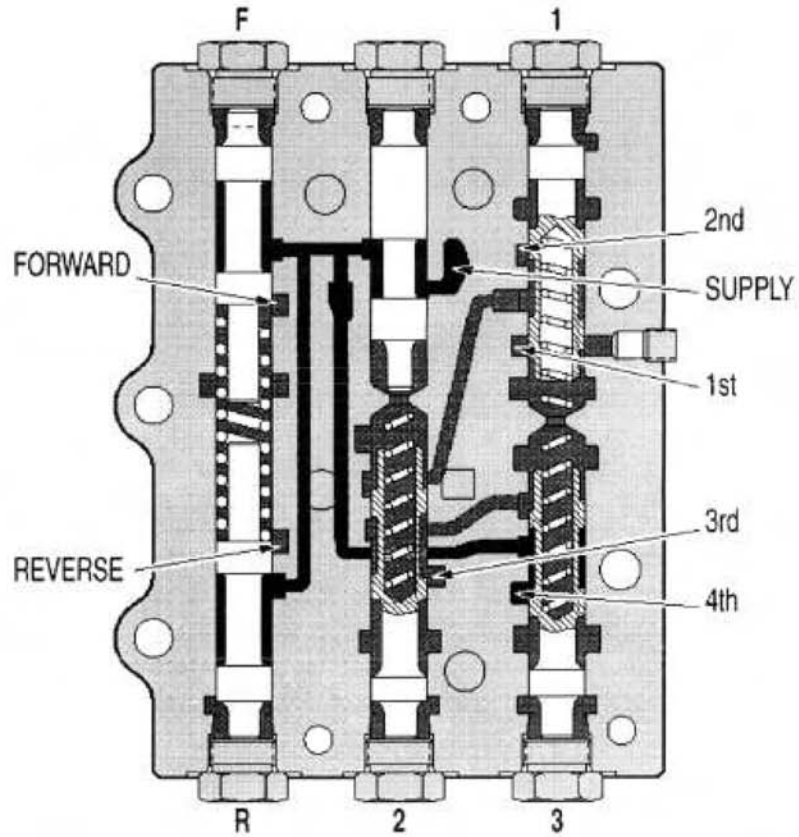
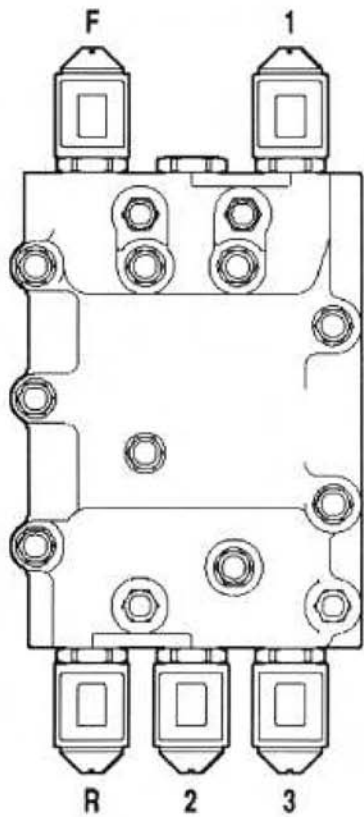


**OFF-HIGHWAY COMPONENTS**

### Control valve function of 28000 / 32000 - 4 speed : forward 4th

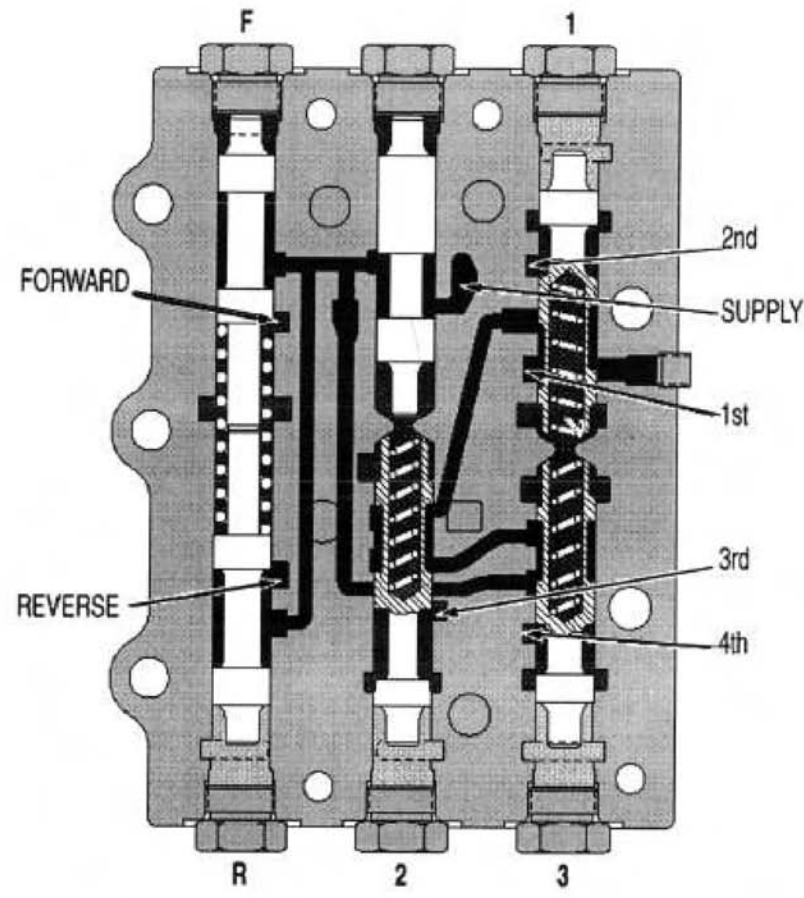
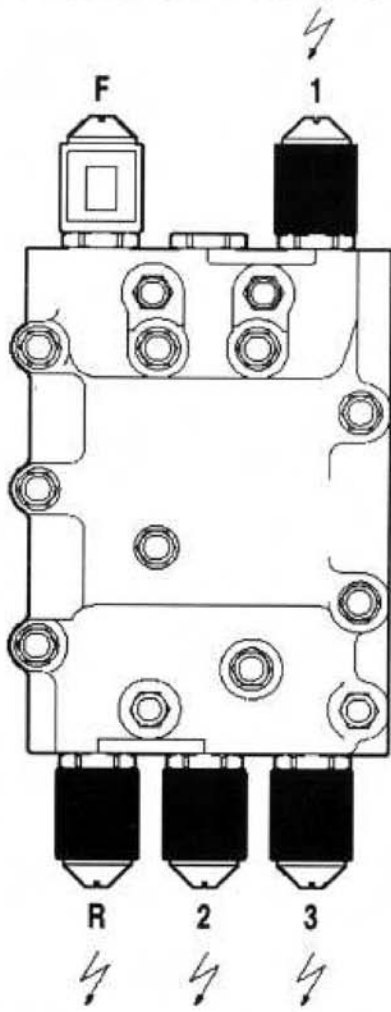


## Control valve function of 28000 / 32000 - 4 speed : neutral 4th



**OFF-HIGHWAY COMPONENTS**

### Control valve function of 28000 / 32000 - 4 speed : reverse 1st



—105—

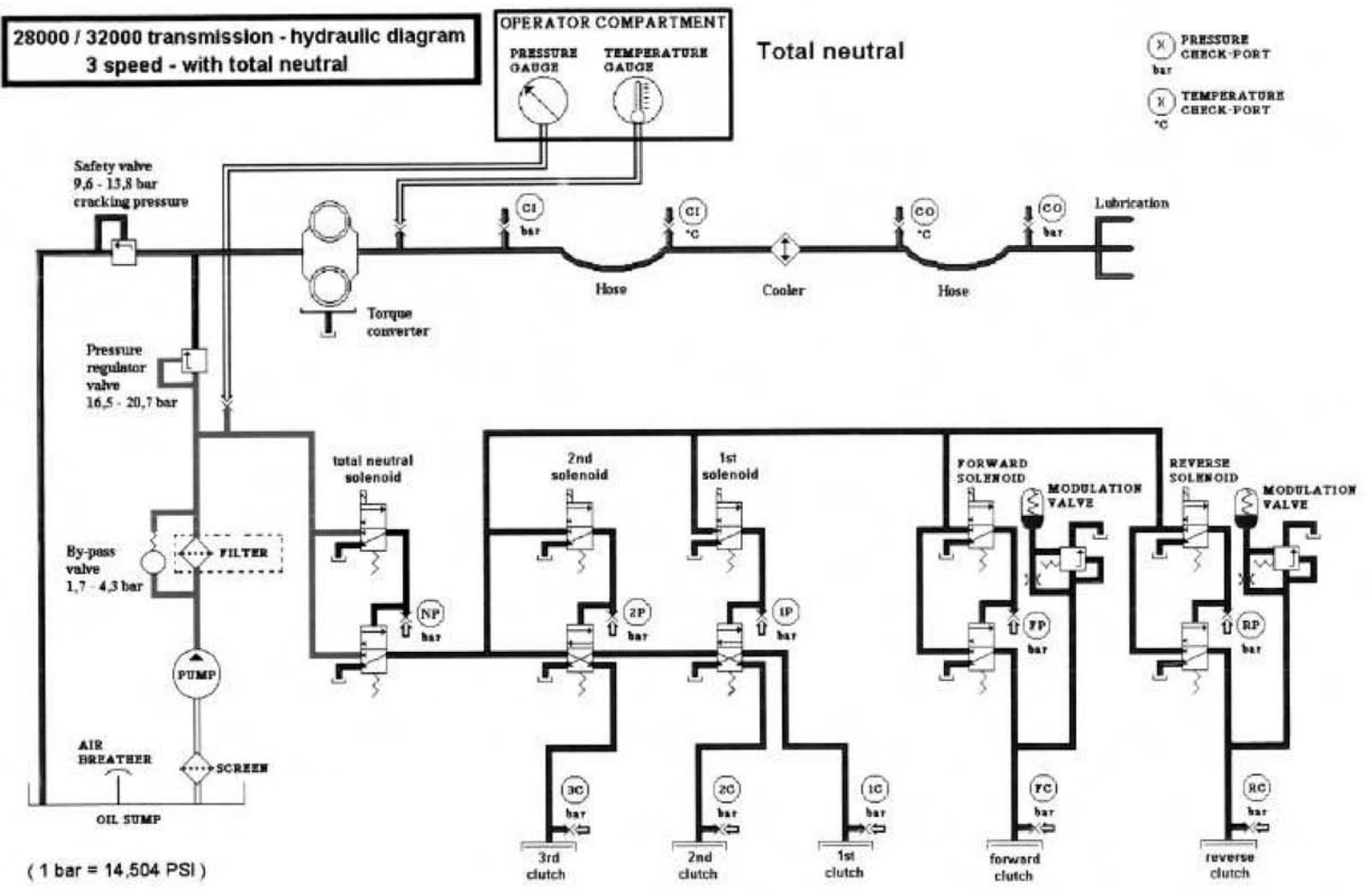
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**OFF-HIGHWAY COMPONENTS**

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-107-

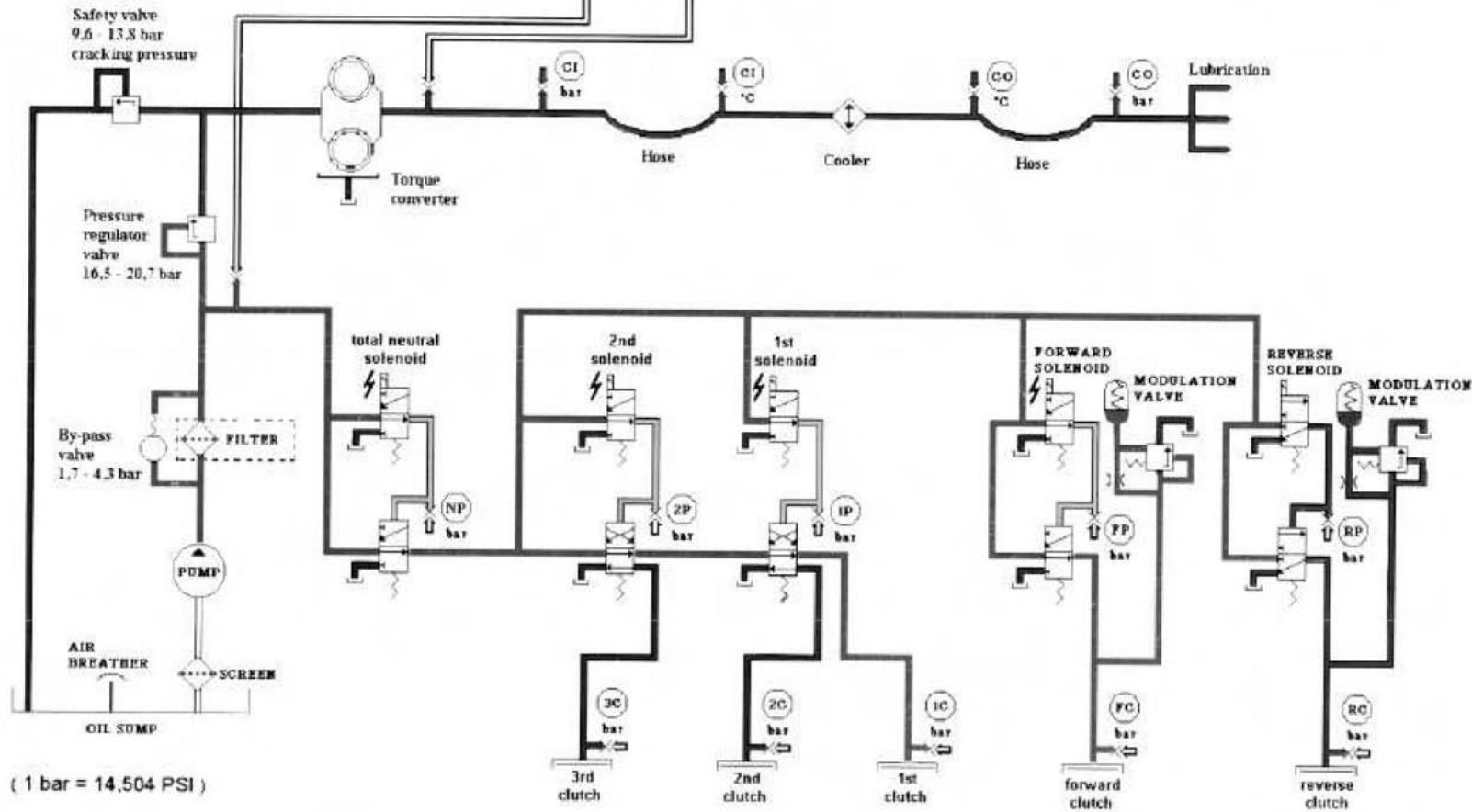
F-153

**28000 / 32000 transmission - hydraulic diagram  
3 speed - with total neutral**

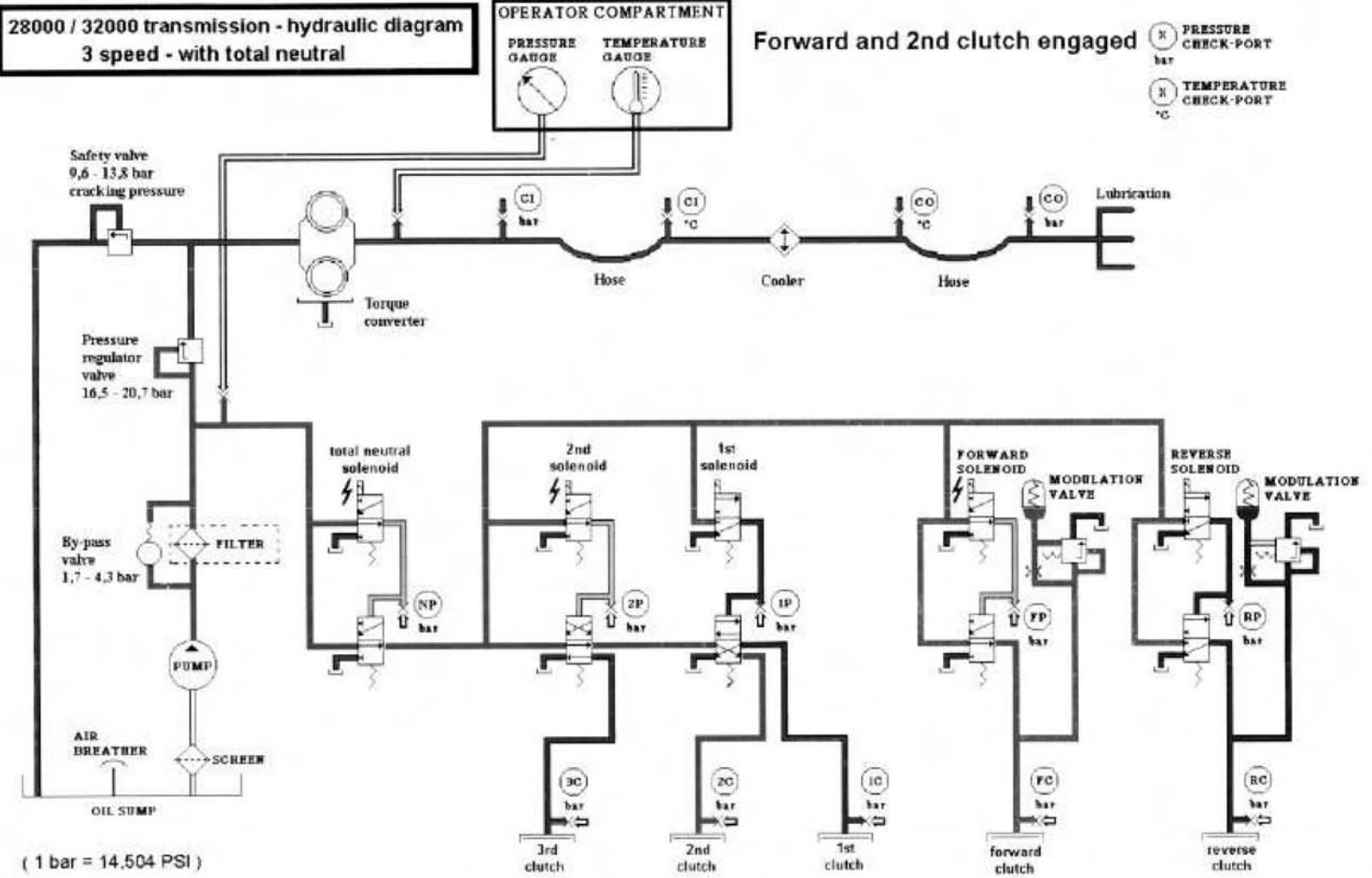
**OPERATOR COMPARTMENT**  
 PRESSURE GAUGE    TEMPERATURE GAUGE

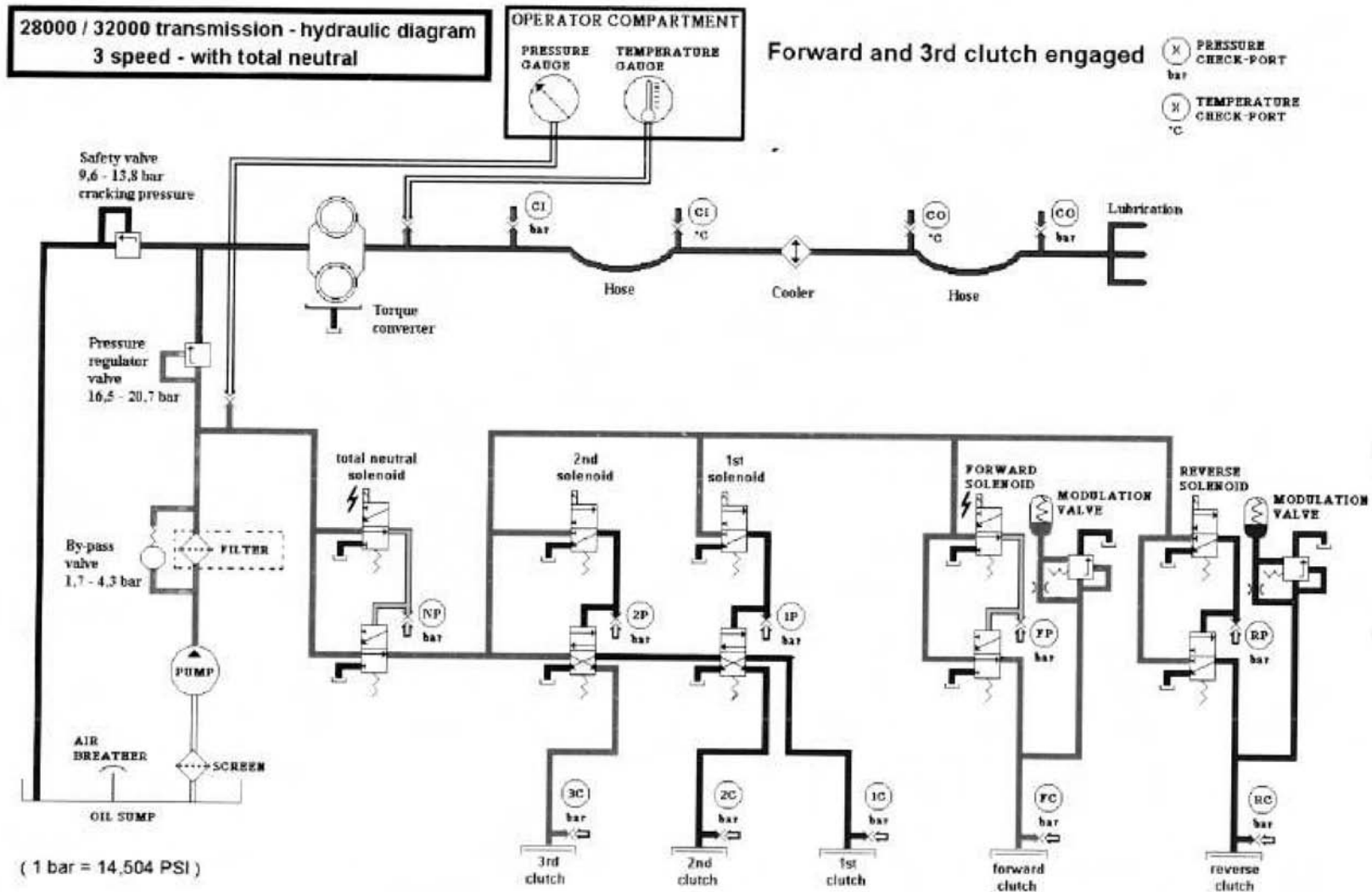
Forward and 1st clutch engaged

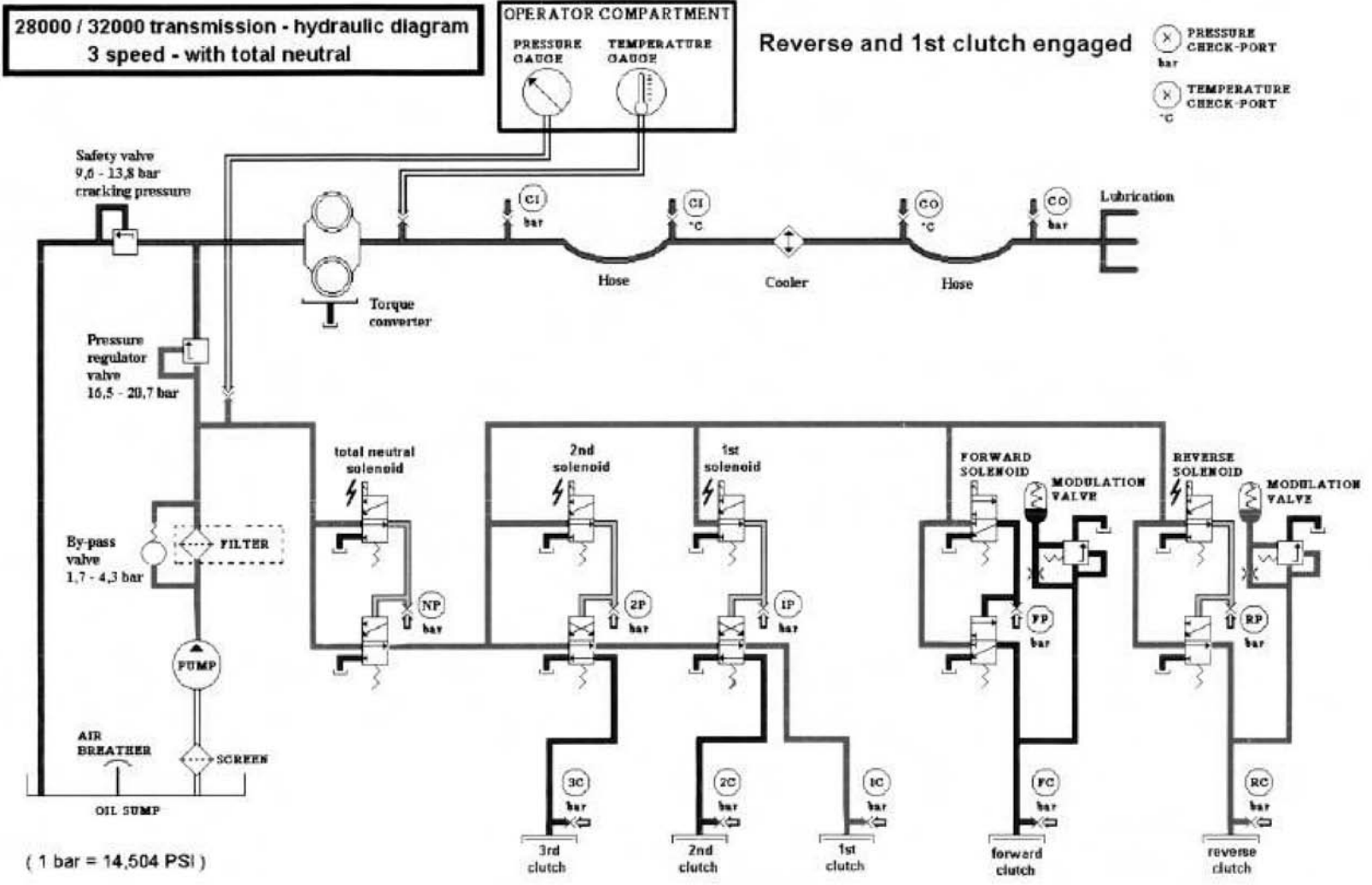
- (X) PRESSURE CHECK-PORT  
bar
- (C) TEMPERATURE CHECK-PORT  
°C



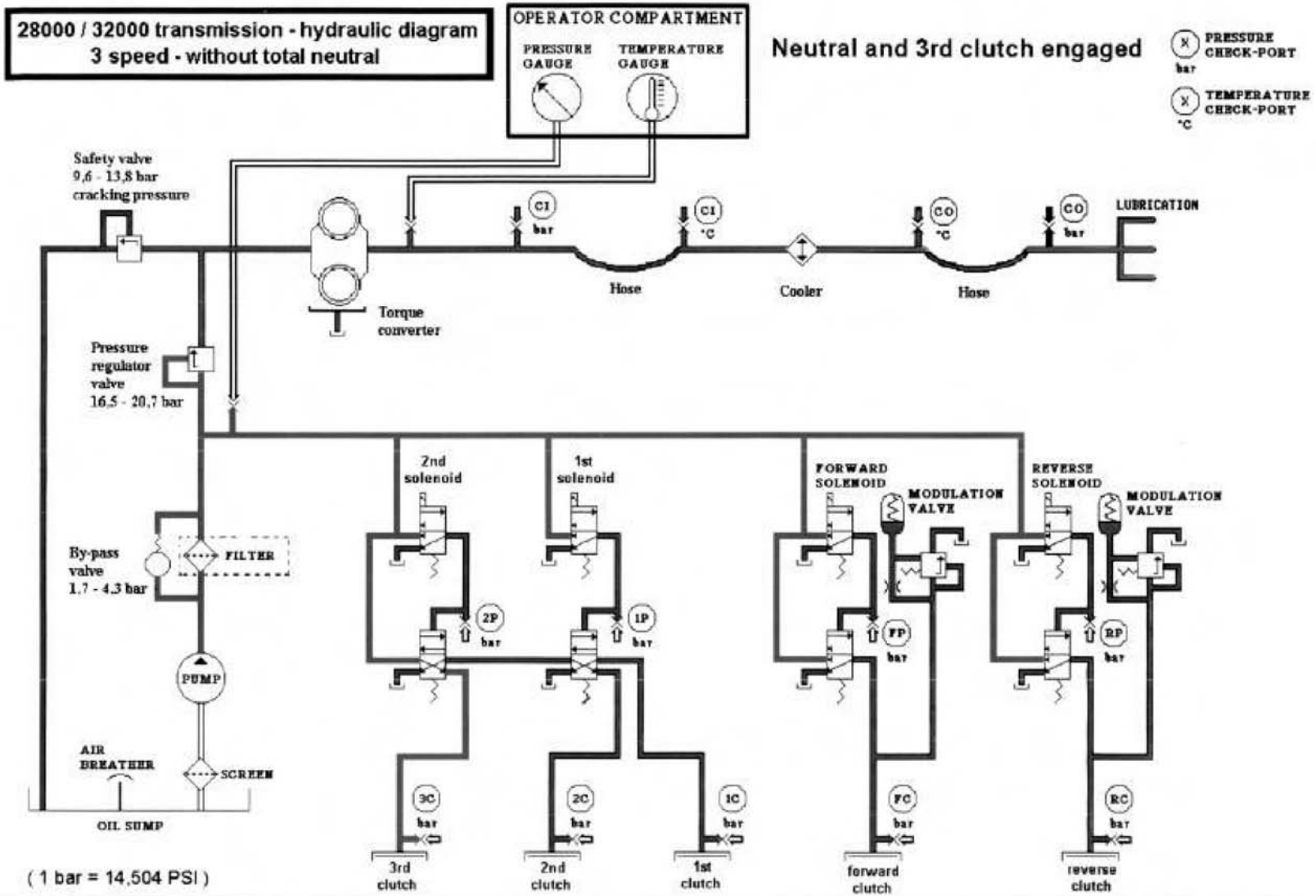
**OFF-HIGHWAY COMPONENTS**

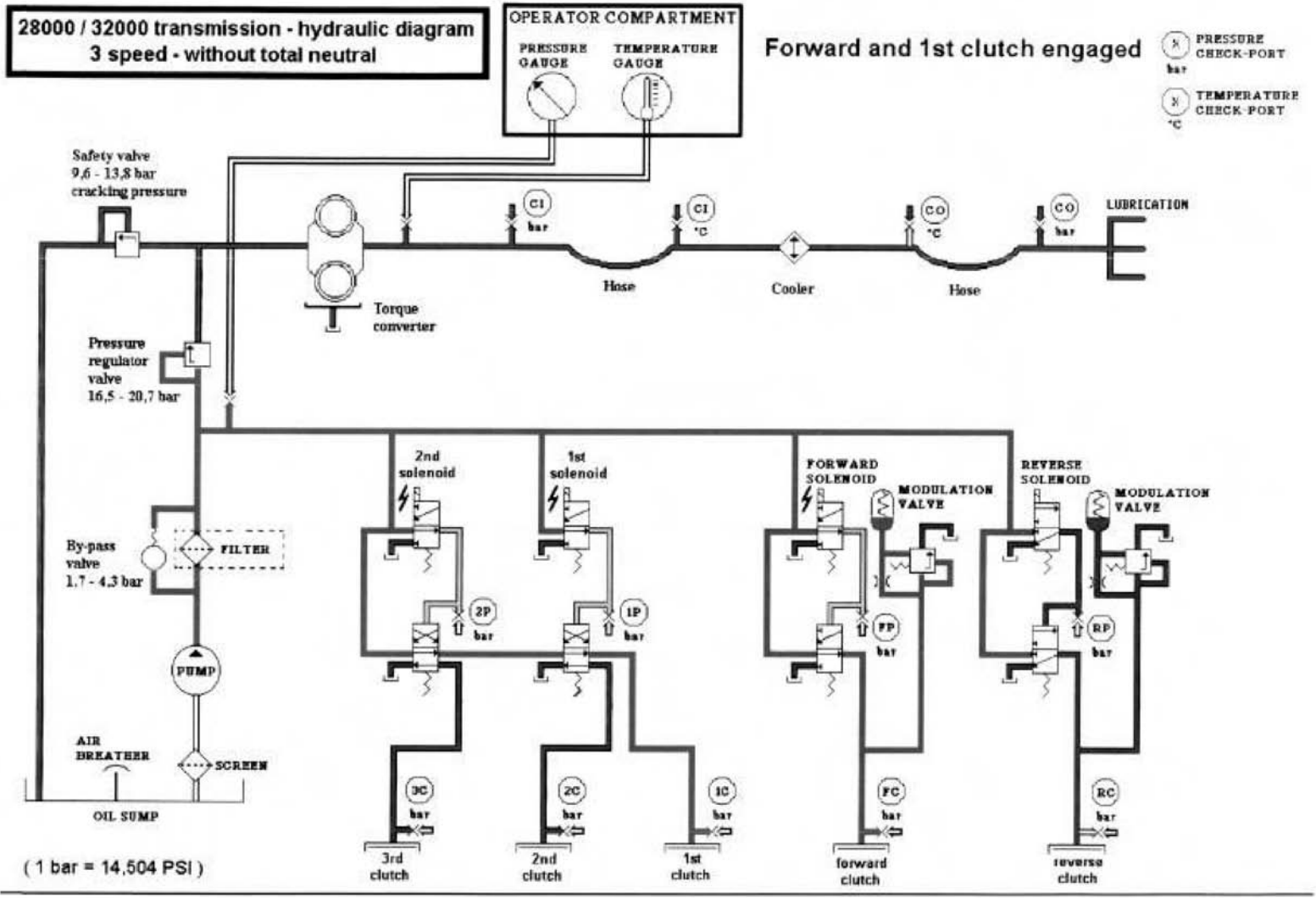






**OFF-HIGHWAY COMPONENTS**

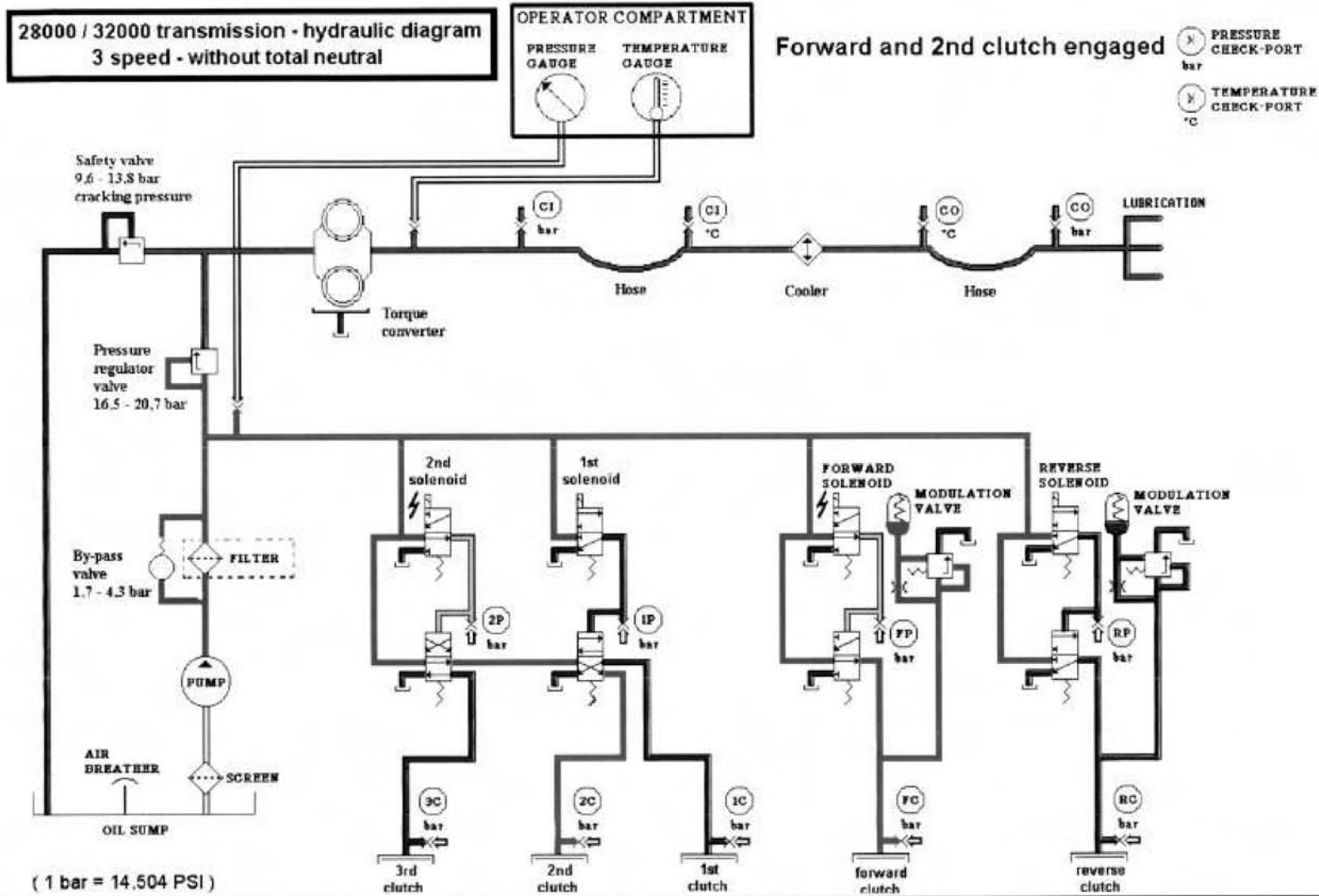




-113-

F-159





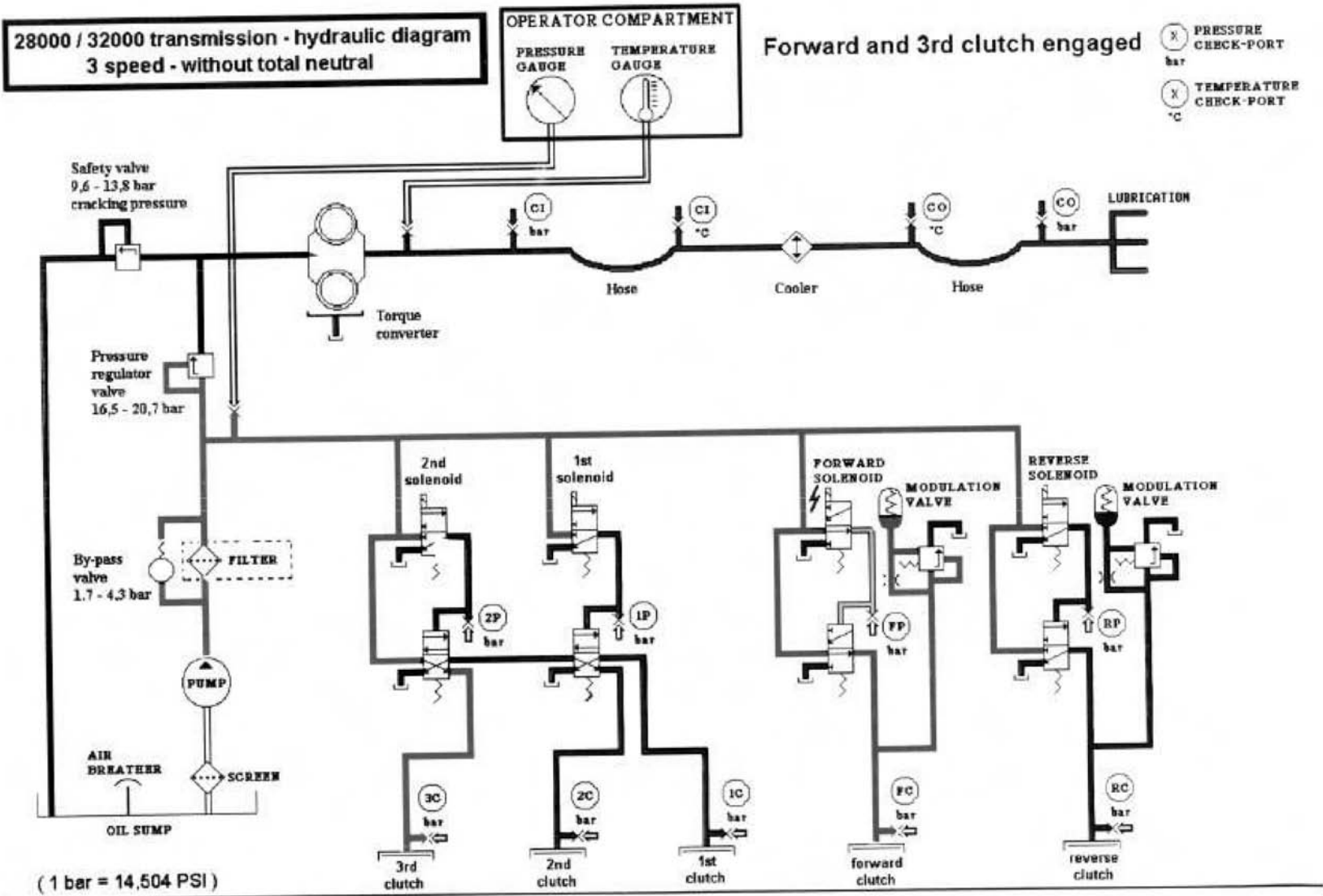
**OFF-HIGHWAY COMPONENTS**



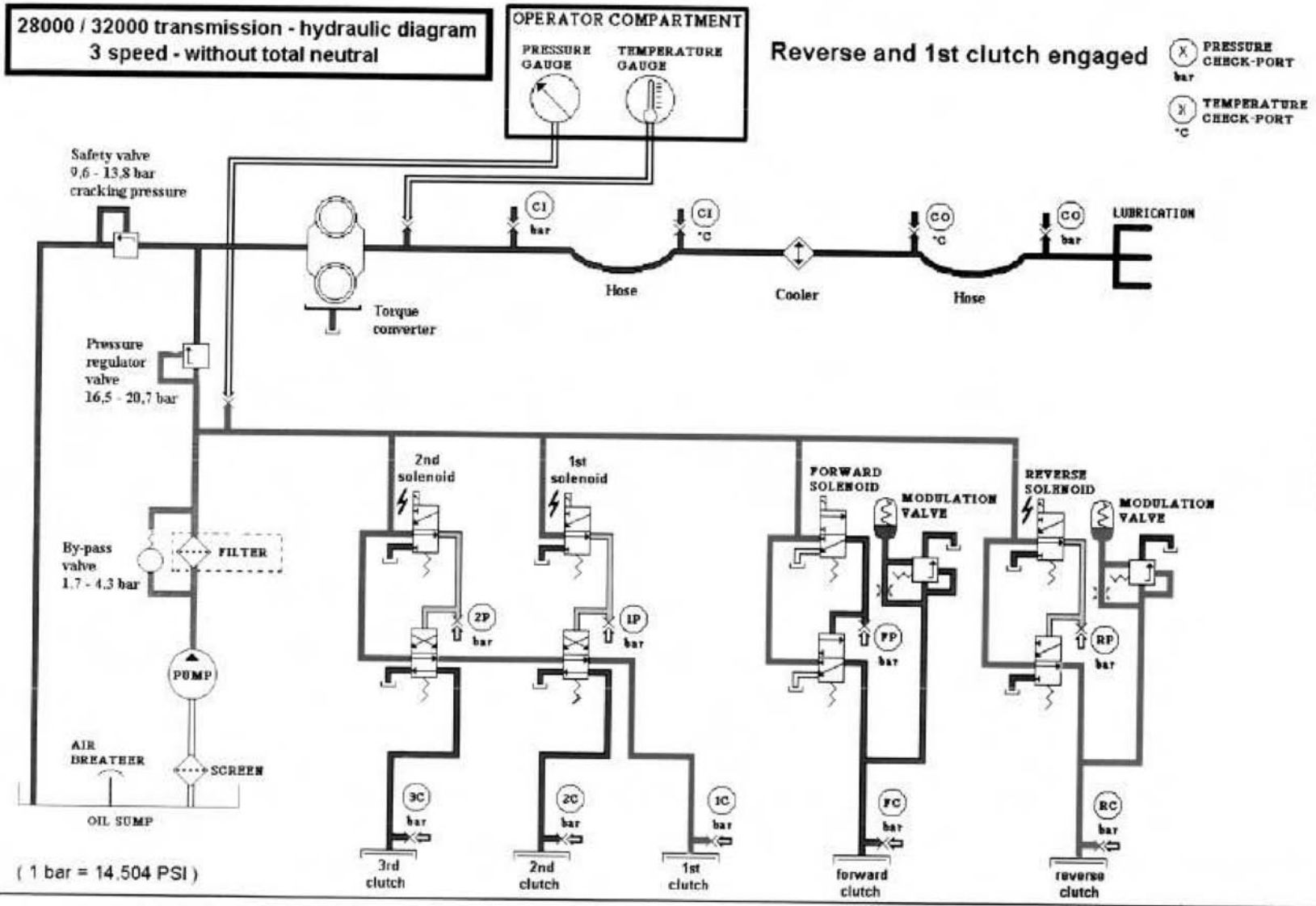
**28000 / 32000 transmission - hydraulic diagram**  
**3 speed - without total neutral**

Forward and 3rd clutch engaged

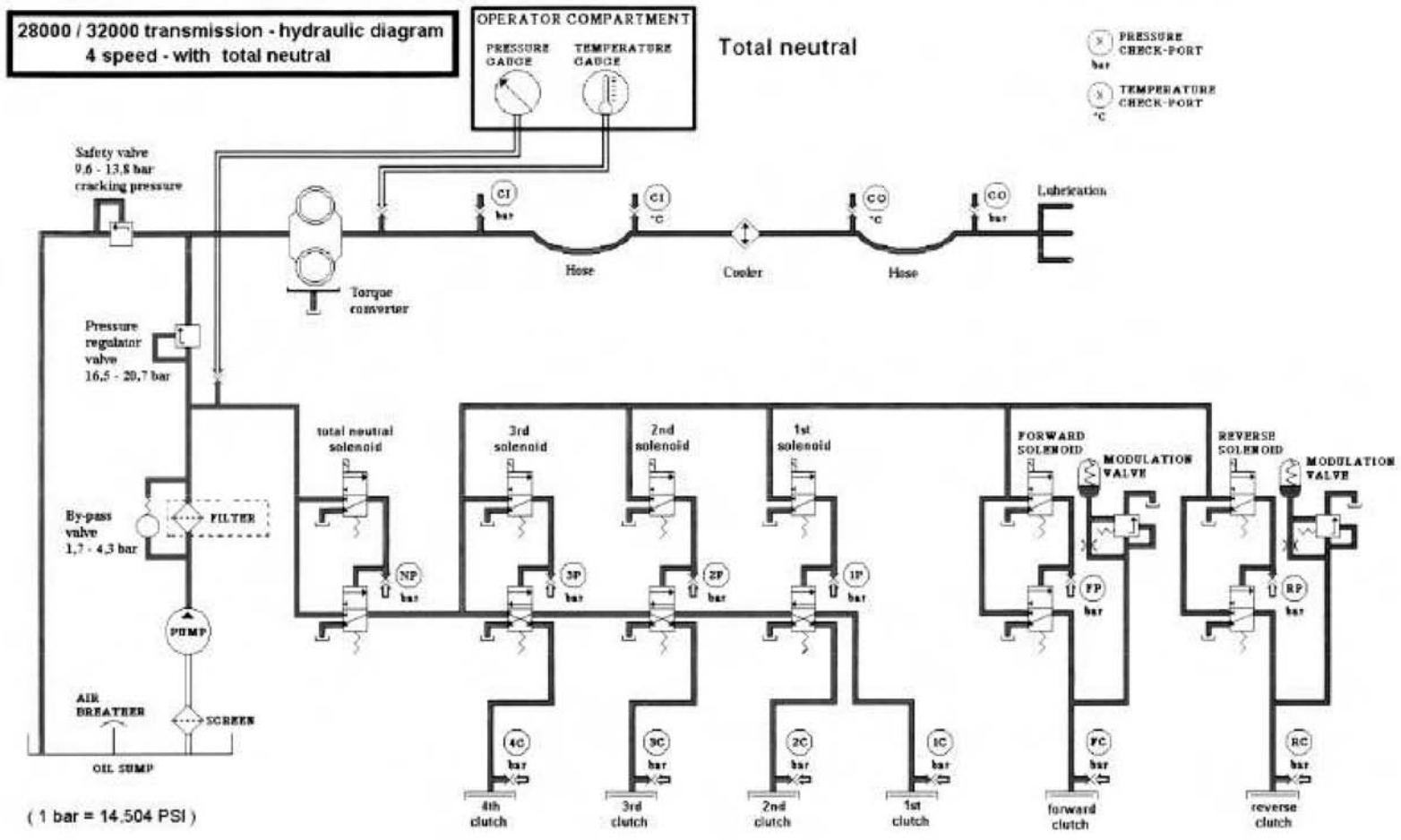
- (X) PRESSURE CHECK-PORT  
bar
- (X) TEMPERATURE CHECK-PORT  
°C



**OFF-HIGHWAY COMPONENTS**



**OFF-HIGHWAY COMPONENTS**

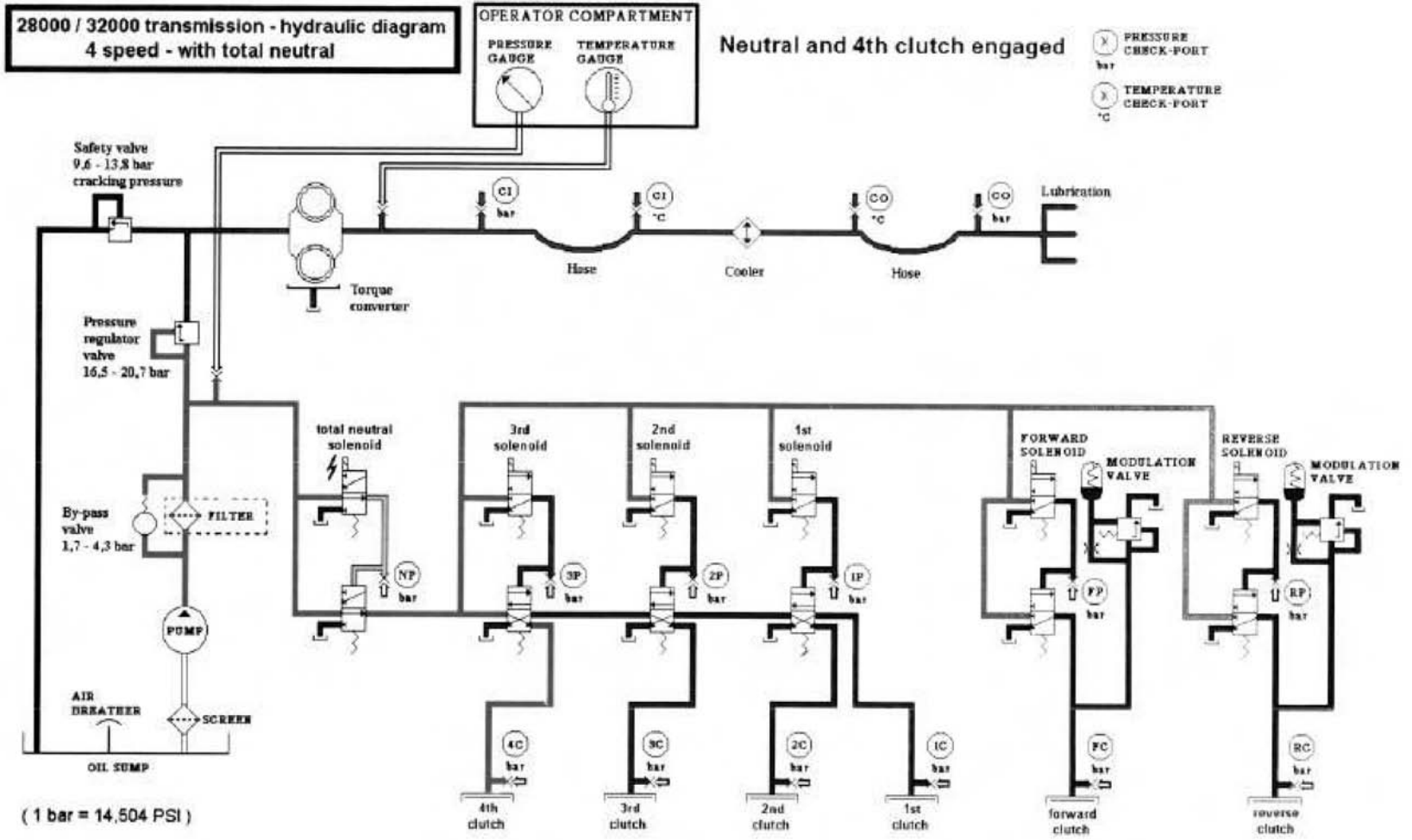


-117-

F-163



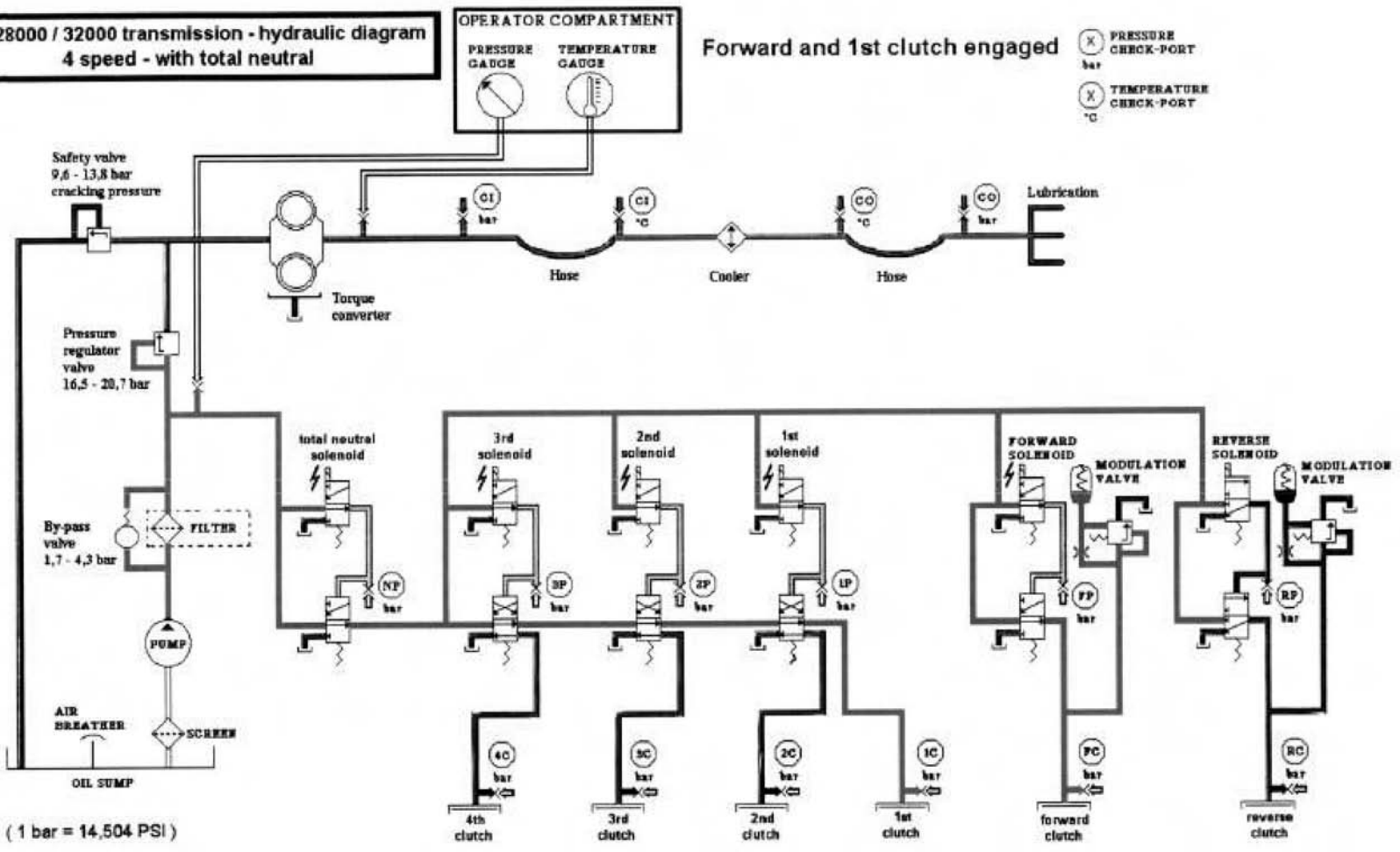
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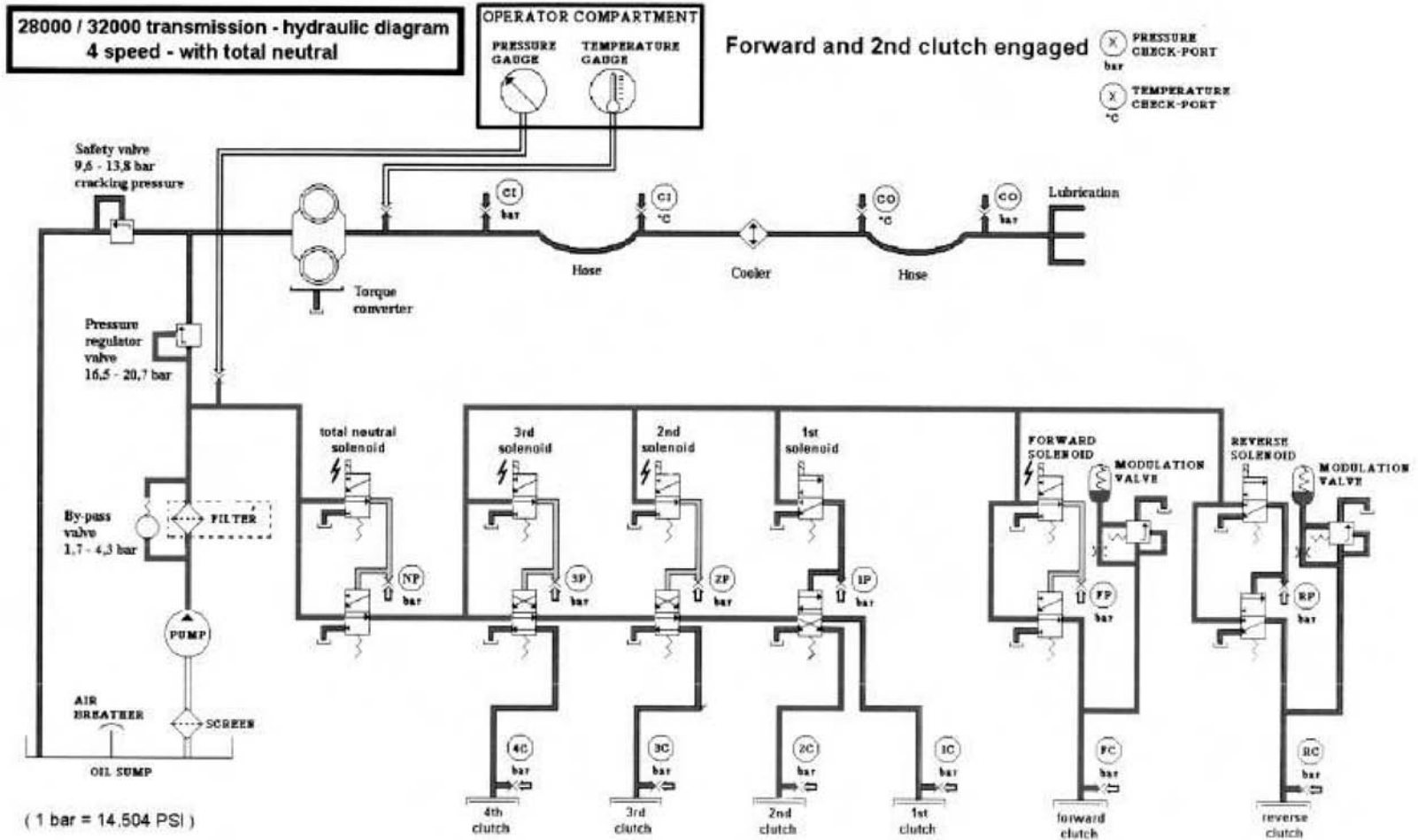


**OFF-HIGHWAY COMPONENTS**

**28000 / 32000 transmission - hydraulic diagram  
4 speed - with total neutral**

Forward and 1st clutch engaged





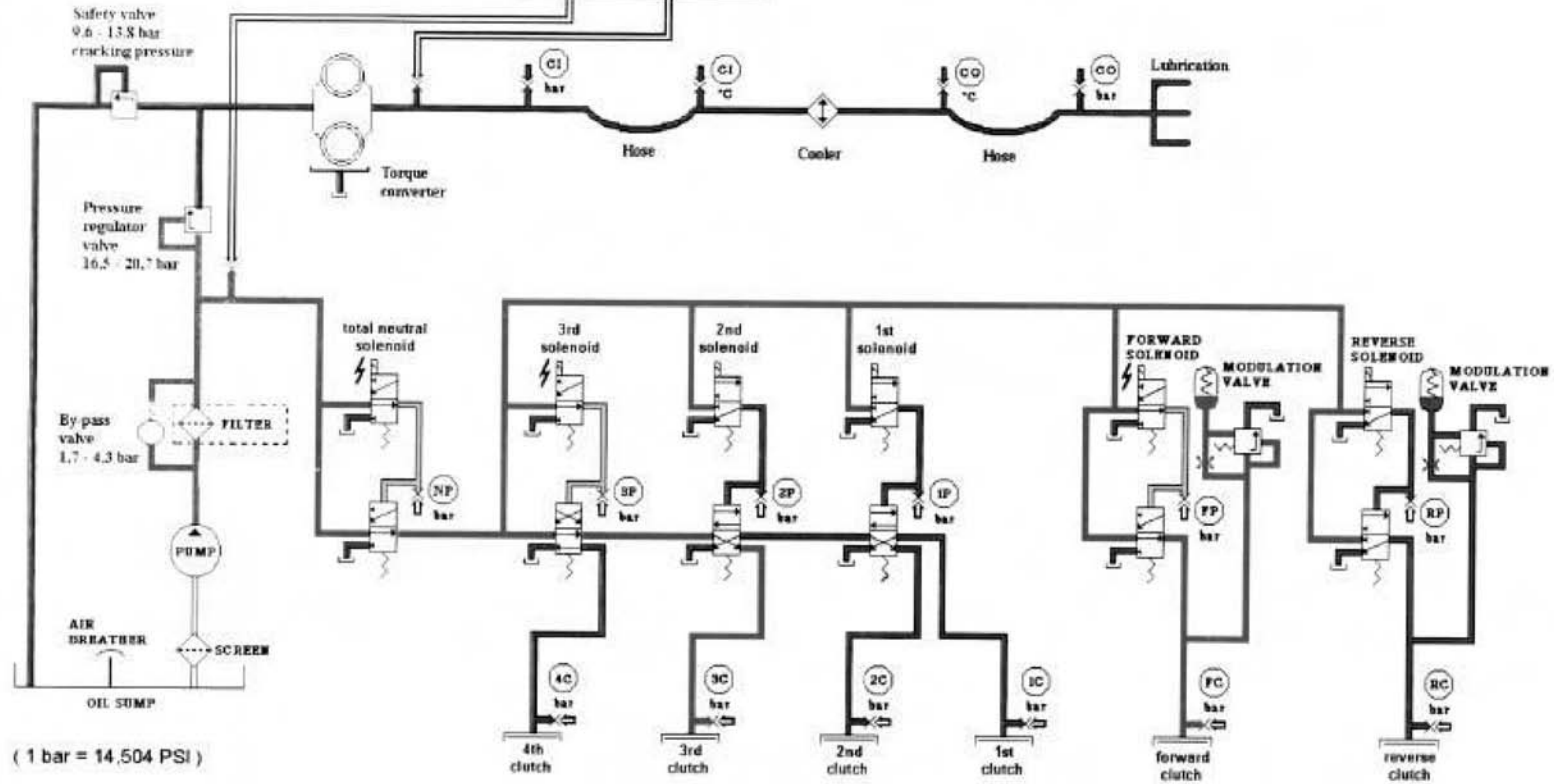
28000 / 32000 transmission - hydraulic diagram  
4 speed - with total neutral

OPERATOR COMPARTMENT

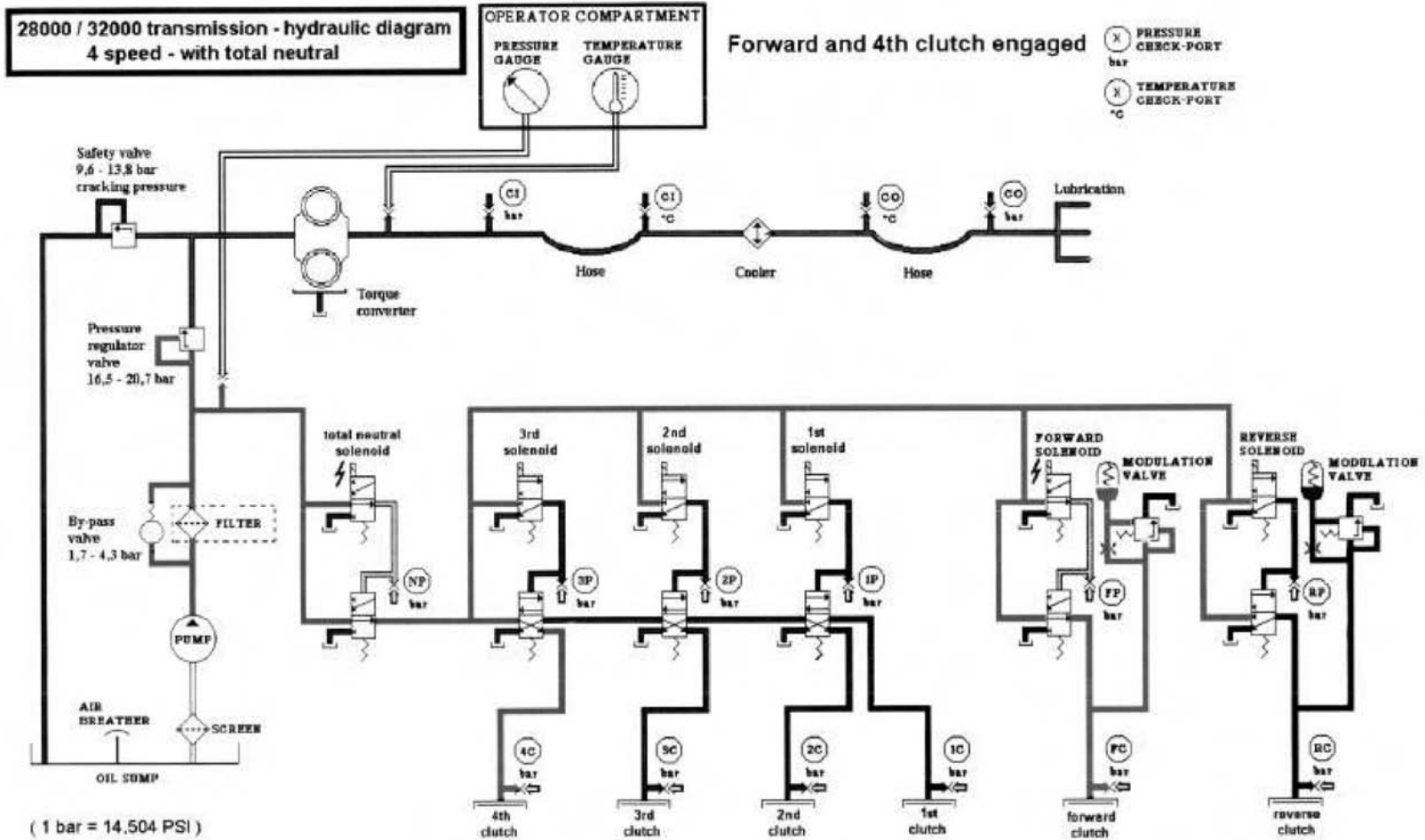
PRESSURE GAUGE    TEMPERATURE GAUGE

Forward and 3rd clutch engaged

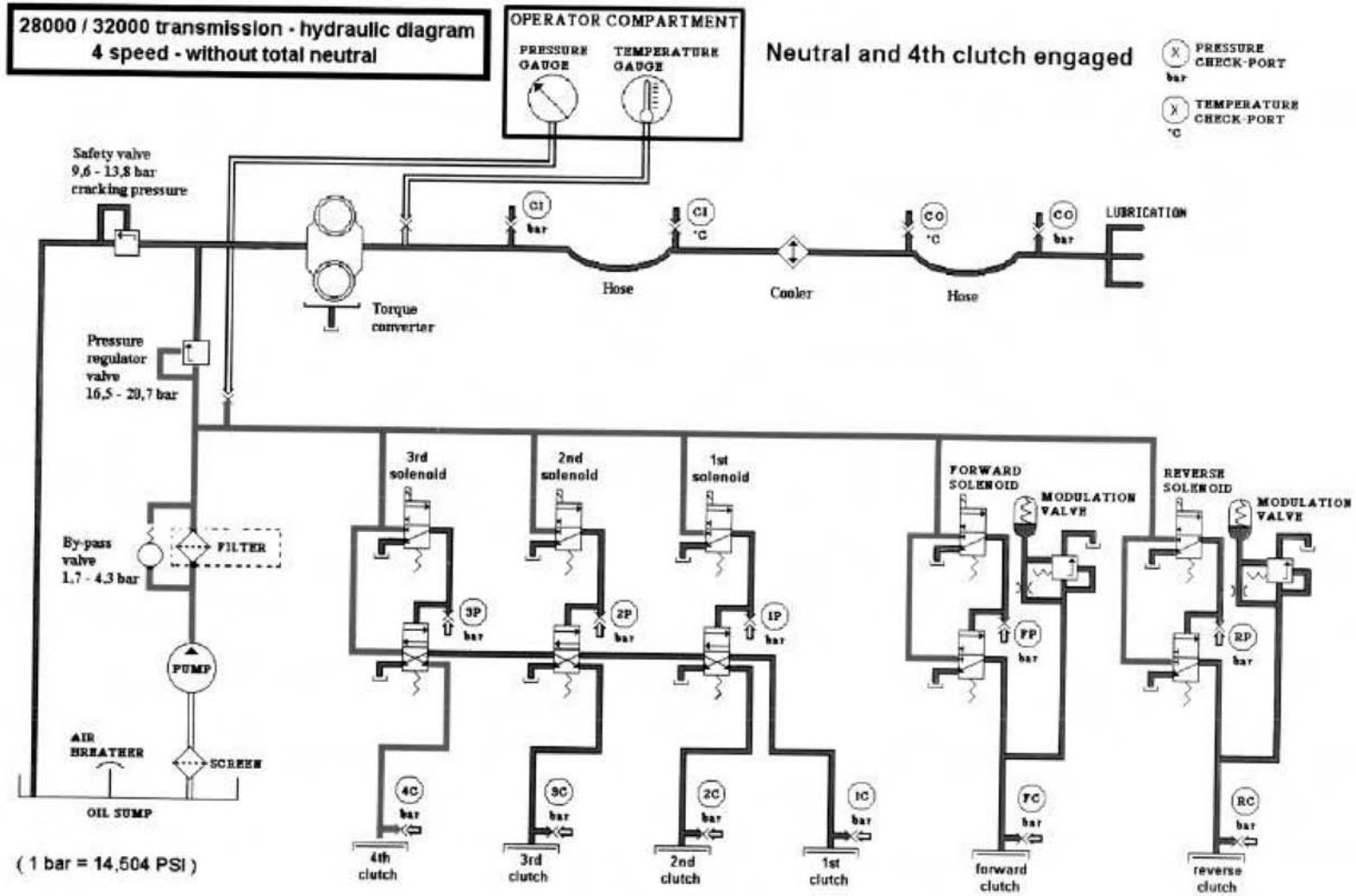
- (X) PRESSURE CHECK-PORT  
bar
- (X) TEMPERATURE CHECK-PORT  
°C



OFF-HIGHWAY COMPONENTS







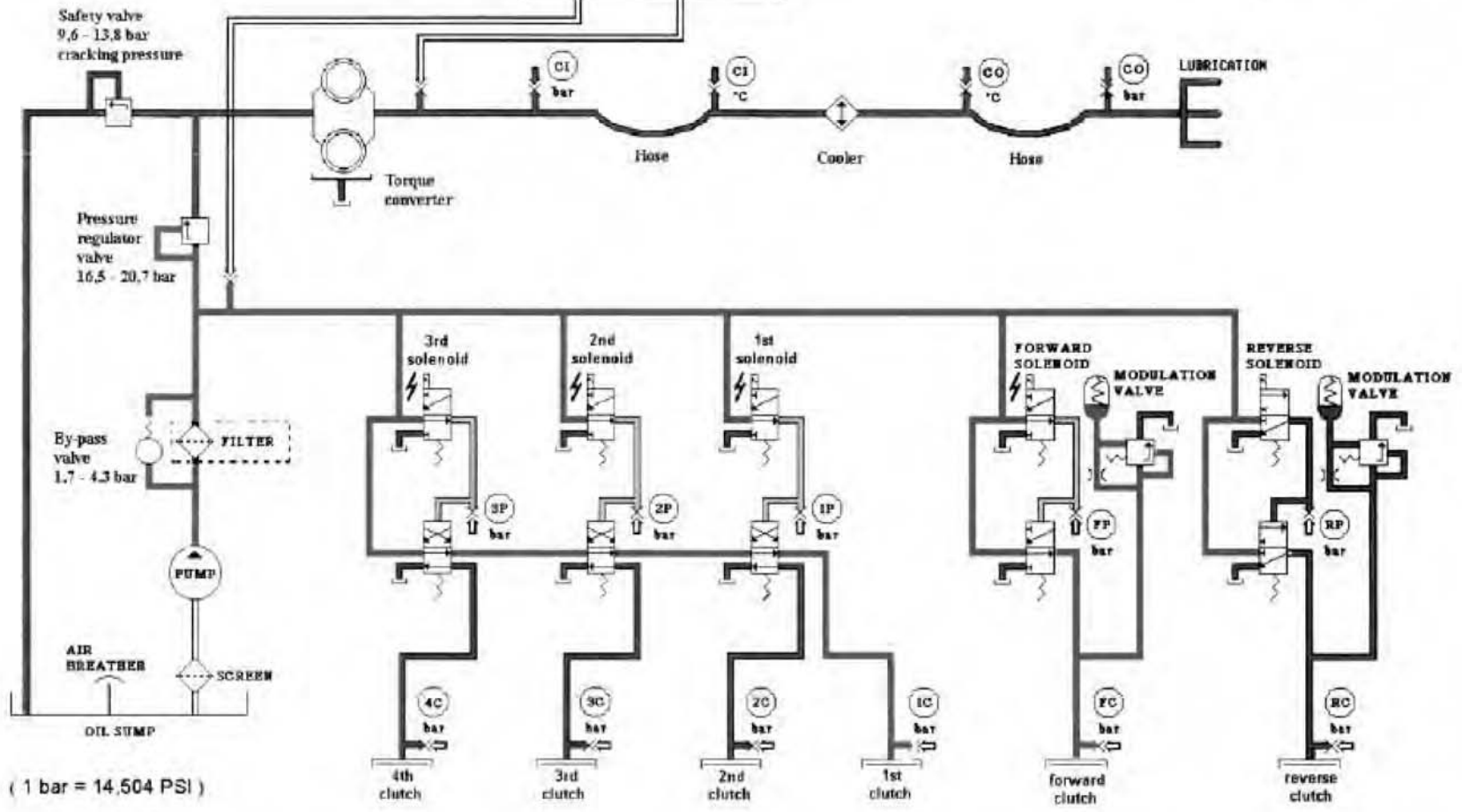
**28000 / 32000 transmission - hydraulic diagram  
4 speed - without total neutral**

**OPERATOR COMPARTMENT**

PRESSURE GAUGE      TEMPERATURE GAUGE

Forward and 1st clutch engaged

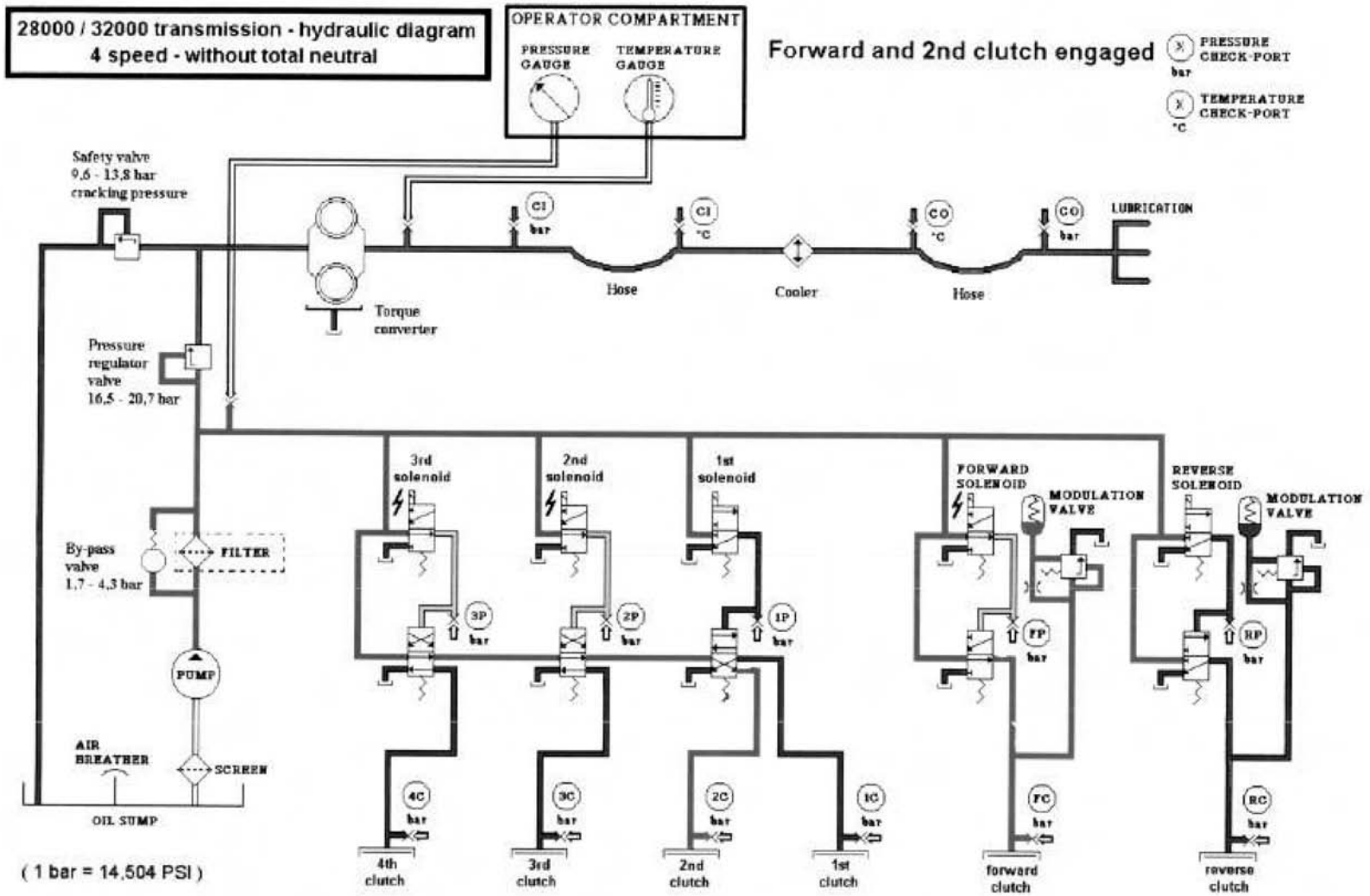
- (X) PRESSURE CHECK-PORT  
bar
- (C) TEMPERATURE CHECK-PORT  
°C



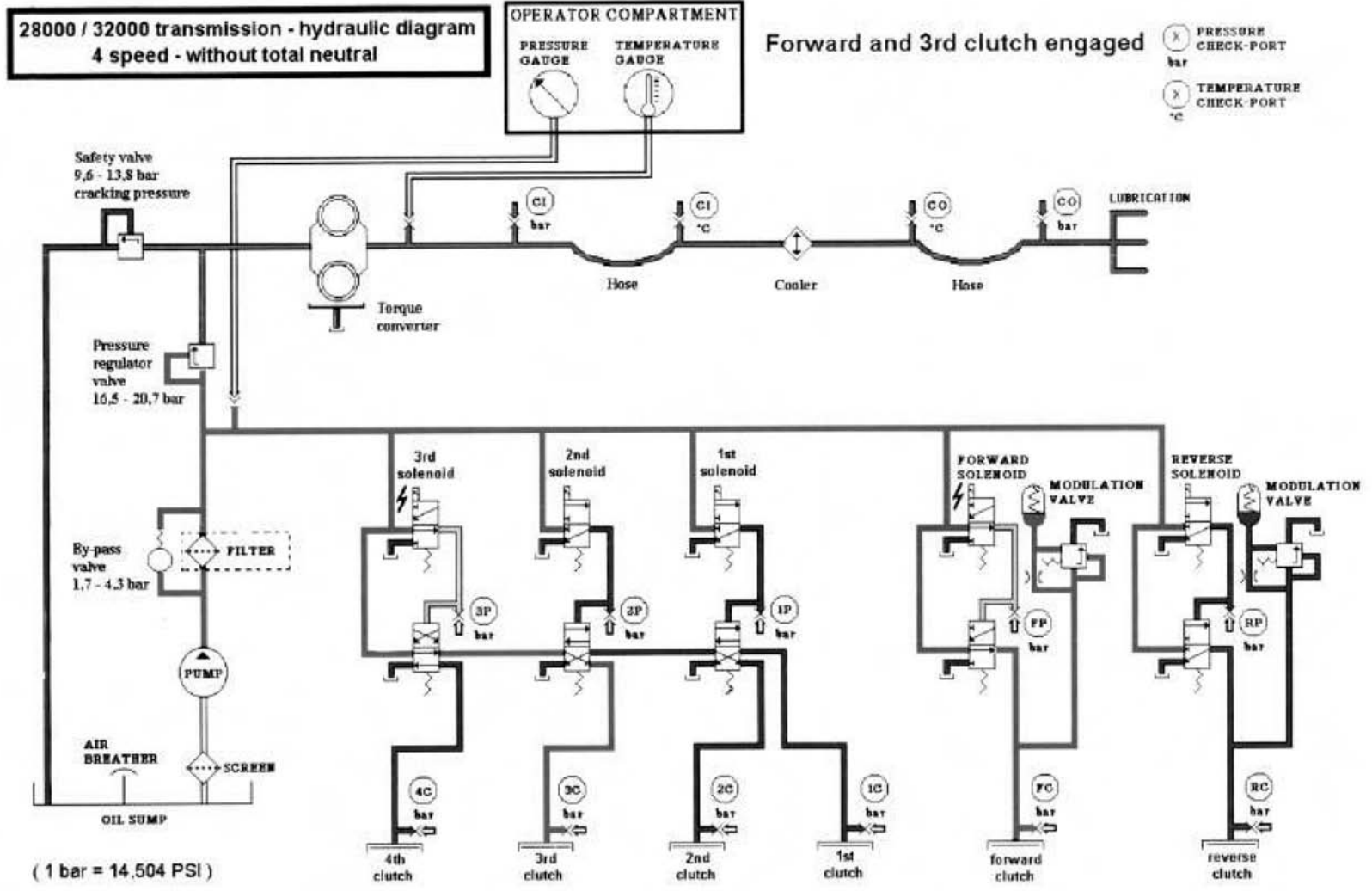
( 1 bar = 14,504 PSI )

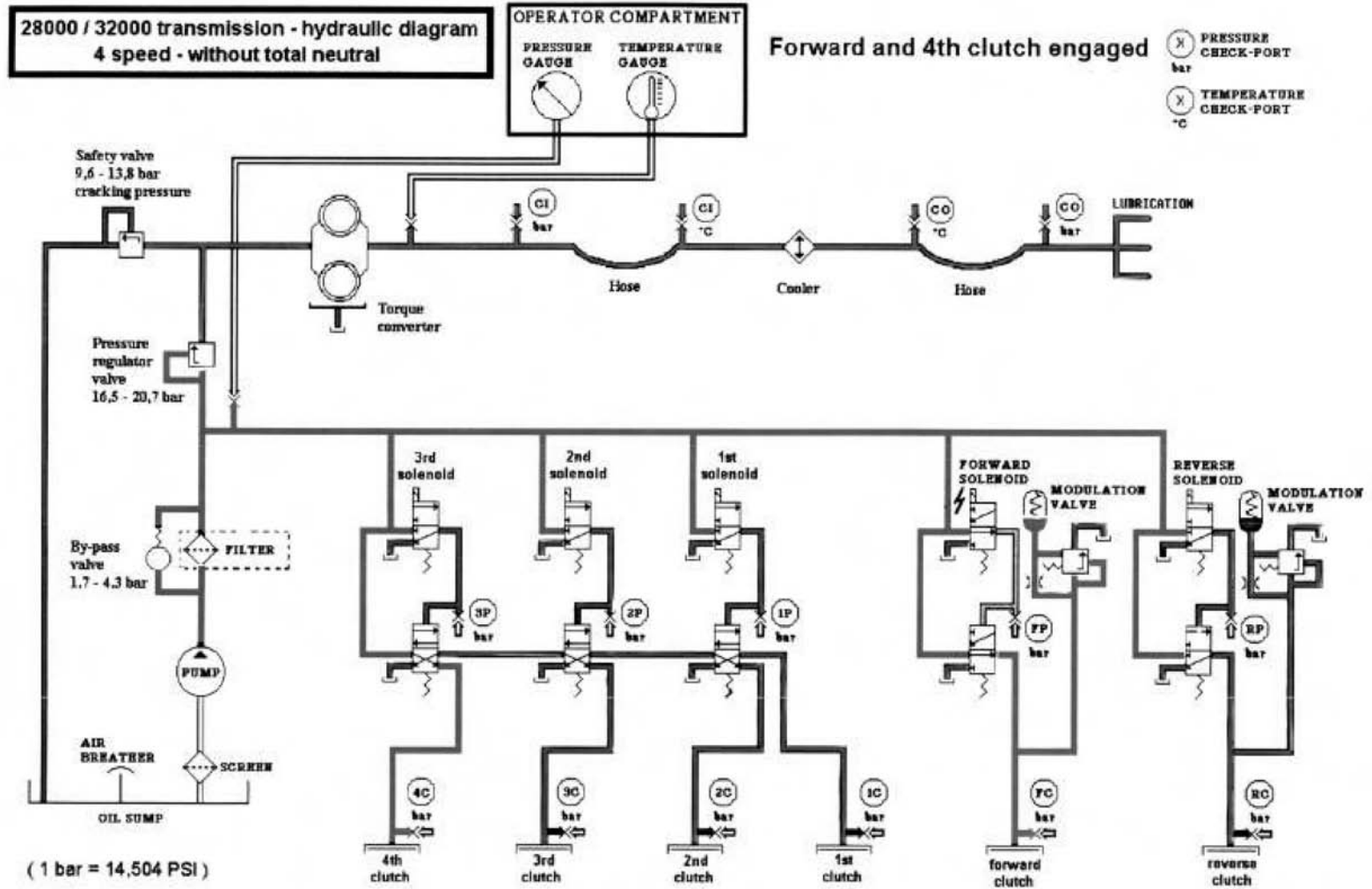


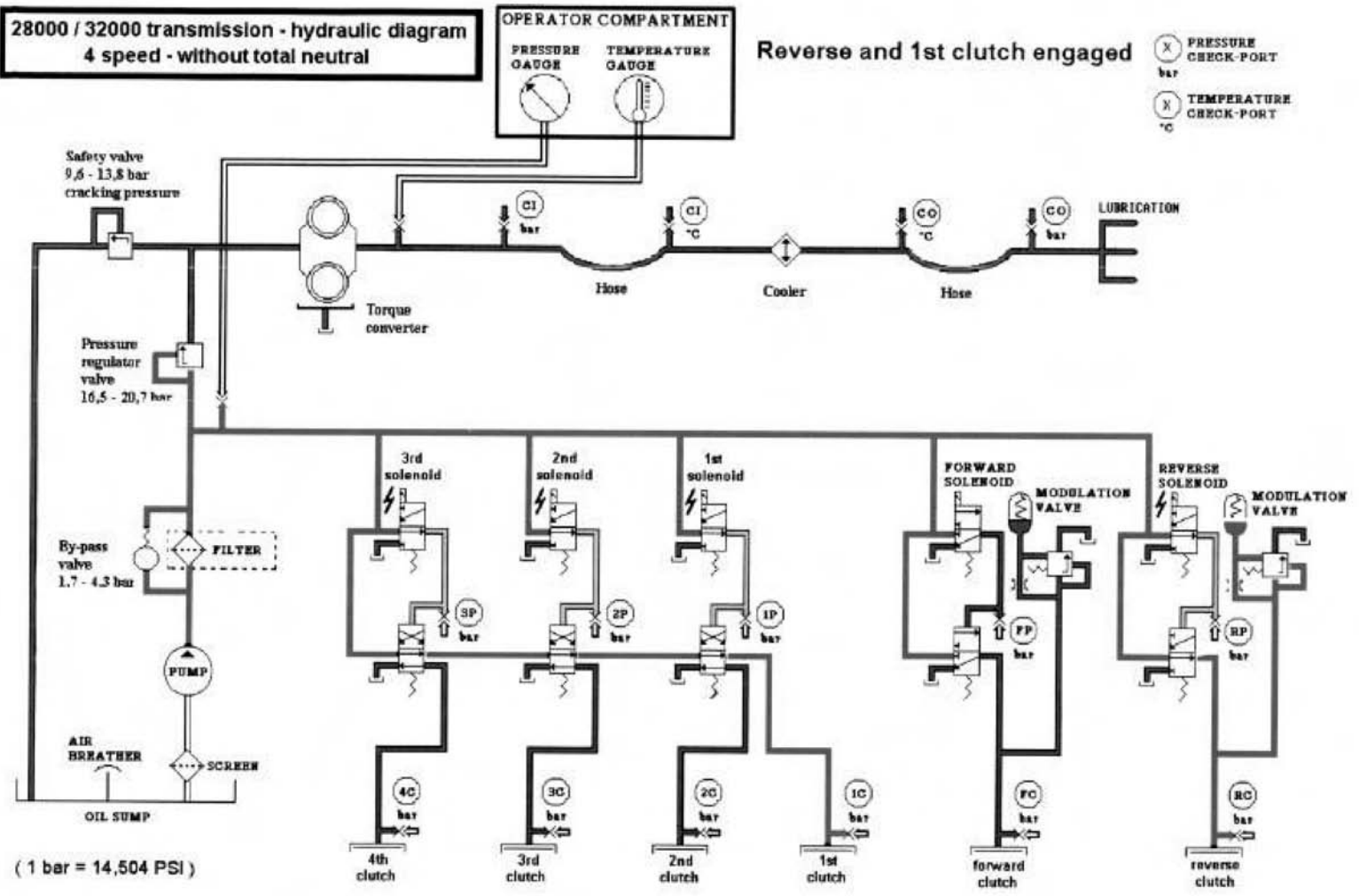
**OFF-HIGHWAY COMPONENTS**



**OFF-HIGHWAY COMPONENTS**







# APPENDIX G

## Electronic Gear Selector (EGS) User Manual

Contents	Para	Page
Scope.....	G-1	G-1
General.....	G-2	G-1
EGS Self-Test Function.....	G-3	G-2

### Section I. U.S. Army Supplement to Dana Spicer Clark-Hurth Material.

#### G-1. SCOPE.

This appendix contains information for using the EGS. What follows is the manufacturer's technical manual. This manual is unedited and covers multiple models of Dana Spicer Clark-Hurth EGS units. Refer to Para G-2 for details on how to use this material.

#### G-2. GENERAL.

Most pages will also include two different page numbers. The appendix page number will have the appendix letter and a page number like the one at the bottom of this page. This page number will be used in all references made in Section I. The other page number is the vendor material page numbering. It will be used for any references made within the vendor material.

The IHMEE uses the grip-type EGS unit. All information in Section II that does not pertain to the grip-type EGS unit should be ignored. Refer to TM 5-2420-230-24P for parts information.

<b>G-3. EGS SELF-TEST FUNCTION.</b>		
This Task Covers:		
a. Input Test	b. Speed Sensor Test	c. Output Test
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i>	<i>Equipment Conditions</i>	
None	<i>TM or Para</i>	<i>Condition Description</i>
	TM 5-2420-230-10	Vehicle positioned on level ground.
<i>Tools and Special Tools</i>		
None	TM 5-2420-230-10	Engine ON.
<i>Materials/Parts</i>	<i>Drawings Required</i>	
None	None	
<i>Personnel Required</i>	<i>Estimated Time to Complete Task</i>	
MOS 62B, Construction Equipment Repairer	Refer to MAC in Appendix B	
<i>References</i>		
None		

**a. Input Test.**

Refer to page G-23 for Input Test.

**b. Speed Sensor Test.**

Refer to page G-24 for Speed Sensor Test.

**c. Output Test.**

Refer to page G-25 for Output Test.

**d. Follow-On Maintenance.**

Shut OFF engine (TM 5-2420-230-10).

**Section II. Vendor Operator Manual.**

Section II contains information for operating the EGS in the form of the manufacturer's operation manual which follows this page. Section I contains U.S. Army supplemental information to the vendor manual.



EGS  
USER MANUAL  
REVISION 4

SPICER CLARK-HURTH

EGS user manual. Page 1 of 25  
Document reference : egsm4.doc  
Revision date: 07/04/97

Ten Briele 3, 8200 Brugge, Belgium

Tel: +32/50/402445

Fax: +32/50/402402

## 1. PRODUCT DEFINITION

**EGS** stands for **E**lectronic **G**ear **S**elector.

The EGS is designed to control the selected gear in a powershift transmission.

It distinguishes itself from conventional shift levers by its flexibility (customer's need) and its ability to protect the complete driveline from driver's abuse.

The EGS integrates a complete microcomputer and an indicator display (using bi-coloured LED's) into the shift lever housing.

Possible features include :

- Functionally replaces all existing CLARK-HURTH shift levers
- Direction reversal protection
- Downshift protection
- Automatic powerup in neutral
- Neutral start protection
- Automatic Lockup
- Shift sequencing
- Kickdown function
- Speedo-meter output
- Neutral lock function
- Declutch function
- Speed limitation
- ... etc.

These functions can be implemented through use of dedicated software programs for the internal microcomputer.

## 2. FUNCTIONAL DESCRIPTION

The EGS has a mechanical shift lever which passes information (contactless) to the computer. This information together with acquired vehicle speed (by using a speed sensor ) is used to shift to the requested gear or to prevent this, while indicating this on the shift lever's display.

The computer system receives information from 4/5 internal inputs (shift lever and kickdown button, if used), 2 external ON/OFF inputs, and a speed sensor input channel.

This information is used to control up to 8 power switches (which control the transmission and other functions) and a speedometer output.

**SPICER CLARK-HURTH**

EGS user manual. Page 2 of 25  
Document reference : egsm4.doc  
Revision date: 07/04/97

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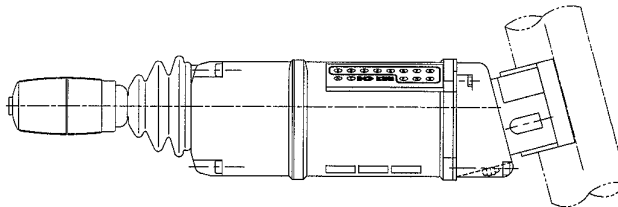
### 3. PRODUCT HARDWARE

Basically, two versions of the EGS are available : the **GRIP TYPE** and the **STANDARD TYPE**. Both have a number of common features but most EGS units have a customised control program, giving quite a range of functional differences.

Refer to the application specific EGS description for an explanation of customer specific features (its EGS Functional Description).

#### 3.1 GRIP type EGS

The GRIP type EGS is a shift lever, intended for mounting on the left side of the steering column.



**front view of a grip type EGS**

**SPICER CLARK-HURTH**

EGS user manual. Page 3 of 25  
 Document reference : egsm4n4.doc  
 Revision date: 07/04/97

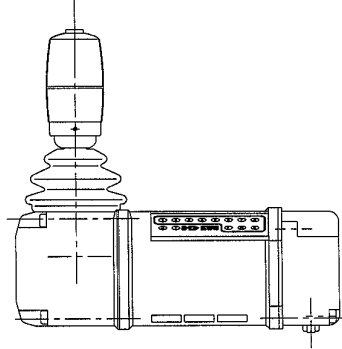
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### 3.2 STANDARD type EGS

The STANDARD type EGS is a shift lever intended to be mounted on the right side of the driver. Left side mounting is also possible (software modification - decal modification).



**front view of a standard type EGS**

### 3.3 KICKDOWN option

The GRIP type EGS is also available with a shift lever integrated PUSH BUTTON, which is used for the kickdown function.

Usually it's used for requesting a downshift from 2nd to 1st gear, which is dropped after a direction change (used on wheeled loaders) :

**F2 ⇒ kickdown ⇒ F1 ⇒ R2.**

This is called kickdown.

If however the speed is too high, the kickdown request is stored for a certain time. If during this time the speed has not slowed down sufficiently, the request is dropped.

This kickdown function is NOT used on "low speed direction change" applications.

The kickdown function can also be assigned to an external input for the EGS to suit those applications needing REMOTE KICKDOWN control.

**SPICER CLARK-HURTH**

EGS user manual. Page 4 of 25  
Document reference : egsm4.doc  
Revision date: 07/04/97

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## 4. USER INTERFACE

### 4.1 Shift lever operation

All EGS applications share the principle of selecting direction and gear positions.

**Direction** is selected by placing the lever in **ONE OF THREE DETENTED POSITIONS** (Neutral, Forward or Reverse).

**Gear-shifts** are made by bringing the lever either in the **UPSHIFT POSITION** or in the **DOWNSHIFT POSITION**. These positions are **SPRING RETURNED**.

With the EGS, shifts are made **RELATIVE** to the previous position : the EGS **REMEMBERS** the selected gear position and shifts either to a higher gear or to a lower gear.

The EGS display always shows the selected shift lever position, the selected direction, the gear position and the gear direction.

This operating principle accounts for the flexibility of the EGS system : it makes possible to control any (electric) powershift transmission with the same shift lever, provided the correct **software** (a program for the EGS computer) is installed.

It also facilitates features such as kickdown, automatic powerup in neutral, preset gear selection after a direction change, etc...

#### 4.1.1 Grip type operation

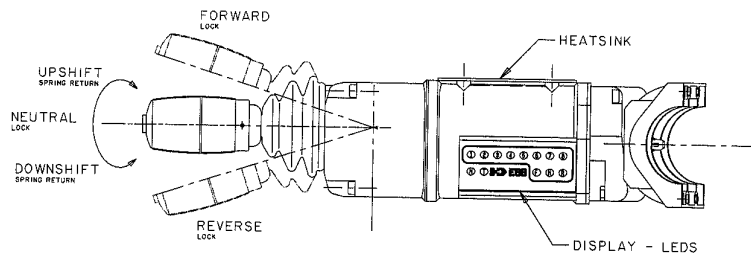
The **FORWARD** driving direction is selected by pushing the lever **away from the driver** (this usually corresponds with pushing it to the normal driving direction).

The **REVERSE** driving direction is selected by pulling the lever **towards the driver**.

**NEUTRAL** can be selected by placing the lever into its **central** detented position.

An **UPSHIFT** is requested by **rotating** the shift lever **counter clockwise**.

A **DOWNSHIFT** is requested by **rotating** the shift lever **clockwise**.



**view of the shift lever positions of the grip type EGS**

**SPICER CLARK-HURTH**

EGS user manual. Page 5 of 25  
 Document reference : egsm4.doc  
 Revision date: 07/04/97

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Fax: +32/50/402402

**4.1.2 Standard type operation**

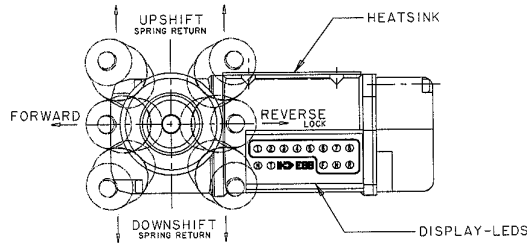
The **FORWARD** driving direction is selected by **pushing** the lever **towards the normal driving direction**.

The **REVERSE** driving direction is selected by **pulling** the lever **towards the reverse driving direction**.

**NEUTRAL** can be selected by placing the lever into its **central detented position**.

An **UPSHIFT** is requested by **pushing** the lever **towards the right side** (away from the driver). This action is spring returned.

A **DOWNSHIFT** is requested by **pulling** the lever **towards the left side** (towards the driver). This action is spring returned.



**view of the shift lever positions of the standard type EGS**

**SPICER CLARK-HURTH**

EGS user manual. Page 6 of 25  
 Document reference : egsm4.doc  
 Revision date: 07/04/97

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## 4.2 [Standard features](#)

Below described functions available on the EGS units.

### 4.2.1 Automatic powerup in neutral

When power is **first applied** to the EGS, **NEUTRAL is always selected**.

This is REGARDLESS of the position of the shift lever (it can be in either forward, neutral or reverse position).

In order to start driving, the driver first has to place the shift lever into the neutral (central detented) position before a specific direction can be selected.

### 4.2.2 Neutral start protection

Each EGS can have an output signal, which is deactivated whenever the shift lever is in the neutral position.

This signal can be used to control a normal closed relay preventing engine start-up whenever the shift lever is NOT in the neutral detented position.

If during powerup the shiftlever is in forward or in reverse, the neutral start protection will not be activated (due to the function "automatic powerup in neutral"). Only after leaving this function "automatic powerup in neutral" the **neutral start protection** will be activated.

### 4.2.3 Shift repeat

While making an up- or down shift for a short time (more than 0.1 sec), this will result in an upshift or a downshift. If **holding** the lever in either UP or DOWN position, the EGS will produce **subsequent upshifts or downshifts** with a certain time interval (example 1.5 seconds).

## 4.3 [External inputs](#)

Apart from the shift lever, external signals can be used to customise the behaviour of the EGS.

Both inputs can be used for various functions (application dependent) such as transmission declutch, force neutral, throttle sensing, kickdown, mode select, etc...

Note : when an integrated push button is used, only one additional external input is available.

SPICER CLARK-HURTH

EGS user manual. Page 7 of 25  
Document reference : egsm4.doc  
Revision date: 07/04/97

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#### 4.4 [Display function](#)

The EGS has an internal bicolour LED display for displaying the selected shiftlever position, the selected shiftlever direction, the transmission position and the transmission direction.

Application specific details are described in a separate document : **EGS Functional Description**. This EGS functional description can be requested for each EGS unit. This description overrules the below description wherever applicable.

##### 4.4.1 Displayed information

Typically four types of information about the EGS and the transmission can be of interest to the driver :

- selected shiftlever position and transmission position
- selected shiftlever direction and transmission direction
- application specific information
- diagnostic information

##### 4.4.1.a Selected position and direction

The difference between shift lever position and transmission position might not be immediately clear, but when one remembers that the EGS can protect the transmission (example : by not allowing a downshift), it becomes clear that the REQUESTED position (the shift lever position) can be different from the ACTUAL ENGAGED position (the position of the transmission).

Both shift lever position and transmission position can be divided in two subcategorises :

- GEAR POSITION (1st,2nd,3rd etc...)
- DRIVING DIRECTION (forward, neutral, reverse)

##### 4.4.1.b Application specific information

This can be anything (whatever the customer wants to see).

As an example : on an EGS automatically controlling the lockup clutch, it's interesting to see whether or not the converter is in lockup. This can be indicated on the EGS display by using the LED 7 - yellow.

**SPICER CLARK-HURTH**

EGS user manual. Page 8 of 25  
Document reference : egsm4.doc  
Revision date: 07/04/97

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#### 4.4.1.c Diagnostic information

Two types of diagnostic information are considered :

##### ON LINE diagnostics

This information is given during normal driving when something special happens.

In most applications, the LED 8 is used to indicate standstill. This helps to spot problems with the speed sensor in an early stage before the lack of protection resulting from the failure can produce damage to the drivetrain.

Which ON LINE diagnostic functions are provided is detailed in the application specific EGS Functional Description.

##### OFF LINE diagnostics :

There are three selftest modes built into the EGS. Details about their function and usage are described in chapter 7. Selftest functions.

#### 4.4.2 Display layout

The EGS uses **LED's** (Light Emmitting Diodes) to give information to the driver.

It consists of eight **multicolour LED's** :

labelled '1' to '8' and can light up in RED, GREEN and YELLOW.

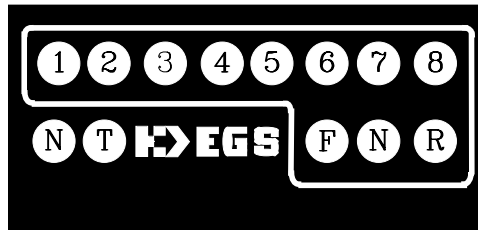


fig. 4.3 EGS top panel display

These numbered LED's are used for displaying both the **shift lever** selection and the **transmission** engagement.

They also used to indicate diagnostic information in the different test modes.

The RED LED is labelled 'N' and when this lights up it indicates that the transmission is placed in neutral (this is possible even while the shift lever is not in neutral).

The YELLOW LED is labelled 'T' which stands for Trouble(Shooting). This LED is ON while working in one of the three selftest modes described in chapter 7.

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 9 of 25 Document reference : egsm4.doc Revision date: 07/04/97</p>
<p>Ten Briele 3, 8200 Brugge, Belgium</p>	<p>Tel: +32/50/402445 Fax: +32/50/402402</p>

**4.4.3 Display method**

Basically the GEAR POSITION is shown by turning ON the LED that corresponds with the selected position. In 1st gear, LED '1' is ON, in 2nd gear, LED '2' is on etc..

The selected direction is shown with the COLOUR of the LED :

<b>RED</b>	<b>indicates</b>	<b>NEUTRAL</b>
<b>GREEN</b>	<b>indicates</b>	<b>FORWARD</b>
<b>YELLOW</b>	<b>indicates</b>	<b>REVERSE</b>

Additionally LED 'N' (RED) is ON while the transmission is in neutral.

The position shown is ALWAYS the selected SHIFT LEVER position. Most of the time, the actual transmission position will be the same as the shown one, and in that case that's all there is.

However if, because of an active protection or because of some internally generated delay, there is a discrepancy between transmission position and shift lever position, a 2nd LED will indicate the transmission position (colour indicates direction).

To let the driver know the difference between both indications, the transmission LED blinks while the shift lever LED stays ON all the time.

While this may seem a bit confusing at first, it's very easy to understand the shown information in reality.

example : Driving in 4th gear forward at high speed ⇒ LED 4 - GREEN

When the driver is making a downshift, but due to a too high speed the EGS will protect the transmission and will not allow the requested downshift. Thus the transmission will stay in 4th gear forward, while the shiftlever is in 3rd gear forward

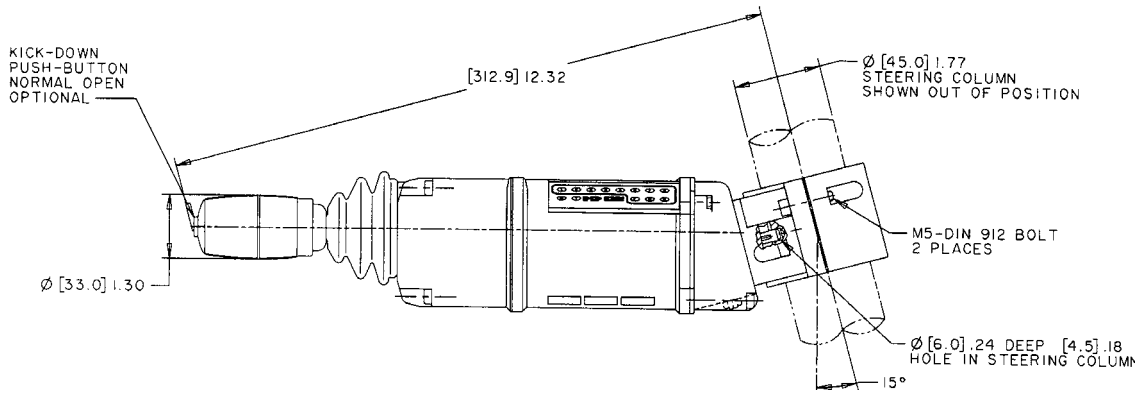
⇒ LED 3 - GREEN &  
LED 4 - blinking GREEN

**5. MACHINE INTERFACE**

**5.1 Physical interface**

**5.1.1 View on Grip type EGS mounting**

The Grip type EGS is mounted on the left side of the steering column and mates with popular light switch assemblies. It can also be mounted using a customer supplied clamp, and two metric M5x20 bolts as shown below.



**view of the mounting of a grip type EGS**

**SPICER CLARK-HURTH**

EGS user manual. Page 11 of 25  
 Document reference : egsm4.doc  
 Revision date: 07/04/97

Ten Briele 3, 8200 Brugge, Belgium

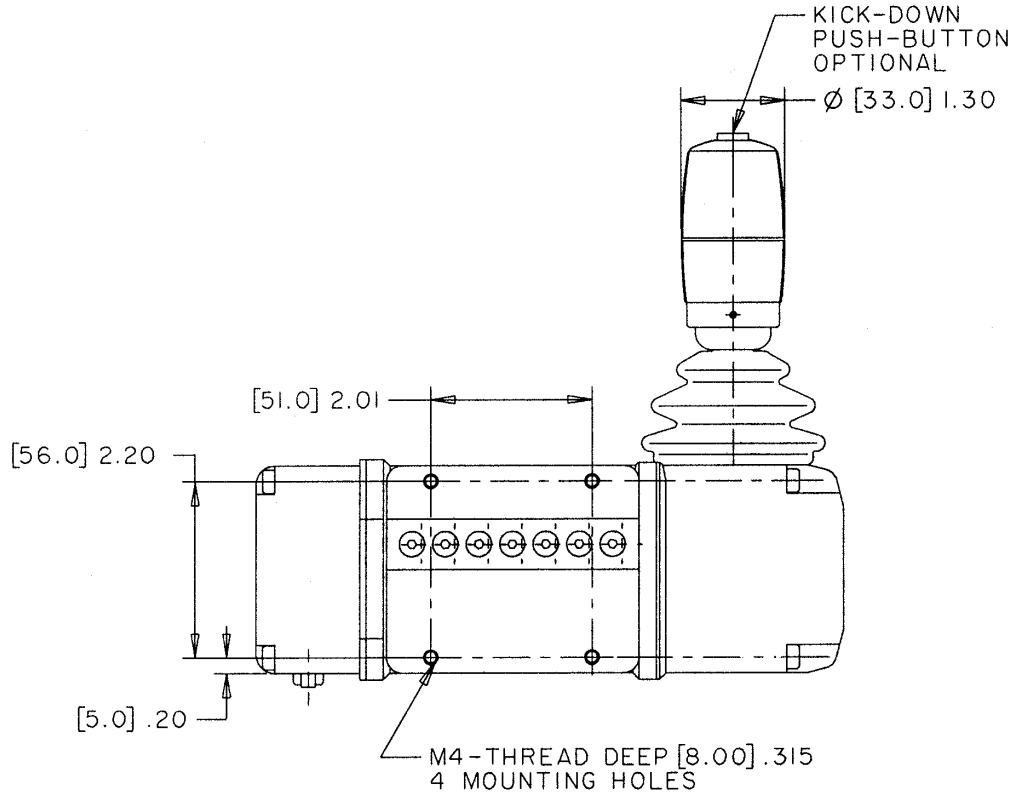
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**5.1.2 View on Standard type EGS mounting**

The Standard type EGS is mounted to either the right or left side of the driver seat with the display facing towards the driver using four M4x8 bolts at the back of the EGS as shown below.

Note : when the Standard type EGS is mounted on the left side, a special EGS software modification and an other type of decal has to take care of the fact that (for the EGS) forward and reverse are swapped.



**view of the mounting of a standard type EGS**

**SPICER CLARK-HURTH**

EGS user manual. Page 12 of 25  
Document reference : egsm4n4.doc  
Revision date: 07/04/97

Ten Briele 3, 8200 Brugge, Belgium

Tel: +32/50/402445

Fax: +32/50/402402

**5.2 Electrical interface**

The EGS is connected with the vehicle wiring through a 15 pole male DSUB connector.

Each EGS application gets its own wiring diagram, describing how to connect these 15 wires to the vehicle's light system, the transmission control valve and to other outputs and inputs.

**5.2.1 Pin designations**

Below table lists the function of each EGS connector pin for an 8 speed transmission :

pin	comment
1	BATTERY PLUS
2	BATTERY GROUND
3	Option dependant output
4	C.V. Solenoid 1
5	C.V. Solenoid 2
6	C.V. Forward solenoid
7	C.V. Reverse solenoid
8	Option dependant output
9	C.V. Solenoid 3
10	Speed sensor input HOT
11	Speed sensor input GND
12	Speed sensor supply 8 Volt / speedometer output
13	C.V. Forward High solenoid
14	Option dependant input
15	Option dependant input
16	Shield ground (internally connected to wire 2)

'C.V.' stands for Control Valve.

**5.2.2 Speed sensor mounting**

The EGS can support inductive (2 wire), hall-effect (3 wire) and magneto resistive (2 wire) speed sensors. Speed sensor informs the EGS about the vehicle and the turbine speed.

This information is used to protect the transmission for overspeeding and implementation of various functions such as automatic lockup, automatic speed sensed shifting, ... etc.

**5.2.2.a Inductive sensors**

**Sensor installation :**

Inductive sensors (p/n 4200572, 4200573 & 4200669) generate analogue voltages with amplitudes ranging from millivolts to several volts (depending on gear speed and sensor mounting).

The **distance** from the **sensor head** to the **gear teeth** must be smaller than 0.6 mm. This is accomplished on each transmission in our factory.

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 13 of 25                  Document reference : egsm4.doc                  Revision date: 07/04/97</p>
	<p>Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402</p>

During installation on the machine it's sufficient to unscrew the protective plug and screw the sensor with its o-ring right down to the bottom and tighten it.

**Sensor wiring :**

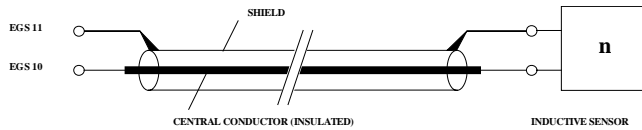
The sensor has to be connected with EGS pin 10 and 11. A suitable sensor connector is supplied along with the sensor.

A good connection between sensor and EGS can be achieved in two ways :

- use of a shielded cable
- use of a twisted pair cable

**Shielded cable :**

If shielded cable is used, make sure that the mechanical strength of the cable and its temperature specification is suitable for the application.



**Connection of an inductive speed sensor with shielded cable**

The central conductor of the shielded cable has to be connected with EGS pin 10 (HOT sensor input) on one end and with a sensor pin on the other side.

The shield has to be connected to EGS pin 11 (GND sensor input) on one end and with the other sensor pin on the other side. (Inductive sensors have no polarity)

***MAKE SURE NOT TO CONNECT THE SHIELD TO THE VEHICLE CHASSIS !***

This would produce electrical noise on the sensor input and can lead to degraded operation.

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 14 of 25                  Document reference : egsm4n4.doc                  Revision date: 07/04/97</p>
	<p>Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402</p>

**Twisted pair cable :**

Twisted pair cable is plain electrical cable (AWG20) which is twisted with at least 20 turns per meter.



**Connection of an inductive speed sensor with twisted cable**

While being less critical to install, noise rejection of a twisted pair cable is somewhat less than that of a shielded cable.

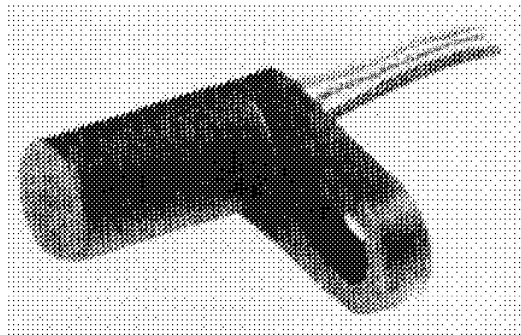
The sensor pins are connected to EGS pins 10 and 11 using the twisted pair cable. No polarity has to be observed.

**5.2.2.b Hall effect sensors**

**Sensor installation :**

Hall effect sensors generate square wave voltages with a fixed amplitude determined by the EGS hardware regardless of gear speed.

The Hall effect sensor currently in use (p/n 247135) is pictured below and is mounted according to a transmission specific installation diagram.



**view of the hall effect gear tooth sensor**

**Sensor wiring :**

The sensor has 3 wires, a **red** one for power supply plus, a **black** one for power supply ground and a **green** wire giving the speed information.

These three wires have to be connected with EGS pins 10,11 and 12 as follows :

connection EGS	connection sensor	Comment
EGS pin 10	GREEN	sensor signal
EGS pin 11	BLACK	sensor ground
EGS pin 12	RED	sensor plus

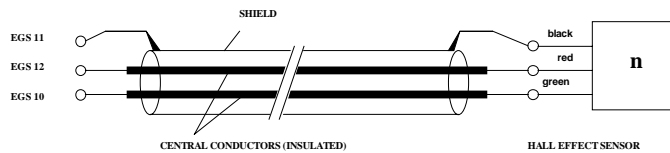
This sensor has loose wires and does NOT have a sensor connector.

A good connection between sensor and EGS can be achieved in two ways :

- use of shielded pair cable (2 central conductors + shield)
- use of 3 twisted wires (of different colour)

**Shielded pair cable :**

If shielded cable is used, make sure that the mechanical strength of the cable and its temperature specification is suitable for the application.



**Connection of a 3 wire sensor with shielded cable**

The first central conductor of the shielded cable has to be connected with EGS pin 10 (HOT sensor input) on one end and with the GREEN wire on the other side. The second central conductor of the shielded cable has to be connected with EGS pin 12 (sensor supply 8 Volt) on one end and with the RED wire on the other side.

The shield has to be connected to EGS pin 11 (GND sensor input) on one end and with the BLACK sensor lead on the other side.

***MAKE SURE NOT TO CONNECT THE SHIELD TO THE VEHICLE CHASSIS !***

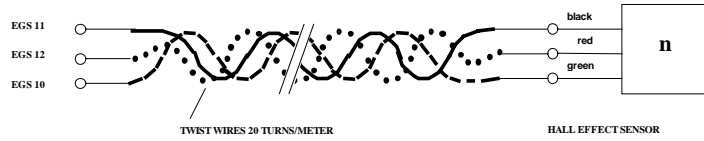
This would produce electrical noise on the sensor input and can lead to degraded operation.

SPICER CLARK-HURTH	EGS user manual. Page 16 of 25	
	Document reference : egsm4.doc	
	Revision date: 07/04/97	
Ten Briele 3, 8200 Brugge, Belgium	Tel: +32/50/402445	Fax: +32/50/402402



**3 Wire twisted cable :**

Using three twisted wires we can achieve sufficient amount of noise rejection provided the wires are twisted at least 20 turns per meter.



**Connection of a 3 wire sensor with twisted wires**

The sensor wires are connected to EGS pins 10 and 11 and 12 the same way as described above.

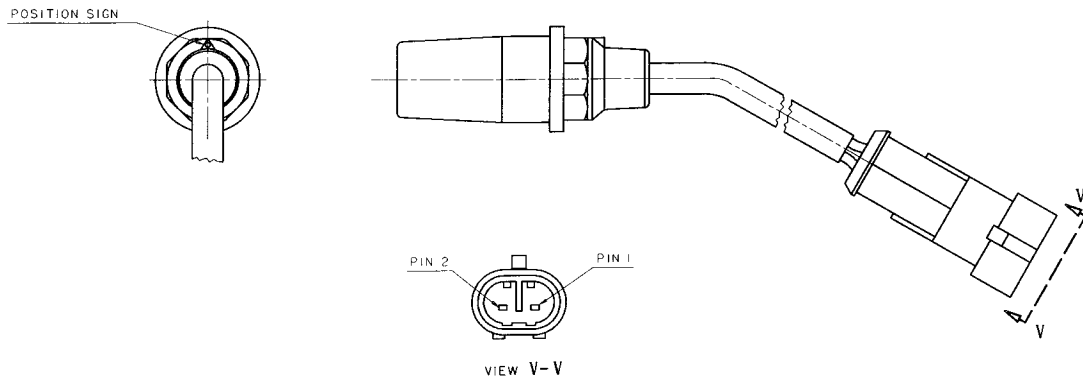
***Be sure to correctly observe sensor polarities,  
AS WRONG CONNECTIONS WILL DESTROY THE  
SENSOR !***

**5.2.2.c Magneto Resistive sensors**

**Sensor installation :**

Magneto resistive sensors generate a square wave current with a fixed amplitude changing between 7 mA and 14 mA.

The **Magneto Resistive sensor** currently in use (p/n 4202485) is pictured below. On the sensor's body, there is a small plastic triangular position sign. Make sure the position sign on the sensor points in the direction of the movement of the gear teeth (teeth rotation).



**view of the Magneto Resistive sensor**

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 17 of 25 Document reference : egsm4.doc Revision date: 07/04/97</p>
	<p>Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402</p>

**Sensor wiring :**

The sensor has an integrated AMP Superseal 2 pin connector. The two pins are numbered 1 and 2. Following table shows the relation between wire colour, pin number and connection to the respective EGS wires :

Colour	Pin number	Function	EGS wire
Brown	1	Current input	10
Blue	2	Current output	11

For the wire connection see 5.2.2.a inductive sensors - sensor wiring.

**Note : the sensor wires have a polarity!**

***Be sure to correctly observe sensor polarities,  
AS WRONG CONNECTIONS WILL DEACTIVATE  
THE SENSOR !***

**5.2.3 Power supply considerations**

Traditionally electrical wiring on vehicles is known as being susceptible to problems such as moisture, vibrations and other environmental stresses.

Adequate connection sealing and cable size usually take care of these problems.

Not so often recognised are problems caused by '**common resistance**' in vehicle wiring.

These problems stem from the fact that when a conductor conducts several amperes of current, due to its internal resistance, significant voltage drops can develop along it.

If a conductor is used to power both a heavy load (e.g. head lamps) and a light load (e.g. a relay), the light load 'sees' the same supply voltage as the heavy load. Because of the current drawn by the heavy load, their COMMON supply conductor can easily create voltage drops up to volts.

A conductor with a resistance of 0.05 Ohms connecting both loads with the battery plus generates a voltage drop of 0.5 Volts when conducting a current of 10 Amperes.

This means that with a 12 Volt battery the relay gets a voltage of 11.5 Volts.

Now if the return line is also shared by both loads (with the same 0.05 Ohm resistance), also here a voltage drop of 0.5 Volts results. This brings the actual voltage across the relay down to 11 Volts.

In reality larger voltage drops are observed and therefor in some applications it's a must to have separate power and ground wires **as direct to the battery as possible** (e.g. via a relay controlled by the starter switch).

<b>SPICER CLARK-HURTH</b>	EGS user manual. Page 18 of 25
	Document reference : egsm4.doc Revision date: 07/04/97
Ten Briele 3, 8200 Brugge, Belgium	Tel: +32/50/402445 Fax: +32/50/402402

The EGS is in fact an electronic computer and is rather sensitive to supply voltage variations. It operates well within a large voltage span (9 V DC ⇒ 28 V DC, except when a magneto resistive sensor is used : 9 V DC ⇒ 16 V DC or 18 V DC ⇒ 28 V DC) but when the supply voltage drops below the lower limit for too long (milli seconds, example 100 m sec.), it will restart and select neutral or stay in a reset condition permanently.

So having separate power conductors is specially important for EGS applications.

They assure proper operating conditions for the EGS and prevent that the current flowing through the EGS (up to 6 amperes) produces voltage drops on supply lines of other sensitive equipment (e.g. VHF radios etc...).

Finally as the current drawn by an EGS by its nature is 'pulsed' (it's not a continuous current), its advisable to TWIST power and ground wires just like the twisted pair connections used for sensors. This significantly reduces the electromagnetic energy radiated by these wires.

Be sure **not to reverse the polarity** of the connections.

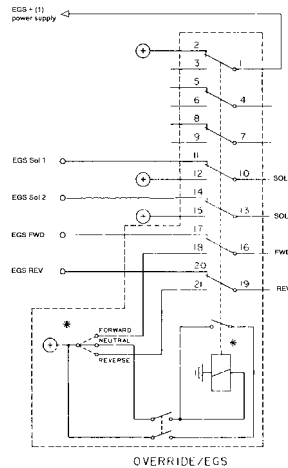
## 6. VERRIDE SYSTEM

The EGS (Electronic Control System) is designed to be reliable and fail-safe.

In reality, failures do exist and in case of a failure, the customer wants his vehicle to be functional again as soon as possible.

If a vehicle is grounded because of a failure in the electronic shift system, the override system can be activated.

Example of an override system :



### Override system of a EGS for a 3 speed transmission

SPICER CLARK-HURTH

EGS user manual. Page 19 of 25  
Document reference : egsm4.doc  
Revision date: 07/04/97

Ten Briele 3, 8200 Brugge, Belgium

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It allows the vehicle to be operated in a certain (hardwired) gear position. Direction selection is accomplished with a separate 3 position electrical switch. Use of this system allows to still move the vehicle in case of an EGS breakdown.

The override system is in fact a switch, which either connects the solenoid valves to the EGS or to the 'fixed gear' alternate direction switch.

In the first case the transmission is controlled electronically by the EGS, in the latter it is operated manually in a preset gear.

- Note :
- When the override system is activated, **all drivetrain protections are bypassed.**
  - Using the override system can be of help to find out whether a problem is related to the EGS OR if it is hydraulic, electromechanical, pneumatic.

## 7. SELFTEST FUNCTIONS

The EGS has special circuitry to help verifying its operation.

**Three selftest modes** are built into the EGS control programs :

- **Input test**
- **Speed sensor test + Lamptest**
- **Output test**

The EGS furthermore has the ability to check for possible problems **while driving** (ON LINE diagnostics).

As described in 4.4.2, the 'T' LED is used for identifying different Trouble(Shoot) modes. This is done in combination with the status of the 'N' LED.

### 7.1 Operation of the 'N' and 'T' LED's

#### 7.1.1 Overview

In normal situations (driving, no problems)	'T' LED is always OFF
When error is detected	'T' LED is ON or BLINKING
In selftest mode	'T' LED is always ON

#### 7.1.2 Detailed operation

Situation	'N' LED	'T' LED
Normal Operation	On when transmission neutral	OFF
INTERNAL FAULT	ON	blinking SLOWLY
INPUT TEST	blinking SLOWLY	ON
OUTPUT TEST	blinking FAST	ON
SPEED SENSOR TEST	OFF	ON

<h2>SPICER CLARK-HURTH</h2>	EGS user manual. Page 20 of 25 Document reference : egsm4.doc Revision date: 07/04/97
	Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402

**7.2 Selftest Operation**

Selftest modes can only be started **WHILE POWERING UP** the EGS.

Invocation of a certain mode is done by moving the shift lever to a specific position while switching on the power of the EGS.

Leaving the selftest mode is done by switching OFF the power of the EGS.

**7.2.1 Selftest mode invocation**

Below table lists what conditions must be satisfied during POWERUP to get into a specific selftest mode :

SELFTEST MODE	TO ENTER MODE
INPUT TEST	FWD & UP
SPEED SENSOR TEST	REV & UP
OUTPUT TEST	FWD & DOWN

**7.2.2 Input test**

When EGS shiftlever is held in the **forward up** position **while power is applied**, INPUT TEST mode is activated.

In this mode, driving is **not possible**, since all EGS outputs remain off until the testmode is left.

This test is used to verify operation of the shiftlever and its inputs.

**The LED's (gearposition indicators) on the EGS top cover are used to display test information :**

SHIFT LEVER POSITION	LED COLOUR	LED NUMBER
Neutral	RED	4
UP (*)	RED	5
DOWN (*)	RED	3
FWD	GREEN	4
FWD & UP	GREEN	5
FWD & DOWN	GREEN	3
REV	YELLOW	4
REV & UP	YELLOW	5
REV & DOWN	YELLOW	3
wire 14 = GROUND	RED	1 (together with above LED)
wire 15 = GROUND	GREEN	1 (together with above LED)

Note : If wire 14 and wire 15 are grounded simultaneously LED '1' lights up YELLOW  
 (\*) : these shift lever positions can **NOT be selected** on a STANDARD type EGS.

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 21 of 25                  Document reference : egsm4n4.doc                  Revision date: 07/04/97</p>
	<p>Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402</p>

**7.2.3 Speed sensor test**

When EGS is held in the **reverse up** position **while power is applied**, SPEED SENSOR TEST mode is activated.

In this mode, **driving is possible**.

The test begins with a LAMPTEST, and then displays the speed sensor information.

**7.2.3.a Lamptest**

Immediately after starting up, all lamps are switched on one by one, in order to show their operation.

**7.2.3.b Speed display**

The LED corresponding with below table burns to indicate converter turbine speed :

Turbine rpm	LED number (GREEN)
0	1 blinks
0 - 249	1 on
250 - 499	2 on
500 - 749	3 on
750 - 999	4 on
1000 - 1249	5 on
1250 - 1499	6 on
1500 - 1749	7 on
1750 - 1999	8 on
above 2000	8 blinks

**7.2.4 Output test**

When EGS is held in the **forward down** position **while power is applied**, OUTPUT TEST mode is activated.

In this mode, **driving is not possible**, since all EGS outputs remain off until the testmode is left.

LED's '1'-'8' light up sequentially during output test :

First LED '1' is switched on shortly, then LED '2' etc...

When LED '8' is switched off, LED '1' is again switched on and so on.

The colour of the LED indicates its status :

COLOUR	STATUS
GREEN	OUTPUT OK
YELLOW	OUTPUT NOT CONNECTED OR SHORTED TO BATTERY PLUS
RED	OUTPUT SHORTED TO GROUND (OR TO ANOTHER OUTPUT)

The LED numbers correspond to output wires as follows :

LED NUMBER	OUTPUT WIRE
1	6
2	7
3	4
4	5
5	9
6	13
7	8
8	3

Note : to find the function of the corresponding output wires - see EGS Functional Description

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 23 of 25                  Document reference : egsm4.doc                  Revision date: 07/04/97</p>
	<p>Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402</p>





**Table of contents**

**1. PRODUCT DEFINITION.....2**

**2. FUNCTIONAL DESCRIPTION.....2**

**3. PRODUCT HARDWARE.....3**

**3.1 GRIP type EGS.....3**

**3.2 STANDARD type EGS.....4**

**3.3 KICKDOWN option.....4**

**4. USER INTERFACE.....5**

**4.1 Shift lever operation.....5**

    4.1.1 Grip type operation .....5

    4.1.2 Standard type operation .....6

**4.2 Standard features .....7**

    4.2.1 Automatic powerup in neutral.....7

    4.2.2 Neutral start protection .....7

    4.2.3 Shift repeat.....7

**4.3 External inputs .....7**

**4.4 Display function.....8**

    4.4.1 Displayed information.....8

        4.4.1.a Selected position and direction .....8

        4.4.1.b Application specific information.....8

        4.4.1.c Diagnostic information.....9

    4.4.2 Display layout .....9

    4.4.3 Display method .....10

**5. MACHINE INTERFACE .....11**

**5.1 Physical interface.....11**

    5.1.1 View on Grip type EGS mounting .....11

    5.1.2 View on Standard type EGS mounting .....12

**5.2 Electrical interface .....13**

    5.2.1 Pin designations .....13

    5.2.2 Speed sensor mounting .....13

        5.2.2.a Inductive sensors.....13

        5.2.2.b Hall effect sensors.....15

        5.2.2.c Magneto Resistive sensors .....17

    5.2.3 Power supply considerations.....18

<p><b>SPICER CLARK-HURTH</b></p>	<p>EGS user manual. Page 24 of 25                  Document reference : egsm4.doc                  Revision date: 07/04/97</p>
	<p>Ten Briele 3, 8200 Brugge, Belgium    Tel: +32/50/402445    Fax: +32/50/402402</p>

**6. OVERRIDE SYSTEM ..... 19**

**7. SELFTEST FUNCTIONS..... 20**

**7.1 Operation of the 'N' and 'T' LED's ..... 20**

    7.1.1 Overview..... 20

    7.1.2 Detailed operation..... 20

**7.2 Selftest Operation..... 21**

    7.2.1 Selftest mode invocation..... 21

    7.2.2 Input test ..... 21

    7.2.3 Speed sensor test..... 22

        7.2.3.a Lamptest..... 22

        7.2.3.b Speed display ..... 22

    7.2.4 Output test..... 23

# APPENDIX H

## Backhoe Service Manual

Contents	Para	Page
Scope.....	H-1	H-1
General.....	H-2	H-1
Swing Tower Replacement.....	H-3	H-2
Boom Replacement.....	H-4	H-4
Dipper Replacement.....	H-5	H-6
Bucket and Dipper Hydraulic Cylinder Repair.....	H-6	H-8
Boom Hydraulic Cylinder Repair.....	H-7	H-8.2
Swing Hydraulic Cylinder Repair.....	H-8	H-8.4

### Section I. U.S. Army Supplement to Case Material.

**H-1. SCOPE.**

This appendix contains information for servicing the backhoe. Section contains U.S. Army supplemental information to the vendor manual. The supplemental information includes initial setup task boxes for all maintenance tasks covered in the vendor manual that apply to the IHMEE. The supplemental information also includes individual task headings and page references to aid in locating the tasks in the vendor manual.

Section contains the manufacturer’s technical manual. This manual is unedited and covers multiple models of Case backhoes and cylinders. This manual also contains parts information for Case backhoes and cylinders. Refer to Para H-2 for details on how to use this material.

**H-2. GENERAL.**

To perform a task covered in this appendix, refer to the task box for initial setup information as you would with a normal maintenance procedure. The individual task headings have page references to aid in locating the tasks in the vendor manual. Most pages will also include two different page numbers. The appendix page number will have the appendix letter and a page number like the one at the bottom of this page. This page number will be used in all references made in Section . The other page number is the vendor material page numbering. It will be used for any references made within the vendor material.

The IHMEE uses 580 Super M backhoe components. The IHMEE does not have an extendable dipper or quick-coupler cylinder. All information in Section that does not pertain to the 580 Super M series backhoe components and all parts information should be ignored. Refer to TM 5-2420-230-24P for parts information.

### H-3. SWING TOWER REPLACEMENT.

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

#### INITIAL SETUP

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

- Field, maintenance, basic, Item 23, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Equipment, suitable lifting
- Hydraulic valve manual override lever, BII, TM 5-2420-230-10

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Vehicle positioned on level ground.
TM 5-2420-230-10	Parking brake applied.
TM 5-2420-230-10	Engine shut OFF.
TM 5-2420-230-10	Electrical master switch OFF.
TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
TM 5-2420-230-10	Backhoe extended.
Para 10-5	Hydraulic pressure released.

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Oil, molydisulfide, Item 45, Appendix C
- Solvent, degreasing, Item 58, Appendix C
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

TM 5-2420-230-24P Figure 166

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete*

Refer to MAC in Appendix B

#### a. Removal.

### WARNING

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- The swing tower assembly is heavy. To avoid personal injury, exercise extreme care when manually handling the swing tower assembly. Failure to comply may result in injury or death to personnel.
- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

### NOTE

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Refer to page H-39 for removal.
  - (2) If required, refer to general bushing replacement (Para 17-6).

#### ***b. Installation.***

### **WARNING**

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

Refer to page H-40 for installation.

#### ***c. Follow-On Maintenance.***

- (1) Return backhoe to stowed position (TM 5-2420-230-10).
- (2) Install backhoe valve guard (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**H-4. BOOM REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

- Field, maintenance, basic, Item 23, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Equipment, suitable lifting
- Hydraulic valve manual override lever, BII, TM 5-2420-230-10

*Equipment Conditions*

*TM or Para*

*Condition Description*

- TM 5-2420-230-10 Vehicle positioned on level ground.
- TM 5-2420-230-10 Parking brake applied.
- TM 5-2420-230-10 Engine shut OFF.
- TM 5-2420-230-10 Electrical master switch OFF.
- TM 5-2420-230-10 "Do Not Operate" tag attached to ignition switch.
- TM 5-2420-230-10 Backhoe extended.
- Para 10-5 Hydraulic pressure released.

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Oil, molydisulfide, Item 45, Appendix C
- Solvent, degreasing, Item 58, Appendix C
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

- TM 5-2420-230-24P Figure 168
- TM 5-2420-230-24P Figure 169

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete*

Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- The swing tower assembly is heavy. To avoid personal injury, exercise extreme care when manually handling the swing tower assembly. Failure to comply may result in injury or death to personnel.
- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

## NOTE

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Refer to page H-43 for removal.
  - (2) If required, refer to general bushing replacement (Para 17-6).

### ***b. Installation.***

## **WARNING**

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

Refer to page H-44 for installation.

### ***c. Follow-On Maintenance.***

- (1) Return backhoe to stowed position (TM 5-2420-230-10).
- (2) Install backhoe valve guard (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**H-5. DIPPER REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*References*

None

*Tools and Special Tools*

- Field, maintenance, basic, Item 23, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Equipment, suitable lifting
- Hydraulic valve manual override lever, BII, TM 5-2420-230-10

*Equipment Conditions*

- | <i>TM or Para</i> | <i>Condition Description</i>                      |
|-------------------|---|
| TM 5-2420-230-10  | Vehicle positioned on level ground.               |
| TM 5-2420-230-10  | Parking brake applied.                            |
| TM 5-2420-230-10  | Engine shut OFF.                                  |
| TM 5-2420-230-10  | Electrical master switch OFF.                     |
| TM 5-2420-230-10  | “Do Not Operate” tag attached to ignition switch. |
| TM 5-2420-230-10  | Backhoe extended.                                 |
| Para 10-5         | Hydraulic pressure released.                      |

*Materials/Parts*

- Cap and plug set, Item 4, Appendix C
- Oil, molydisulfide, Item 45, Appendix C
- Solvent, degreasing, Item 58, Appendix C
- Tags, identification, Item 63, Appendix C
- Ties, cable, Item 68, Appendix C

*Drawings Required*

- TM 5-2420-230-24P Figure 172

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Estimated Time to Complete*

Refer to MAC in Appendix B

**a. Removal.**

**WARNING**

- The IHMEE hydraulic system operates at oil pressures up to 3,000 psi (20 680 kPa). Never disconnect any hydraulic line or fitting without first dropping system pressure to zero. Failure to comply may result in injury or death to personnel.
- The swing tower assembly is heavy. To avoid personal injury, exercise extreme care when manually handling the swing tower assembly. Failure to comply may result in injury or death to personnel.
- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- Use care when removing or installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.



**NOTE**

- Ensure all hoses and tubes are disconnected and clear before removal.
  - Remove cable ties as necessary.
  - Tag all hoses and tubes and note their positions before removal.
  - Cap and plug all tubes, hoses, and fittings upon removal.
- (1) Refer to page H-50 for removal.
  - (2) If required, refer to general bushing replacement (Para 17-6).

**b. Installation.**

**WARNING**

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

Refer to page H-50 for installation.

**c. Follow-On Maintenance.**

- (1) Return backhoe to stowed position (TM 5-2420-230-10).
- (2) Install backhoe valve guard (TM 5-2420-230-10).
- (3) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**H-6. BUCKET AND DIPPER HYDRAULIC CYLINDER REPAIR.**

This Task Covers:

- a. Disassembly
- b. Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*

Field maintenance, artillery, Item 22.1, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 10-17	Bucket cylinder removed (as required).
Para 10-19	Dipper cylinder removed (as required).

*Material/parts*

Cloth, abrasive, Item 8.1, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Compound, sealing, Loctite 242, Item 19, Appendix C  
Compound, sealing, Loctite 243, Item 20, Appendix C  
Dexron III, Item 27, Appendix C  
Kit, seal, Item 96.1, Appendix D (Bucket cylinder)  
Kit, seal, Item 96.4, Appendix D (Dipper cylinder)  
Solvent, degreasing, Item 58, Appendix C

*Drawings Required*

TM 5-2420-230-24P	Figure 168
TM 5-2420-230-24P	Figure 172

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

*Personnel Required*

MOS 62B, Construction Equipment Repairer

**a. Disassembly.**

**WARNING**

- Hydraulic cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**NOTE**

- The bucket and dipper cylinders are disassembled in a similar manner.
- Use the appropriate tools found in the Artillery Field Maintenance shop set in place of the special tools listed in the vendor instructions.

Refer to page H-13 for disassembly procedures.

**b. Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page H-13 for inspection procedures.

**c. Assembly.**

**WARNING**

- Cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

- The bucket and dipper cylinders are assembled in a similar manner.
- Lubricate all packing, O-rings, and seals with Dexron III prior to assembly.

Refer to page H-15 for assembly procedures.

**d. Follow-On Maintenance.**

- (1) If removed, install bucket cylinder (Para 10-17).
- (2) If removed, install dipper cylinder (Para 10-19).

**END OF TASK**

<b>H-7. BOOM HYDRAULIC CYLINDER REPAIR.</b>		
This Task Covers:		
a. Disassembly	b. Inspection	c. Assembly
d. Follow-On Maintenance		
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	
<i>Tools and Special Tools</i> Field maintenance, artillery, Item 22.1, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>References</i> None	
<i>Material/parts</i> Cloth, abrasive, Item 8.1, Appendix C Cloth, lint-free, Item 10, Appendix C Compound, sealing, Loctite 242, Item 19, Appendix C Compound, sealing, Loctite 243, Item 20, Appendix C Dexron III, Item 27, Appendix C Kit, seal, Item 96.2, Appendix D (Boom cylinder) Solvent, degreasing, Item 58, Appendix C	<i>Equipment Conditions</i> <i>TM or Para</i> Para 10-18	
	<i>Condition Description</i> Boom cylinder removed.	
	<i>Drawings Required</i> TM 5-2420-230-24P Figure 168	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Disassembly.**

**WARNING**

- Hydraulic cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**NOTE**

Use the appropriate tools found in the Artillery Field Maintenance shop set in place of the special tools listed in the vendor instructions.

Refer to page H-17 for disassembly procedures.

**b. Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page H-17 for inspection procedures.

**c. Assembly.**

**WARNING**

- Cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

Lubricate all packing, O-rings, and seals with Dexron III prior to assembly.

Refer to page H-19 for assembly procedures.

**d. Follow-On Maintenance.**

Install boom cylinder (Para 10-18).

**END OF TASK**

**H-8. SWING HYDRAULIC CYLINDER REPAIR.**

This Task Covers:

- a. Disassembly
- b. Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Tools and Special Tools*  
Field maintenance, artillery, Item 22.1, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*References*  
None

*Material/parts*  
Cloth, abrasive, Item 8.1, Appendix C  
Cloth, lint-free, Item 10, Appendix C  
Compound, sealing, Loctite 242, Item 19, Appendix C  
Compound, sealing, Loctite 243, Item 20, Appendix C  
Dexron III, Item 27, Appendix C  
Kit, seal, Item 96.3, Appendix D (Swing cylinder)  
Solvent, degreasing, Item 58, Appendix C

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 10-20      Swing cylinder removed.

*Drawings Required*  
TM 5-2420-230-24P      Figure 166

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Disassembly.**

**WARNING**

- Hydraulic cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**NOTE**

Use the appropriate tools found in the Artillery Field Maintenance shop set in place of the special tools listed in the vendor instructions.

Refer to page H-33 for disassembly procedures.

**a. Inspection.**

**WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.

Refer to page H-33 for inspection procedures.

**b. Assembly.**

**WARNING**

- Cylinders are heavy. To avoid personal injury, exercise extreme care when manually handling the cylinders. Failure to comply may result in serious injury or death to personnel.
- Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury or death to personnel.

**CAUTION**

Cleanliness is essential for correct and safe operation of hydraulic system. Ensure dirt and debris are not allowed to enter hydraulic system. Failure to comply may result in damage to equipment.

**NOTE**

Lubricate all packing, O-rings, and seals with Dexron III prior to assembly.

Refer to page H-33 for assembly procedures.

**c. Follow-On Maintenance.**

Install swing cylinder (Para 10-20).

**END OF TASK**

## **Section II. Vendor Service Manual.**

This section contains information for servicing the backhoe in the form of the manufacturer's technical manual which follows this page. Section contains U.S. Army supplemental information to the vendor manual.



# Section 8006

## CYLINDERS

8006

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Bur 6-41750  
H-9

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## TABLE OF CONTENTS

SPECIFICATIONS .....	3
SPECIAL TOOLS .....	4
ALL CYLINDERS EXCEPT THE BOOM CYLINDERS, 590 SUPER M DIPPER CYLINDER, SWING CYLINDERS, AND QUICK COUPLER CYLINDER .....	5
Disassembly .....	5
Inspection .....	5
Assembly .....	7
580M BOOM CYLINDER .....	9
Disassembly .....	9
Inspection .....	9
Assembly .....	11
580 SUPER M AND 590 SUPER M BOOM CYLINDER .....	13
Disassembly .....	13
Inspection .....	13
Assembly .....	13
590SM DIPPER CYLINDER .....	17
Disassembly .....	17
Inspection .....	17
Assembly .....	17
590SM EXTENDABLE DIPPER CYLINDER .....	20
Disassembly .....	20
Inspection .....	20
Assembly .....	21
QUICK COUPLER CYLINDER .....	23
Disassembly .....	23
Inspection .....	23
Assembly .....	23
SWING CYLINDERS .....	25
Disassembly .....	25
Inspection .....	25
Assembly .....	25

**SPECIFICATIONS**

Torque specifications for piston bolt with 243 Loctite on the threads.

CYLINDER DESCRIPTION	580M	580 Super M	590 Super M
Loader Cylinders			
Bucket	365 To 460 Nm (270 To 340 Pound-feet)	365 To 460 Nm (270 To 340 Pound-feet)	895 To 1110 Nm (660 To 820 Pound-feet)
Lift	895 To 1110 Nm (660 To 820 Pound-feet)	660 To 820 Pound-feet (895 To 1110 Nm)	660 To 820 Pound-feet (895 To 1110 Nm)
Clam	895 To 1110 Nm (660 To 820 Pound-feet)	895 To 1110 Nm (660 To 820 Pound-feet)	895 To 1110 Nm (660 To 820 Pound-feet)
Backhoe Cylinders			
Boom	1780 To 2180 Nm (1310 To 1610 Pound-feet)	1780 To 2180 Nm (1310 To 1610 Pound-feet)	2400 To 2940 Nm (1770 To 2170 Pound-feet)
Dipper	2400 To 2940 Nm (1770 To 2170 Pound-feet)	3310 To 3850 Nm (2440 To 2840 Pound-feet)	3310 To 3850 Nm (2440 To 2840 Pound-feet)
Bucket	1780 To 2180 Nm (1310 To 1610 Pound-feet)	1780 To 2180 Nm (1310 To 1610 Pound-feet)	1780 To 2180 Nm (1310 To 1610 Pound-feet)
Extendable Dipper	365 To 460 Nm (270 To 340 Pound-feet)	365 To 460 Nm (270 To 340 Pound-feet)	365 To 460 Nm (270 To 340 Pound-feet)
Swing	895 To 1110 Nm (660 To 820 Pound-feet)	895 To 1110 Nm (660 To 820 Pound-feet)	895 To 1110 Nm (660 To 820 Pound-feet)
Stabilizer	1780 To 2180 Nm (1310 To 1610 Pound-feet)	1780 To 2180 Nm (1310 To 1610 Pound-feet)	1780 To 2180 Nm (1310 To 1610 Pound-feet)

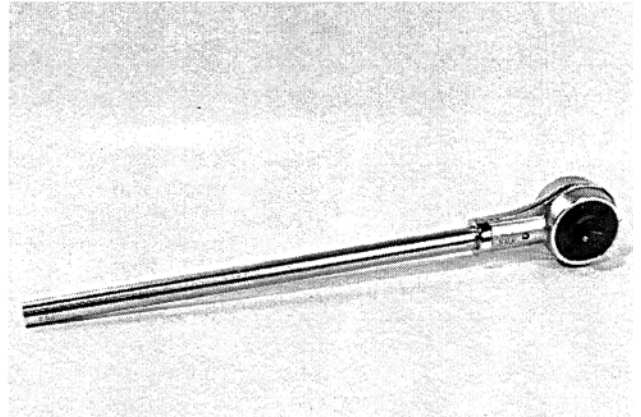
## SPECIAL TOOLS



B786441M

**THIS TOOL IS USED TO REMOVE AND INSTALL THE GLAND ON CASE CYLINDERS.**

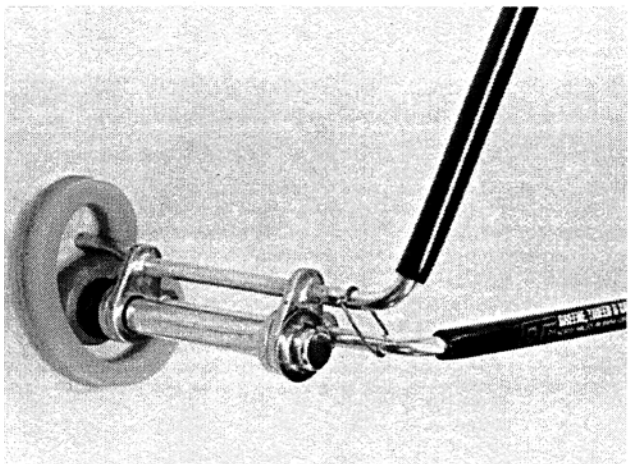
**CAS-1456.**



B795329M

**THE TORQUE MULTIPLIER IS USED TO LOOSEN AND TIGHTEN THE PISTON BOLT.**

**CAS-1039**



B505802M

**THE TOOL SHOWN IS USED TO INSTALL THE SEAL IN THE GLANDS OF THE CYLINDERS.**

## ALL CYLINDERS EXCEPT THE BOOM CYLINDERS, 590 SUPER M DIPPER CYLINDER, SWING CYLINDERS, AND QUICK COUPLER CYLINDER

### Disassembly

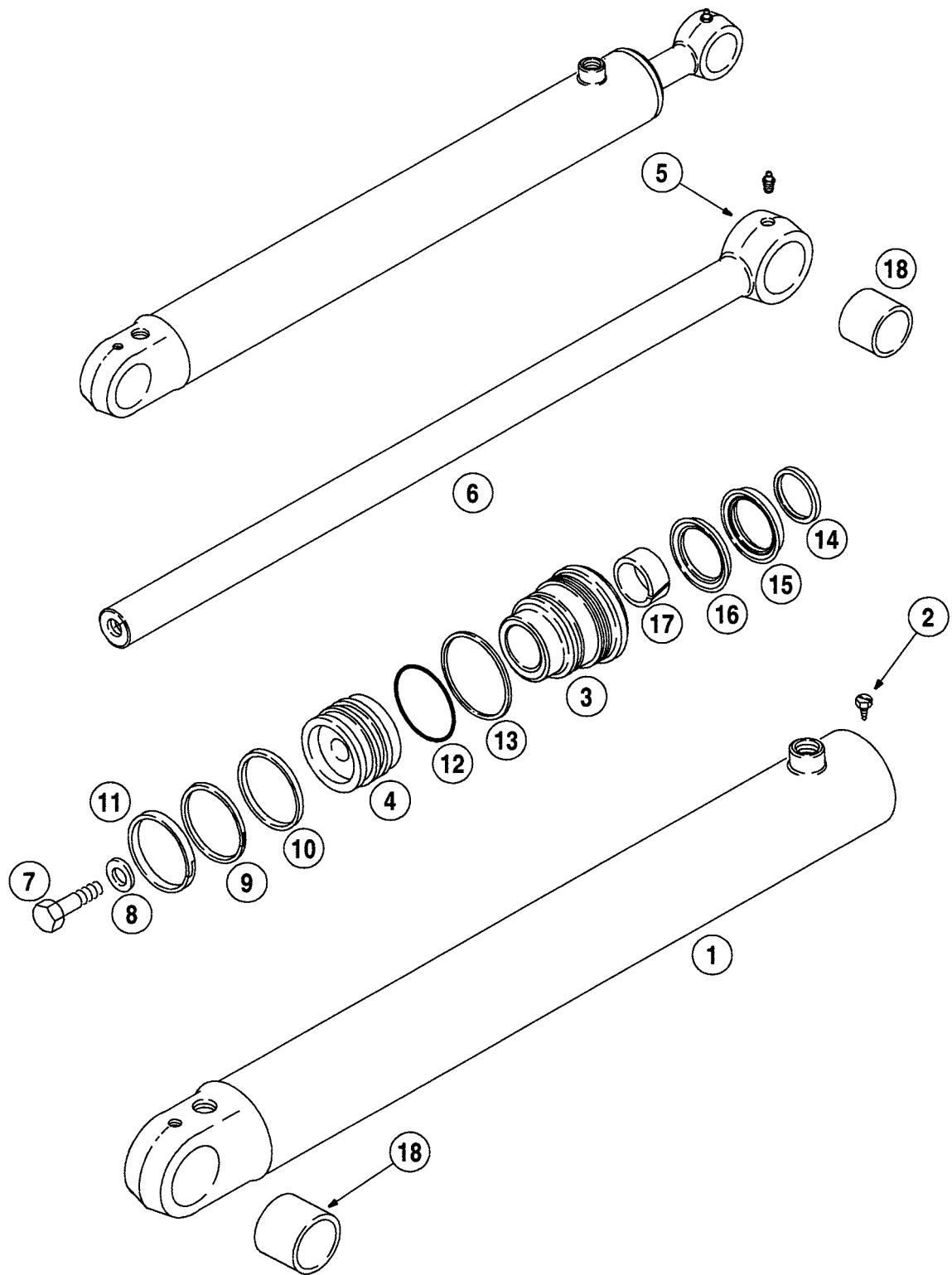
**NOTE:** Refer to illustration on page 6.

Clean the outside of the cylinder. If the hoses were removed with the cylinder, remove the hoses from the cylinder.

1. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
2. Loosen and remove the lock screw (2) from the gland (3) and tube (1).
3. Use the gland wrench shown on page 4 to loosen and remove the gland (3) from the tube (1).
4. Pull the piston rod (6) straight out of the tube (1) to prevent damage to the tube (1).
5. Fasten the piston rod eye (5) in a vise and put a support below the piston rod (6) near the piston (4). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston rod (6).
6. Loosen and remove the bolt (7) and hardened washer (8) that holds the piston (4). Use the torque multiplier shown on page 4 for bolts that have a high torque value.
7. Remove the piston (4) from the piston rod (6).
8. Remove the gland (3) from the piston rod (6).
9. Remove the seal (9), backup ring (10), and wear ring (11) from the piston (4).
10. Remove the O-ring (12), backup ring (13), wiper (14), rod seal (15), buffer seal (16), and bushing (17) from the gland (3).

### Inspection

1. Clean the piston (4), gland (3), piston rod (6), tube (1), hardened washer (8), and bolt (7) in cleaning solvent.
2. Discard the parts that were removed from the piston (4) and the gland (3).
3. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used.
4. Check to be sure that the piston rod (6) is straight. If the piston rod (6) is not straight, install a new piston rod (6).
5. Remove small scratches on the inside of the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
6. Inspect the bushing (18) in the piston rod eye (5) and the closed end of the tube (1), replace as required.
7. Inspect the gland (3) for rust and clean and remove rust as required.
8. Inspect the gland end of the tube (1) for sharp edges that will cut the gland O-ring (12), remove as required.



- 1. TUBE
- 2. LOCK SCREW
- 3. GLAND
- 4. PISTON
- 5. PISTON ROD EYE

- 6. PISTON ROD
- 7. BOLT
- 8. HARDENED WASHER
- 9. SEAL
- 10. BACKUP RING

- 11. WEAR RING
- 12. O-RING
- 13. BACKUP RING
- 14. WIPER
- 15. ROD SEAL

- 16. BUFFER SEAL
- 17. BUSHING
- 18. BUSHING

B9501084T

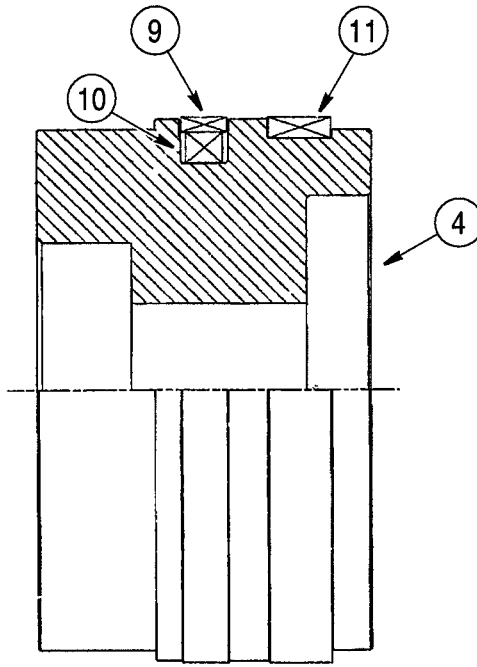
**TYPICAL CYLINDER**

## Assembly

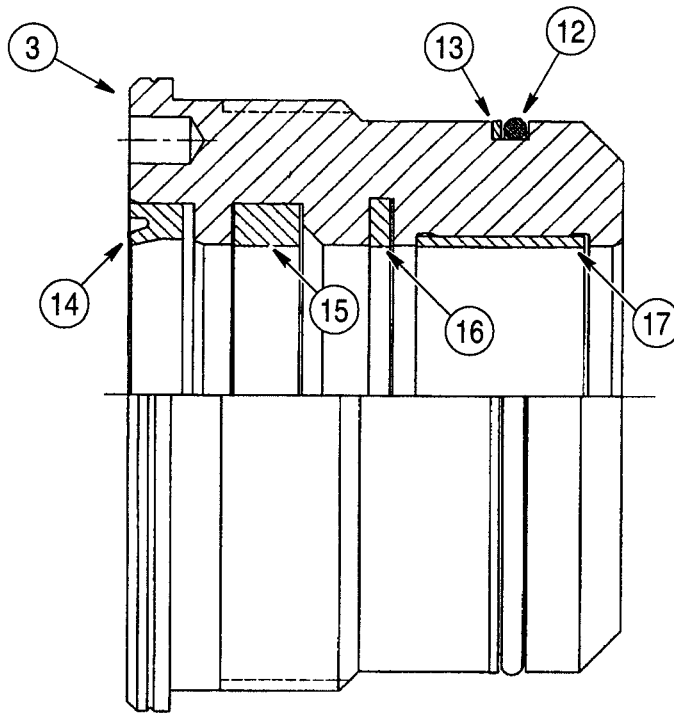
**NOTE:** Refer to illustration on page 6 and 8.

**NOTE:** If a new gland (3) is being installed, put the part number of the cylinder on the new gland (3).

1. Install the bushing (17) in the gland (3).
2. Install the buffer seal (16) in the gland (3). The side of the buffer seal (16) with the lip must be toward the small end of the gland (3).
3. Install the rod seal (15) in the gland. The rod seal (15) is to be installed so that the lips of the rod seal (15) are toward the small end of the gland (3). The wide seal (15) can be difficult to install. Use the tool shown on page 4.
4. Install a new wiper (14) in the gland (3). The lips of the wiper (14) must be toward the large end of the gland (3).
5. Install a new backup ring (13) in the groove on the outside of the gland (3). If both sides of the backup ring (13) are not flat, the side that is not flat must be toward the small end of the gland (3).
6. Install the O-ring (12) next to the backup ring (13) in the groove on the outside of the gland (3). The O-ring (12) must be toward the small end of the gland (3).
7. Fasten the piston rod eye (5) in the vise.
8. Remove any marks and sharp edges on the chamfer at the end of the piston rod (6).
9. Lubricate the bore of the gland (3) with clean oil.
10. Push the gland (3) onto the piston rod (6). If necessary, use a soft hammer to drive the gland (3) onto the piston rod (6).
11. Put a support below and near the end of the piston rod (6). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston (4).
12. Put the piston (4) on the end of the piston rod (6).
13. Put the washer (8) on the bolt (7).
14. Clean the threads on the end of the piston rod and the threads of the bolt using Loctite cleaning solvent. Allow to dry. Apply Loctite 243 to the piston rod threads, 6.4 mm (1/4 inch) from the open end of the piston rod so that there is 12.7 mm (1/2 inch) of Loctite 242 on the piston rod threads. **DO NOT** apply Loctite to the first 6.4 mm (1/4 inch) of the piston rod threads.
15. Install the bolt (7). Tighten the bolt (7) to the torque value on page 3 for the cylinder that is being repaired. A torque multiplier can be used to help tighten the bolt.
16. Install a new wear ring (11) in the end groove on the outside of the piston (4).
17. Install a new backup ring (10) in the center groove on the outside of the piston (4).
18. Install a new seal (9) on top of the backup ring (10) on the outside of the piston (4).
19. Lubricate the inside of the tube (1) and the piston (4) with clean oil. Use a piston ring compression tool to hold the new wear ring (11) in place.
20. Push the tube (1) straight onto the piston (4).
21. Start the tube (1) onto the piston rod assembly. Push the tube onto the piston rod assembly until the compression tool is pushed off the piston rod assembly. Be careful not to damage the wear ring and seal.
22. When the piston (4) is in the smooth part of the tube (1), start the gland (3) into the tube (1).
23. Lubricate the O-ring (12) on the gland (3) with clean oil.
24. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet). If the lock screw (2) holes become aligned in this torque range, install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound-inches). If the lock screw (2) holes are not aligned, do steps 25 through 27.
25. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet).
26. Use a No. 26 drill and drill a hole half in the gland (3) and half in the tube (1). Drill to a depth of 11 mm (7/16 inch). Do not drill in line with a hole in the gland (3) for the gland wrench.
27. Install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound inches).
28. If the hoses were removed with the cylinder, install new O-rings, if equipped, on the hose fittings. Lubricate the O-rings with clean oil. Install the hoses.



BS01C123



- 3. GLAND
- 4. PISTON
- 9. SEAL
- 10. BACKUP RING
- 11. WEAR RING

- 12. O-RING
- 13. BACKUP RING
- 14. WIPER
- 15. ROD SEAL
- 16. BUFFER SEAL

- 17. BUSHING

BS01C122

**TYPICAL CYLINDER**



## 580M BOOM CYLINDER

### Disassembly

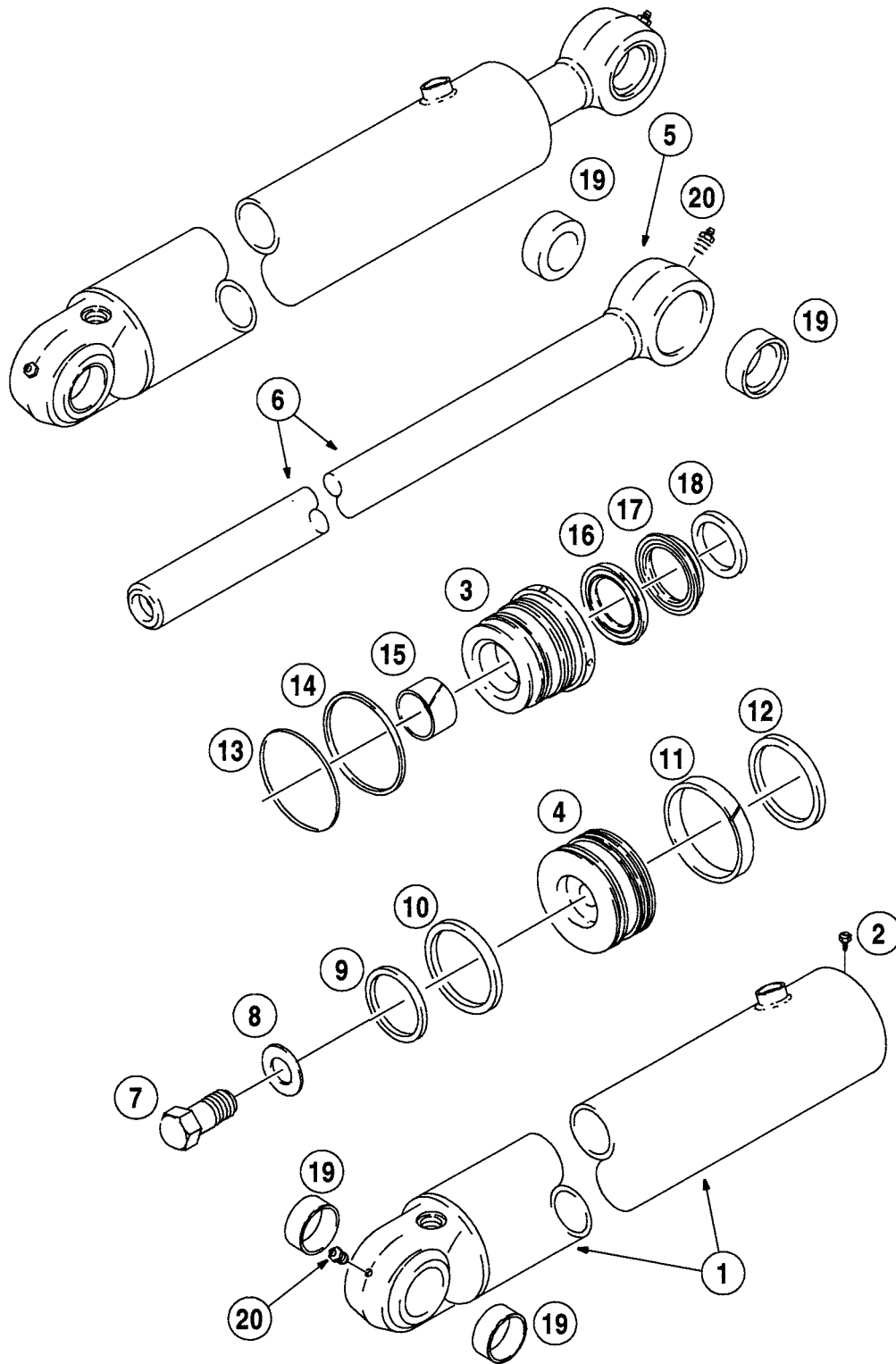
**NOTE:** Refer to illustration on page 10 and 12.

Clean the outside of the cylinder. If the hoses were removed with the cylinder, remove the hoses from the cylinder

1. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
2. Loosen and remove the lock screw (2) from the gland (3) and tube (1).
3. Use the gland wrench shown on page 4 to loosen and remove the gland (3) from the tube (1).
4. Pull the piston rod (6) straight out of the tube (1) to prevent damage to the tube (1).
5. Fasten the piston rod eye (5) in a vise and put a support below the piston rod (6) near the piston (4). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston rod (6).
6. Loosen and remove the bolt (7) and washer (8) that holds the piston (4). Use the torque multiplier shown on page 4 for bolts that have a high torque value.
7. Remove the piston (4) from the piston rod (6).
8. Remove the gland (3) from the piston rod (6).
9. Remove the seal (9), backup ring (10), wear ring (11), and the piston ring (12) from the piston (4).
10. Remove the O-ring (13), backup ring (14), wiper (18), wide seal (17), buffer seal (16), and bushing (15) from the gland (3).

### Inspection

1. Clean the piston (4), gland (3), piston rod (6), tube (1), washer (8), and bolt (7) in cleaning solvent.
2. Discard the parts that were removed from the piston (4) and the gland (3).
3. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used.
4. Check to be sure that the piston rod (6) is straight. If the piston rod (6) is not straight, install a new piston rod (6).
5. Remove small scratches on the inside of the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
6. Inspect the bushings (19) in the piston rod eye (5) and the closed end of the tube (1). Replace as required.
7. Inspect the gland (3) for rust and clean and remove rust as required.
8. Inspect the gland end of the tube (1) for sharp edges that will cut the gland O-ring (13) and remove as required.
9. Inspect the piston (4) for damage and wear. If the piston (4) is damaged or worn, a new piston (4) must be used.



- 1. TUBE
- 2. LOCK SCREW
- 3. GLAND
- 4. PISTON
- 5. PISTON ROD EYE

- 6. PISTON ROD
- 7. BOLT
- 8. HARDENED WASHER
- 9. SEAL
- 10. BACKUP RING

- 11. WEAR RING
- 12. PISTON RING
- 13. O-RING
- 14. BACKUP RING
- 15. BUSHING

- 16. BUFFER SEAL
- 17. WIDE SEAL
- 18. WIPER
- 19. BUSHING
- 20. GREASE FITTING

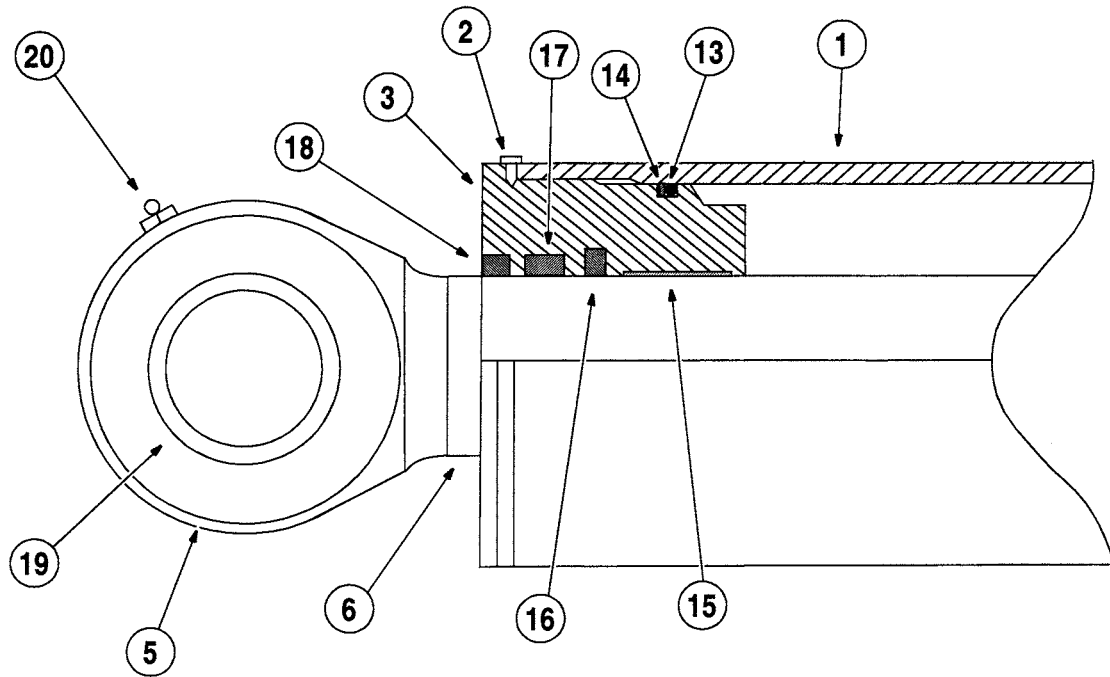
B9501086T

**580M BOOM CYLINDER**

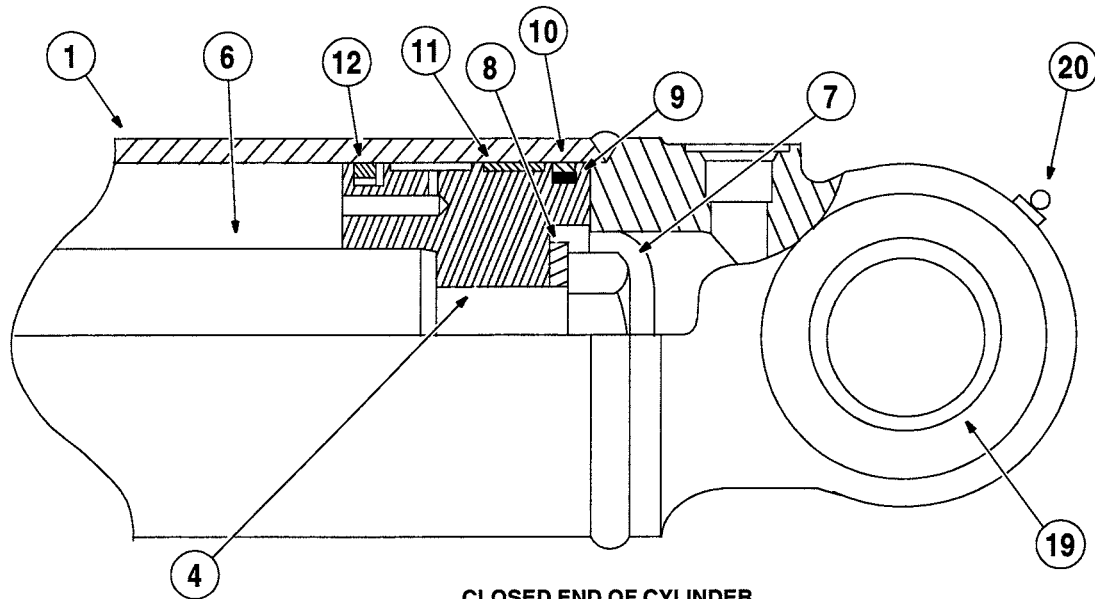
## Assembly

**NOTE:** Refer to illustration page 10 and 12.

1. Install the bushing (15) in the gland (3).
2. Install the buffer seal (16) in the gland (3). The side of the buffer seal (16) with the lip must be toward the small end of the gland (3).
3. Install the wide seal (17) in the gland (3). The wide seal (17) is to be installed so that the lips of the wide seal (17) are toward the small end of the gland (3). The wide seal (17) can be difficult to install. Use the tool shown on page 4.
4. Install a new wiper (18) in the gland (3). The lips of the wiper (18) must be toward the large end of the gland (3).
5. Install a new backup ring (14) in the groove on the outside of the gland (3). If both sides of the backup ring (14) are not flat, the side that is not flat must be toward the small end of the gland (3).
6. Install the O-ring (13) next to the backup ring (14) in the groove on the outside of the gland (3). The O-ring (13) must be toward the small end of the gland (3).
7. Fasten the piston rod eye (5) in the vise.
8. Remove any marks and sharp edges on the chamfer at the end of the piston rod (6).
9. Lubricate the bore of the gland (3) and the piston rod (6) with clean oil.
10. Push the gland (3) onto the piston rod (6). If necessary, use a soft hammer to drive the gland (3) onto the piston rod (6).
11. Put a support below and near the end of the piston rod (6). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston (4).
12. Put the piston (4) on the end of the piston rod (6).
13. Put the hardened washer (8) on the bolt (7).
14. Clean the threads on the end of the piston rod and the threads of the bolt using Loctite cleaning solvent. Allow to dry. Apply Loctite 243 to the piston rod threads 6.35 mm (1/4 inch) from the open end of the piston rod so that there is 12.7 mm (1/2 inch) of Loctite 243 on the piston rod threads. DO NOT apply Loctite to the first 6.35 mm (1/4 inch) of the piston rod threads.
15. Install the bolt (7). Tighten the bolt (7) to the torque value on page 3 for the cylinder that is being repaired. A torque multiplier can be used to help tighten the bolt (7).
16. Install a new wear ring (11) in the groove in the center of the piston (4).
17. Install a new seal (9) in the groove on the outside end of the piston (4). The seal (9) must be in the groove at the end of the piston (4) with the large bore.
18. Install a backup ring (10) over the seal (9) on the piston (4).
19. Install the piston ring (12) in the remaining groove in the outside of the piston (4).
20. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
21. Lubricate the inside of the tube (1) and the piston (4) with clean oil.
22. Push the piston (4) straight into the tube (1).
23. When the piston (4) is in the smooth part of the tube (1), start the gland (3) into the tube (1).
24. Lubricate the O-ring (13) on the gland (3) with clean oil.
25. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet). If the lock screw (2) holes become aligned in this torque range, install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound-inches). If the lock screw (2) holes are not aligned, do steps 26 through 28.
26. Tighten the gland (3) -to 135 to 542 Nm (100 to 400 pound-feet).
27. Use a No. 26 drill and drill a hole half in the gland (3) and half in the tube (1). Drill to a depth of 11 mm (7/16 inch). Do not drill in line with a hole in the gland (3) for the gland wrench.
28. Install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound inches).
29. If the hoses were removed with the cylinder, install new O-rings, if equipped, on the hose fittings. Lubricate the O-rings with clean oil. Install the hoses.



ROD END OF CYLINDER



CLOSED END OF CYLINDER

- 1. TUBE
- 2. LOCK SCREW
- 3. GLAND
- 4. PISTON
- 5. PISTON ROD EYE

- 6. PISTON ROD
- 7. BOLT
- 8. HARDENED WASHER
- 9. SEAL
- 10. BACKUP RING

- 11. WEAR RING
- 12. PISTON RING
- 13. O-RING
- 14. BACKUP RING
- 15. BUSHING

- 16. BUFFER SEAL
- 17. WIDE SEAL
- 18. WIPER
- 19. BUSHING
- 20. GREASE FITTING

B9501087T

580M BOOM CYLINDER

## 580 SUPER M AND 590 SUPER M BOOM CYLINDER

### Disassembly

**NOTE:** Refer to illustrations on page 14 and 16.

Clean the outside of the cylinder. If the hoses were removed with the cylinder, remove the hoses from the cylinder.

1. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
2. Loosen and remove the lock screw (2) from the gland (3) and tube (1).
3. Use the gland wrench shown on page 4 to loosen and remove the gland (3) from the tube (1).
4. Pull the piston rod (6) straight out of the tube (1) to prevent damage to the tube (1).
5. Fasten the piston rod eye (5) in a vise and put a support below the piston rod (6) near the piston (4). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston rod (6).
6. Remove the check valve (12) from the piston.
7. Loosen and remove the bolt (7) and hardened washer (8) that holds the piston (4). Use the torque multiplier shown on page 4 for bolts that have a high torque value.
8. Remove the piston (4) from the piston rod (6).
9. Remove the gland (3) from the piston rod (6).

**NOTE:** If the boom cylinder is being disassembled for repair because of poor performance and the seals (10) on the piston (4) are good, replace the check valve (12) and the O-ring (13). If the seals (10) are damaged, do the next step.

10. Remove the wear ring (9), seals (10), and the backup rings (11) from the piston (4).
11. Remove the O-ring (14), backup ring (15), wiper (19), wide seal (18), buffer seal (17), and bushing (16) from the gland (3).
12. Remove the O-ring (13) from the check valve (12).

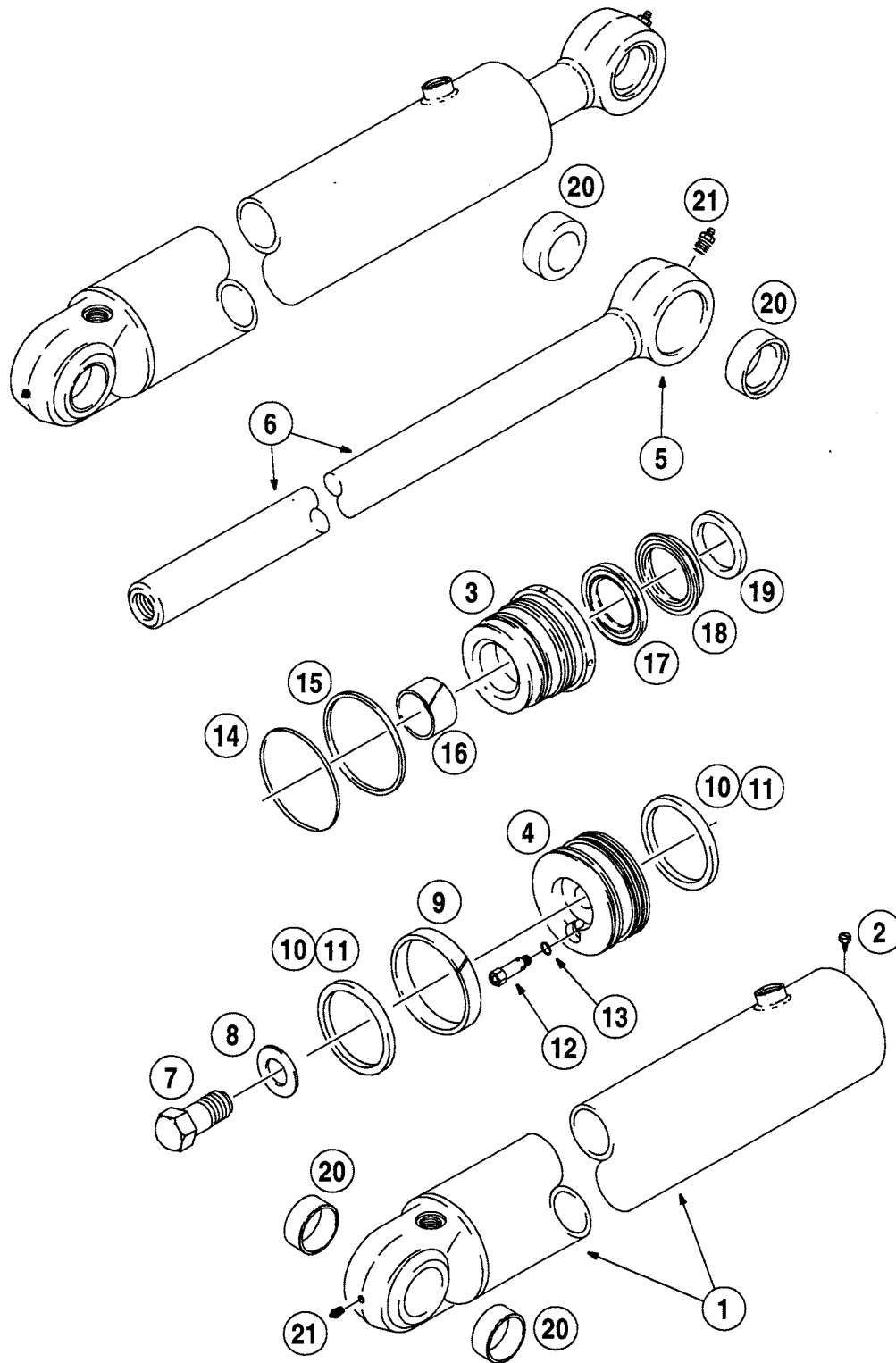
### Inspection

1. Clean the piston (4), gland (3), piston rod (6), tube (1), hardened washer (8), and bolt (7) in cleaning solvent. Make sure the orifice in the piston (4) is open.
2. Discard the parts that were removed from the piston (4), check valve (12), and the gland (3).
3. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used.
4. Check to be sure that the piston rod (6) is straight. If the piston rod (6) is not straight, install a new piston rod (6).
5. Remove small scratches on the inside of the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
6. Inspect the bushing (20), if equipped, in the piston rod eye (5) and the closed end of the tube (1), and replace as required.
7. Inspect the gland (3) for rust and clean and remove rust as required.
8. Inspect the gland end of the tube (1) for sharp edges that will cut the gland O-ring (14) and remove as required.
9. Inspect the piston (4) for damage and wear. If the piston (4) is damaged or worn, a new piston (4) must be used.

### Assembly

**NOTE:** If a new gland (3) is being installed, put the part number of the cylinder on the new gland.

1. Install the bushing (16) in the gland (3).
2. Install the buffer seal (17) in the gland (3). The side of the buffer seal (17) with the lip must be toward the small end of the gland (3).
3. Install the wide seal (18) in the gland (3). The wide seal (18) is to be installed so that the lips of the wide seal (18) are toward the small end of the gland (3). The wide seal (18) can be difficult to install. Use the tool shown on page 4.
4. Install a new wiper (19) in the gland (3). The lips of the wiper (19) must be toward the outside of the gland (3).
5. Install a new backup ring (15) in the groove on the outside of the gland (3). If both sides of the backup ring (15) are not flat, the side that is not flat must be toward the small end of the gland (3).

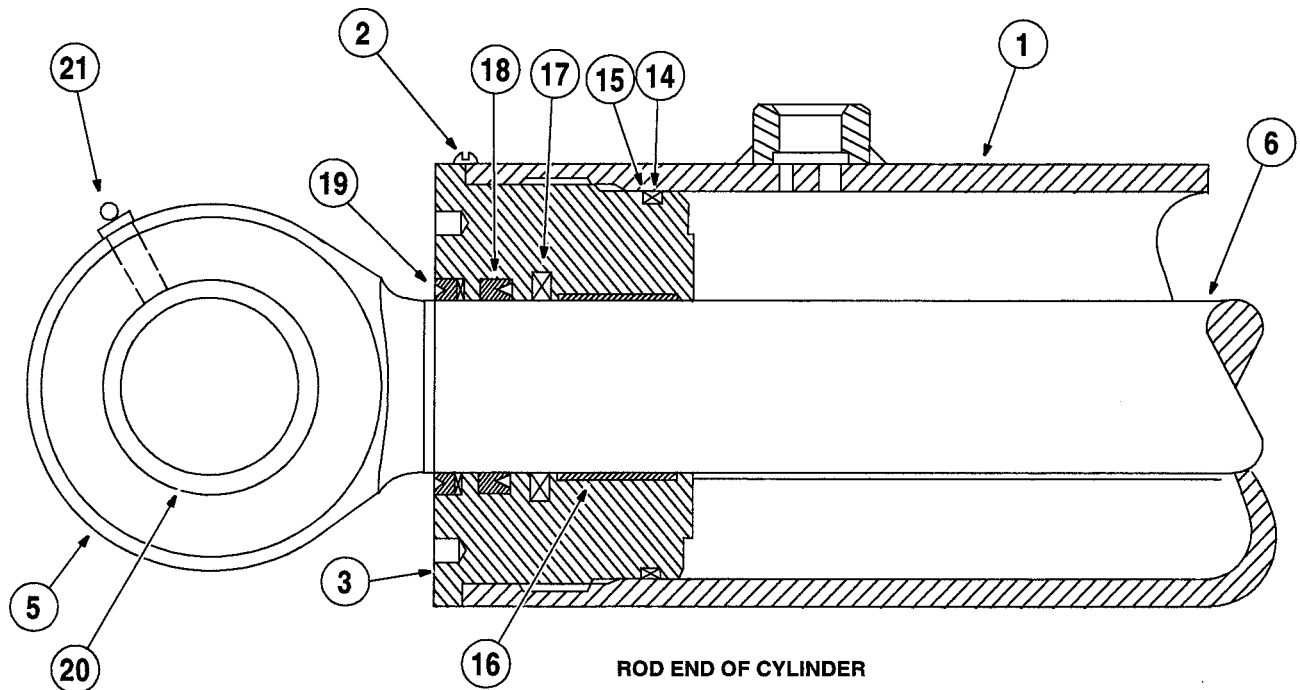


- |                   |                    |                 |                    |
|-------------------|--------------------|-----------------|--------------------|
| 1. TUBE           | 7. BOLT            | 13. O-RING      | 19. WIPER          |
| 2. LOCK SCREW     | 8. HARDENED WASHER | 14. O-RING      | 20. BUSHING        |
| 3. GLAND          | 9. WEAR RING       | 15. BACKUP RING | 21. GREASE FITTING |
| 4. PISTON         | 10. SEAL           | 16. BUSHING     |                    |
| 5. PISTON ROD EYE | 11. BACKUP RING    | 17. BUFFER SEAL |                    |
| 6. PISTON ROD     | 12. CHECK VALVE    | 18. WIDE SEAL   |                    |

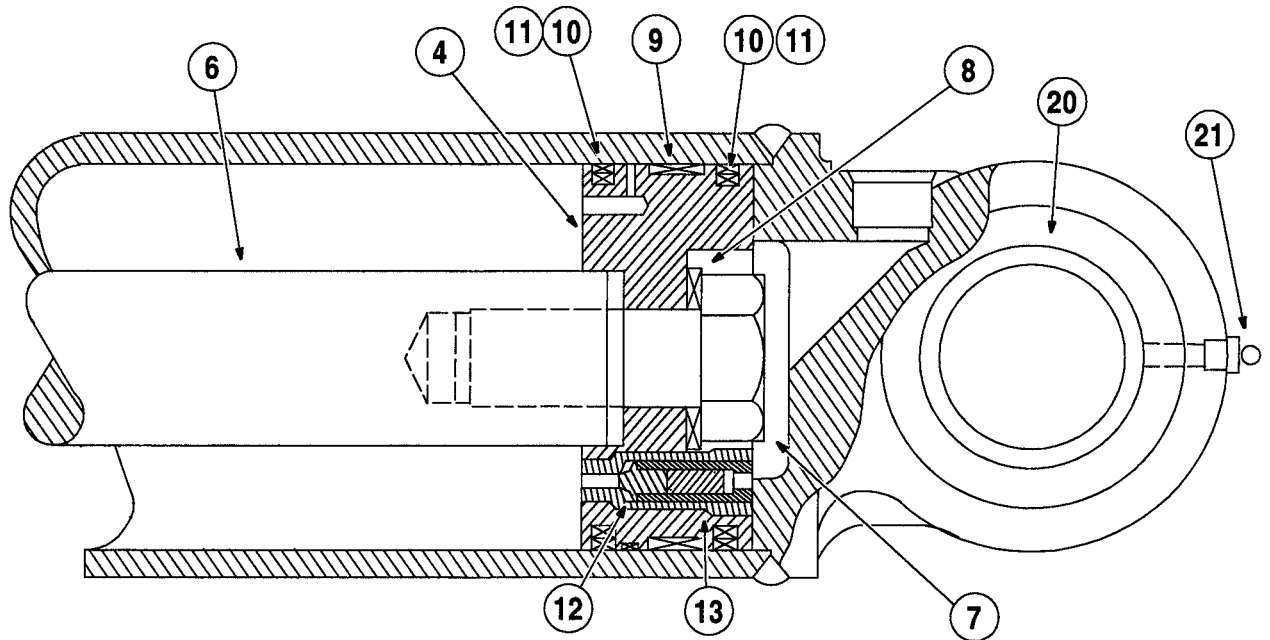
B9501088T

**580 SUPER M AND 590 SUPER M BOOM CYLINDER**

6. Install the O-ring (14) next to the backup ring (15) in the groove on the outside of the gland (3). The O-ring (14) must be toward the small end of the gland (3)
7. Fasten the piston rod eye (5) in the vise.
8. Remove any marks and sharp edges on the chamfer at the end of the piston rod (6)
9. Lubricate the bore of the gland (3) and the piston rod (6) with clean oil.
10. Push the gland (3) onto the piston rod (6). If necessary, use a soft hammer to drive the gland (3) onto the piston rod (6).
11. Put a support below and near the end of the piston rod (6). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston (4).
12. Install a new O-ring (13) on the check valve (12). Apply a thin strip of Loctite 243 to the threads of the check valve (12). Lubricate the O-ring (13) with clean oil.
13. Install the check valve (12) in the piston (4). Tighten the check valve (12) to 27 to 34 Nm (239 to 301 pound-inches).
14. Put the piston (4) on the end of the piston rod (6).
15. Put the hardened washer (8) on the bolt (7).
16. Clean the threads on the end of the piston rod (6) and the threads of the bolt using Loctite cleaning solvent. Allow to dry. Apply Loctite 243 to the piston rod threads 6.35 mm (1/4 inch) from the open end of the piston rod so that there is 12.7 mm (1/2 inch) of Loctite 242 on the piston rod threads. DO NOT apply Loctite to the first 6.35 mm (1/4 inch) of the piston rod threads.
17. Install the bolt (7). Tighten the bolt (7) to the torque value on page 3 for the cylinder that is being repaired. A torque multiplier can be used to help tighten the bolt (7).
18. Install a new wear ring (9) in the groove in the center of the piston (4).
19. Install a new backup ring (11) in each groove on the outside ends of the piston (4).
20. Install a new seal (10) over each backup ring (11) on the outside ends of the piston (4).
21. Lubricate the inside of the tube (1) and the piston (4) with clean oil.
22. Push the tube (1) straight onto the piston (4).
23. Start the tube (1) onto the piston rod assembly. Be careful not to damage the wear ring and seal.
24. When the piston (4) is in the smooth part of the tube (1), start the gland (3) into the tube (1).
25. Lubricate the O-ring (12) on the gland (3) with clean oil.
26. Tighten the gland (3) to 135 to 542 Nm (100 to 400 poundfeet). If the lock screw (2) holes become aligned in this torque range, install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 poundinches). If the lock screw (2) holes are not aligned, do steps 28 through 30.
27. Tighten the gland (3) to 135 to 542 Nm (100 to 400 poundfeet).
28. Use a No. 26 drill and drill a hole half in the gland (3) and half in the tube (1). Drill to a depth of 11 mm (7/16 inch). Do not drill in line with a hole in the gland (3) for the gland wrench.
29. Install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound-inches).
30. If the hoses were removed with the cylinder, install new O-rings, if equipped, on the hose fittings. Lubricate the O-rings with clean oil. Install the hoses.



ROD END OF CYLINDER



CLOSED END OF CYLINDER

- |                   |                    |                 |                    |
|-------------------|--------------------|-----------------|--------------------|
| 1. TUBE           | 7. BOLT            | 13. O-RING      | 19. WIPER          |
| 2. LOCK SCREW     | 8. HARDENED WASHER | 14. O-RING      | 20. BUSHING        |
| 3. GLAND          | 9. WEAR RING       | 15. BACKUP RING | 21. GREASE FITTING |
| 4. PISTON         | 10. SEAL           | 16. BUSHING     |                    |
| 5. PISTON ROD EYE | 11. BACKUP RING    | 17. BUFFER SEAL |                    |
| 6. PISTON ROD     | 12. CHECK VALVE    | 18. WIDE SEAL   |                    |

B9501089T

580 SUPER M AND 590 SUPER M BOOM CYLINDER



## 590SM DIPPER CYLINDER

### Disassembly

**NOTE:** Refer to illustration on page 19.

Clean the outside of the cylinder. If the hoses were removed with the cylinder, remove the hoses from the cylinder.

1. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
2. Loosen and remove the lock screw (2) from the gland (3) and tube (1).
3. Use the gland wrench shown on page 4 to loosen and remove the gland (3) from the tube (1).
4. Pull the piston rod (6) straight out of the tube (1) to prevent damage to the tube (1).
5. Fasten the piston rod eye (5) in a vise and put a support below the piston rod (6) near the piston (4). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston rod (6).
6. Loosen and remove the bolt (7) and washer (8) that holds the piston (4). Use the torque multiplier shown on page 4 for bolts that have a high torque value,
7. Remove the piston (4) from the piston rod (6).
8. Remove the gland (3) from the piston rod (6).
9. Remove the seal (9), backup ring (10), and wear ring (11) from the piston (4).
10. Remove the O-ring (12), backup ring (13), wiper (17), rod seal (16), buffer seal (15), and bushing (14) from the gland (3).

### Inspection

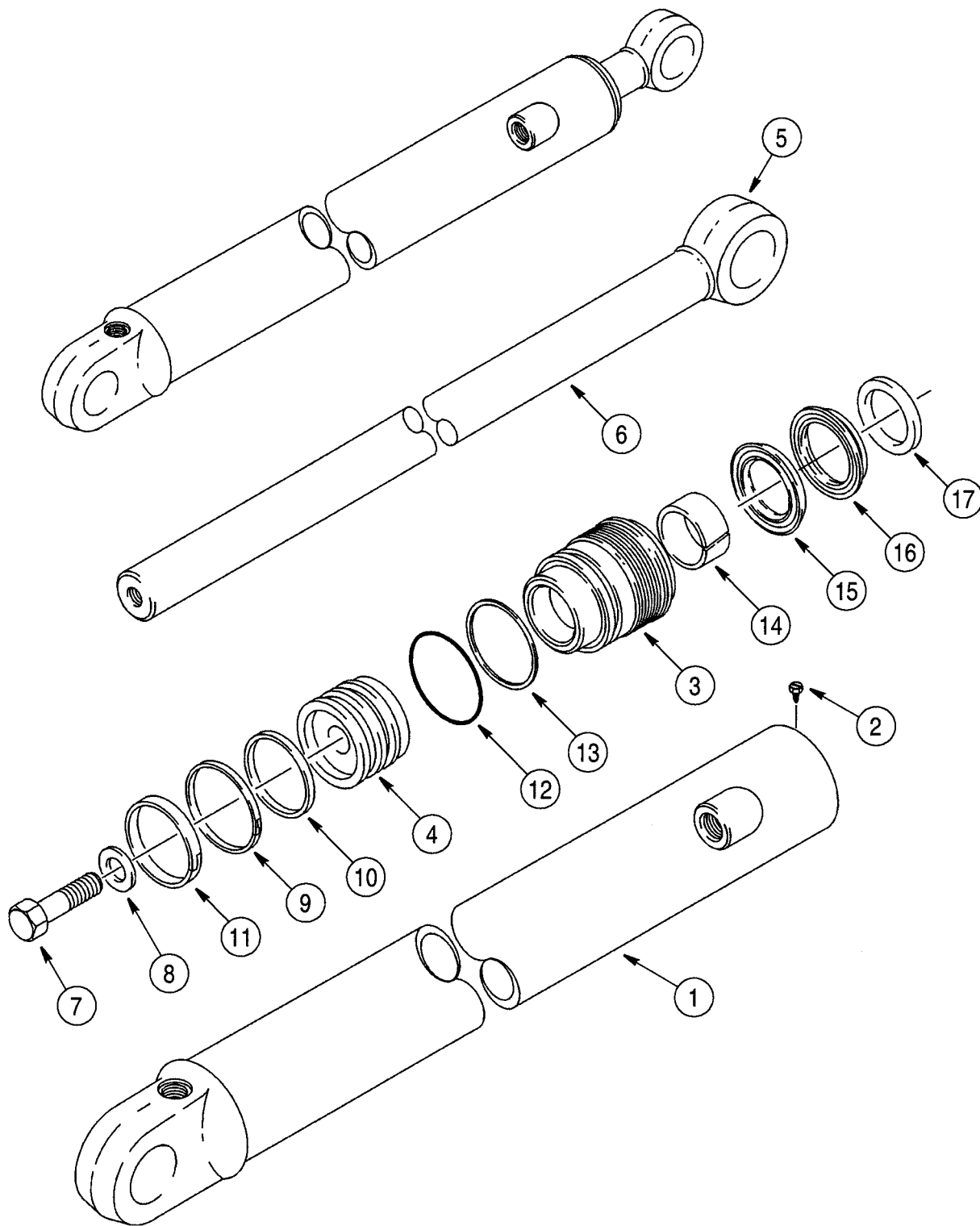
1. Clean the piston (4), gland (3), piston rod (6), tube (1), washer (8), and bolt (7) in cleaning solvent.
2. Discard the parts that were removed from the piston (4) and the gland (3).
3. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used.
4. Check to be sure that the piston rod (6) is straight. If the piston rod (6) is not straight, install a new piston rod (6).

5. Remove small scratches on the inside of the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
6. Inspect the gland (3) for rust and clean and remove rust as required.
7. Inspect the gland end of the tube (1) for sharp edges that will cut the gland O-ring (12) and remove as required.
8. Inspect the piston (4) for damage and wear. If the piston (4) is damaged or worn, a new piston (4) must be used.

### Assembly

1. Install the bushing (14) in the gland (3).
2. Install the buffer seal (15) in the gland (3). The side of the buffer seal (15) with the lip must be toward the small end of the gland (3).
3. Install the rod seal (16) in the gland (3). The rod seal (16) is to be installed so that the lips of the rod seal (16) are toward the small end of the gland (3). The rod seal (16) can be difficult to install. Use the tool shown on page 4.
4. Install a new wiper (17) in the gland (3). The lips of the wiper (17) must be toward the outside of the gland (3).
5. Install a new backup ring (13) in the groove on the outside of the gland (3). If both sides of the backup ring (13) are not flat, the side that is not flat must be toward the small end of the gland (3).

6. Install the O-ring (12) next to the backup ring (13) in the groove on the outside of the gland (3). The O-ring (12) must be toward the small end of the gland (3).
7. Fasten the piston rod eye (5) in the vise.
8. Remove any marks and sharp edges on the chamfer at the end of the piston rod (6).
9. Lubricate the bore of the gland (3) and the piston rod (6) with clean oil.
10. Push the gland (3) onto the piston rod (6). If necessary, use a soft hammer to drive the gland (3) onto the piston rod (6).
11. Put a support below and near the end of the piston rod (6). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston (4).
12. Put the piston (4) on the end of the piston rod (6).
13. Put the hardened washer (8) on the bolt (7).
14. Clean the threads on the end of the piston rod and the threads of the bolt using Loctite cleaning solvent. Allow to dry. Apply Loctite 242 to the piston rod threads 6.4 mm (1/4 inch) from the open end of the piston rod so that there is 12.7 mm (1/2 inch) of Loctite 242 on the piston rod threads. DO NOT apply Loctite to the first 6.4 mm (1/4 inch) of the piston rod threads.
15. Install the bolt (7). Tighten the bolt (7) to the torque value on page 3 for the cylinder that is being repaired. A torque multiplier can be used to help tighten the bolt (7).
16. Install a new wear ring (11) in the groove in the center of the piston (4).
17. Install a new seal (9) in the groove on the outside end of the piston (4). The seal (9) must be in the groove at the end of the piston (4) with the large bore.
18. Install a backup ring (10) over the seal (9) on the piston (4).
19. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
20. Lubricate the inside of the tube (1) and the piston (4) with clean oil.
21. Push the piston (4) straight into the tube (1).
22. When the piston (4) is in the smooth part of the tube (1), start the gland (3) into the tube (1).
23. Lubricate the O-ring (12) on the gland (3) with clean oil.
24. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet). If the lock screw (2) holes become aligned in this torque range, install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound-inches). If the lock screw (2) holes are not aligned, do steps 25 through 27.
25. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet).
26. Use a No. 26 drill and drill a hole half in the gland (3) and half in the tube (1). Drill to a depth of 11 mm (7/16 inch). Do not drill in line with a hole in the gland (3) for the gland wrench.
27. Install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 poundinches).
28. If the hoses were removed with the cylinder, install new O-rings, if equipped, on the hose fittings. Lubricate the O-rings with clean oil. Install the hoses.



- 1. TUBE
- 2. LOCK SCREW
- 3. GLAND
- 4. PISTON
- 5. PISTON ROD EYE
- 6. PISTON ROD

- 7. BOLT
- 8. WASHER
- 9. SEAL
- 10. BACKUP RING
- 11. WEAR RING
- 12. O-RING

- 13. BACKUP RING
- 14. BUSHING
- 15. ROD SEAL
- 16. ROD SEAL
- 17. WIPER

**590 SM DIPPER CYLINDER**

BC1C007

## 590SM EXTENDABLE DIPPER CYLINDER

### Disassembly

**NOTE:** Refer to illustration on page 22.

Clean the outside of the cylinder. If the hoses were removed with the cylinder, remove the hoses from the cylinder

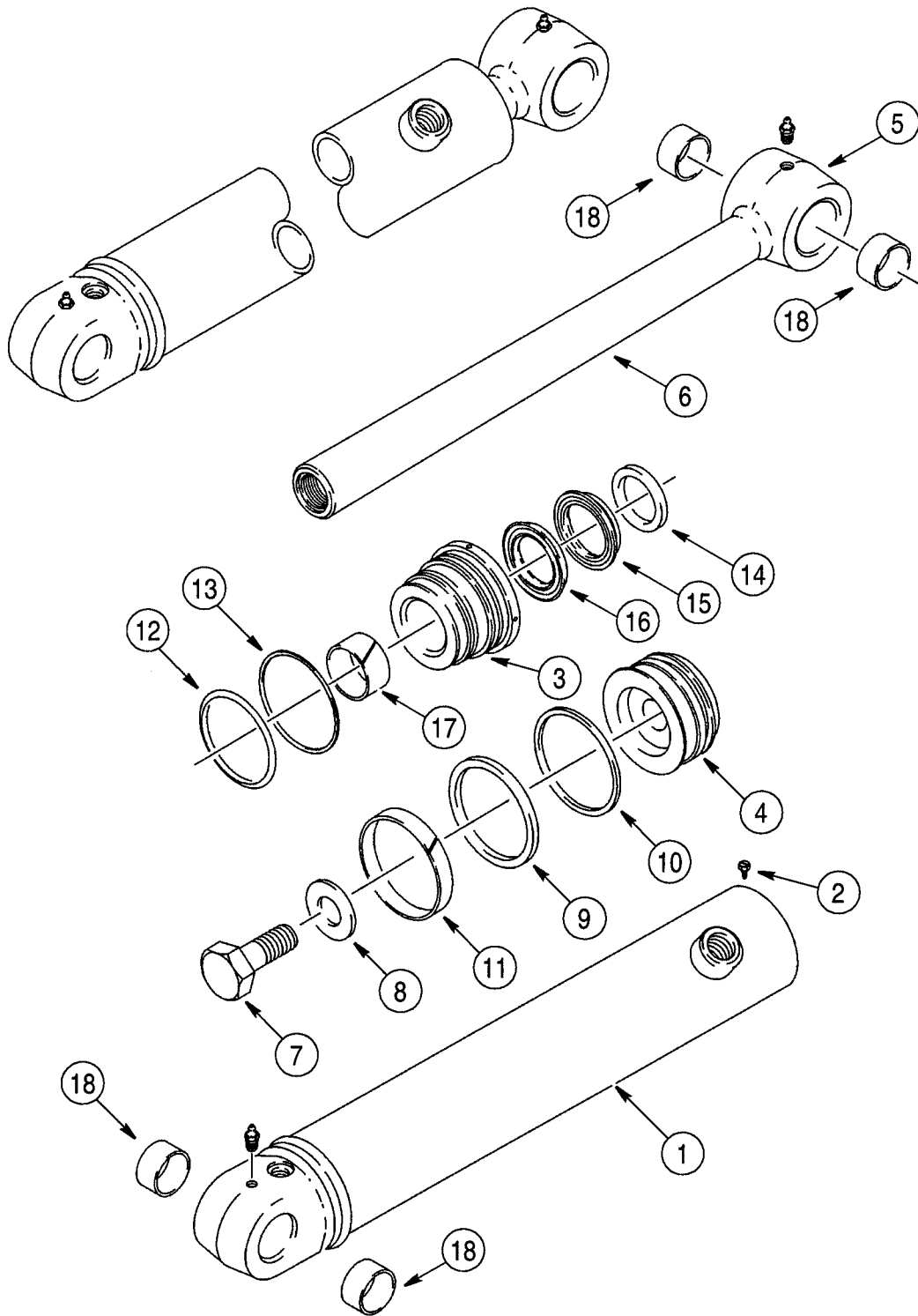
1. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
2. Loosen and remove the lock screw (2) from the gland (3) and tube (1).
3. Use the gland wrench shown on page 4 to loosen and remove the gland (3) from the tube (1).
4. Pull the piston rod (6) straight out of the tube (1) to prevent damage to the tube (1).
5. Fasten the piston rod eye (5) in a vise and put a support below the piston rod (6) near the piston (4). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston rod (6).
6. Loosen and remove the bolt (7) and washer (8) that holds the piston (4). Use the torque multiplier shown on page 4 for bolts that have a high torque value.
7. Remove the piston (4) from the piston rod (6).
8. Remove the gland (3) from the piston rod (6).
9. Remove the seal (9), ring (10), and wear ring (11) from the piston (4).
10. Remove the O-ring (12), backup ring (13), wiper (14), rod seal (15), seal (16), and bushing (17) from the gland (3).

### Inspection

1. Clean the piston (4), gland (3), piston rod (6), tube (1), washer (8), and bolt (7) in cleaning solvent.
2. Discard the parts that were removed from the piston (4) and the gland (3).
3. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used.
4. Check to be sure that the piston rod (6) is straight. If the piston rod (6) is not straight, install a new piston rod (6).
5. Remove small scratches on the inside of the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
6. Inspect the bushings (18) in the piston rod eye (5) and the closed end of the tube (1). Replace as required.
7. Inspect the gland (3) for rust and clean and remove rust as required.
8. Inspect the gland end of the tube (1) for sharp edges that will cut the gland O-ring (12) and remove as required.
9. Inspect the piston (4) for damage and wear. If the piston (4) is damaged or worn, a new piston (4) must be used.

## Assembly

1. Install the bushing (17) in the gland (3).
2. Install the buffer seal (16) in the gland (3). The side of the buffer seal (16) with the lip must be toward the small end of the gland (3).
3. Install the rod seal (15) in the gland (3). The rod seal (15) is to be installed so that the lips of the rod seal (15) are toward the small end of the gland (3). The rod seal (15) can be difficult to install. Use the tool shown on page 4.
4. Install a new wiper (14) in the gland (3). The lips of the wiper (14) must be toward the outside of the gland (3).
5. Install a new backup ring (13) in the groove on the outside of the gland (3). If both sides of the backup ring (13) are not flat, the side that is not flat must be toward the small end of the gland (3).
6. Install the O-ring (12) next to the backup ring (13) in the groove on the outside of the gland (3). The O-ring (12) must be toward the small end of the gland (3).
7. Fasten the piston rod eye (5) in the vise.
8. Remove any marks and sharp edges on the chamfer at the end of the piston rod (6)
9. Lubricate the bore of the gland (3) and the piston rod (6) with clean oil.
10. Push the gland (3) onto the piston rod (6). If necessary, use a soft hammer to drive the gland (3) onto the piston rod (6).
11. Put a support below and near the end of the piston rod (6). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston (4).
12. Put the piston (4) on the end of the piston rod (6).
13. Put the hardened washer (8) on the bolt (7).
14. Clean the threads on the end of the piston rod and the threads of the bolt using Loctite cleaning solvent. Allow to dry. Apply Loctite 243 to the piston rod threads 6.4 mm (1/4 inch) from the open end of the piston rod so that there is 12.7 mm (1/2 inch) of Loctite 243 on the piston rod threads. DO NOT apply Loctite to the first 6.4 mm (1/4 inch) of the piston rod threads.
15. Install the bolt (7). Tighten the bolt (7) to the torque value on page 3 for the cylinder that is being repaired. A torque multiplier can be used to help tighten the bolt (7).
16. Install a new wear ring (9) in the groove in the center of the piston (4).
17. Install a new seal (9) in the groove on the outside end of the piston (4). The seal (9) must be in the groove at the end of the piston (4) with the large bore.
18. Install a ring (10) over the seal (9) on the piston (4).
19. Install the wear ring (11) on the piston (4).
20. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
21. Lubricate the inside of the tube (1) and the piston (4) with clean oil.
22. Push the piston (4) straight into the tube (1)
23. When the piston (4) is in the smooth part of the tube (1), start the gland (3) into the tube (1).
24. Lubricate the O-ring (12) on the gland (3) with clean oil.
25. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet). If the lock screw (2) holes become aligned in this torque range, install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound-inches). If the lock screw (2) holes are not aligned, do steps 25 through 27.
26. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet).
27. Use a No. 26 drill and drill a hole half in the gland (3) and half in the tube (1). Drill to a depth of 11 mm (7/16 inch). Do not drill in line with a hole in the gland (3) for the gland wrench.
28. Install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 poundinches).
29. If the hoses were removed with the cylinder, install new O-rings, if equipped, on the hose fittings. Lubricate the O-rings with clean oil. Install the hoses.



- |                   |               |                 |
|-------------------|---------------|-----------------|
| 1. TUBE           | 7. BOLT       | 13. BACKUP RING |
| 2. LOCK SCREW     | 8. WASHER     | 14. WIPER       |
| 3. GLAND          | 9. SEAL       | 15. SEAL        |
| 4. PISTON         | 10. RING      | 16. BUFFER SEAL |
| 5. PISTON ROD EYE | 11. WEAR RING | 17. BUSHING     |
| 6. PISTON ROD     | 12. O-RING    | 18. BUSHING     |

**590 SM EXTENDABLE DIPPER CYLINDER**

BC01C008

## QUICK COUPLER CYLINDER

### Disassembly

**NOTE:** Refer to illustrations on page 24.

1. Remove the snap ring (2) from the gland (5). Then push the gland (5) slightly into the cylinder.
2. Remove the spacer (3).
3. Remove the snap ring (4) from the tube (1).
4. Install the plastic service ring into the snap ring groove in the tube (1).

**IMPORTANT:** See illustration on this page for orientation of the plastic service ring.

5. Pull the rod assembly (6) out of the tube (1).
6. Remove the plastic service ring from the tube (1).
7. Remove the gland (5) from the rod (6).
8. Fasten the rod (6) in a vise with soft jaws.
9. Remove the seal (7), ring (8), ring (9), and O-ring (10) from the piston.
10. Remove the wiper seal (11), bushing (12), seal (13), O-ring (14), and backup ring (15) from the gland (5).
11. Do steps 1 through 10 for the other side.

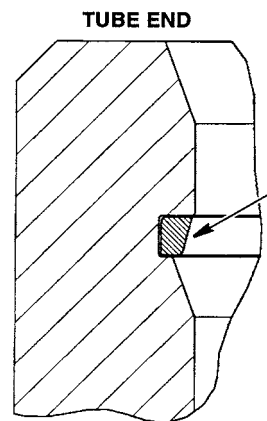
### Inspection

1. Clean the glands (5), piston rods (6) and tube (1) in cleaning solvent.
2. Discard the parts that were removed from the pistons and the glands (5).
3. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used. See section 8001 for removal of cylinder tube.
4. Remove small scratches on the inside of the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
5. Check to be sure that the piston rods (6) are straight. If a piston rod (6) is not straight, install a new piston rod (6).

### Assembly

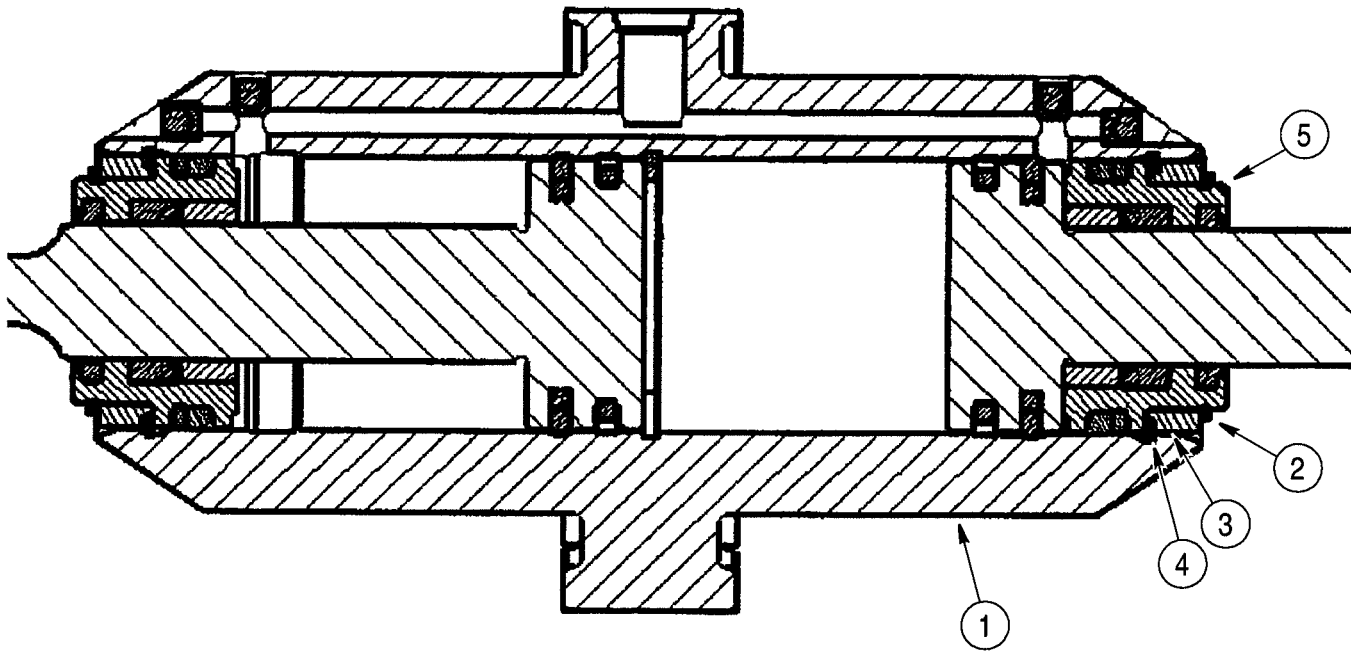
1. Install the wiper seal (11) in the gland (5). The lips must be toward the small end of the gland (5).

2. Install the seal (13) and bushing (12) in the gland (5).
3. Install the backup ring (15) and O-ring (14) on the outside of the gland (5).
4. Install a new O-ring (10), ring (9), ring (8), and seal (7) on the piston.
5. Lubricate the bore of the gland (5) with clean oil and push the gland assembly onto the piston rod (6). The wide end of the gland (5) should contact the piston.
6. Do steps 1 through 5 for the other gland (5) and piston rod (6).
7. Lubricate the seals of the piston rod (6) and the gland (5) with clean oil. Push the piston rod and gland sub-assembly into the bore of the tube (1) far enough to allow the installation of the snap ring (4). If necessary, use a soft hammer to drive the piston rod (6) and gland (5) into the tube (1).
8. Install the snap ring (4) in the tube (1).
9. Pull the rod (6) outwards until the gland (5) is seated against the snap ring (4).
10. Install the spacer (3) on the gland (5).
11. Install the snap ring (2) on the gland (5).
12. Do steps 7 through 12. for the other side.



PLASTIC SERVICE RING ORIENTATION

BS00C112



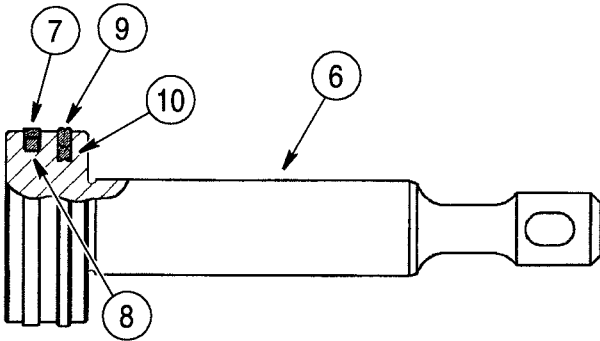
- 1. TUBE
- 2. SNAP RING

- 3. SPACER
- 4. SNAP RING

- 5. GLAND

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**QUICK COUPLER CYLINDER**

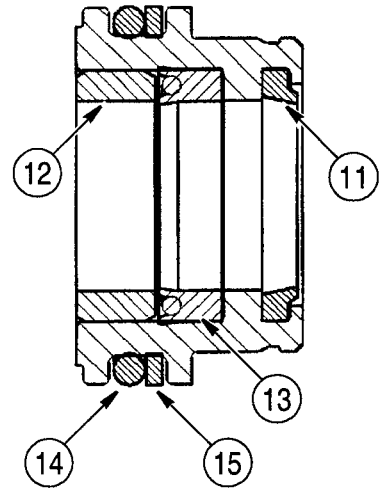


- 6. PISTON ROD
- 7. SEAL
- 8. RING

- 9. RING
- 10. O-RING

BS01C101

**COUPLER CYLINDER PISTON**



- 11. WIPER SEAL
- 12. BUSHING

- 13. SEAL
- 14. O-RING

- 15. BACKUP RING

BS01C109

**COUPLER CYLINDER GLAND**



## SWING CYLINDERS

### Disassembly

**NOTE:** Refer to illustrations on page 26 and 28.

Clean the outside of the cylinder. If the hoses were removed with the cylinder, remove the hoses from the cylinder.

1. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
2. Loosen and remove the lock screw (2) from the gland (3) and tube (1).
3. Use the gland wrench shown on page 4 to loosen and remove the gland (3) from the tube (1).
4. Pull the piston rod (6) straight out of the tube (1) to prevent damage to the tube (1).
5. Fasten the piston rod eye (5) in a vise and put a support below the piston rod (6) near the piston (4). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston rod (6).
6. Loosen and remove the bolt (7) and hardened washer (8) that holds the piston (4). Use the torque multiplier shown on page 4 for bolts that have a high torque value.
7. Remove the piston (4) from the piston rod (6).
8. Remove the gland (3) from the piston rod (6).
9. Remove the wear ring (9), seal (10), backup ring (11), and piston ring (12) from the piston (4).
10. Remove the O-ring (13), backup ring (14), wiper (15), wide seal (16), buffer seal (17), and bushing (18) from the gland (3).
11. Remove the end cap (21) from the tube (1).
12. Remove the backup ring (19) and O-ring (20) from the end cap (21).

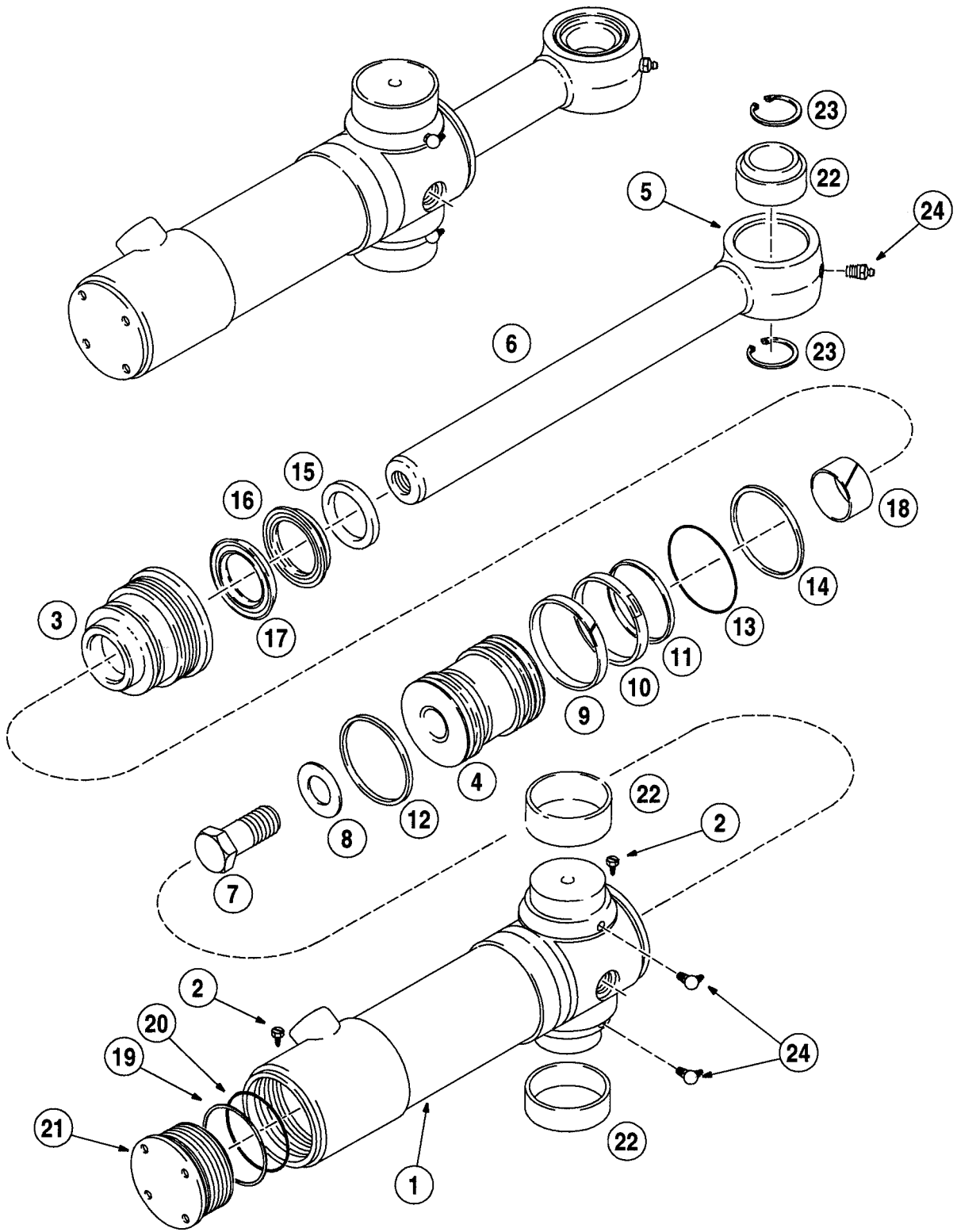
### Inspection

13. Clean the piston (4), gland (3), piston rod (6), tube (1), hardened washer (8), and bolt (7) in cleaning solvent. Make sure the orifice in the piston (4) is open.
14. Discard the parts that were removed from the piston (4), gland (3) and the end cap (21).
15. Illuminate the inside of the tube (1). Inspect the inside of the tube (1) for deep grooves and other damage. If there is damage to the tube (1), a new tube (1) must be used.
16. Check to be sure that the piston rod (6) is straight. If the piston rod (6) is not straight, install a new piston rod (6).
17. Remove small scratches on the piston rod (6) or inside the tube (1) with emery cloth of medium grit. Use the emery cloth with a rotary motion.
18. Inspect the bushing (22) and snap rings (23) in the piston rod eye (5) and bushings (22) on the trunnions on the tube (1), replace as required.
19. Inspect the gland (3) for rust and clean and remove rust as required.
20. Inspect the gland end of the tube (1) for sharp edges that will cut the gland O-ring (13), remove as required.

### Assembly

**NOTE:** If a new gland (3) is being installed, put the part number of the cylinder on the new gland.

1. Install the bushing (18) in the gland (3).
2. Install the buffer seal (17) in the gland (3). The side of the buffer seal (17) with the lip must be toward the small end of the gland (3).
3. Install the wide seal (16) in the gland. The wide seal (16) is to be installed so that the lips of the wide seal (16) are toward the small end of the gland (3). The wide seal (16) can be difficult to install. Use the tool shown on page 4.
4. Install a new wiper (15) in the gland (3). The lips of the wiper (15) must be toward the large end of the gland (3).
5. Install a new backup ring (14) in the groove on the outside of the gland (3). If both sides of the backup ring (14) are not flat, the side that is not flat must be toward the small end of the gland (3).
6. Install the O-ring (13) next to the backup ring (14) in the groove on the outside of the gland (3). The O-ring (13) must be toward the small end of the gland (3).

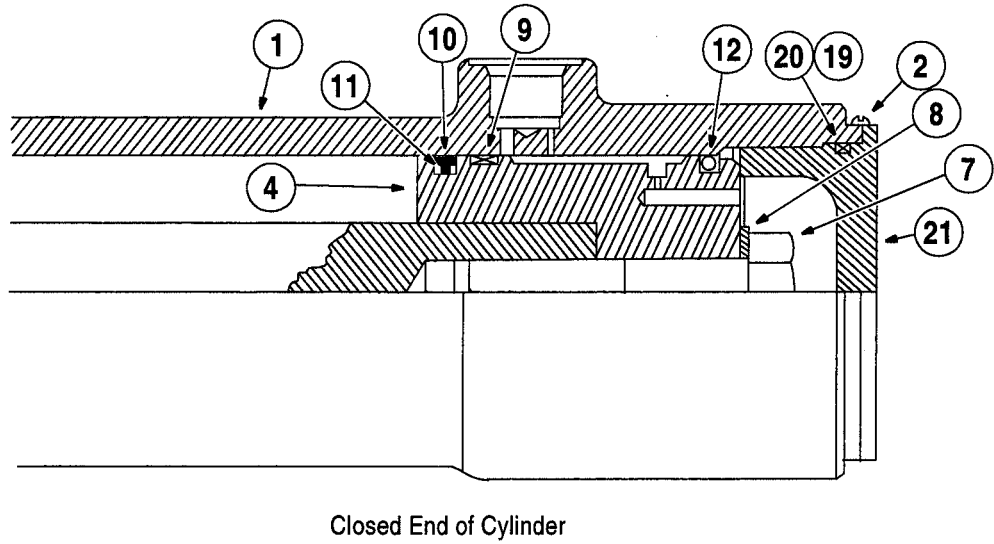
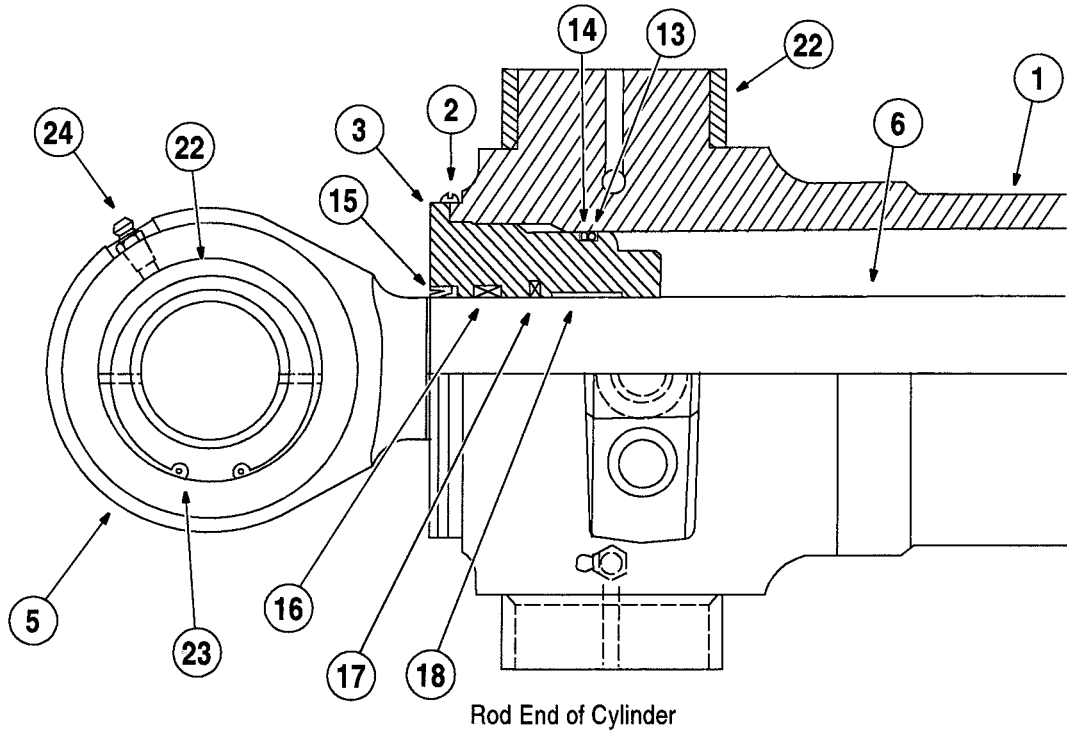


- |                   |                    |                 |                    |
|-------------------|--------------------|-----------------|--------------------|
| 1. TUBE           | 7. BOLT            | 13. O-RING      | 19. BACKUP RING    |
| 2. LOCK SCREW     | 8. HARDENED WASHER | 14. BACKUP RING | 20. O-RING         |
| 3. GLAND          | 9. WEAR RING       | 15. WIPER       | 21. END CAP        |
| 4. PISTON         | 10. SEAL           | 16. WIDE SEAL   | 22. BUSHING        |
| 5. PISTON ROD EYE | 11. BACKUP RING    | 17. BUFFER SEAL | 23. SNAP RING      |
| 6. PISTON ROD     | 12. PISTON RING    | 18. BUSHING     | 24. GREASE FITTING |

B9501092T

**SWING CYLINDER**

7. Fasten the piston rod eye (5) in the vise.
8. Remove any marks and sharp edges on the chamfer at the end of the piston rod (6).
9. Lubricate the bore of the gland (3) with clean oil.
10. Push the gland (3) onto the piston rod (6). If necessary, use a soft hammer to drive the gland (3) onto the piston rod (6).
11. Put a support below and near the end of the piston rod (6). Use a shop cloth between the support and the piston rod (6) to prevent damage to the piston (4).
12. Put the piston (4) on the end of the piston rod (6).
13. Put the hardened washer (8) on the bolt (7).
14. Clean the threads on the end of the piston rod and the threads of the bolt using Loctite cleaning solvent. Allow to dry. Apply Loctite 243 to the piston rod threads 6.35 mm (1/4 inch) from the open end of the piston rod so that there is 3.7 mm (1/2 inch) of Loctite 243 on the piston rod threads. DO NOT apply Loctite to the first 6.35 mm (1/4 inch) of the piston rod threads.
15. Install the bolt (7). Tighten the bolt (7) to the torque value on page 3 for the cylinder that is being repaired. A torque multiplier can be used to help tighten the bolt.
16. Install a new piston ring (12) in the groove at the bolt end of the piston (4).
17. Install a new wear ring (9) in the center groove on the outside of the piston (4).
18. Install a new backup ring (11) in the groove on the outside of the piston (4).
19. Install a new seal (10) on top of the backup ring (11) on the outside of the piston (4).
20. Fasten the tube (1) in a vise or other holding equipment. Be careful to prevent damage to the tube (1).
21. Install a new backup ring (19) and O-ring (20) in the groove on the outside of the end cap (21).
22. Lubricate the O-ring (20) on the end cap (21) with clean oil.
23. Install the end cap (21) in the tube (1).
24. Lubricate the inside of the tube (1) and the piston (4) with clean oil.
25. Use a piston ring compression tool to hold the new wear ring (9) in place.
26. Push the tube (1) straight onto the piston (4).
27. Start the tube (1) onto the piston rod assembly. Push the tube onto the piston rod assembly until the compression tool is pushed off the piston rod assembly. Be careful not to damage the wear ring (9) and seal (10).
28. Lubricate the O-ring (13) on the gland (3) with clean oil.
29. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet). If the lock screw (2) holes become aligned in this torque range, install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 pound-inches). If the lock screw (2) holes are not aligned, do steps 30 through 32.
30. Tighten the gland (3) to 135 to 542 Nm (100 to 400 pound-feet).
31. Use a No. 26 drill and drill a hole half in the gland (3) and half in the tube (1). Drill to a depth of 11 mm (7/16 inch). Do not drill in line with a hole in the gland (3) for the gland wrench.
32. Install the lock screw (2). Tighten the lock screw (2) to 2.3 Nm (20 poundinches).
33. If the hoses were removed with the cylinder, install new O-rings, if equipped, on the hose fittings. Lubricate the O-rings with clean oil. Install the hoses.



- |                   |                    |                 |                    |
|-------------------|--------------------|-----------------|--------------------|
| 1. TUBE           | 7. BOLT            | 13. O-RING      | 19. BACKUP RING    |
| 2. LOCK SCREW     | 8. HARDENED WASHER | 14. BACKUP RING | 20. O-RING         |
| 3. GLAND          | 9. WEAR RING       | 15. WIPER       | 21. END CAP        |
| 4. PISTON         | 10. SEAL           | 16. WIDE SEAL   | 22. BUSHING        |
| 5. PISTON ROD EYE | 11. BACKUP RING    | 17. BUFFER SEAL | 23. SNAP RING      |
| 6. PISTON ROD     | 12. PISTON RING    | 18. BUSHING     | 24. GREASE FITTING |

???????

**SWING CYLINDER**

# Section 9008

## BACKHOE

9008

CASE CORPORATION  
700 State Street  
Racine, WI 53404 U.S.A.

CASE CANADA CORPORATION  
3350 South Service Road  
Burlington, ON L7N 3M6 CANADA

Bur 6-42130  
H-37

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# TABLE OF CONTENTS

SWING TOWER .....	3
Removal .....	3
Installation .....	4
BOOM .....	7
Removal .....	7
Installation .....	8
DIPPER .....	14
Removal .....	14
Installation .....	14
DIPPER EXTENSION .....	25
Removal .....	25
Installation .....	25
580M WEAR PLATES FOR THE EXTENDABLE DIPPER .....	35
Replacing .....	35
580 SM AND 590 SM WEAR PLATES FOR THE EXTENDABLE DIPPER .....	35
Replacing .....	35
CUTTING EDGES .....	35
Universal and Heavy Duty Buckets .....	35
High Capacity Buckets .....	37
BUCKET TEETH .....	38

## SWING TOWER

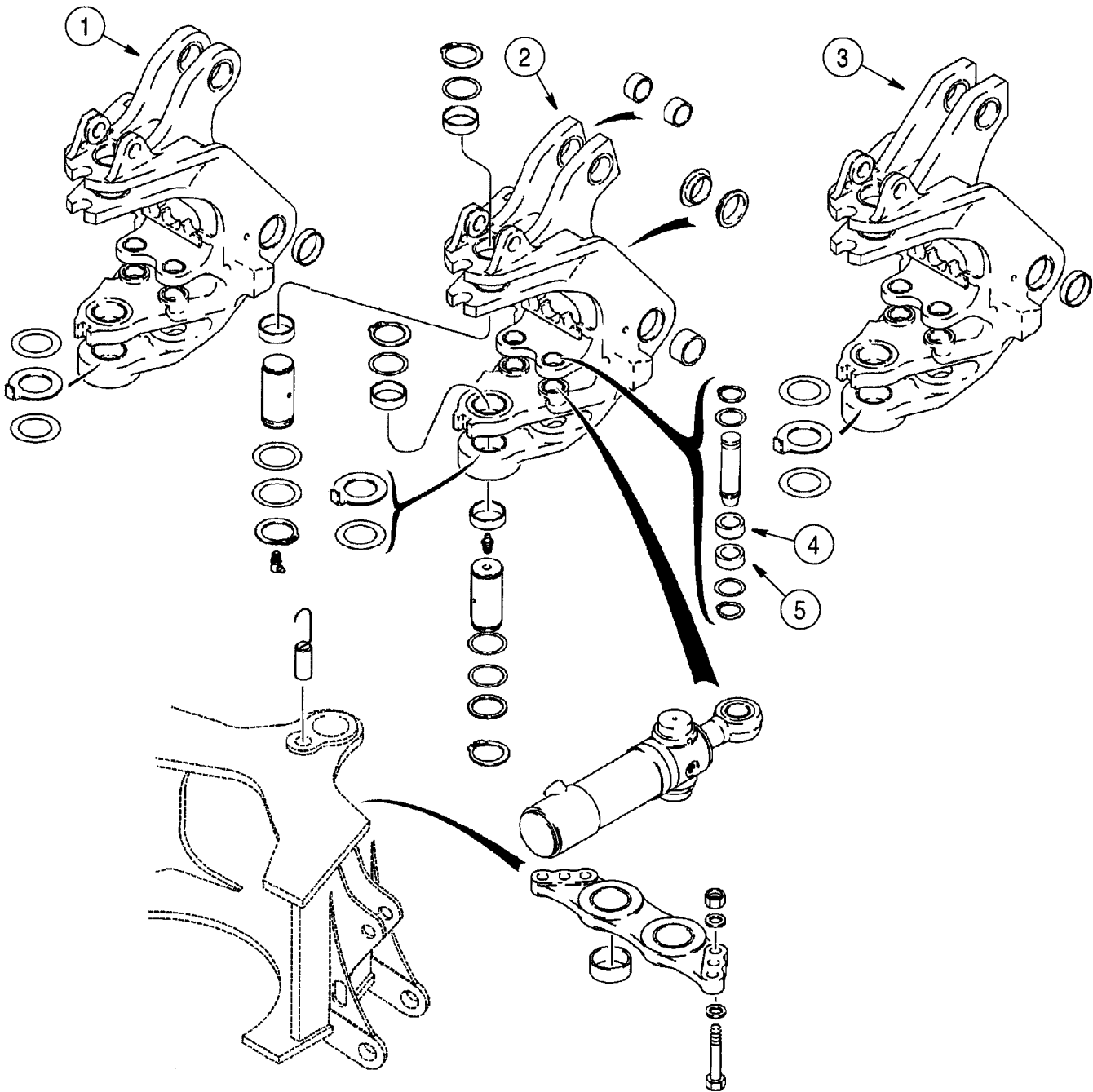
### Removal

1. Remove all dirt from the hose connections at the backhoe control valve.
  2. Start the engine and run the engine at 1000 rpm (r/min). Roll the bucket in all the way. Extend the dipper and the boom as far as possible in the space that is available. Lower the bucket to the floor and stop the engine.
  3. Fasten acceptable lifting equipment to the boom and dipper pivot area to prevent the boom and the dipper from falling when the boom is free of the swing tower.
  4. Move the backhoe control levers in both directions to relieve any pressure in the circuits.
  5. Disconnect the hoses from the backhoe control valve and fasten an identification tag to each hose.
  6. Install a cap on each fitting and a plug in each hose.
  7. Remove the hardware which fastens the vertical clamps near the center of the swing tower. Remove the vertical clamps.
  8. On 580 Super M and 590 Super M machines, there is a horizontal clamp to the rear of the vertical clamps. The 580M does not have this clamp. If your machine has this clamp, remove the hardware and the clamp.
  9. Write an identification number on each clamp ring so that you can install the hoses in the correct places during installation.
  10. Fasten acceptable lifting equipment to the boom cylinder to hold the boom cylinder when the pivot pin is removed.
  11. Remove the snap ring and the flat washer(s) from one end of the pivot pin for the boom cylinder.
  12. Drive the pivot pin out of the swing tower.
  13. Lower the boom cylinder until the boom cylinder rests on the boom. Remove the lifting equipment.
  14. Fasten acceptable lifting equipment to the boom to hold the boom when the pivot pins are removed.
  15. Remove the bolts, the hardened washers, and the spacers that hold the pivot pins for the boom.
  16. Remove the pivot pins.
- NOTE:** *There may be flat washers installed between the boom and the swing tower. These flat washers fill the gaps between the boom and the swing tower. The flat washers also keep the boom centered in the swing tower. Put identification tags on these flat washers so that they can be returned to the same locations during installation.*
17. Carefully move the machine away from the boom.
  18. Remove the snap ring and the flat washer(s) from one end of the pivot pin for the rod eye of each swing cylinder.
  19. Use a hammer or hydraulic ram and an acceptable driver to remove the pivot pins from the swing tower.
  20. Remove the snap ring and the flat washer(s) from one end of the pivot pin for the boom latch.
  21. Drive the pivot pin out of the swing tower.
  22. Move the boom latch out of the way.
  23. Remove the snap ring and the flat washer(s) from the bottom of the bottom pivot pin for the swing tower.
  24. Fasten acceptable lifting equipment to the swing tower to hold the swing tower when the pivot pins are removed.
  25. Use a hammer or hydraulic ram and an acceptable driver to remove the bottom pivot pin.
  26. Remove the snap ring and the flat washer(s) from the top of the top pivot pin for the swing tower.
  27. Use a hammer or hydraulic ram and an acceptable driver to remove the top pivot pin.
  28. Remove the swing tower from the frame.
- NOTE:** *Record the number and locations of any flat washers or shims that are found between the swing tower and the frame so that the flat washers or shims can be returned to the correct locations during installation.*

## Installation

1. Install the swing tower in the frame. Make sure that the thrust washer (the flat washer with the tab) is installed on top of the lower frame plate. The tab must be up so that it engages the notch in the swing tower. The flat washers or shims that are used to decrease the clearance between the swing tower and the frame must be installed below the lower frame plate.
2. Install the top pivot pin for the swing tower so that the grease fitting is down.
3. Install the flat washer(s) and the snap ring to fasten the top pivot pin.
4. Install the bottom pivot pin for the swing tower so that the grease fitting is up.
5. Install the flat washer(s) and the snap ring to fasten the bottom pivot pin.
6. Put the boom latch in position.
7. Install the pivot pin for the boom latch.
8. Install the flat washer(s) and the snap ring to fasten the pivot pin for the boom latch.
9. Move the swing cylinders as necessary to align the rod eyes with the mounting holes in the swing tower.
10. Install the pivot pins for the rod eyes of the swing cylinders.
11. Install the flat washer(s) and the snap ring to fasten each pivot pin.
12. Carefully move the machine to align the swing tower with the boom.
13. If necessary, install flat washers between the boom and the swing tower. The flat washers should fill the gaps between the boom and the swing tower. They should also keep the boom centered in the swing tower.
14. Install the pivot pins for the boom. Turn the pivot pins as necessary so that the hole in the ear of each pivot pin is aligned with the hole in the swing tower.
15. Install the spacers, the hardened washers, and the bolts to fasten the pivot pins to the swing tower.
16. Fasten acceptable lifting equipment to the boom cylinder. Move the boom cylinder as necessary so that the rod eye is aligned with the swing tower.
17. Install the pivot pin for the boom cylinder.
18. Install the flat washer(s) and the snap ring to fasten the pivot pin for the boom cylinder.
19. If your machine has a horizontal hose clamp to the rear of the vertical hose clamps, install the horizontal hose clamp on the hoses. Install the hardware.
20. Install the vertical clamps and the hardware.
21. Connect the hoses to the backhoe control valve.
22. Use molydisulfide grease to lubricate all pivot pins.
23. Run the engine at 1000 rpm (r/min). Slowly operate the bucket, dipper, dipper extension (if equipped), and boom cylinders through four complete cycles to remove any air from the circuits.
24. The boom latch lever should have 0 to 8 mm (0 to 0.32 inch) of free play at the knob when boom is unlatched.

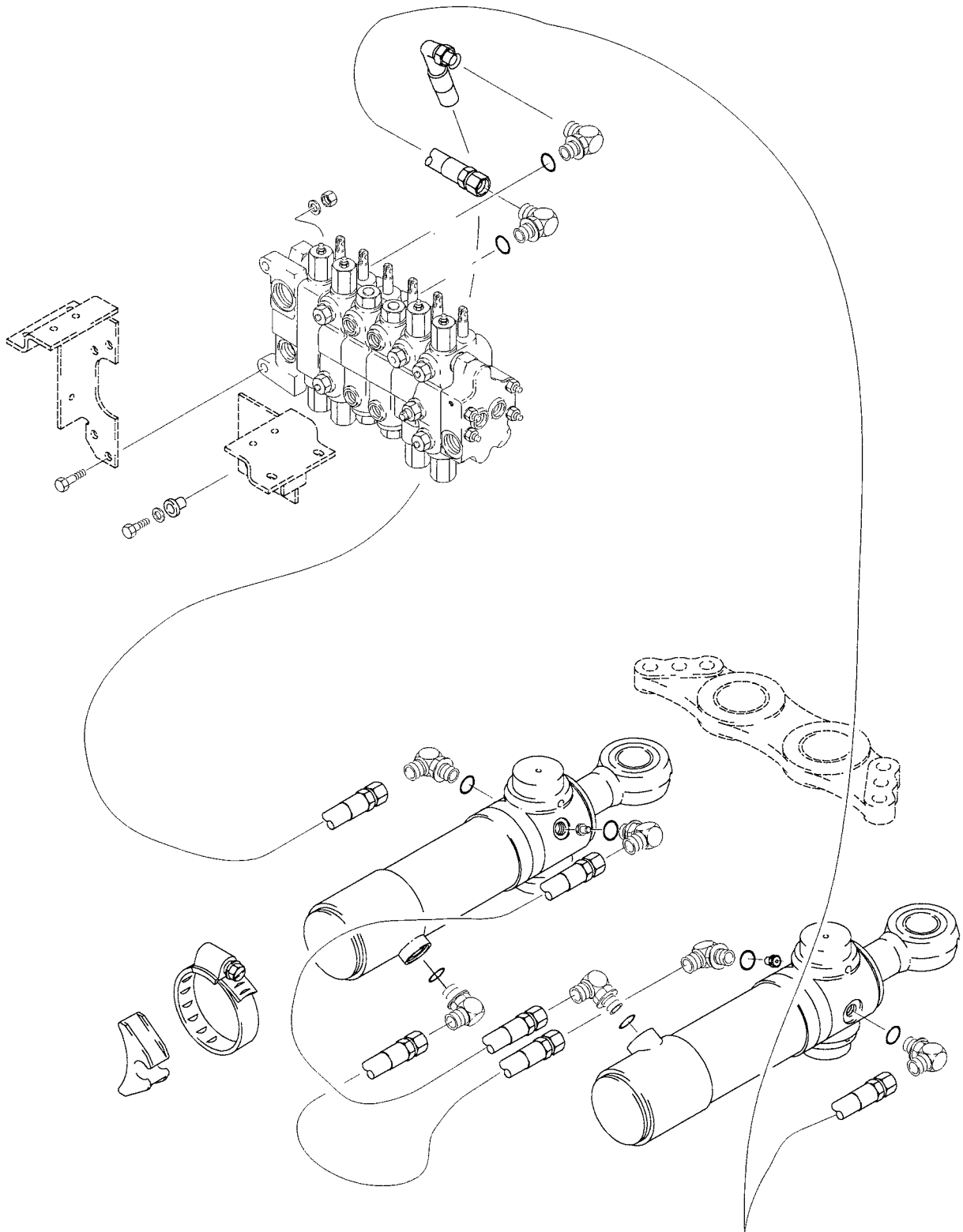




- 1. SWING TOWER - 580 SUPER M
- 2. SWING TOWER - 580 M
- 3. SWING TOWER - 590 SUPER M
- 4. SPACER - ONE USED ON 580M OR 580 SUPER M. TWO USED ON 590 SUPER M
- 5. SPACER - USED ON 580M AND 580 SUPER M ONLY

**SWING TOWER AND SWING CYLINDER INSTALLATION**

BC01B046



BT95M049

**SWING CYLINDER HYDRAULIC INSTALLATION**

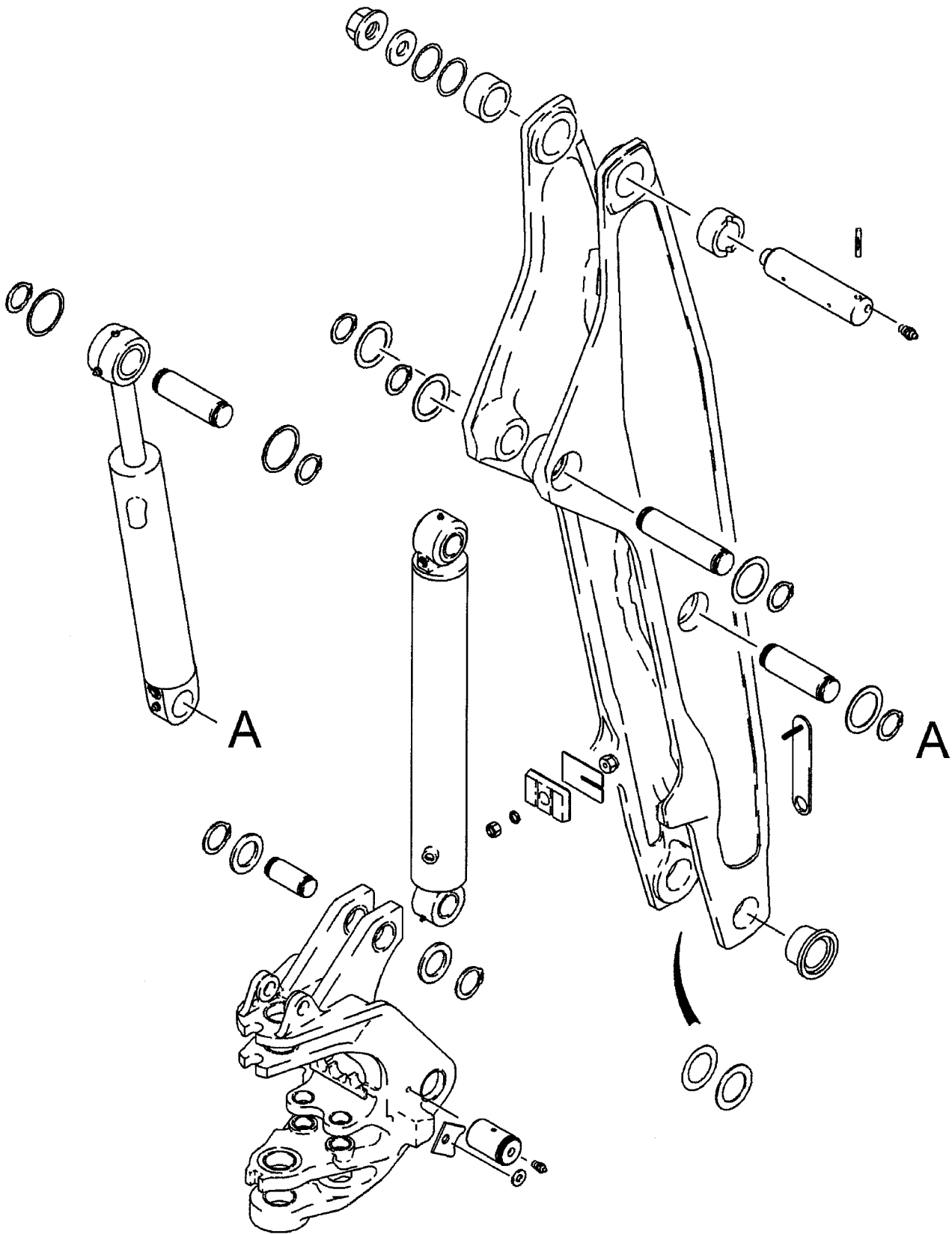
## BOOM

### Removal

1. Start the engine and run the engine at 1000 rpm (r/min). Roll the bucket in all the way.
  2. Put the boom and the dipper in an acceptable position for removal of these parts. Make sure that the bucket is on the floor.
  3. Stop the engine. Move the backhoe control levers in both directions to relieve any pressure in the circuits.
  4. For all machines except the 580M without extendable dipper, disconnect the bucket cylinder hoses at the connections inside the upper end of the boom. For 580M machines without extendable dipper, disconnect the bucket cylinder hoses at the bucket cylinder.
  5. Install caps or plugs on all hoses and tubes.
  6. If the machine has an extendable dipper, disconnect the extension cylinder hoses at the connections inside the upper end of the boom.
  7. Install caps or plugs on all hoses and tubes.
  8. Fasten acceptable lifting equipment to the dipper cylinder and to the boom or the dipper as necessary to hold these parts when the pivot pin is removed from the rod eye of the dipper cylinder.
  9. Remove the snap ring and the flat washer(s) that hold the pivot pin for the rod eye of the dipper cylinder.
  10. Drive the pivot pin out of the dipper.
  11. Lower the dipper cylinder to the boom.
  12. Adjust the lifting equipment, if necessary, so that the lifting equipment will hold the boom and the dipper when the pivot pin for the dipper is removed.
  13. Remove the Self-Locking nut and the hardened washer that hold the pivot pin for the dipper.
- NOTE:** *There may be one or more shims installed between the hardened washer and the boom. If so, record the number and the location of the shims so that they can be returned to the correct location during installation.*
14. Drive the pivot pin out of the boom.
  15. Move the dipper out of the way.
  16. Adjust the lifting equipment, if necessary, so that the lifting equipment will hold the boom when the pivot pin for the rod eye of the boom cylinder is removed.
  17. Fasten acceptable lifting equipment to the boom cylinder to hold the boom cylinder when the pivot pin is removed.
  18. Remove the snap ring and the flat washer(s) from one end of the pivot pin for the boom cylinder.
  19. Drive the pivot pin out of the swing tower.
  20. Lower the boom cylinder until the boom cylinder rests on the boom. Remove the lifting equipment from the boom cylinder.
  21. For 580 Super M and 590 Super M machines, disconnect the backhoe hoses at the connections inside the lower end of the boom. For 580M machines, disconnect the backhoe hoses at the backhoe control valve. Fasten an identification tag to each hose.
  22. Install caps or plugs on all hoses and tubes.
  23. On 580M machines only, remove the hardware which fastens the vertical clamps near the center of the swing tower. Remove the vertical clamps.
  24. Adjust the lifting equipment, if necessary, to hold the boom when the pivot pins for the boom are removed.
  25. Remove the bolts, the hardened washers, and the spacers that hold the pivot pins for the boom.
  26. Remove the pivot pins.
- NOTE:** *There maybe flat washers installed between the boom and the swing tower. These flat washers fill the gaps between the boom and the swing tower. The flat washers also keep the boom centered in the swing tower. Put identification tags on these flat washers so that they can be returned to the same locations during installation.*
27. Remove the boom from the machine. On 580M machines, carefully pull the backhoe hoses from the swing tower as you remove the boom.

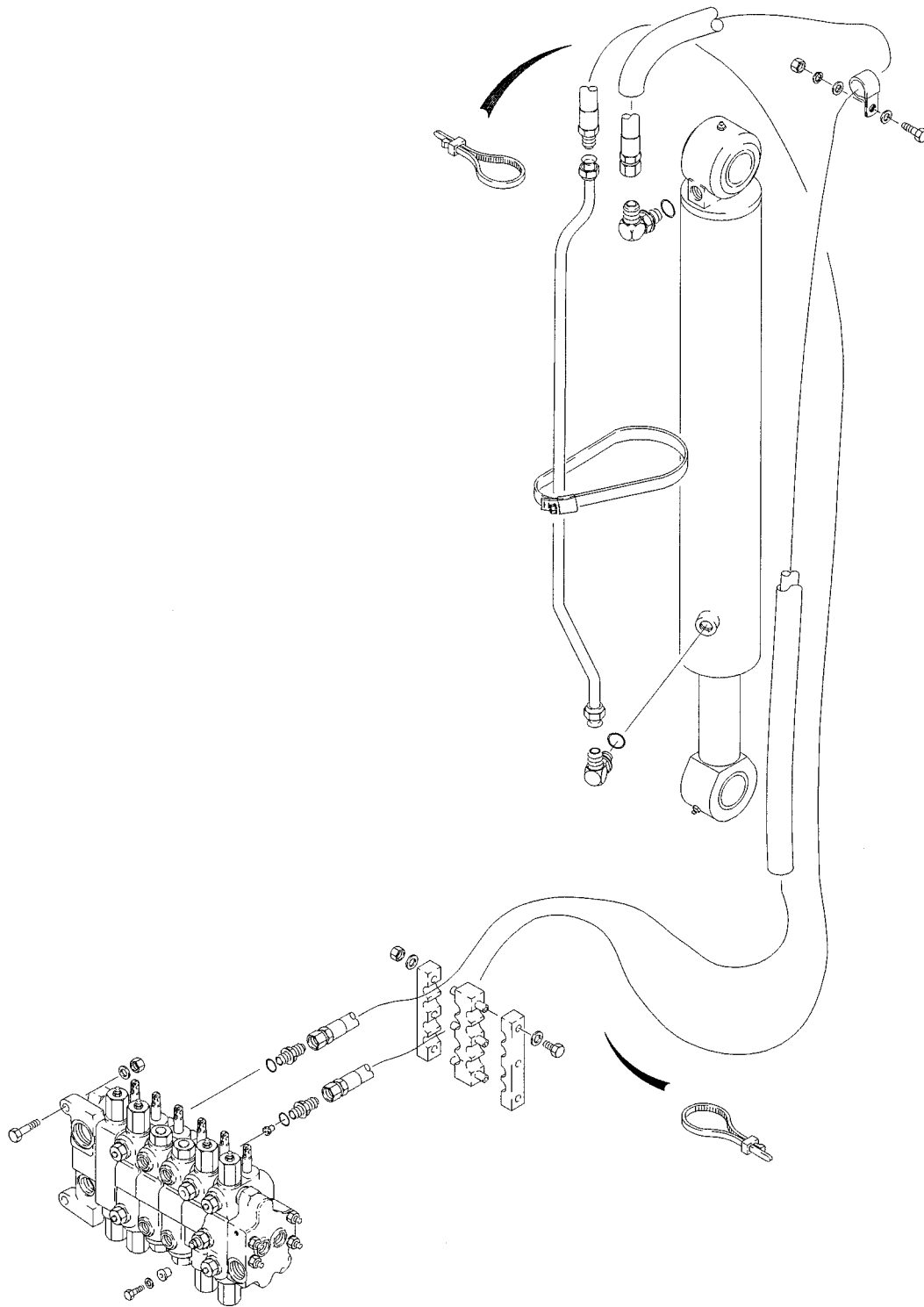
## Installation

1. Put the boom into position on the machine. On 580M machines, carefully guide the backhoe hoses through the swing tower.
2. If necessary, install flat washers between the boom and the swing tower. The flat washers should fill the gaps between the boom and the swing tower. They should also keep the boom centered in the swing tower.
3. Install the pivot pins for the boom. Turn the pivot pins as necessary so that the hole in the ear of each pivot pin is aligned with the hole in the swing tower.
4. Install the spacers, the hardened washers, and the bolts to fasten the pivot pins to the swing tower.
5. On 580M machines only, install the vertical clamps and the hardware.
6. On 580M machines only, connect the backhoe hoses to the backhoe control valve. On 580 Super M and 590 Super M machines, connect the backhoe hoses at the connections inside the lower end of the boom.,
7. Fasten acceptable lifting equipment to the boom cylinder. Move the boom cylinder as necessary so that the rod eye is aligned with the swing tower.
8. Install the pivot pin for the boom cylinder.
9. Install the flat washer(s) and the snap ring to fasten the pivot pin for the boom cylinder.
10. Put the dipper in position on the boom.
11. Install the pivot pin for the dipper.
12. If there were shims installed between the hardened washer and the boom, install the shims. The correct thickness of shims will cause the ears of the boom to be pulled together 1 to 3 mm (1/16 to 1/8 inch) when the self-locking nut is tightened.
13. Install the hardened washer and the self-locking nut for the pivot pin. Tighten the self-locking nut to a torque of 678 to 949 Nm (500 to 700 pound-feet).
14. Fasten acceptable lifting equipment to the dipper cylinder. Move the dipper cylinder as necessary so that the rod eye is aligned with the hole in the dipper.
15. Install the pivot pin for the dipper cylinder.
16. Install the flat washer(s) and the snap ring to fasten the pivot pin for the dipper cylinder.
17. If the machine has an extendable dipper, connect the extension cylinder hoses at the connections inside the upper end of the boom.
18. For all machines except the 580M without extendable dipper, connect the bucket cylinder hoses at the connections inside the upper end of the boom. For 580M machines without extendable dipper, connect the bucket cylinder hoses at the bucket cylinder.
19. Use molydisulfide grease to lubricate all pivot pins.
20. Run the engine at 1000 rpm (r/min). Slowly operate the bucket, dipper, dipper extension (if equipped), and boom cylinders through four complete cycles to remove any air from the circuits.



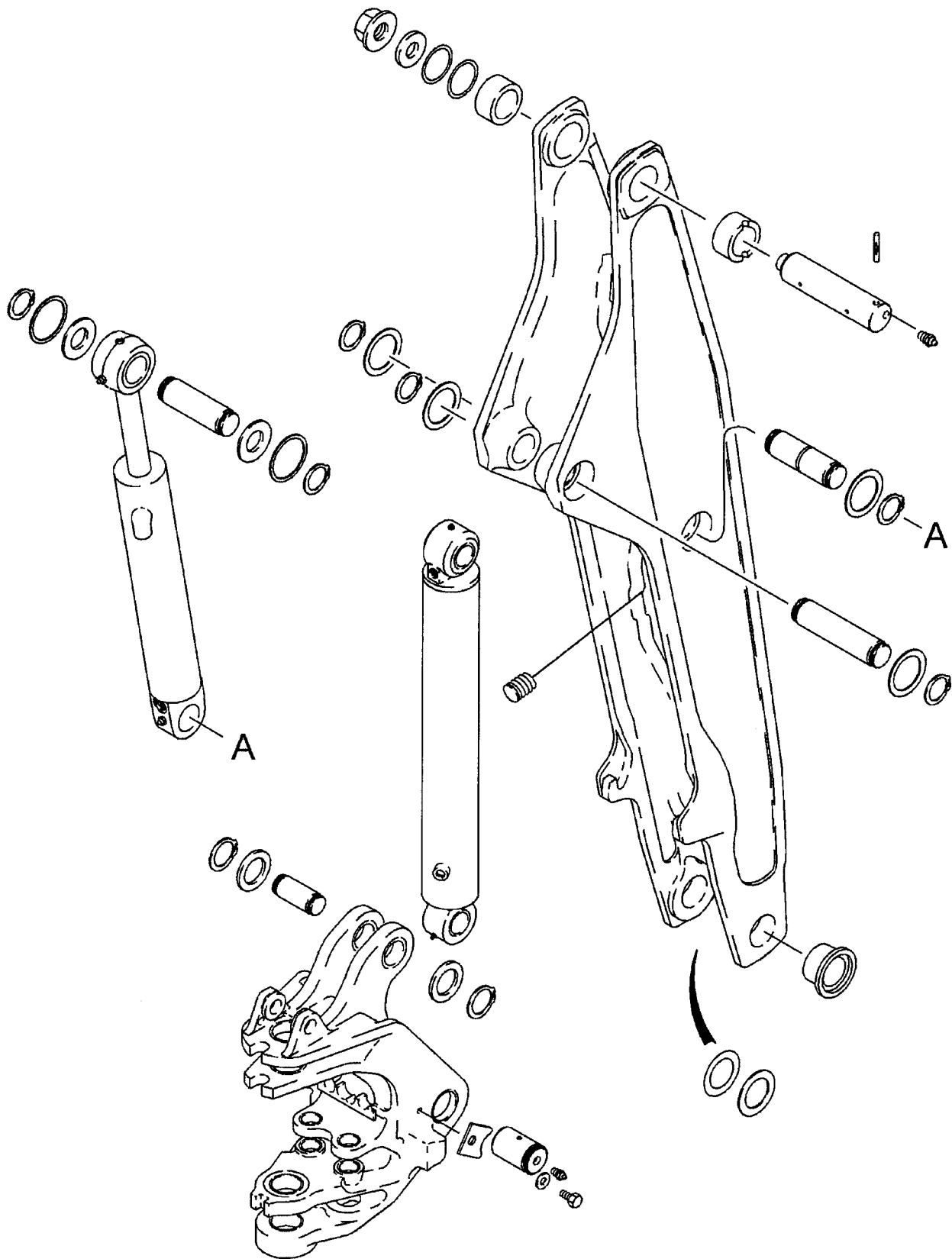
BOOM INSTALLATION - 580M

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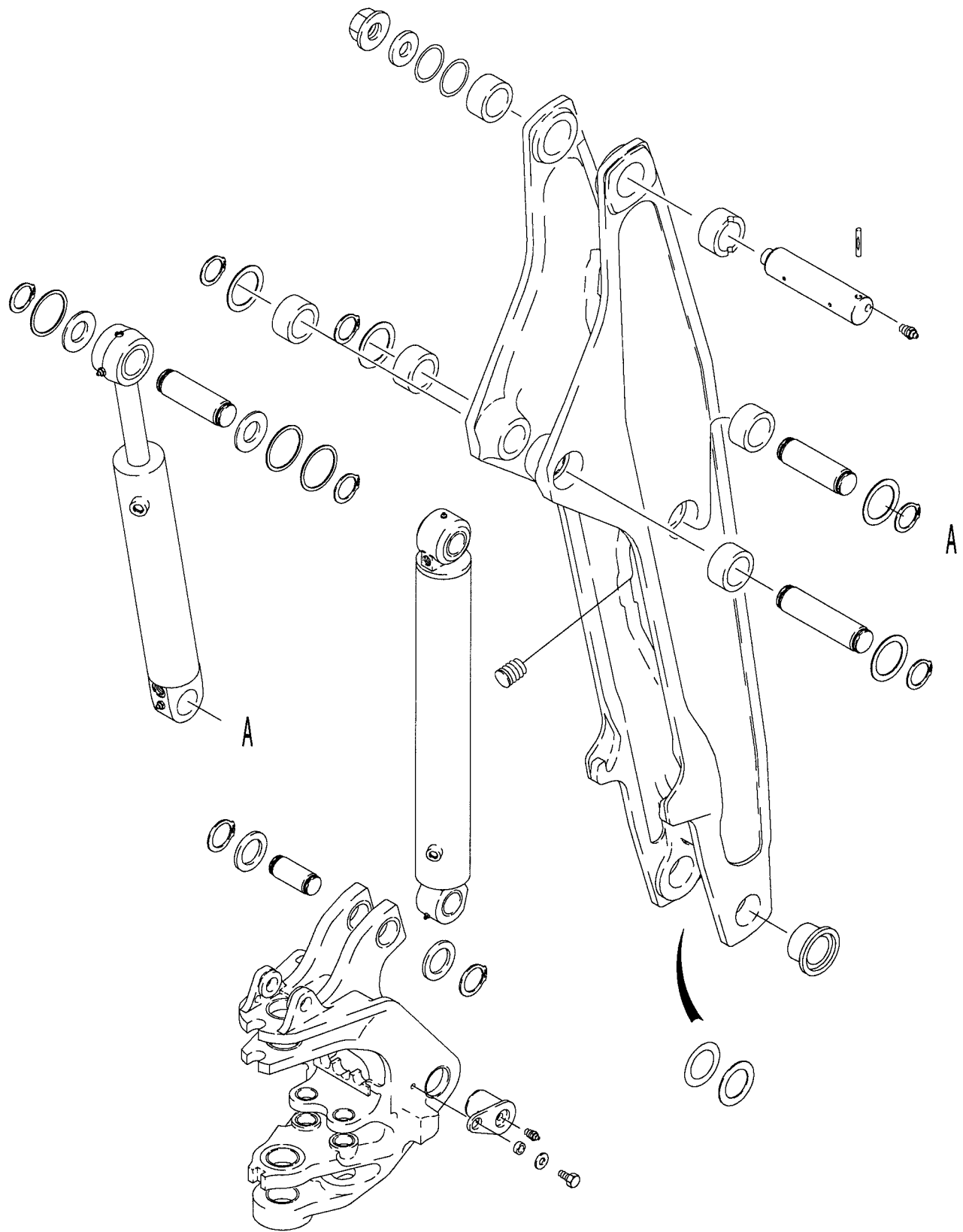
**BOOM CYLINDER HYDRAULIC INSTALLATION - 580M**

BT95M056



BOOM INSTALLATION - 580 SUPER M

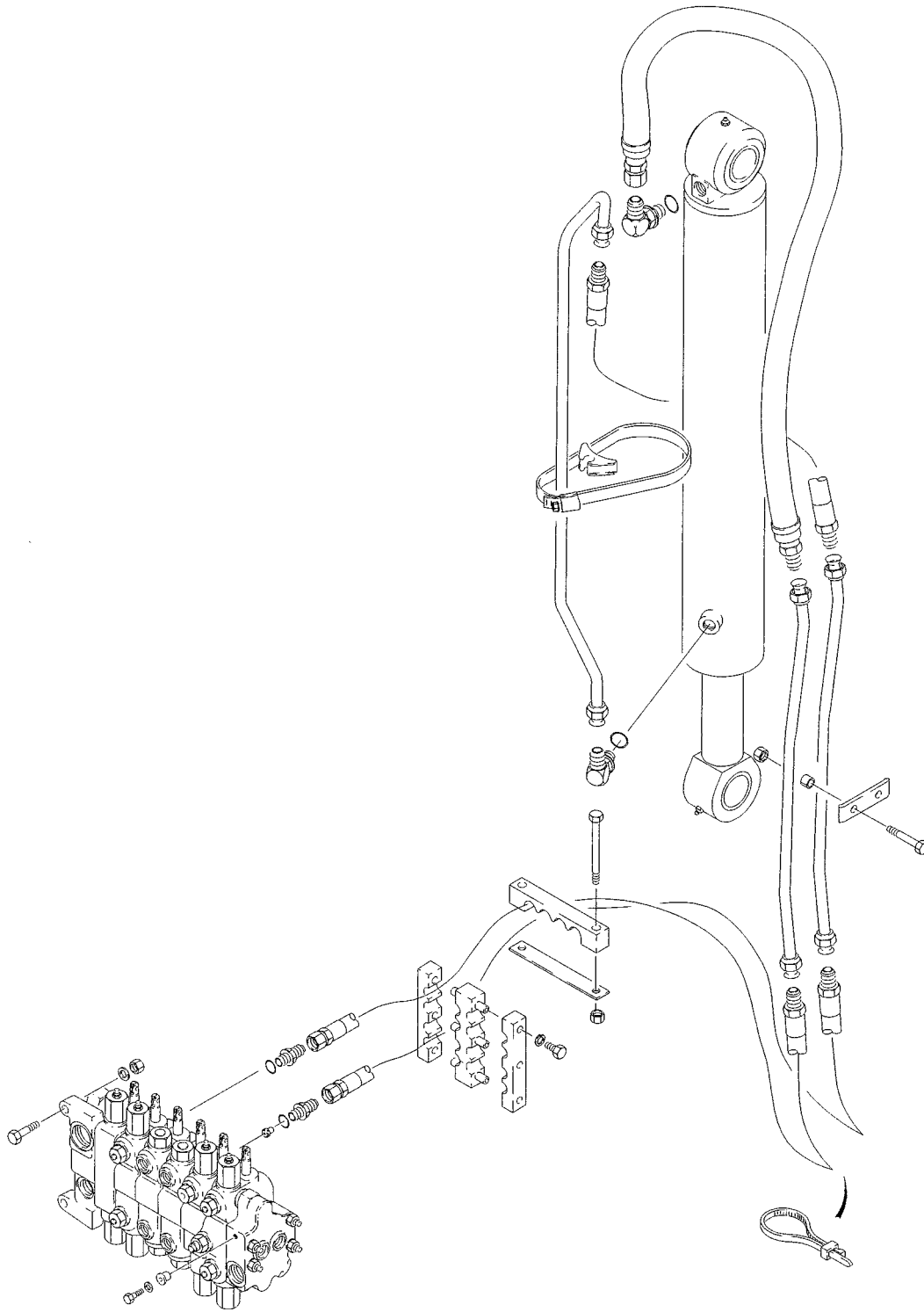
BS01B036



**BOOM INSTALLATION - 590 SUPER M**

BT95M055





**BOOM CYLINDER HYDRAULIC INSTALLATION - 580 SUPER M AND 590 SUPER M**

BT95M057

## DIPPER

### Removal

1. Start the engine and run the engine at 1000 rpm (r/min). Put the bucket in position so that the bucket teeth are just off the floor and below the pivot pin for the bucket. Stop the engine.
2. Remove the snap ring and the flat washer(s) from one end of the pivot pin for the bucket.
3. Remove the pivot pin for the bucket.
4. Start the engine and run the engine at 1000 rpm (r/min). Move the backhoe as necessary to disengage the coupler from the bucket. Move the bucket out of the way.
5. Retract the bucket cylinder. Put the boom and the dipper in an acceptable position for removal of the dipper.
6. Stop the engine. Move the extension control lever, if equipped, and the bucket control lever in both directions to relieve any pressure in the circuits.
7. For all machines except the 580M without extendable dipper, disconnect the bucket cylinder hoses at the connections inside the upper end of the boom. For 580M machines without extendable dipper, disconnect the bucket cylinder hoses at the bucket cylinder.
8. Install caps or plugs on all hoses and tubes.
9. If the machine has an extendable dipper, disconnect the extension cylinder hoses at the connections inside the upper end of the boom.
10. Install caps or plugs on all hoses and tubes.
11. Fasten acceptable lifting equipment to the dipper cylinder and to the boom or the dipper as necessary to hold these parts when the pivot pin is removed from the rod eye of the dipper cylinder.
12. Remove the snap ring and the flat washer(s) that hold the pivot pin for the rod eye of the dipper cylinder.
13. Drive the pivot pin out of the dipper.
14. Lower the dipper cylinder to the boom.
15. Adjust the lifting equipment, if necessary, so that the lifting equipment will hold the boom and the dipper when the pivot pin for the dipper is removed.

16. Remove the self-locking nut and the hardened washer that hold the pivot pin for the dipper.

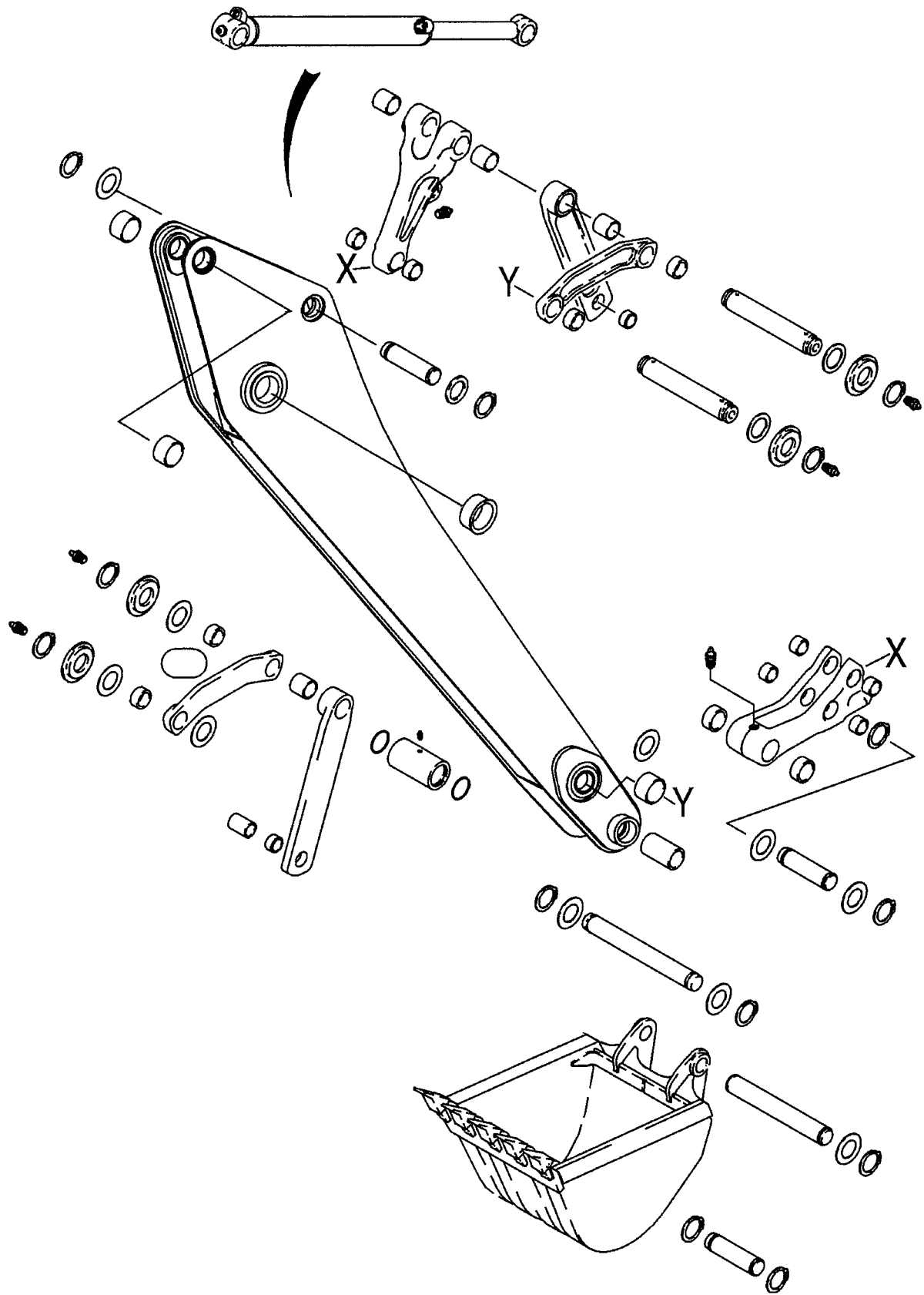
**NOTE:** *There may be one or more shims installed between the hardened washer and the boom. If so, record the number and the location of the shims so that they can be returned to the correct location during installation.*

17. Drive the pivot pin out of the boom.
18. Remove the dipper.

### Installation

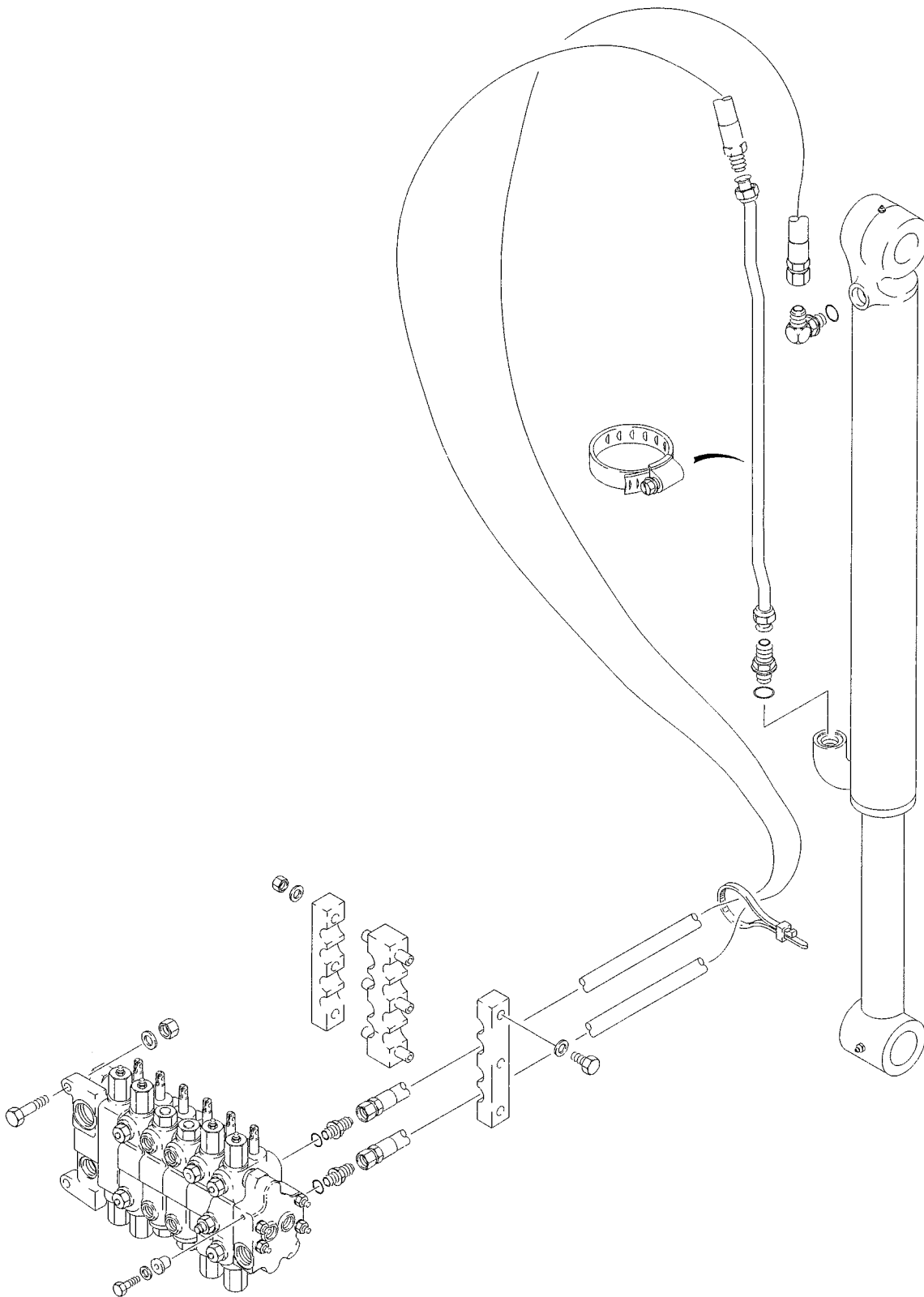
1. Put the dipper in position on the boom.
2. Install the pivot pin for the dipper.
3. If there were shims installed between the hardened washer and the boom, install the shims. The correct thickness of shims will cause the ears of the boom to be pulled together 1 to 3 mm (1 /16 to 1/8 inch) when the self-locking nut is tightened.
4. Install the hardened washer and the self-locking nut for the pivot pin. Tighten the self-locking nut to a torque of 678 to 949 Nm (500 to 700 poundfeet).
5. Fasten acceptable lifting equipment to the dipper cylinder. Move the dipper cylinder as necessary so that the rod eye is aligned with the hole in the dipper.
6. Install the pivot pin for the dipper cylinder.
7. Install the flat washer(s) and the snap ring to fasten the pivot pin for the dipper cylinder.
8. If the machine has an extendable dipper, connect the extension cylinder hoses at the connections inside the upper end of the boom.
9. For all machines except the 580M without extendable dipper, connect the bucket cylinder hoses at the connections inside the upper end of the boom. For 580M machines without extendable dipper, connect the bucket cylinder hoses at the bucket cylinder.
10. Put the bucket into position. Start the engine and run the engine at 1000 rpm (r/min). Move the backhoe as necessary to engage the bucket with the coupler. Then move the bucket as necessary so that the pivot pin can be installed. Stop the engine.
11. Install the pivot pin for the bucket.

12. Install the flat washer(s) and the snap ring to fasten the pivot pin.
13. Use molydisulfide grease to lubricate all pivot pins.
14. Run the engine at 1000 rpm (r/min). Slowly operate the bucket, dipper, dipper extension (if equipped), and boom cylinders through four complete cycles to remove any air from the circuits.



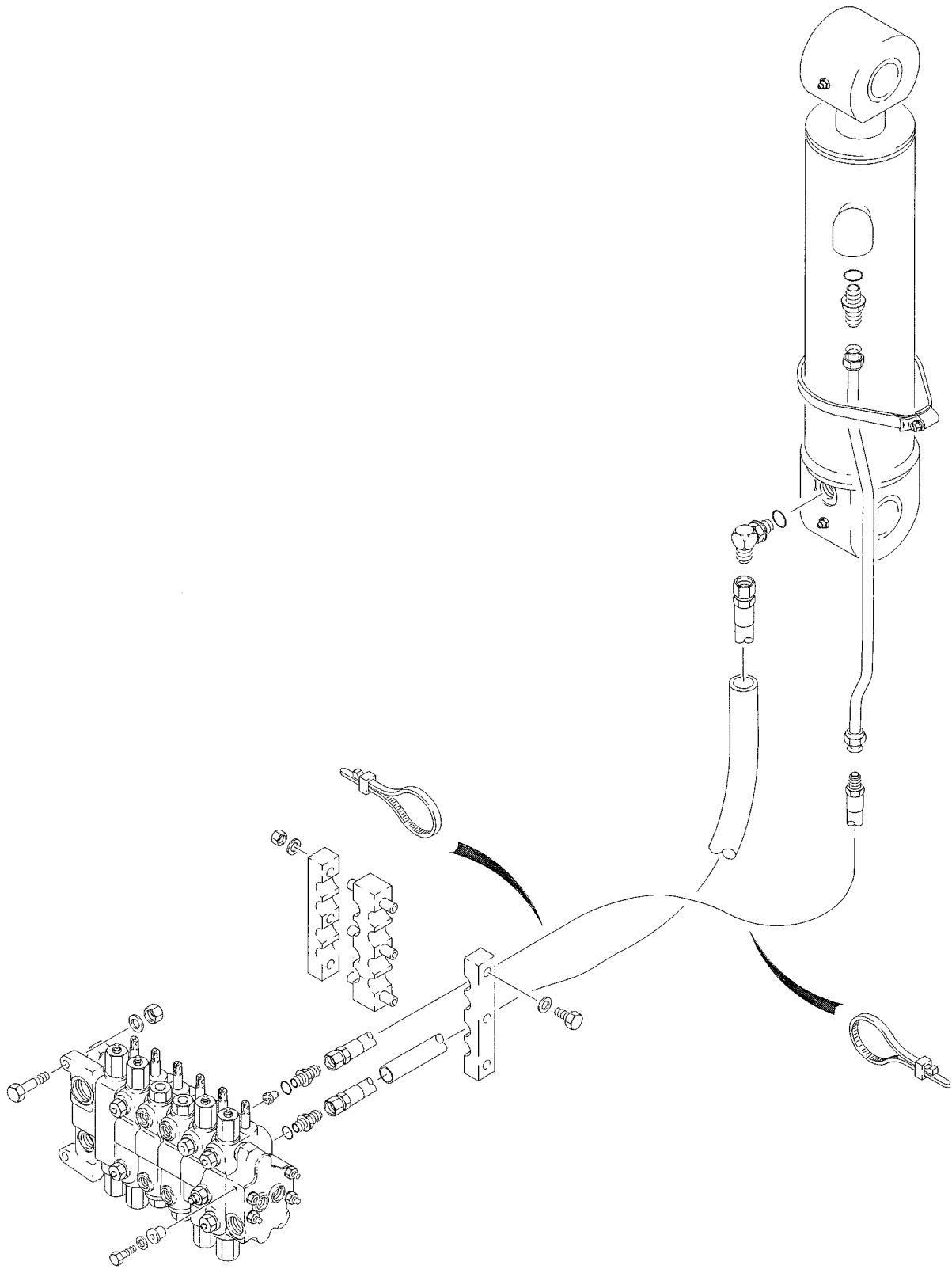
DIPPER AND BUCKET INSTALLATION - 580M

BC01B037



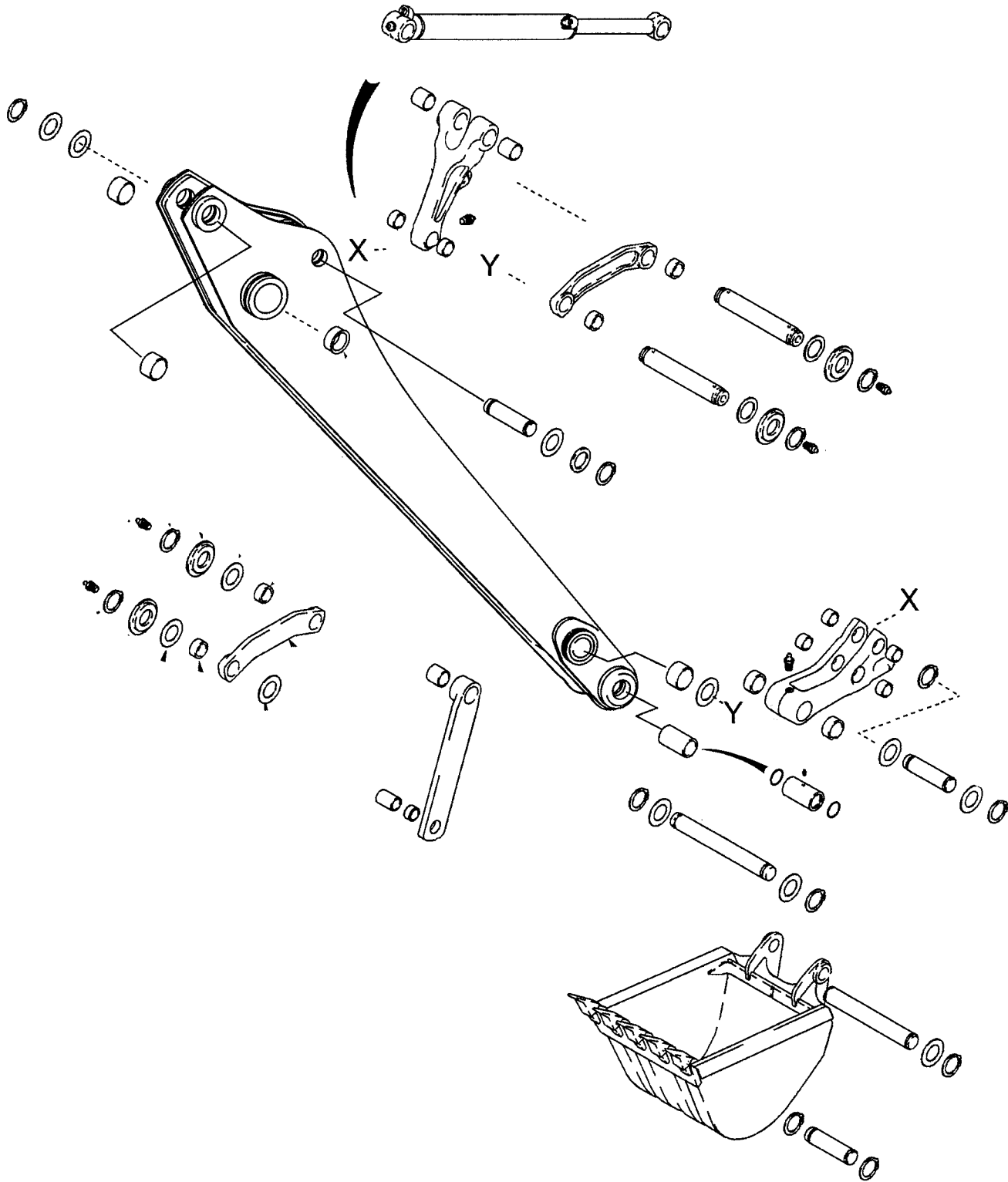
**BUCKET CYLINDER HYDRAULIC INSTALLATION WITHOUT EXTENDABLE DIPPER - 580M**

BT95M064



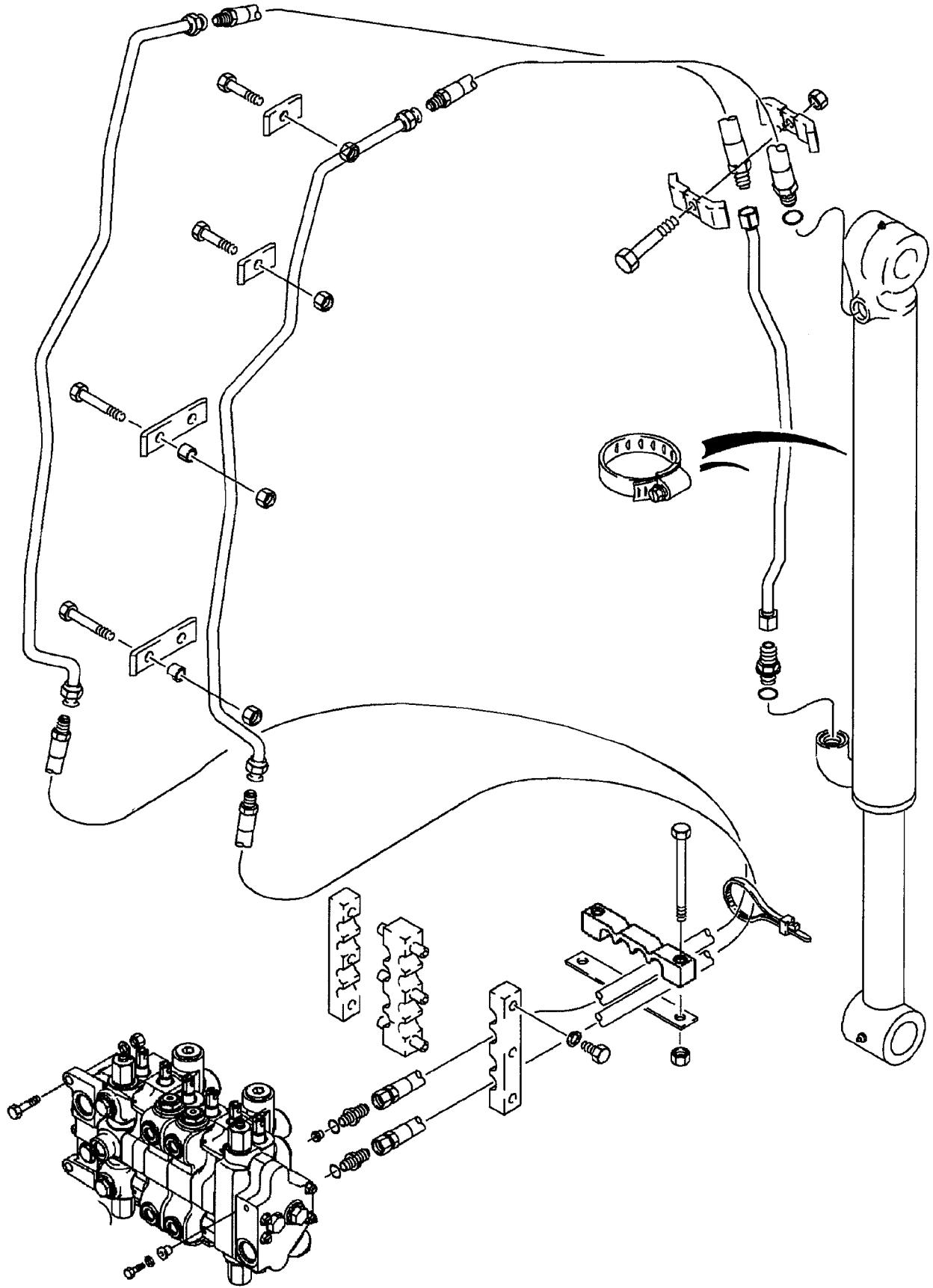
**DIPPER CYLINDER HYDRAULIC INSTALLATION - 580M**

BT95M061



DIPPER AND BUCKET INSTALLATION - 580 SUPER M

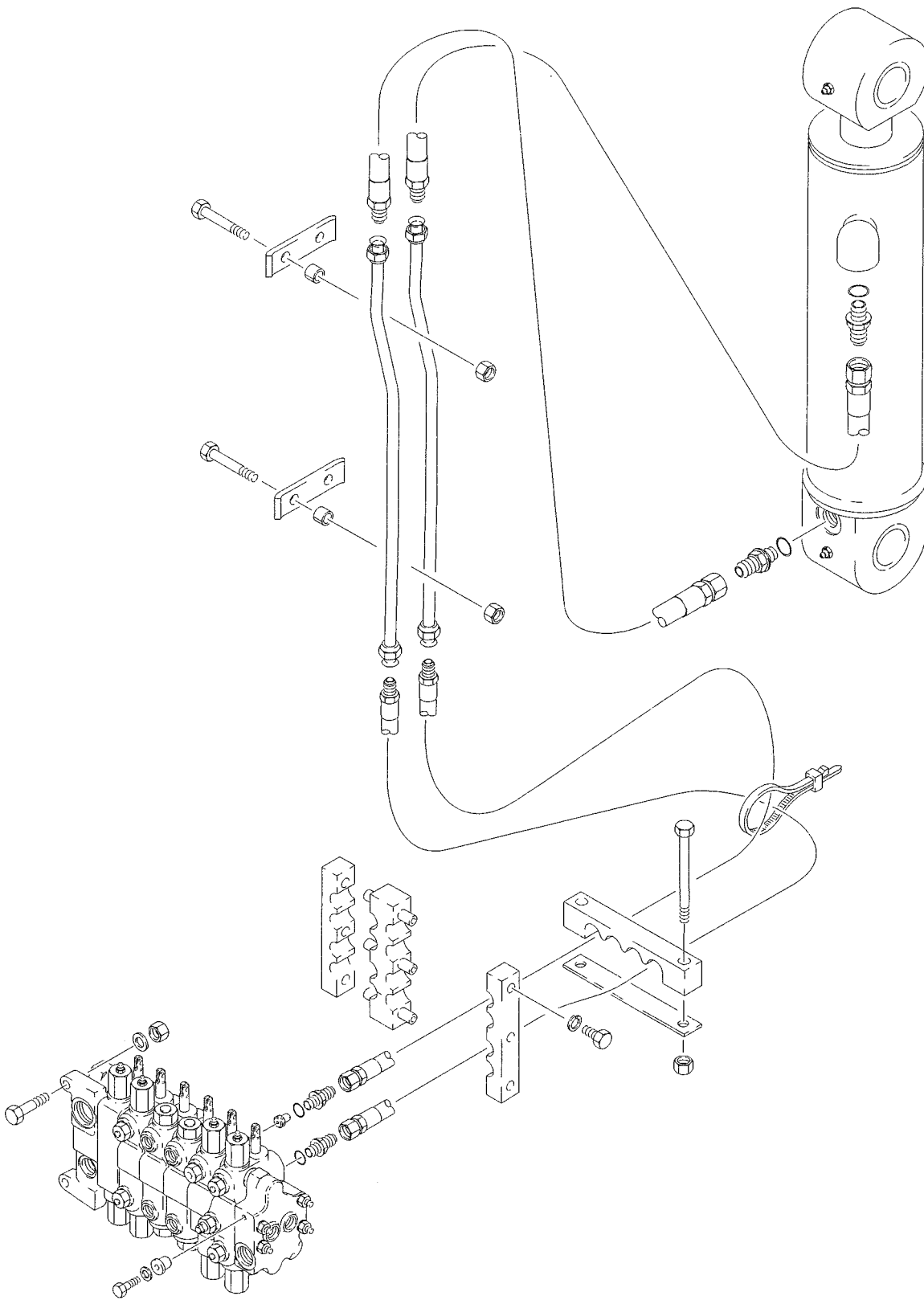
BS01B038



BUCKET CYLINDER HYDRAULIC INSTALLATION WITHOUT EXTENDABLE DIPPER - 580 SUPER M

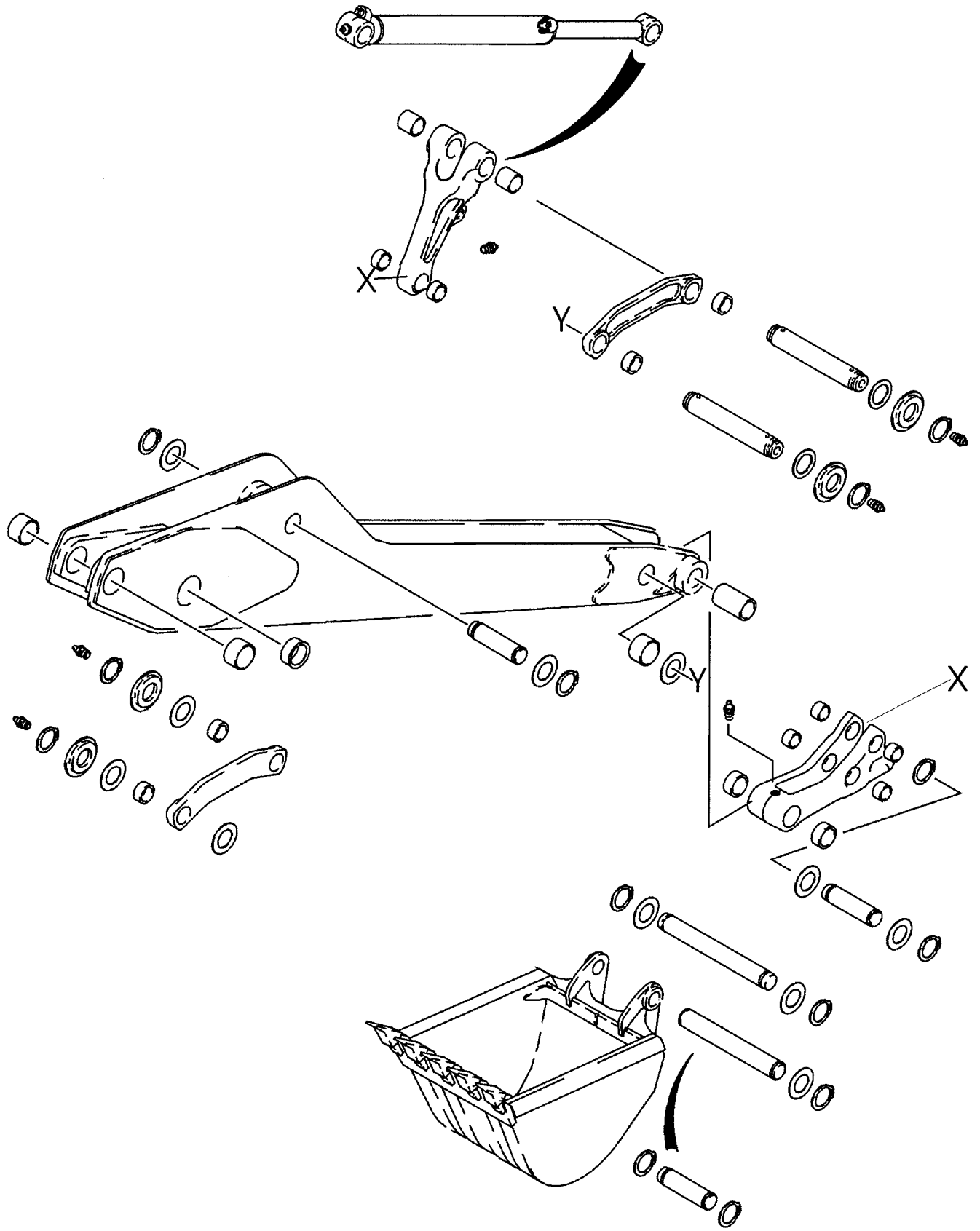
BS01B040





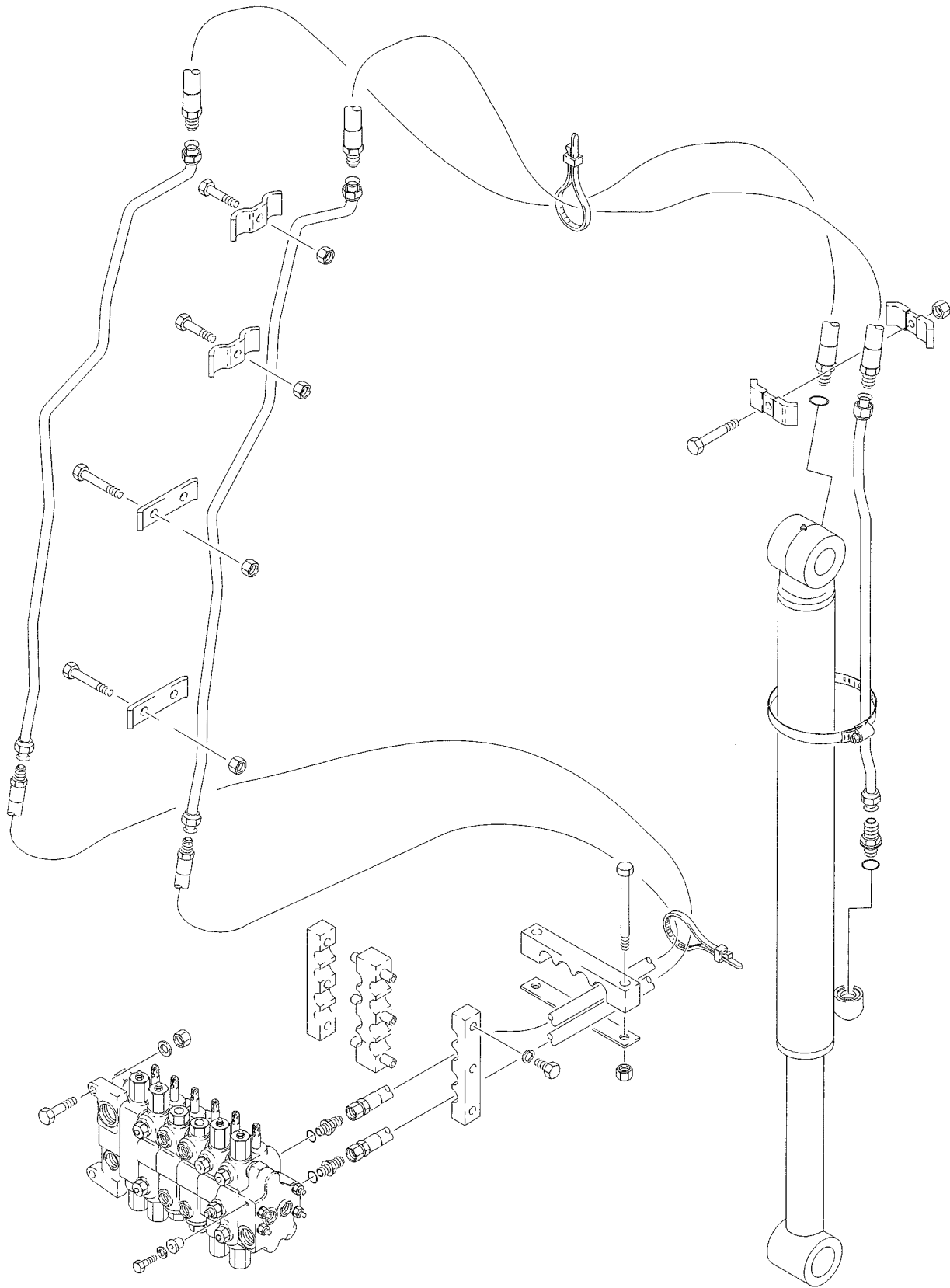
DIPPER CYLINDER HYDRAULIC INSTALLATION - 580 SUPER M

BT95M062



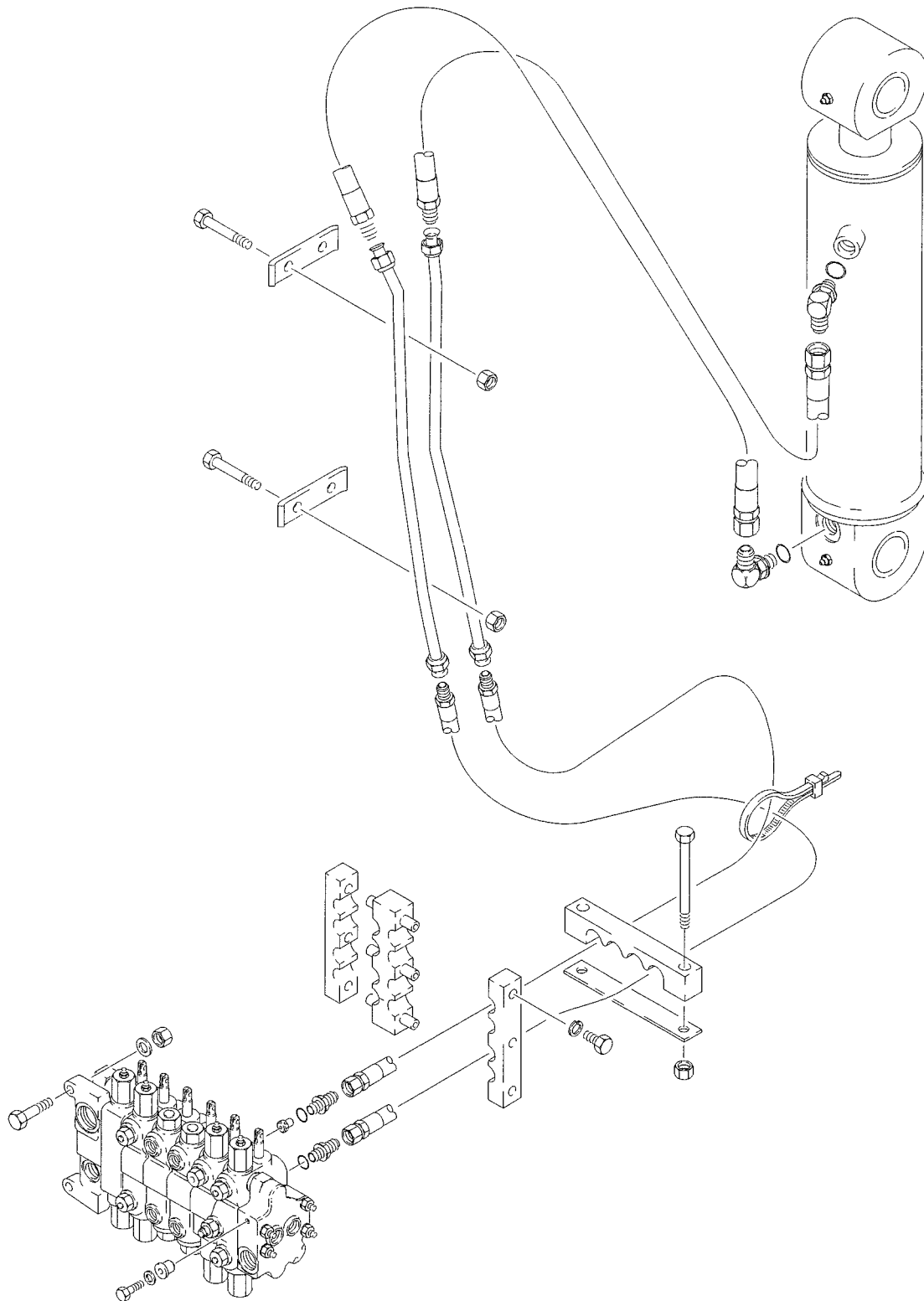
DIPPER AND BUCKET INSTALLATION - 590 SUPER M

BC01B039



**BUCKET CYLINDER HYDRAULIC INSTALLATION WITHOUT EXTENDABLE DIPPER - 590 SUPER M**

BT95M066



**DIPPER CYLINDER HYDRAULIC INSTALLATION - 590 SUPER M**

BT95M063

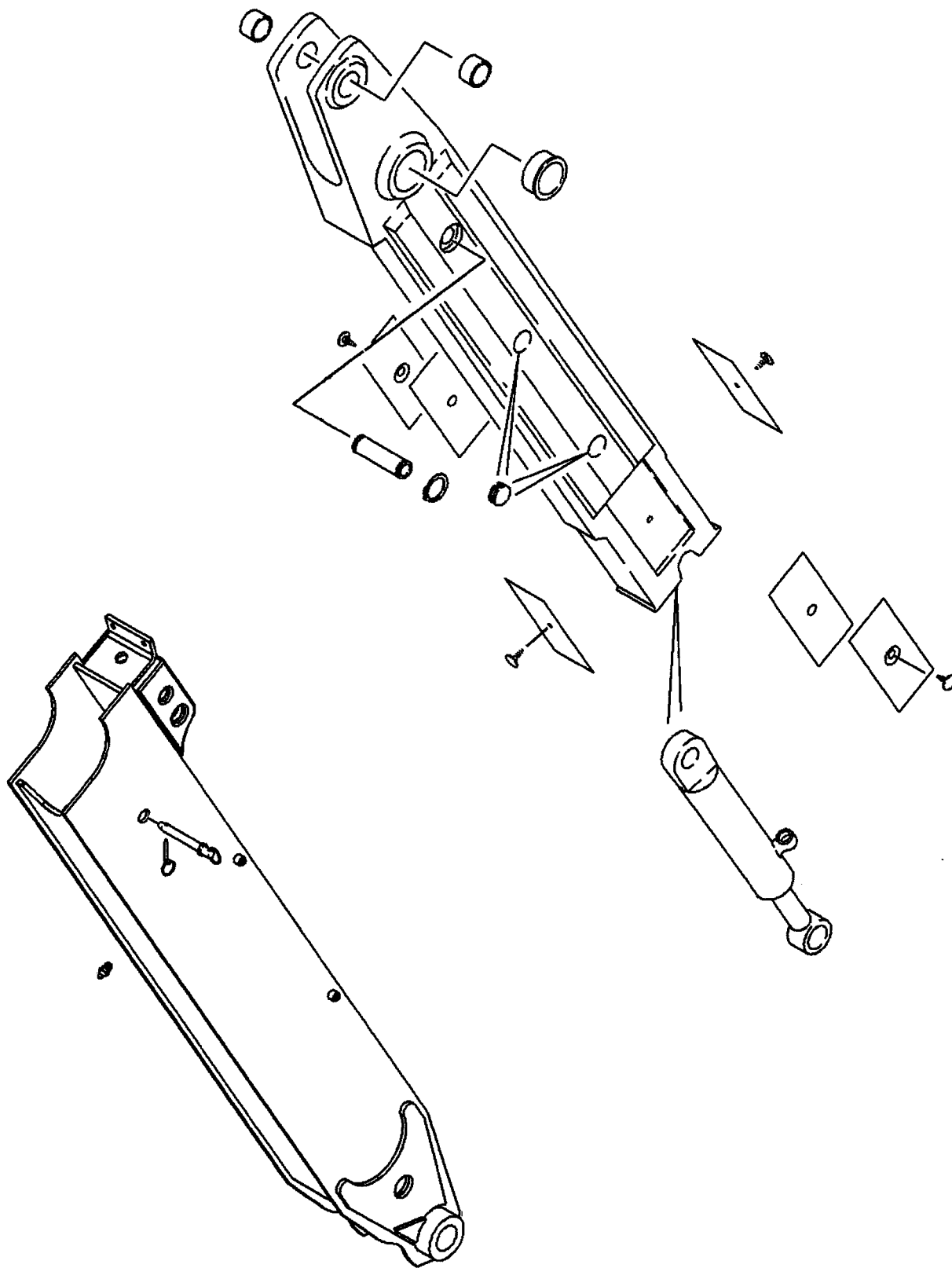
## DIPPER EXTENSION

### Removal

1. Start the engine and run the engine at 1000 rpm (r/min). Put the bucket in position so that the bucket teeth are just off the floor and below the pivot pin for the bucket. Stop the engine.
2. Remove the snap ring and the flat washer(s) from one end of the pivot pin for the bucket.
3. Remove the pivot pin for the bucket.
4. Start the engine and run the engine at 1000 rpm (r/min). Move the backhoe as necessary to disengage the coupler from the bucket. Move the bucket out of the way.
5. Completely extend the dipper and raise or lower the boom so that the end of the dipper is approximately three feet (one meter) above the floor.
6. Retract the bucket cylinder. Stop the engine.
7. Put a block under the bucket cylinder to hold the bucket cylinder when the pivot pin is removed from the bottom ends of the guide links.
8. Disconnect the bucket cylinder hoses at the connections inside the upper end of the boom.
9. Remove the snap ring, the washer(s), and the spacer(s) from one end of the pivot pin for the bottom ends of the guide links. Drive the pivot pin out of the guide links and the dipper extension. Record the number and locations of any washers or spacers on the pivot pin so that these parts can be returned to the correct locations during installation.
10. Install acceptable lifting equipment to hold the dipper extension when the dipper extension is removed from the dipper.
11. Insert a bar through the hole for the pivot pin for the bucket. Use the bar to pull the dipper extension from the dipper.
3. Install the snap ring on the pivot pin.
4. Connect the bucket cylinder hoses at the connections inside the upper end of the boom.
5. Remove the block from under the bucket cylinder.
6. Put the bucket into position. Start the engine and run the engine at 1000 rpm (r/min). Move the backhoe as necessary to engage the bucket with the coupler. Then move the bucket as necessary so that the pivot pin can be installed. Stop the engine.
7. Install the pivot pin for the bucket.
8. Install the flat washer(s) and the snap ring to fasten the pivot pin.
9. Use molydisulfide grease to lubricate all pivot pins.
10. Run the engine at 1000 rpm (r/min). Slowly operate the bucket, dipper, dipper extension, and boom cylinders through four complete cycles to remove any air from the circuits.

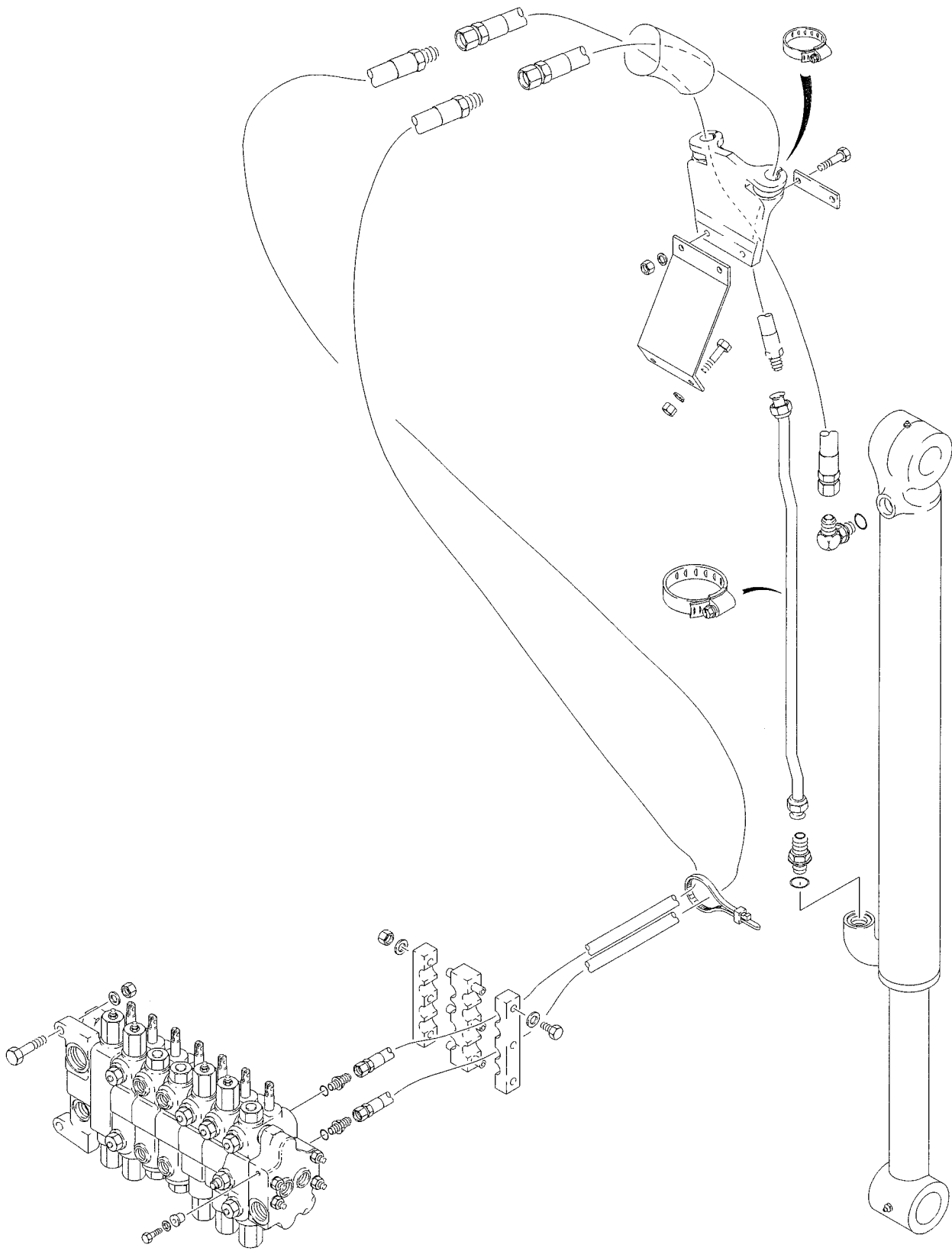
### Installation

1. Put the dipper extension into position on the dipper. Push the dipper extension onto the dipper until the rod eye of the extension cylinder is aligned with the hole for the pivot pin for the bottom ends of the guide links.
2. Put the guide links into position and install the pivot pin through the guide links, the dipper extension, and the rod eye. Make sure that the washer(s) and spacer(s) which were removed are installed in the correct locations.



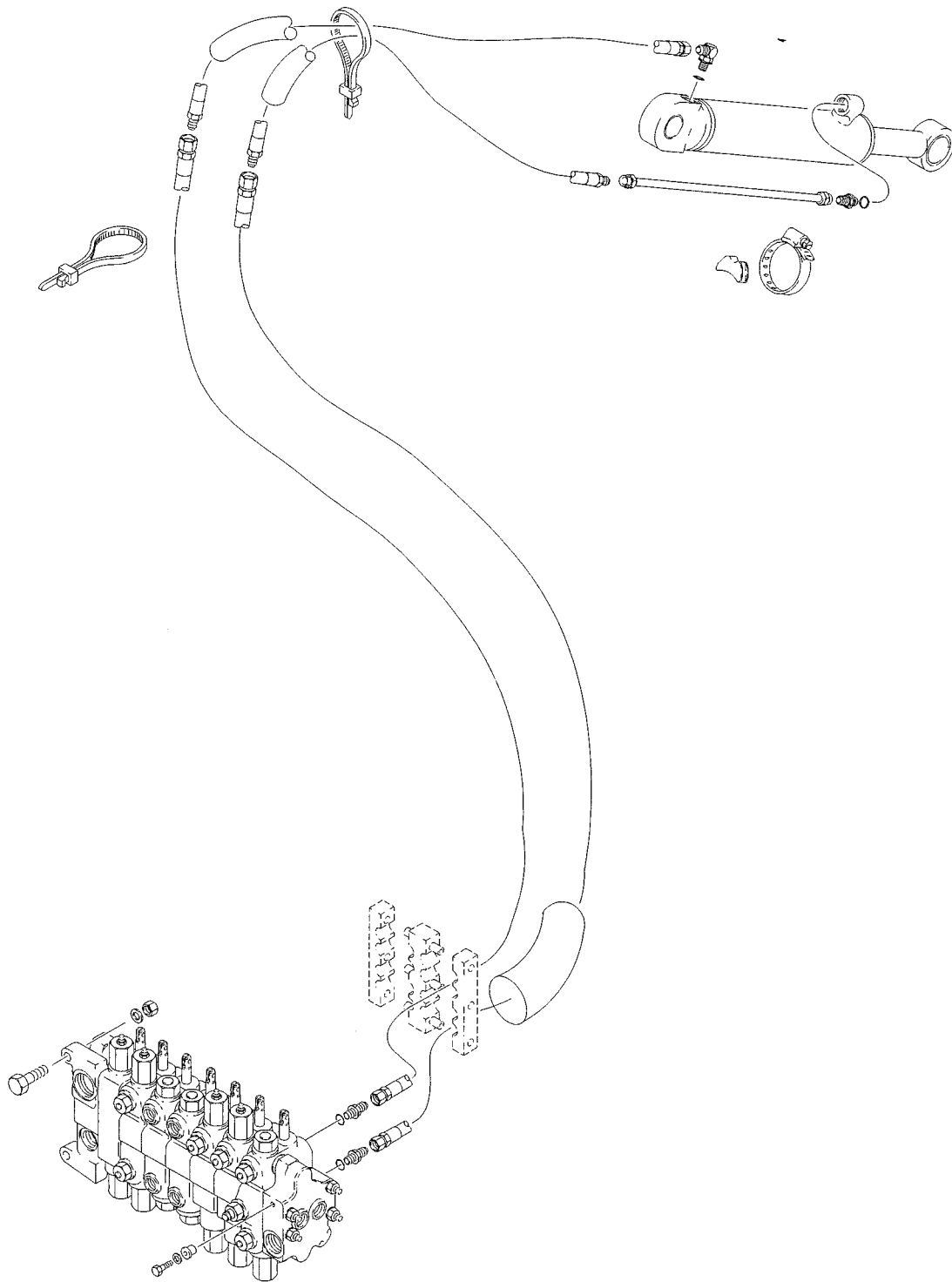
EXTENDABLE DIPPER INSTALLATION - 580M

BS01B041



**BUCKET CYLINDER HYDRAULIC INSTALLATION WITH EXTENDABLE DIPPER - 580M**

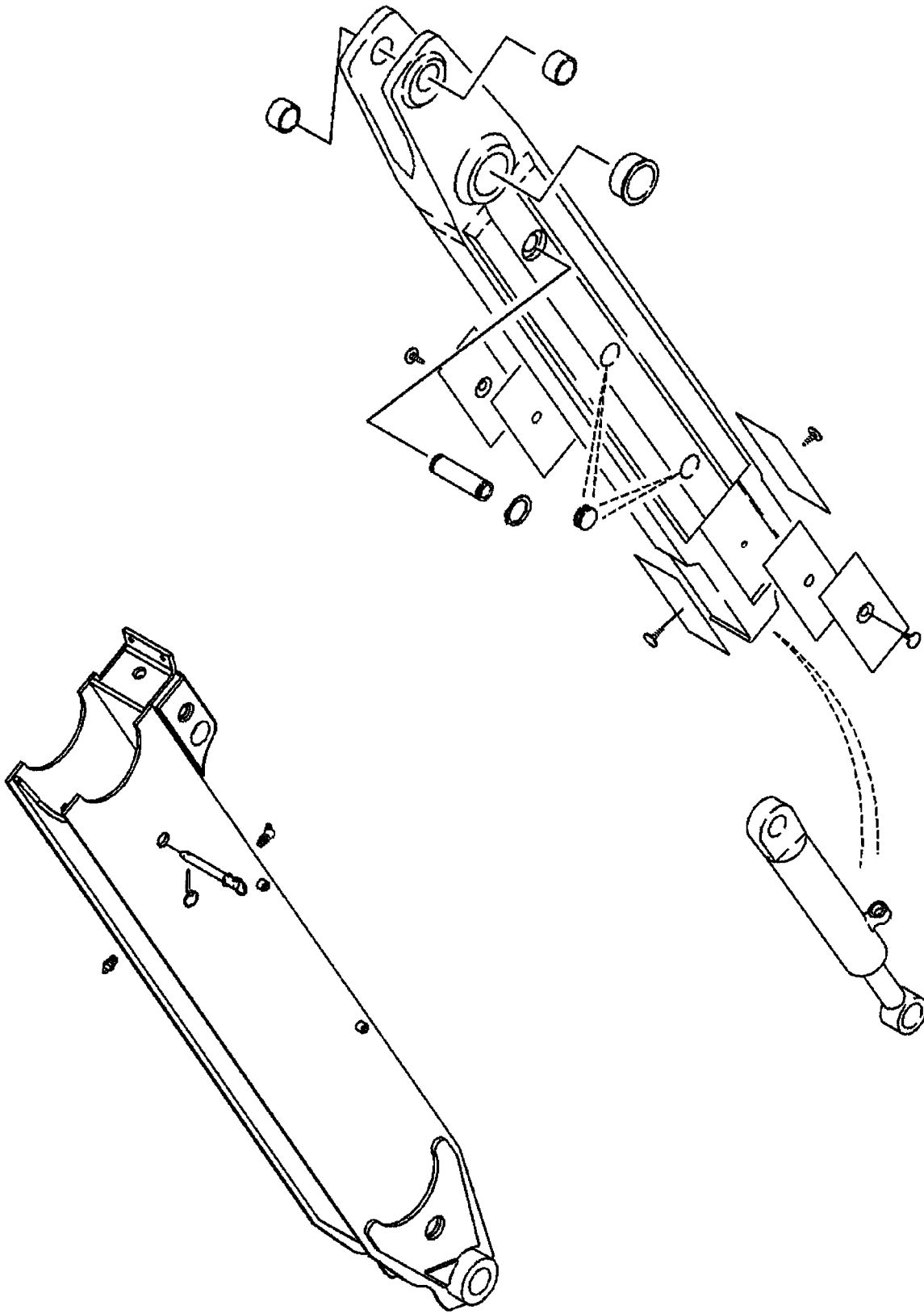
BT95M070



**EXTENSION CYLINDER HYDRAULIC INSTALLATION - 580M**

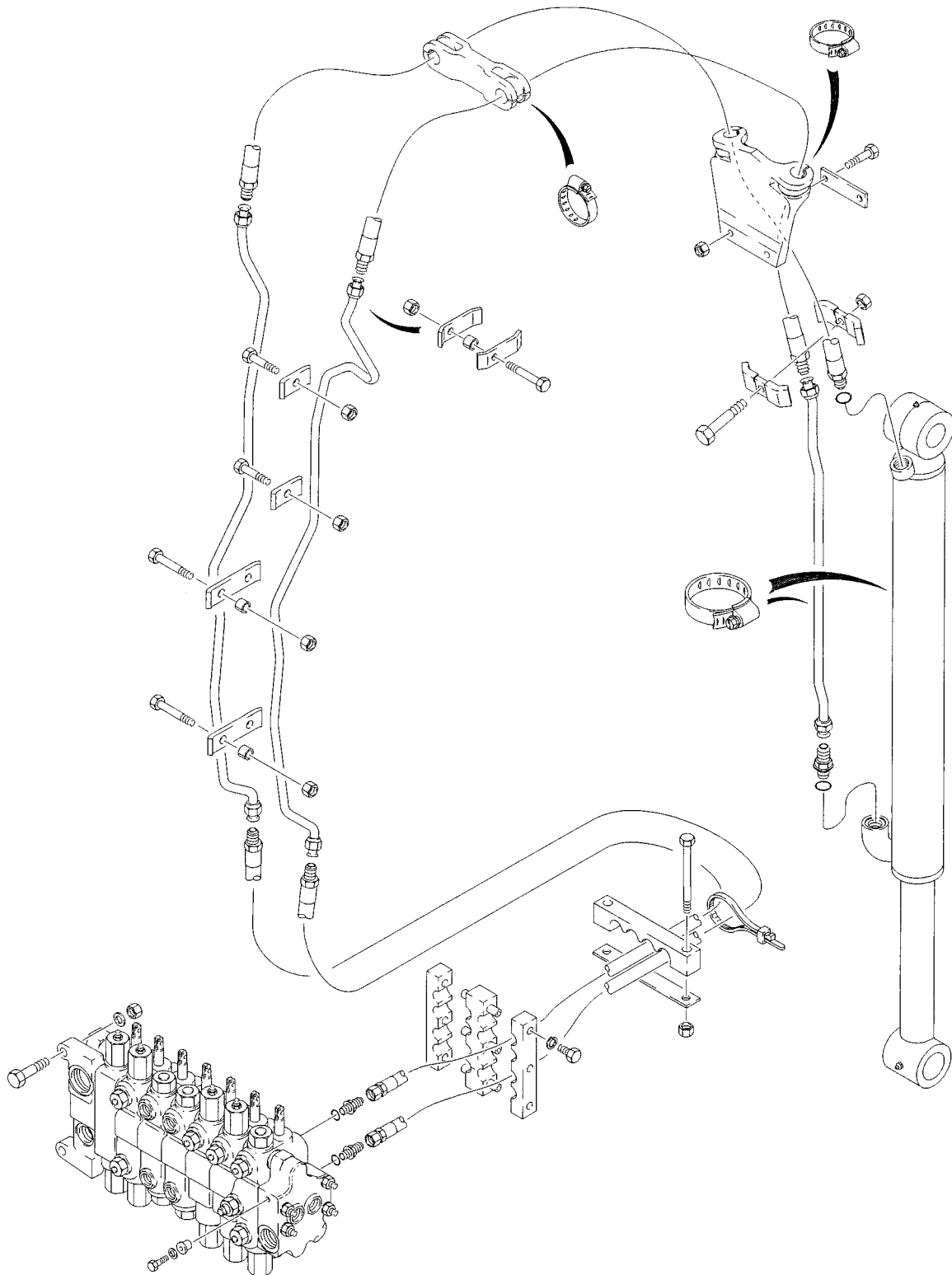
BT95M073





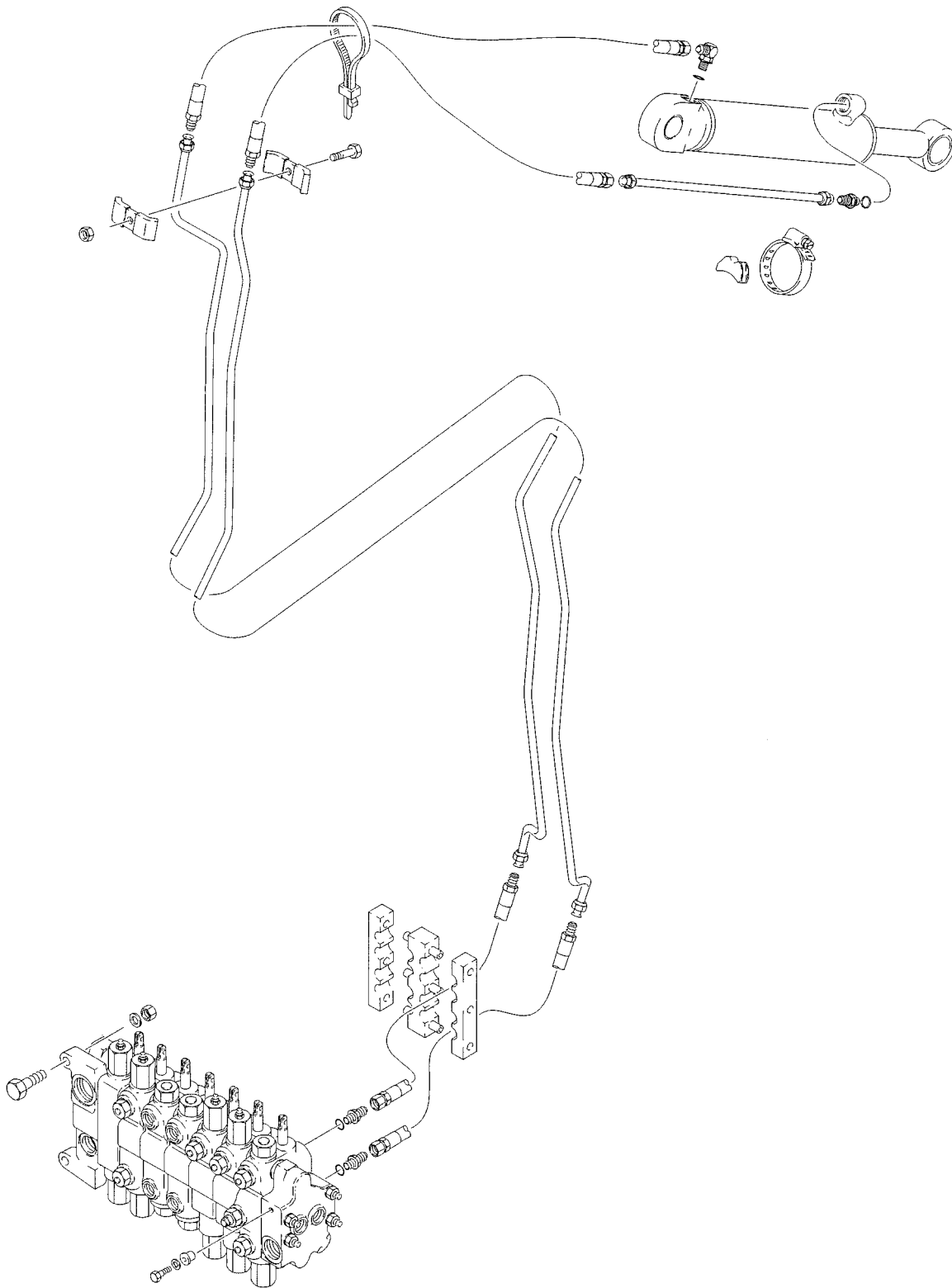
**EXTENDABLE DIPPER INSTALLATION - 580 SUPER M**

BS01B042



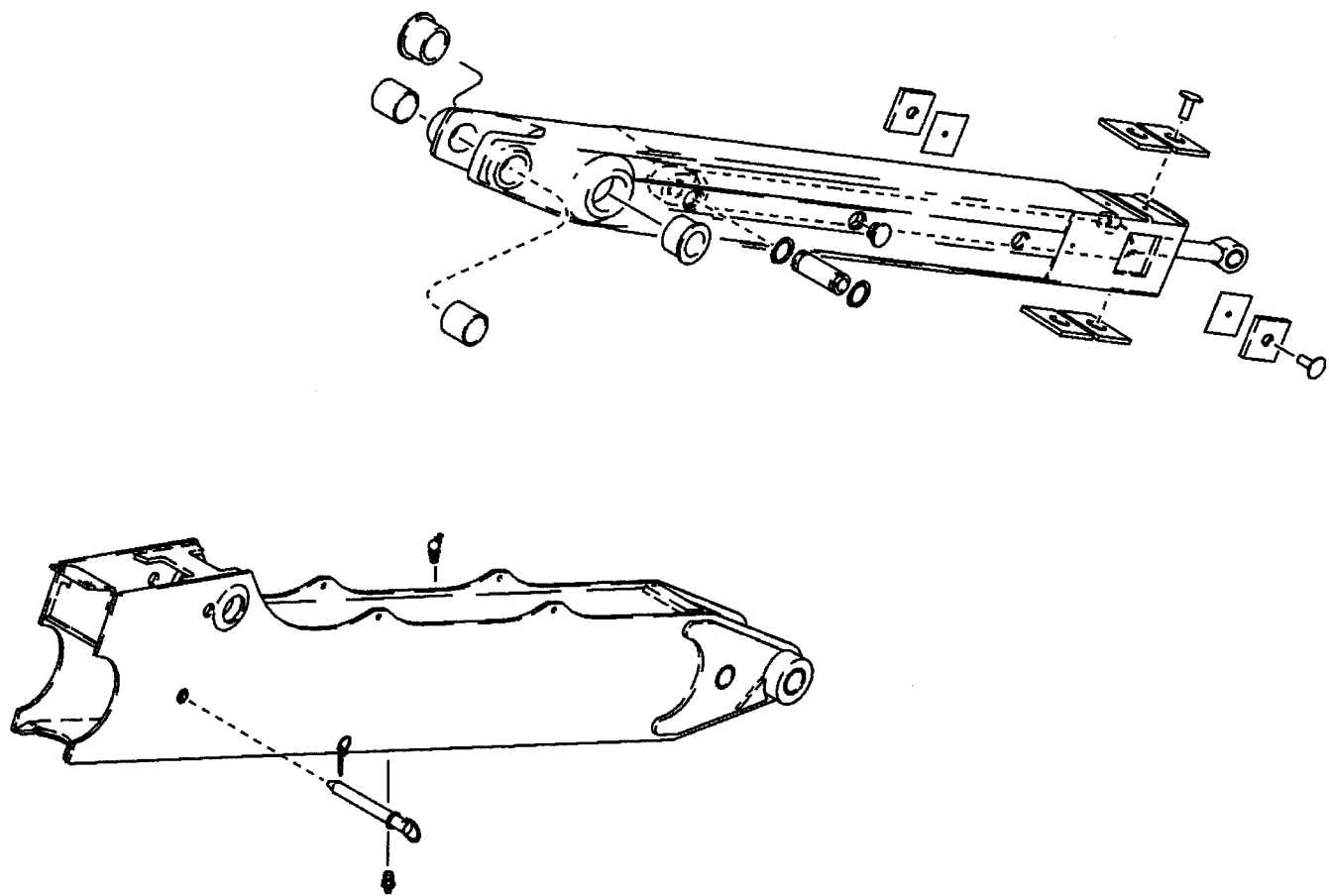
**BUCKET CYLINDER HYDRAULIC INSTALLATION WITH EXTENDABLE DIPPER - 580 SUPER M**

BT95M071



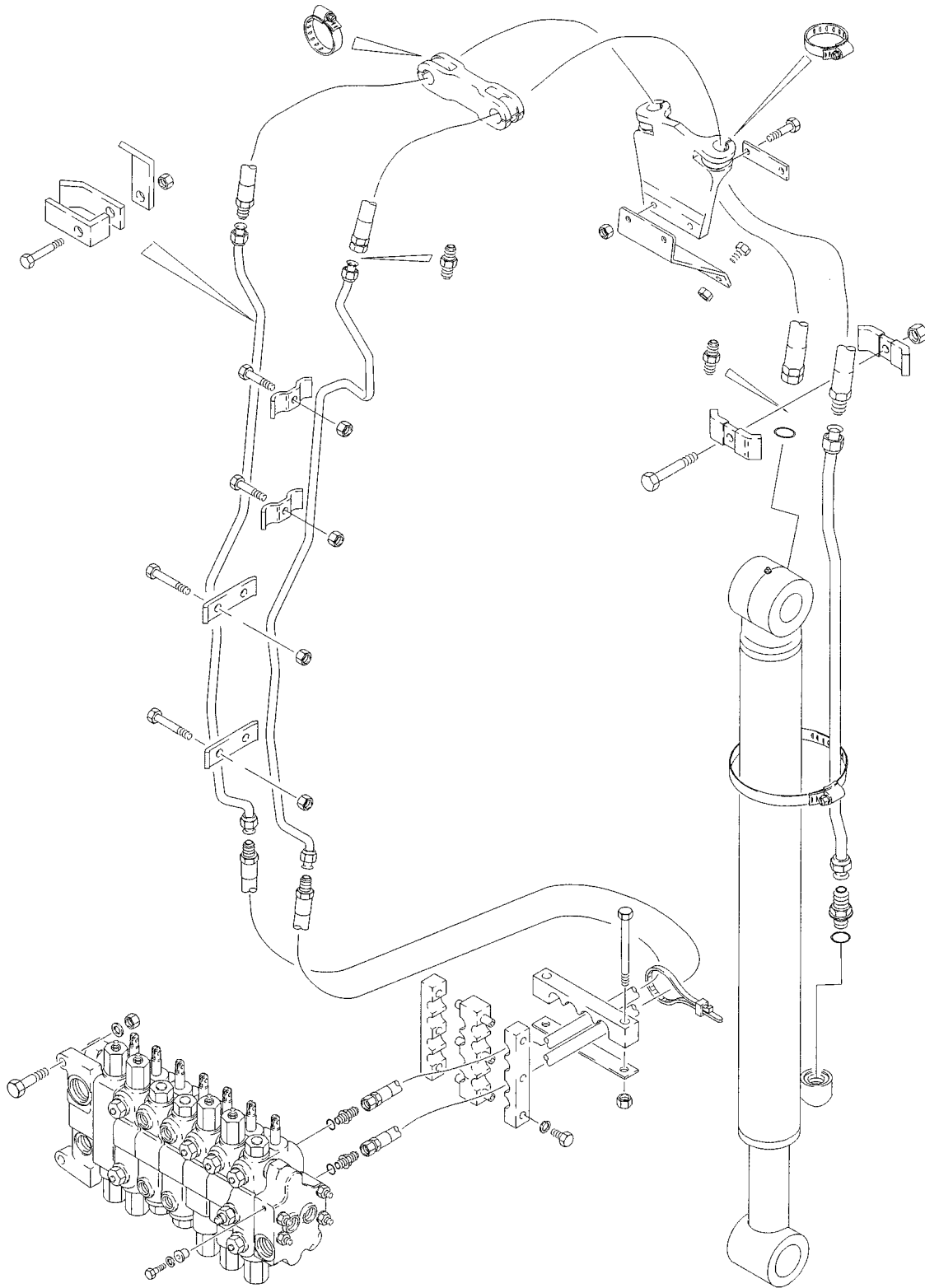
**EXTENSION CYLINDER HYDRAULIC INSTALLATION - 580 SUPER M**

BT95M074



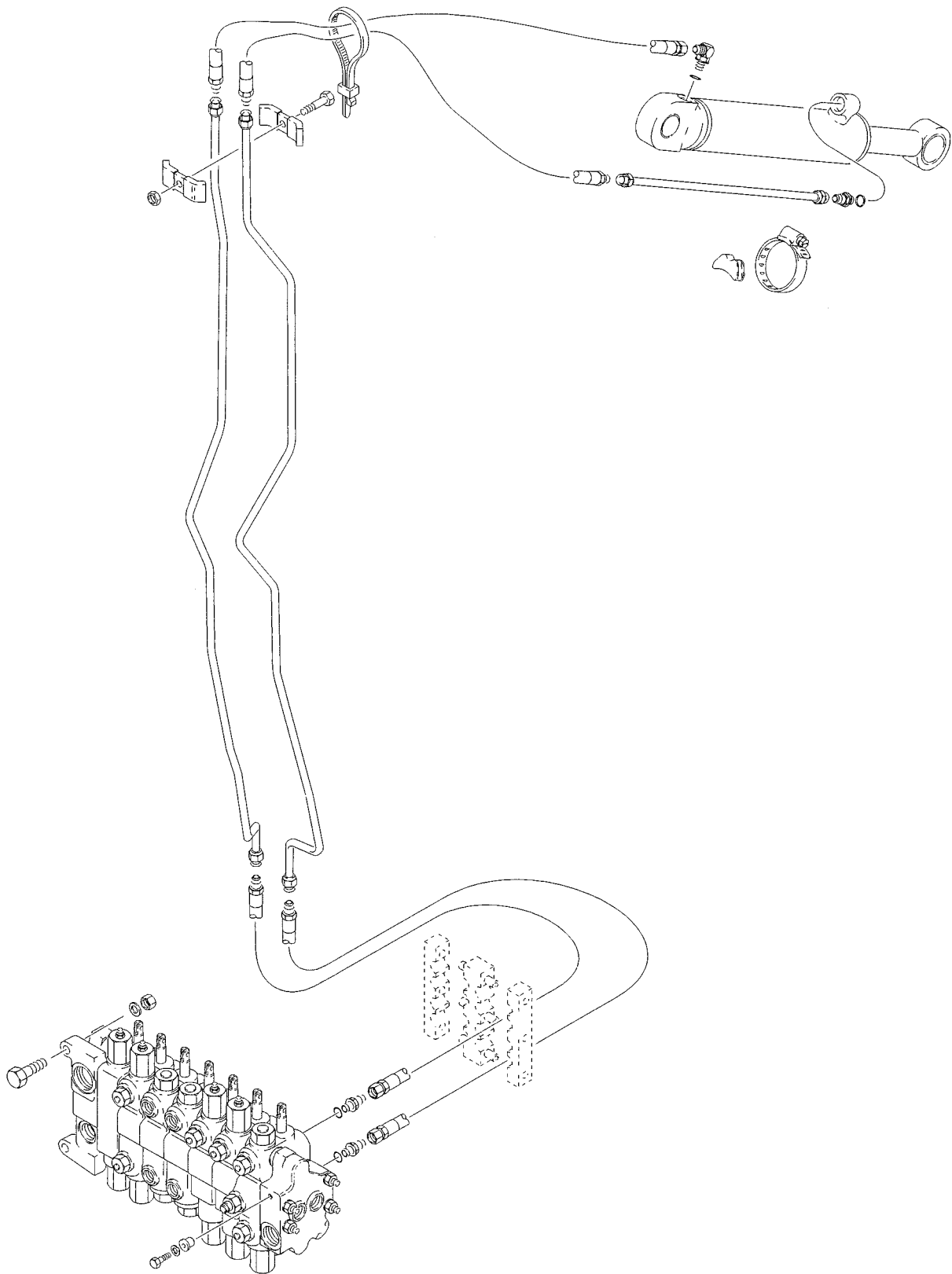
**EXTENDABLE DIPPER INSTALLATION - 590 SUPER M**

BC01B043



**BUCKET CYLINDER HYDRAULIC INSTALLATION WITH EXTENDABLE DIPPER - 590 SUPER M**

BT95M072



**EXTENSION CYLINDER HYDRAULIC INSTALLATION - 590 SUPER M**

BT95M075

## 580M WEAR PLATES FOR THE EXTENDABLE DIPPER

### Replacing

1. Remove the dipper extension according to the instructions in this section.
2. On 580M machines only, plastic pins are used to hold the wear plates and the shims in position during assembly. Usually, these pins wear away during operation. Remove any remaining plastic pins. Then remove the wear plates and the shims.
3. Remove the grease from the sides and the bottom of the dipper and from the inside of the dipper extension.
4. Select shims for the side wear plates so that the total distance from one wear surface to the other is 5.75 to 5.79 inches (146 to 147 mm). The wear surface of each side wear plate must be even with or up to 0.030 inch (0.8 mm) beyond the rails on the dipper.
5. Use new plastic pins to install the side wear plates and shims.
6. Use new plastic pins to install the top and bottom wear plates.
7. Apply molydisulfide grease to the rails on the dipper.
8. Install the dipper extension according to the instructions in this section.

## 580 SM AND 590 SM WEAR PLATES FOR THE EXTENDABLE DIPPER

### Replacing

1. Remove the dipper extension according to the instructions in this section.
  2. Remove the bolts, the washers, the wear plates, and the shims.
  3. Remove the grease from the sides and the bottom of the dipper and from the inside of the dipper extension.
  4. Select shims for the side wear plates so that the total distance from one wear surface to the other is 146 to 147 mm (5.75 to 5.79 inches). The wear surface of each wear plate must be even with or up to 0.8 mm (0.030 inch) beyond the rails on the dipper.
  5. Install the shim(s), the side wear plates, the stepped washers, and the bolts.
- NOTE:** *On 590 Super M machines only, 9.5 mm (318 inch) flat washers are used in addition to the stepped washers. Use a 9.5 mm (318 inch) flat washer ONLY when there is no more than one shim installed under that side wear plate.*
6. Tighten the bolts to a torque of 52 to 57 pound-feet (70.5 to 77.3 Nm).
  7. Select shims for the top and bottom wear plates so that the total distance from one wear surface to the other is 234 to 235 mm (9.21 to 9.25 inches). The wear surface of each wear plate must be even with or up to 0.8 mm (0.030 inch) beyond the rails on the dipper.
  8. Install the shim(s), the side wear plates, the stepped washers, and the bolts.
- NOTE:** *On 590 Super M machines only, 9.5 mm (318 inch) flat washers are used in addition to the stepped washers. Use a 9.5 mm (318 inch) flat washer ONLY when there are no more than three shims installed under that top or bottom wear plate.*
9. Tighten the cap screws to a torque of 70.5 to 77.3 Nm (52 to 57 pound-feet).
  10. Apply molydisulfide grease to the rails on the dipper.
  11. Install the dipper extension according to the instructions in this section.

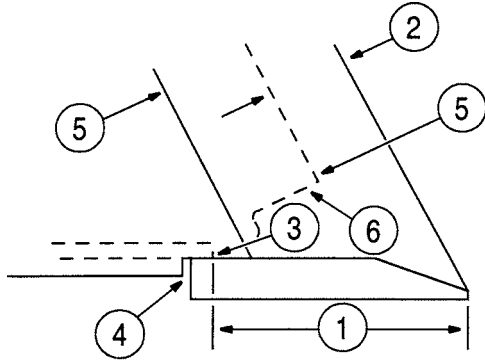
## CUTTING EDGES

### Universal and Heavy Duty Buckets

#### Replacing Bottom Cutting Edge

1. Remove the bucket teeth. Use carbon arc rod or an acetylene cutting torch to remove the welds.
  2. Use carbon arc rod or an acetylene cutting torch to remove the welds that hold the bottom cutting edge.
- IMPORTANT:** *When you remove the bottom weld at the rear of the bottom cutting edge, DO NOT cut through the bottom of the bucket.*

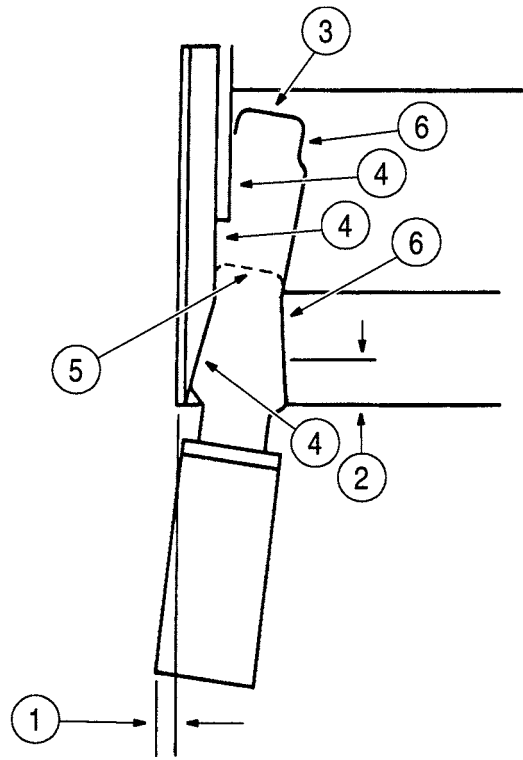
3. Use a grinder to remove any welds or extra metal still on the bucket so that the new bottom cutting edge will fit the bucket.
4. Put the new bottom cutting edge in position and make several tack welds to hold it.
5. See the following illustration for the weld locations and specifications. DO NOT make any welds on the inside of the bucket except the bottom of the bucket to the bottom cutting edge. Use E7018 welding rod to weld the bottom cutting edge in position.



BT95M078

1. UNIVERSAL BUCKET - 147 MM (5.79 INCHES)  
HEAVY DUTY BUCKET - 151 MM (5-15/16 INCHES)
2. UNIVERSAL BUCKET - 44 MM (1.73 INCH)  
HEAVY DUTY BUCKET - 47 MM (1-7/8 INCH)
3. 10 MM (3/8 INCH) FILLET TOP AND BOTTOM
4. FILL GROOVE BETWEEN WEAR PLATES AND BOTTOM CUTTING EDGE
5. 6 MM (1/4 INCH) FILLET ALL AROUND
6. TWO PASS 6 MM (1/4 INCH) WELD TO FILL VOID

6. See the following illustration. Install the corner bucket teeth and weld the bucket teeth in position. Use E7018 welding rod.



B8611750R

1. 14 MM (9/16 INCH)
2. 20 MM (3/4 INCH) NO WELD
3. NO WELD, TOP ONLY
4. FIRST WELD. 10 MM (3/8 INCH) FLARE BEVEL WELD.  
SECOND WELD. 10 MM (3/8 INCH) FILLET WELD.
5. BOTTOM ALL AROUND 8 MM (3/4 INCH) FILLET. WELD TWO TIMES.
6. 8 MM (5/16 INCH) FILLET. WELD TWO TIMES.

7. Weld the remaining bucket teeth to the bottom cutting edge according to the instructions in this section.

### Replacing Side Cutting Edge

1. Use carbon arc rod or an acetylene cutting torch to remove the welds that hold the side cutting edge.
2. Use a grinder to remove any welds or extra metal still on the bucket so that the new side cutting edge will fit the bucket.
3. Use E7018 welding rod to weld the side cutting edge to the bucket with a 6 mm (1/4 inch) fillet all around the side cutting edge.



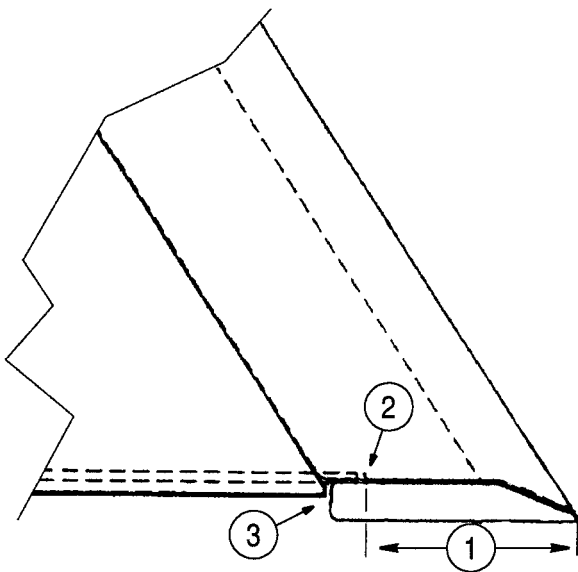
## High Capacity Buckets

### Replacing Bottom Cutting Edge

1. Remove the bucket teeth. Use carbon arc rod or an acetylene cutting torch to remove the welds.
2. Remove all welds that hold the bottom cuffing edge in position. Use carbon arc rod or an acetylene cutting torch to remove the welds.
3. Remove the cutting edge from the bucket.
4. Use a grinder to remove any welds or extra metal still on the bucket so that the new cutting edge will fit the bucket.
5. Put the new bottom cutting edge in position and use C-clamps to hold it.
6. See the following illustration for weld locations and specifications. Use E7018 welding rod to weld the bottom cutting edge to the bucket.

### Replacing Side Cutting Edge

1. Remove all welds that hold the side cutting edge in position. Use carbon arc rod or an acetylene cutting torch to remove the welds.
2. Remove the side cutting edge from the bucket.
3. Use a grinder to remove any welds or extra metal still on the bucket so that the new side cutting edge will fit the bucket.
4. Put the side cutting edge in position and use a C-clamp to hold it.
5. Use E7018 welding rod to weld the side cutting edge to the bucket. Use a 6 mm (1/4 inch) fillet weld all around the side cutting edge.



BS01B231

1. 48 MM (1-7/8 INCH)
2. 6 MM (1/4 INCH) FILLET TOP AND BOTTOM
3. FILL GROOVE BETWEEN WEAR PLATES AND BOTTOM

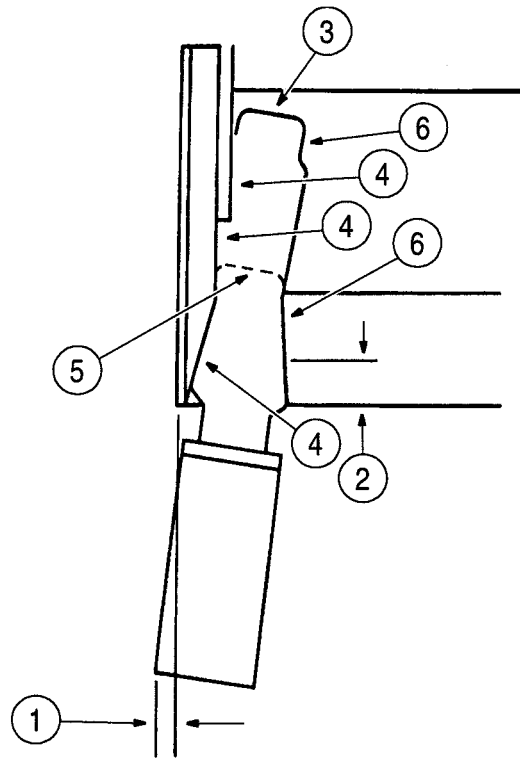
# BUCKET TEETH

## Replacing a Tooth Point

1. Use a hammer and a punch to remove the flex pin from the tooth point.
2. Install a new tooth point and drive a new flex pin into the tooth point. Install the flex pin so that the shoulders are toward the cutting edge.

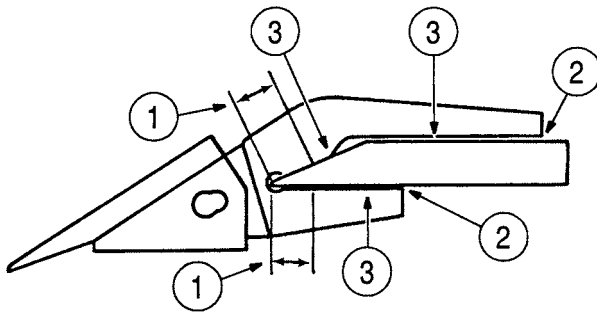
## Replacing a Tooth Shank

1. Use carbon arc rod or an acetylene cutting torch to remove the welds that hold the tooth shank.
2. Use a grinder to remove any welds or extra metal that will prevent the new tooth shank from fitting correctly.
3. If a new cutting edge has been installed, see the illustrations on the following page for correct location of the bucket teeth.
4. See the following illustration for weld specifications for all bucket teeth except the corner bucket teeth for the universal and the heavy duty buckets. Use E7018 welding rod to weld the tooth shanks in position.



B8611750R

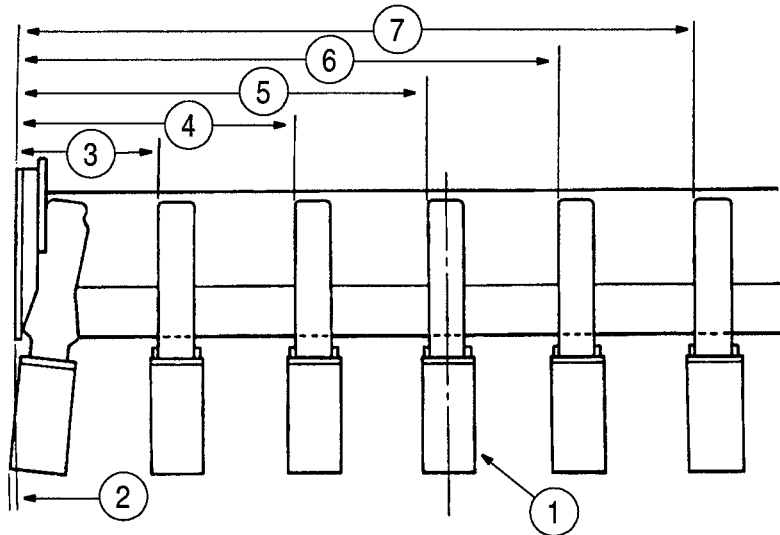
1. 14 MM (1/2 INCH)
2. 20 MM (7/8 INCH) NO WELD
3. NO WELD, TOP ONLY
4. FIRST WELD. 10 MM (7/16 INCH) FLARE BEVEL WELD. SECOND WELD. 10 MM (7/16 INCH) FILLET WELD.
5. BOTTOM ALL AROUND 8 MM (5/16 INCH) FILLET. WELD TWO TIMES.
6. 8 MM (5/16 INCH) FILLET. WELD TWO TIMES.



B861752R

1. 20 MM (7/8 INCH) NO WELD
2. NO WELD
3. 8 MM (5-16 INCH) FILLET BOTH SIDES. WELD TWO TIMES

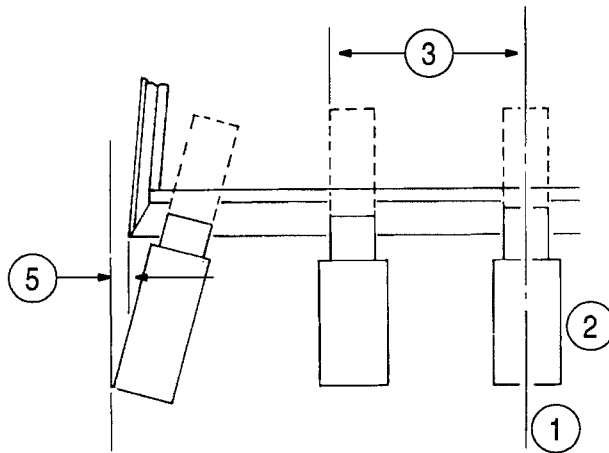
5. Universal and heavy duty buckets only. See the following illustration for the weld specifications for the corner bucket teeth. Use E7018 welding rod to weld the tooth shanks in position.



B872455J

- |  |  |
|--|--|
| 1. CENTER TOOTH                                    | 5. 304 MM (12 INCH) BUCKET - 131.1 MM (5.16 INCH)  |
| 2. 12 MM (0.47 INCH)                               | 406 MM (16 INCH) BUCKET - 182.2 MM (7.17 INCH)     |
| 3. 457 MM (18 INCH) BUCKET - 141.18 MM (5.56 INCH) | 457 MM (18 INCH) BUCKET - 271.36 MM (10.68 INCH)   |
| 610 MM (24 INCH) BUCKET - 139.5 MM (5.49 INCH)     | 610 MM (24 INCH) BUCKET - 282.5 MM (11.12 INCH)    |
| 762 MM (30 INCH) BUCKET - 141.2 MM (5.56 INCH)     | 762 MM (30 INCH) BUCKET - 286.1 MM (11.26 INCH)    |
| 914 MM (36 INCH) BUCKET - 156.6 MM (6.17 INCH)     | 914 MM (36 INCH) BUCKET - 434.9 MM (17.12 INCH)    |
| 4. 914 MM (36 INCH) BUCKET - 295.7 MM (11.64 INCH) | 6. 914 MM (36 INCH) BUCKET - 573.7 MM (22.59 INCH) |
|  | 7. 610 MM (24 INCH) BUCKET - 425.5 MM (16.75 INCH) |
|  | 762 MM (30 INCH) BUCKET - 576 MM (22.68 INCH)      |
|  | 914 MM (36 INCH) BUCKET - 712.8 MM (28.06 INCH)    |

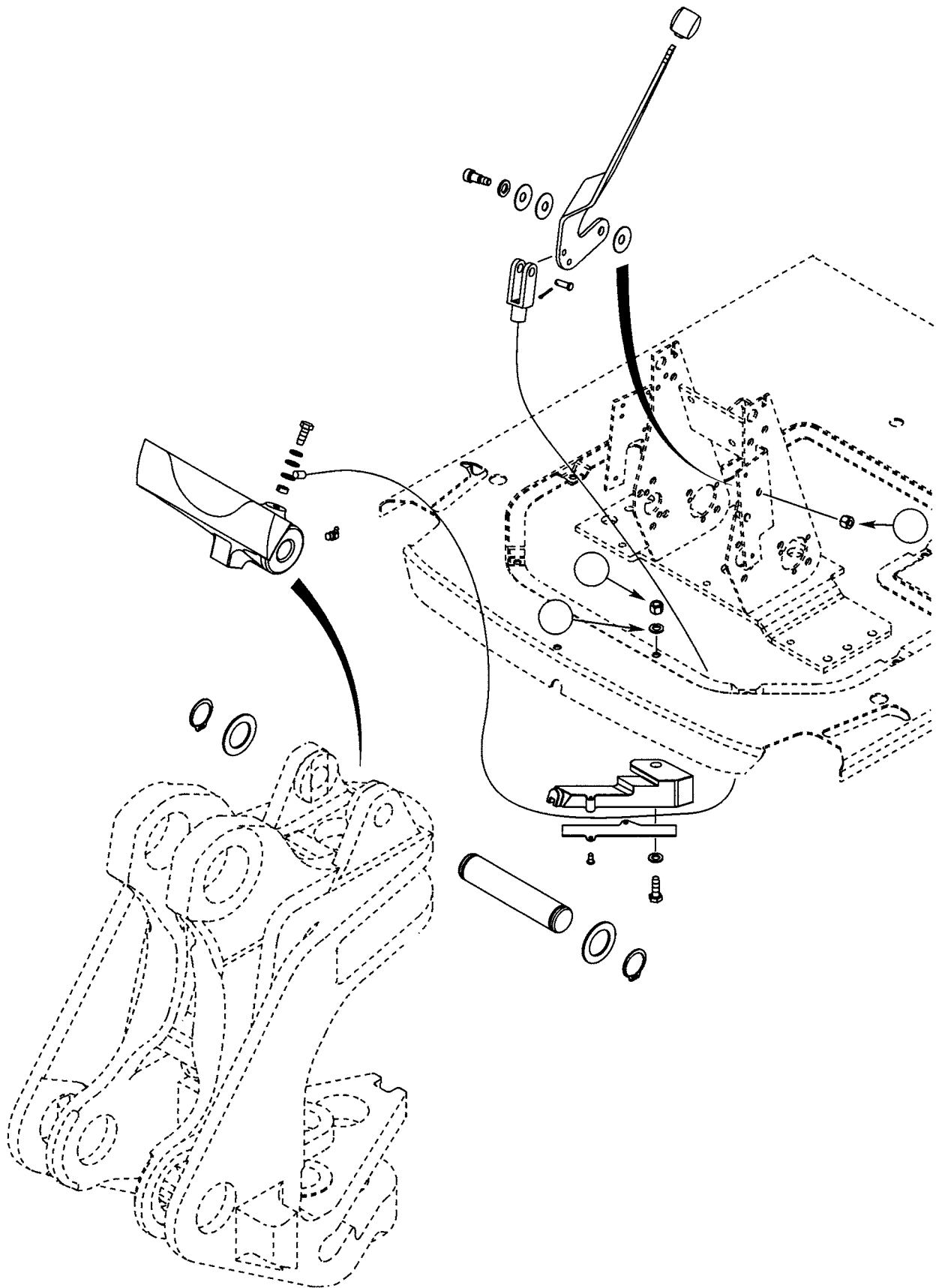
**TOOTH LOCATIONS FOR UNIVERSAL AND HEAVY DUTY BUCKETS**



B902038J

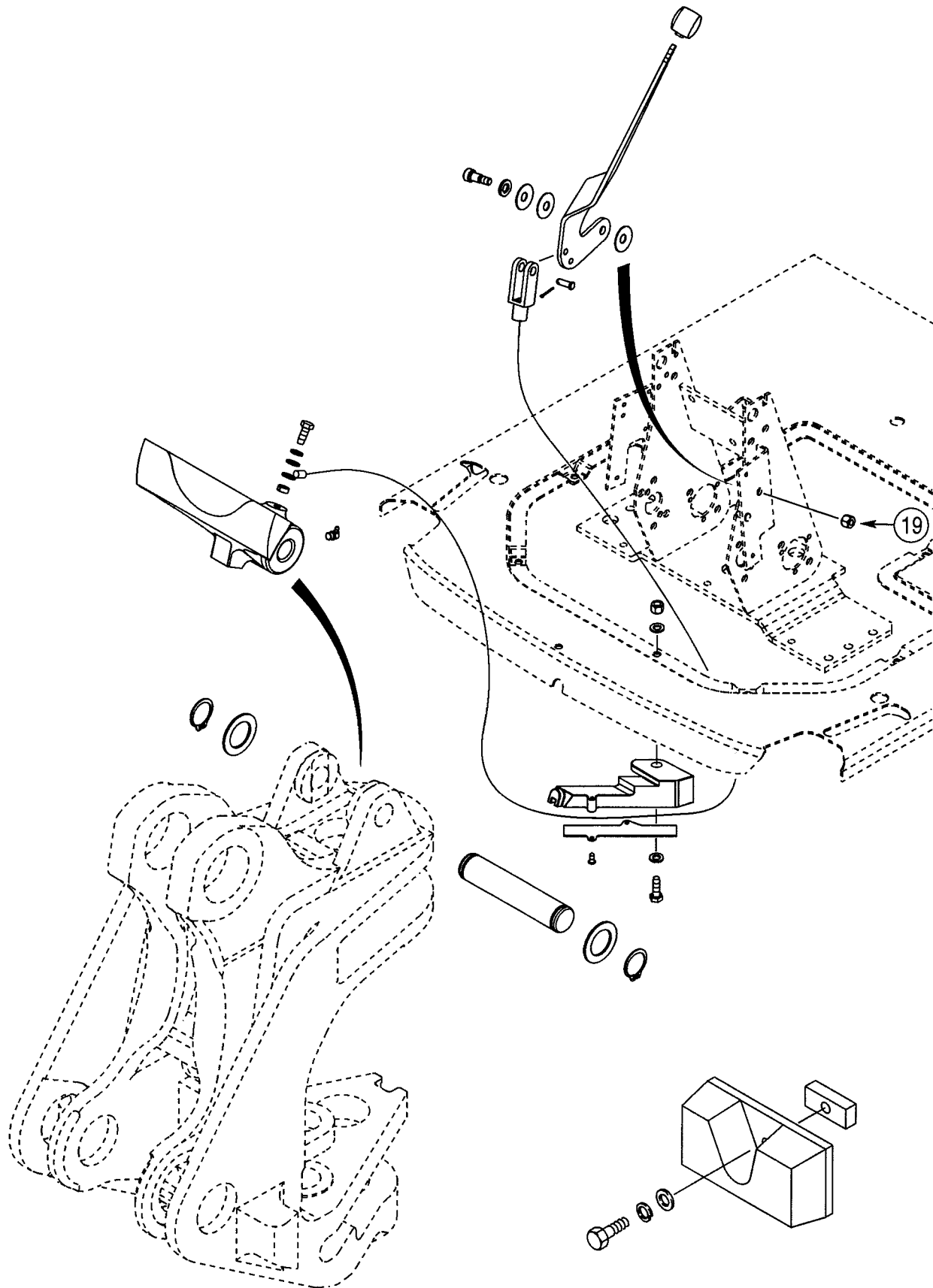
1. CENTERLINE
2. CENTER TOOTH
3. 610 MM (24 INCH) BUCKET - 98 MM (3.86 INCH)
- 762 MM (30 INCH) BUCKET - 130.6 MM (5.14 INCH)
4. PUT TOOTH SHANK AS NEAR CORNER AS POSSIBLE AND KEEP TOOTH POINT 15 MM (0.59 INCH) OUTSIDE OF CUTTING EDGE

**TOOTH LOCATIONS FOR HIGH CAPACITY BUCKETS**



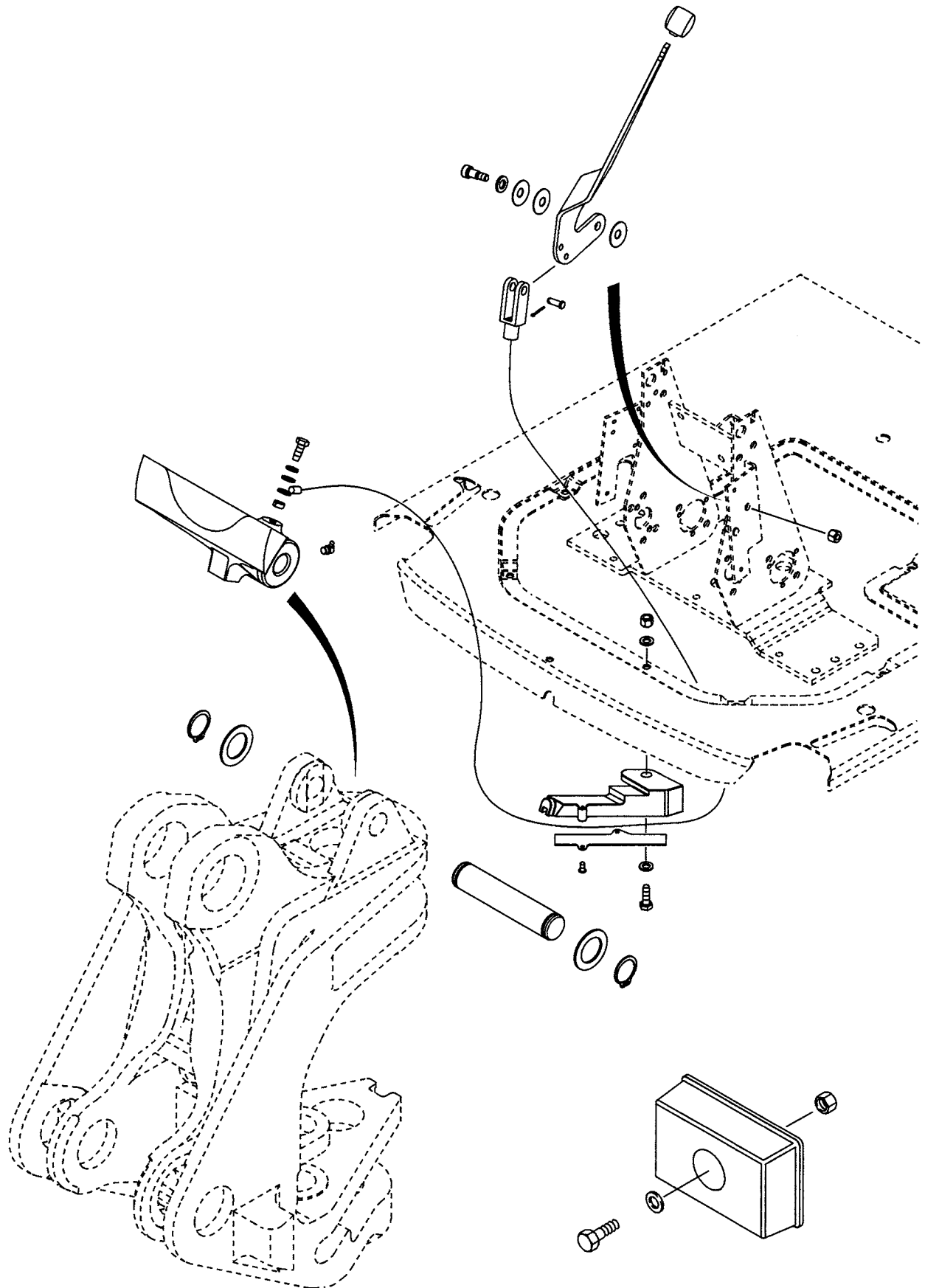
**BOOM LATCH INSTALLATION - 580M**

BC01B032



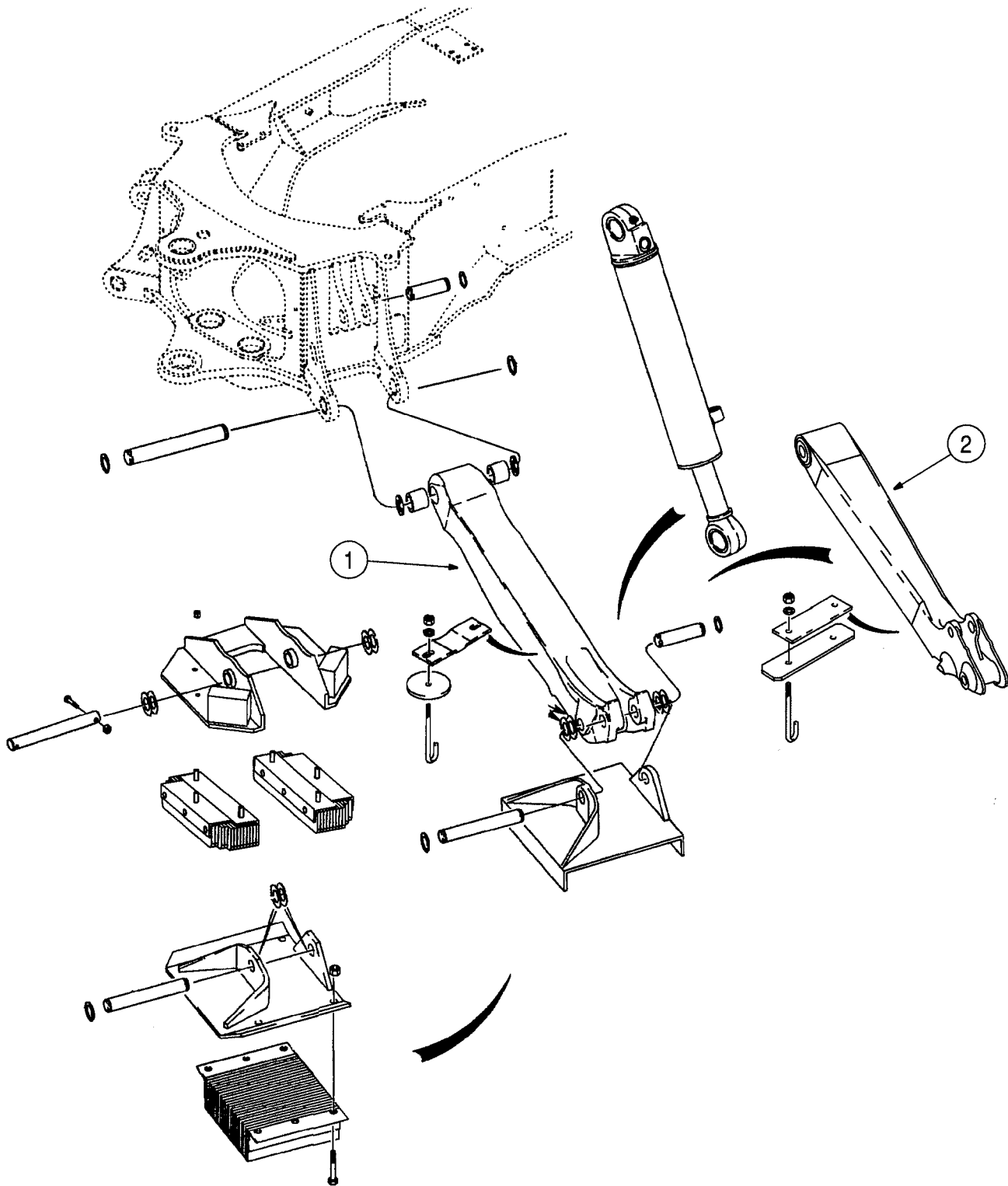
**BOOM LATCH INSTALLATION - 580 SUPER M**

BC01B033



**BOOM LATCH INSTALLATION - 590 SUPER M**

BC01B034



- 1. STABILIZER LEG - 580M AND 580 SUPER M
- 2. STABILIZER LEG - 590 SUPER M

**STABILIZER INSTALLATION**

BS01B045

# NOTES



## APPENDIX J

### Axle Service Manual

<b>Contents</b>	<b>Para</b>	<b>Page</b>
Scope.....	J-1	J-1
General.....	J-2	J-1
Front Axle Repair (Front Wheel Hub Repair).....	J-3	J-2
Front Axle Repair (Complete Front Brake Assembly Repair).....	J-4	J-4
Front Brake Shoe Replacement.....	J-5	J-5
Front Axle Repair (Steering Head and Axle Stub).....	J-6	J-6
Front Axle Repair (Drive Head Replacement).....	J-7	J-8
Front Differential Assembly Repair.....	J-8	J-9
Front Axle Repair (Front Air Chamber Replacement).....	J-9	J-10
Rear Axle Repair (Rear Wheel Hub Repair).....	J-10	J-11
Rear Axle Repair (Complete Rear Brake Assembly Repair).....	J-11	J-12
Rear Brake Shoe Replacement.....	J-12	J-13
Rear Axle Repair (Drive Head Replacement).....	J-13	J-14
Rear Differential Assembly Repair.....	J-14	J-15
Rear Axle Repair (Rear Air Chamber Replacement).....	J-15	J-16

#### Section I. U.S. Army Supplement to Dana Spicer Material.

**J-1. SCOPE.**

This appendix contains information for servicing the axles. Section I contains U.S. Army supplemental information to the vendor manual. The supplemental information includes initial setup task boxes for all maintenance tasks covered in the vendor manual that apply to the IHMEE. The supplemental information also includes individual task headings and page references to aid in locating the tasks in the vendor manual.

Section II contains the manufacturer’s technical manual. This manual is unedited and covers the Dana Spicer axles used on the IHMEE. This manual also contains parts information for Dana Spicer axles. Refer to Para J-2 for details on how to use this material.

**J-2. GENERAL.**

To perform a task covered in this appendix, refer to the task box for initial setup information as you would with a normal maintenance procedure. The individual task headings have page references to aid in locating the tasks in the vendor manual. All parts information should be ignored. Refer to TM 5-2420-230-24P for parts information.

Most pages will also include two different page numbers. The appendix page number will have the appendix letter and a page number like the one at the bottom of this page. This page number will be used in all references made in Section I. The other page number is the vendor material page numbering. It will be used for any references made within the vendor material.

**J-3. FRONT AXLE REPAIR (FRONT WHEEL HUB REPAIR).**

This Task Covers:

- a. Disassembly
- b. Inspection
- c. Assembly
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*Tools and Special Tools*

- Field, maintenance, basic, Item 23, Appendix B
- Pan, drain, Item 29, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B
- Wrench, hub bearing nut, Item 42, Appendix B
- Equipment, suitable lifting

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-21	Vehicle raised.
Para 8-8	Brakes caged.
TM 5-2420-230-10	Wheels and tires removed.
Para 14-4	Hub oil drained.

*Materials/Parts*

- Cloth, lint-free, Item 10, Appendix C
- Grease, ball bearing, Item 31, Appendix C
- Solvent, degreasing, Item 58, Appendix C
- Clip, Item 39, Appendix D, (4)
- Lockplate, Item 98, Appendix D (8)
- Nut, self-locking, Item 126.6, Appendix D
- O-ring, Item 154, Appendix D (2)
- O-ring, Item 156, Appendix D (6)
- Oil, GO 80W/90, Item 42, Appendix C
- Seal, oil, Item 245, Appendix D (4)

*Drawings Required*

TM 5-2420-230-24P Figure 101

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Disassembly.**

- (1) Refer to page J-33 to disassemble the planet carrier.
- (2) Refer to page J-34 to disassemble the hub, annulus and brake drum units.

**b. Inspection.**

Refer to page J-33 for inspection of the planet carrier.

**c. Assembly.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
  - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
  - Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- (1) Refer to page J-58 for assembly of the hub and annulus.
  - (2) Refer to page J-61 for assembly of the brake drum units.
  - (3) Refer to page J-60 for assembly of the planet carrier.

**d. Follow-On Maintenance.**

- (1) Fill hub oil (TM 5-2420-230-10).
- (2) Install wheels and tires (TM 5-2420-230-10).
- (3) Lower vehicle (Para 2-21).
- (4) Uncage the brakes (Para 8-8).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**J-5. FRONT BRAKE SHOE REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Field, maintenance, basic, Item 23, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B  
Equipment, suitable lifting

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para J-3              Brake drum removed.

*Drawings Required*  
TM 5-2420-230-24P      Figure 135

*Materials/Parts*  
Cloth, lint-free, Item 10, Appendix C  
Wire, nonelectrical lock, Item 70, Appendix C

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

**WARNING**

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

**a. Removal.**

Refer to page J-36 to remove the brake shoes.

**b. Installation.**

Refer to page J-39 to install the brake shoes.

**c. Follow-On Maintenance.**

Install brake drum (Para J-3).

**END OF TASK**

**J-6. FRONT AXLE REPAIR (STEERING HEAD AND AXLE STUB).**

This Task Covers:

- |                 |                          |             |
|-----------------|--------------------------|-------------|
| a. Removal      | b. Disassembly           | c. Assembly |
| d. Installation | e. Follow-On Maintenance |             |

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

- Equipment, suitable lifting
- Field, maintenance, basic, Item 23, Appendix B
- Pan, drain, Item 29, Appendix B
- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Bearing, ball, Item 6.1, Appendix D (4)
- Bushing, Item 30, Appendix D, (2)
- Bushing, Item 31, Appendix D, (2)
- Compound, cleaning (Loctite 7070), Item 13, Appendix C
- Compound, retaining (Loctite 638), Item 18, Appendix C
- Grease, automotive and artillery, Item 30, Appendix C
- Housing, seal, Item 91, Appendix D, (2)
- Nut, self-locking, Item 117.2, Appendix D (32)
- Nut, self-locking, Item 126.2, Appendix D (16)
- O-ring, Item 150, Appendix D, (2)
- Pin, cotter, Item 170.1, Appendix D (3)
- Retainer, packing, Item 182.3, Appendix D (2)

*Materials/Parts (Cont.)*

- Ring, retaining, Item 39, Appendix D (4)
- Seal, oil, Item 240, Appendix D, (2)
- Seal, oil, Item 241, Appendix D, (2)
- Seal, oil, Item 242, Appendix D (2)
- Sealing, (Loctite 242) compound, Item 19, Appendix C
- Solvent, degreasing, Item 58, Appendix C
- Washer, lock, Item 291, Appendix D (8)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para J-3	Hub removed.
Para 5-13	Tie rod removed.

*Drawings Required*

TM 5-2420-230-24P Figure 101

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Removal.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
- If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
- Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- The front axle assembly is heavy. To avoid personal injury, exercise extreme care when manually handling axle. Failure to comply may result in injury or death to personnel.

Refer to page page J-42 to remove the steering head assembly.

**b. Disassembly.**

- (1) Refer to page J-44 to disassemble the steering head/axle stub.
- (2) Refer to page J-46 to remove the U-joint assembly.
- (3) Refer to page J-47 to disassemble the DBM U-joint.

**c. Assembly.**

- (1) Refer to page J-48 to assemble the DBM U-joint.

**d. Installation.**

- (1) Refer to page J-50 to install the U-joint assembly.
- (2) Refer to page J-51 to assemble and install the swivel jaw and axle stub.

**e. Follow-On Maintenance.**

- (1) Install tie rod (Para 5-13).
- (2) Install hub (Para J-3).

**END OF TASK**





**J-8. FRONT DIFFERENTIAL ASSEMBLY REPAIR.**

This Task Covers:

- a. Disassembly
- b. Assembly
- c. Adjustment
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*Tools and Special Tools*

Tool kit, common no. 2, Item 36, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B

*References*

None

*Materials/Parts*

Bushing, Item 32, Appendix D  
 Bushing, pinion, Item 33, Appendix D, (4)  
 Nut, self-locking, Item 126.2, Appendix D  
 Nut, self-locking, Item 126.3, Appendix D  
 Nut, self-locking, Item 126.5, Appendix D  
 O-ring, Item 137, Appendix D  
 Pin, cotter, Item 170.1, Appendix D  
 Pin, cotter, Item 174.1, Appendix D  
 Seal, plain encased, Item 250, Appendix D  
 Washer, lock, Item 290.2, Appendix D

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Engine shut OFF.
Para J-7	Head assembly removed.
Para J-9	Air chamber removed.

*Drawings Required*

TM 5-2420-230-24P Figure 98

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Disassembly.**

- (1) Refer to page J-70 for the disassembly of the bevel pinion assembly.
- (2) Refer to page J-70 for the disassembly of the differential and gear casing assembly.
- (3) Refer to page J-71 for the disassembly of the differential lock.

**b. Assembly.**

- (1) Refer to page J-72 for assembly of differential lock assembly.
- (2) Refer to page J-73 for assembly of bevel pinion sub assembly.
- (3) Refer to page J-75 to assemble pinion unit.
- (4) Refer to page J-77 for initial preparation of differential.
- (5) Refer to page J-78 to install bevel pinion into differential.

**c. Adjustment.**

- (1) Refer to page J-79 to set “No End Float” condition.
- (2) Refer to page J-79 to set the backlash.
- (3) Refer to page J-74 to check pinion bearing pre-load.
- (4) Refer to page J-81 to check pinion mesh.

**d. Follow-On Maintenance.**

- (1) Install air chamber (Para J-9).
- (2) Install head assembly (Para J-7).

**END OF TASK**

**J-9. FRONT AXLE REPAIR (FRONT AIR CHAMBER REPLACEMENT).**

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 15-4      Air tanks drained.

*Materials/Parts*  
Nut, self-locking, Item 105, Appendix D (2)  
Nut, self-locking, Item 126.4, Appendix D

*Drawings Required*  
TM 5-2420-230-24P    Figure 136

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

Refer to page J-71 for removal of air chamber assembly.

**b. Inspection.**

Refer to page J-71 for inspection of the air chamber assembly.

**c. Installation.**

Refer to page J-87 for installation of air chamber assembly.

**d. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10) and allow air pressure to build.
- (2) Functionally test brakes.

**END OF TASK**

**J-10. REAR AXLE REPAIR (REAR WHEEL HUB REPAIR).**

This Task Covers:

- a. Disassembly
- b. Assembly
- c. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

Field, maintenance, basic, Item 23, Appendix B  
 Pan, drain, Item 29, Appendix B  
 Tool kit, common no. 2, Item 36, Appendix B  
 Tool kit, general mechanics, Item 38, Appendix B  
 Wrench, hub bearing nut, Item 42, Appendix B  
 Equipment, suitable lifting

*Materials/Parts*

Cloth, lint-free, Item 10, Appendix C  
 Lockplate, Item 98, Appendix D (8)  
 Nut, self-locking, Item 128, Appendix D (8)  
 O-ring, Item 155, Appendix D (2)  
 O-ring, Item 156, Appendix D (6)  
 Oil, lubricating, Item 42, Appendix C  
 Ring, retaining, Item 39, Appendix D  
 Seal, plain, encased, Item 157, Appendix D (4)

*Materials/Parts (Cont.)*

Sleeve, wearing, Item 257, Appendix D (2)  
 Solvent, degreasing, Item 58, Appendix C

*Personnel Required*

MOS 62B, Construction Equipment Repairer (2)

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para 2-21	Vehicle raised.
Para 8-8	Brakes caged.
TM 5-2420-230-10	Wheels and tires removed.
Para 14-4	Hub oil drained.

*Drawings Required*

TM 5-2420-230-24P Figure 103

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Disassembly.**

- (1) Refer to page J-95 to disassemble the planet carrier unit.
- (2) Refer to page J-96 to disassemble the axle hub and annulus units.

**b. Assembly.****WARNING**

- Degreasing Solvent (MIL-PRF-680) is toxic and flammable. Keep away from heat or flame. Never smoke when using solvent. The flashpoint for Type II Degreasing Solvent is 141 °F (61 °C). Wear protective goggles, face shield, and gloves; use only in a well-ventilated area; avoid contact with skin, eyes, and clothes; and do not breathe vapors. Failure to comply may result in injury or death to personnel.
  - If personnel become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts skin or clothes, flush with cold water. If solvent contacts eyes, immediately flush eyes with water and get immediate medical attention.
  - Adhesives, solvents, and sealing compounds burn easily and give off vapors that are harmful to the skin and clothing. To avoid injury or death, keep away from open fire when using these materials, and use only in well-ventilated areas. If adhesives, solvents, or sealing compounds contact the skin or clothing, wash immediately with soap and water, and rinse thoroughly. Failure to comply may result in injury or death to personnel.
- (1) Refer to page J-102 for assembly of the axle hub and annulus unit and brake drum units.
  - (2) Refer to page J-105 for assembly of the planet carrier assembly.

**c. Follow-On Maintenance.**

- (1) Fill hub oil (TM 5-2420-230-10).
- (2) Install wheels and tires (TM 5-2420-230-10).
- (3) Lower vehicle (Para 2-21).
- (4) Uncage the brakes (Para 8-8).
- (5) Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**J-11. REAR AXLE REPAIR (COMPLETE REAR BRAKE ASSEMBLY REPAIR).**

This Task Covers:

- a. Removal
- b. Disassembly
- c. Assembly
- d. Installation
- e. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*Tools and Special Tools*  
Equipment, suitable lifting  
Field, maintenance, basic, Item 23, Appendix B  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*  
Cap, protective, Item 37, Appendix D (4)  
Cloth, lint-free, Item 10, Appendix C  
Grease, ball bearing, Item 31, Appendix C  
Grease, high temperature, Item 33, Appendix C  
Nut, self-locking, Item 126.2, Appendix D (16)  
Oil, lubricating, Item 42, Appendix C  
O-ring, Item 153, Appendix D (4)  
Pin, cotter, Item 174, Appendix D (4)  
Ring, retaining, Item 191.1, Appendix D  
Seal, plain, encased, Item 249, Appendix D (4)  
Spring, helical, Item 266.1, Appendix D (4)

*Materials/Parts (Cont.)*  
Washer, recessed, Item 292.1, Appendix D (8)  
Washer, lock, Item 271, Appendix D (4)  
Washer, lock, Item 284, Appendix D (4)  
Washer, lock, Item 291, Appendix D (4)

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*References*  
None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
Para J-10	Hub removed.

*Drawings Required*  
TM 5-2420-230-24P Figure 137

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**WARNING**

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

**a. Removal.**

Refer to page J-97 to remove the complete brake assembly.

**b. Disassembly.**

Refer to page J-98 to disassemble the brake bracket and cam shaft unit.

**c. Assembly.**

Refer to page J-99 to assemble the brake bracket and cam shaft unit.



**d. Installation.**

**WARNING**

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

Refer to page J-100 for final assembly and installation of the complete brake assembly.

**e. Follow-On Maintenance.**

Install hub (Para J-10).

**END OF TASK**

<b>J-12. REAR BRAKE SHOE REPLACEMENT.</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	
<i>Tools and Special Tools</i> Equipment, suitable lifting Field, maintenance, basic, Item 23, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>References</i> None	
<i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C Grease, automotive and artillery, Item 30, Appendix C Pin, Split, Item 174.1, Appendix D (4) Wire, nonelectrical lock, Item 70, Appendix D	<i>Equipment Conditions</i> <i>TM or Para</i> Para J-10	<i>Condition Description</i> Brake drum removed.
	<i>Drawings Required</i> TM 5-2420-230-24P Figure 137	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**WARNING**

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

**a. Removal.**

Refer to page J-97 to remove the brake shoes.

**b. Installation.**

Refer to page J-100 to install the brake shoes.

**c. Follow-On Maintenance.**

Install brake drum (Para J-10).

**END OF TASK**

<b>J-13. REAR AXLE REPAIR (DRIVE HEAD REPLACEMENT).</b>		
This Task Covers:		
a. Removal	b. Installation	c. Follow-On Maintenance
<b>INITIAL SETUP</b>		
<i>Test Equipment</i> None	<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	
<i>Tools and Special Tools</i> Dunnage, suitable Equipment, suitable lifting Field, maintenance, basic, Item 23, Appendix B Pan, drain, Item 29, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B	<i>References</i> None	
<i>Materials/Parts</i> Compound, sealing (Loctite 515), Item 21, Appendix C Nut, self-locking, Item 126.2, Appendix D (18) O-ring, Item 156, Appendix D (6) Sealing compound, Loctite 242, Item 19, Appendix C	<i>Equipment Conditions</i> <i>TM or Para</i> Para 2-21 Para 8-8 TM 5-2420-230-10 Para 14-4	<i>Condition Description</i> Vehicle raised. Brakes caged. Wheels and tires removed. Hub oil drained.
	<i>Drawings Required</i> TM 5-2420-230-24P Figure 99 TM 5-2420-230-24P Figure 103	
	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Removal.**

Refer to page J-112 to remove drive head from axle.

**b. Installation.**

- (1) Refer to page J-128 to install drive head into axle.
- (2) Refer to page J-130 for final installation of drive head.

**c. Follow-On Maintenance.**

- (1) Fill hub oil (TM 5-2420-230-10).
- (2) Install wheels and tires (TM 5-2420-230-10).
- (3) Lower vehicle (Para 2-21).
- (4) Uncage the brakes (Para 8-8).
- (5) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**



**J-14. REAR DIFFERENTIAL ASSEMBLY REPAIR.**

This Task Covers:

- a. Disassembly
- b. Assembly
- c. Adjustment
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*

None

*Tools and Special Tools*

- Tool kit, common no. 2, Item 36, Appendix B
- Tool kit, general mechanics, Item 38, Appendix B

*Materials/Parts*

- Bush, differential, Item 32, Appendix D
- Compound, sealing (Loctite 515), Item 21, Appendix C
- Compound, sealing (Loctite 601), Item 24, Appendix C
- Compound, sealing (Loctite 641), Item 24.1, Appendix C
- Nut, self-locking, Item 117.2, Appendix D (4)
- Nut, self-locking, Item 126.2, Appendix D (18)
- Nut, self-locking, Item 126.3, Appendix D (8)
- O-ring, Item 137, Appendix D
- Pin, cotter, Item 174.1, Appendix D (2)

*Materials/Parts (Cont.)*

- Seal, plain encased, Item 250, Appendix D
- Washer, lock, Item 290.2, Appendix D (12)

*Personnel Required*

MOS 62B, Construction Equipment Repairer

*References*

None

*Equipment Conditions*

<i>TM or Para</i>	<i>Condition Description</i>
TM 5-2420-230-10	Engine shut OFF.
Para J-13	Head assembly removed.
Para J-15	Air chamber removed.

*Drawings Required*

TM 5-2420-230-24P Figure 99

*Estimated Time to Complete Task*

Refer to MAC in Appendix B

**a. Disassembly.**

- (1) Refer to page J-113 for disassembling the bevel pinion assembly.
- (2) Refer to page J-113 for disassembling the differential and gear casing assembly.
- (3) Refer to page J-114 for disassembling the differential lock.

**b. Assembly.**

- (1) Refer to page J-115 for assembly of the differential lock assembly.
- (2) Refer to page J-116 for assembly of the bevel pinion sub assembly.
- (3) Refer to page J-118 to for final assembly of the pinion unit.
- (4) Refer to page J-120 for initial preparation of the differential.
- (5) Refer to page J-121 to install the bevel pinion into the differential.

**c. Adjustment.**

- (1) Refer to page J-122 to set “No End Float” condition.
- (2) Refer to page J-122 to set the backlash.
- (3) Refer to page J-117 to set the bearing pre-load.
- (4) Refer to page J-124 to check the pinion mesh.

**d. Follow-On Maintenance.**

- (1) Install head assembly (Para J-13).
- (2) Install air chamber (Para J-15).

**END OF TASK**

**J-15. REAR AXLE REPAIR (REAR AIR CHAMBER REPLACEMENT).**

This Task Covers:

- a. Removal
- b. Inspection
- c. Installation
- d. Follow-On Maintenance

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2, Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 15-4      Air tanks drained.

*Materials/Parts*  
None

*Drawings Required*  
TM 5-2420-230-24P    Figure 99

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Removal.**

Refer to page J-114 for removal of the air chamber assembly.

**b. Inspection.**

Refer to page J-114 for inspection of the air chamber assembly.

**c. Installation.**

Refer to page J-128 for installation of the air chamber assembly.

**d. Follow-On Maintenance.**

- (1) Start engine (TM 5-2420-230-10) and allow air pressure to build.
- (2) Functionally test brakes.
- (3) Remove "Do Not Operate" tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**Section II. Vendor Service Manual.**

This section contains information for servicing the axles in the form of the manufacturer's technical manual which follows this page. Section I contains U.S. Army supplemental information to the vendor manual.



**PARTS AND SERVICE MANUAL FOR  
STEER DRIVE AXLE TYPE SD66 - 11 - 1S  
REAR AXLE TYPE D66 - 11 - 1S**

**CUSTOMER A.D.I**

**FIRST AXLE  
LIST NUMBER 26088/0746**

**REF DRAWING Nos.  
INSTALLATION F4819E  
HUB 7609A  
DIFF R8540A  
BRAKE R8270  
DIFF LOCK R8394L**

**SECOND AXLE  
LIST NUMBER 34026/0746**

**REF DRAWING No.s  
INSTALLATION R2134E  
HUB R8283C  
DIFF R8540A  
BRAKE 7758B  
DIFF LOCK R8394L**

*Compiled by Philip Sykes*



The description, testing procedures, and specifications contained in this parts / service publication were current at time of printing. This manual will not be updated. If in doubt about any aspect of maintenance or servicing of the axle please contact the vehicle builder or our service department direct.

Spicer Speciality axle Division reserves the right to discontinue or modify its procedures and to change specifications at any time without notice and without incurring obligation.

The recommendations of the vehicle manufacturer should be considered as the primary source of service information regarding this **SPICER**® product. This manual is intended to be used as a supplement to such information.

Any references to brand names in this publication is made simply as an example of the types of tools and materials recommended for use and, as such, should not be considered as an endorsement. Equivalents, if available, may be used.

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MANUAL ISSUE SHEET

Page No.	Issue	Description / Alteration	Reason	Date
All	A			Dec.97
B35	B	Parts altered	Updated	Oct .98
C28	B	Parts altered	Updated	Oct .98
D18	B	Parts altered	Updated	Oct .98
A2	B	Lub info altered	Revised Spec	Mar. 00
A3	B	Maint info altered	Revised Spec	Mar. 00
A4	B	Maint info altered	Revised Spec	Mar. 00
A5	B	Lub info altered	Revised Spec	Mar. 00
A6	B	Maint info altered	Revised Spec	Mar. 00
B3	B	Item 2.8 altered	Revised Spec	Mar. 00
B9	B	Rivetting info altered	Revised Spec	Mar. 00
B14	B	13.16 added	Revised Spec	Mar. 00
B32	B	Tracking note added	Revised Spec	Mar. 00
B33	B	Torque altered	Correction	Mar. 00
B35	C	Parts altered	Revised Spec	Mar. 00
B36	B	Parts altered	Revised Spec	Mar.00
B37	B	Parts altered	Revised Spec	Mar. 00
B38	B	Parts altered	Revised Spec	Mar. 00
C28	C	Parts altered	Revised Spec	Mar. 00
C29	B	Parts altered	Revised Spec	Mar. 00
D8	B	Rivetting Procedure Alt	Revised Spec	Mar. 00
D18	C	Parts altered	Revised Spec	Mar. 00
D19	B	Parts altered	Revised Spec	Mar. 00
E25	B	Parts altered	Revised Spec	Mar. 00



MANUAL CONTENTS

SECTION A	LUBRICATION	Page No.
	Front page	A1
	Lubrication of steer drive axle type SD66 -11 -1S	A2
	Routine maintenance	A3 & A4
	Lubrication of rear axle type D66 -11 -1S	A5
	Routine maintenance	A6
SECTION B	SERVICE INSTRUCTIONS FOR STEER DRIVE VERSION OF TYPE 1S HUB REDUCTION UNIT	
	Front page	B1
	Description	B2
	Tooling list	B2
	<b>DISMANTLING HUB REDUCTION UNIT</b>	
Section 1	Draining oil	B3
Section 2	Dismantling planet carrier	B3
Section 3	Dismantling hub, annulus and brake drum units	B4
	<b>OVERHAUL INSTRUCTIONS FOR BRAKES</b>	
Section 4	Removal of complete brake assembly	B5 & B6
Section 5	Brake shoe removal (after removal of complete brake unit)	B6
Section 6	Brake shoe removal (with complete hub unit in position)	B6
Section 7	Dismantling brake shoe unit	B7
Section 8	Dismantling brake bracket & cam shaft unit	B7
Section 9	Re-assembly of brake bracket and camshaft	B8
Section 10	Re-assembly of brake shoe unit	B9 & B10
Section 11	Final assembly of brake	B10 to B11
	<b>STEERING HEAD AND AXLE STUB</b>	
Section 12	Removal of steering head assembly	B12 & B13
Section 13	Dismantling steering head / axle stub	B14
Section 14	Dismantling ball socket	B15
Section 15	Removing U.J. assembly	B16
Section 16	Dismantling U.J. unit	B17
Section 17	Re-assembly of U.J. unit	B18
Section 18	Initial assembly of U.J. unit prior to fitting to axle casing	B19
Section 19	Fitting U.J. into axle casing	B20
Section 20	Assembly of axle stub / swivel jaw	B21 & B22
Section 21	Assembly of swivel jaw and swivel	B23 to B25
Section 22	Assembly of ball socket and tie rod	B26 & B27
Section 23	Rebuilding hub unit	B28
Section 24	Rebuilding annulus unit	B28
Section 25	Hub bearing setting	B29
Section 26	Planet carrier assembly	B30
Section 27	Sun gear and brake drum assembly	B31
Section 28	Final assembly	B32
	Torque table for type 1S hub reduction unit	B33
	TD183/1	B34
	Parts identification / spares list	B35 to B38
	<b>Illustration of type 1S hub reduction unit (FH55)</b>	



Contents cont.

<b>SECTION C</b>	<b>SERVICE INSTRUCTIONS FOR TYPE D66 DRIVE HEAD UNIT WITH DIFF. LOCK</b>	
	Front page	C1
	General description	C2
	Introduction	C2
Section 1	Preparation for overhaul	C3
Section 2	Removal of complete drive head assembly	C4 & C5
Section 3	Dismantling spiral bevel pinion assembly	C6
Section 4	Dismantling differential and gear casing assembly	C6
Section 5	Dismantling differential lock unit	C7
Section 6	Removal of air chamber	C7
	Tooling list	C8
Section 7	Re-assembling differential lock assembly	C8
Section 8	Spiral bevel pinion sub-assembly	C9
Section 9	Checking pinion bearing pre-load	C10
Section 10	Final assembly of pinion unit	C11
Section 11	Assembling crownwheel and differential unit	C12
Section 12	Initial preparation before fitting crownwheel and diff. unit to casing	C13
Section 13	Fitting crownwheel and differential unit into casing	C14
Section 14	Setting 'NO END FLOAT' condition	C15
Section 15	Setting crownwheel and pinion backlash	C15
Section 16	Setting crownwheel bearings	C16
Section 17	Gear identification / crownwheel & pinion mesh	C17
Section 18	Checking crownwheel and pinion mesh	C18 to C20
Section 19	Re-fitting drive head unit into axle casing	C21 to C23
Section 20	Differential lock setting procedure	C23
Section 21	Installation and use of differential locks	C24
Section 22	Final assembly / adjustment	C25
	Tightening torque table for type D66 drive head	C26
	TD183/1	C27
	Parts identification / spares lists	C28 & C29
	Notes	C30
	Illustration for type D66 drive head (DH119)	



Contents cont.

<b>SECTION D</b>	<b>SERVICE INSTRUCTIONS FOR REAR TYPE 1S HUB REDUCTION UNIT (2ND.AXLE)</b>	
	Front page	D1
	Description	D2
	Routine maintenance	D2
	Special tools	D2
Section 1	Draining the oil	D3
Section 2	Dismantling planet carrier	D3
Section 3	Dismantling hub and annulus units	D4
Section 4	Removal of complete brake unit	D5
Section 5	Brake shoe removal	D5
Section 6	Dismantling brake shoe unit	D6
Section 7	Dismantling brake bracket and camshaft assembly	D6
Section 8	Brake bracket and cam re-assembly	D7
Section 9	Re-building brake shoe lined assembly	D8 & D9
Section 10	Final assembly of brake	D9 & D10
Section 11	Hub and annulus re-assembly	D11 & D12
Section 12	Setting hub bearing	D13
Section 13	Initial preparation to build planet carrier	D13
Section 14	Rebuilding planet carrier unit	D14
Section 15	Final assembly	D15
	Tightening torque table	D16
	TD183/1	D17
	Parts identification / spares lists	D18 & D19
	Notes	D20
	Illustration of type 1S hub reduction unit (H82)	





Contents cont.

<b>SECTION E</b>	<b>SERVICE INSTRUCTIONS FOR TYPE D66 DRIVE HEAD UNIT WITH DIFF. LOCK (2ND. AXLE)</b>	
	Front page	E1
	General description	E2
	Introduction	E2
Section 1	Preparation for overhaul	E3
Section 2	Removal of complete drive head unit	E3
Section 3	Dismantling spiral bevel pinion unit	E4
Section 4	Dismantling differential and gear casing unit	E4
Section 5	Dismantling differential lock unit	E5
Section 6	Removal of air chamber	E5
	Tooling list	E6
Section 7	Re-assembling differential lock unit	E6
Section 8	Spiral bevel pinion sub-assembly	E7
Section 9	Checking pinion bearing pre-load	E8
Section 10	Final assembly of pinion unit	E9
Section 11	Assembling crownwheel and differential unit	E10
Section 12	Initial preparation before fitting crownwheel and diff. unit to casing	E11
Section 13	Fitting crownwheel and differential unit into casing	E12
Section 14	Setting 'NO END FLOAT' condition	E13
Section 15	Setting crownwheel and pinion backlash	E13
Section 16	Setting crownwheel bearings	E14
Section 17	Gear identification / crownwheel & pinion mesh	E15
Section 18	Checking crownwheel and pinion mesh	E15 to E18
Section 19	Re-fitting drive head unit into axle casing	E19
Section 20	Differential lock setting procedure	E19
Section 21	installation and use of cross axle and third diff locks.	E20
Section 22	Final adjustment	E21
	Tightening torque table for type D66 drive head TD183/1	E22
	Parts identification / spares lists	E23
	Notes	E24 & E25
		E26
	Illustration for type D66 drive head (DH122)	



# NOTES



**LUBRICATION AND MAINTENANCE INSTRUCTIONS  
FOR SD66 - 11 - 1S AXLE  
AND D66 - 11 - 1S REAR AXLE**

**MANUAL SECTION A**



**SECTION 1 LUBRICATION OF TYPE SD66-11-1S STEER DRIVE AXLE (1ST. AXLE)**

**Note :- New and reconditioned axles leaving Dana Spicer Europe Ltd. are charged with grease , where applicable, but ARE NOT filled with oil.**

**1.1 OIL CHANGE PERIOD**

With new units ; drain and refill after first month whilst the axle is still warm after a short run, then at intervals of 30000 miles (48000 km) or 6 months whichever is shorter.

**Note :- Fill steer drive hubs slowly (preferably by hand gravity fill rather than using a pressurised line filler) to allow oil to percolate through gears and achieve correct level. This is to ensure that correct amount of oil is fed into hub and to avoid splash back of oil giving a false level indication.**

**1.1 OIL LEVEL**

Check oil levels monthly or every 5000 miles (8000 km) whichever is shorter and top up when level falls to 1" (25mm) below maximum level.

**Approximate capacities:**

Each hub :- 2<sup>1</sup>/<sub>2</sub> pints (1.5 litres).  
Drive head :- 15 pints (8.5 litres).

Recommended oil is high grade EP mineral oil to GL5 class Mil - L - 2105D.

**1.1 LUBRICANT REQUIREMENTS**

Ambient Temperature Range		Spiral Bevel - Hypoid and Spur Reduction	
Above	30°C	SAE 140	85W / 140
From	30°C to minus 10°C	SAE 90	80W / 90
From	minus 10°C to minus 25°C	SAE 80W	80W / 90
From	minus 25°C to minus 40°C	SAE 75	75W

**1.1 GREASING PERIOD (axle grease points shown below)**

Steering head bush / bearing Steering ball joints	Regular intervals not exceeding 7 days or 50 hours.
Recommended grease :-	Lithium base roller bearing grease NLGI - No.2 (Shell retinax LX or equivalent).
Brake cam bush Slack adjuster	Every month or 250 hours.
Recommended grease :-	Lithium base roller bearing grease NLGI - No.2 (Shell retinax LX or equivalent).

**RECOMMENDED GREASES**

To Chart 'F' in Lubrication Manual



SECTION 2 ROUTINE MAINTENANCE

2.1 At first vehicle service (1000 miles - 1500 km) then every 30000 miles - 48000 km or 6 months, whichever is soonest, check the following :-

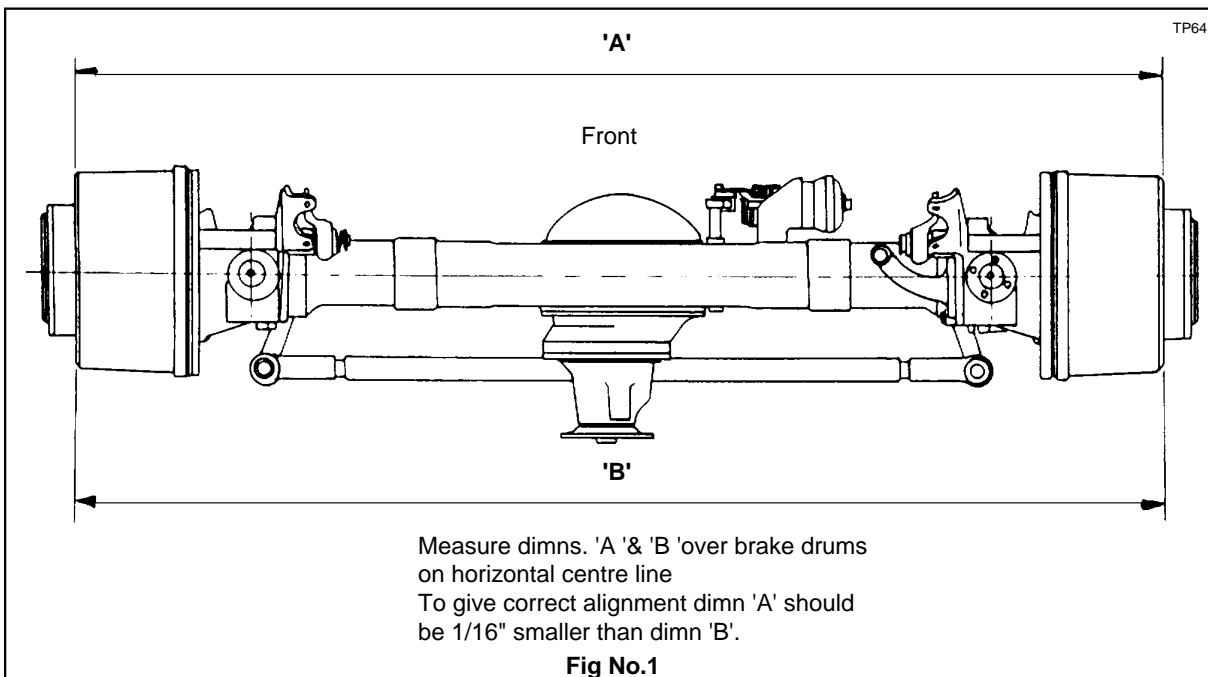
- 1) Hub end float for excess.
- 2) Planet pin bearing surfaces for signs of wear or pitting, renewing pins if damage is evident.
- 3) Planet and sun gears for signs of wear or pitting, renewing if damage is seen.
- 4) Front wheel alignment see section no.28, page no.B35.
- 5) Brake adjustment.
- 6) General condition of nuts and bolts and casing.
- 7) Joints / oil seals for signs of leakage.
- 8) Drain and refill axle with clean gear oil - see lubrication section A for details.
- 9) Re-line brake shoes when brake liners wear down to  $\frac{5}{16}$ " (8mm) thickness, measured at centre of brake shoe.
- 10) Coupling flange for wear / damage.
- 11) Pinion oil seals for leaks.
- 12) Breathers for signs of leakage or dirt ingress.
- 13) Leaks around joints.
- 14) General conditions of nuts, bolts and casing.
- 15) Tighness of all nuts and bolts. Adjust and replace as necessary.

**Note :- Spicer Speciality Axle Division recommend that brake springs are replaced whenever brakes are re-lined. Manufacturers of crimped metal or nylon ring locknuts recommend that they are replaced after being re-used one time.**

**Note :- At the axle build, tracking is set to TD 186/1 i.e 'Toe Out'. However, where part time all wheel drive is used the axle should be re-aligned to 'Toe In' as below:-**

2.2 Check wheel alignment as follows :-

Set wheels in a straight ahead position, and at points level with wheel centre, measure distance between edges of wheel rims both in front and behind axle centre.  
 For correct alignment front measurement ('A') should be 0" to  $\frac{1}{16}$ " smaller than that of rear ('B') i.e. toe-in. To allow for inaccuracies in wheels, same checks should be made with vehicle moved so that wheels have moved a further half a revolution (see fig no. 1).  
 Adjust if required by slackening ball joint clamp bolts and rotating track rod tube.  
**DO NOT forget to re-tighten clamp bolts to 51 - 62lbs.ft. (69 - 84Nm.) after adjusting.**





## 2 ROUTINE MAINTENANCE Cont.

- 2.3 Check permissible slackness in swivel (king) pins every 30000 miles (48000 km) as follows :-  
Aspects to be considered are :-

- |    |                     |
|----|---------------------|
| a) | Lateral slackness.  |
| b) | Vertical slackness. |

Before commencing checks, apply parking brake, raise wheels off the ground and support axle on stands.

- a) Checking lateral slackness

Whilst this is being carried out the brake must be applied.

Place a set-square with its stock on ground and its blade against the tyre wall.

Place a mark on the ground to indicate position of stock end.

Insert a lever through bottom cut-out of wheel and lever it upwards thus moving set-square outboard.

Mark the changed position of the stock end.

Maximum allowable stock displacement (for 22" wheels) is 8mm.

If displacement exceeds 8mm then the need for bush / bearing attention and possible renewal, is in evidence.

- b) Checking vertical slackness

This is measured by a dial indicator anchored to the axle beam and having its pointer placed vertical against the swivel top.

Place a jack against the underside of the swivel and, whilst applying a lifting force, observe any movement on indicator dial.

If vertical movement is evident and it exceeds 0.030" (0.76mm) then re-adjustment of swivel is required.

- 2.4 Replace brake pivot pin lockscrews (45- FH55) whenever brake is overhauled.

**SECTION 3 LUBRICATION OF TYPE D66-12-1S (2ND. AXLE)**

**NOTE :-** New and reconditioned axles leaving Kirkstall are charged with grease, where applicable, but ARE NOT filled with oil

**3.1 OIL CHANGE PERIOD**

With new units drain and refill after first month whilst the axle is still warm after a short run, then at intervals of 30000 miles (48000 km.) or 6 months whichever is shortest.  
Oil flows freely through hubs and drive head. When filling, top up each hub followed by drive head.

**Note :-** Always check final oil level at drive head.

**3.2 OIL LEVEL**

Check oil levels monthly or every 5000 miles (8000 km.) whichever is shorter and top up when level falls 1" below maximum oil level.

**Approximate capacities**  
Each hub....2 pints (1.15 litres)  
Drive head 17 pints (9.7 litres)

Recommended oil is high quality EP mineral oil to GL5 class Mil - L - 2105D

**3.3 LUBRICANT REQUIREMENTS**

Ambient Temperature Range		Spiral Bevel - Hypoid and Spur Reduction	
Above	30°C	SAE 140	85W / 140
From	30°C to minus 10°C	SAE 90	80W / 90
From	minus 10°C to minus 25°C	SAE 80W	80W / 90
From	minus 25°C to minus 40°C	SAE 75	75W

**3.4 GREASE REQUIREMENTS**

Brake cam bushes	Grease every month or 250 hours
Slack adjuster	
Recommended grease	Lithium base roller bearing grease NLGI - No.2

**3.5 RECOMMENDED GREASES**

To Chart 'F' in Lubrication Manual



## SECTION 4 ROUTINE MAINTENANCE

- 4.1 At first vehicle service (1000 miles - 1600 km) then every 6 months or 30000 miles - 48000 km whichever is shortest, check the following :-
- 1) Hub end float, see section no.B12.
  - 2) Planet pin bearing surfaces for signs of wear or pitting, renewing pins if damage is found.
  - 3) Planet and sun gears for signs of wear or pitting, renewing if damage is evident.
  - 4) Brake adjustment see section no.B15.
  - 5) General condition of nuts, bolts and casing.
  - 6) Joints / oil seals for signs of leakage.
  - 7) Re-line / replace brake shoes when linings wear to  $\frac{5}{16}$ " (8mm) thick, measured at centre of brake shoe.
  - 8) Coupling flange for wear / damage
  - 9) Pinion oil seals for leaks.
  - 10) Breathers for signs of leakage or dirt ingress.
  - 11) Tighness of all nuts and bolts.Adjust and replace as necessary.

**Note :- Spicer Speciality Axle Division recommends that brake springs are replaced whenever brakes are re-lined.  
Manufacturers of crimped metal or nylon ring locknuts recommend that they are replaced after being re-used one time.**

- 4.2 Replace brake pivot pin lockscrews (61 - H82) whenever brake is overhauled.





**OVERHAUL INSTRUCTIONS FOR STEER DRIVE TYPE 1S HUB REDUCTION UNIT  
(WITH KIRKSTALL 15 $\frac{1}{2}$ " x 6" S CAM BRAKE )**

**ILLUSTRATION No. : FH55**

**MANUAL SECTION B**



**SERVICE INSTRUCTIONS FOR STEER DRIVE TYPE 1S HUB UNIT  
(WITH KIRKSTALL 15 $\frac{1}{2}$ " x 6" BRAKE)**

**DESCRIPTION**

Drive is transmitted to the hubs by a D.B.M. type universal joint, the outer drive shaft being splined to a floating sun gear. The sun gear mates with three planet gears carried in a robust carrier bolted to the hub. The annulus is a two piece variety splined to axle stub; it also serves to support the outer hub bearing. The hubs are mounted on fully floating taper roller bearings and use two single lip oil seals to stop ingress of dirt and prevent oil leakage into brake drum. The axle stub is bolted to a steering head, supported by a taper roller bearing at the bottom and plain bush at the top, which is bolted to the axle casing.

**Note :- On dismantling, clean all parts (except brake drum and brake liners) in paraffin or other suitable cleaning agent and place on clean work surface.**

**TOOLING LIST**

## TOOLING LIST

Light hydraulic / hand press ( U.J. unit assembly)  
 Spring balance to read to 50lbs  
 Magnetic dial indicator  
 2 off  $\frac{7}{16}$ " UNF x 1  $\frac{1}{2}$ " L extractor bolt  
 3 off  $\frac{1}{2}$ " UNF x 1  $\frac{1}{2}$ " L extractor bolt  
 2 off  $\frac{1}{2}$ " UNF x 2  $\frac{1}{2}$ " L extractor bolt  
 E316 - brake cam bush bumper  
 E317 - hub outer bearing cup bumper  
 E320 - brake shoe bush bumper  
 E321 - bumper handle  
 E398 - hub oil seal wear sleeve bumper  
 E399 - hub bearing nut spanner  
 E405 - extractor equipment for swivel bearing cone  
 E412 - U.J. shaft bush bumper  
 E414 - brake cam oil seal bumper  
 E422 - U.J. shaft oil seal protection sleeve  
 E442 - U.J. support tool  
 E443 - Axle stub oil seal bumper  
 E467 - U.J. extraction tool  
 E544 - inner hub bearing cup bumper  
 E545 - swivel jaw bearing cup bumper  
 E546 - swivel jaw bush bumper  
 E547 - swivel oil seal bumper  
 E548 - U.J. shaft oil seal bumper  
 E549 - U.J. shaft bearing bumper  
 E550 - swivel stub bush bumper  
 E551 - swivel oil seal bumper  
 E552 - hub oil seal bumper (1st seal)  
 E553 - hub oil seal bumper (2nd seal)  
 E557 - Punch tool (U.J. unit dismantling)  
 E558 - Rest (U.J. unit dismantling)  
 E559 - Metal ring (U.J. unit dismantling)  
 E560 - Extractor & screw (U.J. unit dismantling)  
 E562 - Drift for U.J. unit assembly  
 E567 - Swivel dirt excluder bumper  
 E568 - Swivel jaw dirt excluder bumper



**OVERHAUL INSTRUCTIONS FOR TYPE 1S STEER DRIVE HUB  
(WITH KIRKSTALL 15 $\frac{1}{2}$ " x 6" BRAKE)**

**SECTION 1 DRAINING THE HUB OIL**

- 1.1 Before attempting to remove road wheels, drive vehicle onto a level, solid concrete floor; preferably after a short run to warm up the oil.
- 1.2 Chock wheels that are left on ground and apply parking brake.
- 1.3 With road wheels still on ground, loosen wheel nuts (1)
- 1.4 Jack up vehicle and support with axle stands.
- 1.5 Remove wheel nuts (1) then pull off road wheels (care must be taken during this operation)
- 1.6 Rotate to bring planet drain setscrew (66) to its lowest point.
- 1.7 Place a suitable drip tray under axle hub (approximate capacity 2  $\frac{1}{2}$  pts, 1.5 litres)
- 1.8 Remove planet level plug (68) and its washer (67)
- 1.9 Remove drain setscrew (66) and washer (65) to drain oil from hub.
- 1.10 When hub is empty, remove drip tray and dispose of old oil.
- 1.11 Similarly, place a drip tray under drive head (approx. capacity 14 pints, 8 litres) then remove filler and drain plugs to empty axle of oil.

**SECTION 2 DISMANTLING PLANET CARRIER UNIT**

- 2.1 Remove planet carrier setscrews (66) and washers (65)
- 2.2 Screw two of planet carrier setscrews (66) into tapped holes provided in planet carrier flange (6) and tighten evenly to extract planet carrier assembly from hub.
- 2.3 Remove and discard planet carrier 'O' ring (64).
- 2.4 Inspect planet carrier dowels (15) for signs of wear and / or damage and if replacement is necessary, drive out towards inboard side.
- 2.5 Remove planet pin / collar setscrews (3), then ease out planet pin collar (4) and 'O' ring (5).
- 2.6 Support planet carrier assembly, inner face down, on blocks then knock out planet pins (63).
- 2.7 Planet wheels (10), thrust washers (6 & 11), needle rollers (8 & 10), and spacer (9) can then be lifted from planet carrier (6).
- 2.8 Remove plug (69) from planet carrier (6)

**INSPECTION**

Inspect all dismantled parts for wear and / or damage, replacing where required, paying particular attention to check for scoring on planet pin (63), pitting on needle roller bearings (8 & 10) excessive scoring and wear on planet wheels (10) and for stress cracks / damage to planet carrier (6).



## SECTION 3 DISMANTLING HUB ANNULUS AND BRAKE DRUM UNITS

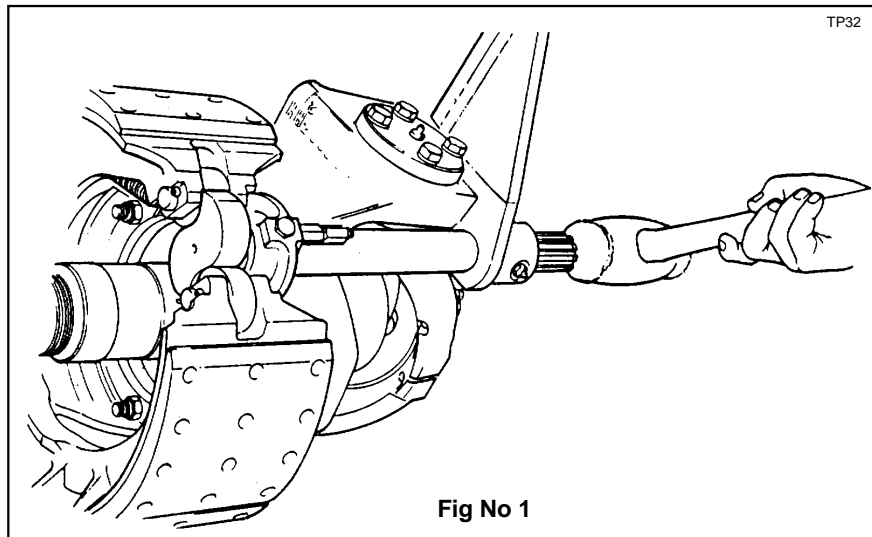
- 3.1 Remove brake drum retaining sectscrew (70) then back off brakes.
- 3.2 Support brake drum (2) approximate weight 105 lb with a sling, or other suitable lifting equipment. Insert 2 off  $\frac{7}{16}$ " UNF x  $1\frac{1}{2}$ " long extractor bolts in tapped holes provided in drum and tighten to draw drum from hub (16). Clean inner face of drum with a clean damp cloth (**do not use paraffin**).
- 3.3 Remove sun gear circlip (62) then pull sun gear (61) off outer drive shaft / U.J. unit (102).
- 3.4 Remove pinch bolt nut (57) and pinch bolt (59) then with service tool no. E399, take off hub bearing nut (58).
- 3.5 Screw a  $\frac{1}{2}$ " UNF x  $1\frac{1}{2}$ " long bolt into each of three tapped holes provided in annulus carrier (14) then evenly tighten bolts to draw annulus assembly, complete with outer hub bearing cone (53A) from axle stub (98).
- 3.6 Pull off outer bearing cone (53A) from annulus carrier arm.
- 3.7 If, for any reason, (stress cracks / damage to annulus gear / carrier) annulus gear (13) needs to be separated from annulus carrier (14) straighten tabs on annulus lockwashers (55) . Take out annulus carrier setscrews (54) and discard lockwashers.
- 3.8 Annulus gear (13) can then be knocked from its register on annulus carrier (14) using a hide faced hammer.
- 3.9 Inspect annulus dowels (56) for wear / damage and pull out for replacement if required.
- 3.10 With hub (16) supported by a sling, or other suitable lifting equipment, knock hub from axle stub (98) using a hide faced hammer.
- 3.11 Place hub assembly, outer face down on work surface and remove and discard hub oil seals (52).
- 3.12 Lift out inner hub bearing cone (18A).
- 3.13 Inspect inner and outer bearing cups (18 & 120) for wear / damage and knock out for replacement if required.

**Note :- If either bearing cup or cone needs replacing, a new matched cup and cone must be fitted.**

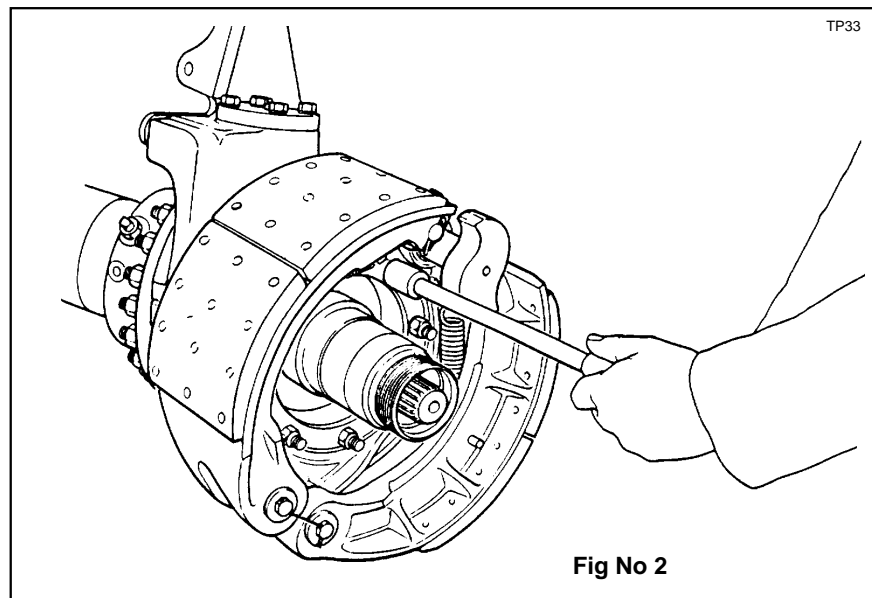
- 3.14 Check wheel studs (17) for signs of misalignment, looseness or wear and knock out for replacement if required.

**MAINTENANCE AND OVERHAUL INSTRUCTIONS FOR KIRKSTALL 15 1/2 " DIA 'S' CAM FRONT BRAKE**
**SECTION 4 REMOVAL OF COMPLETE BRAKE ASSEMBLY**

- 4.1 Turn hub onto full lock to give maximum room at cam side of axle.
- 4.2 Disconnect air chamber from air chamber bracket (88) and support air chamber to prevent air line leakage.
- 4.3 Remove brake cam circlip (93) followed by brake cam washer and spring (92 & 94).
- 4.4 Tap slack adjuster (91) off brake cam shaft (19).
- 4.5 Using a hide faced mallet, knock splined end of brake cam (19) toward outboard side of axle to release brake cam from between brake shoe rollers (33) thus enabling it to be pulled out of assembly along with brake cam washer (24). See fig. no.1.



- 4.6 Remove brake cam washer (24) from brake cam (19).
- 4.7 Remove brake bracket nuts (47) also one (23) which is to the left of brake cam head. See fig. no.2.





**SECTION 4 REMOVAL OF COMPLETE BRAKE ASSEMBLY Cont.**

4.8 Using a hide faced mallet, knock complete assembly from its register. Suitable lifting gear may be required to remove assembly and place on bench. See fig. no.3.

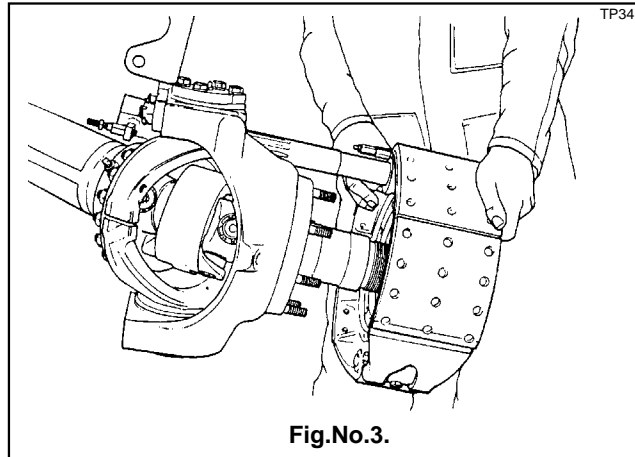


Fig.No.3.

**SECTION 5 BRAKE SHOE REMOVAL ( After removal of complete brake assembly)**

- 5.1 Cut, remove and discard lockwire securing two of four brake shoe pivot bush setscrews (42).
- 5.2 Remove brake shoe pivot bush setscrews (42) and washers (43) from one end of brake shoe pivot pins (46).
- 5.3 Repeat operations 5.1 and 5.2 for other brake shoe pivot bush setscrews and washers on other end of brake shoe pivot pins (46).
- 5.4 Cut, remove and discard lockwire securing brake shoe pivot pin lockscrows (45) then remove lockscrows .
- 5.5 Drive out in turn brake shoe pivot pins (46). Care must be taken during this operation so as not to damage pivot pin setscrew hole thread in the end of pivot pin.
- 5.6 Removal of brake shoe pivot pins (46) reduces brake shoe return spring (20) pressure on brake shoe assemblies, enabling brake shoe return springs (20) to be unhooked from their anchor pins (21 & 50).
- 5.7 The brake shoe assemblies can now be lifted from brake bracket (44).

**SECTION 6 BRAKE SHOE REMOVAL (WITH COMPLETE HUB UNIT IN POSITION)**

- 6.1 Remove brake drum retaining setscrew (70) then, after backing off brakes, remove brake drum (2). Use lifting equipment if required - approx. weight of drum = 105lbs using 2 off 7/16" UNF x 1 1/2" long extractor bolts.
- 6.2 Remove lockwire securing brake pivot pin setscrews (42), also lockscrows (45).
- 6.3 Remove pivot pins with washers (46 & 43) followed by lockscrows (45).
- 6.4 Turn hub until pivot pin extractor hole in hub flange (16) is in line with one of the pivot pins (46) then remove pin outwards through extraction hole. See fig. no. 4.
- 6.5 Unhook brake shoe spring (20) then lift off brake shoe assembly (48).
- 6.6 Repeat operations 6.4 and 6.5 for other pivot pin / brake shoe assembly.

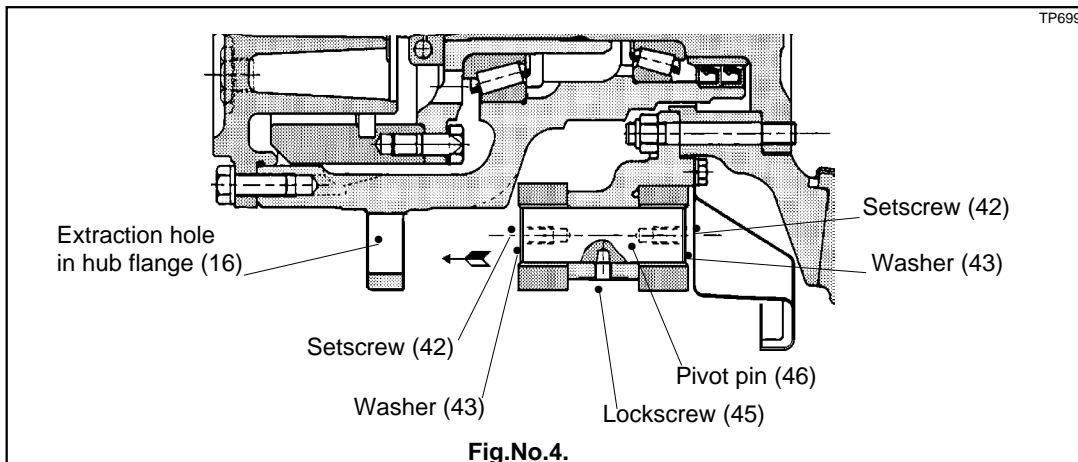


Fig.No.4.



## SECTION 7 DISMANTLING THE BRAKE SHOE UNIT

- 7.1 Inspect brake linings (37) for wear / damage.  
Minimum allowable thickness of liner (37) is  $\frac{3}{8}$ " (9.5mm) measured at centre of brake shoe.
- 7.2 If new linings are required, drill out, using a  $\frac{1}{4}$ " dia. twist drill and discard brake shoe rivets (39).
- 7.3 Inspect brake shoe bushes (49) for wear/ damage and using service tool no. E320 or other suitable bumper, knock out for replacement if required.
- 7.4 Pull out brake shoe roller pin split pin (32) then knock out brake shoe roller pin (36) thus releasing brake shoe roller (33).
- 7.5 Inspect both roller and pin for wear / damage and replace if required.
- 7.6 Remove brake shoe anchor pin split pin (51) and pull out brake shoe anchor pin (50) using a  $\frac{1}{8}$ " dia wire hook.
- 7.7 Repeat operations 8.1 to 8.6 for other brake shoe assembly.

## SECTION 8 DISMANTLING BRAKE BRACKET AND CAM SHAFT UNIT

**Note :- The hub assembly must be removed before starting this section**

- 8.1 Disconnect air chamber from slack adjuster (91).
- 8.2 Remove brake cam circlip (93), washer (92) and spring (94).
- 8.3 Mark position of slack adjuster (91) relative to cam shaft (19) then tap slack adjuster from its position on brake cam shaft splines (19).
- 8.4 Pull brake cam shaft (19) from brake bracket (44).
- 8.5 Remove cam head washer (24) from cam shaft (19).
- 8.6 Remove and discard cam head 'O' ring (25) and oil seal (28) from brake bracket (44).
- 8.7 Inspect brake cam bush (27) for signs of wear / corrosion and if replacement is required knock out of brake bracket (44) using service tool no. E316 or other suitable bumper tool.
- 8.8 Check chamber bracket bush (90) for wear / corrosion and knock out for replacement, if required, as follows :-
  - a) Remove chamber bracket nuts (95).
  - b) Tap brake chamber bracket (88) from its position on chamber bracket studs (83)
  - c) Remove and discard 'O' ring (89) then drift out cam bracket bush (90).
- 8.9 Check condition of brake bracket anchor pin (21) and washers (22) for damage / corrosion and remove for replacement if required.
- 8.10 Check lubricators (30 & 87) and lubricator extension (29) for damage or corrosion and remove for replacement if required.
- 8.11 If for any reason brake bracket (44) needs to be removed, take off brake bracket nuts (23 & 47) and then knock brake bracket (44) from swivel jaw (71).

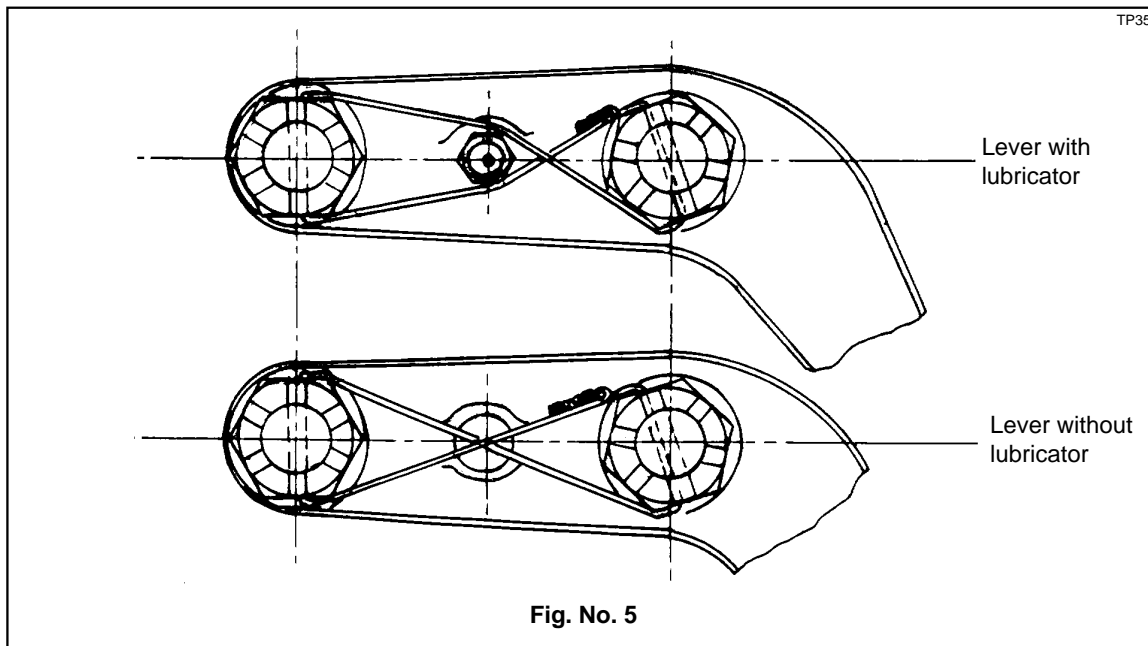


## SECTION 9 BRAKE BRACKET AND CAM SHAFT RE-ASSEMBLY

- 9.1 Refit brake cam lubricators (29 & 49), new protective caps (30 & 51) also lubricator extension (29) into their positions in brake bracket (44) and chamber bracket (88).
- 9.2 Lubricate a new brake cam 'O' ring (89) with clean gear oil and ease into position in chamber bracket (88).
- 9.3 With service tool no. E316 or other suitable bumper tool, refit brake cam bushes (27 & 90) into brake bracket (44) and brake chamber bracket (88) respectively.

**Note :- Take care to line up lubrication holes in bushes and bracket bosses.**

- 9.4 Using service tool no. E414, refit cam oil seal (28) open side first, to abut brake cam bush (27).
- 9.5 Refit chamber / cam bracket (88) onto chamber bracket studs (83) and secure in position with nuts (95). Tighten nuts to 190 - 210 lbs. ft. (258 - 285 Nm.). Secure in position using 16 swg lockwire (see fig. no.5).



**Fig. No. 5**

- 9.6 Tap brake bracket (44) into position on swivel jaw (71) and secure with brake bracket nuts (23 & 112). Tighten nuts to 95 - 110lbs. ft. (128 - 150 Nm).
- 9.7 Refit brake anchor pins (21) and washers (22).
- 9.8 Place cam head washer (24) and cam 'O' ring (25) in position on brake cam shaft (19).
- 9.9 Smear brake cam bushes (27 & 90) 'O' rings (25 & 89) and oil seal (28) with Shell Retinax LX or equivalent grease. Ensure all indentations are full
- 9.10 Feed cam shaft assembly into position taking care not to damage seals.





**SECTION 10 BRAKE SHOE ASSEMBLY**

- 10.1 Using service tool no. E320 or other suitable bumper tool, fit two brake shoe bushes (49) into one of brake shoes (48) and flush with inner faces of lugs.
- 10.2 Repeat operation 10.1 for other brake shoe (48).
- 10.3 If new liners (37) are to be fitted, proceed as follows :-

For ease of assembly ensure that different sizes of rivets are stored in separate containers.

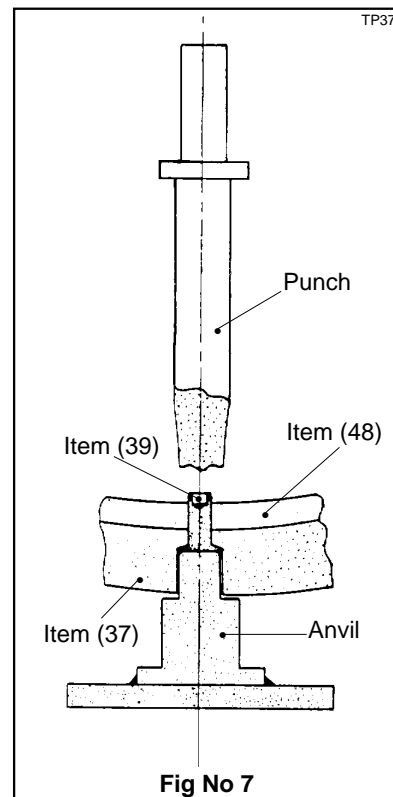
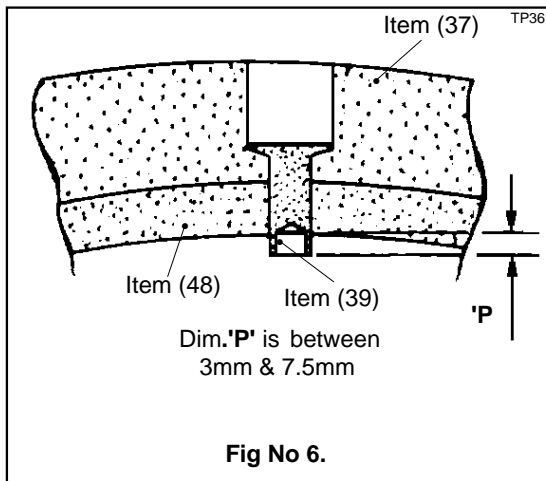
- a) Place brake shoe (48) outer face uppermost, on bench.
- b) Position first liner (37) on shoes and locate in place by fitting rivets (39), in centre line of holes (4 off).  
Then fit rivets (39) into outer lines of holes (8 off).  
Repeat for second liner half (37).
- c) Tap rivets (39) fully home using a suitable drift and hammer.
- d) Turn brake shoe (48) onto its side and check amount of rivet (39) protrusion from inner curved face of brake shoe.  
Correct protrusion 'P' is between 3mm & 7.5mm. See fig.no. 6.

**Note :-** If any holes are fitted with rivets (39) and they protrude **MORE THAN 7.5mm**, then either brake shoe and / or liner are defective and **must be replaced**.  
When all rivets protrude correct amount, insert a thin,  $\frac{1}{64}$  " dia (4.4mm) max, screwdriver or steel rod into end of each rivet (39) in turn and lever sideways to slightly deform end of rivets.  
**This retains rivets in position during final peening operation.**

- e) Place assembled shoe, liners underneath, on riveting machine or suitable hand equipment (see fig. no. 7) and peen over rivets to secure liners (37) to brake shoe.

**Note :-** Due to limited access, centre rivets will have to be peened using hand peening equipment.

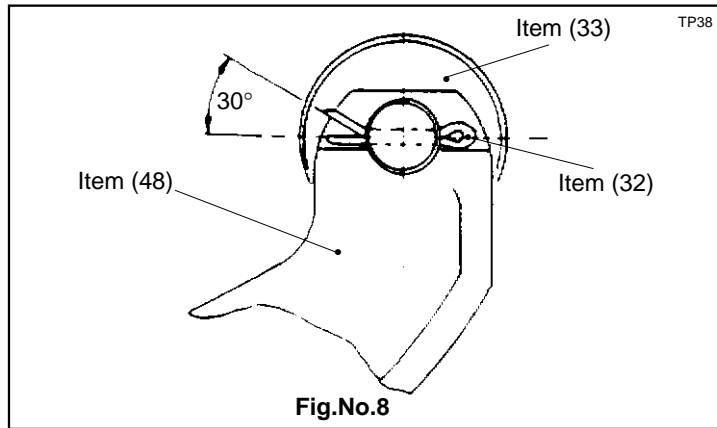
- f) After riveting check brake shoe to liner clearance, using feeler gauges.  
Permissible clearance is 0.000" to 0.004" (0.0 to 0.102mm).





**SECTION 10 BRAKE SHOE ASSEMBLY Cont.**

10.4 Smear bore of one of brake shoe rollers (33) with grease (BP Energrease AS11 or equivalent). Locate roller (33) in position, fit brake shoe roller pin (36) so that headed portion will be towards brake bracket (44) when fitted. Secure in place with brake shoe roller pin split pin (32). Splay pin (32) to approx 30° as shown in fig. no. 8 to avoid fracture of leg.



10.5 Repeat operation 10.4 for other brake shoe assembly.

**SECTION 11 FINAL ASSEMBLY OF BRAKE Ref Fig 9.**

11.1 Wipe clean inner surfaces of brake shoe bushes (49) and smear with BP Keenomax L2 or equivalent high melting point grease. Ensure all indentations are full.

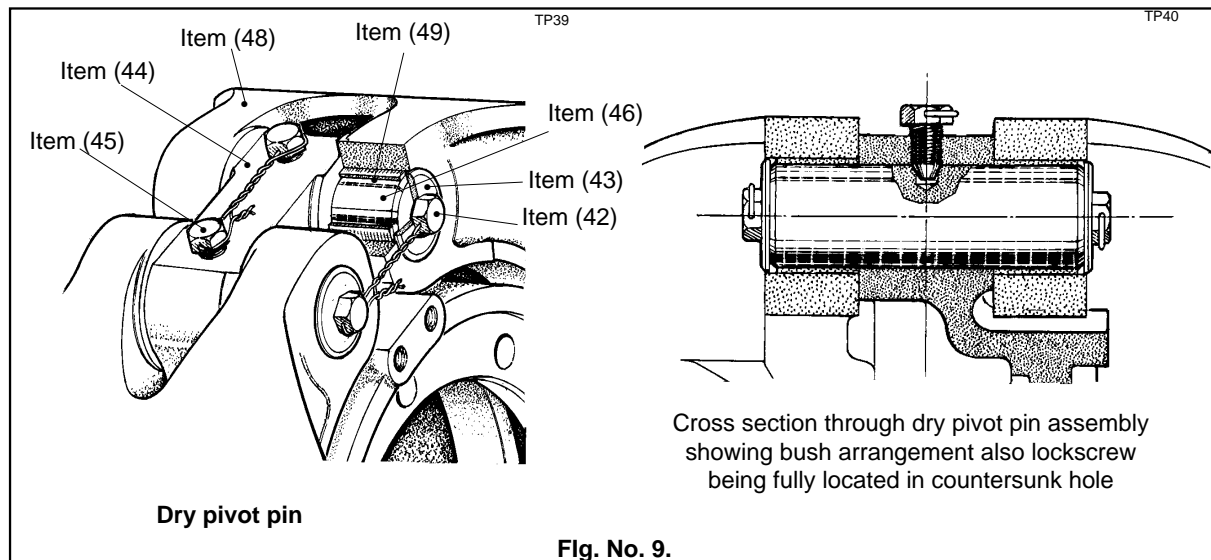
11.2 Fit brake shoe to brake bracket as follows:-

- a) Assemble a brake shoe pivot setscrew washer (43) and a brake shoe pivot bush setscrew (42) together, then screw into one end of a brake shoe pivot pin (46), finger tight.
- b) Position first brake shoe (48) on brake bracket (44). Insert partially assembled pivot pin in pivot pin hole either side of brake shoe, passing through brake bracket and into other bushed hole as shown.
- c) Using pivot pin setscrew (42), rotate pivot pin until countersunk hole in pivot pin is in line with threaded hole on brake bracket (44).
- d) Screw a brake shoe pivot pin lock screw (45) into threaded hole in brake bracket (44) to locate in countersunk hole in pivot pin (46), thus locking pivot pin then tighten lock screw (45).

**Note :- Care must be taken during this operation as misalignment can cause brake drum obstruction.**

- e) Fit second brake shoe pivot pin (46).
- f) Repeat above operations for other brake shoe assembly.

11.3 When both brake shoe assemblies are fitted, secure lock screws (45) and pivot pin setscrews (42) with 18SWG (1.25mm) lockwire as shown.

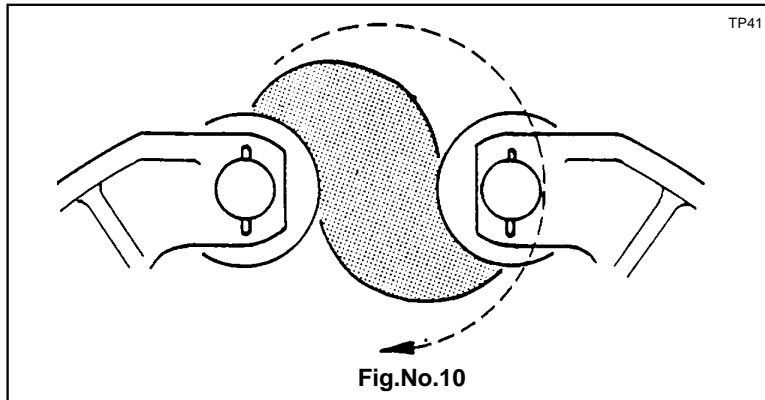


**Fig. No. 9.**

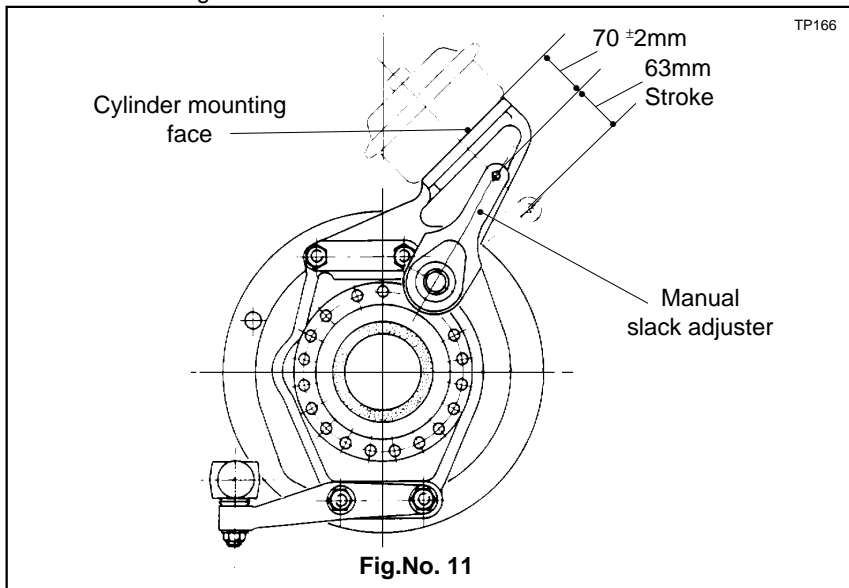


**SECTION 11 FINAL ASSEMBLY OF BRAKE Cont.**

11.4 Seat brake shoe rollers (33) in position on brake cam (19) so that they lie in the depressions, see fig 10. This ensures that cam is in its correct operating position.



- 11.5 Smear anchor pin (50) with BP Energrease AS11 or equivalent grease then refit brake shoe anchor pin split pin (51) and position anchor pin into brake shoe (48).
- 11.6 Hook brake shoe return spring (20) onto brake shoe anchor pin (50), then expand with a spring bar or 1/2" blade screwdriver to position on to brake bracket anchor pin (21).
- 11.7 Repeat operations 11.5 and 11.6 to fit other brake shoe return spring (20) to other brake shoe (48).
- 11.8 Fit slack adjuster as follows :-
  - a) Check that brake chamber push rod is in its fully released position.
  - b) Smear brake camshaft and slack adjuster splines (19 & 91) with BP Keenomax L2 or equivalent grease.
  - c) Fit slack adjuster (91) onto brake camshaft splines (19) in its original marked position as shown in figure no.11.



- d) Screw clevis onto brake chamber push rod to its original position, then secure with locknut.
  - e) Fit clevis pin and secure in position with split pin.
- 11.9 Fit cam spring (94), brake cam washer (92) and circlip (93).



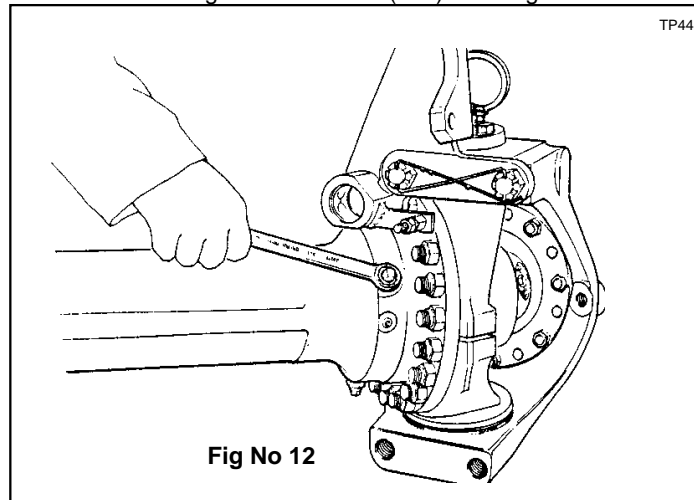
## STEERING HEAD AND AXLE STUB

## SECTION 12 REMOVAL OF STEERING HEAD ASSEMBLY

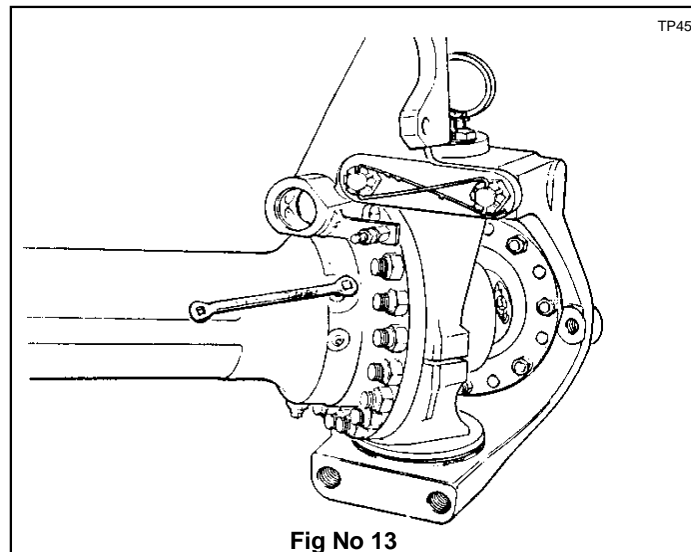
- 12.1 Take out ball socket split pin (132 & 138) then remove ball socket nut (131 & 137) along with washer (133 & 139).
- 12.2 Using a suitable ball pin extractor, remove ball socket assembly (122 & 124) from bottom steering lever (127 & 135).

**Note :-** When separating ball joint from steering lever, an extractor tool **MUST** be used. **DO NOT** strike areas around ball pin tapers with hammer blows under any circumstances due to possible ball pin taper deformation.

- 12.3 Loosen swivel top cap setscrews (80) to release pressure in steering head. Remove one of setscrews along with its washer (79) and replace with an eye bolt.
- 12.4 Remove U.J. fork oil seal housing lockscrew nuts (115). See fig no.12.



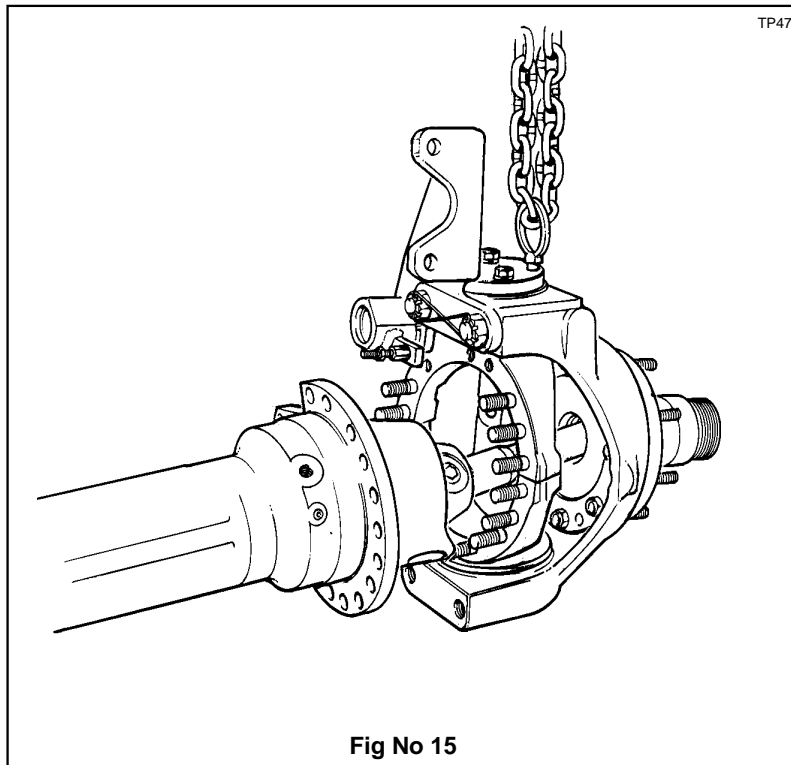
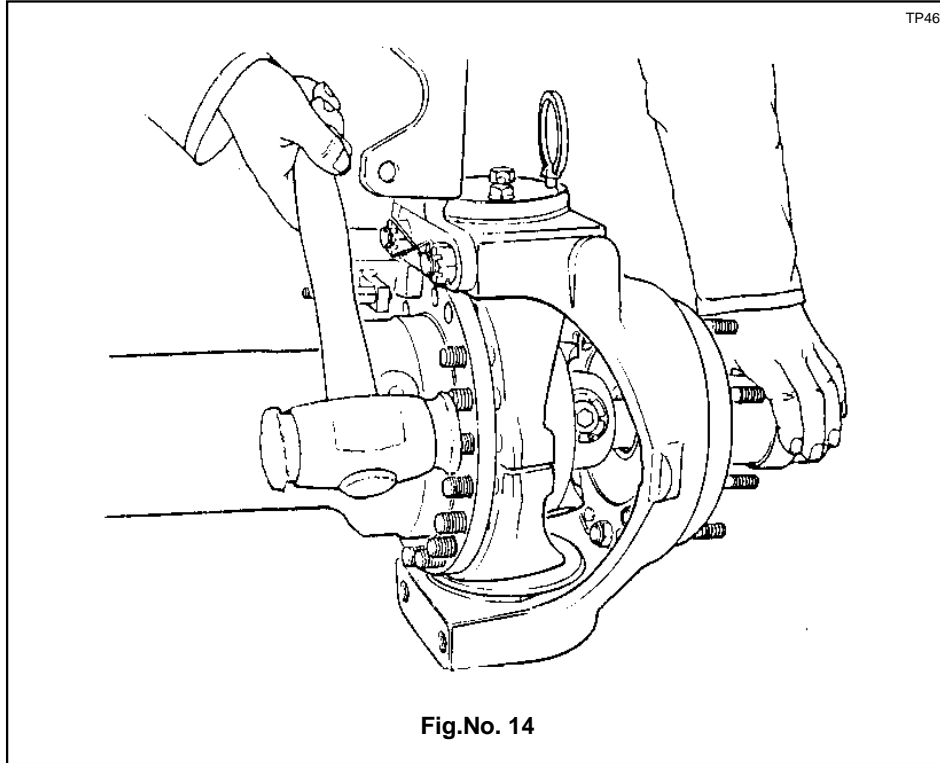
- 12.5 Remove U.J. fork oil seal housing lockscrews (114). See fig no. 13.





**SECTION 12 REMOVAL OF STEERING HEAD ASSEMBLY Cont.**

- 12.6 Remove swivel axle casing setscrews (110) and swivel / axle casing / stud nuts (113).
- 12.7 Using suitable lifting gear, support steering head / axle stub assembly using eye bolt.
- 12.8 Using a hide faced mallet, tap steering head from its register then completely remove and place on suitable bench. See fig.nos. 14 and 15.
- 12.9 Sun gear / U.J. shaft thrust sleeve (60) will be drawn from drive shaft when steering head is removed.





## SECTION 13 DISMANTLING THE STEERING HEAD / AXLE STUB

- 13.1 Remove lubricator (81) with protective cap (82) from top cap (78) followed by top cap setscrews (80) and washers (79).
- 13.2 Lift off top cap (78) complete with thrust button (77), also shims (76) then remove any sealant present on top cap and shim mating faces (78 & 76) using Loctite 'Chisel Gasket Remover' or by carefully scraping sealant from parts.
- 13.3 Screw one of swivel jaw top cap setscrews (80) into tapped hole provided in centre of swivel jaw top cap thrust disc (77), and tighten screw to extract thrust disc.
- 13.4 Swing top swivel (74) horizontally through approx. 35°, enabling it to be dropped down and then pulled outwards from swivel jaw (71). Inspect swivel felt (84) and retaining ring (85) for wear / ingress of dirt and pull off and replace if necessary.  
Inspect axle casing / swivel studs (93 ) for damage and / or misalignment and replace if required.
- 13.5 Lift out bottom swivel (142) complete with dirt excluder (143), oil seals (144) and bearing cone (145A).
- 13.6 Using a hide faced hammer, tap off bearing cone (145A) and remove and discard swivel oil seals (144).  
Inspect dirt excluder (143) for damage or excessive corrosion and tap off for replacement if required.
- 13.7 Inspect bearing housing (146) and swivel bearing cup (145) for signs of wear and / or damage.  
Using suitable extractor tooling, (tool no. E405) remove bearing cup from housing.

**Note :- If either bearing cup or cone is damaged, replace with a new matched cup and cone assembly.**

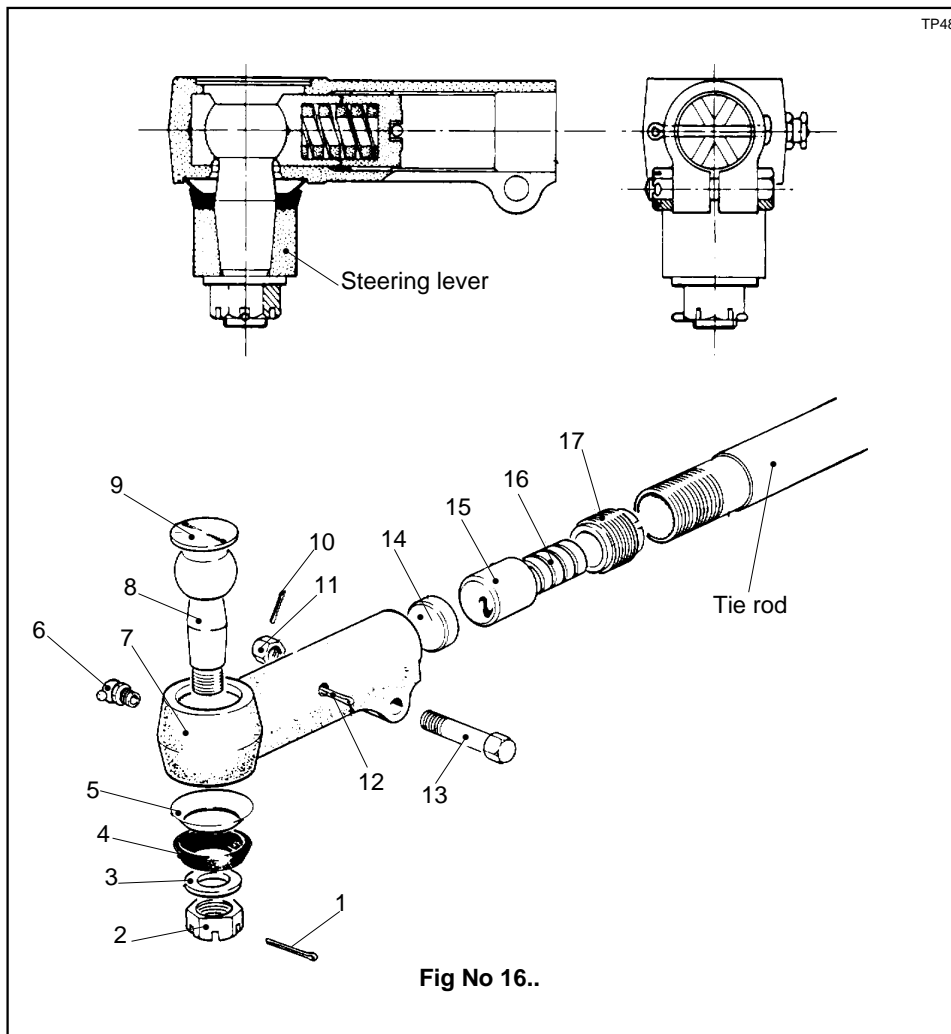
- 13.8 Remove lubricator (147) with protective cap (148) from swivel jaw bearing sleeve (146) then, using a hide faced hammer, knock swivel jaw bearing sleeve from swivel jaw (71).
- 13.9 Inspect swivel top bush (75) for wear and / or corrosion, then with service tool no. E546 drive out bush if required.
- 13.10 Inspect chamber bracket studs (83) and bottom lever studs (140 & 129) for damage and / or misalignment and replace if required.
- 13.11 Remove swivel jaw / swivel stub nuts (116), then separate swivel stub (98) from swivel (71).
- 13.12 Inspect swivel stub / swivel jaw studs (119) for damage and / or misalignment and replace if required.
- 13.13 With a suitable pry bar, remove and discard dirt excluder and swivel stub oil seal (63 & 78).
- 13.14 Inspect swivel stub bush (99) for signs of wear or damage and knock out with a soft metal drift if required.
- 13.15 Inspect brake bracket / swivel stub studs (97 & 117) for damage and / or misalignment and replace if required.
- 13.16 Check condition of pressure relief valve in axle stub.



SECTION 14 DISMANTLING BALL SOCKET SEE FIG No 16

- 14.1 Remove dirt seal (4) also dirt seal (pressing) (5) from ball pin.
- 14.2 Remove split pin (10) from pinch bolt nut (11).
- 14.3 Slacken pinch bolt nut (11) then unscrew and remove ball socket assembly from tie rod having first marked ball socket body and tie rod to enable tracking on re-assembly.
- 14.4 Remove adjuster split pin (12) from ball socket body (7).
- 14.5 Using a suitable tool ie: a piece of 1 " x 1/8 " x 9 " flat bar, unscrew and remove adjusting piece (17). Waggle ball (8) to free thrust cap (15).
- Remove compression spring (16) also thrust cap (15) from ball socket body.
- 14.6 Using a hide faced mallet, tap ball pin (8) out of body. This operation will also remove cover plate (9) from body (7).
- 14.7 The rubbing pad (14) can now be removed from body (7).

Thoroughly clean all parts and check for wear, renewing where necessary.



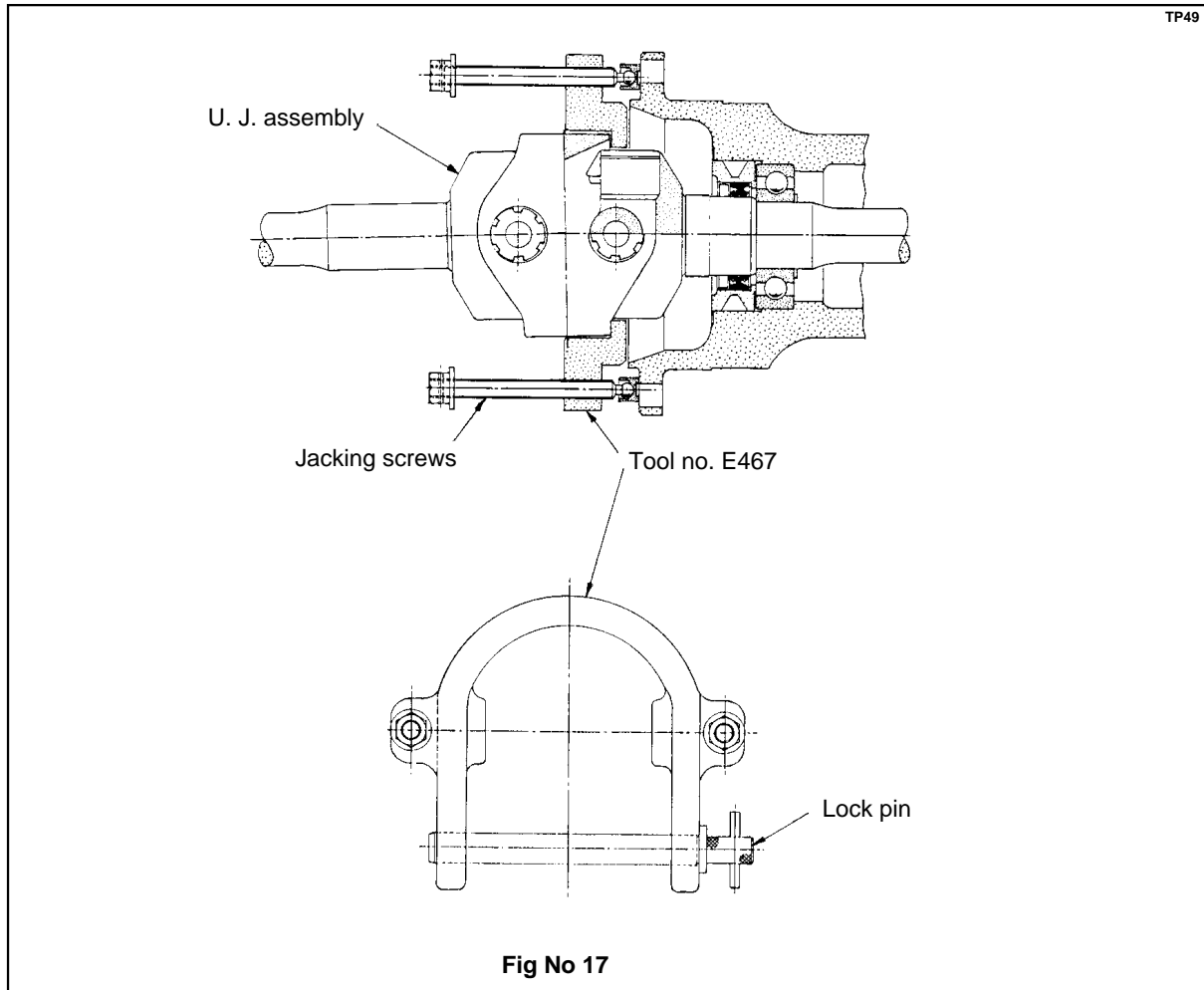


SECTION 15 REMOVAL OF U. J. ASSEMBLY

**Note :-** Before removal of U. J. assembly the axle drive head should be drained of oil ( approx capacity 14 pints - 8 litres).

Having previously removed U. J. fork oil seal housing lock screws and nuts in section 13.4 & 13.5

15.1 Fit tool no. E467 into position on U. J. assembly / axle casing then tighten jacking screws evenly to pull U. J. assembly (64 ) from axle casing (111). (See fig. no. 17).



- 15.2 With suitable circlip pliers, remove drive shaft circlip (109).
- 15.3 Support U. J. assembly with blocks under oil seal housing (106) and tap end of drive shaft with a hide faced mallet to release inner drive shaft bearing (108) and shim (107).
- 15.4 Prise out dirt excluder (103) and oil seal (104) from oil seal housing (106) discard oil seal and dirt excluder.
- 15.5 Strip down U. J. assembly if required ( See instructionson following pages).
- 15.7 Remove any sealant from oil seal housing and its mating face in axle arm (68 & 72) using Loctite Chisel Gasket Remover or by carefully scraping sealant from faces.

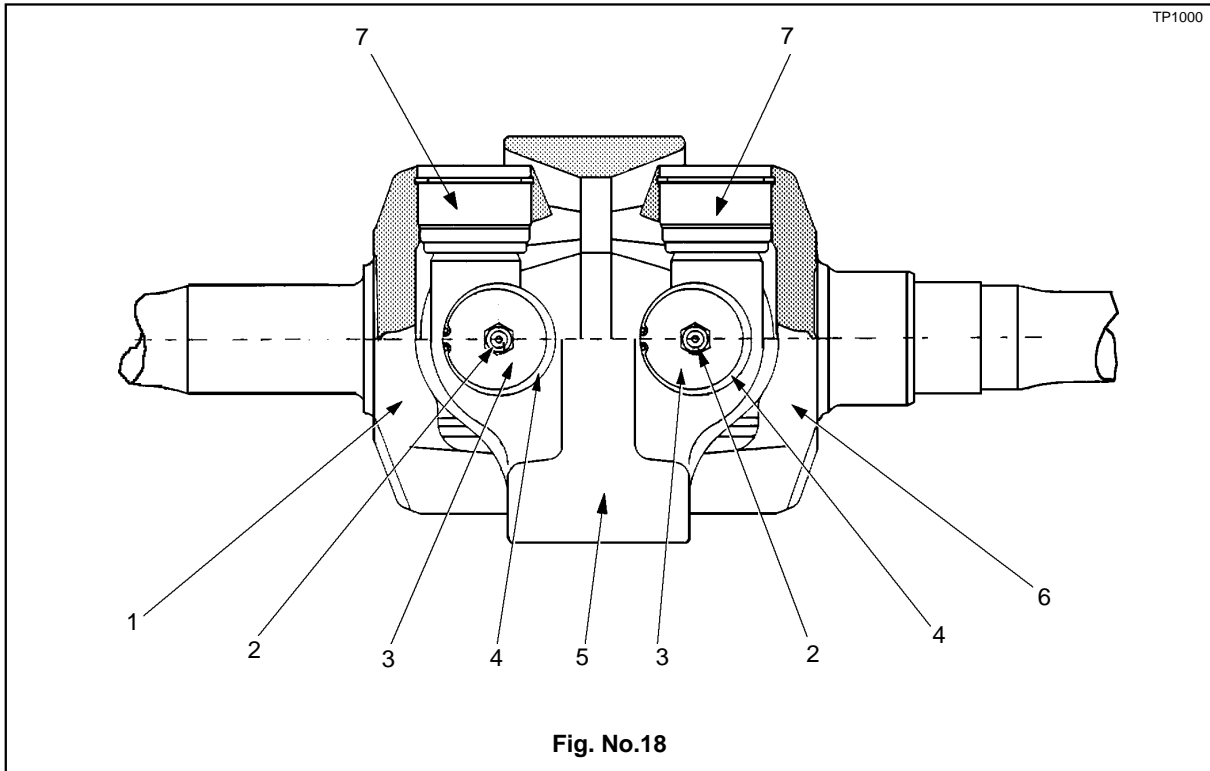




SECTION 16 DISMANTLING OF DBM U.J. UNITS

Tooling and equipment required

- a) Light hydraulic / hand press.
- b) Punch (tool no.E557).
- c) Rest (tool no. E558).
- d) Metal ring (tool no.E559).
- e) Extractor & screw (tool no.E560).
- f) Copper hammer.



- 16.1 Remove lubricators (2) from opposite ends of cross trunnion (7) in central housing (5).
- 16.2 Using punch (tool no. E557) and copper hammer, knock bearing (3) inwards with light taps to release pressure on circlip (snap ring)(4).
- 16.3 Remove circlip (snap ring) (4).
- 16.4 Repeat operations 16.2 & 16.3 for opposite end of trunnion (7).
- 16.5 Remove bearing using extractor tool (tool no. E560).
- 16.6 Remove axle shaft complete with trunnion (7) from central housing (5) by lightly twisting and pulling.
- 16.7 Remove circlips (4) from ends of trunnion (7) as stated in 16.2 to 16.4.
- 16.8 Position axle / trunnion assy. with free ends of trunnion (7) in position in rest (tool no. E558) under the press.
- 16.9 Place metal ring (tool no. E559) over fork (1 or 6) and round bearing (3).
- 16.10 Gently remove bearing (3) using hydraulic / hand press.
- 16.11 Turn assembly over to remove bearing (3) from opposite side.
- 16.12 Repeat operations above to dismantle other drive shaft / U. J. assembly.



SECTION 17 RE-ASSEMBLY OF DBM U.J. UNITS ( Fig. no.27)

Tooling and equipment required

- a) Light hydraulic / hand press.
- b) Copper hammer.
- c) Adequate rest to keep central housing horizontal during press operations.

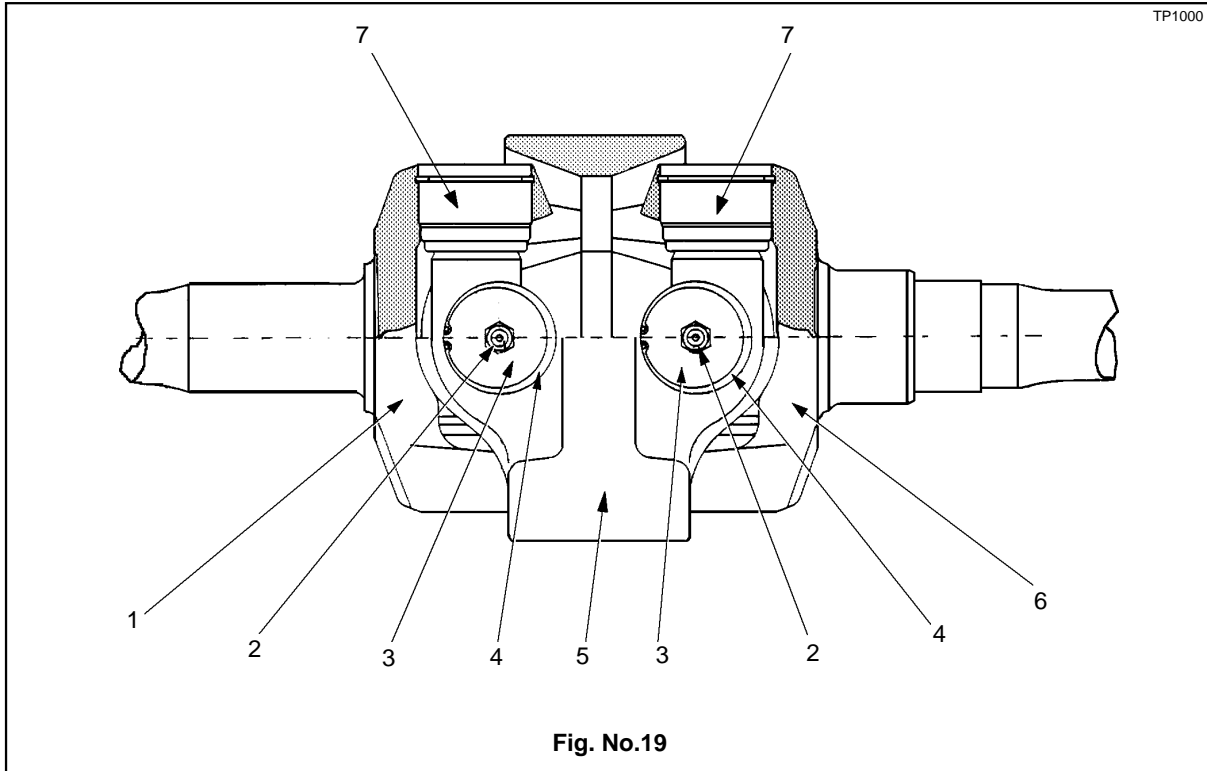


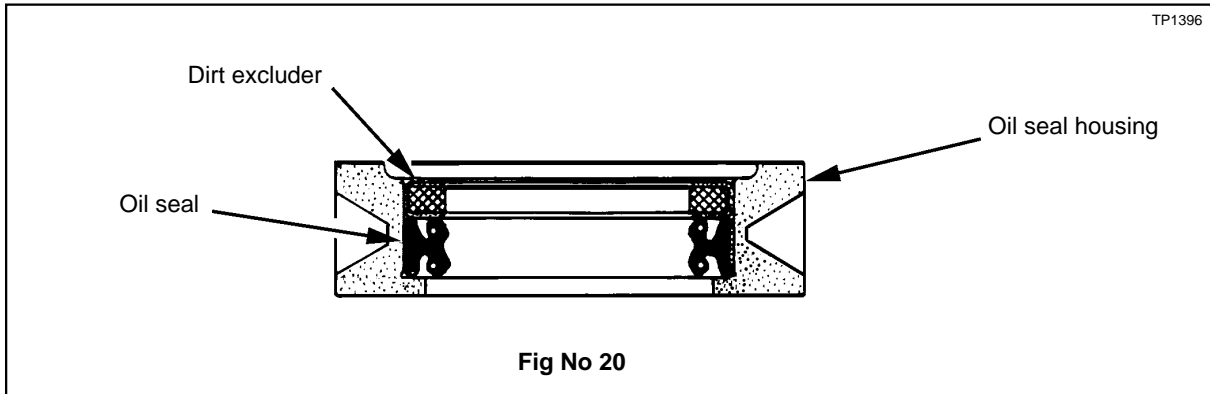
Fig. No.19

- 17.1 Press a bearing (3) half way into axle drive shaft fork (1 or 6).
- 17.2 Insert one end of a trunnion (7) into free hole (bottom) in fork (1 or 6) then pull up to locate in bearing (3).
- 17.3 Press bearing (3) completely in until circlip (4) can be fitted.
- 17.4 Fit circlip (4) in its groove in fork (1 or 6) to secure assembly.
- 17.5 Turn assembly over and press second bearing (3) into position, lining it up with trunnion (7).
- 17.6 Fit circlip (4) in its groove in fork (1 or 6) to secure assembly.
- 17.7 Hold axle shaft assembly in your hand and lightly hit fork (1 or 6) a couple of times on side where second bearing (3) was fitted to settle the unit parts.
- 17.8 Assemble other drive shaft parts as stated in 17.1 to 17.7.
- 17.9 When both axle shaft units are assembled, fit to central housing (5) as follows (Suggested two man operation).
- 17.10 Hold central housing (5) with a cross hole at top then offer axle shaft unit with free end of trunnion (7) lined up with hole, press a bearing half way into housing.
- 17.11 Lift up the axle unit into bearing (3) then press bearing fully home to allow circlip (4) to be fitted.
- 17.12 Turn the assembly over and fit second bearing (3) fully home and secure with circlip (4).
- 17.13 Tap the assembly gently with copper hammer to settle the unit parts.
- 17.14 Repeat operations 17.10 to 17.13 to fit other axle shaft unit to central housing (5).
- 17.15 Re-fit lubricators (2) and then charge the assembly with grease (Shell Retinax LX or equivalent).



## SECTION 18 SUB ASSEMBLY OF U.J. UNIT

- 18.1 Using tool no. E443 knock oil seal (104) metal face first into position abutting oil seal spacer (.). Similarly fit dirt excluder (103) to abut oil seal (104). See fig. no. 20.

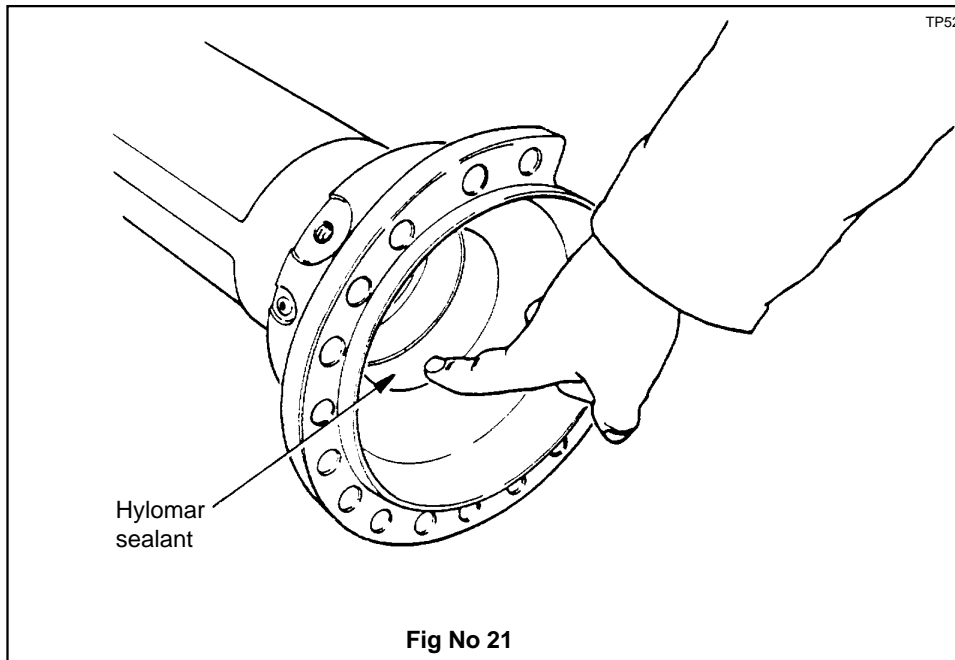


- 18.2 Lightly brush oil seal lips (104) with Auto Lubrication Grease 000EP then carefully push oil seal housing assembly into position on U. J. assembly.
- 18.3 Place shim (107) followed by U. J. bearing (108) into position on U. J. assembly (102) abutting oil seal housing (106).
- 18.4 Pack U. J. bearing (108) with grease (Shell Retinax 'LX' or equivalent) and using a hide faced mallet, tap bearing into position against abutment shoulder on drive shaft.
- 18.5 With circlip pliers, fit drive shaft circlip (109) into its groove on drive shaft (102).

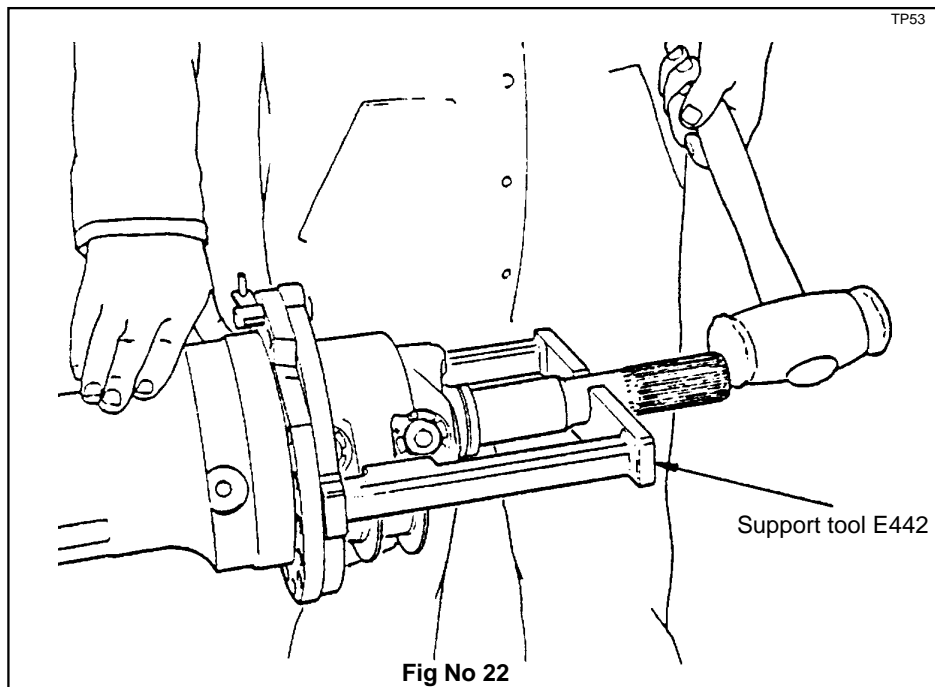


**SECTION 19 FITTING U. J. UNIT INTO AXLE CASING**

- 19.1 Clean o / dia. of oil seal housing and its mating diameter in axle arm (68 & 72) with Loctite ' Solvent no.7070' or other chlorinated cleaning fluid then apply a bead of Hylomar sealant completely around oil seal housing mating diameter in axle casing arm (111). (see fig. no 21).



- 19.2 Fit tool no. E442 to axle casing flange (111) then carefully feed U. J. assembly into position in axle arm, ensuring correct location of drive shaft in drive head splines and that no damage occurs to oil seal in the process.Using a soft metal drift (tool No. E562 or similar)carefully tap oil seal housing into position in axle arm alternately tapping shaft into position using a hide faced mallet as shown in fig no. 22.

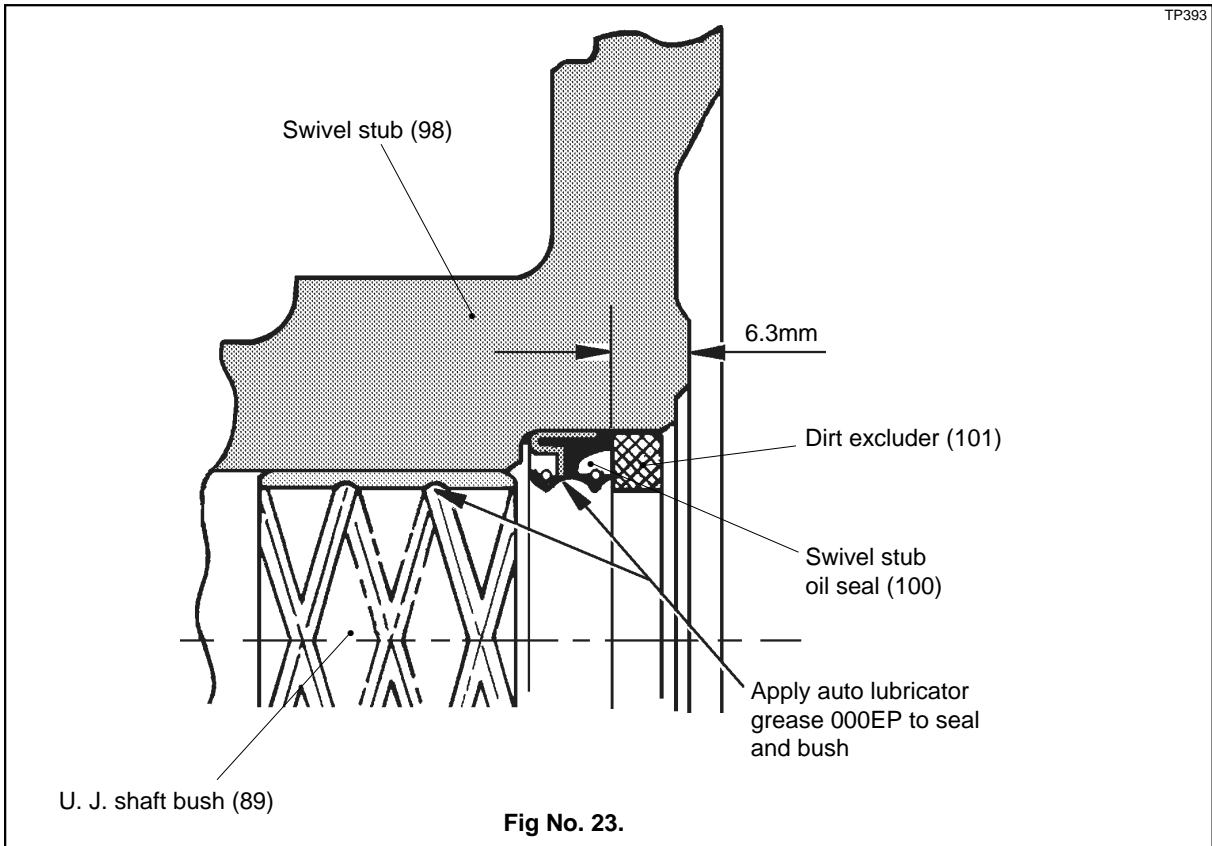


- 19.3 Fit U. J. oil seal housing lockscrows (114) into axle arm (111).  
Tighten lockscrows to 72 - 80 lbs. ft. (98 - 109Nm.)
- 19.4 Fit oil seal housing locknuts (115) and tighten to secure lockscrows (114) in position.
- 19.5 Fit lubricator hole plug (112).



SECTION 20 ASSEMBLY OF SWIVEL JAW AND AXLE STUB

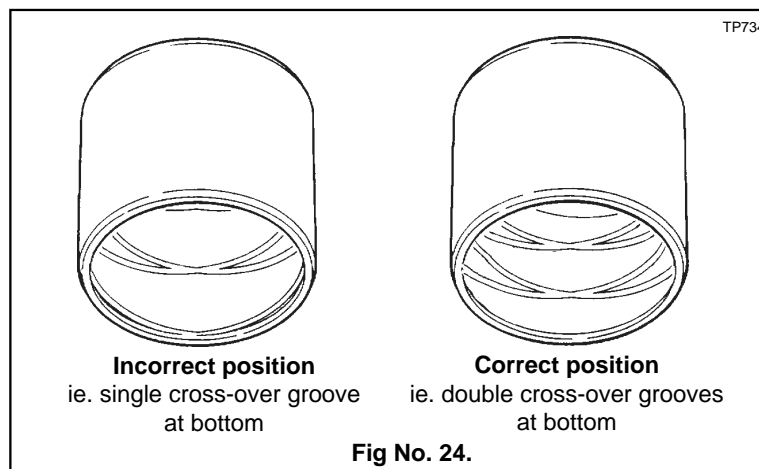
- 20.1 Using service tool no. E550, knock U.J. shaft bush (99) into position in swivel stub (98), ie. flush to  $\frac{1}{16}$ " inside shoulder as shown in fig. no. 23 also that double cross-over grooves in bush will be at bottom when stub and swivel jaw are fitted together. See fig. no. 24.
- 20.2 Using service tool no. E443 or similar, fit twin lip oil seal (100) 6.3mm down stub bore (98) as shown in fig no. 31.



- 20.3 Fit swivel stub dirt excluder (101) to abut oil seal (100) using tool no. E568.
- 20.4 Apply a small amount of auto lubricator grease 000EP between oil seal lips (100), also into grooves in bush (99).

**Note :- This is to ensure that bush and oil seal are lubricated on initial running of axle.**

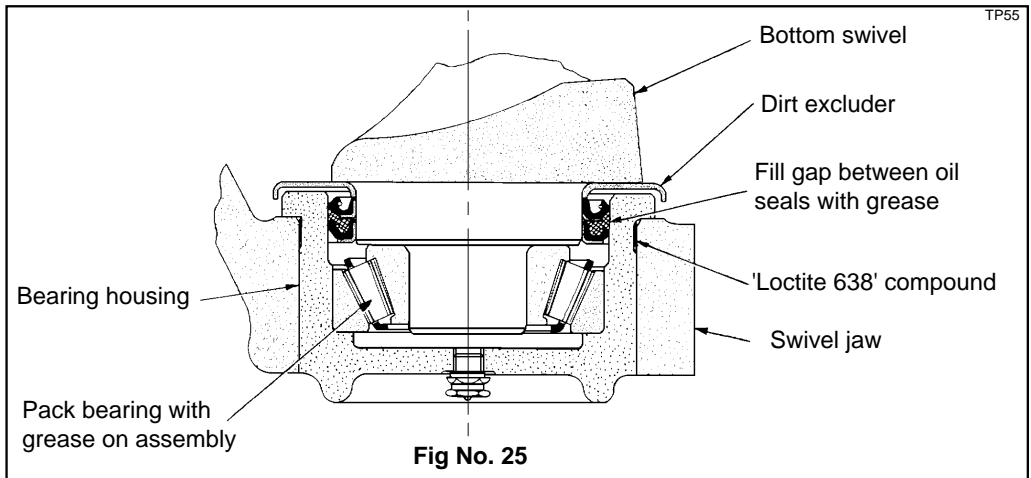
- 20.5 Using service tool no. E545 knock swivel jaw bearing cup (145) into position in swivel jaw bearing sleeve (146).





SECTION 20 ASSEMBLY OF SWIVEL JAW AND AXLE STUB Cont.

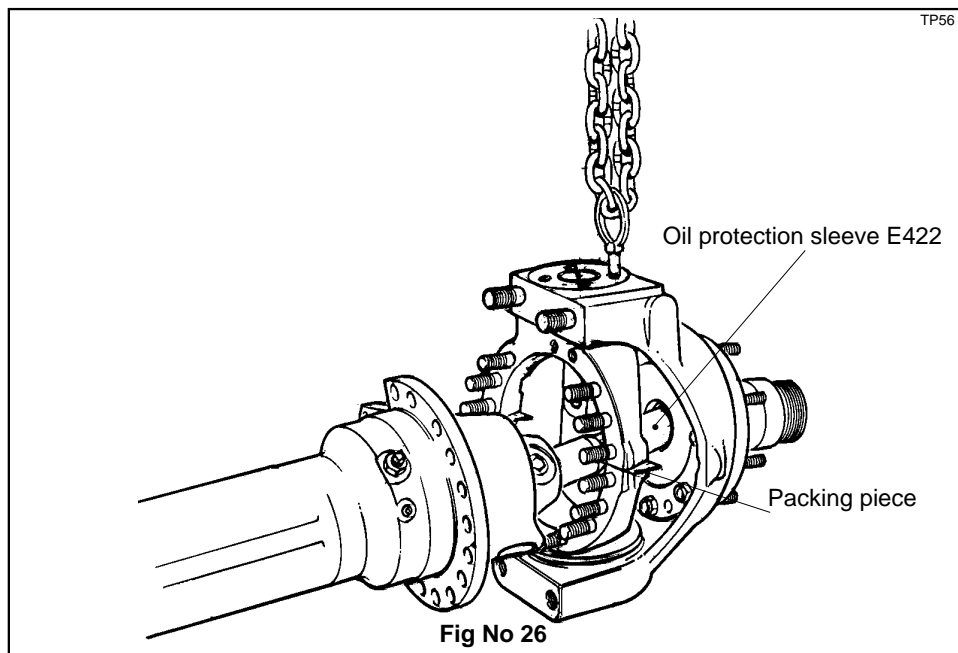
- 20.6 Fit swivel jaw bearing sleeve (146) into swivel jaw as follows:- (see fig no.25.).
- a) Ensure that surface of the swivel jaw bore and outer diameter of bearing sleeve are de-greased, clean and dry.
  - b) Coat undercut diameter of bearing sleeve with 'Loctite 638' to a bond line thickness of 0.007" to 0.009" (0.178 to 0.229 mm).
  - c) Bearing housing (146) should then be inserted into swivel jaw (71) within 10 minutes of Loctite being applied.
  - d) The cure cycle for 'Loctite 638' in average room temperature of 68°F (20 °C) is 15 minutes for handling and 3 - 6 hours for full curing time.



- 20.7 Knock swivel jaw bush (75) into position using service tool no. E546.
- 20.8 Check swivel jaw / swivel stub studs (119) for misalignment and tightness re-fitting to procedure shown on page B40.
- 20.9 Similarly, check brake bracket / swivel jaw / stub studs (117) for misalignment and tightness.
- 20.10 Assemble swivel jaw (71) and swivel stub (98) together ensuring that swivel jaw and stub are positioned with stub bush having double cross-over grooves to bottom.
- 20.11 Fit nuts (116) and tighten to 95 - 115 lbs. ft. (128 - 156Nm.).

## SECTION 21 ASSEMBLY OF SWIVEL JAW AND SWIVEL

- 21.1 Using service tool no. E545 fit dirt excluder (143) followed by swivel dirt seal (144) onto bottom swivel (142)
- 21.2 Tap swivel bearing cone (145A) into position on bottom swivel (142).
- 21.3 Check swivel / axle casing studs (141) in bottom swivel (142) for misalignment and tightness  
If required tighten to TD183/1.. Fit bottom swivel assembly into swivel jaw taking care not to damage dirt seals (144) in the process.
- 21.4 Fully impregnate swivel jaw felt (84) by soaking in clean gear oil.
- 21.5 Fit felt retaining ring (85) and position felt assembly on outside diameter of swivel bush (75) which projects on inside of swivel jaw (71).
- 21.6 Check swivel / axle casing studs (141) in top swivel (74) for misalignment and tightness  
If required tighten to TD183/1.. With top swivel (74) at 90° to bottom swivel (142) feed top swivel assembly into position in swivel jaw (71).  
Ensure that top swivel (74) rotates freely.
- 21.7 Place two  $\frac{1}{8}$ " thick packing pieces between top and bottom swivels (74 & 142) to keep them apart.
- 21.8 Fit a  $\frac{1}{2}$ " - UNF eye bolt into a top cap bolt hole as shown in fig.no. 26.  
This is for handling purposes.



- 21.9 Lightly brush swivel stub oil seal lips (100) with clean gear oil.
- 21.10 Fit oil seal protection sleeve (tool no. E422) on to end of outer drive shaft (102).  
Feed swivel assembly carefully into position on axle casing.  
Remove oil seal protection sleeve when swivel assembly is in position.
- 22.11 Fit locknuts (113) to secure steering head assembly. Apply Loctite 'Nutlock 242' to swivel / axle casing setscrew threads (110) and fit in position.  
Tighten nuts (113) and setscrew (110) to 162 - 178 lbs. ft. (220 - 241 Nm).
- 22.12 Remove packing pieces between top and bottom swivels and eye bolt from top cap bolt hole.
- 22.13 Refit thrust button (77) into top cap (78).
- 22.14 Place shim pack (76) and top cap (78) into position on swivel jaw (71) and secure with top cap setscrews (80) and washers (79) then tighten setscrews to 72 - 80 lbs. ft. (98 - 109 Nm).

**NOTE :- If new shims are to be used fit a nominal shim pack of 0.050 " (1.27 mm)**



## SECTION 21 ASSEMBLY OF SWIVEL JAW &amp; SWIVEL Cont.

21.15 Check swivel bearing setting as follows:-

- a) Wrap a length of cord around stub, approximately 1" from outer end. (fig. no. 27).
- b) Fasten loose end of cord to a spring balance (capable of reading up to 50 lb).
- c) Pull swivel from lock to lock noting spring balance reading (ignoring force required to start rotation).

Correct reading should be 25 to 40 lbs.

If reading is not between these limits, thickness of shim needs to be adjusted.

To **increase** force required, **remove** shims from pack.

To **decrease** force required, **add** shims to pack.

Add or subtract shims from pack until correct reading of 25 to 40 lbs is obtained.

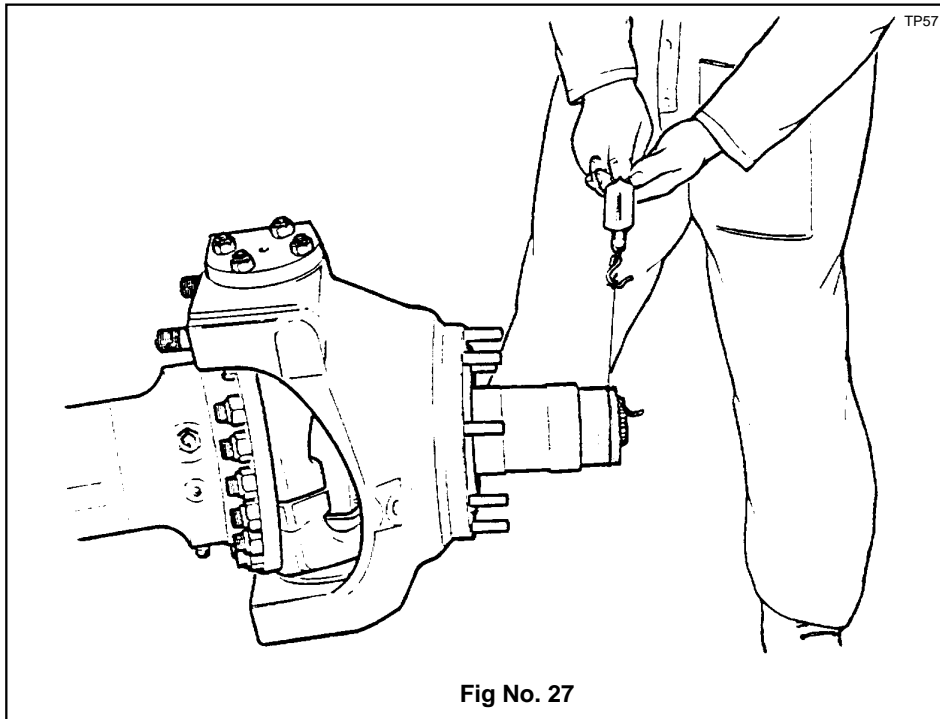


Fig No. 27

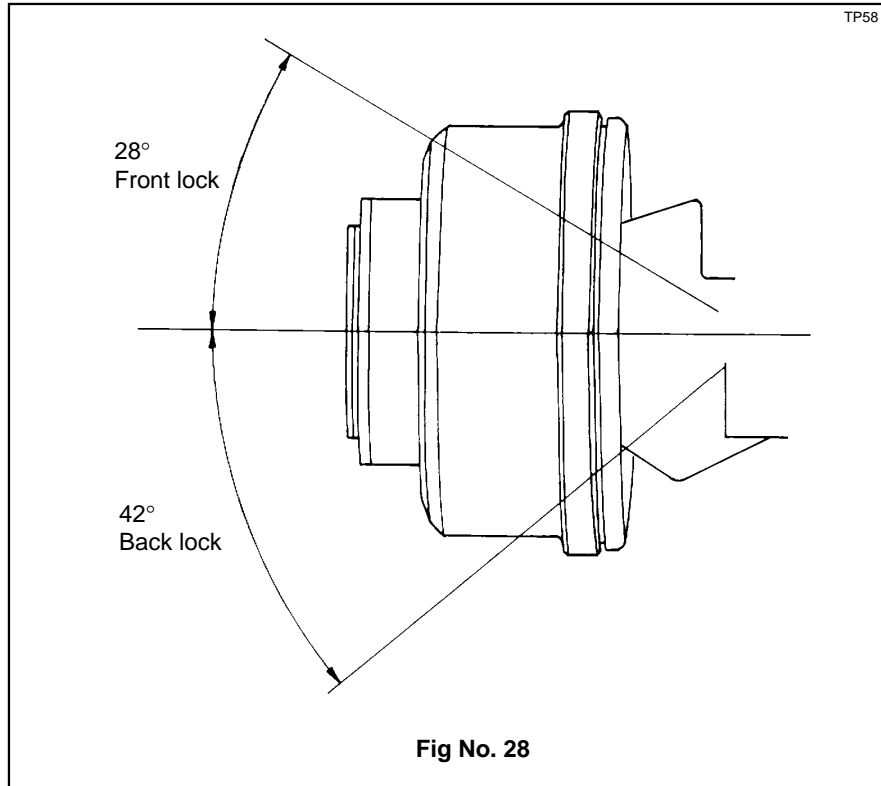
- 21.16 When setting is correct, remove top cap setscrews with washers (80 & 79) and lift off top cap and shim pack (78 & 76).
- 21.17 Clean shims (76), also mating faces of top cap and swivel jaw (78 & 71) using Loctite Solvent' no.7070 or other chlorinated cleaning fluid.
- 21.18 Fit shims and top cap assembly onto swivel jaw.
- 21.19 Fit washers and setscrews (80 & 79) then tighten setscrews to 72 - 80lbs.ft. (98 - 109Nm.) to secure.





**SECTION 21 ASSEMBLY OF SWIVEL JAW & SWIVEL Cont.**

- 21.21 Fit top and bottom lubricators (81 & 147) also protective caps (82 & 148).
- 21.22 Fit swivel jaw stop screw (73) and its lock nut (72) and adjust to give required lock position (see fig. no 28).

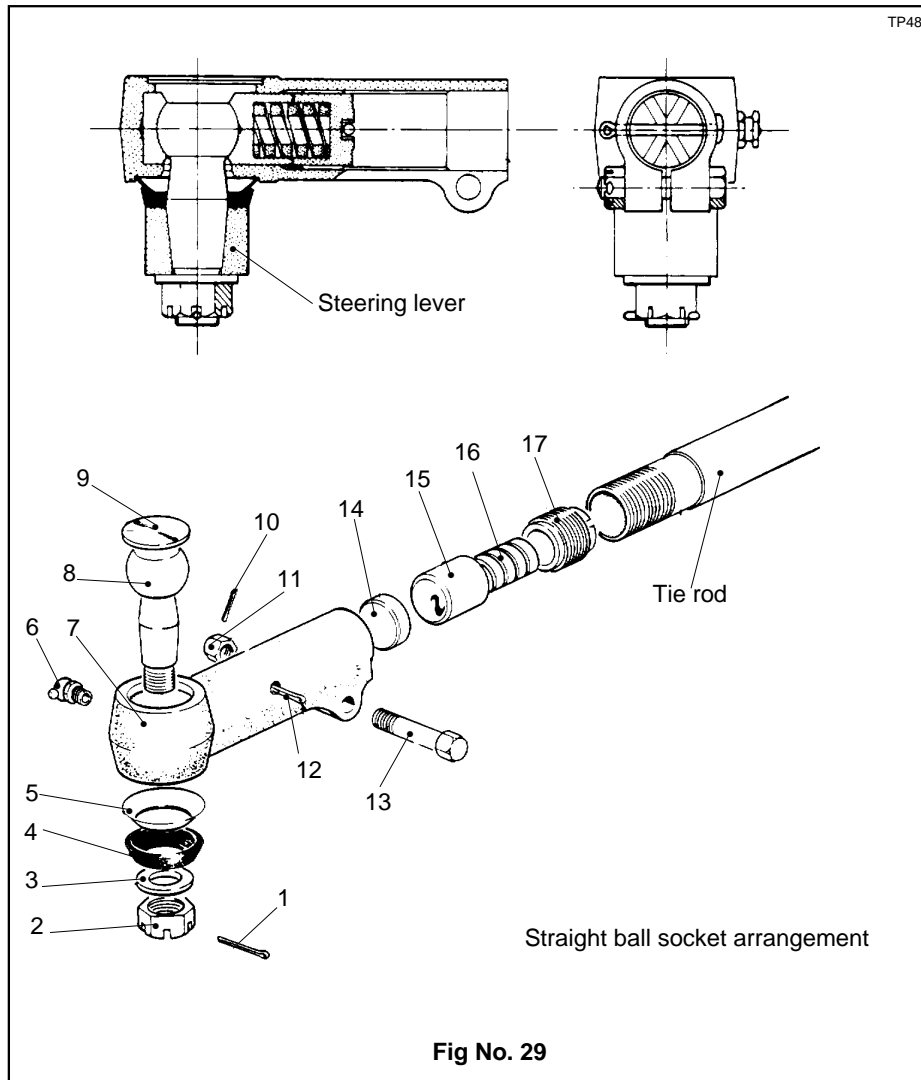


- 21.23 Check bottom steering lever studs (140 & 129) for misalignment, damage and tightness  
If required tighten to TD183/1
- 21.24 Fit bottom steering levers (127 & 135) and secure with nuts (130 & 134) then tighten to 528 - 583lbs.ft. (716 - 790Nm.).



SECTION 22 ASSEMBLY OF BALL SOCKET AND TIE ROD Fig. No.29

- 22.1 Using a scraping tool, clean peened areas on ball socket body to enable cover plate (9) to be fitted.
- 22.2 Knock rubbing pad (14) into its recess in ball socket body.
- 22.3 Thoroughly grease rubbing pad (14) and ball pin (8) with Shell Retinax LX or equivalent.
- 22.4 Insert ball pin (8) into body.
- 22.5 Insert thrust cap (15), compression spring (16) and adjuster piece (17) into body.
- 22.6 Using a suitable tool ie: a 1" x 1/8" x 9" long flat bar, tighten adjuster piece (17) fully home (**SOLID**) locating thrust cup (15) onto ball pin (8).

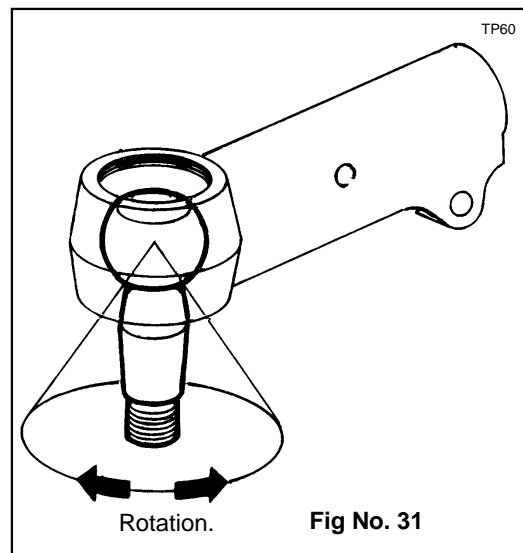
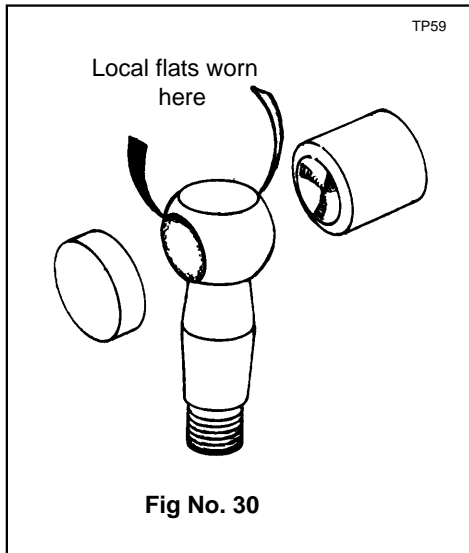




**SECTION 22 ASSEMBLY OF BALL SOCKET AND TIE ROD Cont.**

22.7 Still with tool located on adjuster piece (17), back off carefully (**LEAST AMOUNT**) until adjuster piece split pin (12) is allowed to pass through body, and that ball pin shank can be moved by force of hand, then remove tool.

**Note :-** If ball pin (8) does not rotate when re-adjusted in line with above instructions, this suggests that ball pin has local worn flats as shown in fig.no. 30 in this instance ball pin (8), thrust cup (15) and rubbing pad (14) **MUST** be replaced, if not **FAILURE** could occur in service, ie ball pin (8) not being able to move in assembly when turning from lock to lock as shown in fig 31.



- 22.8 Fit cover plate (9) into top of ball socket body, re-peen using a cold chisel to secure.
- 22.9 Screw assembled ball socket onto tie rod. Lining up marks on both body and tie rod previously made, or retracting using manual Instructions.
- 22.10 Tighten pinch bolt (11) to 51 - 62lbs. ft. (69 - 84Nm.) to secure ball joint to tie rod.
- 22.11 Fit split pin (10) to lock pinch bolt nut (11).
- 22.12 Fit dirt seal (pressing) (5) and dirt seal (rubber) (4) onto ball pin (8).
- 22.13 Locate ball socket and tie rod assembly with steering lever, carefully align and fit ball pin ( 8) into hole in steering lever.

**Note :-** Ball pin and ballpin tapers in bottom steering levers must be clean, dry and free from oil prior to assembly.

- 22.14 Fit pin washer (3) onto ball pin (8).
- 22.15 Screw pin nut ( 2) onto ball pin (8) then tighten to 100 lbs ft.(136Nm.) torque.
- 22.16 Using a 2lb hammer, tap steering lever to 'Shock' ball pin (8) into taper hole.
- 22.17 Re-torque pin nut (2) to 100 lbs ft.(136Nm).
- 22.18 Fit split pin (1), if slot / hole are not in line , adjust up to next slot.

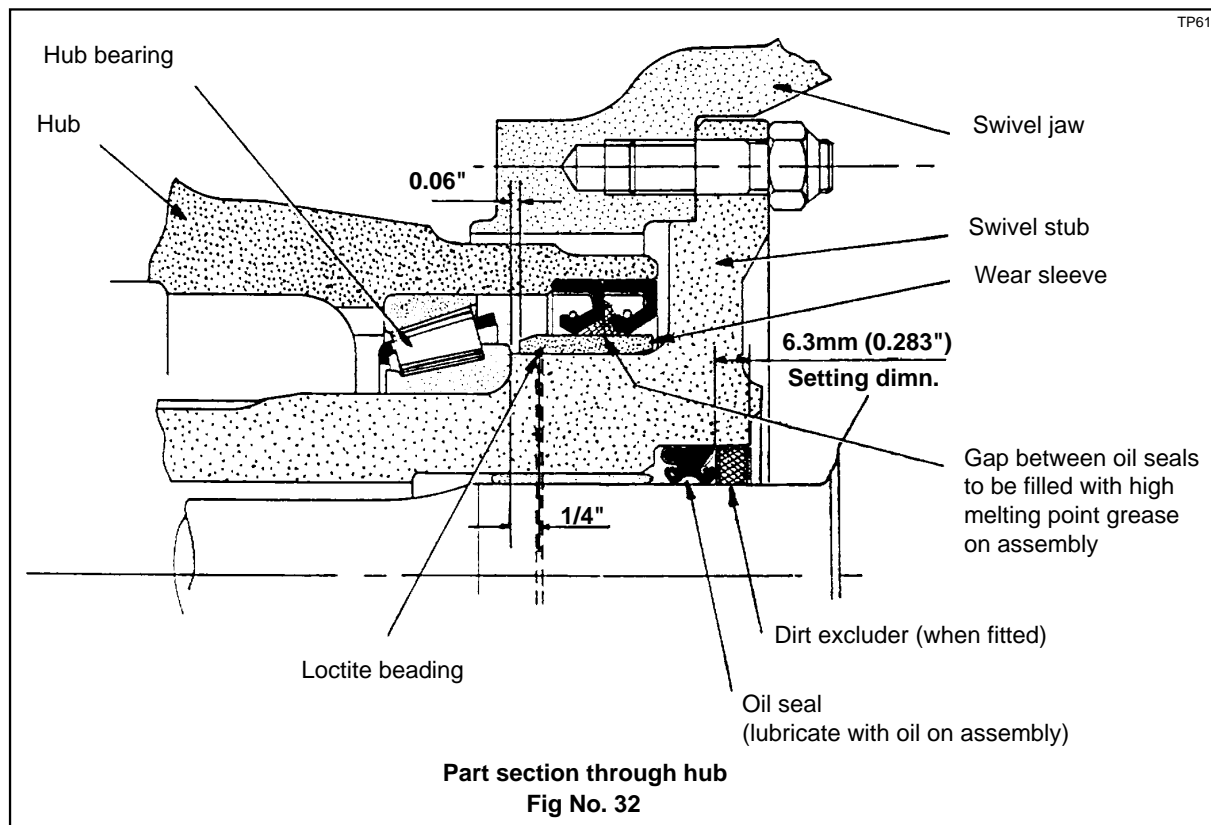
Min pin nut torque 100 lbs ft.(136Nm.) Max pin nut torque 170 lbs ft. (230Nm)

22.19 Re-charge ball socket with Shell Retinax LX or equivalent grease.



**SECTION 23 REBUILDING HUB UNIT**

- 23.1 If wear sleeve (118) has been removed, then a new one should be fitted as follows :-
- a) Clean mating surfaces of sleeve and stub with tricoethylene or similar degreasing agent.
  - b) Apply a bead of Loctite No 601 around axle stub (98) approx  $\frac{1}{4}$ " from bearing shoulder. See fig no. 29.
  - c) Using service tool no. E398 knock hub wear sleeve (118) into position on swivel stub. Allow 2 hours for Loctite to cure.
- 23.2 Check wheel studs (17) for misalignment and tightness.
- 23.3 Using service tool no. E317 knock outer bearing cup (53) into position in hub (16).
- 23.4 Turn hub over and knock inner bearing cup (18) into position with service tool no. E544 then pack inner bearing cone with grease (Shell Retinax LX or equivalent) and place into position on its cup.
- 23.5 Using service tool no E552 press first oil seal (52) with spring loaded lip facing bearing into hub (approx  $\frac{9}{16}$ " in to allow fitment of second seal). Press second seal with spring loaded lip to back of first seal using E553. See fig no. 32. Pack gap between seals with a high melting point grease (BP Keenomax L2 or equivalent) for approx  $240^\circ$  of circumference. Wipe off excess grease.
- 23.6 Carefully guide hub assembly onto swivel stub, taking care not to damage oil seals. Support hub assembly until annulus is fitted.



**SECTION 24 REBUILDING ANNULUS UNIT**

- 24.1 Press outer hub bearing cone (53A) onto annulus stub (14).
- 24.2 Press dowels (56) into annulus gear (13) locate dowels in their respective holes in annulus carrier (14).
- 24.3 Fit lockplates (55) and setscrews (54) then tighten setscrews to 100 - 110 lbs. ft. (136 - 149 Nm.. Bend up ends of lockplates against suitable flat on setscrew head to secure setscrews into position.
- 24.4 Knock annulus assembly into position on axle stub (98) using a hide faced hammer.



**SECTION 25 SET THE HUB BEARING AS FOLLOWS :-**

- 25.1 Fit pinch bolt (59) and nut (57).
- 25.2 Using service tool no. E399 fit hub nut (58) and tighten nut hard to take up bearing slack and to ensure that annulus is fully home. Rotate hub and using a rawhide mallet, knock hub backwards and forwards along axle arm to shock load and thus settle bearings into position.

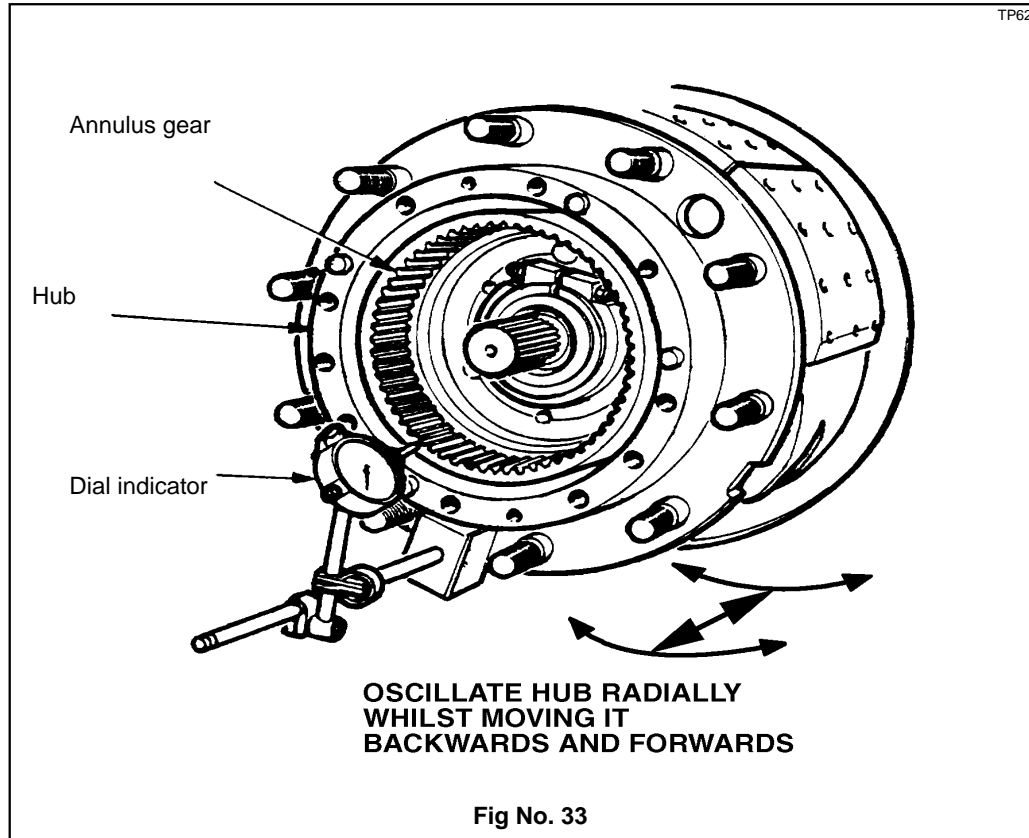
**Note :- It is important to rotate and shock load the hub because :-**

- a) **Rotation serves to ensure that bearing rollers settle in their correct tracks.**
- b) **Shock load is to ensure that bearings are seated up to their shoulder abutment, check tightness of axle tube nut (58) and if loose, re-tighten hard.**

**Rotate and shock load hub again.**

Continue procedure until axle tube nut cannot be tightened after further rotating and shock loading hub.

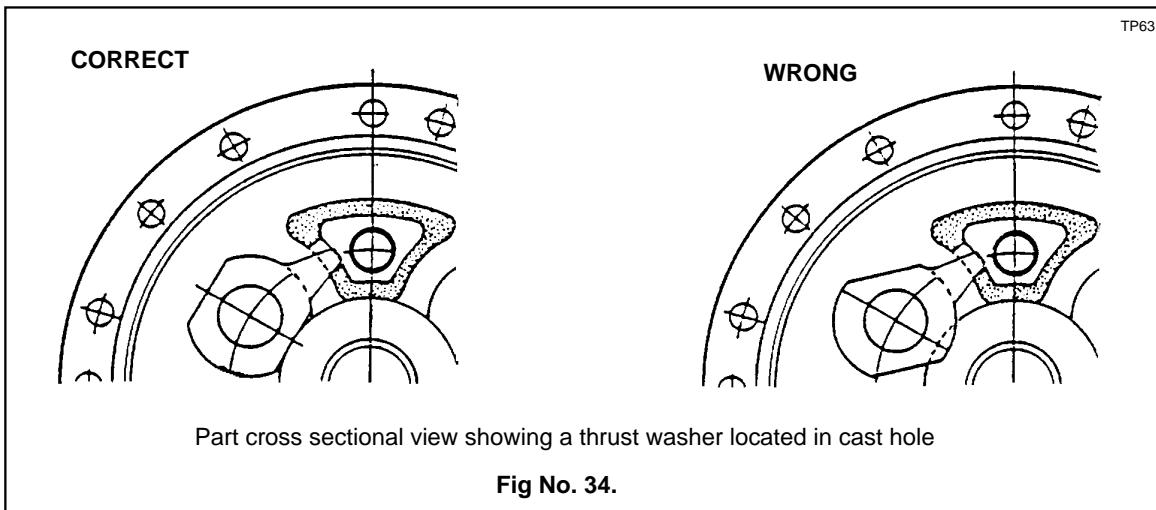
- 25.3 Back off axle tube nut (58) by approx  $\frac{1}{16}$ " (20°) of a turn, then rotate and knock hub outwards along axle arm to release bearings.
- 25.4 Tighten axle tube nut pinch bolt (59) to 30 - 34 lbs. ft. (41 - 46Nm.).
- 25.5 Mount a magnetic dial indicator on hub and position on end of annulus gear (14). See fig. no. 33.
- 25.6 Oscillate hub backwards and forwards along axle arm and note variation shown by dial indicator. Permissible is between 0.0005" to 0.002" (0.013 to 0.051 mm) movement (end float). If end float is outside specified limits slacken pinch bolt (59) and reset axle tube nut (58) using above procedure until correct setting is obtained.





SECTION 26 PLANET CARRIER ASSEMBLY

- 26.1 Place planet carrier (6) on a bench, inner face up with a planet wheel access hole towards fitter.
- 26.2 Smear the bore of a planet wheel (10) with grease (Shell Retinax 'LX' or equivalent).
- 26.3 Insert 22 off needle rollers (7 & 10) into one end of planet wheel (10). The grease will adhere them to bore of planet wheel.
- 26.4 Fit a planet wheel spacer (9) into bore of planet wheel locating needle rollers (7 & 10).
- 26.5 Insert 22 off needle rollers into bore of planet wheel, abutting spacer (8).
- 26.6 Repeat operations 24.2 to 24.5 for other two planet wheels (10).
- 26.7 Fit a thrust washer (6 & 11) into planet carrier (6), ensuring that lock tab is located in cast hole in planet carrier (fig no. 34).



- 26.8 Carefully insert and locate one of assembled planet wheels (7,8,9 & 10) onto thrust washer (6 & 11).
- 26.9 Carefully fit another thrust washer (6 & 11) onto planet wheel, ensuring that lock tab is located correctly as in operation 25.7.
- 26.10 Insert a planet pin (63) into relevant holes in planet carrier inner face (6), to pass down through planet wheel assembly.

**Note :- Care must be taken during this operation not to disturb needle rollers. Also that head of planet pin (63) is correctly seated and thrust washers are correctly located.**

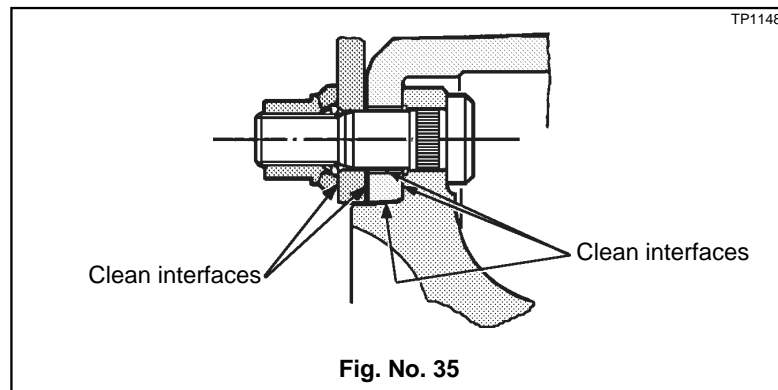
- 26.11 Holding planet pin in situ, turn partially assembled planet carrier completely over (inner face down).
- 26.12 Fit a planet pin 'O' ring (5) onto planet pin collar (4). Insert assembled planet pin collar into relevant hole on face of planet carrier (6).
- 26.13 Screw one of planet collar setscrews (3) into planet pin (63) and tighten to 65 - 75 lbs. ft. ( 88 - 102 Nm).
- 26.14 Repeat operations 26.7 to 26.13 for other two planet wheel assemblies.
- 26.15 Turn planet carrier completely over and fit planet carrier 'O' ring (64) into its groove in planet carrier (6)



## SECTION 27 SUN GEAR AND BRAKE DRUM ASSEMBLY

- 27.1 Fit sun gear thrust washer (60) then sun gear (61) onto outer drive shaft (102).
- 27.2 Secure sun gear with circlip (62).
- 27.3 Slide planet carrier assembly into position ensuring that gears mesh correctly.
- 27.4 Fit washers (65) and planet carrier setscrews (66) to secure planet carrier assembly and tighten to 110 - 125 lbs. ft. (149 - 170 Nm.).
- 27.5 Refit planet carrier relief valve (69).
- 27.6 Charge hub with oil (see lubrication instructions in front of this manual for correct amount and specification).
- 27.7 Fit oil level plug (68) and washer (67) and tighten .
- 27.8 With brake drum (1) suitably supported slide into position on hub.
- 27.9 Fit brake drum retaining setscrew (70) and tighten to 72 - 80 lbs. ft. ( 98 - 109 Nm) torque setting.
- 27.10 Adjust brakes hard against brake drum then back off just enough to allow wheels to revolve without binding.

**Note :- Interfaces between brake drum and hub must be free from dirt, including liner material debris, rust and paint.  
Failure to keep interfaces clean, can and will cause brake drum to distort upon tightening of wheel nuts. For further details see BS AU50 : Part 2 : Section 7A : 1995.**

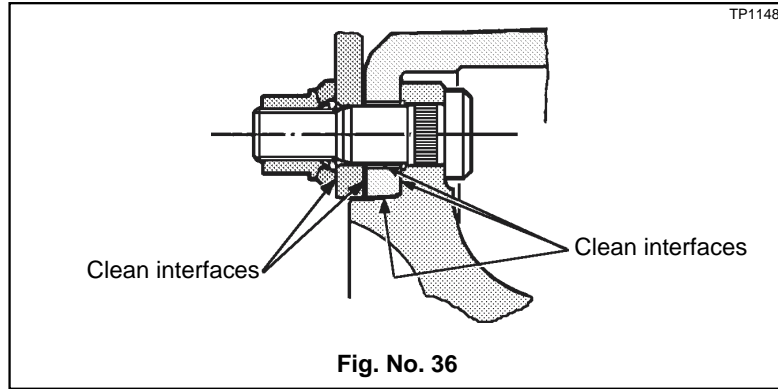




SECTION 28 FINAL ASSEMBLY

- 28.1 Refill drive head with oil (see lubrication section at front of manual for details of specification and quantity).
- 28.2 Refit road wheels, securing with wheel nuts (1). Tighten nuts to 475 - 525 lbs. ft. (644 - 712 Nm).

**Note :- Interfaces must be free from dirt , including liner material debris, rust and paint. Failure to keep interfaces clean, can and will cause brake drum to distort upon tightening of wheel nuts. For further details see BS AU50 : Part 2 : Section 7A : 1995.**

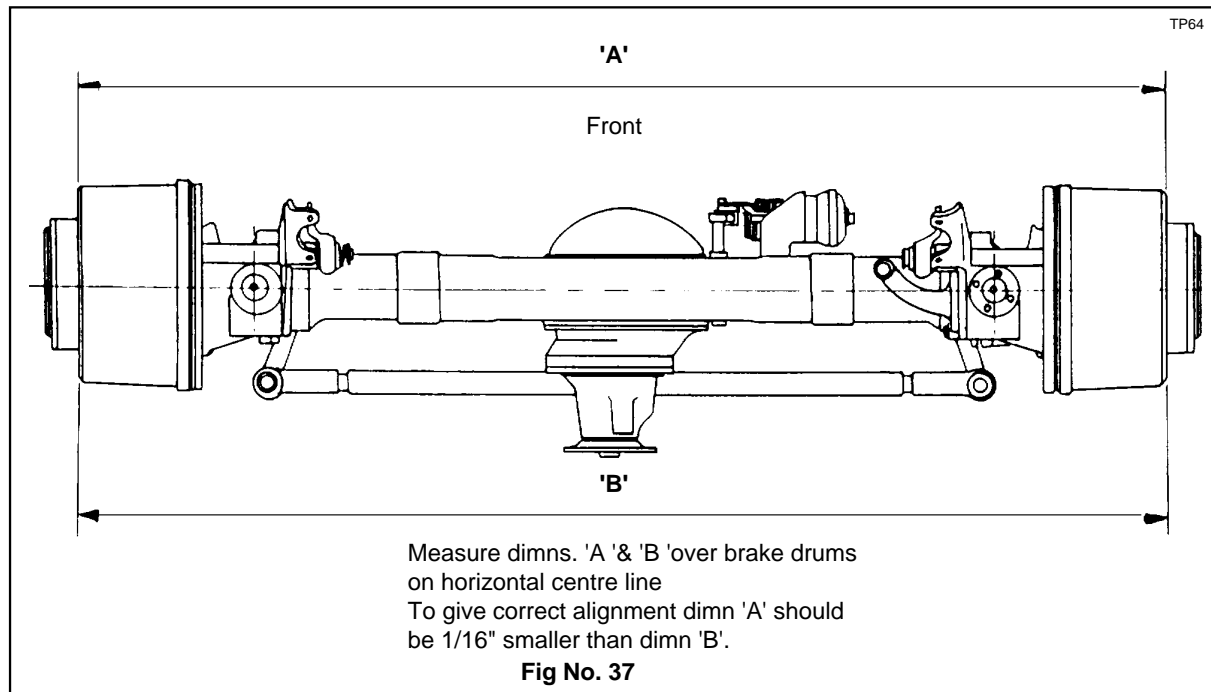


- 28.3 Remove axle supports, then lower vehicle to ground.
- 28.4 Remove chocks and jacks.

**Note :- At the axle build, tracking is set to TD 186/1 i.e 'Toe Out'. However, where part time all wheel drive is used the axle should be re-aligned to 'Toe In' as below:-**

- 28.5 Check wheel alignment as follows :-

Set wheels in a straight ahead position, and at points level with wheel centre, measure distance between edges of wheel rims both in front and behind axle centre.  
 For correct alignment front measurement ('A') should be 0" to  $\frac{1}{16}$ " smaller than that of rear ('B') i.e. toe -in. To allow for inaccuracies in wheels, same checks should be made with vehicle moved so that wheels have moved a further half a revolution (see fig no. 37).  
 Adjust if required by slackening ball joint clamp bolts and rotating track rod tube.  
**DO NOT forget to re-tighten clamp bolts to 51 - 62lbs.ft. (69 - 84Nm.) after adjusting.**







TORQUE TABLE FOR TYPE 1S HUB REDUCTION UNIT  
(FRONT STEER DRIVE VERSION)

Item no	Description	Torque setting
1	Wheel nut	475 - 525 lbs. ft. (644 - 712 Nm)
3	Planet pin collar setscrew	65 - 75 lbs ft. (88 - 102 Nm)
7	Brake drum retaining setscrew	72 - 80 lbs ft (98 - 109 Nm)
23	Brake backplate nut	95 - 115 lbs ft (150 - 170 Nm)
47	Brake backplate nut	95 - 115 lbs ft (150 - 170 Nm)
54	Annulus carrier setscrew	100 - 110 lbs ft (136 - 149 Nm)
57	Hub nut pinch bolt nut	30 - 34 lbs ft (41 - 46 Nm)
66	Planet carrier setscrew	110 - 125 lbs ft (149 - 169 Nm)
80	Top cap setscrew	72 - 80 lbs ft (98 - 109 Nm)
95	Chamber bracket nut	190 - 210 lbs ft (258 - 285 Nm)
110	Axle casing setscrew	162 - 178 lbs ft (220 - 241 Nm)
113	Swivel / axle casing nut	162 - 178 lbs ft (220 - 241 Nm)
114	Inner bearing housing lockscrew	72 - 80 lbs ft (98 - 109 Nm)
116	Swivel jaw stud nut	95 - 115lbs ft (150 - 170 Nm)
130/134	Bottom lever nut	528 - 583lbs.ft. (716 - 790Nm)
137/131	Ball socket nut	100 - 170 lbs ft (135 - 230 Nm)

SEE FOLLOWING PAGE FOR STUD TIGHTENING PROCEDURE

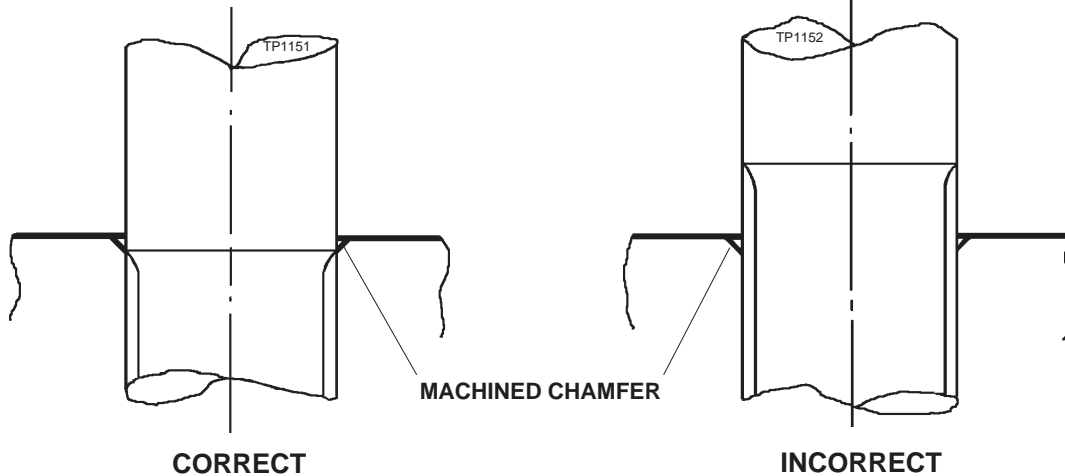


**KIRKSTALL SPECIALITY AXLE DIVISION**

TP1193

**STANDARD STUDS - FITTED INTO MACHINED CHAMFERED HOLES**

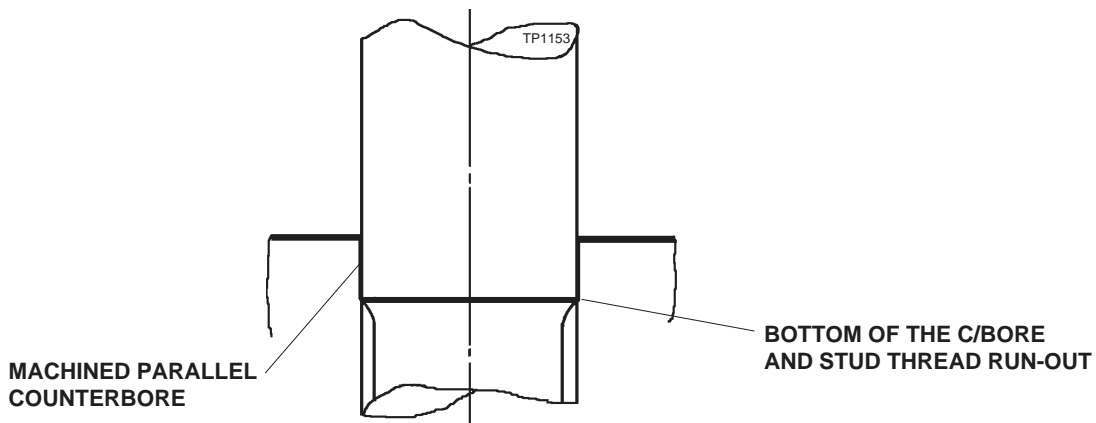
STUDS TO BE INSERTED UNTIL THREAD RUN-OUT LOCKS INTO PARENT METAL



**IMPORTANT :- THIS STUD FITTING PROCEDURE IS TO BE USED IN LIEU OF STATED TORQUE VALUES ON EXISTING ARRANGEMENTS. NEW ARRANGEMENTS WILL SPECIFY TD183/1 FROM THE DATE OF ISSUE.**

**SPECIAL STUDS - FITTED INTO MACHINED PARALLEL COUNTERBORE**

STUDS TO BE INSERTED UNTIL CORRECT TORQUE VALUE IS OBTAINED - AS SHOWN ON RELEVANT ARRANGEMENT DRAWING



**THIS SPECIFICATION IS FOR STUD FITTING ONLY ; NUTS & SETSCREWS MUST BE TORQUED TO VALUE SPECIFIED**

Alteration Numbers

ISSUE A									

DISTRIBUTION  
Front Axle B.U.  
Drive Axle B. U.  
Production

**STUD FITTING PROCEDURES**

**TD183/1**  
SHT 1 OF 1



**OVERHAUL INSTRUCTIONS FOR TYPE D66 DRIVE HEAD UNIT  
WITH DIFFERENTIAL LOCK AS FITTED TO STEER DRIVE AXLE**

**ILLUSTRATION No.DH119**

**MANUAL SECTION C**


**OVERHAUL INSTRUCTIONS FOR TYPE D66 DRIVE HEAD UNIT WITH DIFF LOCK  
(AS FITTED TO STEER DRIVE AXLE)**
**GENERAL DESCRIPTION**

The drive head features an overhung spiral bevel pinion mounted in widely spaced taper roller bearings which are adjustable by graded spacers.

The drive is transmitted through the heavy section crownwheel and differential assembly, again running in taper roller bearings, and adjustable by special nuts, running in the differential straps.

A variety of pinion and crownwheel combinations are available, covering a wide range of ratios.

A differential lock, operating on the drive shafts, is available as an optional extra.

**INTRODUCTION**

Very often noises and vibrations originating in other parts of the machine, are mistakenly believed to emanate from the drive head, with the result that time and effort is wasted on an unnecessary dismantling operation. Therefore, before fixing suspicion on the drive head, investigate all other possible sources of trouble. Where the drive head is definitely suspect however, draining the housing and examining the oil for metal particles will aid diagnosis and help to pinpoint any malfunction.

Check the following defects and note the possible cause :-

- |    |                 |   |
|----|-----------------|---|
| a) | Vibration       | Broken gear teeth / worn bearings                   |
| b) | Continued noise | Worn bearings or gears                              |
| c) | Overheating     | Loss of lubricant                                   |
|    |                 | Spiral bevel gear adjustment tight, seized bearings |
| d) | Noise on turns  | Worn side gear and pinions                          |
|    |                 | Worn or damaged trunnions                           |
|    |                 | Loss of lubricant                                   |
|    |                 | Worn drive shaft splines                            |
| e) | Loss of drive   | Broken drive shaft                                  |
|    |                 | Stripped splines on drive shaft                     |



## Viton 'O' rings and seals (flouro-elastomers) - safety hazards.

It has been brought to our attention that 'Viton' material used in manufacture of oil seals and 'O' rings, produces a highly corrosive acid (hydroflouric) when subjected to temperatures above 315° C.

The resulting contamination can have extreme consequences on human tissue since it is almost impossible to remove after contact.

We therefore recommend the following procedure when it is necessary to inspect any equipment that has been subjected to a high temperature i.e. fire.

- a) **Visually** inspect for any gaskets or seals which have suffered from heat ; they will appear black and sticky.
  - b) If this is affirmed :- **Do Not Touch**.
  - c) Make enquiries to ascertain the material composition.  
Any flouro-elastomer (Viton, Flourel or Tecmoflon) should be considered dangerous but natural rubber and nitrile are non-hazardous.
  - d) If flouroelastomer seals have been used, then the affected area **MUST** be decontaminated before undertaking further work.
  - e) Disposable heavy duty gloves (neoprene) **MUST** be worn and the affected area decontaminated by washing thoroughly with limewater (calcium hydroxide solution).
  - f) Any cloths, residue and gloves used **MUST** be safely discarded after use.
- Note:- Burning of the discarded items is NOT RECOMMENDED, except in an approved incineration process where the gaseous products are treated by alkaline scrubbing.**

### SECTION 1 PREPARATION FOR OVERHAUL

- 1.1 Before attempting to remove road wheels, drive vehicle onto a solid concrete base and over a maintenance pit if possible, preferably after a short run to warm the oil.
- 1.2 Chock appropriate wheels.
- 1.3 With road wheels on ground, loosen wheel nuts on both sides.
- 1.4 Jack up axle and support with suitable axle stands.
- 1.5 Remove wheel nut and take off road wheels.
- 1.6 With suitable drip trays placed under drive head and axle casing ends (approx. capacity drive head 14 pints (8 litres) then remove drain and filler plugs in drive head (36 & 30) to drain oil.
- 1.7 Disconnect propshaft from drive head.



SECTION 2 REMOVAL OF COMPLETE DRIVE HEAD ASSEMBLY

Note:- Part nos. marked (\*) refer to drawing FH55

- 2.1 Disconnect air chamber pushrods from slack adjuster (91\*) on both hub ends. Remove air chambers from their brackets.
- 2.2 Remove planet carrier setscrews (66\*) and washers (65\*). Insert 2 off extractor bolts into planet carrier and screw in to withdraw planet carrier evenly from hub (16\*).
- 2.3 Remove sun gear circlip (62\*) sun gear (61\*) and spacer (60\*) from end of U/J shaft (102\*).
- 2.4 take out ball socket split pins (132 & 138\*) then unscrew and remove ball socket nuts (131 & 137\*) along with washer (90\*).
- 2.5 Using a suitable extractor , remove ball socket assembly (122 & 124\*) from bottom steering levers (127 & 135\*).

**Note :- When separating ball socket from steering lever, an extractor tool MUST be used. DO NOT strike areas around ball pin tapers with hammer blows under any circumstances due to possible ball pin taper deformation.**

- 2.6 Back off swivel top cap setscrews (80\*) to release pressure in steering head . remove one of the setscrews and replace with an eye bolt.
- 2.7 Unscrew and remove U.J. oil seal housing lockscREW nuts (115\*) as shown in fig. no.1.
- 2.8 Unscrew and remove U.J. oil seal housing lockscREWS (114\*) as shown in fig. no.2.

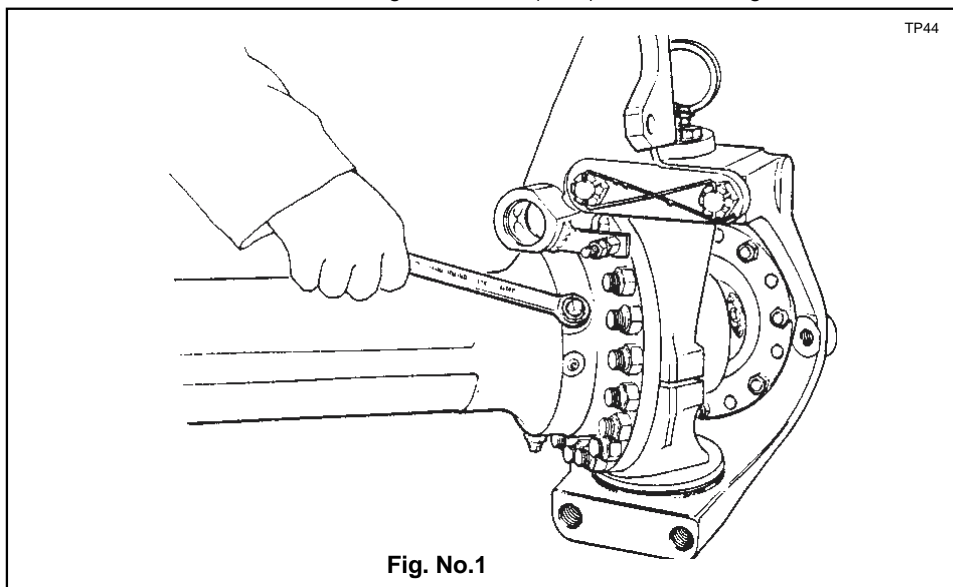


Fig. No.1

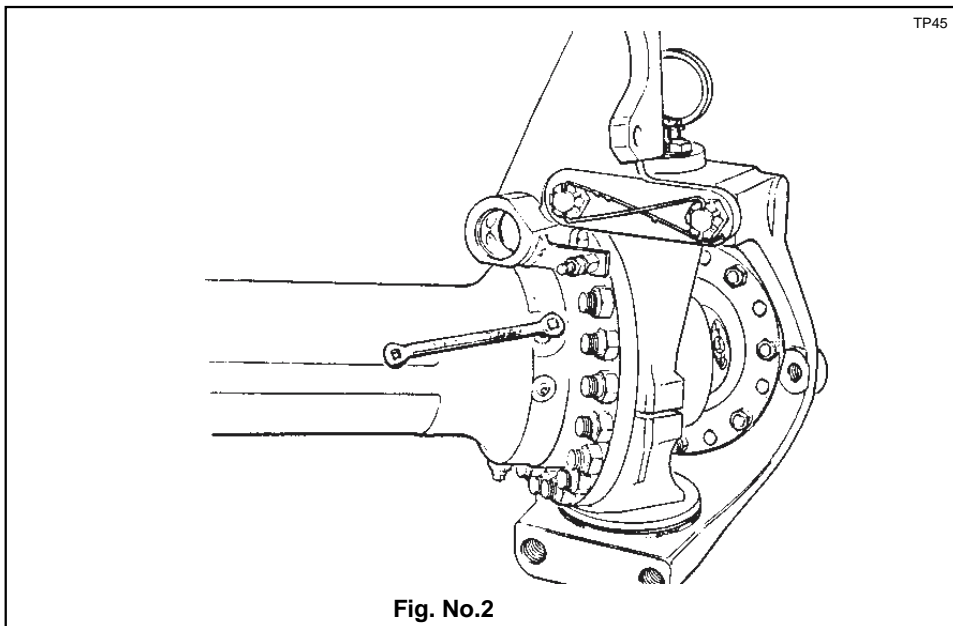


Fig. No.2

## SECTION 2 REMOVAL OF COMPLETE DRIVE HEAD ASSEMBLY Continued.

Note:- Part nos. marked (\*) refer to drawing FH55

- 2.9 Remove axle casing setscrews and nuts (110 & 113\*) then support hub / steering head unit with sling through eye bolt and pull unit from axle casing.
- 2.10 Fit tool E467 into position on U.J. / axle casing assembly and tighten to pull U.J. from axle casing as shown in fig.no.3
- 2.11 Repeat operations 2.3 to 2.10 for other hub assembly.

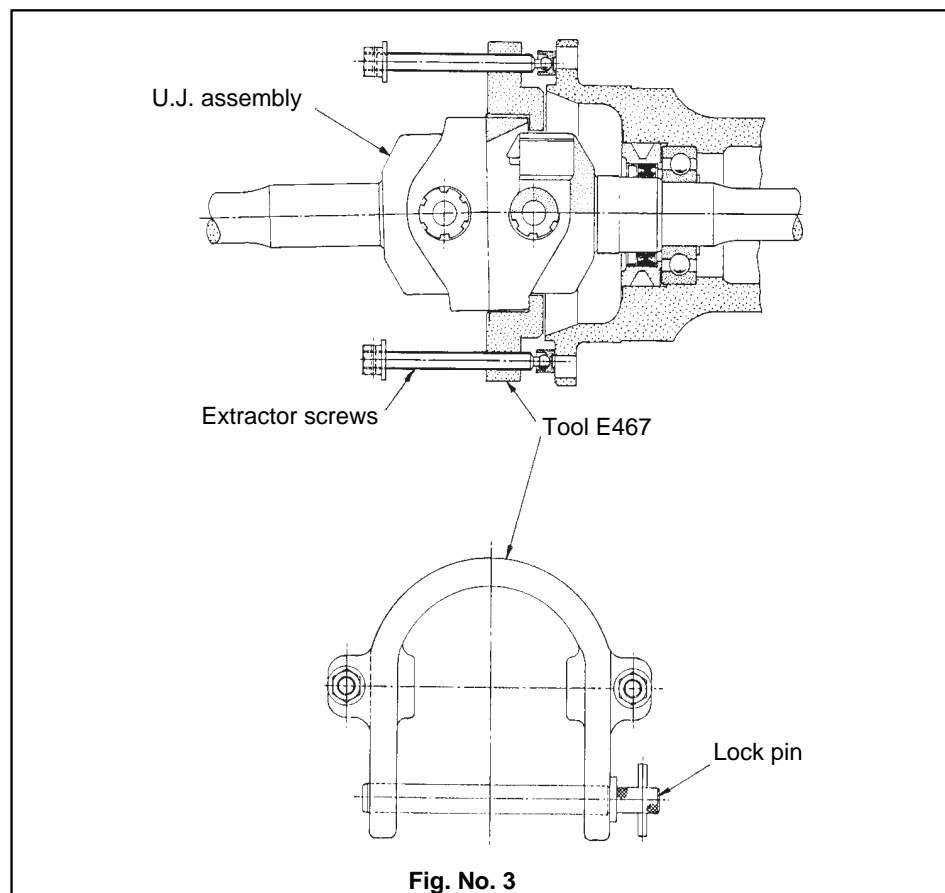


Fig. No. 3

- 2.12 Remove axle casing nuts (10) with washers (11) then scribe a line on diff flange o/dia. (12) and axle casing (25) to aid re-assembly.
- 2.13 Support drive head with a suitable sling and fit 2 off  $\frac{7}{16}$  " UNF x  $1\frac{1}{2}$  " long extractor bolts into tapped holes provided in axle flange and tighten evenly to draw drive head from axle casing (25).
- 2.14 Remove sealant from axle and gear casing mating faces (25 & 12) using Loctite Chisel Gasket Remover or by carefully scraping from faces.



## COMPLETE OVERHAUL OF DRIVE HEAD ASSEMBLY

**SECTION 3      DISMANTLING BEVEL PINION ASSEMBLY**

- 3.1 Place a wedge between crownwheel and pinion teeth, to prevent movement, then, using a suitable pry bar, carefully lever peened portion of coupling flange nut (1) to clear bevel pinion threads.
- 3.2 Loosen coupling flange nut (1).

**Do not remove at this stage.**

- 3.3 Remove bearing housing nuts (5) and washers (6).  
Pull pinion housing (7) from gear casing (12). Lift off setting shims (8).
- 3.4 Remove any Loctite no.515 liquid gasket from between setting shims (8) also mating faces of pinion housing and gear casing (7 & 12) using a suitable sealant remover such as Loctite Chisel Gasket Remover or by carefully scraping sealant from faces.
- 3.5 With assembly resting on pinion face, remove coupling flange nut (1).
- 3.6 Using suitable extraction equipment, pull coupling flange (2) from pinion (58)  
(E303 series equipment is available from our spares and service dept. if required ).
- 3.7 Pull pinion along with inner bearing cone (59A) and bearing spacers (60 & 61) from bearing housing (7).
- 3.8 Lift off spacer, then remove inner housing cone.  
Prise out and discard oil seal (3) then lift out bearing cone (4A).
- 3.9 Using a soft metal drift, tap inner & outer bearing cups (59 & 4) from pinion housing (7).

**SECTION 4      DISMANTLING DIFFERENTIAL AND GEAR CASING ASSEMBLY**

- 4.1 Mark diff. straps (19) to ensure correct re-assembly, remove diff. strap nuts (21) and washers (20).
- 4.2 Lift off straps, then remove and discard adjusting nut split pins (43).
- 4.3 Remove diff. bearing adjusting nuts (18 & 47) and lift out crownwheel and differential unit assembly.
- 4.4 Lift diff. bearing cups (17 & 46) off their cones (17A & 46A) and inspect for wear / damage.  
Tap cones from register on diff. cage halves (14 & 50) if replacement is required.
- 4.5 Remove crownwheel nuts (16) and washers (15) then drive out crownwheel bolts (48) taking care not to damage threads.
- 4.6 With a hide faced hammer, knock crownwheel (49) from its register on flanged diff. cage half (50) taking care not to lose crownwheel dowels (45).
- 4.7 Scribe a line across joining faces of diff. cage halves (14 & 50) to ensure correct re-alignment on assembly.
- 4.8 The diff. cage halves can now be separated, enabling bevel wheels (52), thrust washers (51), along with trunnion (53), diff. bevel pinion and bush assembly (54 & 55) and thrust washer (56) to be removed.

**Note:- The bush (55) is a press fit in bevel pinion bore (54) and should be inspected for wear / damage in situ.**



**SECTION 5      DISMANTLING DIFFERENTIAL LOCK**

- 5.1 Remove fork split pin (40) and pull out pin (37).
- 5.2 Tap out roll pins (44) which secure differential lock fork (41).
- 5.3 Withdraw differential lock lever pin (22).
- 5.4 Remove and discard 'O' ring (26).
- 5.5 The differential lock fork (41) and clutch dog (42) can now be removed from inside axle casing.
- 5.6 Check for signs of oil seepage around bush (27). Knock out for replacement if required.
- 5.7 Remove stop screw (29) and lock nut (28).

**SECTION 6      REMOVAL OF AIR CHAMBER ASSEMBLY**

- 6.1 Loosen locknut (38) then unscrew the fork (39) and locknut from air chamber push rod.
- 6.2 Disconnect air chamber (35) from its air supply and pull off connections for diff lock switch (34).
- 6.3 Remove air chamber nut (31) and washer (32) and pull chamber from its mounting plate.

**INSPECTION**

After carefully cleaning the various parts in paraffin or other suitable cleaning agents, they should be inspected for wear / damage. Any parts found to be defective should be renewed. Oil seals and thrust washers should be replaced as a matter of course at each overhaul.



## ASSEMBLY OF DRIVE HEAD

**Note :- Unless otherwise specified, all bearings must be lightly oiled before setting and rotated whilst being set.**

**TOOLING REQUIRED**

- 1) Spring balance to read in excess of 12 lbs.
- 2) 2 off magnetic dial indicators.
- 3) Engineers marking compound.
- 4) Loctite no.601 sealing compound.
- 5) Loctite no.641 bearing lock.
- 6) Oil seal bumper tool (tool no. E477 is available if required).
- 7) Torque wrench and socket set (A/F sizes).
- 8) Loctite no.515 liquid gasket.

**SECTION 7 DIFFERENTIAL LOCK ASSEMBLY**

- 7.1 Assemble diff. lock fork (41) into groove in clutch dog (42) and place onto plate positioned inside axle casing (25).
- 7.2 If diff. lock bush (27) has been disturbed, it should be loctited in position as follows :-  
Ensure that mating surfaces of bush and casing are clean and free from grease.  
Apply a bead of **Loctite No 601** sealing compound to leading outer edge of bush and to leading edge of bore in casing.  
Press bush fully home and allow 30 mins. for Loctite to cure.
- 7.3 Fit a new bush 'O' ring (26) into position in diff. lock bush (27).
- 7.4 Hold diff. lock fork / clutch dog assembly in line with bush bore (27) and feed operating lever (22) fully into position in axle casing, passing through diff. lock fork (41) and into boss on other side of axle casing.
- 7.5 Align roll pin holes in fork (41) and operating lever (22) and secure with roll pins (44).
- 7.6 Feed diff. lock side drive shaft into axle arm until it just locates in clutch dog splines (42).



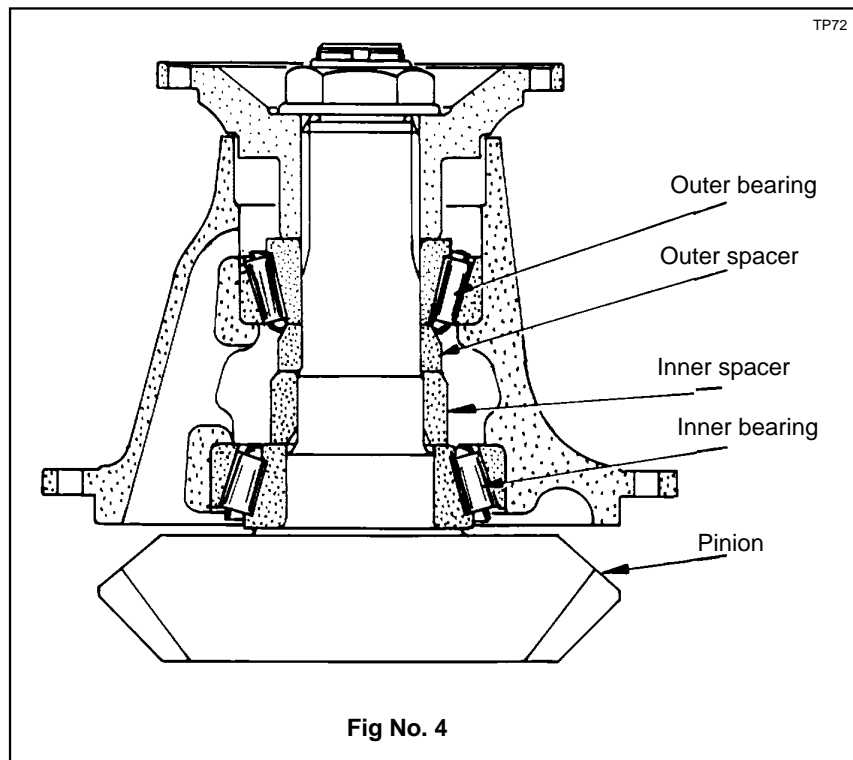
## SECTION 8 SPIRAL BEVEL PINION SUB ASSEMBLY - SEE FIG. No. 4

- 8.1 Fit inner and outer bearing cups (59 & 4) into their respective bores in bearing housing (7).
- 8.2 Press inner bearing cone (59A) onto pinion shaft (58).
- 8.3 Pinion assembly as follows :-

Fit inner bearing spacer (60) large inside chamfer end first, then outer spacer (61) large outside chamfer outwards onto pinion shaft (58). Feed assembly into position in housing.

**Note :- If new parts are being fitted, then assemble with largest of available spacers. This is to ensure that bearing pre-load is erred on low side, thus preventing too great a pre-load and resultant bearing damage.**

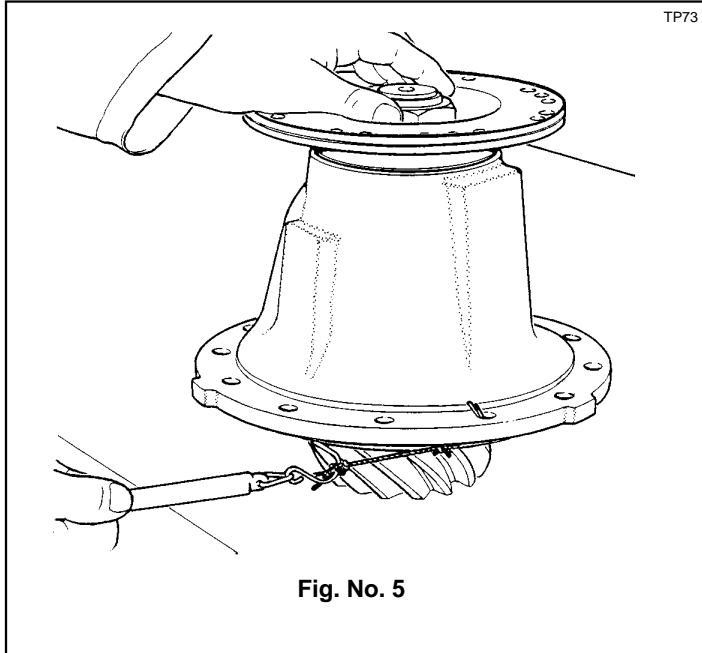
- 8.4 Press outer bearing cone (4A) into position on pinion.
- 8.5 Press coupling flange (2) onto pinion splines and secure with nut (1).
- 8.6 Place assembly in vice (clamp on holding plate fitted to coupling flange ).
- 8.7 Lightly oil bearings with clean gear oil ( see lubrication instructions at front of manual for specification), then progressively tighten nut (1) whilst rotating and shock loading bearing housing (7) with a rawhide mallet, to torque setting of 800 - 900 lbs. ft. (1085 - 1220 Nm).
- 8.8 Remove assembly from vice, take off holding plate.





SECTION 9 CHECKING PINION BEARING PRE-LOAD

- 9.1 Position pinion assembly, coupling flange uppermost on bench.
- 9.2 Secure a length of cord to pinion housing (7) and attach free end to a spring balance. fig. no. 25



- 9.3 Wrap cord around o/d of pinion housing and pull on spring balance to rotate housing. Note force required to maintain rotation, ignoring initial starting force. The force required to maintain rotation should be related in following manner to determine pre-load;

$T = F \times R$ , where  
 T = Torque (pre-load)  
 F = Force to maintain rotation (lbs)  
 R = Radius of secured cord (ins)

The pre-load obtained should be between limits 15 to 25 lbs. ins. (1.7 to 2.8 Nm) which equates to a spring balance reading of 4 - 6 lbsf..

If torque reading is **less** than 15 lbs. ins. then  
 A **smaller** outer spacer needs to be fitted.

If torque is **greater** than 25 lbs. ins., then  
 A **larger** outer spacer needs to be fitted.

**Note :-** If largest available combination of spacers (60 & 61) is already fitted, then a defect must be present in one or more parts of assembly and needs to be found and remedied before continuing axle build.

If stock size spacer is not available, spacers may be ground to size provided that the same amount of material is ground from both sides to a maximum of 0.13mm(0.005") per side whilst maintaining parallelism and squareness with bore within 0.0002" T.I.R.

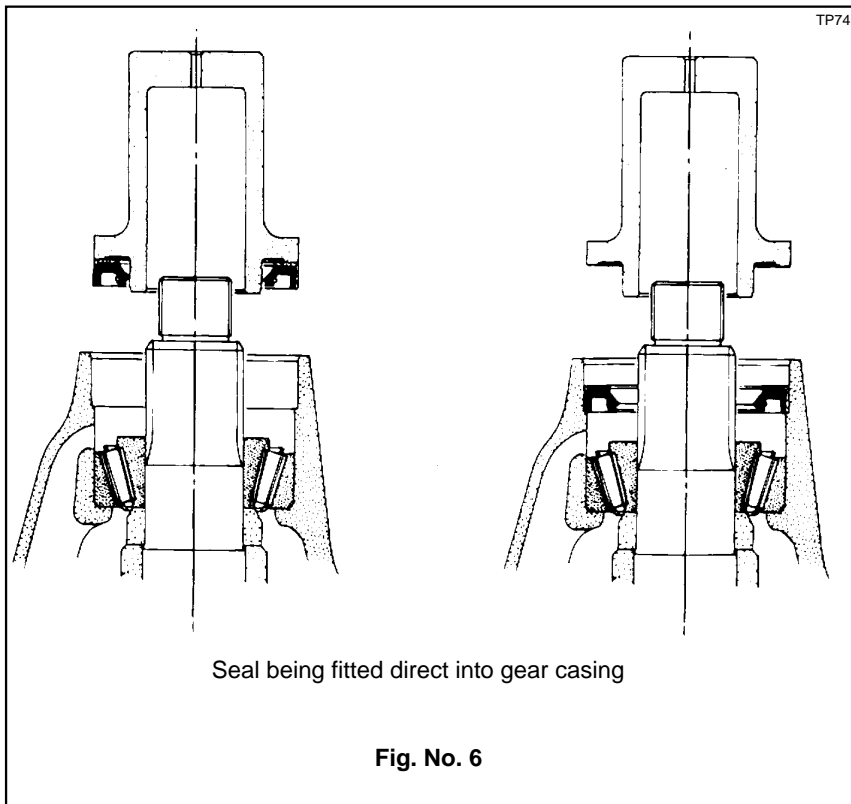
This is to avoid removing all case hardening depth on one side.

- 9.4 When correct pre-load has been obtained, remove coupling flange nut (1) and coupling flange (2).



**SECTION 10 FINAL ASSEMBLY OF PINION UNIT**

- 10.1 Fit oil seal into bearing housing (7) using a suitable fitting tool (tool no. E477 is available from our spares and services dept. if required) as follows :-
- a) The seal must be fitted using a circular tool which bears on seal close to its outside diameter where casing is strongest. The correct fitting tool (E477) or one of similar design should be used. Failure to use a suitable tool will result in distortion of seal casing, uneven wear of lip and leakage. See fig. no. 6.
  - b) The seal must remain square to bore during fitting. If seal cocks over and one side enters bore first in will almost certainly result in distortion of casing which will not be corrected by straightening up seal further down bore. Where possible, seal should be fitted under a press, which reduces the likelihood of this problem.
  - c) The seal must be truly square in bore after fitting. A cocked seal will act as an oil pump.
  - d) When replacing a seal, always check coupling flange for damage in region polished by oil seal lip : even slight damage in this area will cause leakage. Very slight marks may be polished out with fine emery cloth, but it is essential that polishing marks are parallel to seal lip. Where there is no more serious damage, it is permissible to fit two seals back-to-back if there is room in housing, ie. outer seal with spring facing outwards, inner seal with spring facing inwards. The outer seal acts as a spacer and ensures that inner seal is fitted square and that it runs on a different part of coupling flange.
  - e) The lip of seal or journal of coupling flange should be smeared with clean gear oil prior to assembly.  
If seal is assembled dry it can burn out in a matter of minutes, before oil reaches it.



- 10.2 Refit coupling flange (2) and nut (1). Tighten nut to 800 - 900lbs.ft.(1085 - 1220Nm.)
  - 10.3 Lock nut in position by peening locking flange into slot in pinion shaft .
  - 10.4 If any pinion housing / gear casing studs (9) have been removed, renew and tighten to TD183/1
  - 10.5 Place adjusting shim (8) into position on studs (9), then offer pinion assembly to gear casing (12), tapping in position with a rawhide mallet.
- Note :- If new pinion / crownwheels are fitted, a nominal shim pack of 0.050 " (1.27mm) should be fitted.**
- 10.6 Secure in position with washer (6) and nuts (5). Tighten nuts progressively using diagonal selection, until tightened to correct torque. 47 - 53 lbs. ft. (64 - 72 Nm).

**SECTION 11 SEQUENCE OF OPERATIONS TO ASSEMBLY SPIRAL BEVEL WHEEL  
(CROWNWHEEL) AND DIFFERENTIAL**

- 11.1 Press diff. bearing cone (17A) onto its mating diff. cage half (14 ) followed by other bearing cone (46A) onto its diff. cage half (50).
- 11.2 Fit spiral bevel wheel (crownwheel) (49) onto diff. cage (female half) (50) ensuring that diff. cage dowels (45) are correctly located.
- 11.3 Fit diff. cage bolts (48) through spiral bevel wheel (crownwheel) and differential assembly then place assembly on bench supported on blocks, crownwheel end down.
- 11.4 Fit one diff. bevel wheel thrust washer and diff. bevel wheel (51 & 52) into diff. cage half (50).
- 11.5 Assemble four diff. bevel pinion and bush assemblies (54 & 55) and four diff. bevel thrust washers (56) onto diff. trunnion (53).

**Note :- If a new bush (55) is to be fitted into bore of pinion (54) it must be done using a suitable press due to tight fit between pinion and bush. The bush (55) is pressed flush with spherical face of pinion (54). If no press is available, then a new pinion and bush assembly must be fitted.**

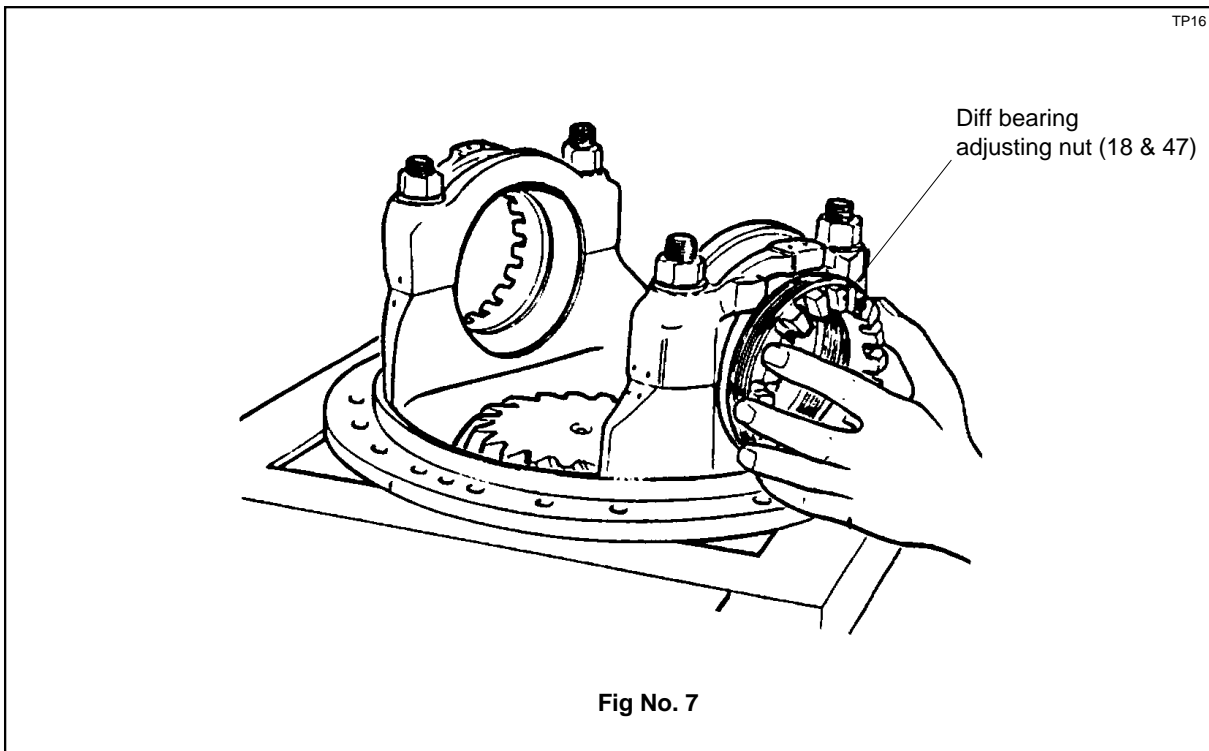
- 11.6 Lay diff. trunnion assembly onto diff. bevel wheel (52) ensuring that teeth mesh correctly.
- 11.7 Place other diff. bevel wheel and thrust washers (52 & 51) onto diff. bevel pinions again ensuring that teeth are correctly meshed.
- 11.8 Carefully fit diff. cage half (14) onto assembly, aligning matching marks on both diff. cage halves, securing with diff. cage bolt nuts and washers (16 & 15), then tighten to 166 - 184 lbs. ft. (225 - 250Nm.).

**SECTION 12 INITIAL PREPARATION BEFORE FITTING ASSEMBLED SPIRAL BEVEL WHEEL (CROWNWHEEL) AND DIFFERENTIAL**

- 12.1 Secure pinion and casing assembly in a suitable diff. build stool.
- 12.2 Check fit of diff. bearing adjusting nuts (18 & 47) as follows :-
- 12.3 Clean and deburr bevel casing legs (12) and bevel casing straps (19).
- 12.4 Fit bearing cups (17 & 46) into relevant half bores of bevel casing (12).
- 12.5 Check bevel casing strap studs (13), if any have been removed, replace then tighten to 88 - 98 lbs. ft. (119 - 133Nm.).
- 12.6 Carefully fit bevel casing straps (19) down studs (13) to locate on bearing cups (17 & 46). Check alignment of matching marks on bevel casing legs and straps (12 & 19) to ensure that straps are not transposed, bearing cups (17 & 46) should rest snugly in bores, and bearing adjusting nuts (18 & 47) should be free to turn with hand pressure only, if not, it may be because of cross threading. Remove and deburr.

**Note :- on no account should extra pressure e.g. hammer be used .**

- 12.7 Fit diff. strap washers (20) and temporary plain nuts onto bevel casing strap studs (13) then tighten to 105 lbs ft. (142Nm.) .
- 12.8 Check freedom of diff. bearing adjusting nuts (18 & 47) by unscrewing and refitting. To assist this operation, tap bevel casing straps (19) lightly on top with a 2lb hammer. See fig. no. 7.



- 12.9 Having checked fitting of adjusting nuts (18 & 47), remove bevel casing straps (19), bearing cups (17 & 46) and adjusting nuts (18 & 47).

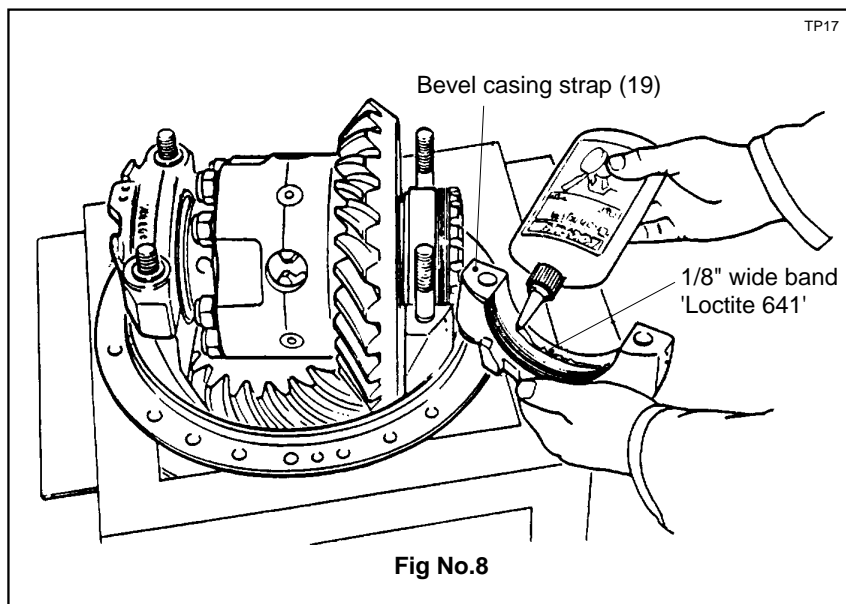


**SECTION 13 FITTING SPIRAL BEVEL WHEEL (CROWNWHEEL) AND DIFFERENTIAL INTO BEVEL CASING**

13.1 Apply a **thin** bead of 'Loctite 641', using correct applicator to give a 1/8" wide band, into bevel casing strap bores (19) See fig. no. 8.

This is to prevent possibility of diff. bearing cups (17 & 46) spinning in service.

**Note :- Assembly and setting procedures are to be completed immediately so as to avoid the 'Loctite' hardening, and preventing adjustment of bearing cups (17 & 46).**



13.2 Hold diff. bearing cups (17 & 46) in position on diff. bearing cones (17A & 46A) and place spiral bevel wheel (crownwheel) and differential assembly in position in bevel casing (12).

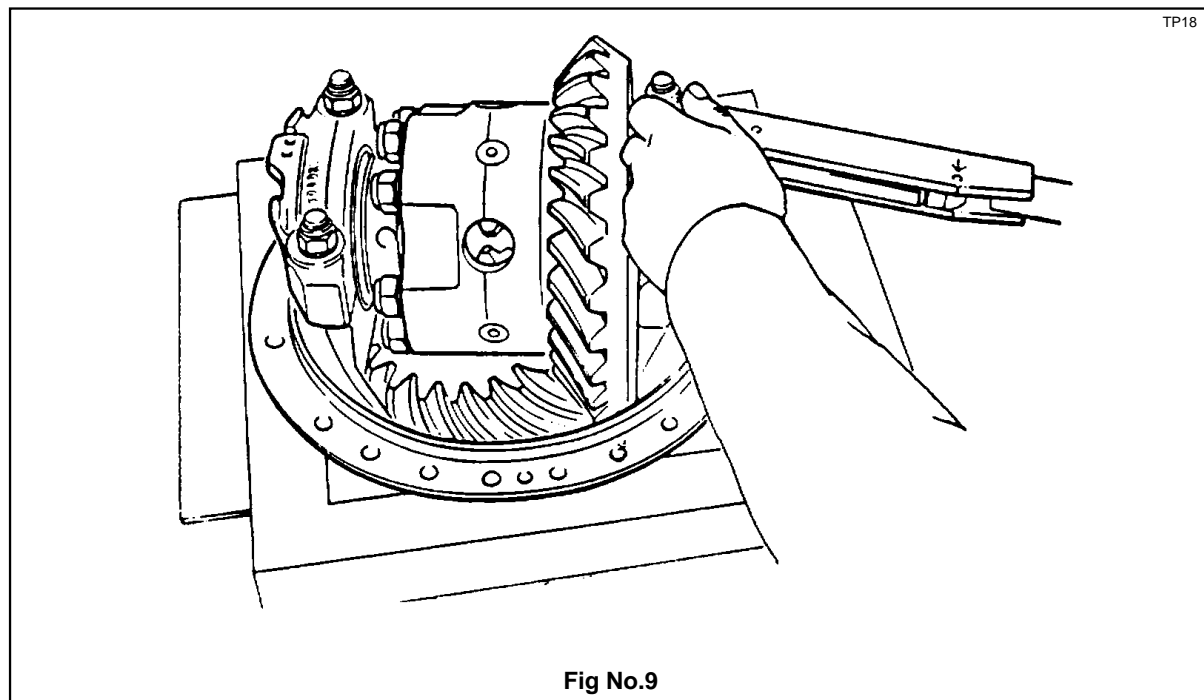
13.3 Fit diff. bearing adjusting nuts (18 & 47) onto half threads of bevel casing legs (12).  
Recheck freedom of nuts in threads.

13.4 Refit bevel casing straps (19) (by hand) onto bevel casing strap studs (13) to locate on bearing cups (17 & 46) and adjusting nuts (18 & 47).

**Note :- Ensuring all matching marks coincide to obviate misalignment of straps (19).**

13.5 Turn bearing adjusting nuts (18 & 47) hand tight against bearings (17 /17A & 46 / 46A).

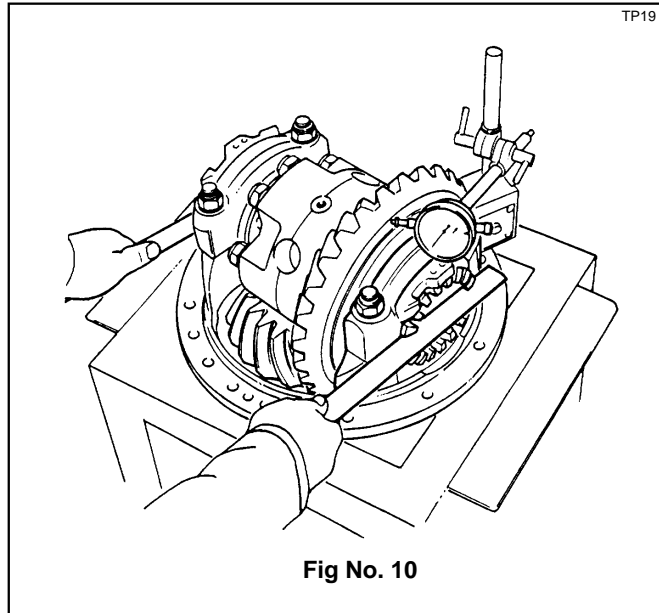
13.6 Fit bevel casing strap washers and bevel casing strap stud nuts (20 & 21), then tighten nuts to 128 - 142 lbs. ft. (174 - 193Nm.). See fig. no.9.



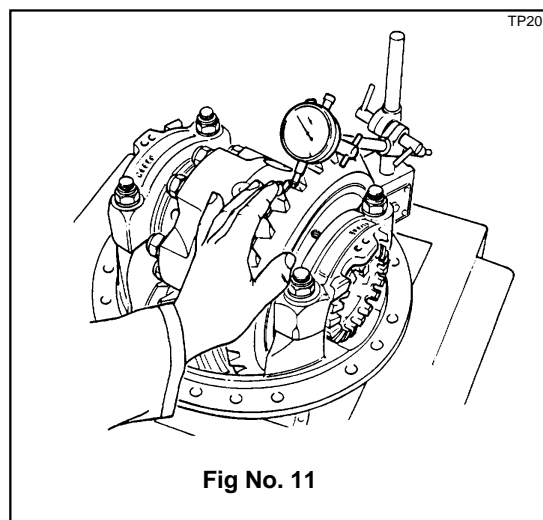



**SECTION 14 SETTING " NO END FLOAT " CONDITION**

- 14.1 Set up a dial indicator on back face of spiral bevel wheel (crownwheel) (49) as shown in fig. 10. and screw in each diff. bearing adjusting nut (18 & 47) just sufficiently to ensure no spiral bevel wheel (crownwheel) axial movement is registered on dial indicator.
- 14.2 Tap bevel casing straps (19) and rotate bevel wheel (crownwheel) then check that no axial movement is present.


**SECTION 15 SETTING THE SPIRAL BEVEL WHEEL (CROWNWHEEL) AND PINION BACKLASH**

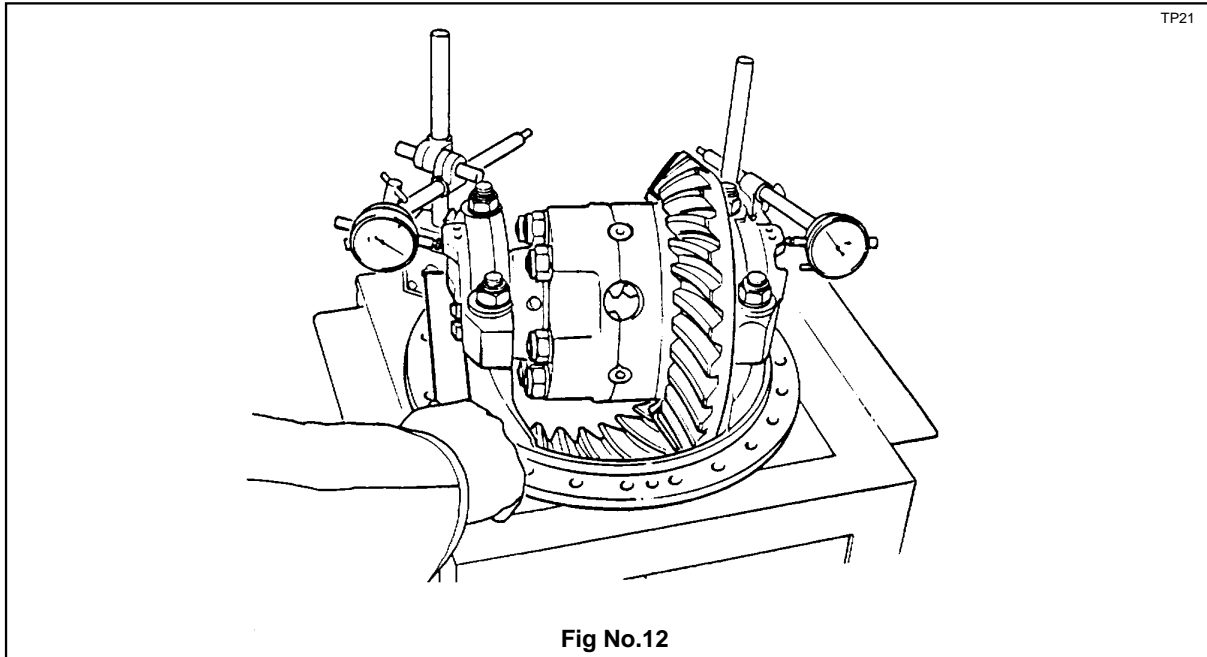
- 15.1 Move dial indicator onto spiral bevel wheel (crownwheel) tooth (49) as shown in fig no. 11. Hold spiral bevel pinion (58) still and rock the spiral bevel wheel (crownwheel) (49) backwards and forwards, to check free play between gears (backlash), and note variation of indicator reading.
- 15.2 Repeat above operation **three more times** so that **four readings** are taken at various positions equally spaced around spiral bevel wheel (crownwheel) (49). The variations of readings on dial indicator must be within limits of 0.008 " to 0.013 " (0.203 to 0.330mm) . If difference in backlash of more than half backlash tolerance exists between any tooth mesh positions, then assembly should be further examined for cause and rectified.





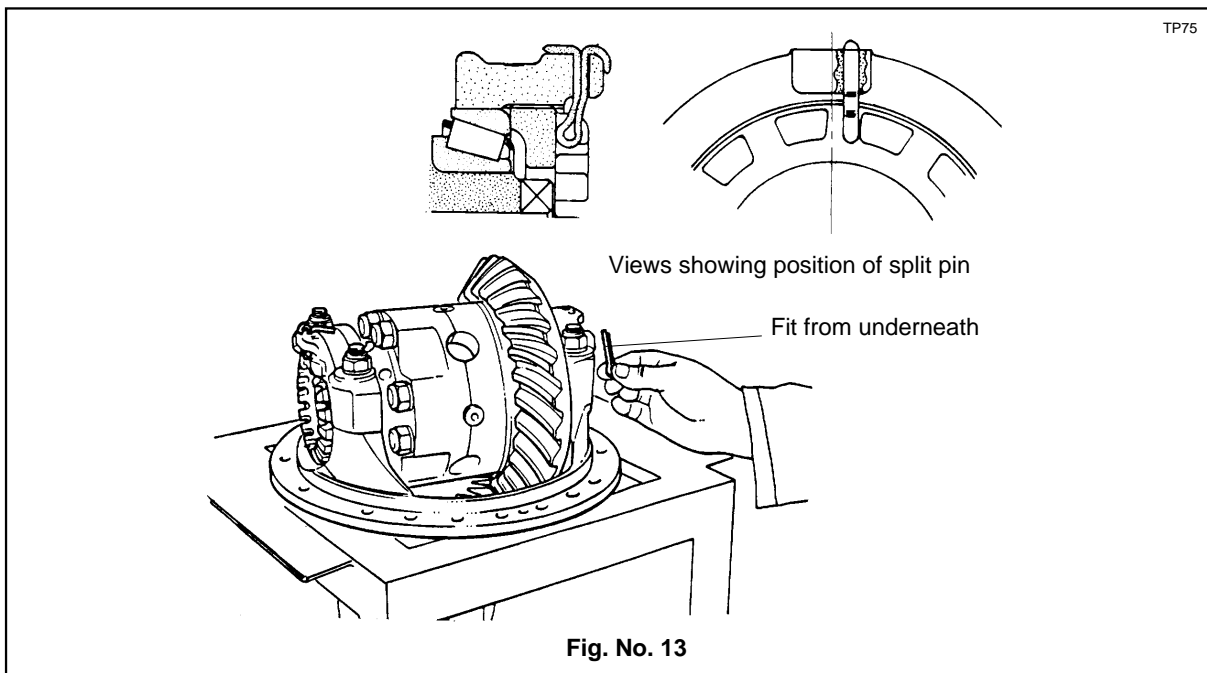
**SECTION 16 SETTING THE SPIRAL BEVEL WHEEL (CROWNWHEEL) BEARINGS**

16.1 Set up two dial indicators diametrically opposite on bevel casing strap register points as shown in fig. no. 12 and set each indicator to zero.



**Fig No.12**

- 16.2 Mark position of diff. bearing adjusting nuts (18 & 47) and then slacken each one slightly to ensure that no spread is present. (ie. dial indicators remain at zero).
- 16.3 Re-tighten each diff. bearing nut (18 & 47) back to its marked position and then tighten a further notch on each end to pre-load differential bearings (17 / 17A & 46 / 46A).  
(a spring balance reading of 2 1/2 " lbs pull , ie. rolling resistance at o/d of diff. cage which equates to 8.75 lbs ins pre-load).  
The sum of dial indicator readings should total between 0.002 " and 0.004 " (0.051 to 0.102mm).  
The adjuster nut slots should line up with one of split pin holes in bevel casing straps (19).
- 16.4 Tighten strap nuts (21) to 128 - 142 lbs. ft. (174 - 193Nm.).
- 16.5 Fit diff. adjusting nut split pins (43) as shown in fig. no. 10.
- 16.6 Set up a dial indicator on spiral bevel wheel (crownwheel) (49) tooth and re-check that backlash is still as previously set. (section 15. fig. no. 13).



**Fig. No. 13**



**SECTION 17 GEAR IDENTIFICATION ALSO CROWNWHEEL & PINION GEAR MESH.**

Because we now produce gears by both Gleason and Oerlikon method of manufacture, the following identification features are given to show differences between types of gears .

**17.1 GLEASON GEARS**

- a) Gear teeth taper towards centre (toe end of teeth).
- b) No suffix identification letter in part no. eg. R8579/1/2.
- c) No identification groove on pinion shank and crownwheel back face.

**17.2 OERLIKON GEARS**

- a) Gear teeth parallel to pitch line .
- b) Part no. has suffix identification letter 'N' eg.R8579/1N/2N.
- c) Pinion shank and crownwheel back face have identification groove.

**NOTE :- The Oerlikon gears are cut in two forms :- N form and G form (Spiroflex)**

**At present, all gears except the following part nos. , are cut in N form.**

**gears cut in G form are as follows:-**

**R8939/1N/2N      R8858/1N/2N      R8859/1N/2N.**

**The only difference between the two forms is in mesh positions as shown in relevant mesh checking diagrams in following section.**

**SECTION 18 CHECKING CROWNWHEEL AND PINION MESH.**

- 18.1 Apply a thin coating of engineers marking compound to several consecutive crownwheel teeth.
- 18.2 Turn crownwheel for a few revolutions, in both directions to make a positive tooth contact impression on crownwheel and pinion teeth.
- 18.3 Inspect deposit of marking compound on crownwheel and pinion teeth and compare them with following relevant diagrams on pages C18 to C20  
In all cases, action, (if any) to be taken is shown below:

- Fig.A. Indicates correct mesh.  
No further action required.
- Fig.B Indicates pinion & crownwheel are too far out of mesh.  
To remedy, move pinion inwards towards crownwheel.  
To maintain backlash, move crownwheel away from pinion in direction of arrow B
- Fig. C Indicates pinion & crownwheel too far into mesh.  
To remedy, move pinion outwards away from crownwheel.  
To maintain backlash,move crownwheel towards pinion in direction of arrow B.

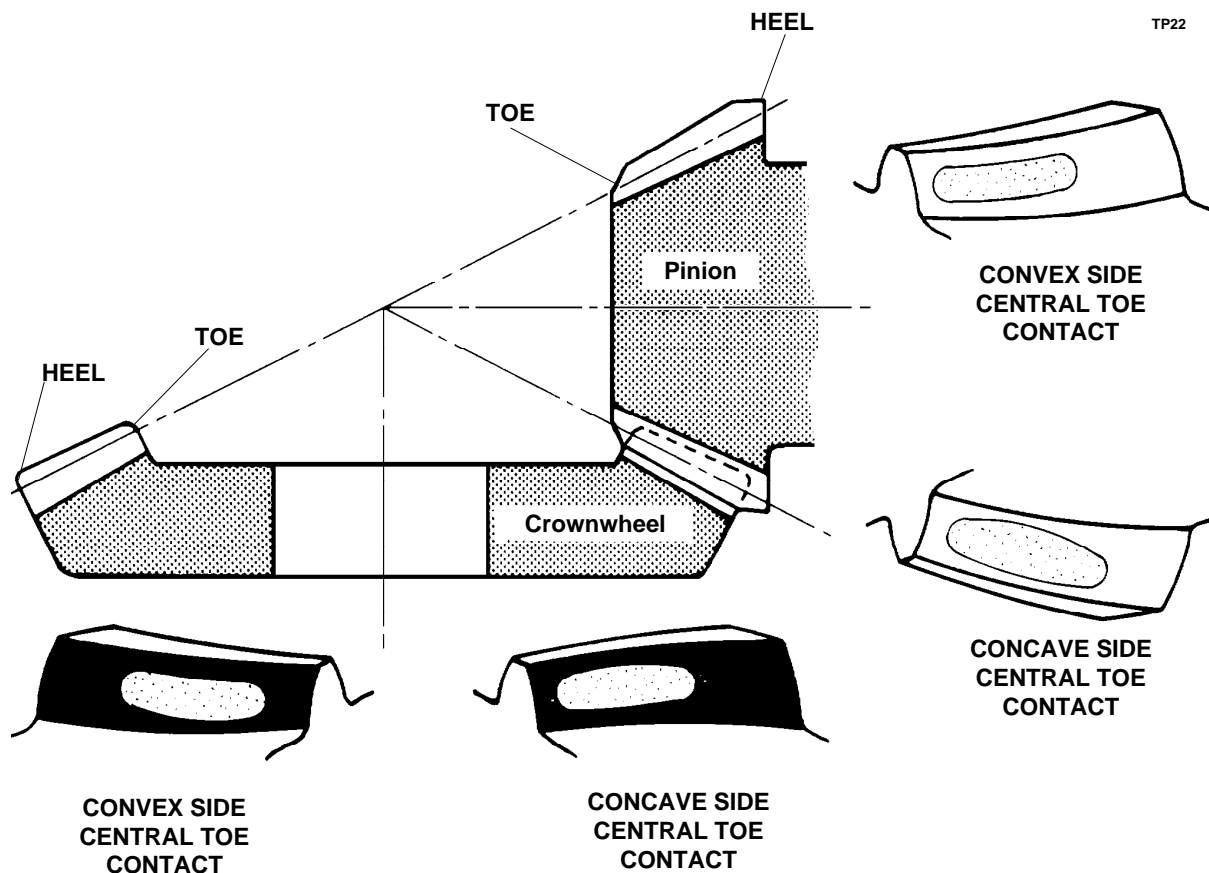
If any action is required, adjust pinion position by altering thickness of pinion bearing shims (8A, B & C) ie.**add** shims to move pinion **away** from crownwheel and **remove** shims to move pinion **towards** crownwheel.

- 18.4 When settings are correct, remove pinion bearing housing nuts with washers (5 & 6) then pull off pinion assembly and lift off shims (8).
- 18.5 Thoroughly clean shims (8), also mating face of pinion housing and gear casing (7 & 12) using Loctite Solvent no.7070 or other suitable chlorinated solvent.
- 18.6 Apply a thin film of Loctite no.515 liquid gasket to one side of each shim (8) then fit, Loctite side first, onto studs (9).
- 18.7 Similarly coat pinion housing mating face (7) with Loctite no.515 liquid gasket and re-fit assembly to gear casing (12), tapping into place with a hide faced hammer.
- 18.8 Secure in position with washer (6) and nuts (5). Tighten nuts progressively using diagonal selection, until tightened to correct torque. 47 - 53 lbs. ft. (64 - 72 Nm).



GLEASON GEARS

Typical preferred tooth contact  
(pinion member left hand in all cases shown)



TP22

Fig. B

Fig. C

**PROFILE ERROR**

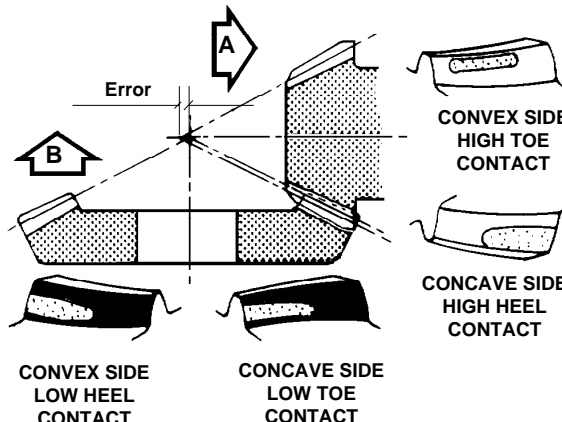
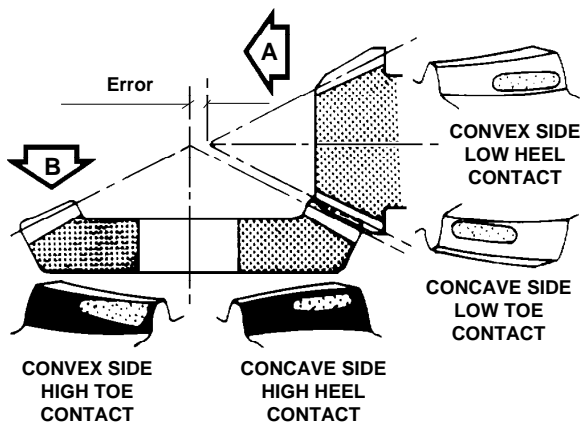
To correct, move pinion towards crownwheel in direction of arrow A.

To maintain backlash, move crownwheel away from pinion in direction of arrow B.

**PROFILE ERROR**

To correct, move pinion away from crownwheel in direction of arrow A.

To maintain backlash, move crownwheel towards pinion in direction of arrow B.





OERLIKON N FORM GEARS

Typical preferred tooth contact  
(pinion member left hand in all cases shown)

Fig.A

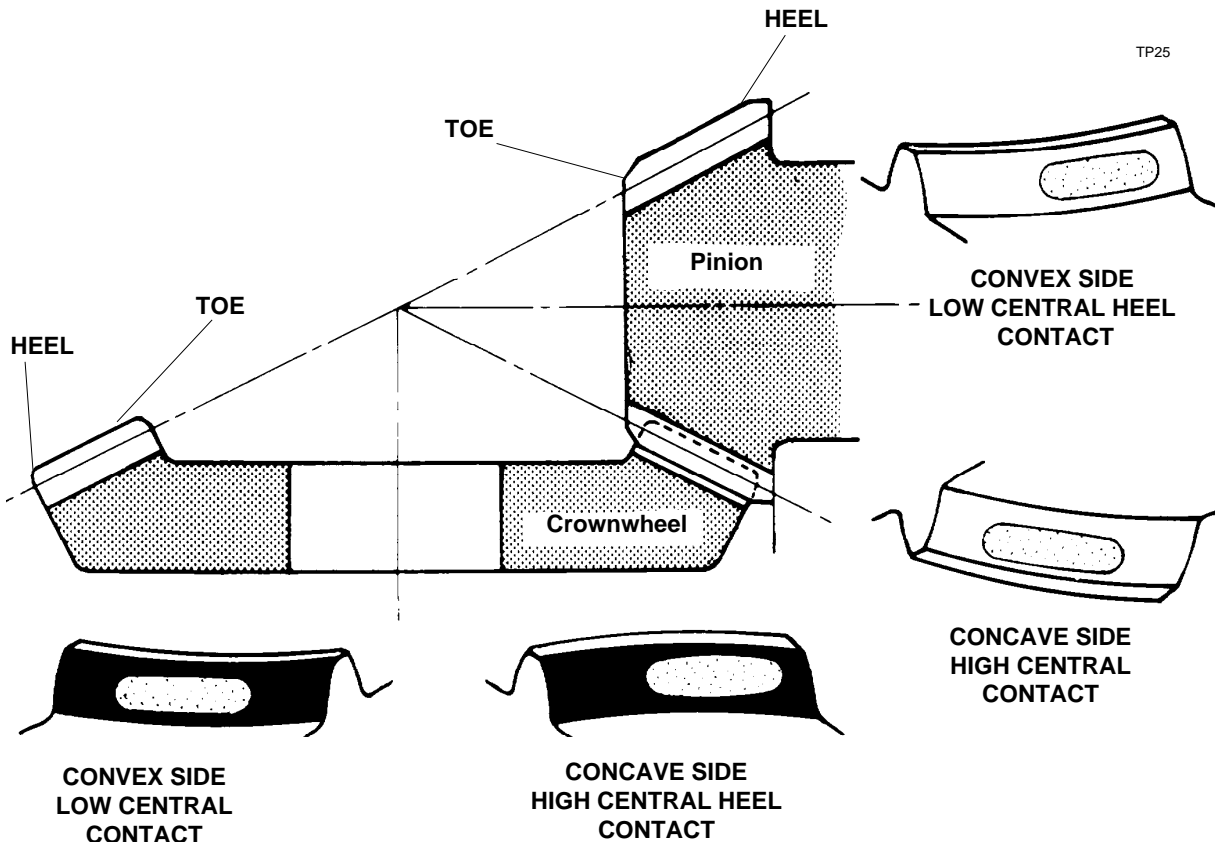


Fig. B

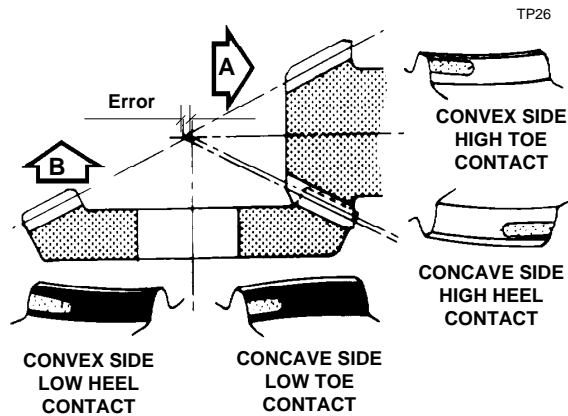
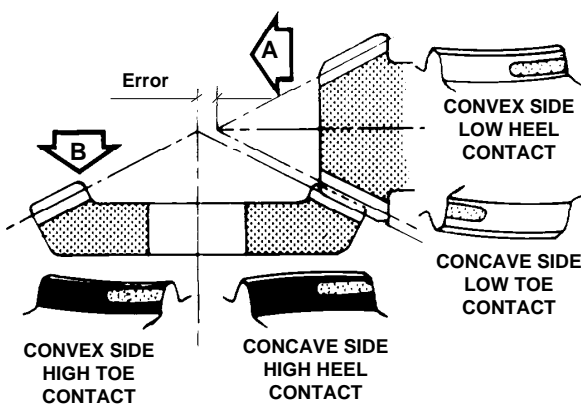
**PROFILE ERROR**  
To correct; move pinion towards crownwheel in direction of arrow A.

To maintain backlash, move crownwheel away from pinion in direction of arrow B.

Fig. C

**PROFILE ERROR**  
To correct; move pinion away from crownwheel in direction of arrow A.

To maintain backlash, move crownwheel towards pinion in direction of arrow B.





OERLIKON G-FORM GEARS

Typical preferred tooth contact  
(pinion member left hand in all cases shown)

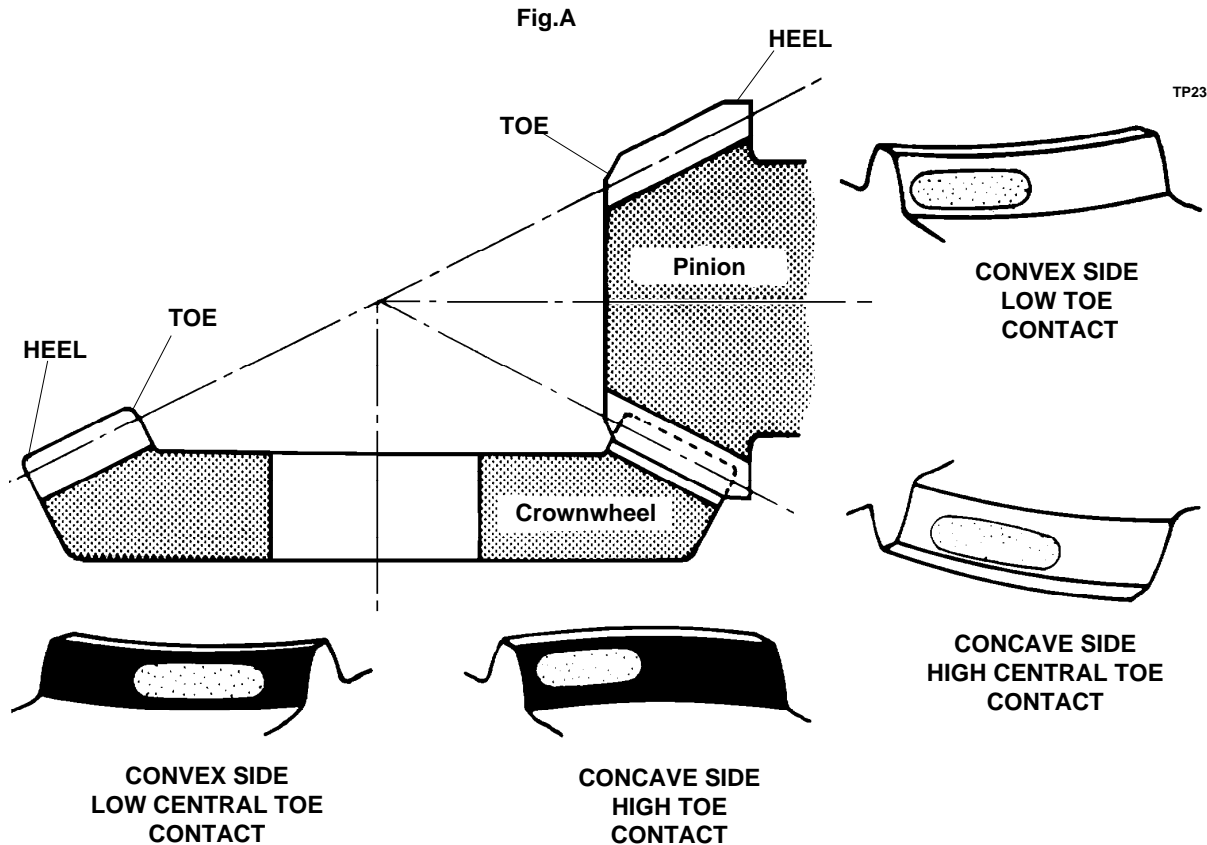


Fig. B

PROFILE ERROR

To correct; move pinion towards crownwheel in direction of arrow A.

To maintain backlash, move crownwheel away from pinion in direction of arrow B.

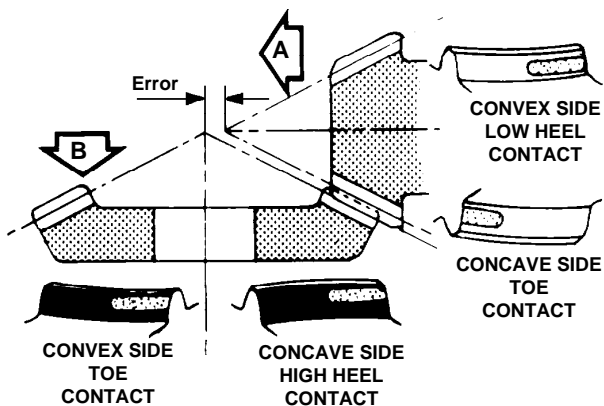
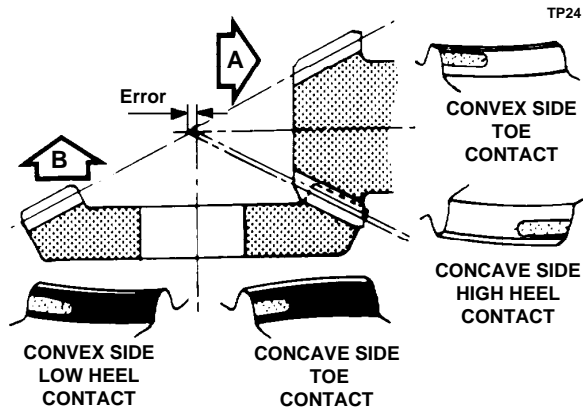


Fig. C

PROFILE ERROR

To correct; move pinion away from crownwheel in direction of arrow A.

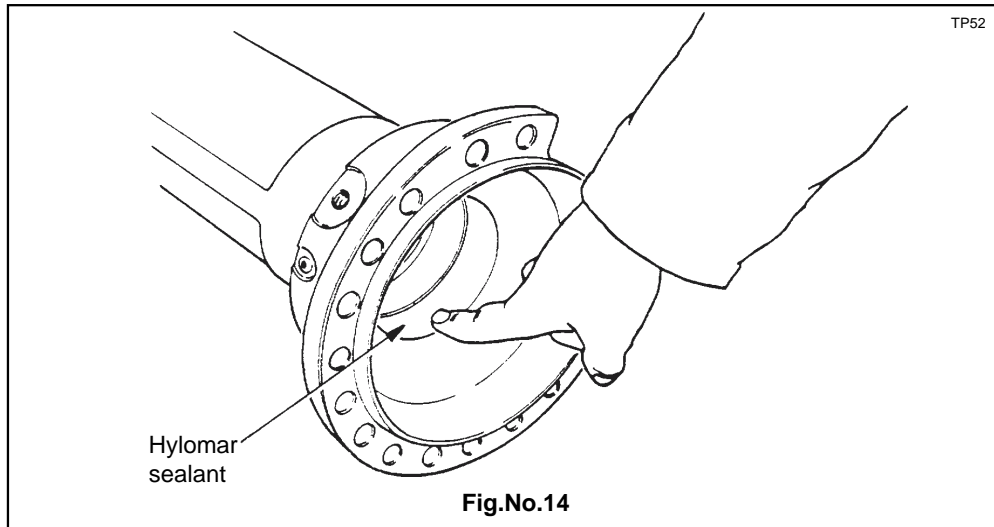
To maintain backlash, move crownwheel towards pinion in direction of arrow B.



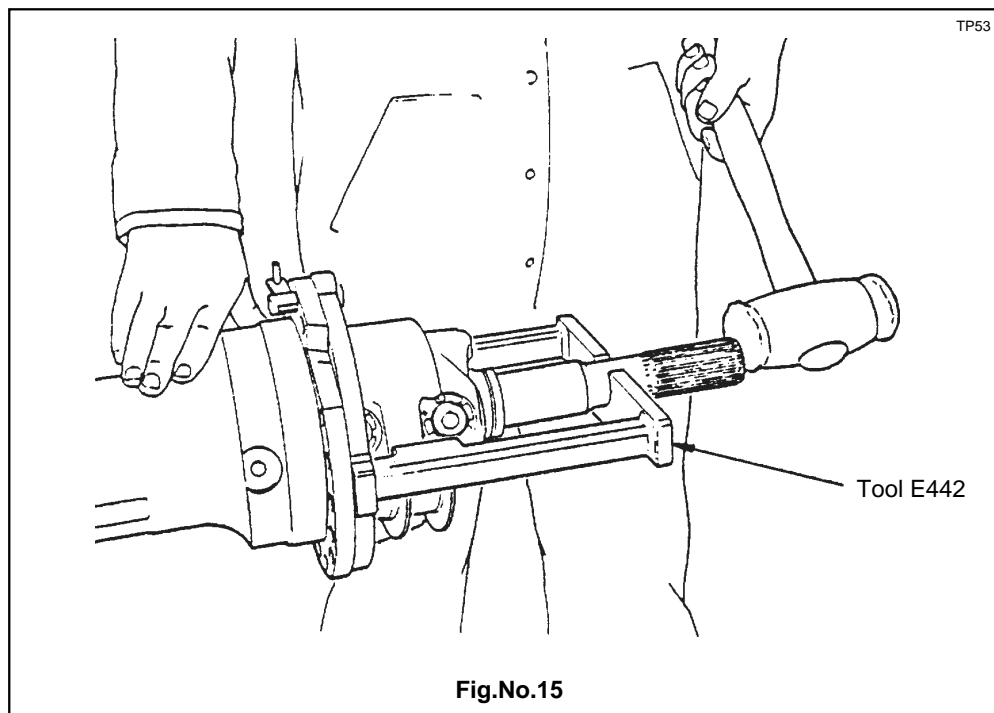


**SECTION 19 REFITTING DRIVE HEAD INTO AXLE**

- 19.1 Refit axle casing studs (23), to TD183/1.
- 19.2 Coat gear casing mating face of axle casing (25) with Loctite no.515.
- 19.3 With drive head supported with a suitable sling offer assembly to axle casing and tap into position using a hide faced hammer.
- 19.4 Fit axle casing washers (11) and nuts (10) then tighten nuts to 99 - 108 lbs. ft. (134 - 148 Nm.).
- 19.5 Fit hub as follows :-
  - a) Apply a film of Hylomar sealant to bearing abutment bore in axle casing. (see fig. no. 14).



- b) Fit tool E 442 to axle casing flange the carefully feed U.J. assembly into position in axle arm, ensuring correct location of drive shaft in drive head splines.and that no damage occurs to oil seal in the process. Using a soft metal (aluminium) drift (tool E562 or similar) carefully tap oil seal housing into position in axle arm alternately tapping drive shaft into position using a hide faced hammer as shown in figure no.15.





## SECTION 19 REFITTING DRIVE HEAD INTO AXLE

**Note :- Part Nos. marked thus \* refer to FH55**

## 19.5 Continued

- c) Fit U.J. oil seal housing lockscrews (114\*) and tighten to 72 - 80 lbs. ft. (98 - 108 Nm.) then fit U.J. oil seal housing locknuts and tighten to secure.
- d) Place two 1/8 " thick packing pieces between top and bottom swivels (74 & 142\*) to keep them apart.
- e) Fit oil seal protection sleeve (tool no. E422 ) onto end of drive shaft (102\*) then feed swivel / hub unit into position on axle casing. Remove oil seal protection sleeve (tool no. E422).
- f) Fit locknuts (113\*) then apply loctite "nutlock 242" to axle casing setscrew threads (110\*) and fit into position . Tighten nuts to 190 - 210lbs.ft. (258 - 285Nm.) and setscrews to 169 - 187lbs.ft.(229 -254 Nm.).
- g) Remove packing pieces and eye bolt then refit top cap setscrew and washer tighten setscrews to 72 - 80lbs.ft. (98 - 108 Nm.).
- h) Refit sun gear spacer (60\*), sun gear (61\*) and circlip (62\*).
- i) Replace planet carrier "O ring" (64\*) and fit planet carrier into position. securing with setscrews and washers (65 & 66\*).
- j) Reconnect slack adjuster to air cylinder push rod in its original position.
- k) Reconnect ball socket assembly to bottom steering lever, fit ball socket washer and nut. Then tighten nut to 100 lbs.ft.(136Nm.).

**Note :- Ball pin and ball pin tapers in bottom steering lever must be clean, dry and free from oil prior to assembly.**

- l) Fit ball pin split pin to secure ball socket assembly.

**Note :- if split pin slot and hole do not line up ,adjust up to next slot.**

**IE :- minimum ball pin nit torque 100 lbs.ft  
maximum ball pin nut torque 170 lbs. ft.**

Repeat above operations for other hub end.



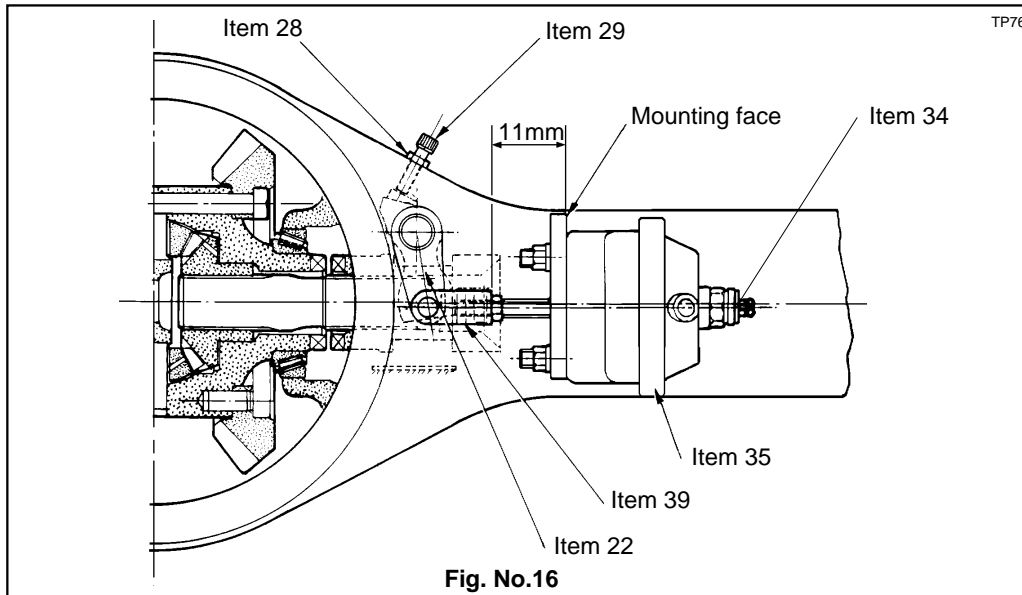


**SECTION 19 REFITTING DRIVE HEAD INTO AXLE Cont.**

19.6 Fit air chamber (35) onto mounting plate and secure into position with locknuts (31) and washers (32).

**Note :-** If new air chamber (54) is to be used, the push rod needs to be cut, prior to fitting, to same length as on original air chamber. This is because air chamber manufacturer supplies chambers with push rods to suit all applications. When fitting diff. lock air chambers ensure that air chamber push rod is fitted in line and operates at 90° to mounting bracket. This is to ensure smooth operation and avoid jamming up problems in service.

19.7 Assemble the locknut (38) and yoke (39) onto the push rod end.  
 19.8 Screw yoke onto push rod until distance from air chamber mounting face to push rod is 11mm - see fig. no.16.



**Fig. No.16**

19.9 Secure yoke (39) with locknut (38).  
 19.10 Connect diff. lock switch (34), if fitted, and air supply to air chamber (35).  
 19.11 Check air chamber to yoke distance with air in system.

**SECTION 20 DIFF LOCK SETTING PROCEDURE.**

20.1 Engage diff. lock then check that lock is fully engaged by rotating one hub, if lock is engaged, other hub will rotate in **same** direction.  
 20.2 Fit stop screw (29) and locknut (28).  
 Screw stop screw into casing until contact with operating lever is felt.  
 20.3 Disengage diff. lock.  
 20.4 Give stop screw (29) **one half turn clockwise**, then lock in position with locknut (28).  
 20.5 Check disengagement as follows :-  
 Rotate **one hub** and observe direction of other hub.  
 If lock is disengaged hubs will rotate in **opposite** directions.



## SECTION 21 INSTALLATION AND USE OF CROSS AXLE AND THIRD DIFFERENTIAL LOCKS

## 21.1 Installation Recommendations and Instructions

**Warning light system**

Each diff. lock is fitted with a switch which shall be connected directly to an individual warning lamp in the drivers cab, to indicate when the lock is fully engaged. Each light shall be of the double bulb type or incorporate a bulb checking feature to avoid an incorrect warning.

Differential locks on steer drive axles

Differential locks are not recommended on steer drive axles. This is because, when a locked axle is steered, the required speed difference between off side and near side wheels is prevented, causing a wind-up of torque in the shafts, gears and dogs. This can cause the tyres to skid, a phenomenon which will affect vehicle control. Moreover, it greatly increases the torque required to turn the steering swivels.

If indeed, a customer does demand a diff. lock on a steer drive axle, then it must be emphasised that this should be engaged only when wheel slippage has immobilised the vehicle and that it must be disengaged within a few seconds of recovery.

## 21.2 Instructions for vehicle operators

**Warnings**

Diff. locks are for use only under conditions where adhesion between tyres and ground is extremely low. They **must** be disengaged as soon as conditions permit.

Prolonged running with locks engaged can (due mainly to steering), promote wind-up between off side and near side shafts, gears and dogs. This can lead to breakage of components.

If a diff. lock is fitted to a steer drive axle, it should only be engaged when wheel slippage has immobilised the vehicle and it must be disengaged within a few seconds of recovery.

**Engagement**

**IMPORTANT :- DIFF. LOCKS SHALL ONLY BE ENGAGED WHILST THE VEHICLE IS STATIONARY.**

- i) On approaching low adhesion terrain :-

The vehicle shall be stopped and diff. lock switches operated. If dogs do not engage fully, as witnessed by the warning lights, the vehicle shall be driven and manoeuvred slowly until full engagement is achieved.

- ii) When vehicle is immobilized due to wheel spin.

**Any wheel spin must be terminated prior to attempting diff. lock engagement.**

Diff lock switches shall be operated. If the dogs do not engage fully, as witnessed by the warning lights, the transmission shall be allowed to rotate until full engagement is achieved.

Driving shall not be resumed until full engagement has been verified by each respective warning light.

**Disengagement**

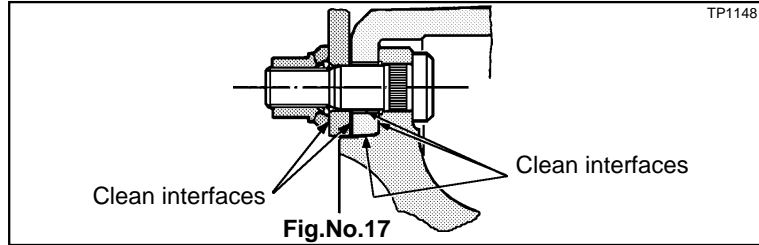
Release pressure from operating chamber. It is then essential that the vehicle is manoeuvred slowly to ensure full disengagement of diff. lock dogs and relieve wind-up.



SECTION 22 FINAL ASSEMBLY / ADJUSTMENTS

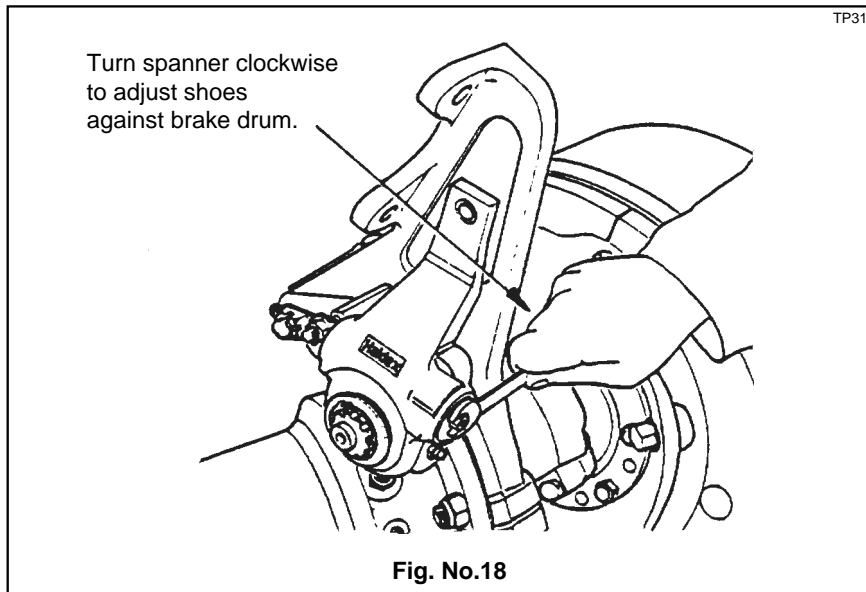
22.1 Clean interfaces between Hub and brake drum then with brake drum (2 - FH55) suitably supported, slide into position on hub (16- FH55).

**Note :- Interfaces must be free from dirt , including liner material debris, rust and paint. Failure to keep interfaces clean, can and will cause brake drum to distort upon tightening of wheel nuts. For further details see BS AU50 : Part 2 : Section 7A : 1995.**



- 22.2 Fit brake drum retaining setscrew (70 - FH55) and tighten to 72 - 80lbs. ft. (98 - 108Nm.).
- 22.3 Repeat operations 22.1 and 22.2 for other hub unit.
- 22.4 Re-connect prop shafts to coupling flange (2).
- 22.5 Refit drain plugs and refill axle with clean gear oil as stated in lubrication section at front of this manual.
- 22.6 Adjust brakes as follows :-

- a) Turn adjusting screw on slack adjuster (91 - FH55) clockwise until brake linings are hard up against brake drum, then back off adjusting screw by  $\frac{3}{4}$  of a turn as shown in fig. no. 18.
- b) Check function of slack adjuster by performing a few brake applications. Adjustment can then be seen when adjusting screw rotates clockwise on return stroke.



- 22.7 Refit road wheels, securing with wheel nuts (1 - FH55) and tighten nuts to 475 - 525lbs.ft. (644 - 712Nm.).
- 22.8 Remove axle supports, then lower vehicle to ground.
- 22.9 Remove chocks and lifting equipment.



**TORQUE TABLE FOR D66 DRIVE HEAD UNIT WITH DIFFERENTIAL LOCK  
(AS FITTED TO STEER DRIVE AXLE)**

<b>Item No</b>	<b>Description</b>	<b>Torque</b>
1	Coupling flange nut	800 - 900 lbs. ft (1085 - 1220Nm)
5	Pinion housing nut	47 - 53 lbs ft (64 - 72 Nm)
10	Axle casing nut	99 - 108 lbs ft (134 - 148 Nm)
13	Diff. strap stud	88 - 98 lbs ft (119 - 133 Nm)
16	Diff. cage nut	166 - 184 lbs ft (225 - 250 Nm)
21	Diff. strap nut	128 - 142 lbs ft 174 - 193 Nm)

SEE FOLLOWING PAGE FOR STUD TIGHTENING PROCEDURE

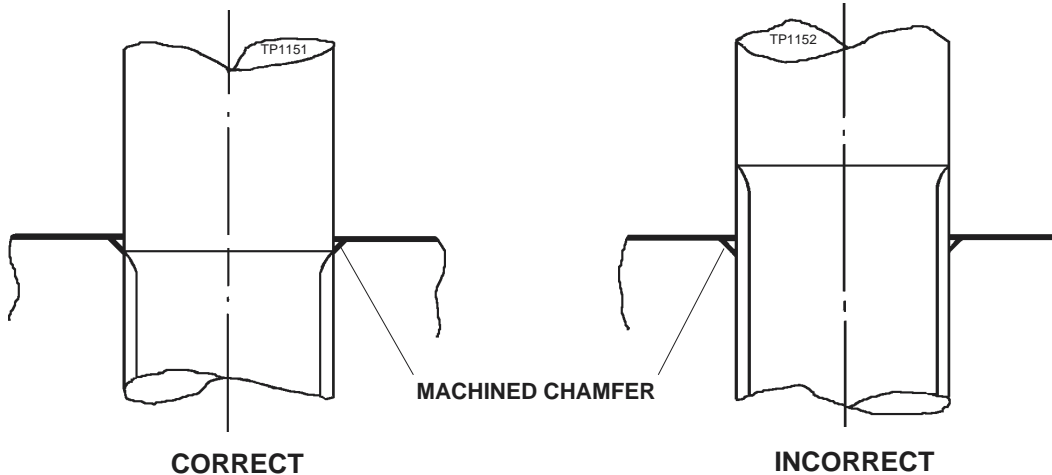


**KIRKSTALL SPECIALITY AXLE DIVISION**

TP1193

**STANDARD STUDS - FITTED INTO MACHINED CHAMFERED HOLES**

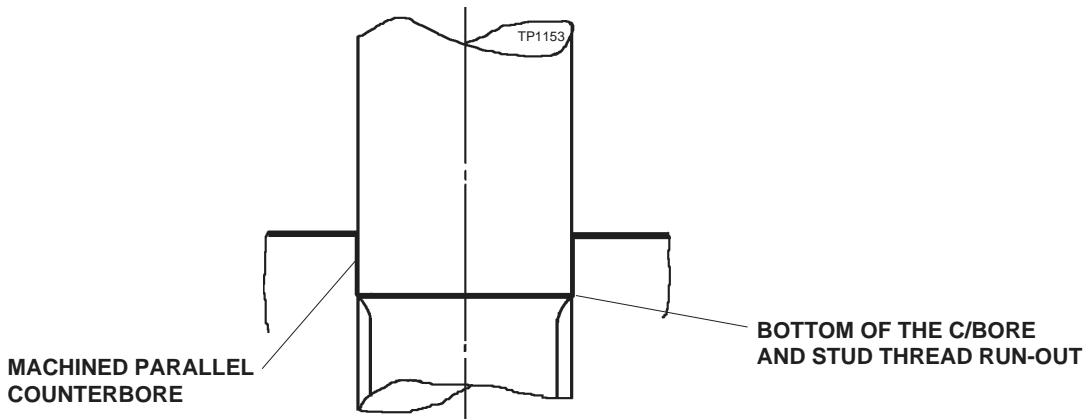
STUDS TO BE INSERTED UNTIL THREAD RUN-OUT LOCKS INTO PARENT METAL



**IMPORTANT :- THIS STUD FITTING PROCEDURE IS TO BE USED IN LIEU OF STATED TORQUE VALUES ON EXISTING ARRANGEMENTS. NEW ARRANGEMENTS WILL SPECIFY TD183/1 FROM THE DATE OF ISSUE.**

**SPECIAL STUDS - FITTED INTO MACHINED PARALLEL COUNTERBORE**

STUDS TO BE INSERTED UNTIL CORRECT TORQUE VALUE IS OBTAINED - AS SHOWN ON RELEVANT ARRANGEMENT DRAWING



**THIS SPECIFICATION IS FOR STUD FITTING ONLY ; NUTS & SETSCREWS MUST BE TORQUED TO VALUE SPECIFIED**

Alteration Numbers

ISSUE A									
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DISTRIBUTION Front Axle B.U. Drive Axle B. U. Production	<h2>STUD FITTING PROCEDURES</h2>	<h1>TD183/1</h1> <p>SHT 1 OF 1</p>
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# NOTES



**OVERHAUL INSTRUCTIONS FOR REAR TYPE 1S HUB REDUCTION UNIT  
WITH KIRKSTALL 15 $\frac{1}{2}$ " x 6" S CAM BRAKE**

**ILLUSTRATION No. : H82**

**MANUAL SECTION D**



**SERVICE INSTRUCTIONS FOR REAR DRIVE TYPE 1S HUB UNIT  
WITH KIRKSTALL 15 $\frac{1}{2}$ " x 6" BRAKE**

**DESCRIPTION**

The hub gears are driven by a floating sun gear splined to the drive shaft. The sun gear mates with three planet wheels mounted on a robust carrier which is bolted onto the hub (20). The annulus is of two piece variety, splined to axle stub (55), also supporting outer hub bearing (71 & 71A). The hub is fully floating, running on taper roller bearings which are adjusted by means of a special split nut (16) with pinch bolt arrangement. Brakes can be of Kirkstall or proprietary manufacture which can be serviced without disturbing hub. Brake drums are made of a special alloy cast iron, carried on outside of hub flanges.

**TOOLING LIST**

Spring balance to read to 50lbs  
 Magnetic dial indicator.  
 2 off  $\frac{7}{16}$ " UNF x  $1\frac{1}{2}$ " long extractor bolt  
 3 off  $\frac{1}{2}$ " UNF x  $1\frac{1}{2}$ " long extractor bolt  
 E316 - brake cam bush bumper  
 E317 - hub outer bearing cup bumper  
 E320 - brake shoe bush bumper  
 E321 - bumper handle  
 E398 - hub oil seal wear sleeve bumper  
 E399 - hub bearing nut spanner  
 E414 - cam oil seal bumper  
 E544 - hub inner bearing cup bumper  
 E552 - hub oil seal bumper (1st)  
 E553 - hub oil seal bumper (2nd)





**OVERHAUL INSTRUCTIONS FOR TYPE 1S REAR DRIVE HUB  
WITH KIRKSTALL 15<sup>1</sup>/<sub>2</sub> " x 6 " BRAKE**

**Viton 'O' rings and seals (flouro-elastomers) - safety hazards.**

It has been brought to our attention that 'Viton' material used in manufacture of oil seals and 'O' rings, produces a highly corrosive acid (hydroflouric) when subjected to temperatures above 315° C.

The resulting contamination can have extreme consequences on human tissue since it is almost impossible to remove after contact.

We therefore recommend the following procedure when it is necessary to inspect any equipment that has been subjected to a high temperature i.e. fire.

- a) **Visually** inspect for any gaskets or seals which have suffered from heat ; they will appear black and sticky.
- b) If this is affirmed :- **Do Not Touch**.
- c) Make enquiries to ascertain material composition.  
Any flouro-elastomer (Viton, Flourel or Tecmoflon) should be considered dangerous but natural rubber and nitrile are non-hazardous.
- d) If flouro-elastomer seals have been used, then the affected area **MUST** be decontaminated before undertaking further work.
- e) Disposable heavy duty gloves (neoprene) **MUST** be worn and the affected area decontaminated by washing thoroughly with limewater (calcium hydroxide solution).
- f) Any cloths, residue and gloves used **MUST** be safely discarded after use.

**Note:- Burning of the discarded items is NOT RECOMMENDED, except in an approved incineration process where the gaseous products are treated by alkaline scrubbing.**

**SECTION 1 DRAINING THE OIL**

- 1.1 Before attempting to remove road wheels, drive vehicle onto a level concrete floor, preferably after a short run to warm the oil.
- 1.2 Chock road wheels left on ground and apply parking brake.
- 1.3 Loosen, but **do not remove** wheel nuts (1).
- 1.4 Jack up vehicle and support on axle stands.
- 1.5 Remove wheel nuts (1) then pull off road wheels.
- 1.6 Rotate hubs in turn to bring planet drain setscrews (82) to their lowest position .
- 1.7 Place drip trays under hubs (approx. capacity - 2 pints : 1.15 litres) and drive head unit (approx. 15 pints : 8.6 litres ] then remove planet level plugs and washers (83 & 80) followed by planet drain setscrews with washers (82 & 81) to drain oil from hubs.
- 1.8 Similarly remove drive head filler and drain plugs to drain oil from drive head.
- 1.9 When axle is completely drained of oil remove drip trays and dispose of old oil.

**SECTION 2 DISMANTLING PLANET CARRIER UNIT**

- 2.1 Remove planet carrier setscrews and washers (82 & 81) then insert two of setscrews into tapped holes provided in planet carrier flange (79) and tighten evenly to draw planet carrier assembly from hub (20).
- 2.2 Remove and discard planet carrier 'O' ring (78).
- 2.3 Inspect planet carrier dowels (19) for wear / damage and drive out for replacement if required.
- 2.4 Remove a planet pin collar setscrew (3) then prise out collar with 'O' ring (4 & 5). Discard 'O' ring.
- 2.5 Knock planet pin (12) inboard with soft metal drift to remove, taking care not to damage setscrew hole threads.
- 2.6 Lift planet gear (9), complete with needle rollers (7 & 10) and spacer (8) taking care not to lose any of needle rollers. Separate gears from rollers and spacer.
- 2.7 Remove planet gear thrust washers (6 & 11) from planet carrier (78).
- 2.8 Repete operations 2.4 to 2.7 for other two planet gear assemblies.



## SECTION 3 DISMANTLING HUB AND ANNULUS UNITS.

- 3.1 Remove brake drum retaining setscrew (84) then back off brake adjustment by turning hexagonal adjuster screw on slack adjuster (49) in an anti-clockwise direction.
- 3.2 Support brake drum (2) (approx. weight - 105 lbs.) then insert 2 off  $\frac{7}{16}$ " UNF x  $1\frac{1}{2}$ " long extractor bolts into tapped holes provided in brake drum (2) and tighten evenly to draw drum from hub (20).
- 3.3 Clean inside of brake drum with a clean damp cloth (**do not** use paraffin).
- 3.4 Pull drive shaft (57) complete with sun gear and circlip (14 & 13) from within axle tube, then take off circlip and tap sun gear from drive shaft.
- 3.5 Lift off sun gear thrust washer (15) from end of axle arm (55).
- 3.6 Loosen axle tube nut pinch bolt and nut (76 & 75) then with service tool no. E399 remove axle tube nut assembly (16, 75 & 76) from axle arm (57).
- 3.7 Support hub (20) with a sling, then screw three  $\frac{1}{2}$ " UNF X  $1\frac{1}{2}$ " long bolts into tapped holes in annulus carrier (18) and tighten evenly to draw annulus carrier assembly complete with outer hub bearing cone (71A) off axle arm splines.
- 3.8 Remove outer bearing cone (71A) from annulus arm (18).
- 3.9 If for any reason, annulus gear (17) needs to be separated from annulus carrier (18), straighten annulus gear lockplate tabs (73) then remove annulus gear setscrews (72) and lockplates (73), discarding lockplates.
- 3.10 Annulus gear (17) can now be knocked from its register on annulus carrier (18).
- 3.11 Inspect annulus gear dowels (74) and pull out for replacement if required.
- 3.12 With hub assembly still supported in horizontal position it can now be pulled from axle arm (55).
- 3.13 Remove hub oil seals (68), followed by inner hub bearing cone (22A) from hub bore (20).
- 3.14 Inspect hub bearing cups (22 & 71) for wear/ damage and drift out for replacement if required.
- Note :- If either bearing cup or cone needs replacing then a new matched cup and cone must be fitted.**
- 3.15 Check wheel studs (21) for misalignment, looseness or wear, removing for replacement if required.
- 3.16 Remove any sealant / oil seal debris present on mating faces using Loctite Chisel Gasket remover or by carefully scraping from parts.

**SECTION 4 REMOVAL OF COMPLETE BRAKE ASSEMBLY**

**Note :- Brake assembly can be removed without completely dismantling brake.**

- 4.1 Disconnect brake cylinder push rod from slack adjuster (49) by removing clevis pin split pin and clevis pin.
- 4.2 Remove brake cam circlip (52) followed by washer (51) and spring (50).
- 4.3 Pull slack adjuster (49) from brake cam (23).
- 4.4 Knock splined end of brake camshaft (23) towards outboard end of axle to release brake cam from between brake shoe rollers (37), enabling it to be pulled from brake assembly along with brake cam washer (27) and 'O' ring (28).
- 4.5 Remove brake cam 'O' ring and washer from brake camshaft (23).
- 4.6 Remove brake backplate nuts (54) and bolts (62) then, with lifting equipment, pull brake assembly from axle stub (55).

**SECTION 5 BRAKE SHOE REMOVAL**

**NOTE :- Operations in this section can be carried out with hub assembly in place.**

- 5.1 Chock appropriate wheels.
- 5.2 Whilst road wheels are still on ground, loosen wheel nuts (1) slightly.
- 5.3 Jack up vehicle and remove road wheel nuts and road wheels.
- 5.4 Back off brake adjustment.
- 5.5 Unscrew and remove brake drum retaining screw (84).
- 5.6 Support brake drum (2) (approx weight 105 lbs 48 kg), with lifting / handling gear.
- 5.7 Insert two  $\frac{1}{2}$ " UNF x  $1 \frac{1}{2}$ " extractor bolts in tapped holes provided in brake drum and tighten to draw drum from hub.
- 5.8 Clean inner face of brake drum (2) with a clean damp cloth.
- 5.9 Cut, remove and discard lockwire securing two of four brake shoe pivot bush setscrews (65).
- 5.10 Unscrew and remove two brake shoe pivot bush setscrews (65) and washers (64) from one end of brake shoe pivot pins (63).
- 5.11 Repeat operations 5.9 and 5.10 for other two brake shoe pivot bush setscrews and washers (65 & 64) on other end of brake shoe pivot pins (63).
- 5.12 Cut, remove and discard lockwire securing two brake shoe pivot pin lockscrews (61).
- 5.13 Unscrew and remove two brake shoe pivot pin lockscrews (61).
- 5.14 Using a soft metal drift, drive out in turn two brake shoe pivot pins (63). Care must be taken during this operation so as not to damage pivot pin setscrew hole thread in end of pivot pin.
- 5.15 The removal of brake shoe pivot pins (63) reduces brake shoe return spring (24) pressure on brake shoe assemblies, enabling brake shoe return springs (24) to be unhooked from their anchor pins (25 & 70).
- 5.16 The brake shoe assemblies can now be lifted from brake bracket (29).

**SECTION 6      DISMANTLING THE BRAKE SHOE UNIT**

- 6.1 Inspect brake linings (40) for wear / damage.  
Minimum allowable thickness of liner (40) is  $\frac{5}{16}$  " (8mm) measured at centre of brake shoe.
- 6.2 If new linings are required, drill out, using a  $\frac{1}{4}$  " dia. twist drill and discard brake shoe rivets (58).
- 6.3 Inspect brake shoe bushes (67) for wear / damage and using service tool E320 or other suitable bumper, knock out for replacement if required.
- 6.4 Pull out brake shoe roller pin split pin (36).
- 6.5 Using a soft metal drift knock out brake shoe roller pin (41) thus releasing brake shoe roller (37).  
Inspect both roller and pin for wear / damage and replace if required.
- 6.6 Remove brake shoe anchor pin split pin (70) and pull out brake shoe anchor pin (69) using a  $\frac{1}{8}$  " dia wire hook.
- 6.7 Repeat operations 6.1 to 6.6 for other brake shoe assembly.

**SECTION 7      DISMANTLING BRAKE BRACKET AND CAM SHAFT UNIT**

**NOTE :- Hub assembly must be removed before starting this section.**

- 7.1 Disconnect air chamber from slack adjuster (49).
- 7.2 Remove brake cam circlip (52) and pull off washer and spring (51 & 50).
- 7.3 Mark position of slack adjuster (49) relative to cam shaft (23) then tap slack adjuster from its position on brake cam shaft splines (23) using a hide faced hammer.
- 7.4 Pull brake cam shaft (23) from brake bracket (29).
- 7.5 Remove cam head 'O' ring and washer (28 & 27) from cam shaft (23).
- 7.6 Remove and discard oil seal (32) from brake bracket (29).
- 7.7 Inspect brake cam bush (31) for signs of wear / corrosion and if replacement is required knock out of brake bracket (29) using service tool no E316 or other suitable bumper tool.
- 7.8 Check cam bracket bush (43) for wear / corrosion and knock out for replacement, if required, as follows :-
  - a) Remove brake cam bracket nuts (47) with washer (48).
  - b) Remove slack adjuster cam bracket (44) from its position on cam bracket studs (53).
  - c) Remove and discard oil seal (42), then drift out cam bracket bush (43).
- 7.9 Check condition of brake bracket anchor pin (25) and washer (26) for damage / corrosion and unscrew and remove for replacement if required.
- 7.10 Check lubricators (34 & 45) and lubricator extension (33) for damage or corrosion and remove for replacement if required.
- 7.11 If for any reason brake bracket (29) needs to be removed, take off brake bracket nuts (54) and bolts (62), then knock brake bracket (29) from axle stub (55).

**SECTION 8 BRAKE BRACKET AND CAM SHAFT RE-ASSEMBLY**

- 8.1 Refit brake cam lubricators (34 & 45) with protective caps (35 & 46), if fitted, also lubricator extension (33) into their positions in brake bracket (29) and cam bracket (44).
- 8.2 With service tool no. E316 or other suitable bumper tool, refit brake cam bushes (31 & 43) into brake bracket (29) and brake cam bracket (44) respectively.

**NOTE :- Take care to line up lubrication holes in bushes and bracket bosses.**

- 8.3 Using service tool no E414, refit cam oil seals (32 & 42) open side outwards, to abut brake cam bushes (31 & 43).
- 8.4 Refit cam bracket (44) onto cam bracket studs (53), and secure in position with nuts and washers (47 & 48). Tighten nuts to 72 - 80lbs.ft. (98 - 108Nm.).
- 8.5 Fit brake bracket (29) into position on axle stub (55) and secure with brake bracket bolts and nuts (62 & 54). Tighten to 95 - 115lbs.ft. (128 - 156 Nm).
- 8.6 Refit brake anchor pins (25) and washers (26).
- 8.7 Place cam head washer (27) and cam 'O' ring (28) in position on brake camshaft (23).
- 8.8 Smear brake cam bushes (31 & 43), 'O' ring (28) and oil seals (32 & 42) with Shell 'Retinax LX' or equivalent grease, ensuring all indentations are full.
- 8.9 Feed camshaft assembly into position taking care not to damage seals.

**SECTION 9 BRAKE SHOE ASSEMBLY**

- 9.1 Using service tool no E320 or other suitable bumper tool, fit brake shoe bushes (67) into one of brake shoes (66) and flush with inner faces of lugs.
- 9.2 Repeat operation 9.1 for other brake shoe (66).
- 9.3 If new liners (40) are to be fitted, proceed as follows :-

For ease of assembly ensure that different sizes of rivets are stored in separate containers.

- a) Place brake shoe (66) outer face uppermost, on bench.
- b) Position first liner (40) on shoes and locate in place by fitting rivets (58), in centre of holes (4 off).  
Then fit rivets (58) into outer lines of holes (8 off).  
Repeat for second liner half (40).
- c) Tap rivets (58) fully home using a suitable drift and hammer.
- d) Turn brake shoe (66) onto its side and check amount of rivet (58) protrusion from inner curved face of brake shoe.  
Correct protrusion 'P' is between 3.0mm & 7.5mm. See fig.1.

**NOTE:- If any holes are fitted with rivets (58) and they protrude MORE THAN 7.5mm, then either brake shoe and / or liner (66 & 40) are defective and must be replaced.**

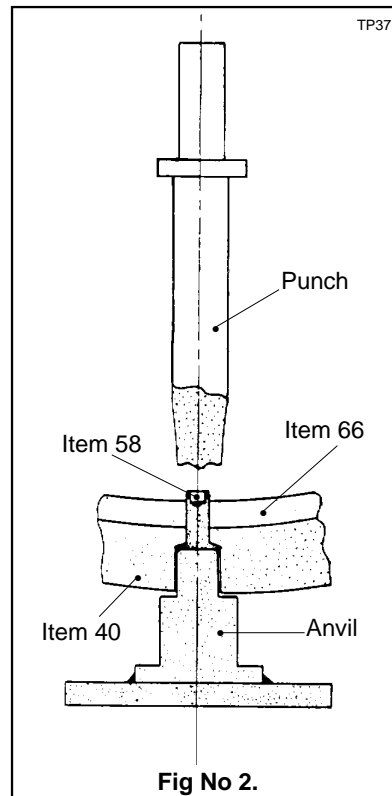
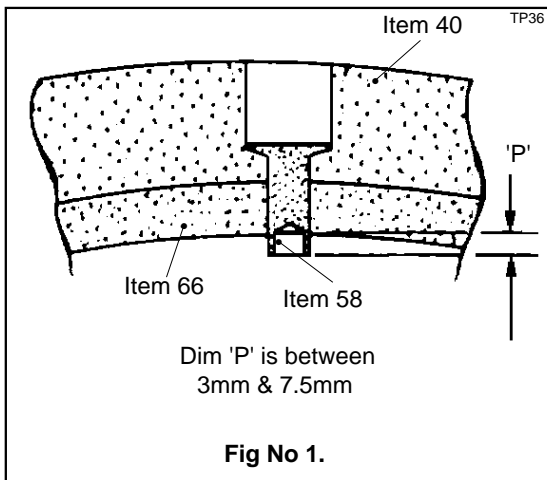
**When all rivets protrude correct amount, insert a thin,  $1\frac{1}{64}$  " dia (4.4mm) max, screwdriver or steel rod into end of each rivet (58) in turn and lever sideways to slightly deform end of rivets.**

**This retains rivets in position during final peening operation.**

- e) Place assembled shoe, liners underneath, on riveting machine or suitable hand equipment (see fig 2) and peen over rivets to secure liners (40) to brake shoe.

**NOTE :- Due to limited access, centre rivets will have to be peened using hand peening equipment.**

- f) After riveting check brake shoe to liner clearance, using feeler gauges.  
Permissible clearance is 0.000" to 0.004" (0.0 to 0.102mm).





**SECTION 9 BRAKE SHOE ASSEMBLY Cont.**

9.4 Smear bore of one of brake shoe rollers (37) also roll pin holes in brake shoes (66) with grease (BP Energrease AS11 or equivalent). Locate roller (37) in position, fit brake shoe roller pin (41) so that headed portion will be towards brake bracket (29) when fitted. Secure in place with brake shoe roller pin split pin (36). Splay pin (36) to approx 30° as shown in fig no. 3. to avoid fracture of leg.

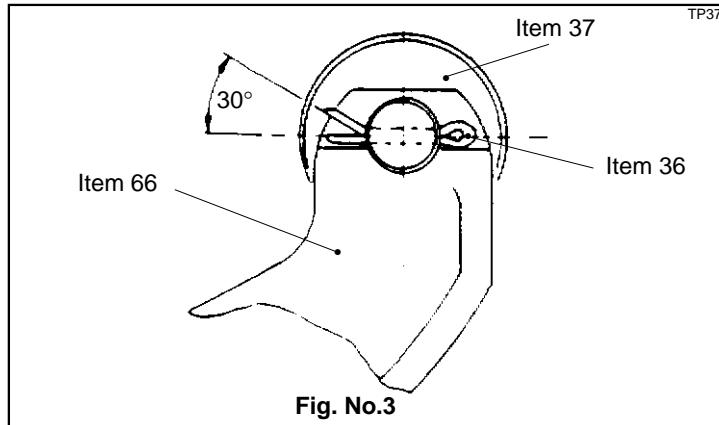


Fig. No.3

9.5 Repeat operation 9.4 for other brake shoe assembly.

**SECTION 10 FINAL ASSEMBLY OF BRAKE Ref. Fig 4.**

10.1 Wipe clean inner surfaces of brake shoe bushes (67) and smear with Shell 'Retinax LX' or equivalent grease ensuring all indentations are full.

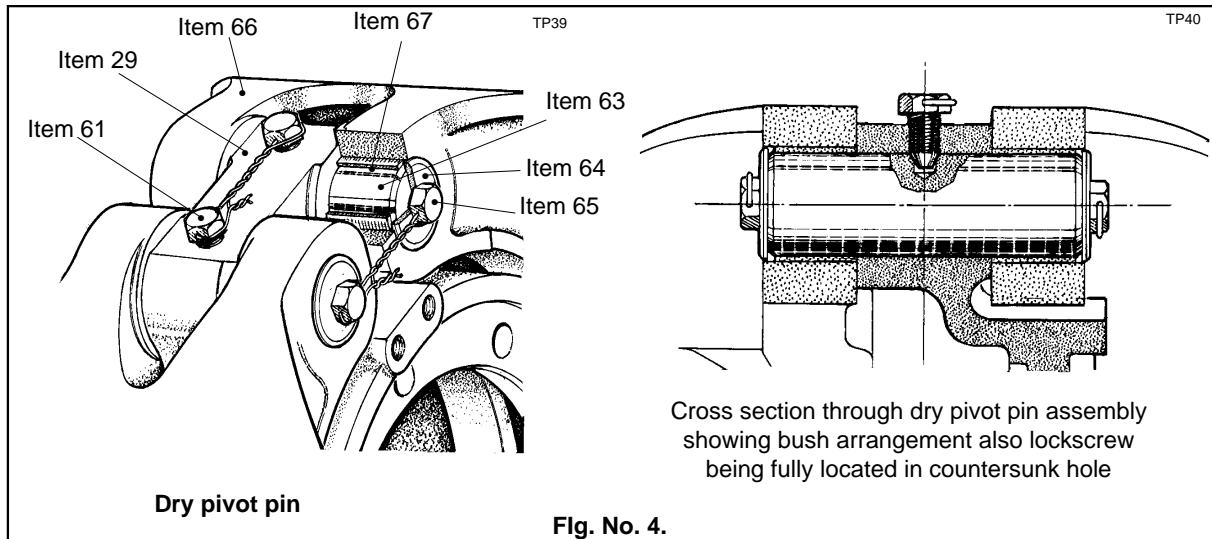
10.2 Fit brake shoe to brake bracket as follows:-

- a) Assemble a brake shoe pivot setscrew washer (64) and a brake shoe pivot bush setscrew (65) together, then screw into one end of one of brake shoe pivot pins (63), finger tight.
- b) Smear pivot pin bore in brake bracket (29) with BP Energrease AS11 or equivalent grease.
- c) Position first brake shoe (66) on brake bracket (29). Insert partially assembled pivot pin in pivot pin hole either side of brake shoe, from inboard side, passing through brake bracket and into other bushed hole as shown.
- d) Using pivot pin setscrew (65), rotate pivot pin until countersunk hole in pivot pin is in line with threaded hole on brake bracket (29).
- d) Screw a brake shoe pivot pin lockscrew (61) into threaded hole in brake bracket (29) to locate in countersunk hole in pivot pin (63), thus locking pivot pin then tighten lockscrew (61) to 26 - 32lbs.ft. (35 - 43Nm.).

**NOTE :- Care must be taken during this operation as misalignment can cause brake drum obstruction.**

- f) Fit other brake shoe pivot pin setscrew and washer (65 & 64) and tighten setscrews to 26 - 32lbs.ft. (35 - 43Nm.).
- g) Repeat above operations for other brake shoe assembly.

10.3 Secure pivot pin setscrews (65) with 18SWG lockwire as shown in fig. no. 4.



Dry pivot pin

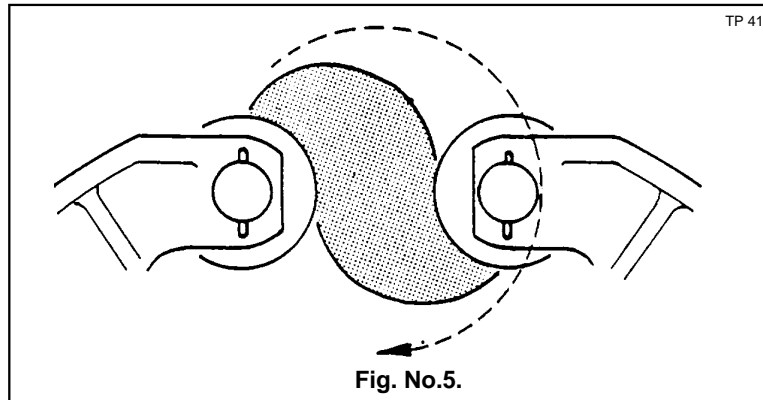
Fig. No. 4.

Cross section through dry pivot pin assembly showing bush arrangement also lockscrew being fully located in countersunk hole



## SECTION 10 FINAL ASSEMBLY OF BRAKE Cont

- 10.4 Seat brake shoe rollers (37) in position on brake cam (23) so that they lie in depressions, see fig 5. This ensures that cam is in its correct operating position.



- 10.5 Refit brake shoe anchor pin split pin (70) and position anchor pin (69) into brake shoe (66).
- 10.6 Hook brake shoe return spring (24) onto brake shoe anchor pin (69), then expand with a spring bar or  $\frac{1}{2}$ " blade screwdriver to position on to brake bracket anchor pin (25).
- 10.7 Repeat operations 10.5 and 10.6 to fit other brake shoe return spring (24) to other brake shoe (66).
- 10.8 Fit slack adjuster as follows :-
- Check that brake chamber push rod is in its fully released position.
  - Smear brake camshaft and slack adjuster splines (23 & 49) with BP Keenomax L2 or equivalent grease.
  - Fit slack adjuster (49) onto brake camshaft splines (24) in its original marked position.
  - Screw clevis onto brake chamber push rod to its original marked position, then secure with locknut.
  - Fit clevis pin and secure in position with split pin.
- 10.9 Fit cam end spring (50), followed by washer (51) and circlip (52) onto camshaft (23).





**SEQUENCE OF OPERATIONS TO BUILD HUB REDUCTION UNIT ONTO AXLE ARM  
(THE BRAKE ASSEMBLY WILL BE IN SITU)**

**Note :-** Prior to assembly lightly oil all gears and oil seal faces, also pack all taper bearings with grease (Shell Retinax LX or equivalent) using a bearing packer or manually kneading grease between rollers, race and cage before setting and rotated whilst being set.

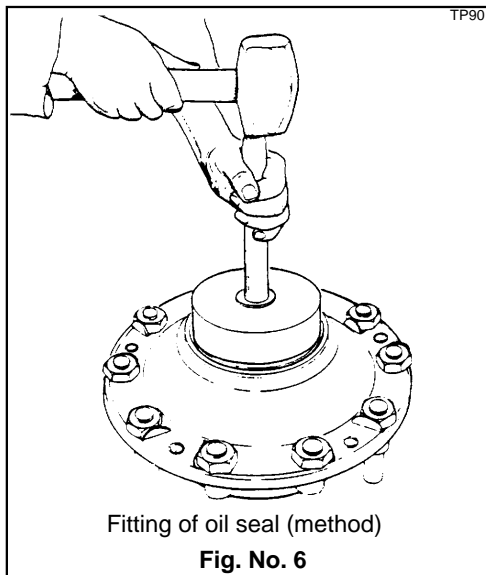
**SECTION 11 HUB AND ANNULUS RE-ASSEMBLY**

- 11.1 Using suitable bumper tool, fit outer and inner hub bearing cups (22 & 71) into their relevant bores in hub (20).
- 11.2 Place hub (20), outer end down on bench and place lightly oiled inner hub bearing cone (22A) into inner hub bearing cup (22).
- 11.3 Fit hub oil seals (68) as follows:-

**Note :-** Before fitting seals, wipe hub bore (20) clean, also outside diameter of seal.

- a) Smear a thin coat of EP 90 oil, in hub bore (**use no sealants**).
- b) Using correct service tool (E552) and a rawhide mallet, drive first seal into hub bore, sealing lip first until it abuts its shoulder in hub bore. See fig.6.

**Extreme care must be taken during this operation so as not to damage seals.**

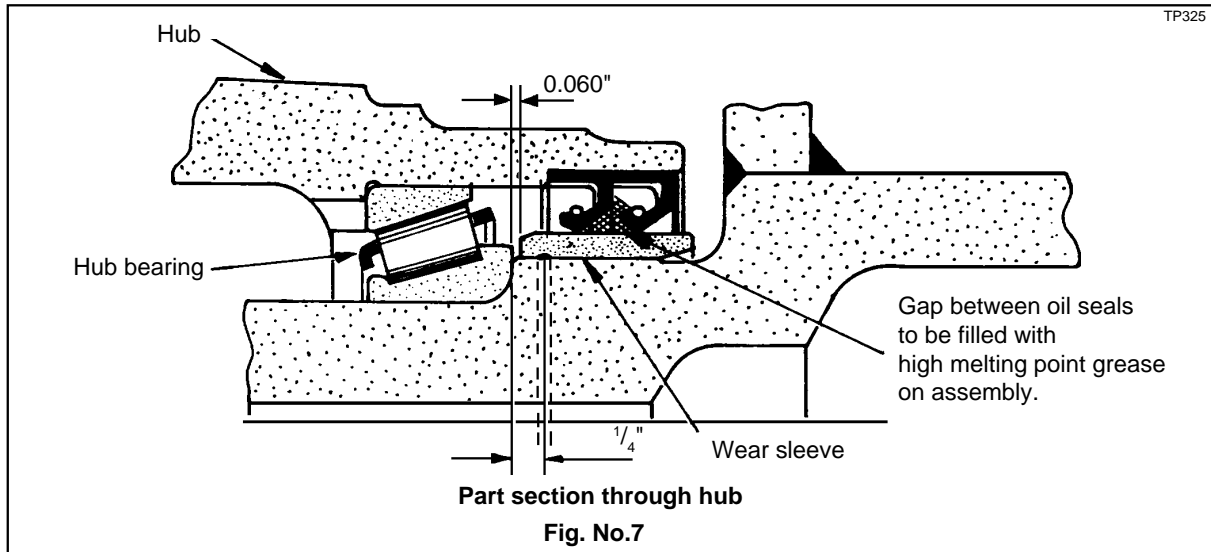


- c) Similarly using correct service tool (E553) and a rawhide mallet, drive second seal into hub bore, sealing lip first until it abuts first seal in hub bore.
- 11.4 Fill cavity between seals (68) for 240° of circumference with a high melting point grease (BP Keenomax L2 or equivalent).
  - 11.5 If any wheel studs have been removed, refit into hub (20) fully home, ensuring that they are 90° to hub outer face.
  - 11.6 If annulus gear (17) and annulus carrier (18) have been separated, re-assemble as follows :-
    - a) Check annulus gear dowels (74) for wear / damage, remove and replace if required.
    - b) Fit annulus gear (17) onto annulus carrier (18) and secure with annulus gear setscrews and annulus gear setscrew lockplates (73), ensuring that two of lockplates are fitted across dowel holes to prevent dowels from working out in service.
    - c) Tighten setscrews to 105 - 150 lbs. ft. (142 - 203Nm.) and lock them in position by bending over a portion of lockplates up against a convenient flat on setscrew head.



SECTION 11 HUB AND ANNULUS RE-ASSEMBLY Cont.

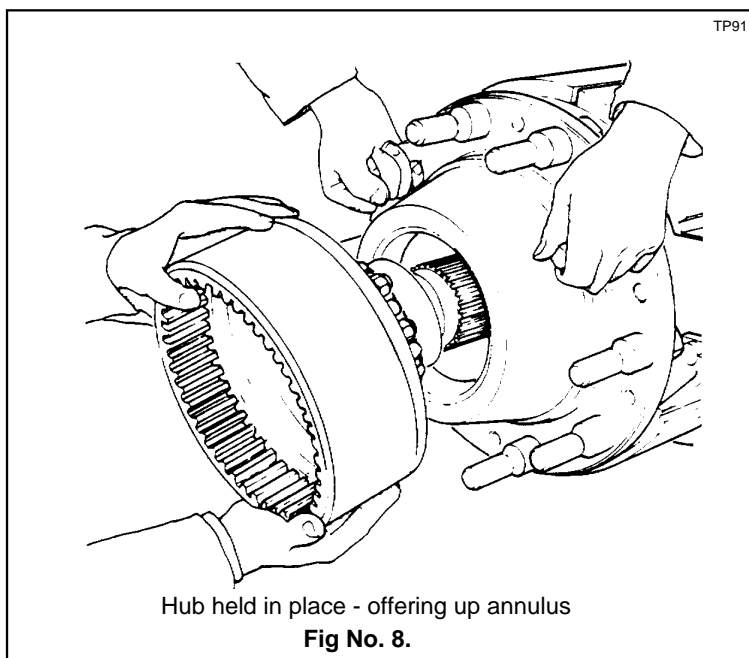
- 11.7 Press outer hub bearing cone (71A) onto annulus carrier (18).
- 11.8 If oil seal wear sleeve (56) has been removed, then a new sleeve should be fitted as follows :-
  - a) Clean mating surfaces of sleeve and axle stub (56 & 55) with Loctite 7070 or similar degreasing agent.
  - b) Apply a bead of Loctite No.275 sealing compound completely around axle stub (55), approx.  $\frac{1}{4}$ " from inner bearing shoulder as shown in fig. no.7.
  - c) Using service tool No. E398, knock wear sleeve (56) into position on swivel stub (55).
  - d) Allow 2 hours for loctite to cure.



- 11.9 Lightly oil hub inner bearing (22 / 22A), then ease hub onto axle arm (55) such that hub bearing (22 / 22A) slides onto its location diameter, also seals (68) are felt to contact their location diameter.

**Note :- Throughout this operation hub MUST be supported so as not to be left 'hanging' at any point.**

- 11.10 With hub held in place by an assistant or suitably held in a sling, then lightly oil hub outer bearing cone (71A), and offer annulus assembly to axle arm (55). See fig. no.8.



- 11.11 Fit axle tube nut pinch bolt and nut (76 & 75) onto axle tube nut (16). Tighten pinch bolt nut finger tight.
- 11.12 Fit axle tube nut assembly onto axle arm (55), using service tool no. E399, and tighten nut hard.



**SECTION 12 SETTING HUB BEARINGS**

12.1 Rotate hub, and using a rawhide mallet, knock hub backwards and forwards along axle arm to shock load and thus settle bearings into position.

**Note :- It is important to rotate and shock load hub because :-**

- a) **Rotation serves to ensure that bearings settle in their correct tracks.**
- b) **'Shock load' serves to ensure that bearings are seated correctly up to their shoulder abutments.**

12.2 Check tightness of axle tube nut (16) and, if loose, retighten hard. Rotate and shock load hub again.

12.3 Continue this procedure until axle tube nut (16) cannot be tightened further after rotating and shock loading hub.

12.4 Back off axle tube nut (16) by approx  $\frac{1}{16}$ " (20°) of a turn, then rotate and knock hub outwards along axle arm to release bearings.

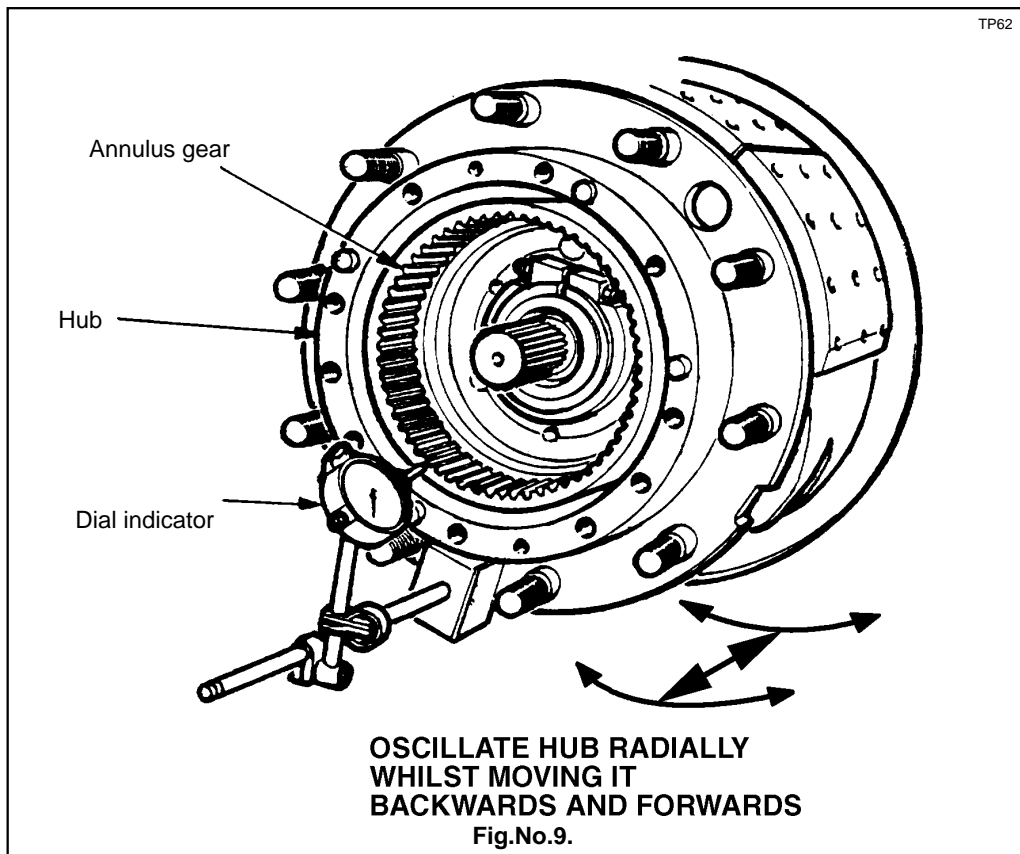
12.5 Tighten axle tube pinch bolt nut (75) to 30 - 34 lbs ft. (41 - 46Nm.).

12.6 Mount a magnetic dial indicator on hub and position pointer on end of axle arm or on annulus gear end (17) - See fig. no. 9.

12.7 Oscillate hub backwards and forwards along axle arm and note variation shown by dial indicator.

12.8 The permissible variation is between 0.0005" to 0.002" (0.013 to 0.51 mm) movement (end float).

12.9 If end float is outside specified limits, back off pinch bolt nut (75) and reset axle tube nut (16), using the above procedure, until correct setting is obtained.



**SECTION 13 INITIAL PREPARATION TO BUILD PLANET CARRIER UNIT**

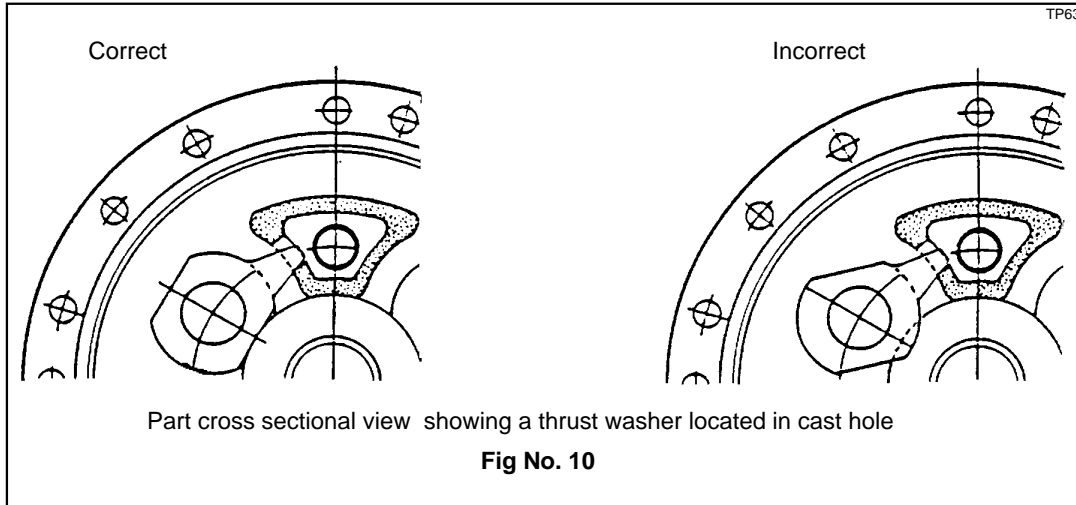
13.1 Place planet carrier (79) outer face down on bench.

13.2 Fit sun gear thrust button (77) into centre location in bore of planet carrier (79), chamfered face down.

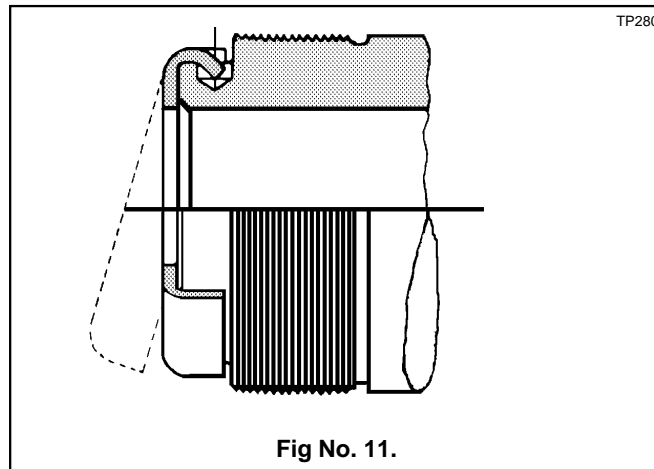
13.3 Smear planet pin 'O' rings (5) with clean hub bearing grease then fit onto planet pin collars (4).

SECTION 14 RE- ASSEMBLY OF PLANET CARRIER ASSEMBLY

- 14.1 Place partially assembled planet carrier on bench, outer face down, planet gear access hole facing fitter.
- 14.2 Smear bore of a planet gear (9) with grease. Insert needle rollers (7) into one end of planet gear (9). Grease will adhere them to bore of planet gear.
- 14.3 Fit a planet gear needle roller spacer (8) into bore of planet gear, locating on needle rollers. Insert needle rollers (10) into bore of planet gear (9), locating on spacer (8).
- 14.4 Repeat operations 14.2 and 14.3 for other two planet gears (9).
- 14.5 Fit a planet gear thrust washer (6) into planet carrier (86), ensuring that lock tab is correctly located in slot provided in planet carrier (79). See fig. no. 10.
- 14.6 Carefully insert and locate one of assembled planet gears (7 to 10) onto planet gear washer (6).
- 14.7 Carefully fit another of planet gear thrust washers (11) onto planet gear (8), ensuring that lock tab is located correctly in slot provided in planet carrier (79). See fig. no.10.



- 14.8 Insert one of planet pins (12) into relevant hole on planet carrier (79) inner face to pass down through planet gear assembly.  
**Note:- Care must be taken during this operation not to disturb needle rollers (7 & 10).**
- 14.9 Holding planet pin in situ, turn partially assembled planet carrier completely over (inner face down).
- 14.10 Insert a planet pin collar (4) and greased 'O' ring (5) into relevant hole on face of planet carrier (79).
- 14.11 Screw a planet pin collar setscrew (3), having first applied 'Loctite Screwlock 222 to threads, into planet pin (12) then tighten to 65 -75 lbs ft. (88 - 102Nm.).
- 14.12 Repeat operations 14.8 to 14.11 for other two planet gear assemblies.
- 14.13 Screw planet gear level plug (83) with washer (80) into relevant hole in face of planet carrier (79), finger tight.
- 14.14 Turn planet carrier assembly completely over.
- 14.15 Fit greased planet carrier 'O' ring (78) into groove on planet carrier (79).
- 14.16 Fit sun gear thrust washer (15) in position on end of axle arm (55). See fig.no.11.

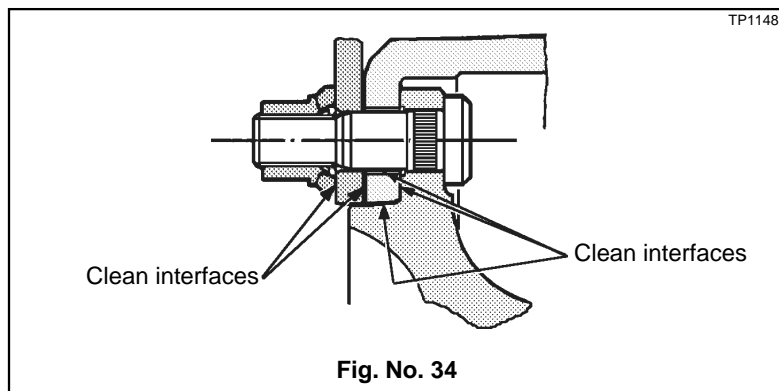




SECTION 15 FINAL ASSEMBLY

- 15.1 Fit sun gear (14) onto drive shaft (57) and secure with circlip (13).
- 15.2 Fit drive shaft / sun gear assembly carefully into axle.
- 15.3 Slide planet carrier assembly into position ensuring gears mesh correctly, then fit planet carrier washer and setscrews (82 & 81) to secure and tighten to 110 - 125 lbs. ft. (149 - 170 Nm.).
- 15.4 Charge hub with oil (see lubrication instructions in front of this manual for correct amount and specification).
- 15.5 Fit oil level plug (83) and washer (80) and tighten .
- 15.6 With brake drum (2) suitably supported slide into position on hub (20).

**Note :- Interfaces between brake drum and hub must be free from dirt, including liner material debris, rust and paint. Failure to keep interfaces clean, can and will cause brake drum to distort upon tightening of wheel nuts. For further details see BS AU50 : Part 2 : Section 7A : 1995.**



- 15.7 Fit brake drum retaining setscrew (84) and tighten to 72 - 80 lbs. ft. ( 98 - 108 Nm) torque setting.
- 15.8 Adjust brakes as follows :-
  - a) Turn adjusting screw on slack adjuster (49) clockwise until brake linings are hard up against brake drum, then back off adjusting screw just enough to allow free rotation.

- 15.9 Refill drive head with oil (see lubrication section at front of manual for details of specification and quantity).  
Oil flows freely through hubs and drive head. When filling, top up each hub followed by drive head.

**Note :- Always check final oil level at drive head.**

- 15.10 Refit road wheels, securing with wheel nuts (1) and tighten nuts to 475 - 525 lbs. ft. (644 - 712 Nm.).

**Note :- Interfaces must be free from dirt , including liner material debris, rust and paint. Failure to keep interfaces clean, can and will cause brake drum to distort upon tightening of wheel nuts. For further details see BS AU50 : Part 2 : Section 7A : 1995.**

- 15.11 Remove axle supports, then lower vehicle to ground.
- 15.12 Remove chocks and jacks.



**TORQUE TABLE FOR TYPE 1S HUB REDUCTION UNIT  
(REAR DRIVE VERSION)**

<b>Item No</b>	<b>Description</b>	<b>Torque Setting</b>
1	Wheel nut	475 - 525 lbs. ft. (644 - 712 Nm.)
3	Planet pin collar setscrew	65 - 75 lbs. ft. (88 - 102 Nm.)
39	Dust cover setscrew	19 - 21 lbs. ft. (26 - 28 Nm.)
47	Cam bracket nut	72 - 80 lbs. ft. (98 - 108 Nm.)
4	Brake backplate nut	95 - 115lbs. ft. (128 - 156 Nm.)
61	Pivot pin lockscrew	26 - 32lbs.ft. (35 - 43Nm.)
65	Pivot pin setscrew	26 - 32lbs.ft. (35 - 43Nm.)
72	Annulus carrier setscrews	105 - 150lbs.ft. (142 - 203Nm.)
75	Hub nut pinch bolt nut	30 - 34 lbs. ft. (41 - 46 Nm.)
82	Planet carrier setscrews	110 - 125 lbs. ft. (149 - 170 Nm.)
84	Brake drum retaining setscrew	72 - 80 lbs. ft. (98 - 108 Nm.)

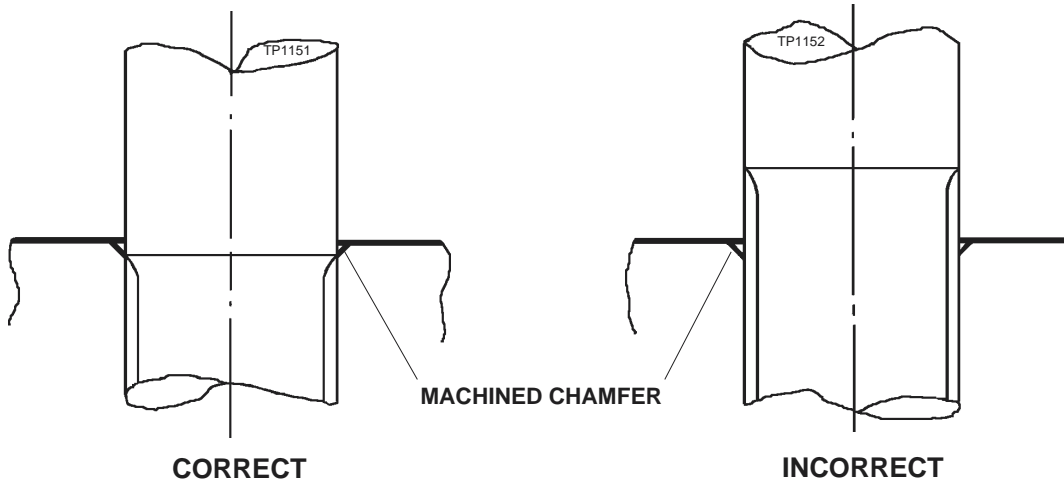
SEE FOLLOWING PAGE FOR STUD TIGHTENING PROCEDURE



**KIRKSTALL SPECIALITY AXLE DIVISION**

**STANDARD STUDS - FITTED INTO MACHINED CHAMFERED HOLES**

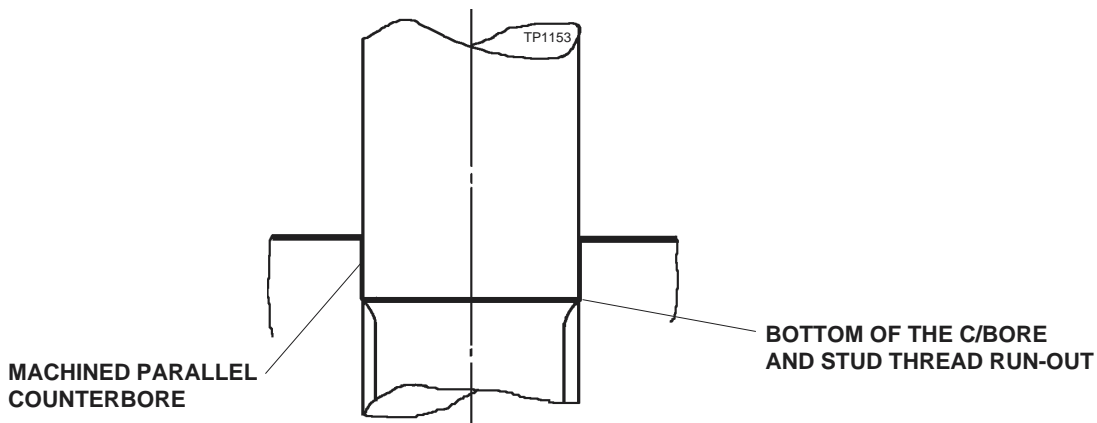
STUDS TO BE INSERTED UNTIL THREAD RUN-OUT LOCKS INTO PARENT METAL



**IMPORTANT :- THIS STUD FITTING PROCEDURE IS TO BE USED IN LIEU OF STATED TORQUE VALUES ON EXISTING ARRANGEMENTS. NEW ARRANGEMENTS WILL SPECIFY TD183/1 FROM THE DATE OF ISSUE.**

**SPECIAL STUDS - FITTED INTO MACHINED PARALLEL COUNTERBORE**

STUDS TO BE INSERTED UNTIL CORRECT TORQUE VALUE IS OBTAINED - AS SHOWN ON RELEVANT ARRANGEMENT DRAWING



**THIS SPECIFICATION IS FOR STUD FITTING ONLY ; NUTS & SETSCREWS MUST BE TORQUED TO VALUE SPECIFIED**

Alteration Numbers

ISSUE A									
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DISTRIBUTION Front Axle B.U. Drive Axle B. U. Production	<b>STUD FITTING PROCEDURES</b>	<b>TD183/1</b> SHT 1 OF 1
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# NOTES





**OVERHAUL INSTRUCTIONS FOR TYPE D66 DRIVE HEAD UNIT  
WITH DIFFERENTIAL LOCK AS FITTED TO REAR DRIVE AXLE**

**ILLUSTRATION No.DH122**

**MANUAL SECTION E**



**OVERHAUL INSTRUCTIONS FOR TYPE D66 DRIVE HEAD UNIT WITH DIFF LOCK  
(AS FITTED TO REAR DRIVE AXLE)**

**GENERAL DESCRIPTION**

The drive head features an overhung spiral bevel pinion mounted in widely spaced taper roller bearings which are adjustable by graded spacers.

Drive is transmitted through a heavy section crownwheel and differential assembly, again running in taper roller bearings, and adjustable by special nuts, running in differential straps.

A variety of pinion and crownwheel combinations are available, covering a wide range of ratios.

A differential lock, operating on the drive shafts, is available as an optional extra.

**INTRODUCTION**

Very often noises and vibrations originating in other parts of the machine, are mistakenly believed to emanate from the drive head, with the result that time and effort is wasted on an unnecessary dismantling operation. Therefore, before fixing suspicion on the drive head, investigate all other possible sources of trouble. Where a drive head is definitely suspect however, draining the housing and examining oil for metal particles will aid diagnosis and help to pinpoint any malfunction.

Check following defects and note possible causes :-

- |    |                 |  |
|----|-----------------|--|
| a) | Vibration       | Broken gear teeth / worn bearings  |
| b) | Continued noise | Worn bearings or gears   |
| c) | Overheating     | Loss of lubricant<br>Spiral bevel gear adjustment tight, seized bearings                                 |
| d) | Noise on turns  | Worn side gear and pinions<br>Worn or damaged trunnions<br>Loss of lubricant<br>Worn drive shaft splines |
| e) | Loss of drive   | Broken drive shaft<br>Stripped splines on drive shaft  |

**VITON 'O' RINGS AND SEALS (FLOURO-ELASTOMERS) - SAFETY HAZARDS.**

It has been brought to our attention that 'Viton' material used in manufacture of oil seals and 'O' rings, produces a highly corrosive acid (hydroflouric) when subjected to temperatures above 315° C. Resulting contamination can have extreme consequences on human tissue since it is almost impossible to remove after contact.

We therefore recommend the following procedure when it is necessary to inspect any equipment that has been subjected to a high temperature i.e. fire.

- Visually** inspect for any gaskets or seals which have suffered from heat ; they will appear black and sticky.
- If this is affirmed :- **Do Not Touch.**
- Make enquiries to ascertain the material composition.  
Any flouro-elastomer (Viton, Flourel or Tecmoflon) should be considered dangerous but natural rubber and nitrile are non-hazardous.
- If flouroelastomer seals have been used, then the affected area **MUST** be decontaminated before undertaking further work.
- Disposable heavy duty gloves (neoprene) **MUST** be worn and the affected area decontaminated by washing thoroughly with limewater (calcium hydroxide solution).
- Any cloths, residue and gloves used **MUST** be safely discarded after use.

**Note:- Burning of discarded items is NOT RECOMMENDED, except in an approved incineration process where gaseous products are treated by alkaline scrubbing.**

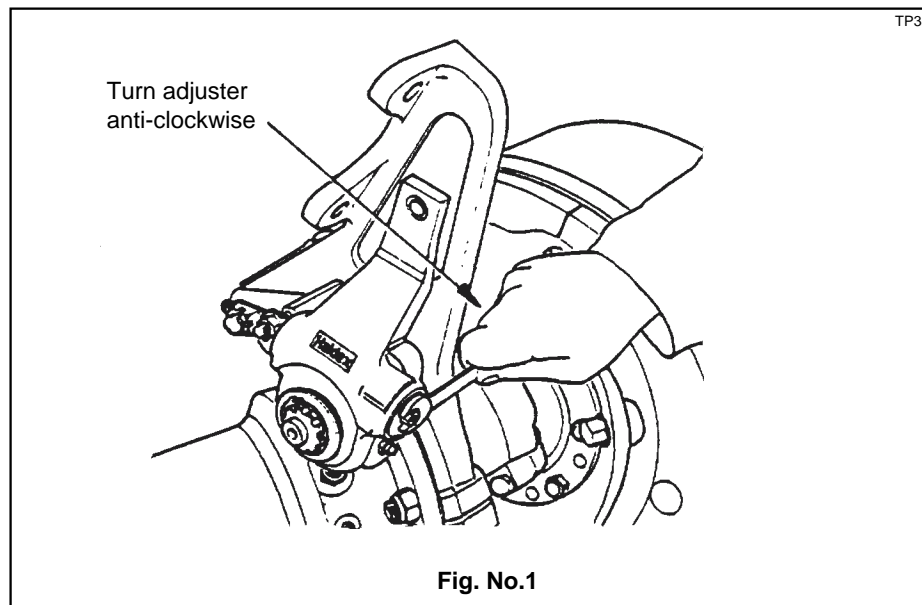


## SECTION 1 PREPARATION FOR OVERHAUL

- 1.1 Before attempting to remove road wheels, drive vehicle onto a solid concrete base and over a maintenance pit if possible, preferably after a short run to warm the oil.
- 1.2 Chock appropriate wheels.
- 1.3 With road wheels on ground, loosen wheel nuts on both sides.
- 1.4 Raise axle and support with suitable axle stands.
- 1.5 Remove wheel nuts and take off road wheels.
- 1.6 With suitable drip tray placed under drive head (approx. capacity drive head 17 pints (9.7 litres) and hub 2 pints (1.15 litres).  
Remove all drain and filler plugs to drain oil.
- 1.7 Disconnect propshaft from drive head.

## SECTION 2 REMOVAL OF COMPLETE DRIVE HEAD ASSEMBLY

- 2.1 Engage main diff lock, then remove brake drum retaining setscrew (84 - H82) then back off brake adjustment by turning hexagonal adjuster screw on slack adjuster (49- H82) in an anti-clockwise direction (see fig. no.1).



- 2.2 Support brake drum (2 - H82) (approx. weight - 105 lbs.) then insert 2 off  $\frac{7}{16}$ " UNF x  $1\frac{1}{2}$ " long extractor bolts into tapped holes provided in brake drum and tighten evenly to draw drum from hub flange (20 - H82).
- 2.3 Clean inside of brake drum with a clean damp cloth (**do not** use paraffin).
- 2.4 Remove planet carrier setscrews with washers (82 & 81 - H82) then insert 2 off  $\frac{7}{16}$ " UNF extractor bolts into holes in planet carrier flange (79 - H82) and tighten evenly to pull planet carrier assembly from hub (20 - H82).
- 2.5 Pull out drive shaft / sun gear assembly from hub (20 - H77).
- 2.6 Repeat operations 2.1 to 2.5 for other hub end.
- 2.7 Disengage main diff. lock.
- 2.8 Remove axle casing nuts (33) and their washers (34).  
Scribe a line on diff. flange o/dia and axle casing to aid re-assembly.
- 2.9 Support drive head with a sling and fit 2 off  $\frac{7}{16}$ " UNF x  $1\frac{1}{2}$ " long extractor bolts into tapped holes in axle flange and tighten evenly to draw drive head from axle casing (52).
- 2.10 Remove any sealant from axle casing and gear casing mounting faces (52 & 19) using a suitable sealant remover such as Loctite Chisel Gasket Remover or by carefully scraping sealant from faces.



## COMPLETE OVERHAUL OF DRIVE HEAD ASSEMBLY

**SECTION 3      DISMANTLING BEVEL PINION ASSEMBLY**

- 3.1 Place a wedge between crownwheel and pinion teeth, to prevent movement, then, using a suitable pry bar, carefully lever peened portion of coupling flange nut (28) to clear bevel pinion threads.
- 3.2 Loosen coupling flange nut (28).

**Do not remove at this stage.**

- 3.3 Remove bearing housing nuts (24) and washers (23).  
Pull pinion housing (22) from gear casing (19). Lift off setting shims (21).
- 3.4 Remove any Loctite no.515 Liquid Gasket from between setting shims (21) also mating faces of pinion housing and gear casing (22 & 19) using a suitable sealant remover such as Loctite Chisel Gasket Remover or by carefully scraping sealant from faces
- 3.5 With assembly resting on pinion face, remove coupling flange nut (28).
- 3.6 Using suitable extraction equipment, pull coupling flange (27) from pinion (32) (E303 series equipment is available from our spares and service dept. if required ).
- 3.7 Pull pinion along with inner bearing cone (31A) and bearing spacers (30 & 29) from bearing housing (22).
- 3.8 Lift off spacer, then remove inner housing cone.  
Prise out and discard oil seal (26) then lift out bearing cone (25A).
- 3.9 Using a soft metal drift, tap inner & outer bearing cups (31 & 25) from pinion housing (22).

**SECTION 4      DISMANTLING DIFFERENTIAL AND GEAR CASING ASSEMBLY**

- 4.1 Mark diff. straps (12) to ensure correct re-assembly, remove diff. strap nuts (10) and washers (11).
- 4.2 Lift off straps, then remove and discard adjusting nut split pins (46).
- 4.3 Remove diff. bearing adjusting nuts (13 & 45) and lift out crownwheel and differential unit assembly.
- 4.4 Lift diff. bearing cups (14 & 44) off their cones (14A & 44A) and inspect for wear / damage.  
Tap cones from register on diff. cage halves (17 & 41) if replacement is required.
- 4.5 Remove crownwheel nuts (15) and washers (16) then drive out crownwheel bolts (42) taking care not to damage threads.
- 4.6 With a hide faced hammer, knock crownwheel (43) from its register on flanged diff. cage half (41) taking care not to lose crownwheel dowels (49).
- 4.7 Scribe a line across joining faces of diff. cage halves (17 & 41) to ensure correct re-alignment on assembly.
- 4.8 The diff. cage halves can now be separated, enabling bevel wheels (39), thrust washers (40), along with trunnion (38), diff. bevel pinion and bush assembly (36 & 37) and thrust washer (35) to be removed.

**Note:- Bush (37) is a press fit in bevel pinion bore (36) and should be inspected for wear / damage in situ.**

**SECTION 5      DISMANTLING DIFFERENTIAL LOCK**

- 5.1      Remove clevis pin fork split pin (60) and pull out pin (57).
- 5.2      Tap out roll pins (47) which secure differential lock fork (48).
- 5.3      Withdraw differential lock lever pin (1).
- 5.4      Remove and discard 'O' ring (2).
- 5.5      Differential lock fork (48) and clutch dog (50) can now be removed from inside axle casing.
- 5.6      Check for signs of oil seepage around bush (3). Knock out for replacement if required.
- 5.7      Remove stop screw (6) and lock nut (7).

**SECTION 6      REMOVAL OF AIR CHAMBER ASSEMBLY**

- 6.1      Loosen locknut (59) then unscrew fork (58) and locknut from air chamber push rod.
- 6.2      Disconnect air chamber (54) from its air supply and pull off connections for diff lock switch (53).
- 6.3      Remove air chamber nut (56) and washer (55) and pull chamber from its mounting plate.

**INSPECTION**

After carefully cleaning the various parts in paraffin or other suitable cleaning agents, they should be inspected for wear / damage. Any parts found to be defective should be renewed. Oil seals, and thrust washers should be replaced as a matter of course at each overhaul.



## ASSEMBLY OF DRIVE HEAD

**Note :-** Prior to assembly lightly oil all gears and oil seal faces, also pack all taper bearings with grease (Shell Retinax LX or equivalent) using a bearing packer or manually kneading grease between rollers, race and cage before setting and rotated whilst being set.

## TOOLING REQUIRED

- 1) Spring balance to read in excess of 12 lbs.
- 2) 2 off magnetic dial indicators.
- 3) Engineers marking compound.
- 4) Loctite no.601 sealing compound.
- 5) Loctite no.641 bearing lock.
- 6) Oil seal bumper tool (tool no. E477 is available if required).
- 7) Torque wrench and socket set (A/F sizes).
- 8) Loctite no.515 liquid gasket.

## SECTION 7 DIFFERENTIAL LOCK ASSEMBLY

- 7.1 Assemble diff. lock fork (48) into groove in clutch dog (50) and place onto plate positioned inside axle casing (52).
- 7.2 If diff. lock bush (3) has been disturbed, it should be loctited in position as follows :-  
Ensure that mating surfaces of bush and casing are clean and free from grease.  
Apply a bead of **Loctite No 601** sealing compound to leading outer edge of bush and to leading edge of bore in casing.  
Press bush fully home and allow 30 mins. for Loctite to cure.
- 7.3 Fit a new bush 'O' ring (2) into position in diff. lock bush (3).
- 7.4 Hold diff. lock fork / clutch dog assembly in line with bush bore (3) and feed operating lever (1) fully into position in axle casing, passing through diff. lock fork (48) and into boss on other side of axle casing.
- 7.5 Align roll pin holes in fork (48) and operating lever (1) and secure with roll pins (47).
- 7.6 Feed diff. lock side drive shaft into axle arm until it just locates in clutch dog splines (50).



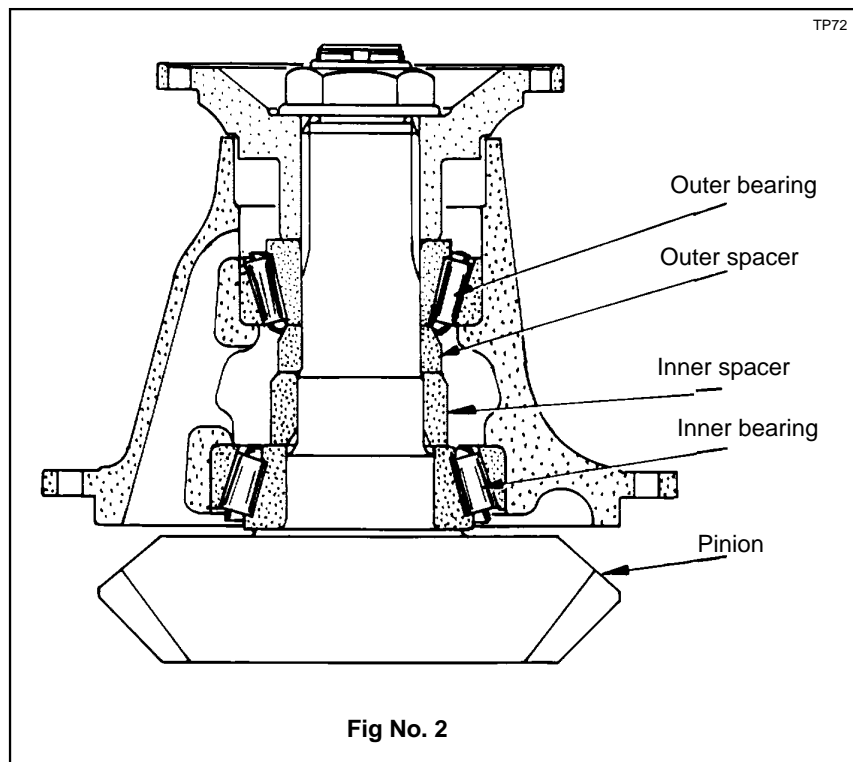
## SECTION 8 SPIRAL BEVEL PINION SUB ASSEMBLY - SEE FIG. No. 2

- 8.1 Fit inner and outer bearing cups (31 & 25) into their respective bores in bearing housing (22).
- 8.2 Press inner bearing cone (31A) onto pinion shaft (32).
- 8.3 Pinion assembly as follows :-

Fit inner bearing spacer (30) large inside chamfer end first, then outer spacer (29) large outside chamfer outwards onto pinion shaft (32). Feed assembly into position in housing.

**Note :- If new parts are being fitted, then assemble with largest of available spacers. This is to ensure that bearing pre-load is erred on low side, thus preventing too great a pre-load and resultant bearing damage.**

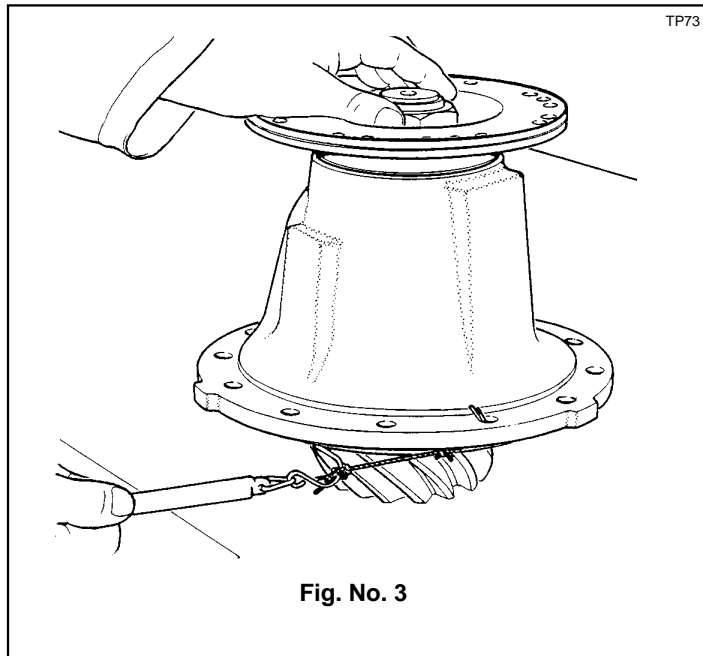
- 8.4 Press outer bearing cone (25A) into position on pinion.
- 8.5 Press coupling flange (27) onto pinion splines and secure with nut (28).
- 8.6 Place assembly in vice (clamp on holding plate fitted to coupling flange).
- 8.7 Progressively tighten nut (28) whilst rotating and shock loading bearing housing (22) with a rawhide mallet, to torque setting of 800 - 900 lbs. ft. (1085 - 1220 Nm).
- 8.8 Remove assembly from vice, take off holding plate.





SECTION 9 CHECKING PINION BEARING PRE-LOAD

- 9.1 Position pinion assembly, coupling flange uppermost on bench.
- 9.2 Secure a length of cord to pinion housing (22) and attach free end to a spring balance. fig. no.3.



- 9.3 Wrap cord around o/d of pinion housing and pull on spring balance to rotate housing. Note force required to maintain rotation, ignoring initial starting force. The force required to maintain rotation should be related in following manner to determine pre-load;

$$T = F \times R, \text{ where}$$

T = Torque (pre-load)  
 F = Force to maintain rotation (lbs)  
 R = Radius of secured cord (ins)

Pre-load obtained should be between limits 15 to 25 lbs. ins. (1.7 to 2.8 Nm).

If torque reading is **less** than 15 lbs. ins. then a **smaller** outer spacer needs to be fitted.

If torque is **greater** than 25 lbs. ins., then a **larger** outer spacer needs to be fitted.

**Note :-** If largest available combination of spacers (29 & 30) is already fitted, then a defect must be present in one or more parts of assembly and needs to be found and remedied before continuing axle build.

If stock size spacer is not available, spacers may be ground to size provided that same amount of material is ground from both sides to a maximum of 0.13mm (0.005") per side whilst maintaining parallelism and squareness with bore within 0.0002" T.I.R.

**This is to avoid removing all case hardening depth on one side.**

- 9.4 When correct pre-load has been obtained, remove coupling flange nut (28) and coupling flange (27).

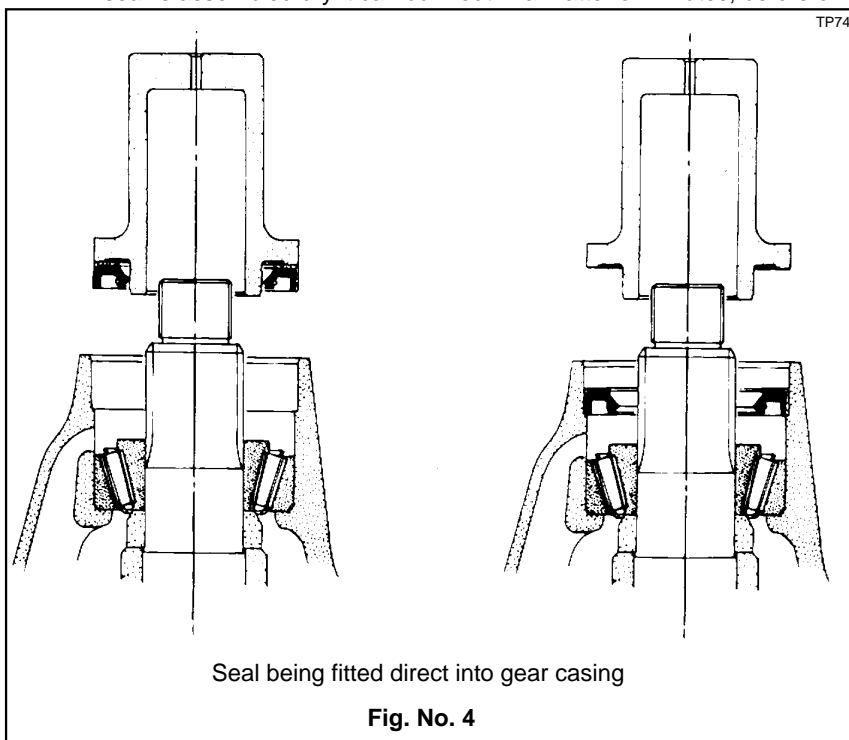




**SECTION 10 FINAL ASSEMBLY OF PINION UNIT**

10.1 Fit oil seal (26) into bearing housing (22) using a suitable fitting tool (tool no. E477 is available from our spares and services dept. if required) as follows :-

- a) Seals must be fitted using a circular tool which bears on seal close to outside diameter where casing is strongest. A correct fitting tool (E477) or one of similar design should be used. Failure to use a suitable tool will result in distortion of seal casing, uneven wear of lip and leakage. See fig. no. 4.
- b) Seals must remain square to bore during fitting. If seal cocks over and one side enters bore first in will almost certainly result in distortion of casing which will not be corrected by straightening up further down bore. Where possible, seals should be fitted under a press, which reduces the likelihood of this problem.
- c) Seals must be truly square in bore after fitting. A cocked seal will act as an oil pump.
- d) When replacing a seal, always check coupling flange for damage in region polished by oil seal lip : even slight damage in this area will cause leakage. Very slight marks may be polished out with fine emery cloth, but it is essential that polishing marks are parallel to seal lip. Where there is no more serious damage, it is permissible to fit two seals back-to-back if there is room in housing, ie. outer seal with spring facing outwards, inner seal with spring facing inwards. The outer seal acts as a spacer and ensures that inner seal is fitted square and that it runs on a different part of coupling flange.
- e) Lips of seals or journals of coupling flanges should be smeared with clean gear oil prior to assembly.  
If seal is assembled dry it can burn out in a matter of minutes, before oil reaches it.



- 10.2 Refit coupling flange (27) and nut (28). Tighten nut to 800 - 900lbs.ft. (1085 - 1220Nm.).
- 10.3 Lock nut in position by peening locking flange into slot in pinion shaft.
- 10.4 If any pinion housing / gear casing studs (20) have been removed, renew and tighten to procedure shown on page G23.
- 10.5 Place adjusting shim (21) into position on studs (20), then offer pinion assembly to gear casing (19), tapping in position with a rawhide mallet.

**Note :- If new pinion / crownwheels are fitted, a nominal shim pack of 0.050 " (1.27mm) should be fitted.**

10.6 Secure in position with washer (23) and nuts (24). Tighten nuts progressively using diagonal selection, until tightened to correct torque. 47 - 53 lbs ft (64 - 72 Nm).

**SECTION 11 SEQUENCE OF OPERATIONS TO ASSEMBLY SPIRAL BEVEL WHEEL  
(CROWNWHEEL) AND DIFFERENTIAL**

- 11.1 Press diff. bearing cone (14A) onto its mating diff. cage half (17) followed by other bearing cone (44A) onto its diff. cage half (41).
- 11.2 Fit spiral bevel wheel (crownwheel) (43) onto diff. cage half (43) ensuring that diff. cage dowels (49) are correctly located.
- 11.3 Fit diff. cage bolts (42) through spiral bevel wheel (crownwheel) and differential assembly then place assembly on bench supported on blocks, crownwheel end down.
- 11.4 Fit diff. bevel wheel thrust washer and diff. bevel wheel (40 & 39) into diff. cage half (41).
- 11.5 Assemble diff. bevel pinion and bush assemblies (36 & 37) and diff. bevel thrust washers (35) onto diff. trunnion (38).

**Note :- If a new bush (37) is to be fitted into bore of pinion (36) it must be done using a suitable press due to tight fit between pinion and bush. Bush (37) is pressed flush with spherical face of pinion (36). If no press is available, then a new pinion and bush assembly must be fitted.**

- 11.6 Lay diff. trunnion assembly onto diff. bevel wheel (39) ensuring that teeth mesh correctly.
- 11.7 Place other diff. bevel wheel and thrust washers (39 & 40) onto diff. bevel pinions again ensuring that teeth are correctly meshed.
- 11.8 Carefully fit diff. cage half (17) onto assembly, aligning matching marks on both diff. cage halves, securing with diff. cage bolt nuts and washers (15 & 16), then tighten to 166 - 184 lbs. ft. (225 - 250Nm.).

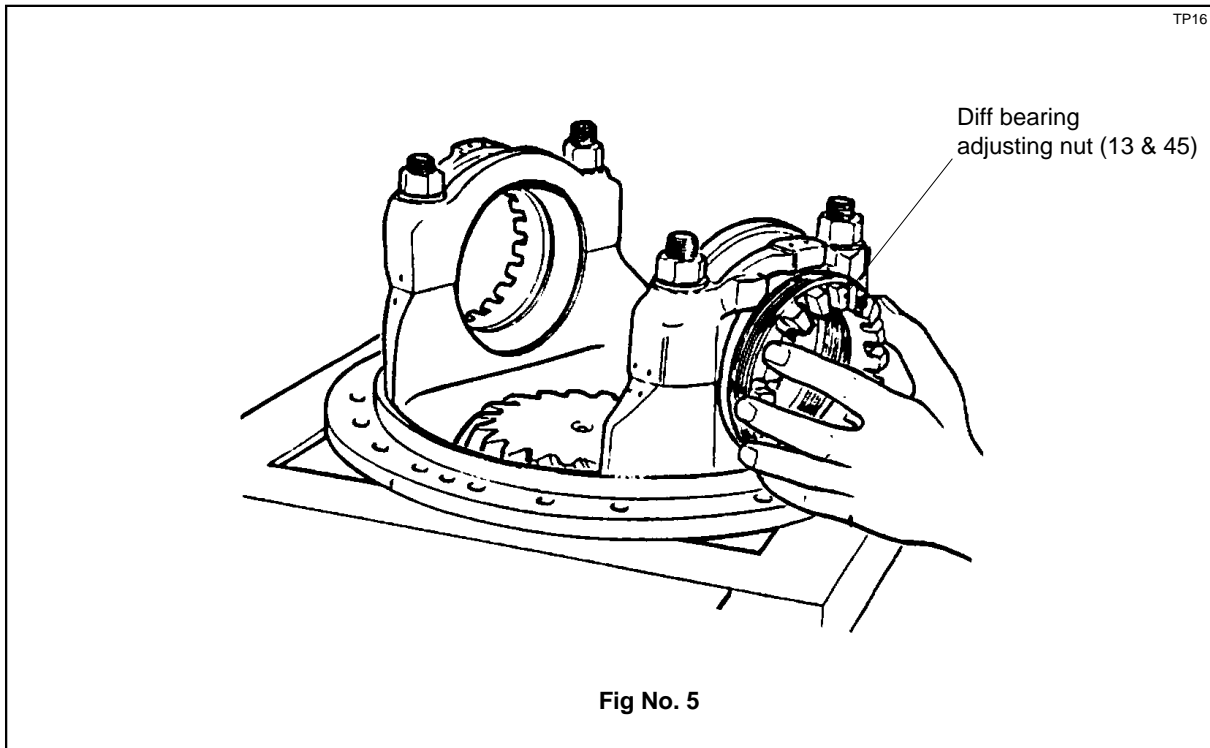


## SECTION 12 INITIAL PREPARATION BEFORE FITTING ASSEMBLED SPIRAL BEVEL WHEEL (CROWNWHEEL) AND DIFFERENTIAL

- 12.1 Secure pinion and casing assembly in a suitable diff. build stool.
- 12.2 Clean and deburr bevel casing legs (19) and bevel casing straps (12).
- 12.3 Fit bearing cups (14 & 44) into relevant half bores of bevel casing (19).
- 12.4 Check bevel casing strap studs (18), if any have been removed, replace then tighten to 88 - 98 lbs ft.(119 - 133Nm.).
- 12.5 Carefully fit bevel casing straps (12) down studs (18) to locate on bearing cups (14 & 44). Check alignment of matching marks on bevel casing legs and straps (19 & 12) to ensure that straps are not transposed, bearing cups (14 & 44) should rest snugly in bores.

**Note :- on no account should extra pressure e.g. hammer be used .**

- 12.6 Fit diff. strap washers (11) and temporary plain nuts onto bevel casing strap studs (18) then tighten to 105 lbs ft. (142Nm.).
- 12.7 Fit bearing adjusting nuts (13 & 45) which should be free to turn with hand pressure only, if not, it may be because of cross threading. Remove and deburr.
- 12.8 Check freedom of diff. bearing adjusting nuts (13 & 45) by unscrewing and refitting. To assist this operation, tap bevel casing straps (12) lightly on top with a 2lb hammer. See fig. no. 5.



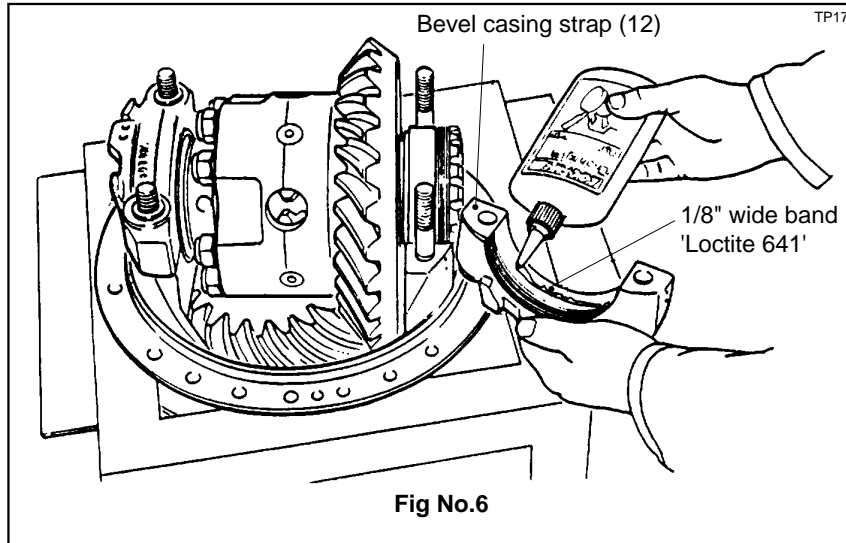
- 12.9 Having checked fitting of adjusting nuts (13 & 45), remove bevel casing straps (12), bearing cups (14 & 44) and adjusting nuts (13 & 45).



**SECTION 13 FITTING SPIRAL BEVEL WHEEL (CROWNWHEEL) AND DIFFERENTIAL INTO BEVEL CASING**

- 13.1 Apply a **thin** bead of ' Loctite 641 ', using correct applicator to give a 1/8" wide band, into bevel casing strap bores (12). See fig. no. 6.  
This is to prevent possibility of diff. bearing cups (13 & 45) spinning in service.

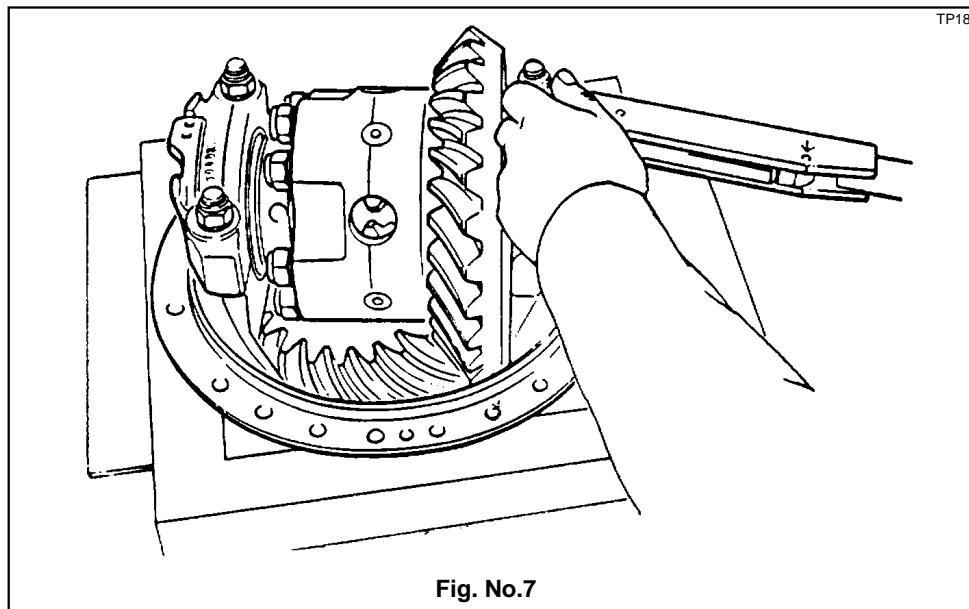
**Note :- Assembly and setting procedures are to be completed immediately so as to avoid the ' Loctite ' hardening, and preventing adjustment of bearing cups (14 & 44).**



- 13.2 Hold diff. bearing cups (14 & 44) in position on diff. bearing cones (14A & 44A) and place spiral bevel wheel (crownwheel) and differential assembly in position in bevel casing (19).
- 13.3 Fit diff. bearing adjusting nuts (13 & 45) onto half threads of bevel casing legs (19).  
Recheck freedom of nuts in threads.
- 13.4 Refit bevel casing straps (12) (by hand) onto bevel casing strap studs (18) to locate on bearing cups (14 & 44) and adjusting nuts (13 & 45).

**Note :- Ensuring all matching marks coincide to obviate misalignment of straps (12).**

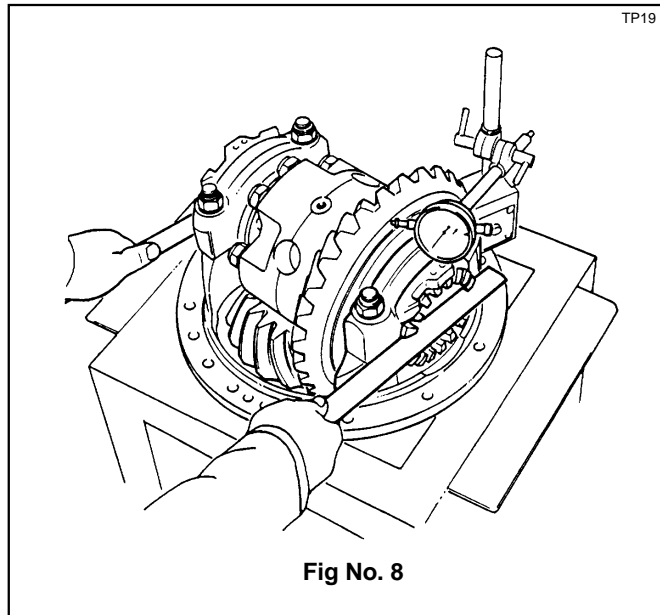
- 13.5 Turn bearing adjusting nuts (13 & 45) hand tight against bearings (14 / 14A & 44 / 44A).
- 13.6 Fit bevel casing strap washers and bevel casing strap stud nuts (11 & 10), then tighten nuts to 128 - 142 lbs ft. (174 - 193Nm.). See fig. no.7.





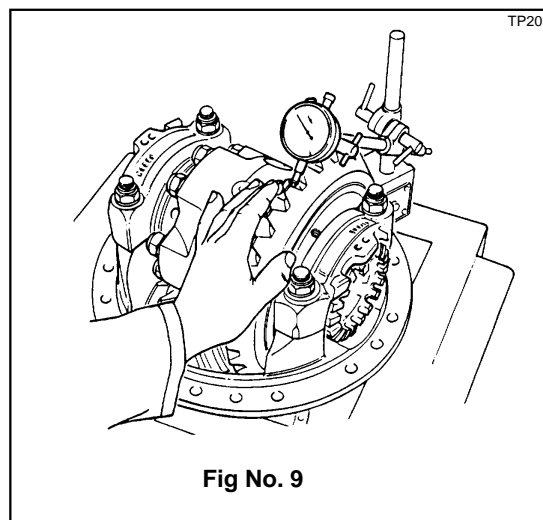
#### SECTION 14 SETTING " NO END FLOAT " CONDITION

- 14.1 Set up a dial indicator on back face of spiral bevel wheel (crownwheel) (43) as shown in fig. 8. and screw in each diff. bearing adjusting nut (13 & 45) just sufficiently to ensure no spiral bevel wheel (crownwheel) axial movement is registered on dial indicator.
- 14.2 Tap bevel casing straps (12) and rotate bevel wheel (crownwheel) then check that no axial movement is present.



#### SECTION 15 SETTING THE SPIRAL BEVEL WHEEL (CROWNWHEEL) AND PINION BACKLASH

- 15.1 Move dial indicator onto spiral bevel wheel (crownwheel) tooth (43) as shown in fig no.9. Hold spiral bevel pinion (32) still and rock spiral bevel wheel (crownwheel) (43) backwards and forwards, to check free play between gears (backlash), and note variation of indicator reading.
- 15.2 Repeat above operation **three more times** so that **four readings** are taken at various positions equally spaced around spiral bevel wheel (crownwheel) (43). Variations of readings on dial indicator must be within limits of 0.008 " to 0.013 " (0.203 to 0.330mm). If difference in backlash of more than half backlash tolerance exists between any tooth mesh positions, then assembly should be further examined for cause and rectified.





**SECTION 16 SETTING THE SPIRAL BEVEL WHEEL (CROWNWHEEL) BEARINGS**

16.1 Set up two dial indicators diametrically opposite on bevel casing strap register points as shown in fig. no.10 and set each indicator to zero.

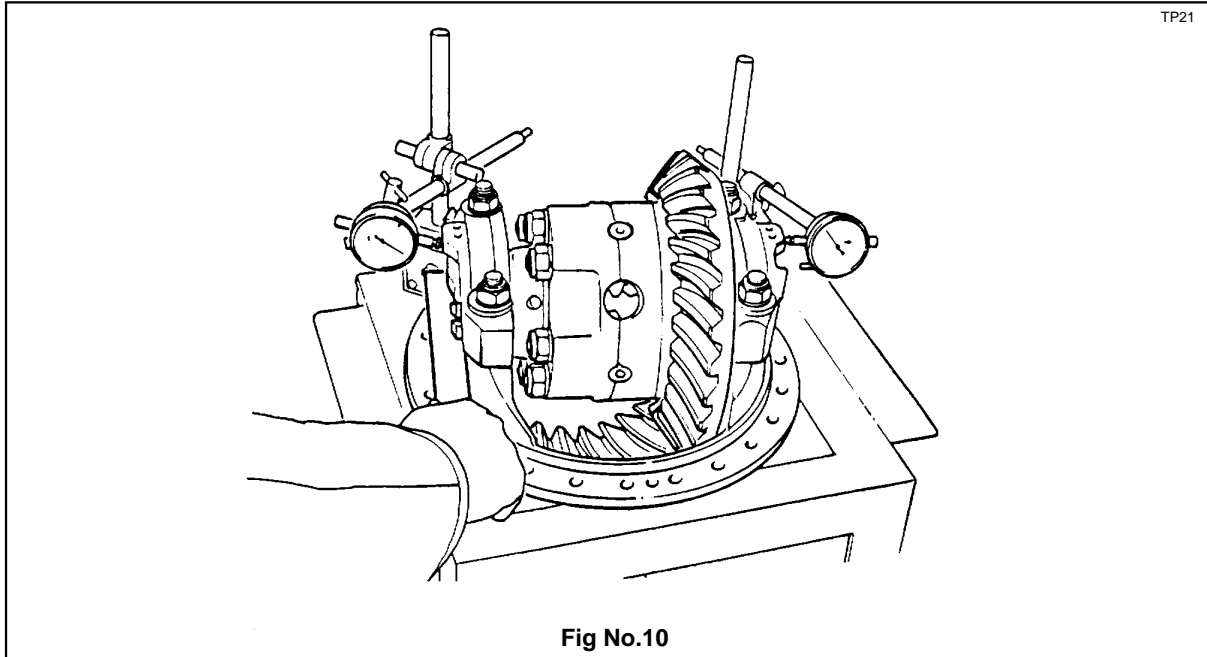


Fig No.10

- 16.2 Mark position of diff. bearing adjusting nuts (13 & 45) and then back off each one slightly to ensure that no spread is present. (ie. dial indicators remain at zero).
- 16.3 Re-tighten each diff. bearing adjusting nut (13 & 45) back to its marked position and then tighten a further notch on each end to pre-load differential bearings (14 / 14A & 44 / 44A). (a spring balance reading of 2 1/2 " lbs pull , ie. rolling resistance at o/d of diff. cage which equates to 8.75 lbs ins pre-load).  
Sum of dial indicator readings should total between 0.002 " and 0.004 " (0.051 and 0.102mm).  
Adjuster nut slots should line up with one of split pin holes in bevel casing straps (12).
- 16.4 Tighten strap nuts (11) to 128 - 142 lbs ft. (174 - 193Nm.).
- 16.5 Fit diff. adjusting nut split pins (46) as shown in fig. no. 11.
- 16.6 Set up a dial indicator on spiral bevel wheel (crownwheel) (43) tooth and re-check that backlash is still as previously set. (section 15. fig. no. 9).

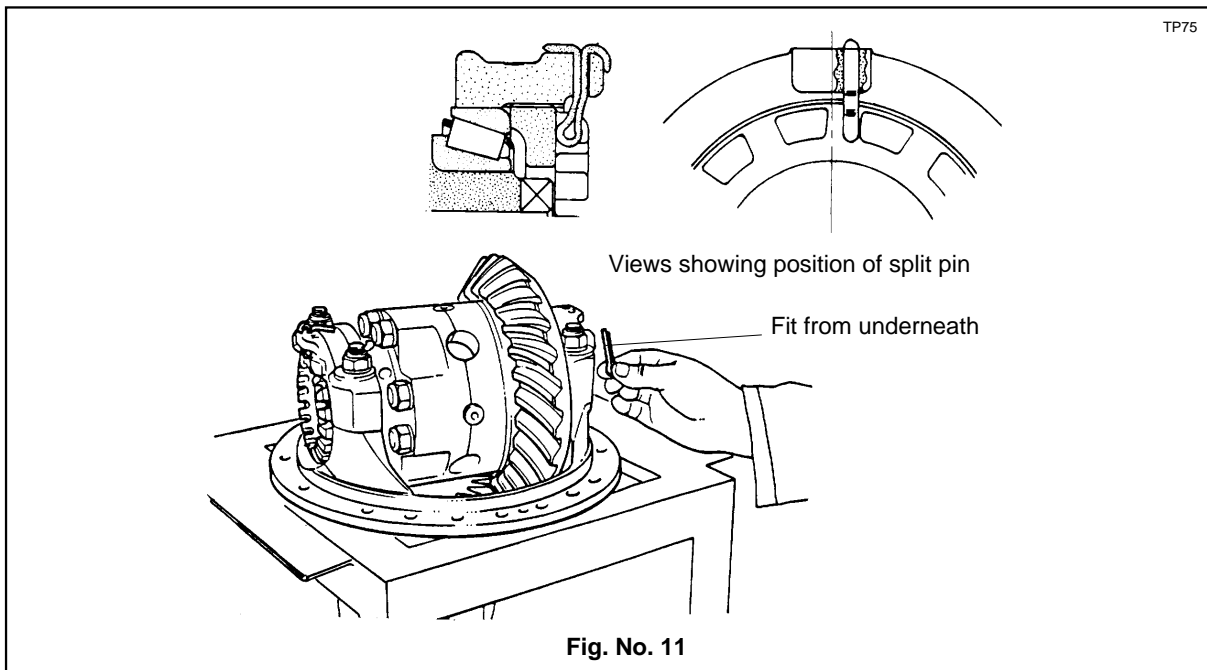


Fig. No. 11



**SECTION 17 GEAR IDENTIFICATION ALSO CROWNWHEEL & PINION GEAR MESH.**

Because we now produce gears by both Gleason and Oerlikon method of manufacture, the following identification features are given to show differences between types of gears .

**17.1 GLEASON GEARS**

- a) Gear teeth taper towards centre (toe end of teeth).
- b) No suffix identification letter in part no. eg. R8579/1/2.
- c) No identification groove on pinion shank and crownwheel back face.

**17.2 OERLIKON GEARS**

- a) Gear teeth parallel to pitch line .
- b) Part no. has suffix identification letter 'N' eg.R8579/1N/2N.
- c) Pinion shank and crownwheel back face have identification groove.

**NOTE :- Oerlikon gears are cut in two forms :- N form and G form (Spiroflex).  
 At present, all gears except the following part nos. , are cut in N form.  
 gears cut in G form are as follows:-  
 R8939/1N/2N      R8858/1N/2N      R8859/1N/2N.  
 Difference between forms is in mesh positions as shown in relevant mesh checking diagrams in following section.**

**SECTION 18 CHECKING CROWNWHEEL AND PINION MESH.**

- 18.1 Apply a thin coating of engineers marking compound to several consecutive crownwheel teeth.
- 18.2 Turn crownwheel for a few revolutions, in both directions to make a positive tooth contact impression on crownwheel and pinion teeth.
- 18.3 Inspect deposit of marking compound on crownwheel and pinion teeth and compare them with following relevant diagrams on pages E16 toE18.  
 In all cases, action, (if any) to be taken is shown below:

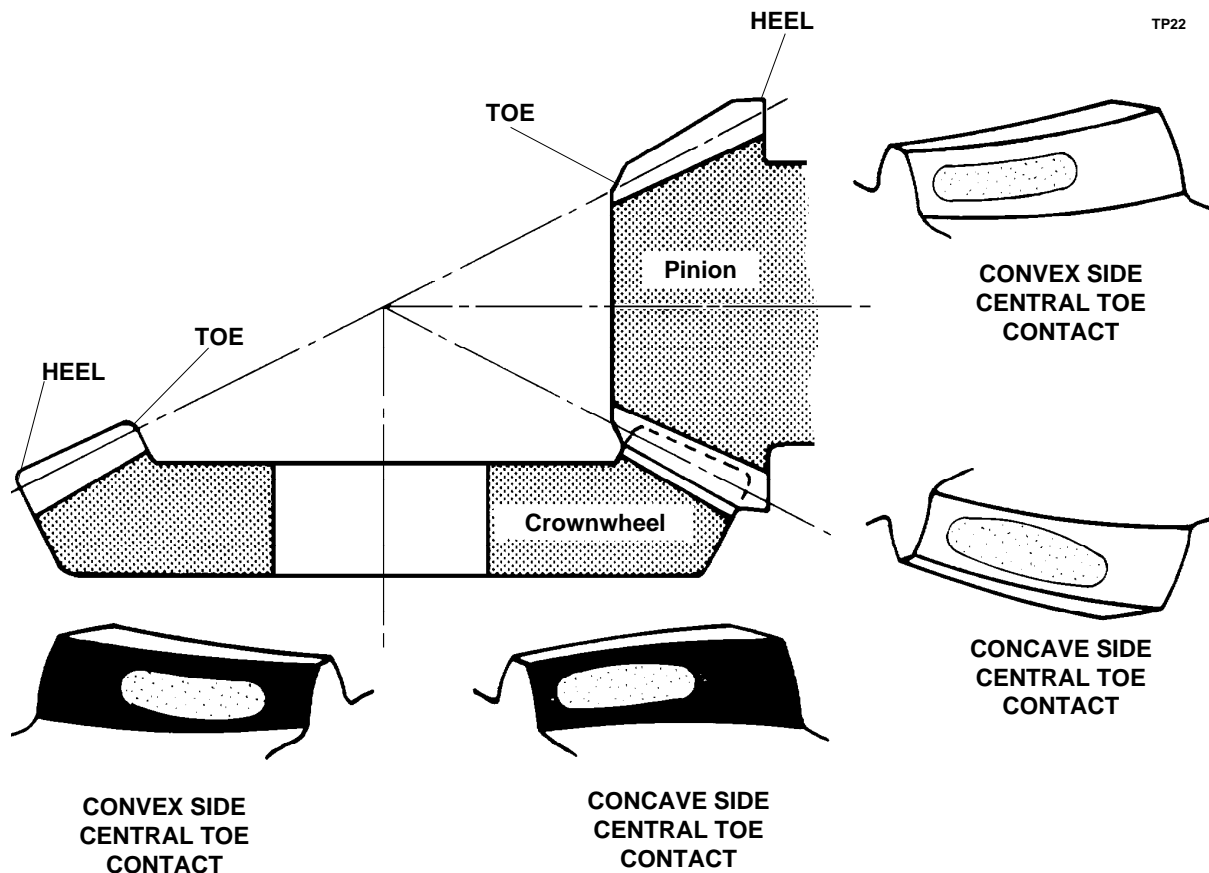
- Fig.A.      Indicates correct mesh.  
 No further action required.
- Fig.B      Indicates pinion & crownwheel are too far out of mesh.  
 To remedy, move pinion inwards towards crownwheel.  
 To maintain backlash, move crownwheel away from pinion in direction of arrow B.
- Fig. C      Indicates pinion & crownwheel too far into mesh.  
 To remedy, move pinion outwards away from crownwheel.  
 To maintain backlash, move crownwheel towards pinion in direction of arrow B.

If any action is required, adjust pinion position by altering thickness of pinion bearing shims (21A, B & C) ie. **add** shims to move pinion **away** from crownwheel and **remove** shims to move pinion **towards** crownwheel.

- 18.4 When settings are correct, remove pinion bearing housing nuts with washers (24 & 23) then pull off pinion assembly and lift off shims (21).
- 18.5 Thoroughly clean shims (21), also mating face of pinion housing and gear casing (5 & 10) using Loctite Superclean Safety Solvent no.706 or other suitable chlorinated solvent.
- 18.6 Apply a thin film of Loctite no.515 Liquid Gasket to one side of each shim (21) then fit, Loctite side first, onto studs (20).
- 18.7 Similarly coat pinion housing mating face (22) with Loctite no.515 Liquid Gasket and re-fit assembly to gear casing (19), tapping into place with a hide faced hammer.
- 18.8 Secure in position with washer (23) and nuts (24). Tighten nuts progressively using diagonal selection, until tightened to correct torque 47 - 53 lbs ft. (64 - 72 Nm).

GLEASON GEARS

Typical preferred tooth contact  
(pinion member left hand in all cases shown)



TP22

Fig. B

Fig. C

**PROFILE ERROR**

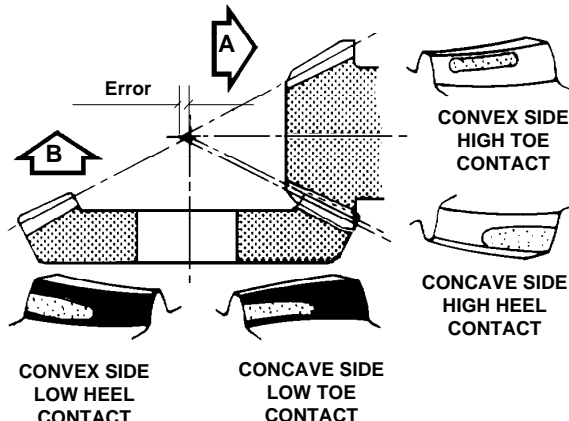
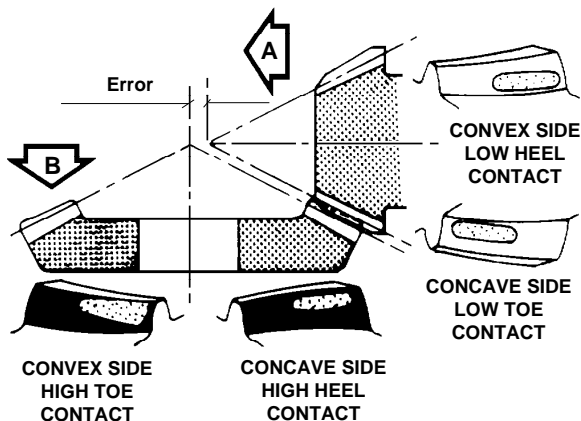
To correct, move pinion towards crownwheel in direction of arrow A.

To maintain backlash, move crownwheel away from pinion in direction of arrow B.

**PROFILE ERROR**

To correct, move pinion away from crownwheel in direction of arrow A.

To maintain backlash, move crownwheel towards pinion in direction of arrow B.







OERLIKON N FORM GEARS

Typical preferred tooth contact  
(pinion member left hand in all cases shown)

Fig.A

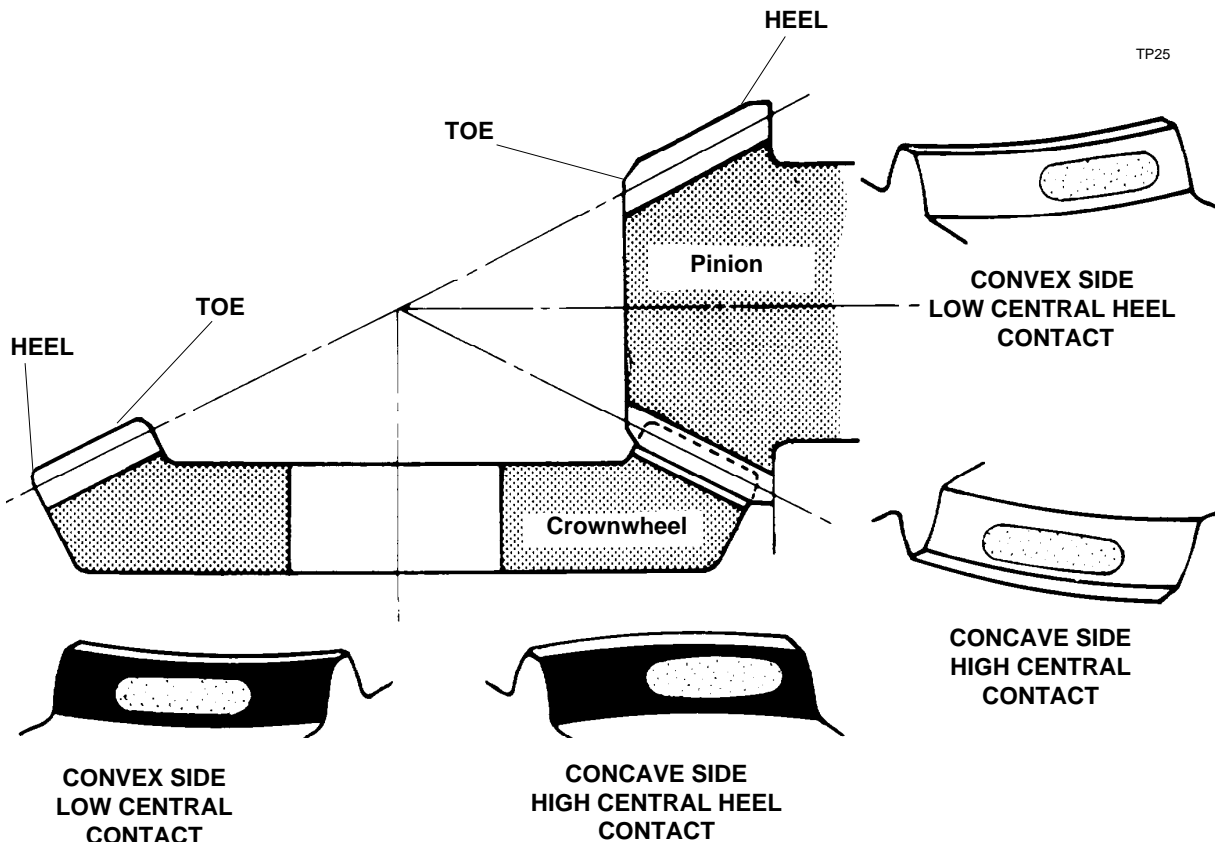


Fig. B

PROFILE ERROR

To correct; move pinion towards crownwheel in direction of arrow A.

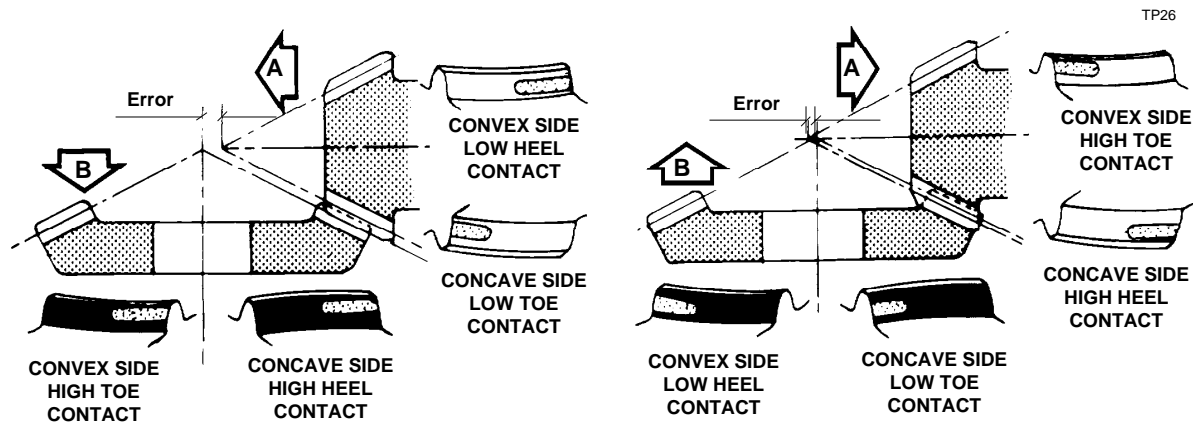
To maintain backlash, move crownwheel away from pinion in direction of arrow B.

Fig. C

PROFILE ERROR

To correct; move pinion away from crownwheel in direction of arrow A.

To maintain backlash, move crownwheel towards pinion in direction of arrow B.





OERLIKON G-FORM GEARS

Typical preferred tooth contact  
(pinion member left hand in all cases shown)

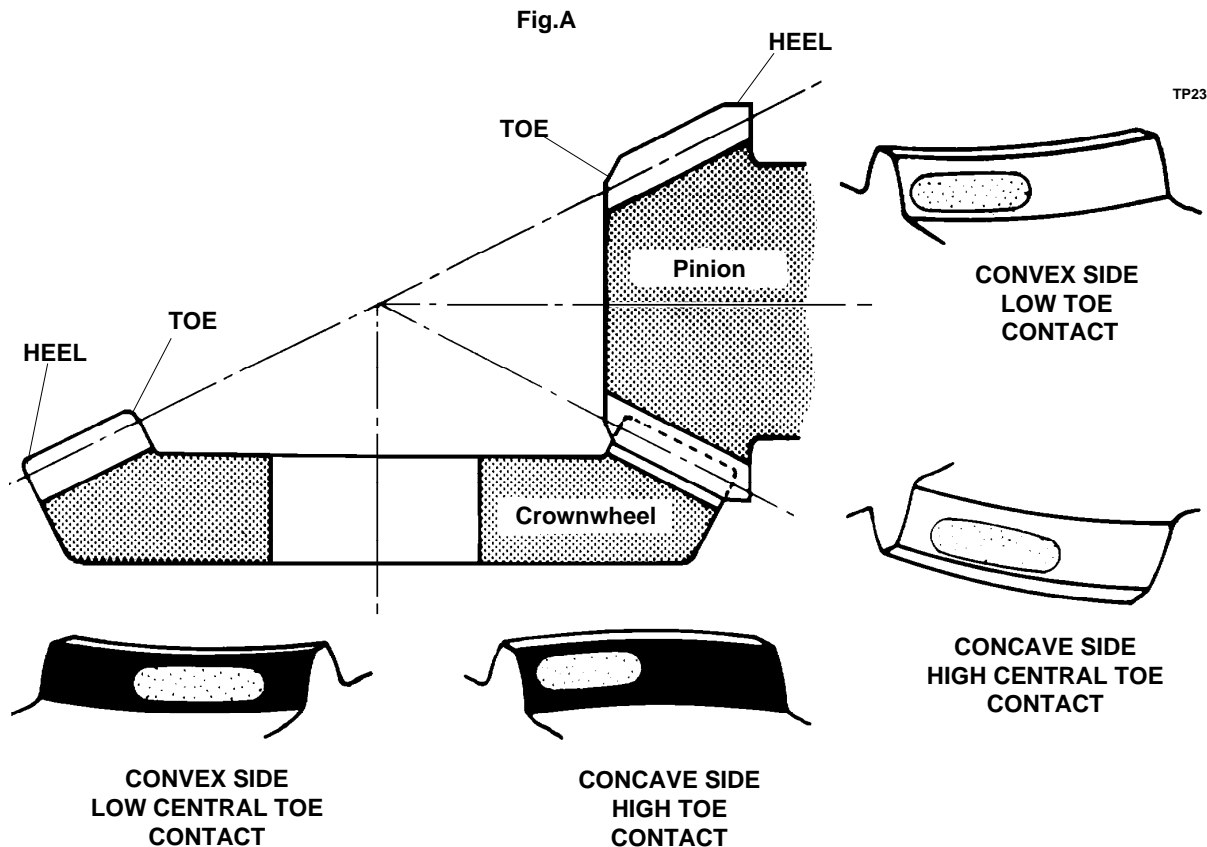


Fig. B

PROFILE ERROR

To correct; move pinion towards crownwheel in direction of arrow A.

To maintain backlash, move crownwheel away from pinion in direction of arrow B.

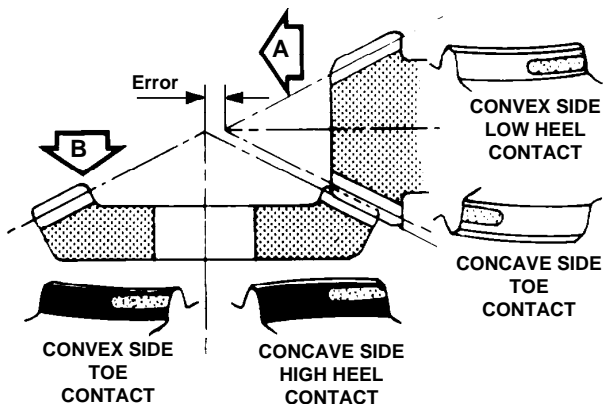
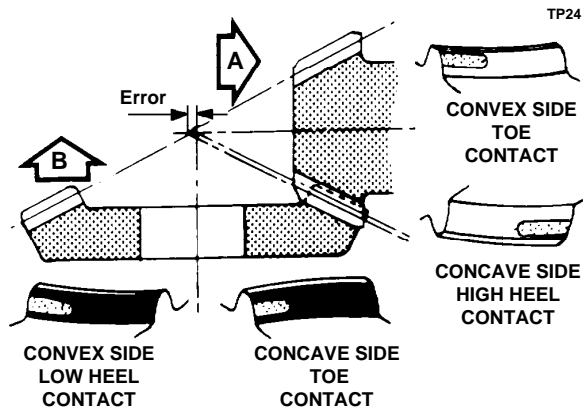


Fig. C

PROFILE ERROR

To correct; move pinion away from crownwheel in direction of arrow A.

To maintain backlash, move crownwheel towards pinion in direction of arrow B.



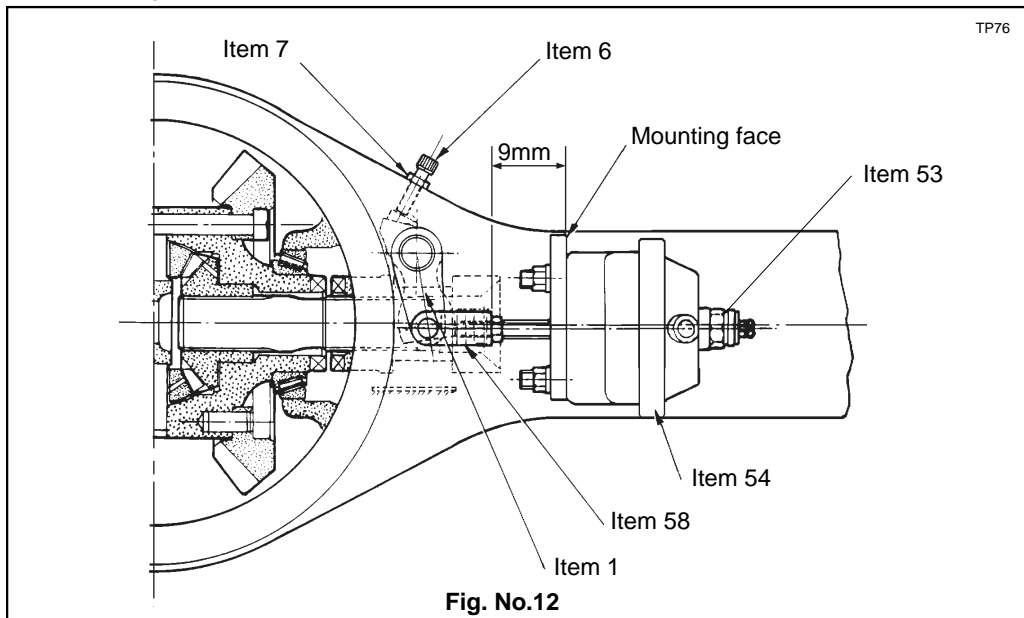


**SECTION 19 REFITTING DRIVE HEAD INTO AXLE**

- 19.1 Refit axle casing studs (8), tightening to procedure shown on page D23.
- 19.2 Apply a thin film of Loctite no. 515 Liquid Gasket to axle casing mating face on bevel casing (22).
- 19.3 With drive head supported with a suitable sling offer assembly to axle casing and tap into position using a hide faced hammer.
- 19.4 Fit axle casing washers (34) and nuts (33) then tighten nuts to 99 - 109lbs. ft. (134 - 148Nm).
- 19.5 Fit hubs as follows :-
  - a) Slide drive shaft (57 - H82) fully home in hub until splines can be felt to engage fully with differential gears.
  - b) Slide planet carrier / hub cap assembly into position ensuring gears mesh correctly, then fit planet carrier setscrews with washers (82 & 81- H82), tightening to 110 - 125lbs.ft. (149 - 169Nm.).
  - c) Repeat operations a) and b) for other hub.
- 19.6 Fit air chamber (54) onto mounting plate and secure into position with locknuts (56) and washers (55).

**Note :-** If new air chamber (54) is to be used, the push rod needs to be cut, prior to fitting, to same length as on original air chamber. This is because air chamber manufacturer supplies chambers with push rods to suit all applications. When fitting diff. lock air chambers ensure that air chamber push rod is fitted in line and operates at 90° to mounting bracket. This is to ensure smooth operation and avoid jamming up problems in service.

- 19.7 Assemble locknut (59) and yoke (58) onto push rod end.
- 19.8 Screw yoke onto push rod until distance from air chamber mounting face to push rod is 9mm - see fig. no.12.



- 19.9 Secure yoke (58) with locknut (59).
- 19.10 Connect diff. lock switch (53), if fitted, and air supply to air chamber (54).
- 19.11 Check air chamber to yoke distance with air in system.

**SECTION 20 DIFF LOCK SETTING PROCEDURE.**

- 20.1 Engage diff. lock then check that lock is fully engaged by rotating one hub, if lock is engaged, other hub will rotate in **same** direction.
- 20.2 Assemble stop screw (6) and locknut (7) together then apply Hylomar sealant to setscrew threads prior to fitting into axle casing (52).
- 20.3 Screw stop screw into casing (52) until contact with operating lever is felt.
- 20.3 Disengage diff. lock.
- 20.4 Give stop screw (6) **one half turn clockwise**, then lock in position with locknut (7).
- 20.5 Check disengagement as follows :-  
 Rotate **one hub** and observe direction of other hub.  
 If lock is disengaged hubs will rotate in **opposite** directions.



## SECTION 21 INSTALLATION AND USE OF CROSS AXLE AND THIRD DIFFERENTIAL LOCKS

## 21.1 Installation Recommendations and Instructions

**Warning light system**

Each diff. lock is fitted with a switch which shall be connected directly to an individual warning lamp in the drivers cab, to indicate when the lock is fully engaged. Each light shall be of the double bulb type or incorporate a bulb checking feature to avoid an incorrect warning.

Differential locks on steer drive axles

Differential locks are not recommended on steer drive axles. This is because, when a locked axle is steered, the required speed difference between off side and near side wheels is prevented, causing a wind-up of torque in the shafts, gears and dogs. This can cause the tyres to skid, a phenomenon which will affect vehicle control. Moreover, it greatly increases the torque required to turn the steering swivels.

If indeed, a customer does demand a diff. lock on a steer drive axle, then it must be emphasised that this should be engaged only when wheel slippage has immobilised the vehicle and that it must be disengaged within a few seconds of recovery.

## 21.2 Instructions for vehicle operators

**Warnings**

Diff. locks are for use only under conditions where adhesion between tyres and ground is extremely low. They **must** be disengaged as soon as conditions permit.

Prolonged running with locks engaged can (due mainly to steering), promote wind-up between off side and near side shafts, gears and dogs. This can lead to breakage of components.

If a diff. lock is fitted to a steer drive axle, it should only be engaged when wheel slippage has immobilised the vehicle and it must be disengaged within a few seconds of recovery.

**Engagement**

**IMPORTANT :- DIFF. LOCKS SHALL ONLY BE ENGAGED WHILST THE VEHICLE IS STATIONARY.**

- i) On approaching low adhesion terrain :-

The vehicle shall be stopped and diff. lock switches operated. If dogs do not engage fully, as witnessed by the warning lights, the vehicle shall be driven and manoeuvred slowly until full engagement is achieved.

- ii) When vehicle is immobilized due to wheel spin.

**Any wheel spin must be terminated prior to attempting diff. lock engagement.**

Diff lock switches shall be operated. If the dogs do not engage fully, as witnessed by the warning lights, the transmission shall be allowed to rotate until full engagement is achieved.

Driving shall not be resumed until full engagement has been verified by each respective warning light.

**Disengagement**

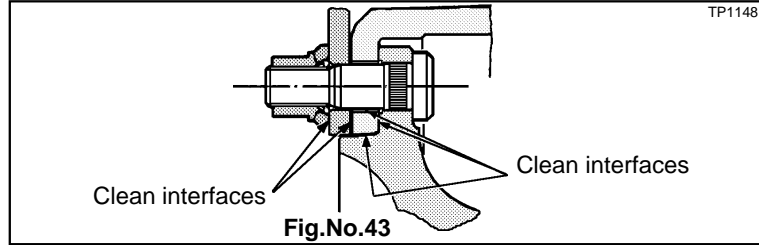
Release pressure from operating chamber. It is then essential that the vehicle is manoeuvred slowly to ensure full disengagement of diff. lock dogs and relieve wind-up.



**SECTION 22 FINAL ASSEMBLY / ADJUSTMENTS**

22.1 Clean interfaces between Hub and brake drum then with brake drum (2 - H82) suitably supported, slide into position on hub (20 - H82).

**Note :- Interfaces must be free from dirt , including liner material debris, rust and paint. Failure to keep interfaces clean, can and will cause brake drum to distort upon tightening of wheel nuts. For further details see BS AU50 : Part 2 : Section 7A : 1995.**

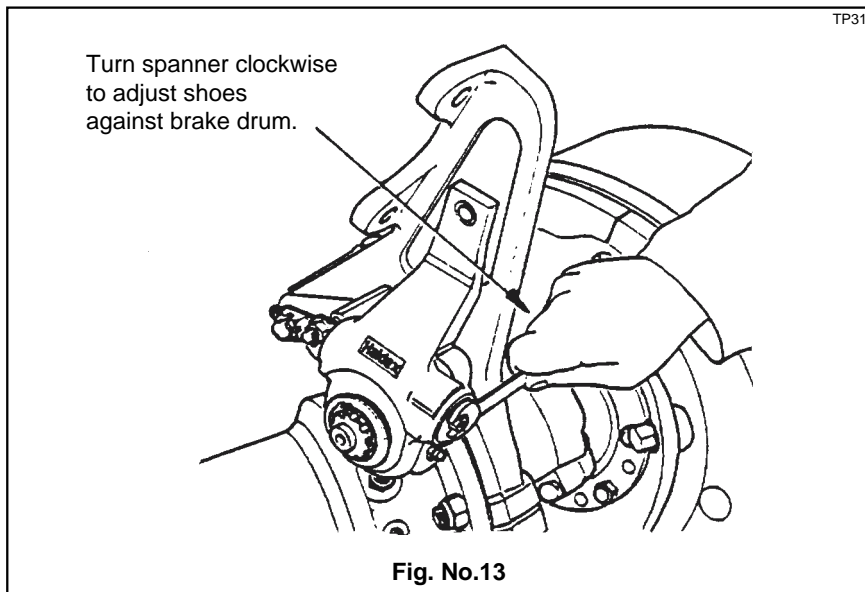


- 22.2 Fit brake drum retaining setscrew (84 - H82) and tighten to 72 - 80lbs. ft. (98 - 108Nm.).
- 22.3 Repeat operations 22.1 and 22.2 for other hub unit.
- 22.4 Re-connect prop shafts to coupling flange (27).
- 22.5 Refit drain plugs and refill axle with clean gear oil as stated in lubrication section at front of this manual.

**Note :- Always check final oil level at drive head. Oil flows freely through hubs and drive head. When filling, top up each hub followed by drive head.**

22.6 Adjust brakes as follows :-

- a) Turn adjusting screw on slack adjuster (49 - H82) clockwise until brake linings are hard up against brake drum, then back off adjusting screw by  $\frac{3}{4}$  of a turn as shown in fig. no. 13.
- b) Check function of slack adjuster by performing a few brake applications.



- 22.7 Refit road wheels, securing with wheel nuts (1 - H82) and tighten nuts to 475 - 525lbs.ft. (644 - 712Nm.).
- 22.8 Remove axle supports, then lower vehicle to ground.
- 22.9 Remove chocks and lifting equipment.


**TORQUE TABLE FOR D66 DRIVE HEAD UNIT WITH DIFFERENTIAL LOCK  
(AS FITTED TO REAR DRIVE AXLE)**

<b>Item No</b>	<b>Description</b>	<b>Torque</b>
10	Diff. strap nut	128 - 142 lbs ft (174 - 193 Nm)
15	Diff. cage nut	166 - 184 lbs ft (225 - 250 Nm)
18	Diff. strap stud	88 - 98 lbs ft (119 - 133 Nm)
24	Pinion housing nut	47 - 53 lbs ft (64 - 72 Nm)
28	Coupling flange nut	800 - 900 lbs ft (1085 - 1220Nm)
33	Axle casing nut	99 - 109lbs ft (134 - 148 Nm)

SEE FOLLOWING PAGE FOR STUD TIGHTENING PROCEDURE

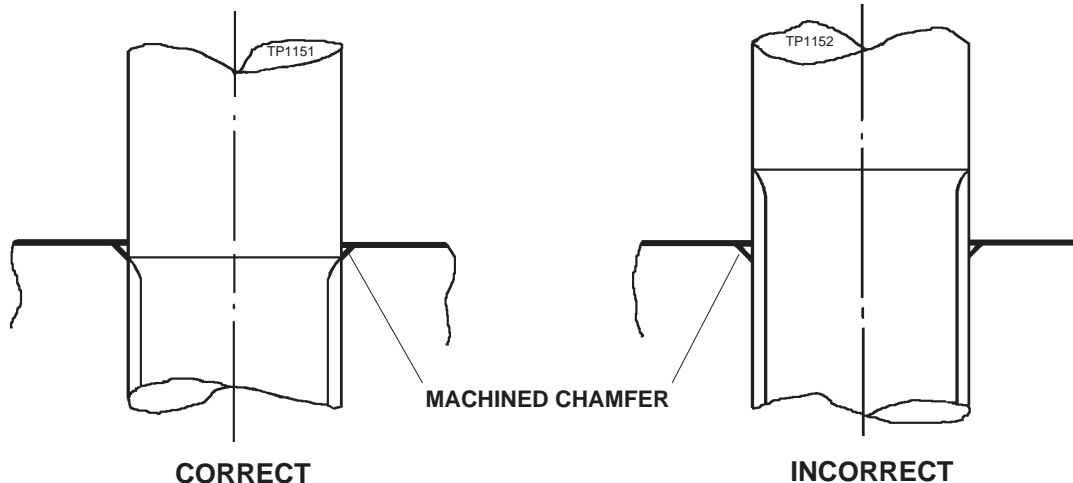


**KIRKSTALL SPECIALITY AXLE DIVISION**

TP1193

**STANDARD STUDS - FITTED INTO MACHINED CHAMFERED HOLES**

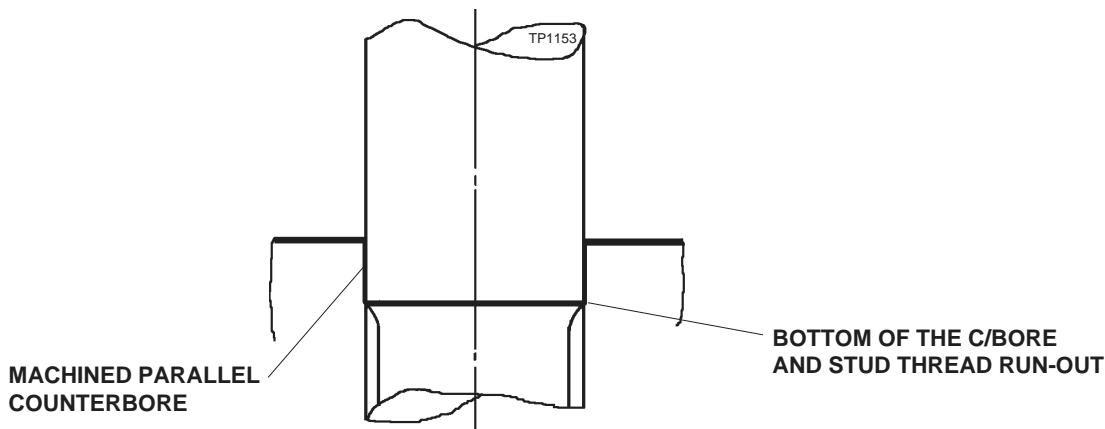
STUDS TO BE INSERTED UNTIL THREAD RUN-OUT LOCKS INTO PARENT METAL



**IMPORTANT :- THIS STUD FITTING PROCEDURE IS TO BE USED IN LIEU OF STATED TORQUE VALUES ON EXISTING ARRANGEMENTS. NEW ARRANGEMENTS WILL SPECIFY TD183/1 FROM THE DATE OF ISSUE.**

**SPECIAL STUDS - FITTED INTO MACHINED PARALLEL COUNTERBORE**

STUDS TO BE INSERTED UNTIL CORRECT TORQUE VALUE IS OBTAINED - AS SHOWN ON RELEVANT ARRANGEMENT DRAWING



**THIS SPECIFICATION IS FOR STUD FITTING ONLY ; NUTS & SETSCREWS MUST BE TORQUED TO VALUE SPECIFIED**

Alteration Numbers

ISSUE A									
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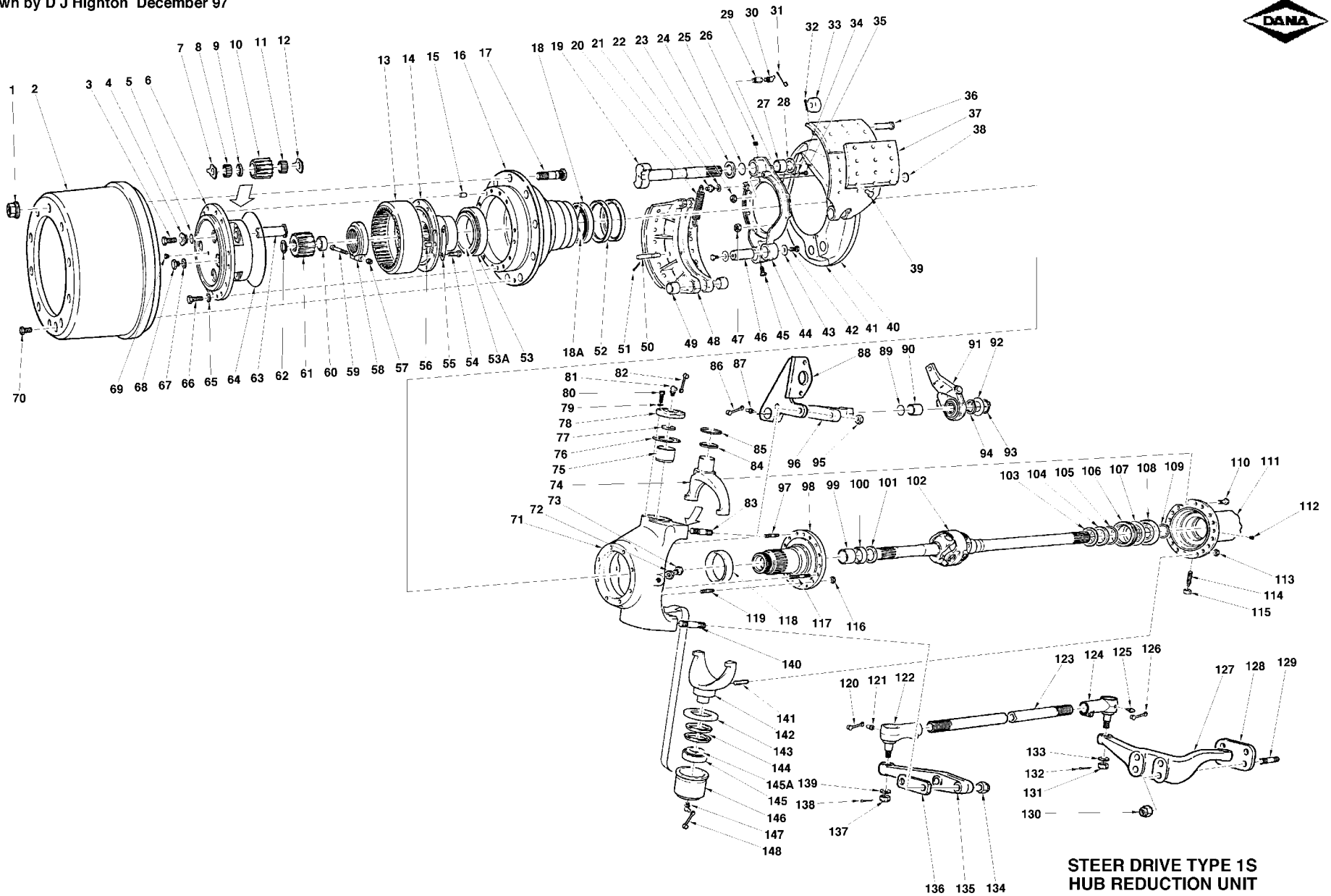
<p><b>DISTRIBUTION</b></p> <p>Front Axle B.U. Drive Axle B. U. Production</p>	<p><b>STUD FITTING PROCEDURES</b></p>	<p><b>TD183/1</b></p> <p>SHT 1 OF 1</p>
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# NOTES



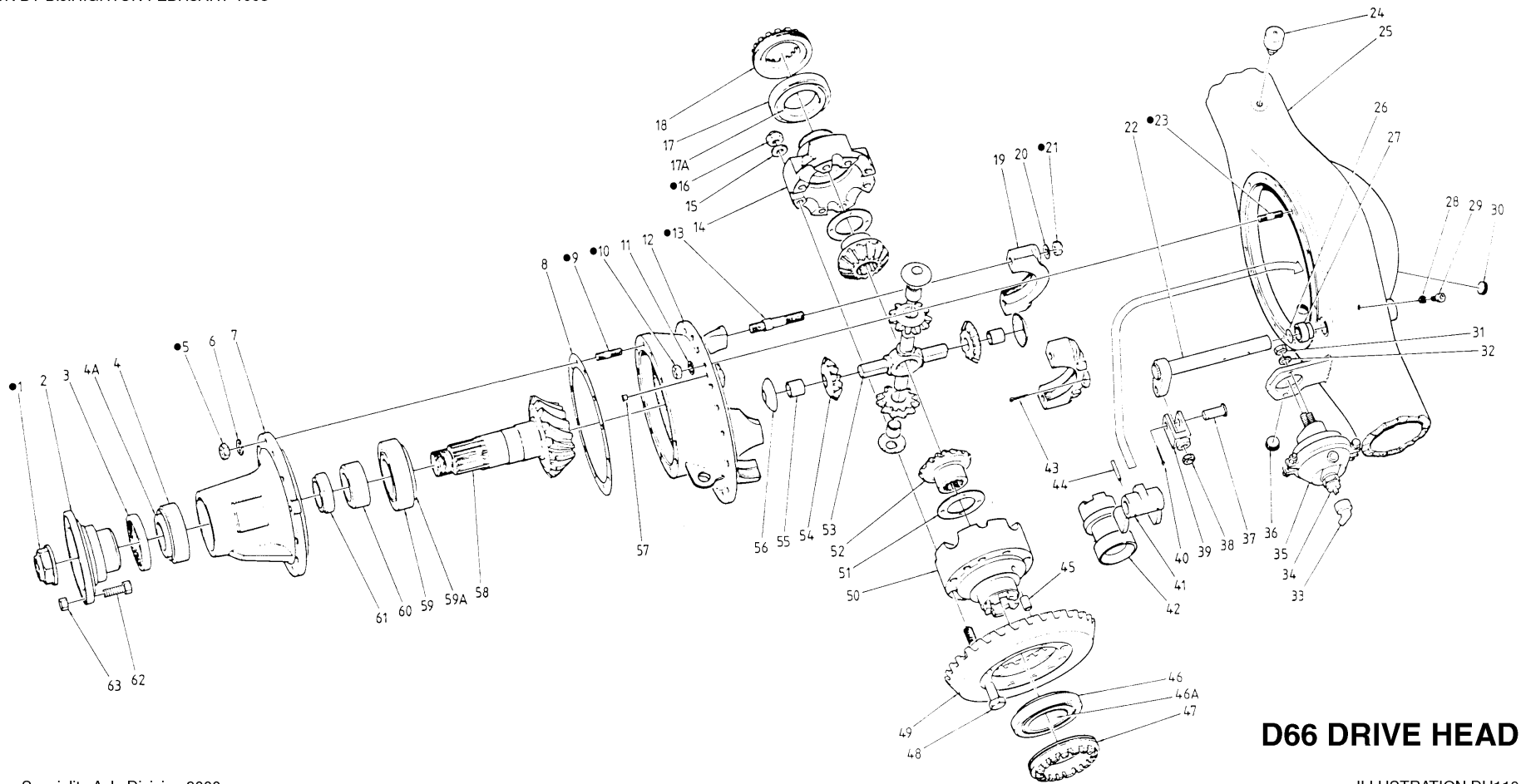
Drawn by D J Highton December 97



J-135

TM 5-2420-230-24-1

DRAWN BY D.J.HIGHTON FEBRUARY 1993



J-136

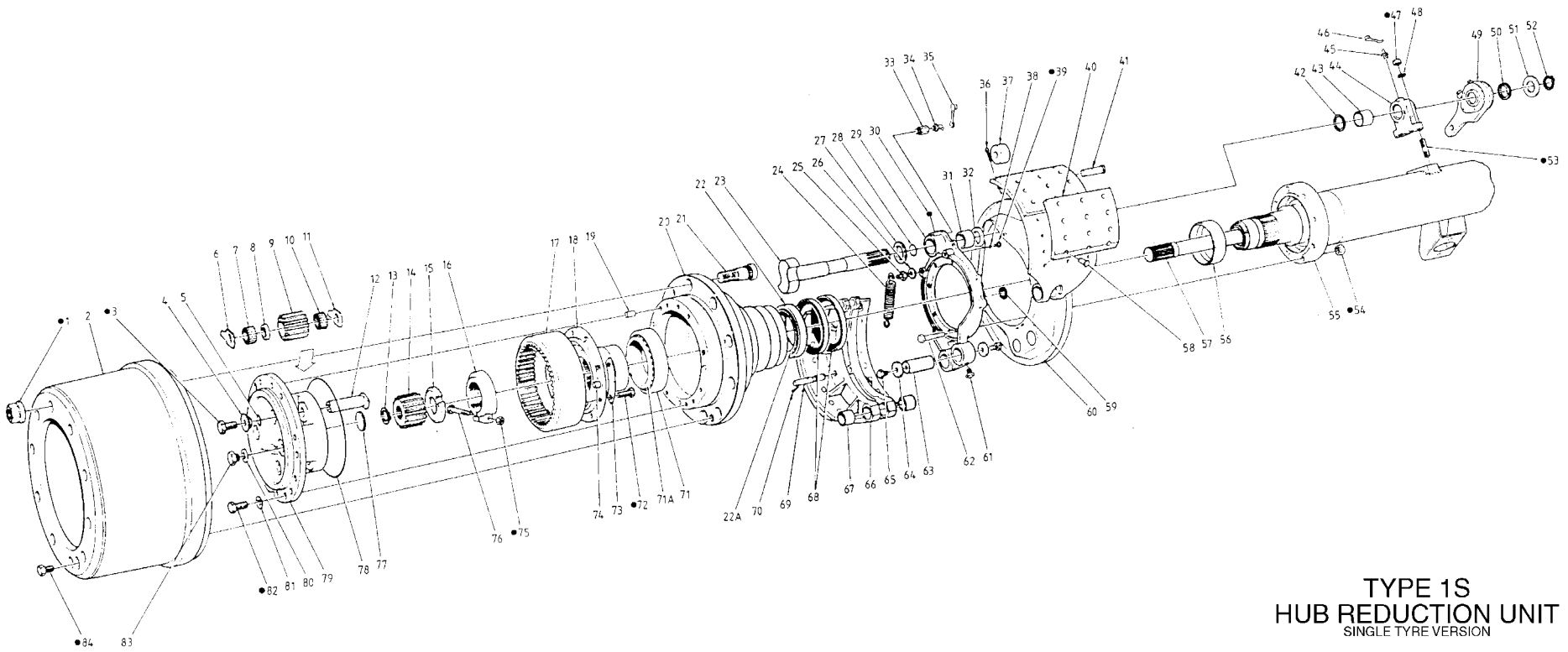
TM 5-2420-230-24-1

### D66 DRIVE HEAD

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ILLUSTRATION DH119

Drawn by D.J.Highton January 1993



**TYPE 1S**  
**HUB REDUCTION UNIT**  
SINGLE TYRE VERSION

ILLUSTRATION N° H82

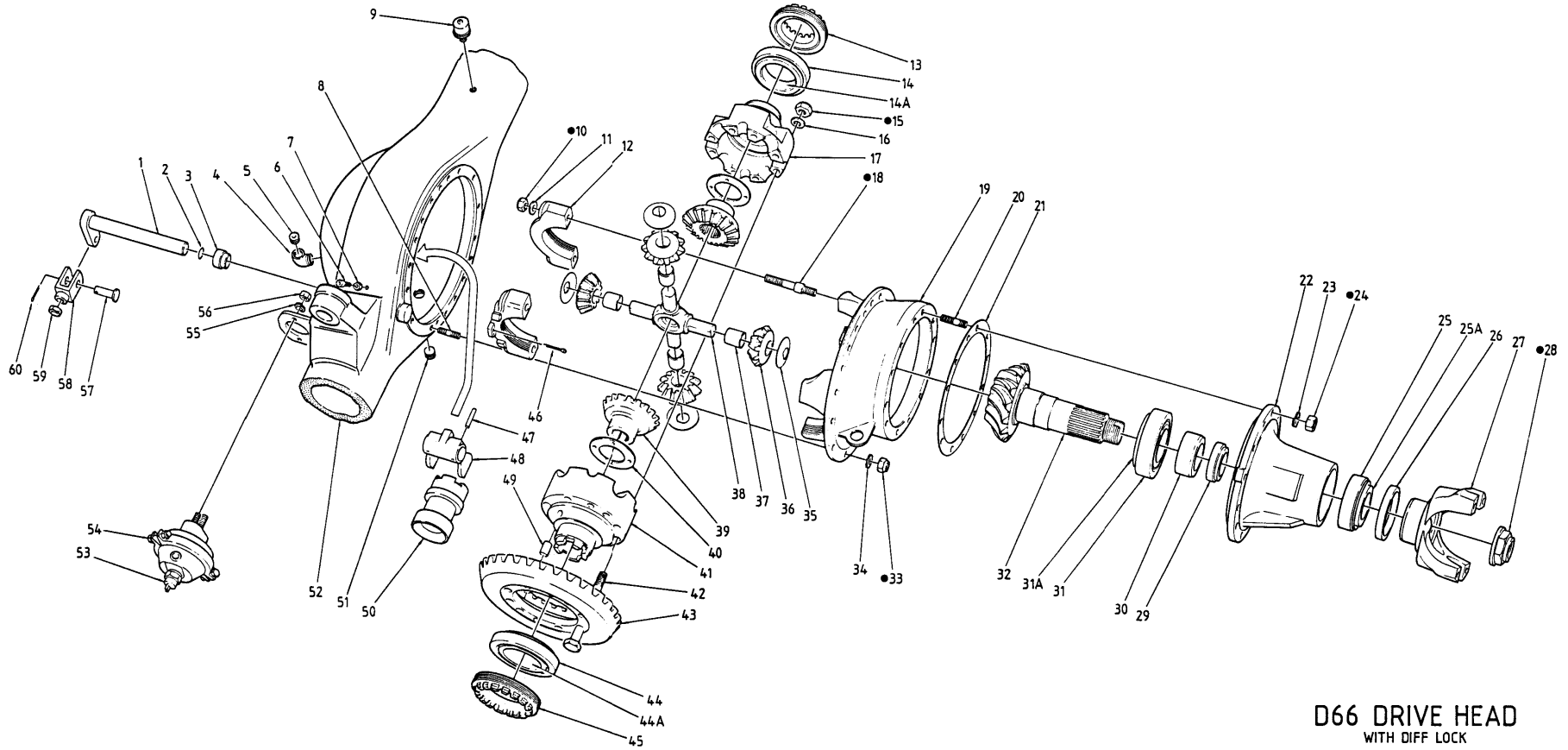
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J-137

TM 5-2420-230-24-1

Drawn by D J Highton June '93

Annotations relevant to Tightening Torque Table ●



D66 DRIVE HEAD WITH DIFF LOCK

Illustration No DH122

## APPENDIX K

### Power Steering Service Manual

Contents	Para	Page
Scope.....	K-1	K-1
General.....	K-2	K-1
Bleeding Single Gear System.....	K-3	K-2
Axle Stop Adjustment.....	K-4	K-3
Pitman Arm Replacement.....	K-5	K-3
Final Adjustments.....	K-6	K-4
Power Steering Pressure and Flow Testing.....	K-7	K-4.1

#### Section I. U.S. Army Supplement to Sheppard Material.

**K-1. SCOPE.**

This appendix contains information for servicing the power steering system. Section I contains U.S. Army supplemental information to the vendor manual. The supplemental information includes initial setup task boxes for all maintenance tasks covered in the vendor manual that apply to the IHMEE. The supplemental information also includes individual task headings and page references to aid in locating the tasks in the vendor manual.

Section II contains the manufacturer’s technical manual. This manual is unedited and covers multiple models of Sheppard power steering gear boxes. This manual also contains parts information for Sheppard power steering gear boxes. Refer to Para K-2 for details on how to use this material.

**K-2. GENERAL.**

To perform a task covered in this appendix, refer to the task box for initial setup information as you would with a normal maintenance procedure. The individual task headings have page references to aid in locating the tasks in the vendor manual. Most pages will also include two different page numbers. The appendix page number will have the appendix letter and a page number like the one at the bottom of this page. This page number will be used in all references made in Section I. The other page number is the vendor material page numbering. It will be used for any references made within the vendor material.

The IHMEE uses the Sheppard M110PED1 power steering gear box. All information in Section II that does not pertain to the M110PED1 and all parts information should be ignored. Refer to TM 5-2420-230-24P for parts information.

**K-3. BLEEDING SINGLE GEAR SYSTEM.**

This Task Covers:

- a. Bleeding
- b. Follow-On Maintenance

**INITIAL SETUP**

<i>Test Equipment</i> None	<i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10	<i>Condition Description</i> Vehicle positioned on level ground.
<i>Tools and Special Tools</i> Pan, drain, Item 29, Appendix B Tool kit, general mechanics, Item 38, Appendix B	TM 5-2420-230-10 TM 5-2420-230-10 TM 5-2420-230-10	Parking brake applied. Engine shut OFF. Electrical master switch OFF.
<i>Materials/Parts</i> Cloth, lint-free, Item 10, Appendix C Dexron III, Item 27, Appendix C	TM 5-2420-230-10	“Do Not Operate” tag attached to ignition switch.
<i>Personnel Required</i> MOS 62B, Construction Equipment Repairer	<i>Drawings Required</i> TM 5-2420-230-24P	Figure 111
<i>References</i> None	<i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B	

**a. Bleeding.**

**WARNING**

Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

Refer to page K-43 for bleeding procedure.

**b. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**K-4. AXLE STOP ADJUSTMENT.**

This Task Covers:

- a. Adjustment
- b. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> TM 5-2420-230-10</p>	<p><i>Condition Description</i> Vehicle positioned on level ground.</p>
<p><i>Tools and Special Tools</i> Tool kit, general mechanics, Item 38, Appendix B</p>	<p>TM 5-2420-230-10</p>	<p>Parking brake applied.</p>
<p><i>Materials/Parts</i> None</p>	<p>TM 5-2420-230-10</p>	<p>Engine shut OFF.</p>
<p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer (2)</p>	<p><i>Drawings Required</i> None</p>	<p>Electrical master switch OFF. “Do Not Operate” tag attached to ignition switch.</p>
<p><i>References</i> None</p>	<p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>	

**a. Adjustment.**

Refer to page K-47 for adjustment.

**b. Follow-On Maintenance.**

Remove “Do Not Operate” tag from ignition switch (TM 5-2420-230-10).

**END OF TASK**

**K-5. PITMAN ARM REPLACEMENT.**

This Task Covers:

- a. Removal
- b. Installation
- c. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i> None</p>	<p><i>References</i> None</p>
<p><i>Tools and Special Tools</i> Puller, pitman arm, Item 31, Appendix B Tool kit, common no. 2, Item 36, Appendix B Tool kit, general mechanics, Item 38, Appendix B</p>	<p><i>Equipment Conditions</i> <i>TM or Para</i> Para 5-15</p> <p><i>Condition Description</i> Drag link removed.</p>
<p><i>Materials/Parts</i> Compound, anti-seize, Item 12, Appendix C Grease, automotive, artillery, Item 30, Appendix C Retaining kit, Item 185.1, Appendix D</p>	<p><i>Drawings Required</i> TM 5-2420-230-24P Figure 109</p> <p><i>Estimated Time to Complete Task</i> Refer to MAC in Appendix B</p>
<p><i>Personnel Required</i> MOS 62B, Construction Equipment Repairer</p>	

**a. Removal.**

Refer to page K-58 for removal.

**b. Installation.**

Refer to page K-60 for installation.

**c. Follow-On Maintenance.**

Install drag link (Para 5-15).

**END OF TASK**

**K-6. FINAL ADJUSTMENTS.**

This Task Covers:

- a. Adjustment

**INITIAL SETUP**

*Test Equipment*  
None

*References*  
None

*Tools and Special Tools*  
Tool kit, common no. 2 Item 36, Appendix B  
Tool kit, general mechanics, Item 38, Appendix B

*Equipment Conditions*  
*TM or Para*      *Condition Description*  
Para 5-9      Power steering gear box installed.

*Materials/Parts*  
None

*Drawings Required*  
None

*Personnel Required*  
MOS 62B, Construction Equipment Repairer

*Estimated Time to Complete Task*  
Refer to MAC in Appendix B

**a. Adjustment.**

Refer to page K-108 for adjustment.

**END OF TASK**



**K-7. POWER STEERING PRESSURE AND FLOW TESTING.**

This Task Covers:

- a. Testing
- b. Follow-On Maintenance

**INITIAL SETUP**

<p><i>Test Equipment</i></p> <p>Flow meter, capable of measuring 10 gpm (39 L/min)</p> <p>Gauge, pressure, capable of measuring 0 to 3,000 psi (0 to 20 684 kPa)</p> <p><i>Tools and Special Tools</i></p> <p>Pan, drain, Item 29, Appendix B</p> <p>Tool kit, common no. 2, Item 36, Appendix B</p> <p>Tool kit, general mechanics, Item 38, Appendix B</p> <p>Tool outfit, HSTRU, Item 40.1, Appendix B</p> <p><i>Materials/Parts</i></p> <p>None</p> <p><i>Personnel Required</i></p> <p>MOS 62B, Construction Equipment Repairer (2)</p> <p><i>References</i></p> <p>None</p>	<p><i>Equipment Conditions</i></p> <p><i>TM or Para</i></p> <p>TM 5-2420-230-10</p> <p>TM 5-2420-230-10</p> <p>TM 5-2420-230-10</p> <p>TM 5-2420-230-10</p> <p>TM 5-2420-230-10</p> <p>TM 5-2420-230-24P</p> <p>TM 5-2420-230-24P</p> <p><i>Drawings Required</i></p> <p>Figure 109</p> <p>Figure 112</p> <p><i>Estimated Time to Complete</i></p> <p>Refer to MAC in Appendix B</p>	<p><i>Condition Description</i></p> <p>Vehicle positioned on level ground.</p> <p>Parking brake applied.</p> <p>Engine shut OFF.</p> <p>Electrical master switch OFF.</p> <p>“Do Not Operate” tag attached to ignition switch.</p>
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**a. Testing.**



Hydraulic fluid (Dexron III) is TOXIC. Wear protective goggles and gloves; use only in well-ventilated area; avoid contact with skin, eyes, and clothes. Skin and clothing that come in contact with hydraulic oil should be washed immediately. Saturated clothing should be removed immediately. Failure to comply may result in injury to personnel.

**NOTE**

- Ensure no 90-degree elbows or hoses with tight bends are used when connecting meters and/or gauges.
  - Ensure suitable hoses and fittings are used when connecting meters and/or gauges.
  - If you are attempting to troubleshoot power steering problems, review the flow and pressure testing portions of the “Diagnosis & Troubleshooting” material starting on page K-16.
- (1) Place drain pan beneath power steering gearbox.
  - (2) Refer to page K-19 for flow and pressure testing procedure.

**b. Follow-On Maintenance.**

- (1) Return power steering gear box and corresponding hoses are returned to proper configuration (Para 5-9).
- (2) Check for leaks and refill power steering reservoir (Para 5-5).

**END OF TASK**

## **Section II. Vendor Service Manual.**

This Section contains information for servicing the power steering system in the form of the manufacturer's technical manual which follows this page. Section I contains U.S. Army supplemental information to the vendor manual.

**sheppard**

**POWER STEERING**



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P.O. Box 877  
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Fax # 717-633-4125*

# **Service Manual**

# This Manual is Divided Into Nine Sections As Listed Below

Section I - INTRODUCTION

Section II - DIAGNOSIS & TROUBLESHOOTING

Section III - COMMON PROCEDURES

Section IV - DISASSEMBLY

Section V - REPAIR - SUB ASSEMBLIES

Section VI - REASSEMBLY

Section VII - DUAL STEERING SYSTEM

Section VIII - FINAL ADJUSTMNTS

Section IX - MISCELLANEOUS

SECTION	DESCRIPTION	PAGE
I	INTRODUCTION/SAFETY NOTICE . . . . .	3
	Oil Flow . . . . .	5
	Gear Identification . . . . .	6
	Exploded View of Steering Gear . . . . .	7
	Service Parts List . . . . .	8
	Service Parts Kits . . . . .	9
	Lubrication . . . . .	10
II	DIAGNOSIS & TROUBLESHOOTING . . . . .	11
	Glossary . . . . .	16
	Troubleshooting Guide . . . . .	17
III	COMMON PROCEDURES . . . . .	21
	Preventive Maintenance . . . . .	22
	Input Shaft Seal Replacement . . . . .	24
	Sector Shaft Seal Replacement . . . . .	30
	Bleeding Single Gear . . . . .	36
	Bleeding Dual Steering Gears . . . . .	37
	Axle Stop Adjustment . . . . .	40
	Set Relief Plungers Manual Plungers Adjustment . . . . .	42
	Set Automatic Relief Plungers . . . . .	43
	Adjust Automatic Relief Plungers . . . . .	45
	Repair Automatic Relief Plungers . . . . .	47
	Pitman Arm Removal - Tab Lock Retainer . . . . .	51
	Pitman Arm Installation - Tab Lock Retainer . . . . .	53
Input Shaft Seal Replacement (M-110P2) . . . . .	58	
IV	DISASSEMBLY . . . . .	69
V	REPAIR - SUB ASSEMBLIES . . . . .	79
	Integral Relief Valve . . . . .	79
	Output Shaft and Pinion (M-110) . . . . .	80
	Rotary Valve Seal Replacement (M-110) . . . . .	81

VI	REASSEMBLY . . . . .	85
	Cleaning and Inspection . . . . .	85
	Reassembly - Steering Gear . . . . .	86
VII	DUAL STEERING SYSTEM . . . . .	97
	Integral Slave Gear (M-Series) . . . . .	100
	Integral Slave Gear (92-Series) . . . . .	102
VIII	FINAL ADJUSTMENTS . . . . .	105
	Torque Specifications . . . . .	106
IX	MISCELLANEOUS . . . . .	107
	Troubleshooting Checklist . . . . .	107
	Order Sheet - Heavy Duty Power Steering Test Kit . . . . .	111

# INTRODUCTION

This service manual covers repair procedures for the Sheppard steering gear assembly only. The Vehicle Manufacturer's Service Manual should be used for removal and reinstallation instructions, and hydraulic supply pump specifications.

Any reference made to a brand name, special tools or item part number are made as a guide.

All information, illustrations and specifications in this manual are the latest available at the time of printing. We reserve the right to make changes without notice. If you are not certain you have the current revision of this manual or if you have questions about procedures, please call our Field Service Department at 717-633-4111 before you begin repairs.

## SAFETY NOTICE

**▲STOP!** Before you begin, please read this manual carefully. The repair procedures outlined in this manual are for repairing the Sheppard Integral Power Steering Gear. To ensure safe and reliable operation, these service and repair procedures must be followed carefully.

## ▲WARNING

This manual contains a number of safety signal words like: DANGER, WARNING, CAUTION, IMPORTANT, or NOTE. The information following a safety signal word is very important.

When you see the word **▲DANGER** it means the information will help you avoid an extreme hazard that could kill or cause a very serious injury every time.

When you see the word **▲WARNING** it means there is a hazard that is not as serious as DANGER but the hazard could cause injury or death if you do not follow the proper rules or procedures.

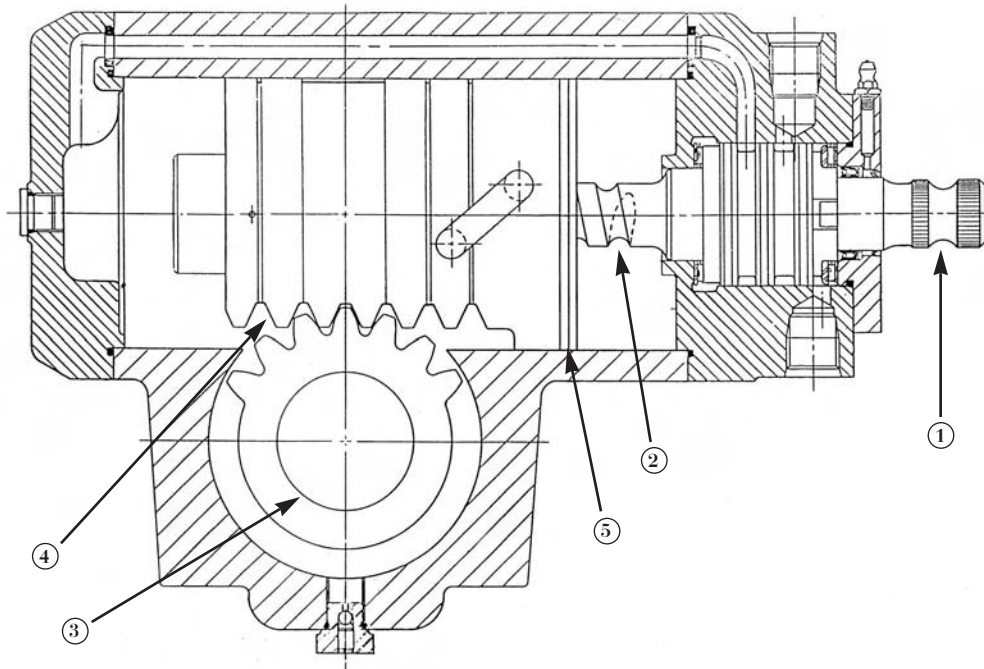
When you see the **▲CAUTION** it means the information that follows will help avoid damage to the steering gear.

The signal words IMPORTANT or NOTE are used to draw attention to ways of doing your job better or right.

## OPERATING PRINCIPLES

The Sheppard M-Series Integral Power Steering Gear provides full-time hydraulic steering. Only enough manual effort to overcome the torsion bar and turn the rotary valve is required.

The actuating shaft (1) is connected to the steering column and is centered within the rotary valve by a torsion bar. The rotary valve shaft is threaded into the piston with ball threads (2) and travels within the piston on steel balls. Circular motion on the actuating shaft causes high pressure fluid to build up on one end of the piston. This higher pressure causes the piston to move in the bore of the gear housing. The sector shaft (3) is engaged to a rack gear (4) machined into one side of the piston. Piston rack movement causes sector shaft and pitman arm rotation. When steering shaft rotation stops, the actuation valve returns to its neutral position. Relief valve plungers or adjustable stops are used in the bearing cap and cylinder head. When the plungers are adjusted properly, they will unload the hydraulic system if the wheels are in a full turn to either direction.



When the engine is running there is constant low pressure oil flow through the steering gear. This constant oil flow provides an instant response and absorbs road shock to help eliminate steering wheel kick. Pressure is equal throughout the steering gear; however, care should be used on towing or moving a vehicle where the engine or hydraulic supply pump is not running.

**NOTE:**

If sudden loss of pressure occurs during normal driving, the parts are designed to provide mechanical back-up steering so that the vehicle may be safely steered to the side of the road.

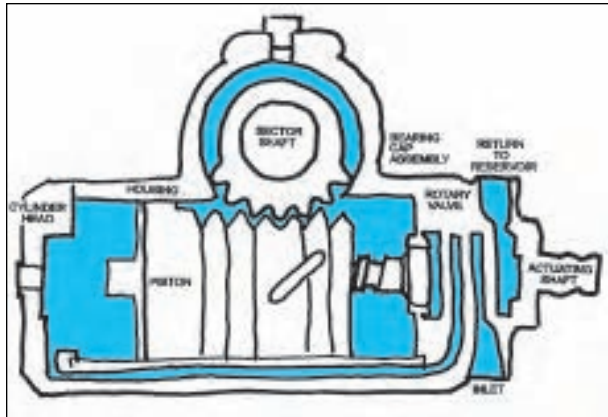
An optional integral pressure relief valve is available on the M-Series Steering Gears. This valve limits maximum steering system relief pressure at the steering gear. This reduces system temperature by avoiding high pressure by-pass and recirculation within the pump.

The Sheppard Integral Power Steering Gears have been designed to provide long service life and simple service repair. The rack and sector shaft does not require center point adjustment. The clearance between the cylinder bore and the piston is closely controlled, and piston ring (5) was added to better use the hydraulic oil supplied.

With reasonable care and limited maintenance the Sheppard M-Series Steering Gear will provide many miles of reliable performance.



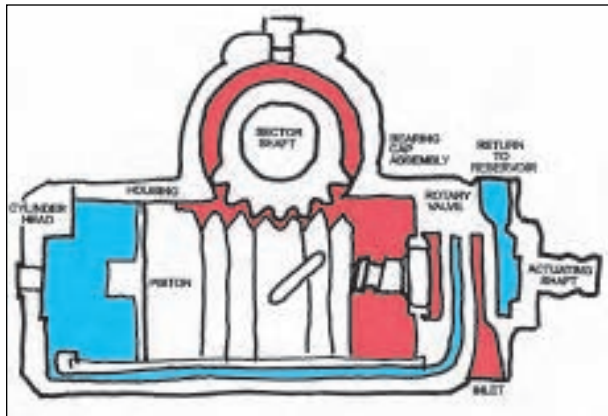
# OIL FLOW THROUGH THE M-SERIES GEAR



**Figure 1**

**Figure 1**

Here we see the steering gear in the neutral or non-steering position. Equal low pressure is being applied to both ends of the steering gear piston. The oil is circulating at back pressure only and provides a hydraulic cushion for the steering gear. All oil is being circulated through the steering gear and back to the reservoir to help cool the system.

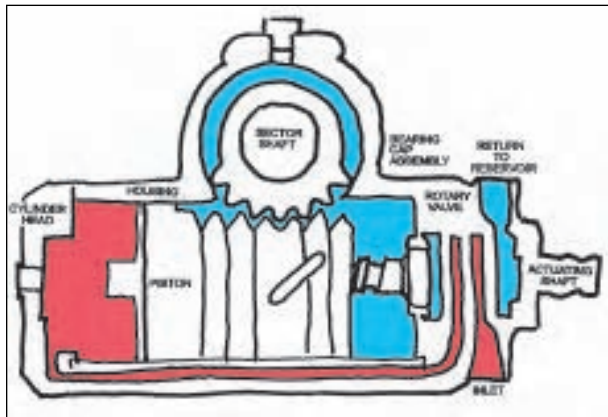


**Figure 2**

**Figure 2**

When the steering wheel is turned, the actuating valve is opened in one direction and all pressurized oil is applied to one end of the steering gear piston. This pressure build up causes the piston to move in the steering gear.

Figure shows all oil being distributed to the input end of the gear.



**Figure 3**

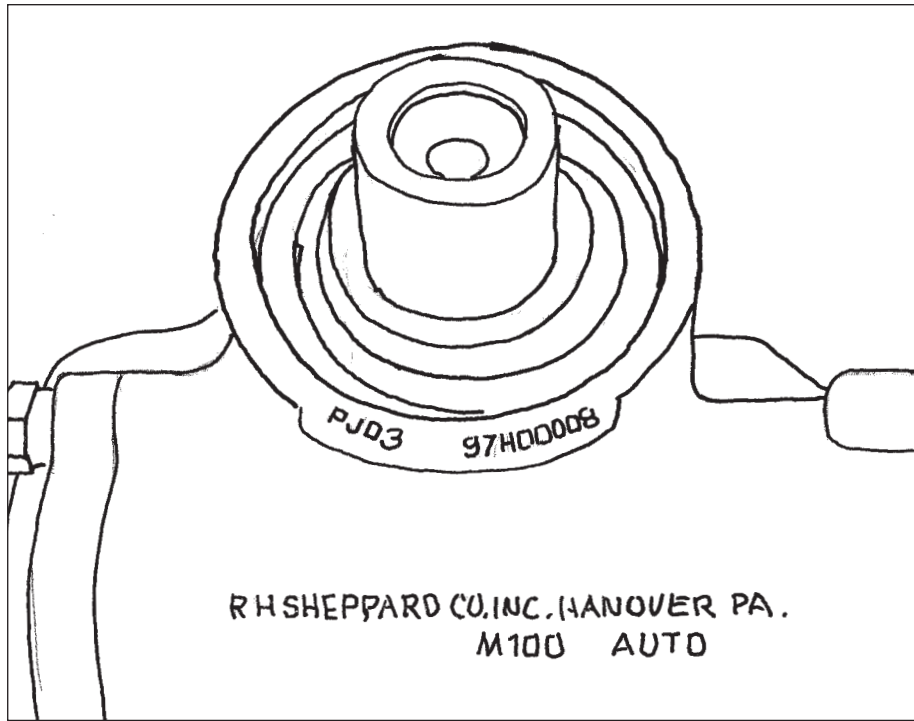
**Figure 3**

Figure shows all oil being distributed to the cylinder head end of the gear.

When no input is applied through the steering wheel the gear returns to the neutral or non-steering position.



TM 5-2420-230-24-1  
**STEERING GEAR IDENTIFICATION**

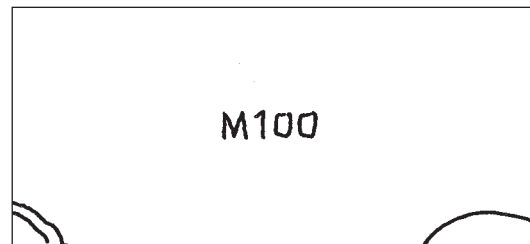
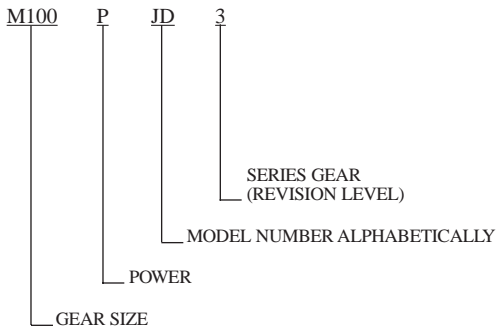


**Figure 4**

A number is cast into the steering gear housing and identifies the basic family the steering gear belongs to.

Stamped letters and numbers on an exposed machined surface of the housing (opposite the mounting side) identifies the gear specification; see gear P/N chart below. In the above example the complete identification is Model M100PAD1A1. Cast number M100 would refer to the M-Series steering gear family.

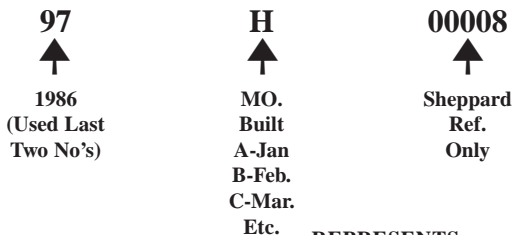
**GEAR P/N CHART**



**Figure 5**

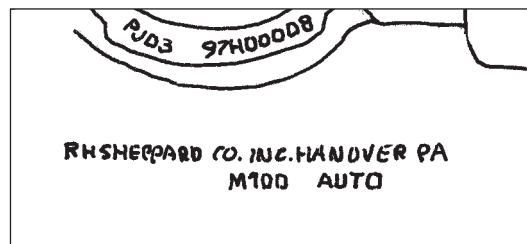
A serial number is also assigned to each steering gear and is interpreted below:

**SERIAL NUMBER SYSTEM**

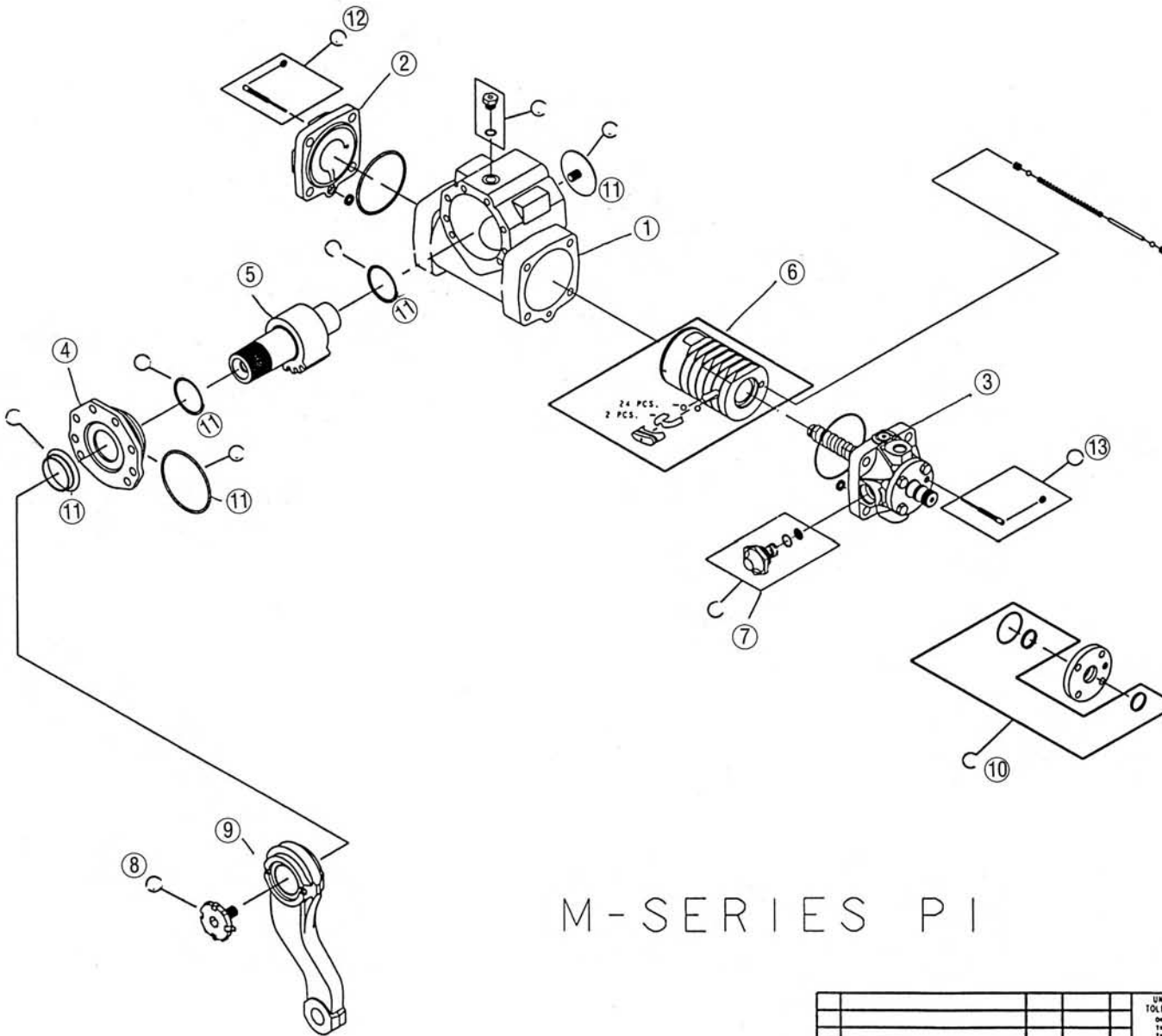


THIS SERIAL NO. IS 97H00008

**REPRESENTS:**  
 (97) YEAR BUILT - 1997  
 (H) MONTH - MARCH  
 (00008) REF. ONLY



**Figure 6**



# M-SERIES PI

- SERVICE PARTS LIST
- ① HOUSING (NOT SOLD SEPARATELY)
  - ② CYLINDER HEAD (NOT SOLD SEPARATELY)
  - ③ BEARING CAP/SHAFT ASSEMBLY
  - ④ SECTOR SHAFT COVER (NOT SOLD SEPARATELY)
  - ⑤ SECTOR SHAFT
  - ⑥ PISTON ASSEMBLY (NOT SOLD SEPARATELY)
  - ⑦ PRESSURE RELIEF CARTRIDGE
  - ⑧ PITMAN ARM RETAINER
  - ⑨ PITMAN ARM (SOLD BY APPLICATION)
  - ⑩ INPUT SHAFT SEAL KIT
  - ⑪ SECTOR SHAFT SEAL KIT
  - ⑫ CYLINDER HEAD PLUNGER KIT
  - ⑬ BEARING CAP PLUNGER KIT
  - ⑭ BLEEDER PLUG KIT

UNLESS OTHERWISE SPECIFIED TOLERANCES ON DIMENSIONS ARE:				R. H. SHEPPARD CO. INC. BANDYER, PA. U.S.A.		
ONE PLACE DEC. 0.01 0.008				NAME		
TWO PLACE DEC. 0.005 0.004				SERVICE PARTS LIST		
THREE PLACE DEC. 0.0005 0.0004				MATERIAL		
ANGLES 0.01				DATE		
P R. H. S. 10 MICRO INCHES MAX.				MODEL NO.		
LATENT		ASSEMBLY		DRAWN BY JHM		SHAFTING NO.
REFERENCE		SPL-75		CHECKED BY		7548043
NO.	CHANGE	C. N.	DATE	BY		

# **SERVICE PARTS LIST**

## **R.H. Sheppard Co., Inc.**

1. HOUSING (NOT SOLD SEPARATELY)
2. CYLINDER HEAD (NOT SOLD SEPARATELY)
3. BEARING CAP/SHAFT ASSEMBLY
4. SECTOR SHAFT COVER (NOT SOLD SEPARATELY)
5. SECTOR SHAFT
6. PISTON ASSEMBLY (NOT SOLD SEPARATELY)
7. PRESSURE RELIEF CARTRIDGE
8. PITMAN ARM RETAINER
9. PITMAN ARM (SOLD BY APPLICATION)
10. INPUT SHAFT SEAL KIT
11. SECTOR SHAFT SEAL KIT
12. CYLINDER HEAD PLUNGER KIT
13. BEARING CAP PLUNGER KIT
14. BLEEDER PLUG KIT

## **M100 COMPLETE SEAL KITS:**

**Sheppard Part No.**

5543211	Complete seal kit for all M100 steering gears with push-on dust boot on sector shaft
5542331	Complete seal kit for all M100 steering gears with a pressed-in excluder seal on the sector shaft
5543481	Complete seal kit for all M100 steering gears with a snap ring cover and a push-on dust boot at the sector shaft
5543491	Complete seal kit for all M100 steering gears with a snap ring cover and a pressed-in excluder seal on the sector shaft

## **M90 COMPLETE SEAL KIT:**

**Sheppard Part No.**

5543551	Complete seal kit for all M90 steering gears
---------	--

## **M80 COMPLETE SEAL KITS:**

**Sheppard Part No.**

5543461	Complete seal kit for all M80 steering gears
---------	--

## **M110 COMPLETE SEAL KITS:**

**Sheppard Part No.**

5541411	Complete seal kit for all M110P2 steering gears
5542621	Complete seal kit for all M110P1 steering gears

## **M-SERIES INPUT SHAFT SEAL KITS:**

**Sheppard Part No.**

5542261	Input shaft seals for all M-Series gears built from June 1991 to present.
5541351B	Input shaft seals for all M-Series gears built prior to June 1991

## **M100 SECTOR SHAFT SEAL KITS:**

**Sheppard Part No.**

5541911	Sector shaft seals for all M100 steering gears with a push-on dust boot at the sector shaft
5542271	Sector shaft seals for all M100 steering gears with a pressed-in excluder seal at the sector shaft
5543601	Sector shaft seals for all M100 steering gears with a push-on dust boot at the sector shaft and a snap ring cover
5543501	Sector shaft seals for all M100 steering gears with a pressed-in excluder seal at the sector shaft and a snap ring cover

# Lubrication - Steering Gears

## FLUID RECOMMENDATIONS

The lubricant used in the power steering system lubricates moving parts and removes heat. Too much heat reduces efficiency and increases wear. It is important to use the lubricant specified by the Vehicle Manufacturer and approved by the R. H. Sheppard Co., Inc.

R. H. Sheppard Co., Inc. approves the use of the following fluids in the M-Series steering gear:

### **R. H. Sheppard Company** **Approved Fluids for Power Steering**

Automatic Transmission Fluid Dexron II  
Automatic Transmission Fluid Type "E" or "F"  
Chevron 10W40  
Chevron Customer 10W40 Motor Oil  
Chevron Torque 5 Fluid  
Cummins Premium Blue 2000 15W40  
Drydene XHD 15W40  
Drydene MP Dexron II / Mercon ATF  
Exxon Auto H32 Hydraulic Fluid  
Fleetrite PSF (Can #990625C2)  
Ford Spec. M2C138CJ  
Mack EO-K2 Engine Oil  
Mobil 1 15W50 Motor Oil  
Mobil ATF 210  
Mobil Super 10W40 Motor Oil  
Mobil Super 15W40 Motor Oil  
Shell Rotella T30W  
Shell Rotella T SAE 30  
Texaco 10W40  
Texaco Code 1831 Power Steering Fluid 11872  
Texaco Code 1854 Mercon / Dexron III  
Union 10W40  
Union 15W40  
Unocal 46 Power Steering Fluids  
Unocal Guardol 15W40 Motor Oil  
Valvoline All-Climate 10W40 Motor Oil

## DIAGNOSIS & TROUBLESHOOTING

This section of the manual is designed to help the mechanic troubleshoot steering complaints. Used properly, this section will assist you in completing a proper and less time consuming diagnosis and repair.

You will find sub-sections covering diagnosis, troubleshooting, definitions and terms for complaints. To properly repair the problem you must have a clear understanding of the driver's complaint. The Glossary of Terms and Definitions will help pin point the problem quickly.

Locate the complaint in the troubleshooting section and complete all the necessary tests as outlined in the proper section of this manual. Complete the troubleshooting checklist and record your findings.

If, after completing the diagnosis and repairs found in the Diagnosis and Troubleshooting section of this manual, you are unsure of your findings, contact the Field Service Department of the R. H. Sheppard Co., Inc. at 717-633-4111. When contacting the R. H. Sheppard Co. with a problem be sure to have your completed troubleshooting checklist available.

Do not remove the gear until you have completed all procedures to solve your problems. Remember the steering gear is only one part of a total steering system. Many factors outside the steering gear will affect steering performance.

# DIAGNOSIS AND TROUBLESHOOTING

## IMPORTANT:

### Do Not Remove The Steering Gear From The Vehicle

To properly diagnose steering complaints it is important to understand the complete steering system. Many factors outside of the steering system will affect steering performance. Factors such as misalignment, looseness in front end components, mismatched tires and dry fifth wheel, to name a few, will affect steering.

A troubleshooting checklist is provided in the Miscellaneous Section of this manual. This form can be removed and photo copied. This checklist will follow the diagnosis outline below.

## GENERAL DIAGNOSIS

Many times a steering gear is removed and disassembled needlessly because an orderly diagnostic procedure is not followed.

A glossary of common terms is provided at the end of this section of the manual. This glossary is intended to help you better understand the problem.

Begin your diagnosis using the following outline as a guide.

### I. DEFINE THE COMPLAINT

- a. Talk to and question the driver - Refer to the glossary to obtain a clear understanding of what the driver is saying.
- b. Drive the vehicle - If possible have the driver show you what he is experiencing. Drive the vehicle together to duplicate the condition.

### II. PERFORM A VISUAL INSPECTION OF THE VEHICLE

- a. Check for dry fifth wheel - Lack of lubrication will tend to steer the vehicle.
- b. Check tires for mismatch, improper inflation or uneven wear patterns.
- c. Check for poor loading practices - Special body or equipment installations should be checked for their effect on steering performance.
- d. Check for suspension sagging or shifting - Out of line rear axles will tend to steer the front end of the vehicle.

### III. INSPECT MECHANICAL COMPONENTS

- a. Check all front axle components for wear, looseness or seizing.
- b. Inspect steering column for drag - more than 10 inch pounds of drag measured with the column suspended at the angle of operation is excessive.
- c. Check steering gear mounting to be sure that it is tight. A steering gear that is shifting on the frame will affect steering performance.

### IV. CHECK THE HYDRAULIC SUPPLY SYSTEM

- a. Follow the procedures as outlined in the hydraulic diagnosis section of this manual. Oil pressure and flow must be within the vehicle manufacturer's specifications.

## HYDRAULIC DIAGNOSIS

The Sheppard M-Series integral power steering gear is a reactionary part of the power steering system. By reactionary we mean that its operation is dependent on the proper supply of oil pressure and flow from the hydraulic supply pump.

When the steering wheel is turned, oil flow is applied to one end of the steering gear piston causing pressure to build. This pressure causes the piston to move. As the piston moves it is displaced by a volume of oil under pressure. The speed the piston moves is dependent on the amount of oil flow or,

**Flow** = Speed of steering.

Maximum system relief pressure limits the amount of steering gear output available to steer your specific vehicle or,

**Pressure** = The amount of work the steering gear can do.

Keeping the basic formula of “Flow = Steering Wheel Speed” and “Pressure = Work” in mind will help you diagnose steering problems.

Oil pressure and flow requirements are set during the design of the steering system. When diagnosing steering problems, oil pressure and flow must meet design specifications. Pressure and flow specifications vary. Follow the vehicle manufacturer’s recommendations.

System back pressure and operating temperature must be considered during the diagnosis of the steering system. High system back pressure will create heat.

High system oil temperatures reduce overall efficiency of the steering pump and steering gear.

Various types of pressure and flow meters are available to diagnose power steering problems. A pressure gauge rated at 3000 PSI and a flow meter with a capacity of 10 GPM are needed to check oil pressure and flow.

A shutoff valve placed downstream from the pressure gauge allows the hydraulic supply pump to be isolated from the gear to check pump relief pressure. A simple thermometer placed in the reservoir will show system temperature.

Pictured below is the Sheppard Heavy Duty Power Steering Test Kit. This is an excellent tool for troubleshooting power steering systems and can be ordered using the form in the Miscellaneous section of this manual.

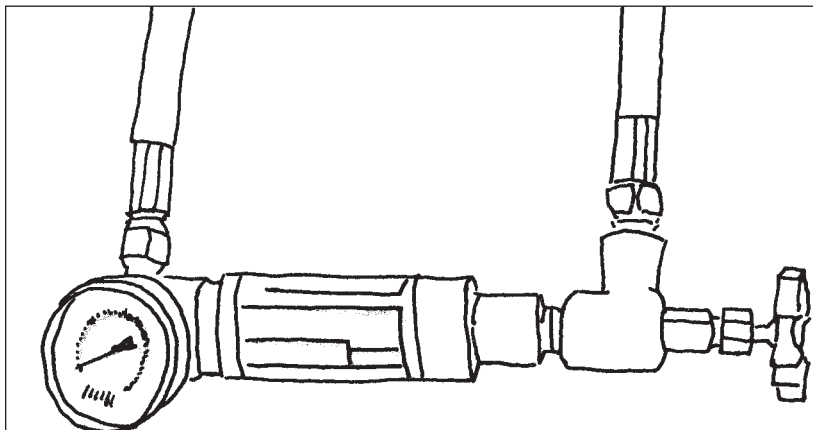


Figure 7

- \* Installs between pump and steering gear
- \* Shutoff valve isolates pump from gear
- \* Pressure and flow can be read at the same time
- \* 0-3000 P.S.I. pressure gauge
- \* 1-10 G.P.M. flow meter
- \* Complete with hoses & standard swivel fitting

Figure 7

This tester is a self contained, direct reading device to check system flow, pressure or both at the same time. It can detect worn components, check flow and pressure control settings or monitor overall system performance.

LOW COST - EASY TO USE

Only one hose connection is broken, either at the pump output or at the pressure input to the power steering gear housing.

**⚠ WARNING**  
**OIL UNDER PRESSURE CAN PENETRATE THE SKIN CAUSING SEVERE INJURY. NEVER USE YOUR HANDS TO CHECK FOR LEAKS.**

Using a pressure and flow test kit, proceed with the evaluation of the hydraulic system. Record your findings on the troubleshooting checklist.



NOTE:

All tests must be performed with the vehicle parked on a clean, dry, solid surface, with the engine running and the full weight of the vehicle on the front wheels.

1. Connect the pressure and flow tester in series with the pressure line of the pump.
2. Start the engine and check system oil level. Make sure the oil flow is in the proper direction as indicated by the arrow on the flow meter.
3. Place a thermometer in the reservoir.
4. Run the engine at idle speed. Slowly close the shutoff valve until you have a pressure reading of 1000 PSI. Maintain this pressure until system temperature reaches 150 degrees Fahrenheit. Open the shutoff valve all the way when the temperature is 150 degrees.
5. Check System Back Pressure:

Normal system back pressure will be between 0 and 100 PSI with the engine idling and the steering wheel stationary. Dual systems will normally read slightly higher. Back pressure should be checked at normal operating temperature.

6. Pump Maximum Relief Pressure:  
With the engine running at specified idle speed, slowly turn the shutoff valve until it's closed and read the pressure at which the pressure relief valve opens. (Open the shutoff valve as quickly as possible to avoid heat build-up or possible damage to the steering pump.) This pressure reading should equal the maximum pump pressure specified by the vehicle manufacturer. Check specifications.

**⚠WARNING**

**A BAD PRESSURE RELIEF VALVE MAY NOT RELIEVE PUMP PRESSURE. CLOSING THE SHUTOFF VALVE MAY CAUSE SEVERE PUMP DAMAGE OR HIGH-PRESSURE HOSES TO RUPTURE. WATCH THE PRESSURE GAUGE CLOSELY. IF PRESSURE RISES RAPIDLY OR GOES ABOVE 2500 PSI. STOP! DO NOT CLOSE THE VALVE ALL THE WAY.**

**SOME STEERING PUMPS ARE NOT EQUIPPED WITH INTEGRAL RELIEF VALVES. CLOSE THE SHUTOFF VALVE SLOWLY AND WATCH THE PRESSURE. IF SYSTEM PRESSURE GOES ABOVE 2500 PSI DO NOT CONTINUE TO CLOSE THE SHUTOFF VALVE. PUMP DAMAGE OR PERSONAL INJURY MAY RESULT.**

7. Flow Test:  
Measure oil flow under the following conditions. Record your findings on the Troubleshooting Checklist in this section.  
Flow at idle with back pressure only  
Flow at idle under a 1500 PSI load applied with the shutoff valve  
Flow at full governed RPM with back pressure only  
Flow at full governed RPM under a 1500 PSI load applied with the shutoff valve
8. Aerated Oil:  
Visually check for air mixed with the oil in the steering system. The oil should be clear. Any signs of frothing indicates air in the system and steering performance will be affected. Carefully check for leakage on the suction side of the steering pump. Drain, refill, and bleed the system. Follow the procedure for setting relief plungers in the "Common Procedures" section of this manual.  
  
Before any steering gear repairs are made, complete the hydraulic supply evaluation and make any repairs. Many times steering gears have been repaired or replaced needlessly because a hydraulic supply system evaluation has not been made.  
  
Additional references to pressure and flow testing will be made in the diagnosis charts in the "General Diagnosis" section of this manual.
9. Dry Park Pressure and Input Effort:  
Measure and record the pressure required to steer the vehicle from full left to full right while parked. Input effort is measured at the steering wheel retaining nut. Use a dial type inch pound torque wrench to check dry park steering.

**OIL FLOW AND PRESSURE RECOMMENDATIONS**

The Sheppard M-Series power steering gears are designed to operate at a maximum pressure of 2175 PSI. Each vehicle manufacturer specifies the maximum operating pressure at which their various steering installations are to be operated. Always refer to you Vehicle Manufacturer’s specifications for the correct pump relief settings for the vehicle you are working on.

**⚠️ WARNING**

**DO NOT INCREASE THE MAXIMUM OPERATING PRESSURE WITHOUT CONSULTING THE VEHICLE MANUFACTURER OR SERIOUS DAMAGES MAY OCCUR.**

Oil flow and pressure for the Sheppard M-Series steering gears are outlined below by model number. Refer to the gear identification section of this manual to determine the model of steering gear you are working on. Oil flow requirements remain the same for all similar models and do not change from installation to installation. Follow the Vehicle Manufacturer’s recommendation.

	<b>M-SERIES STEERING GEARS</b>			
	<b>M80PI</b>	<b>M90PI</b>	<b>M100PI</b>	<b>M110P1+P2</b>
RATED PRESSURE	2175 PSI	2175 PSI	2175 PSI	2175 PSI
MIN. PUMP FLOW (SINGLE)	2.1 GPM	2.5 GPM	3.0 GPM	3.5 GPM
PUMP FLOW RANGE (SINGLE)	2.1 -6.0 GPM	2.5-6.0 GPM	3.0-6.0 GPM	3.5-6.0GPM
PUMP FLOW RANGE (DUAL SYSTEM)	N/A	4.6-6.0 GPM	5.1-6.0 GPM	5.6-6.0 GPM
RATIO	16.8-1	18.9-1	18.9-1	23-1
OUTPUT SHAFT DIAMETER	1.75 IN.	2.0 IN.	2.0 IN.	2.25 IN.

Before any steering gear repairs are made complete the entire troubleshooting checklist provided in this manual. Many times steering gears are removed or replaced needlessly. Remember, once the steering gear is removed there is only one thing that can be determined - its weight!!!

If you have completed the troubleshooting checklist and are unsure of your diagnosis, contact your Vehicle Manufacturer representative, or the Field Service Department of the R. H. Sheppard Co., Inc. at 717-633-4111.

# GLOSSARY

1. Actuating Valve - Internal valve in the bearing cap of the steering gear. It is actuated by the steering wheel through the yoke connection of the steering column.
2. Back Pressure - Circulating pressure of the steering system.
3. Base Mounted Gear - The steering gear is mounted to the frame rail or bracket utilizing the eight mounting holes opposite the sector shaft cover.
4. Bearing Cap - End cap of the steering gear that houses the input shaft and valve.
5. Bearing Cap Cover - Small cover on the end of the bearing cap of the steering gear. The bearing cap cover houses the input shaft oil and salt seal.
6. Bleeder Screw - 1/8" allen screw located in the sector shaft bore of the steering gear.
7. Cavitation - Bubbles that form in the oil which keep the pump from supplying pressure and volume.
8. Contamination - Dirt or other foreign material in a fluid.
9. Cylinder Bore - Long bore of the steering gear where the steering gear piston is housed.
10. Cylinder Head - The end cap of the steering gear bolted on the housing opposite the actuating shaft end of the gear.
11. Displacement - The volume of fluid that can pass through a pump or cylinder in a single revolution or stroke.
12. Feedback - A transfer of energy from the output of a device to its input.
13. Fluid Flow - The stream or movement of a fluid, or the rate of its movement.
14. Piston - Found in the cylinder bore. Changes the hydraulic force to mechanical force in the steering gear.
15. Plunger - Slotted pins that are used to limit the travel of the steering gear piston under pressure. Plungers are located in the cylinder head and bearing cap.
16. Pressure Relief Valve - Optional pressure relief valve integral to the steering gear to limit system operating pressure. Identified by a large hex nut on the side of the bearing cap.
17. Pump - A device that converts mechanical force and motion into hydraulic fluid power.
18. Rack Teeth - The area on the piston that engages the sector shaft teeth.
19. Recirculating Ball Thread - The area of the rotary valve on which the 24 steel balls travel.
20. Relief Valve - A pressure control valve used to limit system pressure.
21. Sector Shaft - The shaft the pitman arm is attached to.
22. Sector Shaft Bore - Area of the steering gear that houses the sector shaft.
23. Slave Gear - Right hand gear in a dual system application.
24. Slave Ports - Threaded openings in the cylinder head, bearing cap and sector shaft bore to install the pressure lines to operate the slave gear.
25. Tab - Lock Retainer - Bolt assembly used to provide initial torque when installing the pitman arm. Uses alignment tabs that fit into the pitman arm and restraining tabs to be locked into the head of the retainer.
26. Volume Of Flow - The amount of fluid that passes a certain point in a unit of time. The volume of flow is usually expressed in gallons per minute for liquids.

## TROUBLESHOOTING GUIDE

This section is designed to give you causes and possible remedies for the most common problems. Three (3) columns which give you the Symptom, Possible Cause and Remedy are listed.

Symptom	Possible cause	Remedy
<b>Oil leaking at output shaft of steering gear.</b>	Damaged sector shaft seal	Replace sector shaft seal
<b>Oil leaking at actuating shaft of steering gear</b>	Worn or damaged oil seal	Replace actuating shaft seal
<b>Oil leaking at supply pump drive shaft</b>	Damaged oil seal Oil seal heat damaged Loose or damaged bushing on pump drive shaft	Replace oil seal Check operating temperature Repair pump per pump service instruction
<b>Lubricant milky or white in appearance</b>	Water entry through reservoir venting system	Clean vent system or replace cap assembly
<b>Oil forced out of reservoir or foaming</b>	Clogged oil filter	Change oil and oil filter Change more often
	Air in system	Bleed air from system Check for air leak on suction side of supply pump
	Relief plungers of steering gear not adjusted properly creating high operating temperatures	Adjust relief plungers (See Common Procedures)
	Air leak in suction side of supply pump	Refer to pump servicing instructions
	Pump cavitating	Check for restriction in pump supply
	Oil overheating	Check for restriction in steering gear return
<b>Engine oil in power steering reservoir (Gear driven pump)</b>	Faulty seal at pump drive shaft	Repair pump
	Faulty seal at accessory shaft driving supply pump	Repair accessory drive
<b>Lubrication oil discolored</b>	Operating temperatures too high	Check and correct cause of overheating
	Change intervals too long Incorrect lubricant used	Change oil more often Drain, flush and refill with recommended fluid
<b>High operating temperatures</b>	Oil flow restriction	Check back pressure
	Oil flow too high	Check maximum oil flow

Symptom	Possible cause	Remedy
<b>No power steering on cold starting</b>	Hydraulic supply pump vanes not extending (Vane type pump only)	Increase engine speed momentarily to extend vanes and start pump action. Usually does not happen often and does not last long. Not a cause for pump repair or replacement.
<b>Excessive pump pressure with steering gear in neutral position.</b>	Pinched oil return line High back pressure	Relocate line
	Binding steering column	Repair steering column
<b>Wheel cuts restricted</b>	Relief plungers not adjusted properly	Adjust relief plungers
<b>Erratic steering or mechanical steering only</b>	Insufficient volume of oil	Refer to pump servicing instructions
	Sticking pressure relief valve in steering gear	Repair or replace relief valve as required
<b>Hard Steering</b>	Loose pump drive belts	Tighten or replace belts
	Faulty supply pump	Check pump flow
	Steering out of alignment	Align front end
	High operating temperature	Locate and correct cause of overheating
<b>Wheel turns hard in one or both directions</b>	Dirt or foreign matter trapped in piston relief	Check piston relief
	Bent or damaged king pins and tie rods	Repair or replace king pins and tie rods Refer to servicing instructions
	Front end load too great	Lighten load
	Low oil level in steering system	Fill oil reservoir as required
	Air in system	Bleed system and check for cause of air
	Caster degree incorrect	Correct to specifications
<b>Wheel turns hard in one direction</b>	Metal or foreign material in relief ball seat in piston of steering gear	Remove and clean relief valve seats or replace damaged parts
<b>No attempt to return straight ahead from turns (should also be hard steering complaint)</b>	No positive caster	Set caster to 3° to 5° positive caster
	Steering column bind	Check and repair U-joints and support bearings

Symptom	Possible cause	Remedy
<b>Darting, wandering (oversteering)</b>	Steering gear mounting distorted	Shim mounting pads to correct piston to bore interference. Make sure correct bolt length is used on the base mount gears.
	Linkage ball sockets seized or binding	Check and repair or replace
	King pins seized or binding	Repair or replace
	Oil flow rate incorrect	Check and correct supply pump
	Oil flow too high	Supply pump not to specifications
	Air trapped in steering gear	Bleed system
	Looseness, worn front end parts	Check and repair as required
	Front end alignment not correct	Align front end caster
	Overloading	Reduce loads
	Rear axle not parallel	Check & repair as required
<b>Excessive backlash/freeplay</b>	Tight tie rod ends & drag link sockets	Check rotational torque & replace if necessary
	Worn universal joint	Replace universal joint
	Pitman arm ball worn "egg-shaped" (if equipped)	Replace pitman arm assembly where riveted ball is used.
	Loose bracket (frame to bracket or bracket to gear)	Remove bracket, clean frame and bracket. Check radius of frame making sure bracket is not bearing on radius surface. Check bracket for wear from being loose. Replace bracket and tighten to recommended torque rating by size and grade of bolts. If necessary, replace bracket.
	Rack on piston damaged	Replace steering gear
	Damaged sector shaft/splines	Replace steering gear
	Worn or damaged pitman arm splines	Replace pitman arm and/or sector shaft
Universal joint yoke loose on actuating shaft	Repair or replace damaged parts.	

Symptom	Possible cause	Remedy
Steering input not smooth	Worn universal joint	Check and replace as required
	Lack of lubrication	Lubricate per vehicle manufacturer's recommendations
	Universal joints not phased properly	Re-phase columns*
	Low oil flow	Idle speed too slow Drive belts slipping Supply pump not to specifications
	Pump cavitating	Correct pump supply
	Overheating	Correct cause of overheating

**NOTE: Universal Joints**

Universal joints are designed to operate best when the angle between the drive and driven shaft is a maximum of 20 to 25 degrees. Angles greater than this may upset steering performance.

**IMPORTANT:**

Actuating shaft thread wear generally comes from improper lubrication or excessive manual steering. Manual steering results from low pump pressure or flow or an overloaded front axle.

\*To check phasing of the universal joints in the steering column, use an inch-pound graduated dial type torque wrench. With a socket on the steering wheel retaining nut, read the difference in the torque while steering from lock-to-lock. Variation of more than 15 in.-lb. means improper phasing. Take the reading with the vehicle stationary and the engine running at idle.

Phasing can usually be corrected by rotating the two-piece intermediate shaft one spline at a time until the torque reading remains the same throughout the 360 degree rotation of the steering wheel.

## Common Procedures

This section of the service manual covers repairs that do not require removal of the power steering gear. Before you attempt repairs, read the procedure and make sure you have all the parts, tools and information needed to finish the job. Always refer to the Vehicle Manufacturer's Service Manual and any service bulletins covering the vehicle you are working on.

Read all the safety warnings. These warnings have information critical to the safe operation of the steering gear and the vehicle.

Additionally, you will find notes, cautions and items marked "Important". These items give information to ensure that you are following proper procedures. They are designed to keep repair times to a minimum and assure a quality repair.

If problems arise during repair or you are unsure of a procedure, call the Field Service Department of the R. H. Sheppard Co. at 717-633-4111 for assistance.

### **WARNING**

**REPAIRS TO HEAVY DUTY POWER STEERING SYSTEMS  
MUST BE MADE BY HIGHLY TRAINED PROFESSIONAL  
MECHANICS.**

**FAILURE TO FOLLOW SAFETY PROCEDURES COULD  
RESULT IN LOSS OF STEERING, ACCIDENT DAMAGE OR  
PERSONAL INJURY.**



## PREVENTIVE MAINTENANCE

Fluid and filter change is necessary to keep the fluid in the system clean. The use of high quality fluids and filters will insure the removal of contaminants and dissipation of heat.

### TOOLS REQUIRED:

Drain pan  
 Filter wrench (if equipped with spin-on filter)  
 Shop towels  
 10" adjustable wrench  
 Hydraulic jack of a suitable size  
 Screwdriver

### WARNING

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING. CLEAN UP ALL OIL SPILLS TO AVOID SLIPS AND FALLS.**

### PARTS REQUIRED:

Specified steering fluid  
 Specified filter

### WARNING

**NEVER USE OLD OR USED SEALS, COTTER PINS, RETAINERS OR CRITICAL FASTENERS. ALWAYS BUY A NEW SEAL KIT. USE ONLY MANUFACTURER APPROVED REPLACEMENT PARTS.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual  
 R. H. Sheppard Co., Inc. Maintenance and Troubleshooting Video

### PROCEDURE:

1. Park the vehicle on a clean, dry, solid surface. Set the parking brake, block the rear wheels and place the transmission in neutral.
2. Raise the front end of the vehicle until the tires have cleared the surface, using the hydraulic jack.
3. Tilt the hood or raise the cab using the procedure in the Vehicle Manufacturer's Service Manual.
4. Place the drain pan under the steering gear to catch the fluid.
5. Remove the pressure and return lines from the steering gear to drain fluid.
6. Wipe off the area around the reservoir cap with a clean towel. Remove the bolt from canister type reservoirs. Remove the cover.
7. Remove the filter from the canister and discard. If a spin-on filter is used, remove the filter using the filter wrench and discard.

#### IMPORTANT:

Discard only the filter element. The other parts may be used to retain the filter in the reservoir assembly.

8. Wipe the inside of the reservoir canister clean with a clean shop towel.
9. With the hoses disconnected, slowly turn the steering wheel from full left to full right three or more times to purge oil from the steering gear. Make sure the drain pan will catch the oil from the steering gear.
10. Attach the pressure and return lines to the steering gear and tighten.
11. Install a new filter element in the reservoir. Follow the directions on the filter element and refer to the Vehicle Manufacturer's Service Manual.

12. Clean the reservoir cap with an approved solvent. Remove the old gasket from the cap and replace it with a new gasket. For vehicles with a spin-on filter element, replace the filter using procedures in the Vehicle Manufacturer's Service Manual.
13. Fill the reservoir with new steering fluid to within 1" of the top of the reservoir canister. Install the reservoir cover and tighten the bolt to the Vehicle Manufacturer's specification.
14. Start the vehicle and allow it to idle.

## CAUTION

**Do not allow the reservoir to empty during start up. Pump damage may result.**

15. Check the fluid level and fill as needed.
16. Steer the vehicle from full left to full right several times and check the fluid level again. Add fluid as needed.
17. Visually check all fittings and hoses for external leaks.

## WARNING

**DO NOT CHECK FOR LEAKS BY HAND, HYDRAULIC OIL UNDER PRESSURE CAN PENETRATE THE SKIN AND CAUSE SEVERE INJURY.**

18. Shut the vehicle off. Remove the drain pan, lower the vehicle until the tires contact the surface and remove the jack.
19. Lower the cab or hood using the procedures in the Vehicle Manufacturer's Manual.

### NOTE:

A note on mixing oils and additives: Chemicals tend to react with one another. Some interactions are of no consequence, others are beneficial, while still others may cause some degradation in the service capability. It is not recommended to mix products which are intended for different service applications; for instance, a transmission and a gear oil.

Since the original lubricant manufacturer puts a lot of time and expense into ensuring that their oil will meet the required qualifications, it is not a good idea to introduce additional chemicals which may upset the delicate and critical balance originally obtained. This means that supplemental additives are not needed and normally are not desired in a fully compounded and qualified lubricant.

## Input Shaft Seal Replacement (Current Production from July 1991)

**IMPORTANT:**  
Do not remove the steering gear for this repair.

### TOOLS REQUIRED:

15 or 16mm socket & ratchet  
Drain pan  
5/8" & 11/16" combination wrenches  
0-150 ft./lb. torque wrench (minimum)  
Screw driver  
1" Socket & short extension (1/2" drive)  
Small hammer

### **⚠ WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

### PARTS REQUIRED:

5542261 Input Shaft Seal Kit  
Specified fluid

### **⚠ WARNING**

**NEVER USE OLD OR USED SEALS, COTTER PINS, RETAINERS OR CRITICAL FASTENERS. ALWAYS BUY A NEW SEAL KIT. USE ONLY MANUFACTURER APPROVED REPLACEMENT PARTS.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual  
R. H. Sheppard Co. Maintenance & Troubleshooting Video (Optional)

### PROCEDURE - Disassembly:

#### NOTE:

Removal of the power steering gear **is not** necessary to complete this repair.

1. Park the vehicle on a clean, dry, solid surface, preferably concrete. Set the parking brake and block the wheels. Place the transmission in neutral.
2. Tilt the hood or cab using the procedure in the Vehicle Manufacturer's Service Manual.
3. Loosen and remove the pinch bolt on the lower end yoke of the steering shaft.
4. Remove the lower yoke from the steering gear input shaft. If necessary, secure the shaft so it will not be in the way.

#### IMPORTANT:

Do not pull the slip shaft out of the steering shaft. This would require rephasing at time of installation.

5. Place the drain pan under the power steering gear. Draining the system is not necessary, but some fluid will be lost.

## ⚠ CAUTION

Before going any further, make sure the power steering gear you are working on was built after July 1990.

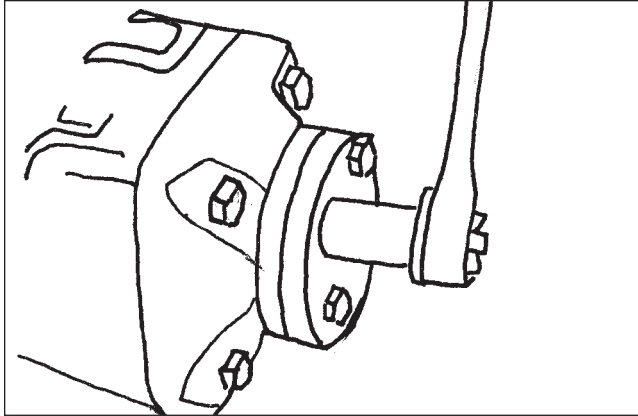


Figure 8

6. Using the ratchet and 15 or 16mm socket, loosen and remove the 4 bearing cap cover bolts and remove the cover (Figure 8).

## ⚠ WARNING

DO NOT TURN THE INPUT SHAFT DURING REPAIRS. TURNING THE SHAFT OR MIXING COMPONENTS WILL CAUSE DAMAGE TO THE BEARING CAP AND ACTUATING SHAFT ASSEMBLY.

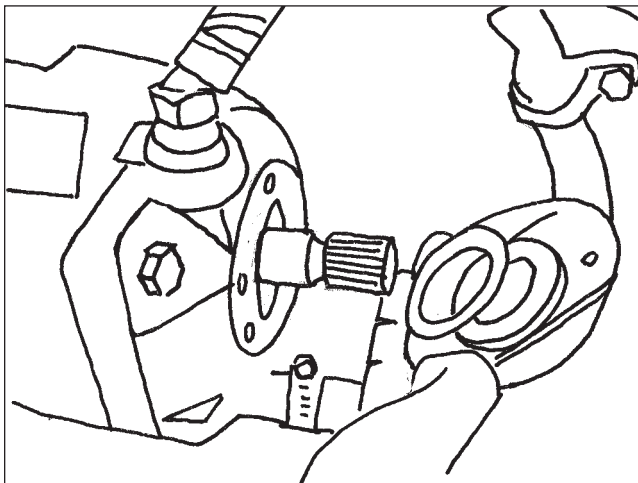


Figure 9

## ⚠ CAUTION

The thrust washer may stick to the bearing cap cover. If this happens, re-install the thrust washer in the steering gear (Figure 9 and Figure 10).

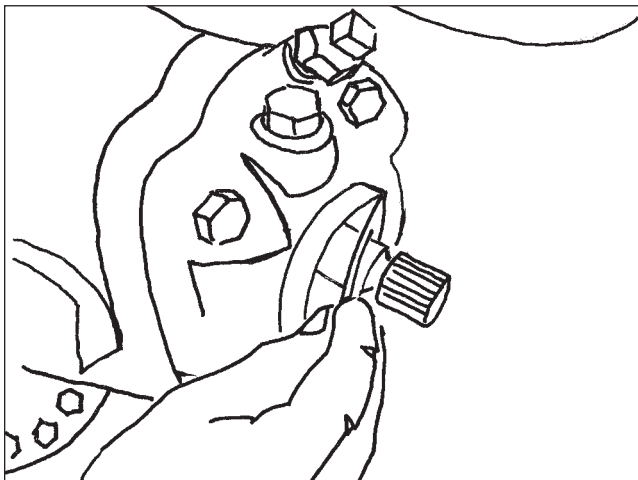


Figure 10

7. With a screwdriver, lightly pry the salt seal out of the bearing cap cover (**Figure 11**).

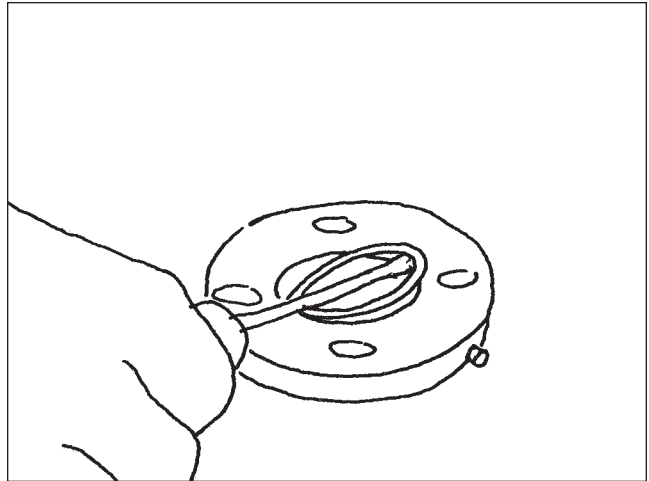


Figure 11

8. Using a suitable size socket and short extension, press the oil seal out of the bearing cap cover. Discard the seals. (**Figure 12**).

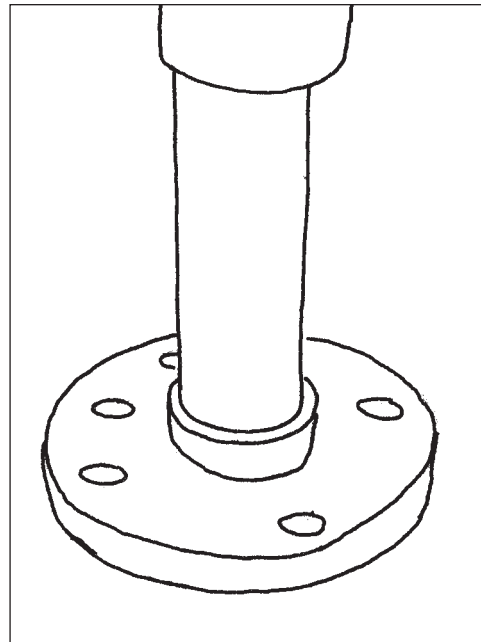


Figure 12

## **⚠WARNING**

**WEAR SAFETY GLASSES AND USE LIGHT HAMMER BLOWS TO PREVENT DAMAGE TO THE EXTENSION.**

9. Remove the bearing cap cover O-ring and discard.
10. Clean the bearing cap cover with an approved solvent and blow it dry with low pressure air.

## **⚠WARNING**

**ALWAYS WEAR SAFETY GLASSES AND USE LOW PRESSURE AIR ONLY TO CLEAN PARTS.**

11. If the steering gear you are working on has a grease fitting in the bearing cap cover, remove it at this time. Fill the grease fitting hole with RTV to prevent ingestion of contaminants. No further greasing will be required. (**Figure 13**)

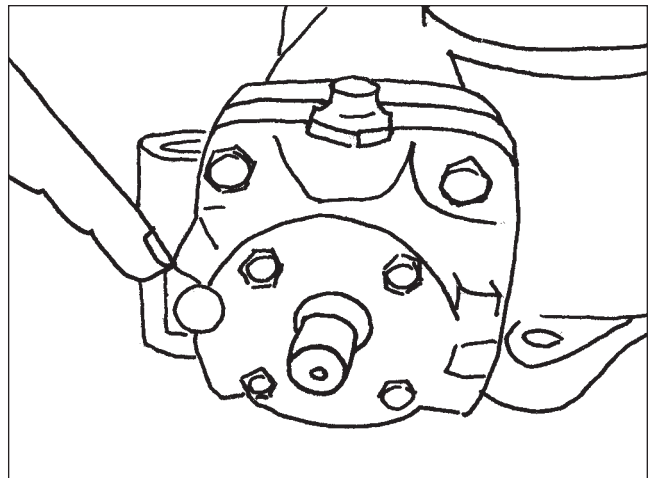


Figure 13

## Reassembly

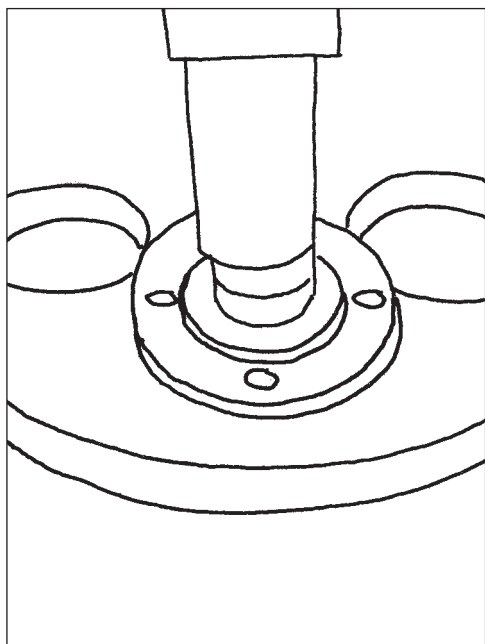


Figure 14

1. Using an appropriate size seal driver, install the oil seal in the bearing cap cover. Coat the outside diameter of the seal with a light coat of grease before installing. Make sure the lip of the seal faces inward. When properly installed, you will be able to see the garter spring of the seal (**Figure 14**).

**NOTE:**

The input shaft oil seal is a press fit. If the seal seems too small, call the Field Service Department of the R. H. Sheppard Co. at 800-274-7437.

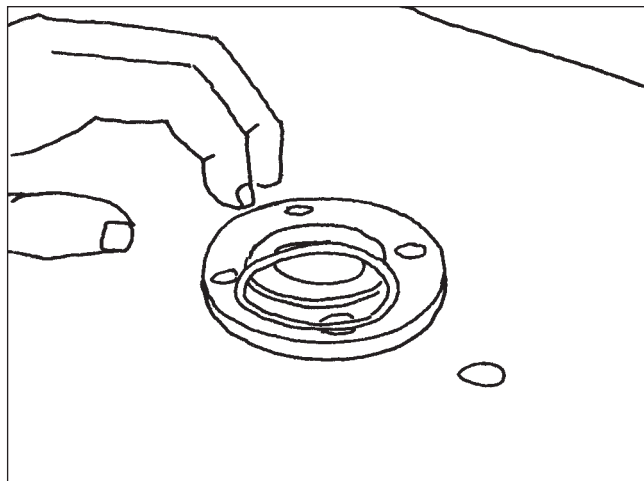


Figure 15

2. Install a new O-ring on the bearing cap cover and coat the O-ring with a light coat of grease (**Figure 15**).

## **CAUTION**

Before installing the bearing cap cover, tape the input shaft splines to prevent damage to the seal at installation.

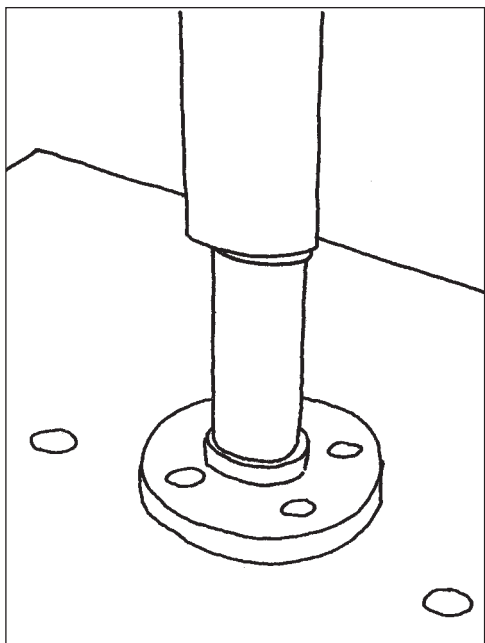


Figure 16

3. Press the salt seal into the bearing cap cover until it is flush with the cover. Make sure the lip of the seal faces out. Pack the area between the salt seal and the oil seal with grease (**Figure 16**).

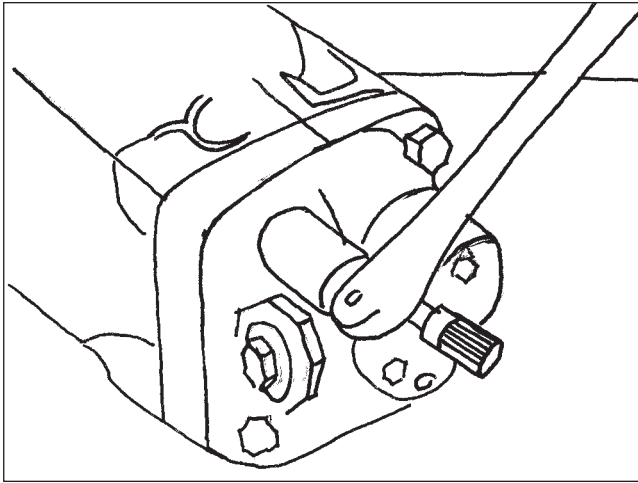


Figure 17

4. Install the bearing cap cover to the gear, insuring the plunger hole in the cover fits over the plunger. Torque to 52 ft. lbs. (Figure 17).

## **⚠ WARNING**

**DO NOT SWAP BEARING CAP COVERS BETWEEN GEARS. MIXING OF COMPONENTS COULD CAUSE STEERING GEAR LOCK-UP.**

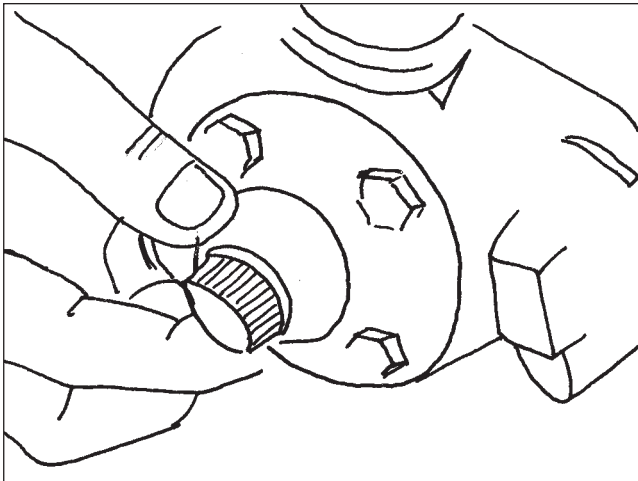


Figure 18

5. Install the rubber boot on the input shaft (Figure 18).

6. Remove the tape from the actuating shaft spline.
7. Slip the lower end yoke of the steering shaft onto the input shaft so the pinch bolt hole lines up with the whistle notch in the input shaft.
8. Reinstall the pinch bolt and nut and tighten to specifications in the Vehicle Manufacturer's Service Manual.

**IMPORTANT:**

Some manufacturers recommend the use of adhesives on splined areas. Review the Vehicle Manufacturer's Service Manual for their specific recommendations.

9. Check the fluid level in the power steering reservoir and make sure that it is full.
10. Start the vehicle and allow it to idle. Check for leaks.
11. Shut the unit off after checking for leaks and check fluid level.
12. Clean any fluid from the power steering gear and remove the drain pan.
13. Lower the cab or hood using the Vehicle Manufacturer's Service Manual.



## Sector Shaft Seal Replacement

### Do not remove the steering gear

Replacement of sector shaft seals requires the gear to be partially disassembled. Should the sector shaft need to be replaced, the steering gear must be timed before reassembly.

#### TOOLS REQUIRED:

Drain pan  
 Hydraulic jack of proper size  
 Small ballpeen hammer  
 Small tapered punch  
 5/8" allen head socket  
 3/4" allen head socket  
 3-jaw puller and suitable wrench  
 18mm socket and breaker bar  
 1/4" allen wrench  
 Soft hammer or brass drift punch

### **⚠**WARNING

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURE FOR LIFTING AND BLOCKING.**

#### ADDITIONAL REFERENCE REQUIRED:

Vehicle Manufacturer's Service Manual

#### PROCEDURE:

1. Park the vehicle on a clean, dry, solid surface, preferably concrete. Set the parking brake and block the wheels.
2. Tilt the cab or hood using the procedure in the Vehicle Manufacturer's Service Manual.
3. Refer to "Pitman Arm Removal Instructions" in the "Common Procedures" section of this manual

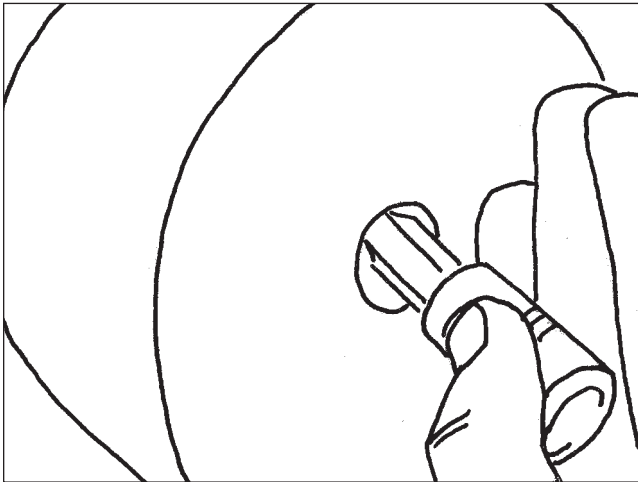


Figure 19

## Disassembly:

4. Remove the rubber boot from the sector shaft, and retain for reassembly (**Figure 20**).

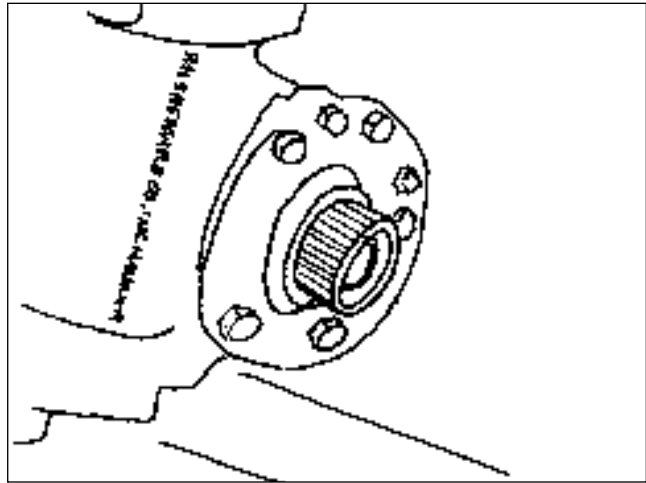


Figure 20

5. Remove the dirt shield from the frame side of the sector shaft. A screwdriver or gasket scraper can be used to shear the old dirt shield from the housing (**Figure 21**).

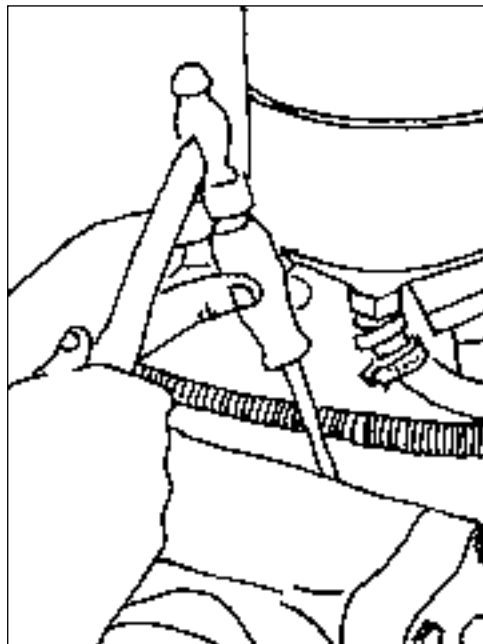


Figure 21

**NOTE:**

It may be necessary to loosen the steering gear mounting bolts to gain access to the frame side dirt shield.

6. Remove the sector shaft cover. Carefully separate the sector shaft cover from the housing. (**Figure 22**).

Use the appropriate tools to remove the sector shaft cover style you are working on. An appropriate size socket or snap ring pliers are recommended.

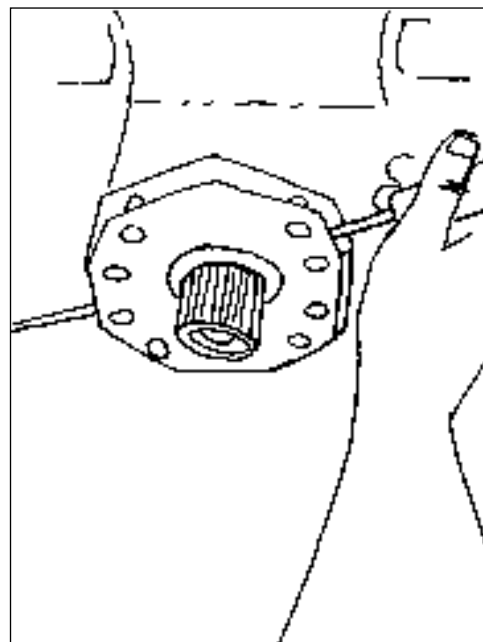


Figure 22

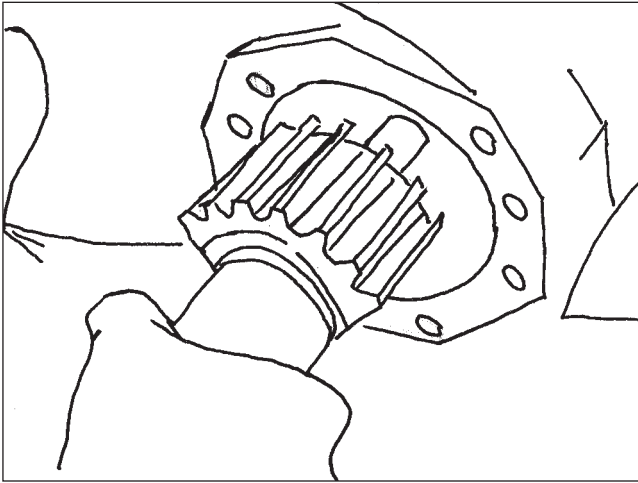


Figure 23

7. Pull the sector shaft out of the housing. Remove the seal from the housing (Figure 23).

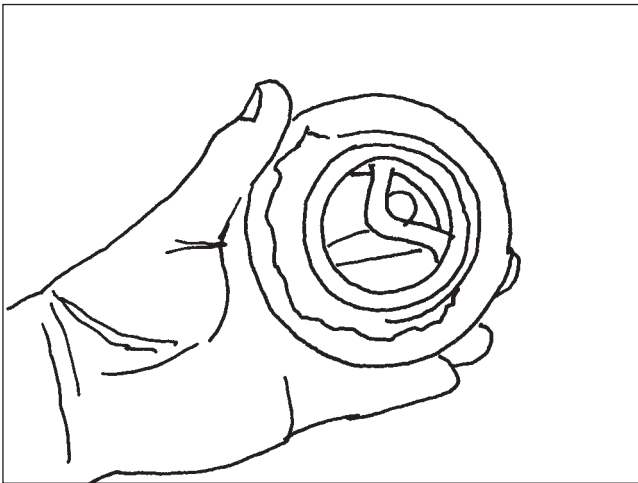


Figure 24

8. Remove the sector shaft seal and O-ring from the cover (Figure 24).

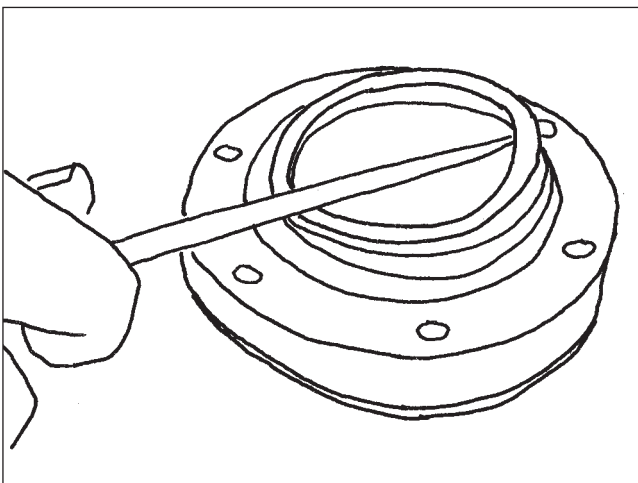


Figure 25

9. Pry the excluder seal out of the sector shaft cover if equipped (Figure 25).

10. Install a new sector shaft seal in the housing. Make sure the blue side of the seal faces toward the outside of the housing (Figure 26).

## ⚠ CAUTION

The sector shaft seal is a two-piece seal. It will be necessary to carefully bend the seal to install it. Once it is in the housing, it may be necessary to work the seal with your fingers or a blunt seal pick so it will sit properly in the groove.

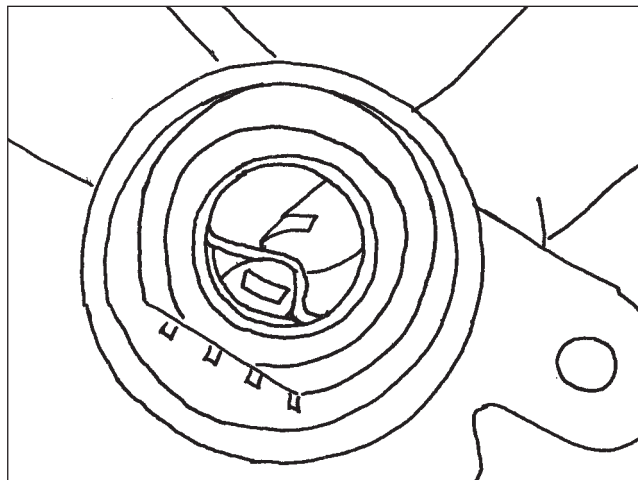


Figure 26

11. Install a new sector shaft seal in the cover. Make sure the blue side of the seal faces outward. Install a new O-ring on the cover (Figure 27).

### NOTE:

Coat all seals lightly with clean oil or grease before reassembly.

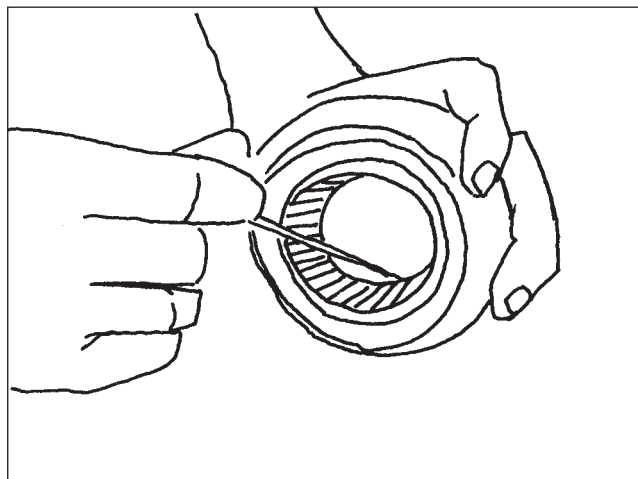


Figure 27

12. Locate the timing marks on the piston and sector shaft. Install the sector shaft (Figure 28).

### IMPORTANT:

The single timing mark on the sector tooth must line up between the two timing marks on the piston rack. It may be necessary to tap the sector shaft with a soft hammer to insure proper sector engagement.

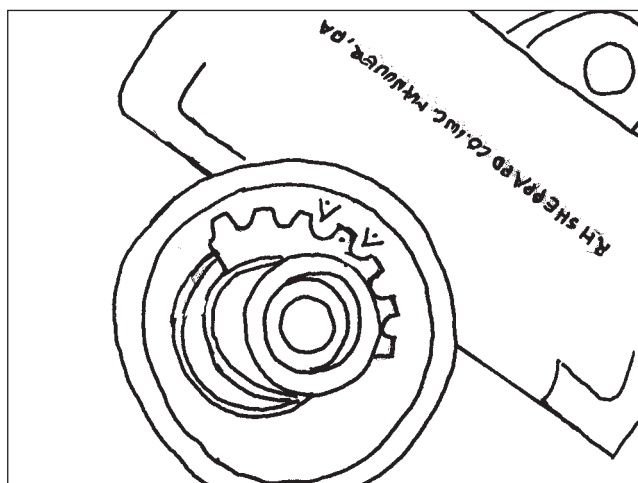


Figure 28

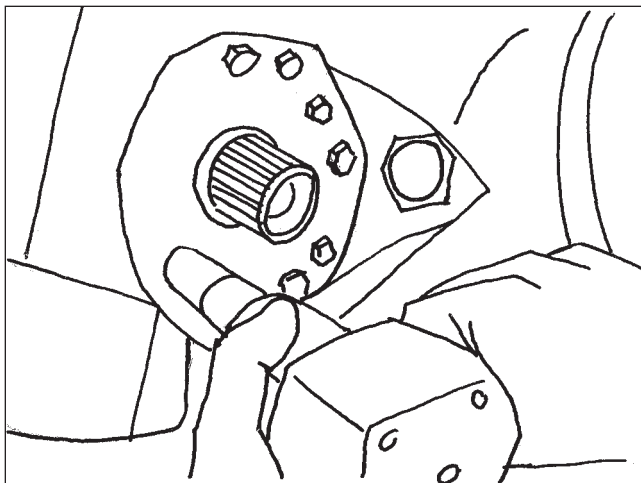


Figure 29

13. Install the sector shaft cover and torque the bolts to specification.(Figure 29).

If you are working with a snap ring cover, make sure the snap ring is properly seated in the snap ring groove.

**! DANGER**

**FAILURE TO PROPERLY SEAT THE SNAP RING IN THE GROOVE CAN CAUSE THE SNAP RING TO SPRING OUT AND PERSONAL INJURY CAN RESULT.**

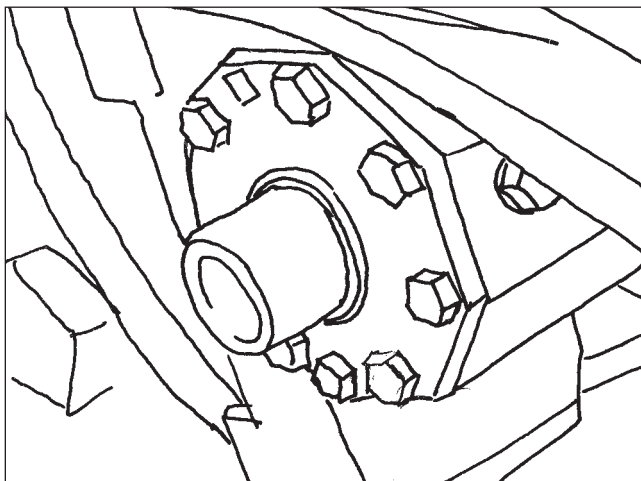


Figure 30

14. Pack the dirt excluder with grease and install it on the sector shaft if equipped. The lip of the seal must face outward (Figure 30).

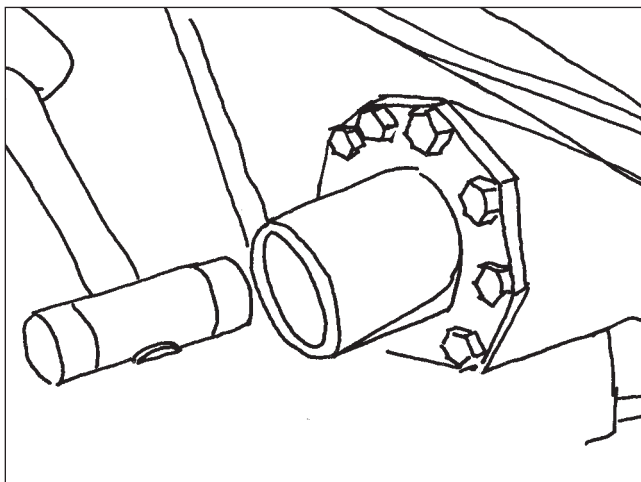
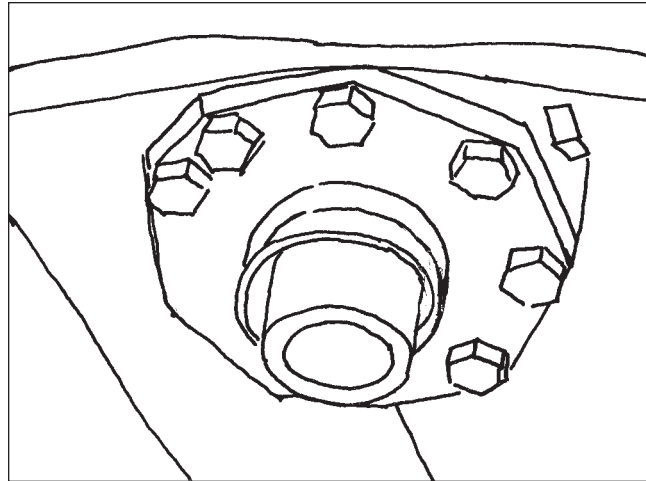


Figure 31

15. Use a 2 1/2" seal driver to install the dirt excluder in the sector shaft cover (Figure 31).

16. Install the rubber boot over the sector shaft. Pack grease under the lip of the boot before installation (**Figure 32**).

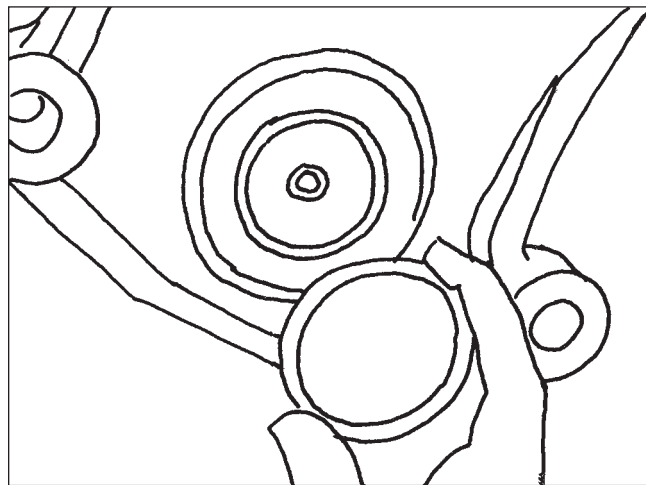


**Figure 32**

17. Install the dust cover on the frame side of the sector shaft (**Figure 33**).

**NOTE:**

When installing the stick-on type cover, clean the area with a suitable solvent and install using an RTV material on the edge of the cover.



**Figure 33**

18. Install the pitman arm on the steering gear. Refer to the "Pitman Arm Installation" instructions in the "Common Procedures" section of this manual.

19. Fill the system with an approved fluid and bleed the system if necessary.

## Bleeding Single Gear System

Bleeding of the steering gear in a single gear system is only necessary if the gear is mounted in a way that will trap air in the sector shaft bore. This procedure should be followed whenever the gear has been disassembled or replaced.

### TOOLS REQUIRED:

1/8" Allen wrench

## **⚠WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

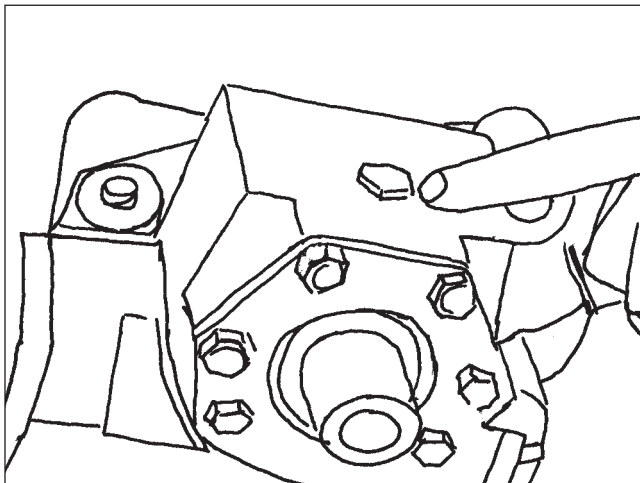
### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual

R. H. Sheppard Co. Maintenance & Troubleshooting Video (Optional )

### PROCEDURE:

1. Park the vehicle on a clean, dry, solid surface-preferably concrete. Set the parking brake and block the wheels. Place the transmission in neutral.
2. Tilt the hood or cab using the procedure in the Vehicle Manufacturer's Service Manual.
3. Make sure the fluid level in the reservoir is at the full mark of the dipstick.
4. Start the vehicle and allow the engine to idle.
5. Steer the vehicle from full left to full right several times. The pitman arm must make full travel .



**Figure 34**

6. Locate the bleeder screw in the plug located on the sector shaft bore (**Figure 34**).

#### IMPORTANT:

Do not turn the steering wheel with the bleeder open.

7. Using the allen wrench, open the bleeder screw until non-aerated fluid flows from the bleed screw.
8. Tighten the bleed screw.
9. Repeat steps 5-8 until no aeration is found in the bleed oil.
10. If this is a replacement steering gear, follow the "Plunger Adjustment Procedures" in this section of the manual.
11. Check the fluid level in the power steering reservoir and fill if necessary.
12. Shut the vehicle off.
13. Lower the hood or cab following procedures in the Vehicle Manufacturer's Service Manual.

## Bleeding Dual Steering Gears

Bleeding the dual steering gear system is necessary whenever the system has been repaired. Different gear sizes may be used together but the bleeding procedure is the same.

### TOOLS REQUIRED:

Hammer  
 1/8" Allen wrench  
 Ball stud removal tool  
 Hydraulic jack - appropriate size  
 0-200 ft./lb. Torque wrench (1/2" drive)  
 Socket and ratchet for drag link nut (1/2" drive)

### **WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

### PARTS REQUIRED:

Cotter pins  
 Specified fluid

### **WARNING**

**NEVER USE OLD OR USED SEALS, COTTER PINS, RETAINERS OR CRITICAL FASTENERS. ALWAYS BUY A NEW SEAL KIT. USE ONLY MANUFACTURER APPROVED REPLACEMENT PARTS.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual  
 R. H. Sheppard Co. Maintenance & Troubleshooting Video (Optional)

### PROCEDURE:

1. Park the vehicle on a clean, dry, solid surface-preferably concrete. Set the parking brake and block the wheels. Place the transmission in neutral.
2. Jack the vehicle up until the front wheels have cleared the surface.
3. Tilt the hood or cab using the procedure in the Vehicle Manufacturer's Service Manual.
4. Make sure the fluid level in the reservoir is at the full mark on the dipstick.
5. Remove the drag links from the pitman arms of the master and slave gears using the procedure in the Vehicle Manufacturer's Service Manual.
6. Start the vehicle and allow the engine to idle.
7. Turn the steering wheel to a full left turn and hold until the slave gear moves its full travel. Then turn the steering wheel to a full right turn and hold until the slave moves its full travel. Repeat this procedure three or more times.



8. Connect the drag link to the master gear. Torque the attaching nut following the procedures in the Vehicle Manufacturer's Service Manual.

**⚠ CAUTION**

**Do not back off the nut when locating the cotter pin hole.**

9. Install a new cotter pin through the ball stud nut, then lock in place.

**⚠ DANGER**

**FAILURE TO INSTALL A NEW COTTER PIN IN THE BALL STUD AFTER PROPER TORQUE COULD RESULT IN LOSS OF STEERING CONTROL.**

10. With the master gear drag link connected, turn the steering wheel to a full left turn and hold until the slave gear pitman arm moves its full travel. Then turn the steering wheel to a full right turn and hold until the slave gear pitman arm moves its full travel. Repeat this procedure three or more times.
11. Connect the drag link to the slave gear by turning the steering wheel until the pitman arm lines up with the drag link.

**IMPORTANT:**

Do not move the pitman arm by hand during this operation. Air may get in the system.

12. Torque the attaching nut following the procedures in the Vehicle Manufacturer's Service Manual.

**⚠ CAUTION**

**Do not back off the nut when locating the cotter pin hole.**

13. Install a new cotter pin through the ball stud nut, then lock in place.

**⚠ WARNING**

**FAILURE TO INSTALL A NEW COTTER PIN IN THE BALL STUD AFTER PROPER TORQUE COULD RESULT IN LOSS OF STEERING CONTROL.**

14. Steer the vehicle full left to full right several more times.

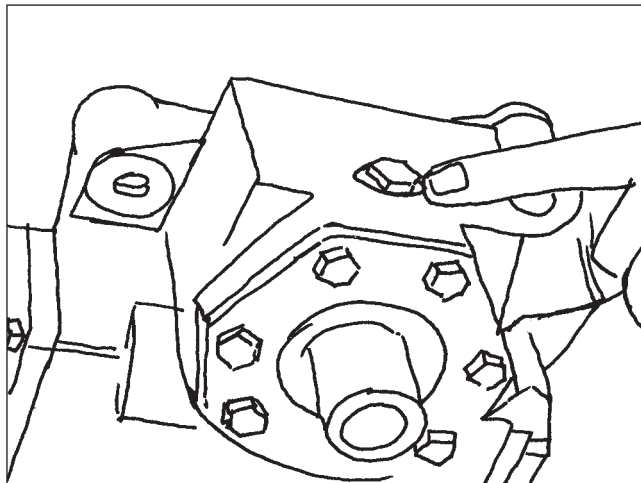


Figure 35

15. Locate the bleeder screw in the master gear located in the plug on the sector shaft bore (Figure 35).

16. Using the allen wrench, open the bleeder screw until non-aerated fluid flows from the bleed screw.

**NOTE:**

Do not turn the steering wheel with the bleeder open.

17. Repeat the procedure on the slave gear if an M-Series slave is used.
18. Check the fluid level in the power steering reservoir and fill if necessary.
19. Shut the vehicle off.
20. Lower the hood or cab following the procedure in the Vehicle Manufacturer's Service Manual.
21. Lower the vehicle until the tires contact the surface and remove the jack.

## Axle Stop Adjustment

Axle stop adjustment should be checked during predelivery. A stop bolt is used on each spindle. The left stop is adjusted for left turn and the right stop is adjusted for right turn.

### TOOLS REQUIRED:

A set of portable turn plates  
Steel tape measure  
Small adjustable wrench  
Combination wrench to fit stop bolt lock nut

### **WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

### ADDITIONAL REFERENCES:

Manufacturer's Technical Manual  
R. H. Sheppard Co. Maintenance & Troubleshooting Video (Optional)

### PROCEDURE:

1. Park the vehicle on a clean, dry, solid surface-preferably concrete. Set the parking brake and block the wheels.
2. Tilt the hood or cab using the procedures in the Vehicle Manufacturer's Service Manual.
3. Using the tape measure, set the vehicle's wheels straight ahead. Use a spot on the frame and a spot on the tire tread to check wheel position.

**NOTE:**

When using an alignment rack, omit Steps 1,2,3,4, & 5.

4. Jack the front end up until the tires have cleared the surface.

**NOTE:**

Make sure the pins are installed in turn plates and the pointers are set on 0.

5. With the lock pins in place, slide the turn plates under the front tires until the plates are centered in the middle of the tire.

### **WARNING**

**DO NOT PUT HANDS OR OTHER BODY PARTS UNDER THE TIRES WHILE THE UNIT IS RAISED.**

6. Slowly lower the jack until the front tires rest on the turn plates and remove the jack.
7. Remove the lock pins from the turn plates and allow the turn plates to swivel.

**NOTE:**

Two people are required to properly set wheel stops.

8. Have one person turn the steering wheel to a full left turn, holding the steering wheel in that position.
9. The other person will look at the pointer on the left turn plate.
10. The pointer will indicate the exact wheel angle for the left turn.
11. Repeat steps 8, 9 & 10 for the right turn.
12. Compare the readings with those specified by the manufacturer.
13. If adjustments are required, use procedures as described in the Vehicle Manufacturer's Service Manual.

**NOTE:**

Turning the bolt in will increase the wheel cut angle. Turning the bolt out will decrease the wheel cut angle.

14. Turn the steering wheel fully to the left and recheck the angle. Repeat step 13 until the angle is right.
15. Recheck the lock nut on the stop bolt when all adjustments are made to be sure it is tight.
16. Repeat steps 12, 13 & 14 for the right turn if needed.

## CAUTION

Check to be sure there is a minimum of 1" clearance between tires and chassis parts and a minimum of 1/2" clearance between any moving steering part (pitman arm, drag link, steering lever, etc.).

17. Repeat step 3 and remove the turn plates. Slowly lower the vehicle onto the surface.

### IMPORTANT:

After the wheel stops are set, make sure the steering gear plungers are set. Use the procedure outlined in this section of the manual. See "Setting Relief Plungers".

## Manual Plunger Adjustment

Relief plunger adjustment should be checked during pre-delivery. Any time tire size or steering gears are changed, relief plunger adjustment will be necessary. A relief plunger is located in each end cap of the steering gear; one for right turn, one for left turn.

### TOOLS REQUIRED:

Small blade screwdriver  
1/8" piece of steel flat stock

## **⚠WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual  
R. H. Sheppard Co. Maintenance & Troubleshooting Video (Optional)

### PROCEDURE:

#### NOTE:

Never attempt to adjust relief plungers until the axle stops are set following Vehicle Manufacturer's Specifications.

1. Park the vehicle on a clean, dry, solid surface-preferably concrete. Set the parking brake and block the wheels.
2. Place the transmission in neutral and start the engine.
3. Allow the engine to operate at idle speed.

#### NOTE:

It is always best to have 2 people when setting plungers; 1 to steer the vehicle and 1 to set and check adjustments.

4. Locate the plungers.
5. Determine which plunger is used to adjust right and left turns based on direction of pitman arm travel.
6. Turn the steering wheel to a full left turn and check the clearance using the steel flat stock as a feeler gauge between the axle stop bolt and the axle. If the clearance is not 1/8", plunger adjustment will be necessary.

## **⚠WARNING**

**IF THE STOP BOLT HITS THE AXLE UNDER PRESSURE, RELEASE THE WHEEL IMMEDIATELY! DAMAGE TO STEERING COMPONENTS MAY RESULT.**

7. Return the front tires to the straight ahead position and release the steering wheel. Using the screwdriver, adjust the plunger for left turn. Turning the plunger in will increase the clearance between the stop bolt and the axle, while turning the plunger out will decrease the clearance.

## **⚠WARNING**

**NEVER ADJUST THE PLUNGER BEYOND FLUSH WITH THE END CAP. LEAKAGE OR PERSONAL INJURY MAY RESULT.**

8. Turn the steering wheel to a full left turn. Check the 1/8" clearance using the steel flat stock as a feeler gauge.

## **⚠WARNING**

**THE FLAT STOCK IS USED AS A FEELER GAUGE ONLY. DO NOT SQUEEZE OR PINCH THE FLAT STOCK BETWEEN THE STOP BOLT AND AXLE. DAMAGE TO PARTS MAY RESULT.**

9. If further adjustment is required, repeat steps 7 & 8 until the 1/8" clearance is achieved.
10. Repeat steps 6 thru 9 for the right turn.

## Set Automatic Relief Plungers

Automatic relief plunger setting should be checked at pre-delivery inspection. Any time tire size is changed or wheel cut is reduced, automatic relief plunger adjustment will be necessary. A relief plunger is located in each end cap of the steering gear. One will adjust right turn; one will adjust left turn.

### TOOLS REQUIRED:

1/4" Punch  
Ball Peen Hammer

## **⚠️ WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES, ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S INSTRUCTIONS FOR LIFTING AND BLOCKING.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual

#### NOTE:

Do not attempt to set automatic relief plungers until the axle stops have been set according to Vehicle Manufacturer's specifications.

### PROCEDURE:

1. Park the vehicle on a clean, dry surface (preferably concrete). Set the parking brake and block the wheels.

#### NOTE:

Identify your steering gear as having automatic relief plungers. Steering gears with automatic pressure relief plungers will have "M100 AUTO" cast in raised letters on the cylinder bore. Plastic caps will cover the plunger hole in each end cap. (Figure 36).



Figure 36

2. Raise the front tires until they clear the surface.
3. Place the transmission in neutral. Start the engine and allow it to run at idle speed.
4. Turn the steering wheel to a full left turn. Apply pressure at the steering wheel in the full lock position to set the plunger assembly.

**NOTE:**

As you reach the end of travel, you will feel the steering gear piston contact the plunger. Continue turning against the axle stop to set the relief plunger.

5. Turn the steering wheel to a full right turn. Apply pressure on the steering wheel in the full lock position to set the plunger assembly.
6. Return the wheels to straight ahead.
7. Lower the vehicle and remove the jack.
8. Verify the proper setting of the automatic relief plungers. With the engine running and the full weight of the vehicle on the front tires, turn the wheels to a full turn in each direction. When properly set, there will be approximately 1/8" to 3/16" gap at the axle stop.
9. Stop the engine. The automatic relief plungers are now set.

## Adjust Automatic Relief Plungers

Automatic relief plungers require no adjustment unless tire size is changed or wheel cut is reduced. A relief plunger is located in each end cap of the steering gear - one for right turn; one for left turn. Automatic relief plungers have plastic caps over the plunger hole on each end.

### TOOLS REQUIRED:

1/4" Punch  
Ball Peen Hammer

## ⚠ WARNING

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES, ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S INSTRUCTIONS FOR LIFTING AND BLOCKING.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual

#### NOTE:

Do not attempt to set automatic relief plungers until the axle stops have been set according to Vehicle Manufacturer's specifications.

### PROCEDURE:

1. Park the vehicle on a clean, dry surface (preferably concrete). Place the transmission in neutral and set the parking brake.
2. Verify that the steering gear you are working on is equipped with automatic relief plungers. Steering gears with automatic pressure relief plungers will have "M100 AUTO" cast in raised letters on the cylinder bore. Plastic caps over the plunger holes are installed as a visual aid in recognizing auto plunger steering gears.

(Figure 37).



Figure 37



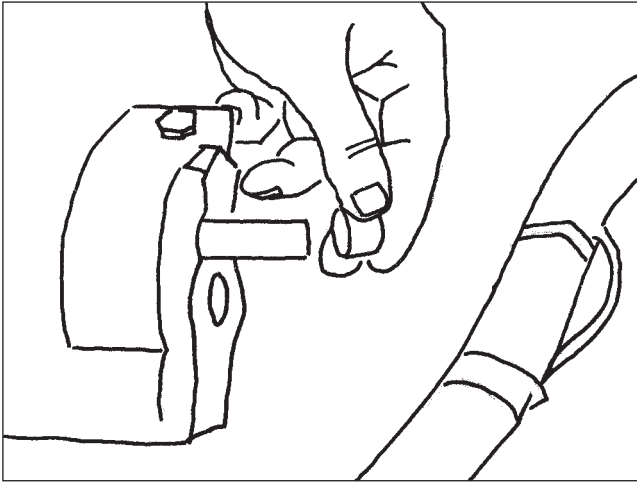


Figure 38

3. Remove the plastic caps from both plunger holes. Insert the 1/4" punch into the hole. Using the hammer, tap the punch until the plunger "bottoms" in the plunger bore. Repeat this procedure for both plungers. Replace the plastic caps after setting the plungers to the maximum depth.(Figure 38).

NOTE:

Take care when using the punch to insure the plunger bore is not damaged when adjusting the auto plunger.

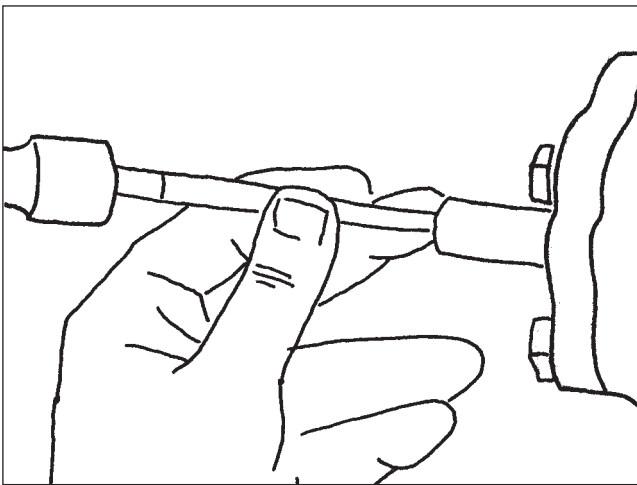


Figure 39

4. Raise the steer tires until the tires clear the surface. Start the engine and allow it to run at idle speed.(Figure 39).

5. Turn the wheel to a full turn in one direction. (Turn until the axle stop contacts the axle.) Pull hard on the wheel to set the auto plunger. Turn the wheel to a full turn in the opposite direction. Pull hard on the steering wheel to set the auto plunger. Return the wheels to straight ahead.

6. Lower the vehicle and remove the jack.

7. Verify the proper setting of the automatic relief plungers. With the steer tires on the ground and the full weight of the vehicle on the tires, turn the wheels to a full turn in one direction. When properly adjusted, there will be a small gap between the axle stop and the axle. Repeat for the opposite turn.

## Repair Procedure

### Sheppard Auto Plungers

Under normal use, the Sheppard auto plunger system will require no regular maintenance. The auto plunger is serviceable only as a kit. Sheppard part #18212821K will fit both the cylinder head and bearing cap end of the steering gear.

#### TOOLS REQUIRED:

22mm Socket  
 1/4" Bladed Screwdriver  
 1/4" Drift Punch  
 1/8" Pin Punch  
 Center Punch  
 Locking Pliers

#### CYLINDER HEAD REPAIR

1. Place a drain pan under the steering gear. Park the vehicle on a clean, dry surface and set the parking brake.

2. Locate the plunger hole in the end cap. Using the 1/4" punch and hammer, drive the auto plunger in until it bottoms out in the bore. Take care to keep the punch straight in the bore and use only light hammer blows to drive the auto plunger assembly (**Figure 40**).

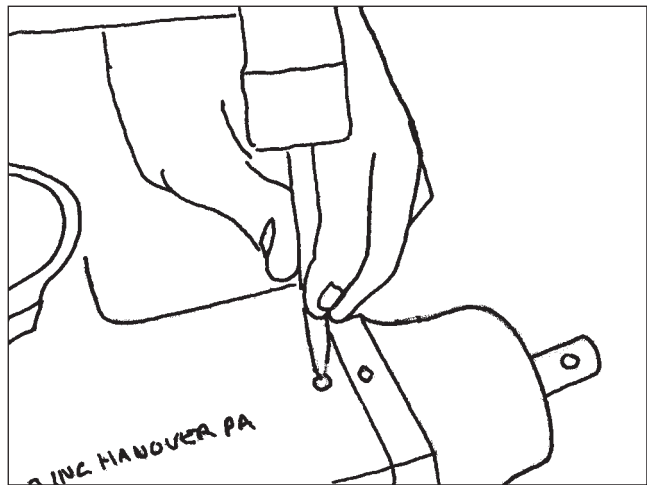


Figure 40

**⚠ DANGER**

**FAILURE TO KEEP THE PUNCH STRAIGHT OR HITTING THE PLUNGER TOO HARD CAN CAUSE DAMAGE TO THE PLUNGER BORE OR AUTO PLUNGER ASSEMBLY.**

3. Mark the cylinder head and housing for reassembly. Remove the four attaching bolts using a 22mm socket and remove the cylinder head.
4. Place the cylinder head in a vise. The spring pin, flange and plunger body should be accessible for removal at this point.
5. Insert the screwdriver into the slotted head of the plunger body to hold the plunger body in place. Use the locking pliers to turn the plunger flange off the plunger body, while holding the plunger body in place with the screwdriver. (**Figure 41**).

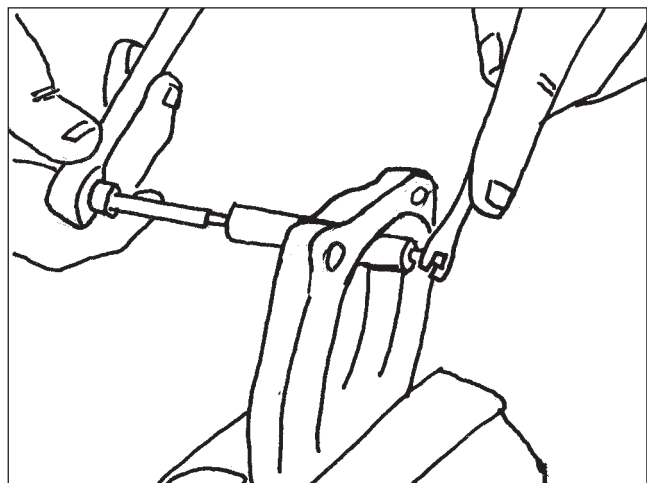


Figure 41

NOTE:

The plunger flange is held in place with patch lock and the threads are staked. Removal of the flange will require approximately 12-15 in/lbs of torque.

6. Remove the plunger body from the spring pin. It may be necessary to lightly tap the plunger body to remove it from the spring pin. Use of an 1/8" pin punch is recommended. (Figure 42).

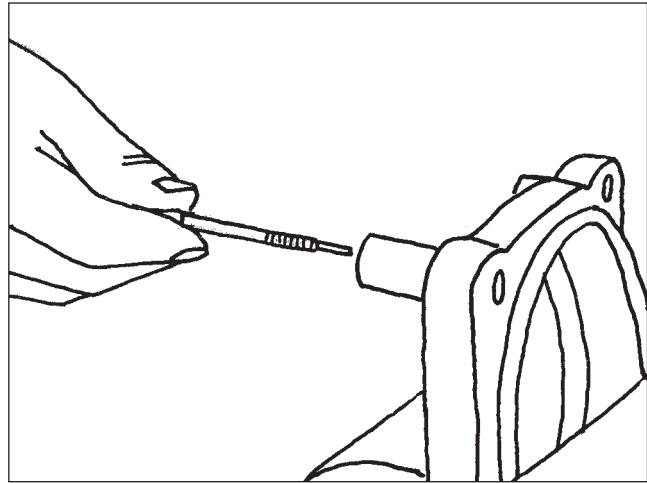


Figure 42

7. Coat the O-ring with a light coat of grease and install the new plunger body through the spring pin.

NOTE:

Inspect the plunger bore for nicks or gouges before installing the plunger body.

8. Use the screwdriver to hold the plunger body and screw the plunger flange onto the plunger body until it contacts the spring pin.

NOTE:

It will be necessary to use the locking pliers to turn the plunger flange over the patch lock. Installation of the plunger flange will require approximately 12-15 in/lbs of torque.

9. With the plunger flange against the spring pin, use a center punch and hammer to stake the threads of the plunger body. (Figure 43).

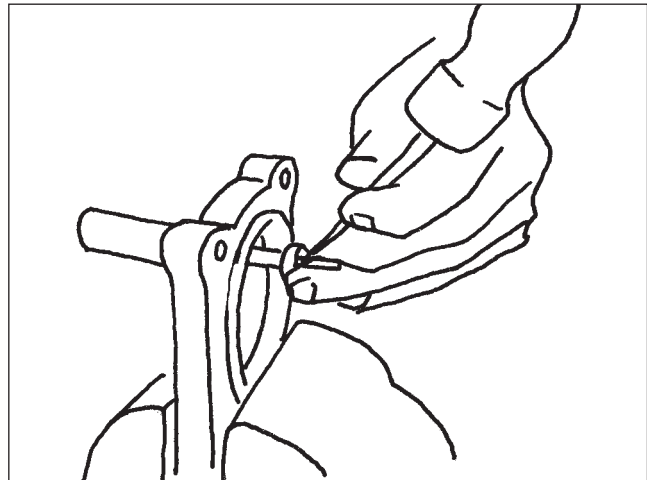


Figure 43

**! DANGER**

**USE EXTREME CAUTION WHEN STAKING THE THREADS OF THE PLUNGER BODY. HITTING THE THREADS TOO HARD WILL BEND THE PLUNGER AND CAN CAUSE STEERING FAILURE.**

10. Align the cylinder head marks and install the cylinder head on the steering gear. Torque the attaching bolts to the recommended specifications.
11. Fill the reservoir with an approved fluid. Start the engine and check for leaks.
12. Raise the front wheels and turn the steering wheel from lock to lock to set the auto plungers.
13. Lower the vehicle.

## Bearing Cap (Or Input) End Repair

1. Place a drain pan under the steering gear. Park the vehicle on a clean, dry surface and set the parking brake.
2. Locate the plunger hole in the end cap. Using the 1/4" punch and hammer, drive the auto plunger in until it bottoms out in the bore. Take care to keep the punch straight in the bore and use only light hammer blows to drive the auto plunger assembly. (Figure 44).

**NOTE:**

It will be necessary to remove the yoke from the steering gear input shaft to gain access to the plunger hole in the bearing cap end of the steering gear.

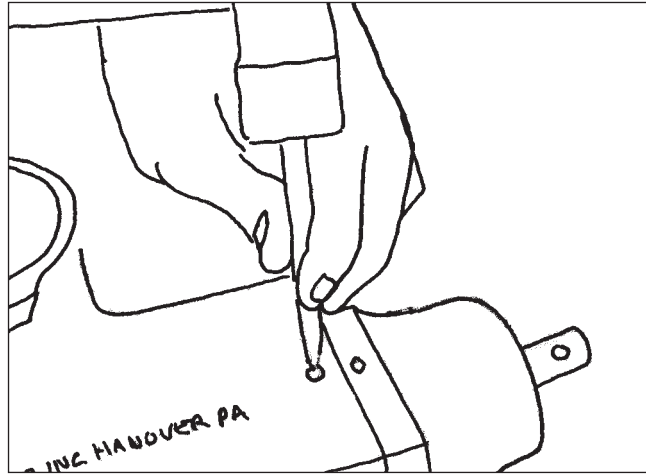


Figure 44

3. Mark the bearing cap and housing for reassembly. Remove the four attaching bolts from the bearing cap using a 22mm socket.
4. Separate the bearing cap from the housing by turning the input shaft out of the steering gear. Turn the shaft until it stops. Block the bearing cap to hold it away from the housing. (Figure 45).

**⚠ DANGER**

**DO NOT FORCE THE SHAFT WHEN TURNING IT OUT. BINDING OF THE SHAFT CAN OCCUR AND STEERING GEAR DAMAGE CAN RESULT.**

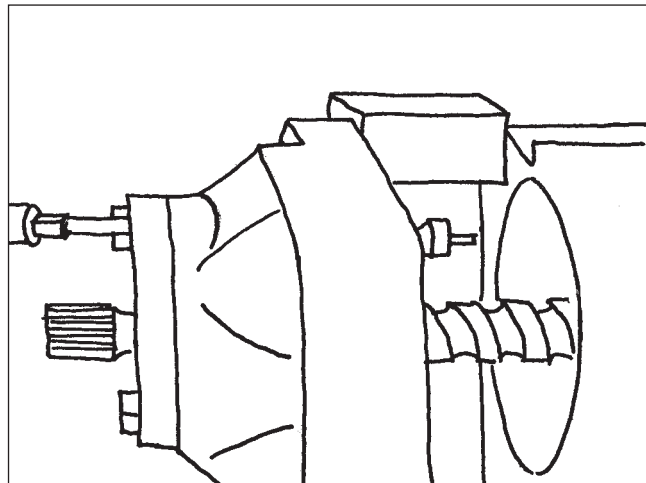


Figure 45

**NOTE:**

Use caution when blocking the bearing cap away from the housing so as not to introduce contaminants into the steering gear cylinder bore.

5. Insert the screwdriver into the slotted head of the plunger body to hold the plunger body in place. Use the locking pliers to turn the plunger flange off the plunger body, while holding the plunger body in place with the screwdriver. (Figure 46).

**NOTE:**

The plunger flange is held in place with patch lock and the threads are staked. Removal of the flange will require approximately 12-15 in/lbs of torque.

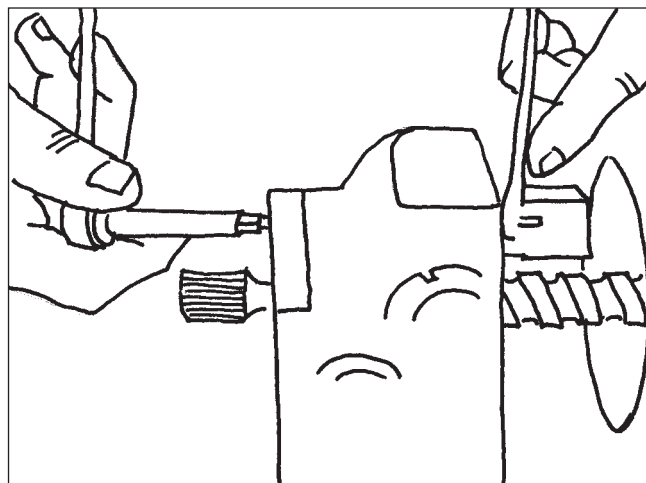


Figure 46

6. Push the plunger body out of the spring pin. It may be necessary to use a small punch to push the plunger body out of the spring pin.
7. Remove the plunger body. Discard the plunger body and flange.

NOTE:

Inspect the plunger bore for nicks or gouges before installing the plunger body.

8. Coat the O-ring of the new plunger body with grease and install it through the spring pin.
9. Use the screwdriver to hold the plunger body and screw the plunger flange onto the plunger body until it contacts the spring pin.

NOTE:

It will be necessary to use the locking pliers to turn the plunger flange over the patch lock. Installation of the plunger flange will require approximately 12-15 in/lbs of torque.

10. With the plunger flange against the spring pin, use a center punch and hammer to stake the threads of the plunger body. (Figure 47).

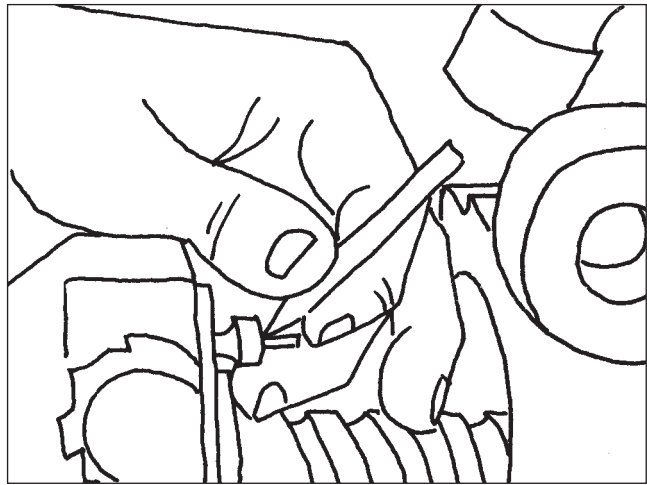


Figure 47

**⚠ DANGER**

**USE EXTREME CAUTION WHEN STAKING THE THREADS OF THE PLUNGER BODY. HITTING THE THREADS TOO HARD WILL BEND THE PLUNGER AND CAN CAUSE STEERING FAILURE.**

11. Align the bearing cap marks and install the bearing cap on the steering gear. Torque the attaching bolts to the recommended specifications.
12. Fill the reservoir with an approved fluid. Start the engine and check for leaks.
13. Raise the front wheels and turn the steering wheel from lock to lock to set the auto plungers.
14. Lower the vehicle.

## Pitman Arm Removal M-Series Tab Lock Retainer

On some installations it is necessary to remove the pitman arm before the steering gear is removed from the chassis. Proper removal of the pitman arm will avoid damage to the steering gear, pitman arm and retainer.

### TOOLS REQUIRED:

Small ball peen hammer  
 Small tapered punch  
 5/8" allen head socket  
 3/4" allen head socket  
 Breaker bar  
 Ball stud removal tool  
 Cotter pin puller or pliers  
 3 - Jaw puller & suitable wrench  
 3 lb. Hammer

### !WARNING

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

### ADDITIONAL REFERENCES:

Vehicle Manufacturer's Service Manual  
 R. H. Sheppard Co. Maintenance and Troubleshooting Video (Optional)

### PROCEDURE:

**NOTE:**

Steps 1, 2, & 3 of this procedure are only required if the steering gear and pitman arm are mounted on the vehicle.

1. Park the vehicle on a clean, dry, solid surface-preferably concrete. Set the parking brake and block the wheels.
2. Tilt the cab or hood using the procedure in the Vehicle Manufacturer's Service Manual.
3. Remove the drag link from the pitman arm using the procedure in the Vehicle Manufacturer's Service Manual.

4. Use the small punch and ball peen hammer to bend the 2 restraining tabs out of the retainer so the retainer can be removed (**Figure 48**).

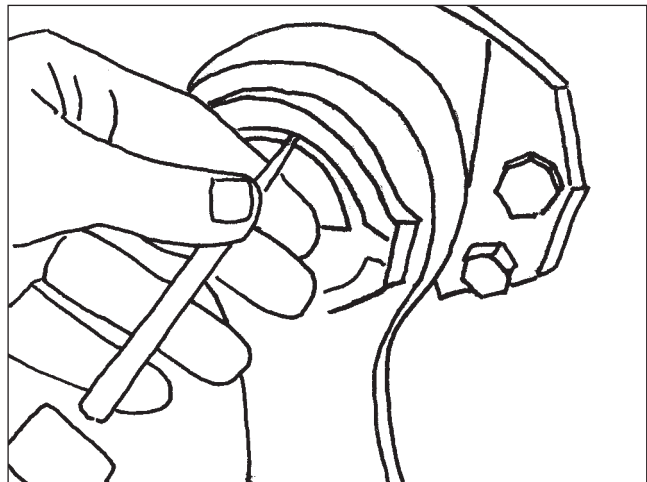


Figure 48

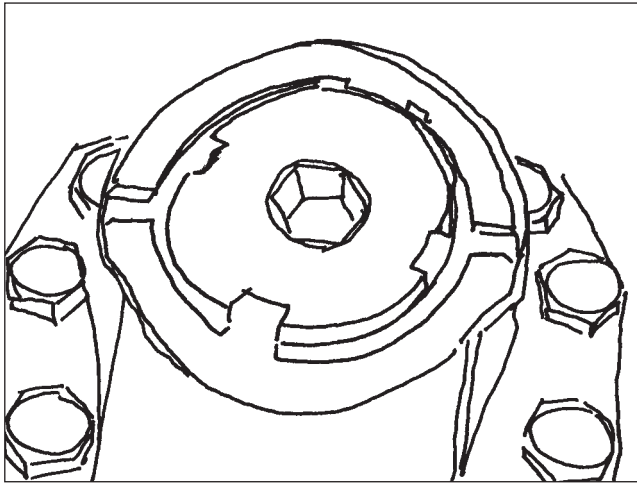


Figure 49

**IMPORTANT:**

Do not bend the tabs in the pitman arm slot (Figure 49).

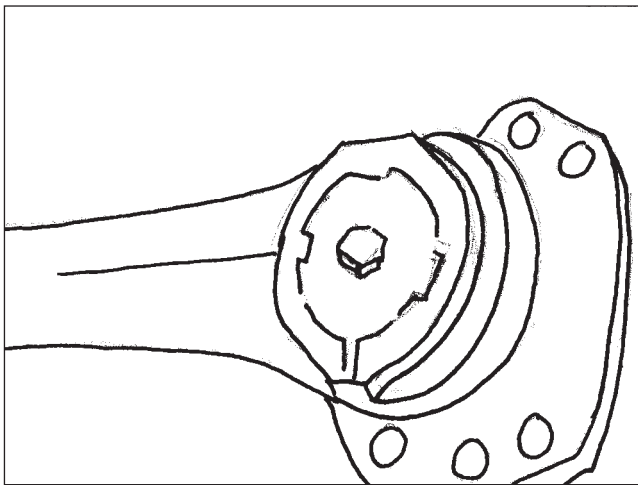


Figure 50

5. Coat the face of the retainer with grease (Figure 50).



Figure 51

6. Slide the pitman arm puller (Kent Moore #ZTSE4439) over the pitman arm, and remove the retainer. As you remove the retainer it will act as a jack screw against the puller to remove the arm (Figure 51).

**⚠ DANGER**

**THE PITMAN ARM WILL BE EXTREMELY TIGHT. DO NOT POUND ON THE PITMAN ARM OR APPLY ANY SOURCE OF HEAT, AS DAMAGE TO THE PITMAN ARM OR SECTOR SHAFT CAN CAUSE AN ACCIDENT AT A LATER DATE. NEVER WELD THE PITMAN ARM OR THE SECTOR SHAFT.**

## Pitman Arm Installation

Proper installation of the pitman arm is critical to the shaft operation of the vehicle. Follow these procedures for the attachment. Correct torque values are very important! Use lubricant where indicated.

### **! DANGER**

**IF THE PITMAN ARM IS NOT APPLIED TO THE PROPER SPECIFICATIONS THE PITMAN ARM COULD WORK LOOSE OR LOSE ITS ATTACHMENT AND CAUSE AN ACCIDENT. IF THE PITMAN ARM IS FOUND LOOSE, REPLACE THE PITMAN ARM AND SECTOR SHAFT. NEVER WELD THE ARM OR SHAFT.**

#### TOOLS REQUIRED:

Small ball peen hammer  
Small tapered punch  
3/4" allen head socket  
5/8" allen head socket

Measuring device graduated to 32nds  
Torque wrench (350 ft./lbs. minimum)  
Anti-Seize Lubricant MIL-A-907 or equivalent  
Suitable socket for drag link nut

### **! WARNING**

**FOR OTHER EQUIPMENT, TOOLS OR SAFETY PROCEDURES ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR LIFTING AND BLOCKING.**

#### PARTS REQUIRED:

Cotter pin  
Tab lock retainer kit (optional)

#### ADDITIONAL REFERENCES:

Manufacturer's Technical Manual  
R. H. Sheppard Co. Maintenance & Troubleshooting Video (Optional)

### **! WARNING**

**NEVER USE OLD OR USED SEALS, COTTER PINS, RETAINERS OR CRITICAL FASTENERS. ALWAYS BUY A NEW SEAL KIT. USE ONLY MANUFACTURER APPROVED REPLACEMENT PARTS.**

### **! DANGER**

**THE PITMAN ARM SHOULD BE INSTALLED AFTER THE STEERING GEAR IS MOUNTED ON THE VEHICLE SO PROPER TORQUE CAN BE APPLIED TO THE PITMAN ARM. LACK OF PROPER TORQUE WILL CAUSE LOOSENESS OF THE PITMAN ARM AND CAN CAUSE AN ACCIDENT!**

#### PROCEDURE:

1. Install the pitman arm on the output shaft, aligning the timing mark of the pitman arm with the timing mark of the output shaft. Some pitman arms will have more than one timing mark. Consult your Vehicle Manufacturer's Service Manual for the proper timing mark for your vehicle (Figure 52).

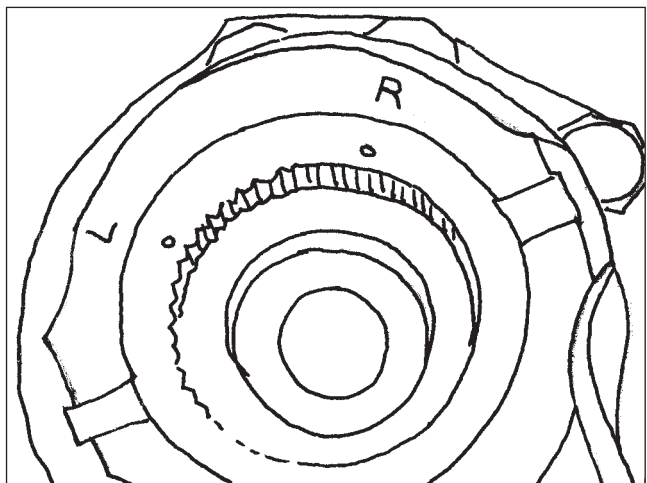


Figure 52

2. If you are reusing a tab lock retainer, inspect the assembly for broken tabs or thread damage before installation. Replace the retainer if any damage is found.
3. If a new retainer is required, read the instruction sheet supplied with the retainer kit carefully! Discard the parts that are not required for your application.



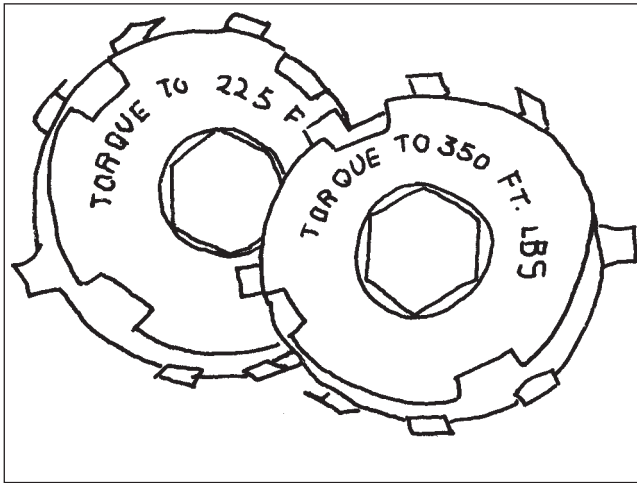


Figure 53

## **⚠WARNING**

TAB LOCK RETAINERS ARE SUPPLIED WITH THREE TORQUE SPECIFICATIONS. EITHER 225 FT./LBS., 350 FT./LBS. OR 450 FT./LBS. THE TORQUE VALUE IS STAMPED ON THE FACE OF THE RETAINER. CHECK THE TORQUE VALUE STAMPED ON YOUR RETAINER AND THE VEHICLE MANUFACTURER'S SPECIFICATION TO BE SURE YOUR RETAINER IS CORRECT! (FIGURE 53).

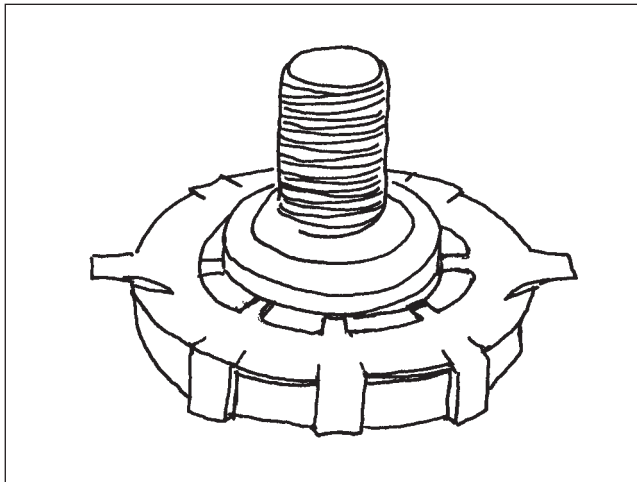


Figure 54

4. Apply the specified Never-Seize compound in the threads of the sector shaft and retainer and on both sides of the friction washer (Figure 54).

**NOTE:**

Do not apply Never-Seize compound to the pitman arm contact side of the tab lock washer.

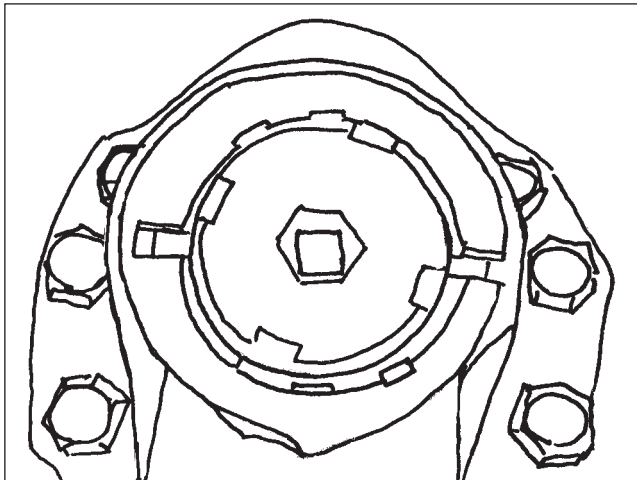


Figure 55

5. Screw the retainer into the output shaft by hand. Align the tabs of the retainer in the notches of the pitman arm (Figure 55).

6. Using the 5/8" or 3/4" allen head socket and torque wrench, install the retainer in the output shaft by torquing the retainer to the torque value stamped on the face of your retainer. (Figure 56).

**IMPORTANT:**

Steps 7, 8 & 9 are required only if you are replacing or reinstalling a pitman arm. If the pitman arm and sector shaft are both new proceed to step 10.

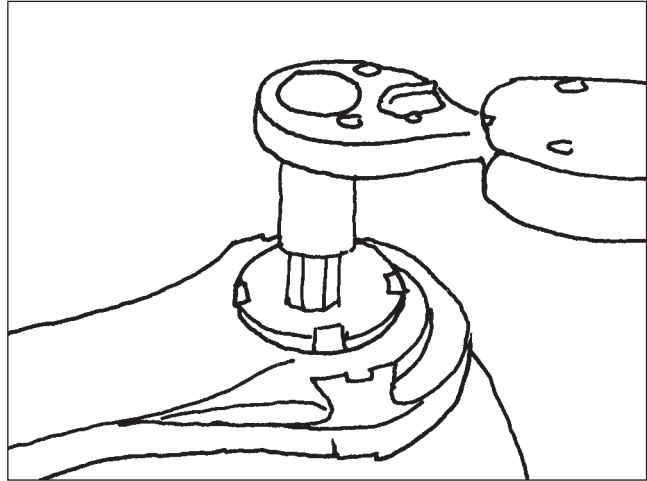


Figure 56

**⚠️ WARNING**

**YOU MUST MEASURE OUTPUT SHAFT TO PITMAN ARM CLEARANCE.**

7. After torquing the retainer, remove the retainer from the output shaft and measure the distance from the end of the output shaft(A) to the recessed area of the pitman arm.(B) The acceptable dimension is  
 225 ft./lbs. retainers 3/32" to 5/32"  
 350 ft./lbs. retainers 3/32" to 5/32"  
 450 ft./lbs. retainers 1/8" to 3/16"  
 (Figure 57).

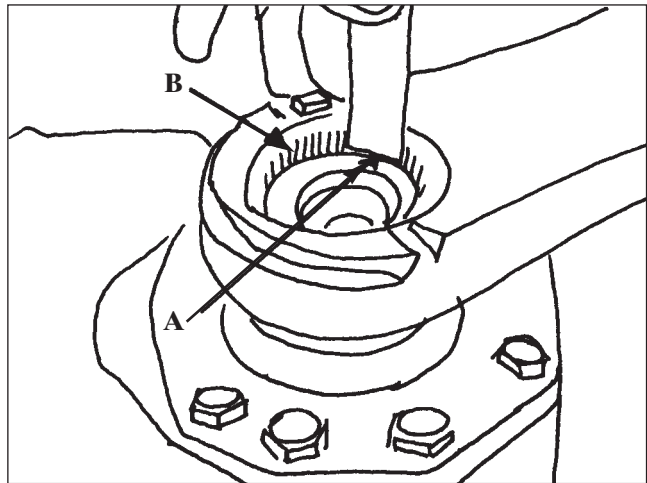


Figure 57

**⚠️ DANGER**

**IF THE MEASUREMENT DOES NOT MEET THE ACCEPTABLE MINIMUM OR MAXIMUM TOLERANCE THE PITMAN ARM AND SECTOR SHAFT MUST BE REPLACED. FAILURE TO TAKE THE MEASUREMENT OR REPLACE WORN PARTS COULD RESULT IN PITMAN ARM LOOSENESS WHICH COULD LEAD TO AN ACCIDENT OR PERSONAL INJURY!**

8. Screw the retainer into the output shaft hand tight. Be sure to align the tabs of the retainer in the notches of the pitman arm Refer to Figure 55.

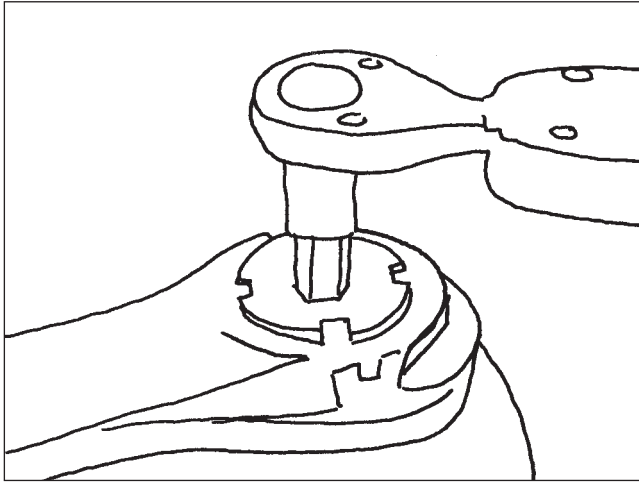


Figure 58

9. Using the 5/8" or 3/4" allen head socket and torque wrench, install the retainer in the output shaft by torquing the retainer to the torque value stamped on the face of your retainer. Either 225 ft./lbs., 350 ft./lbs. or 450 ft./lbs. (Figure 58).

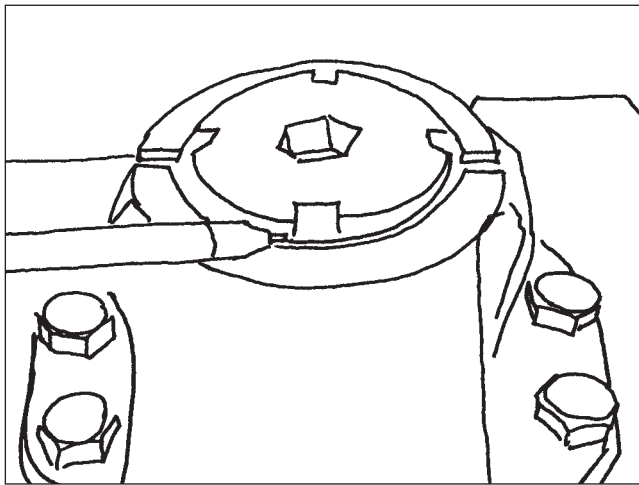


Figure 59

10. After the specified torque value is reached continue torquing until two of the restraining tabs of the tab washer align with the notches in the retainer (Figure 59).

## **⚠WARNING**

**IF THE TABS AND NOTCHES DO NOT LINE UP, TIGHTEN BEYOND THE SPECIFIED TORQUE VALUE UNTIL TWO TABS ALIGN.**

**NEVER BACK OFF THE RETAINER TO ALIGN THE RESTRAINING TABS!**

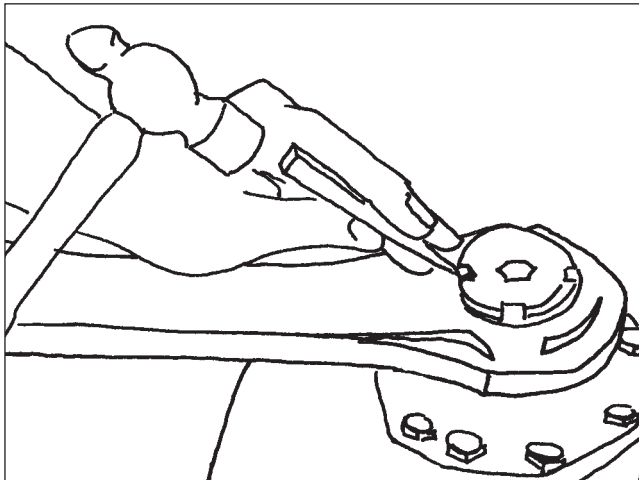


Figure 60

11. Use the tapered punch and hammer to lock the restraining tabs into the retainer (Figure 60).

## **⚠WARNING**

**ALWAYS WEAR SAFETY GLASSES AND NEVER USE A PUNCH THAT IS DAMAGED. PIECES OF STEEL CAN HIT YOUR EYE.**

12. Install the drag link. Torque the nut following the procedures in the Vehicle Manufacturer's Service Manual. Install a new cotter pin in the drag link ball stud.

## **WARNING**

**DO NOT BACK OFF THE NUT TO LOCATE THE COTTER PIN HOLE! FAILURE TO INSTALL AND LOCK THE COTTER PIN IN THE BALL STUD COULD RESULT IN A HAZARDOUS VEHICLE OPERAING CONDITION!**

### NOTE:

Relief plunger adjustment will be necessary if the power steering gear was changed or rebuilt. Refer to the section of the manual, under "Setting Relief Plungers."

## **WARNING**

**ALWAYS FOLLOW THE VEHICLE MANUFACTURER'S PROCEDURES FOR MOUNTING THE GEAR.**

## **DANGER**

**ONCE THE RETAINER IS LOCKED IN PLACE DO NOT RE-TORQUE THE RETAINER. CONSTANT TORQUING OF THE RETAINER CAN CAUSE PITMAN ARM LOOSENESS OR RETAINER FAILURE.**

## Input Shaft Seal Replacement - M110P2

### IMPORTANT:

Removal of the steering gear is required before input shaft seal replacement can be performed.

After you have removed the steering gear from the chassis, it is important that you follow the disassembly procedures in the “Disassembly” section of the manual. After the bearing cap assembly has been removed from the steering gear, you may proceed with changing the input shaft seal.

### TOOLS REQUIRED:

Small hammer  
 Sharp chisel  
 Sheppard tool #3563992  
 Sheppard tool #3563982  
 Bench vise  
 0-150 in/lb dial-type torque wrench  
 0-150 ft/lb torque wrench  
 Assorted sized sockets  
 Small screwdriver

### PARTS REQUIRED:

5541421-Seal Kit  
 5541411-Seal Kit

### ADDITIONAL REFERENCES:

Vehicle Manufacturer’s Service Manual  
 R.H. Sheppard Co. Maintenance & Troubleshooting Video  
 Directions Supplied in Seal Kit

### PROCEDURE:

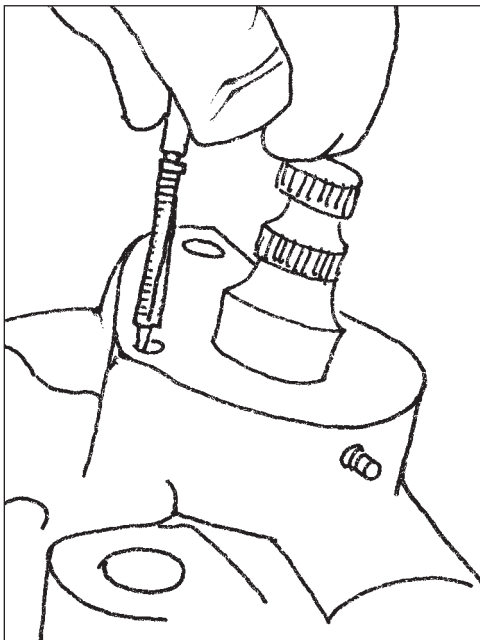


Figure 61

1. With a small screwdriver, remove the bearing cap plunger (Figure 61).

2. Remove and discard the seal ring & tetra seal (**Figure 62**).

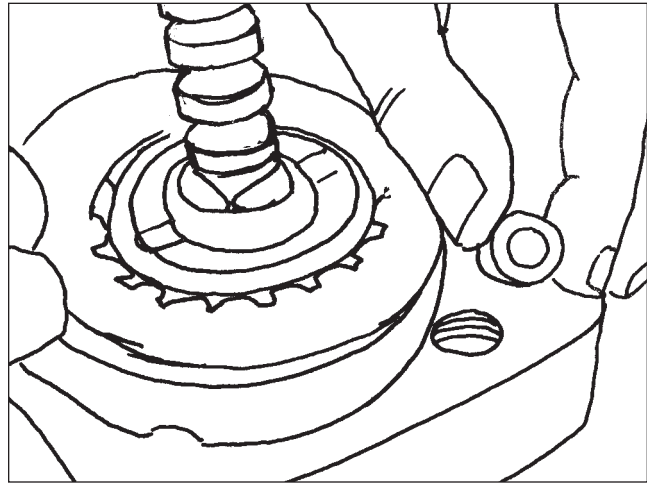


Figure 62

3. Use a vise to hold the bearing cap assembly in position with the rotary valve shaft sticking straight (**Figure 63**).

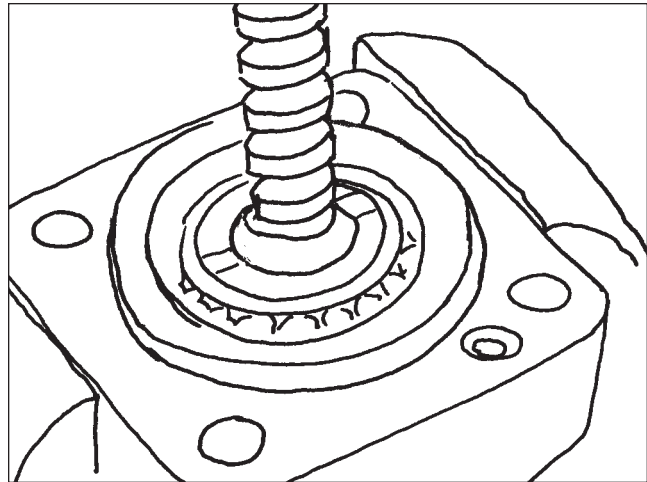


Figure 63

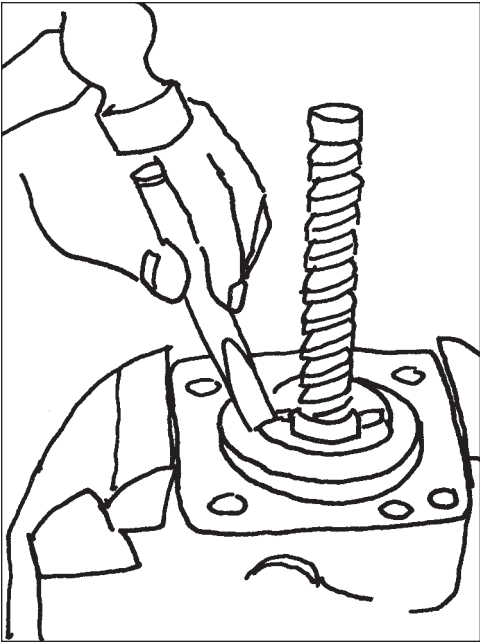


Figure 64

4. Using a hammer and chisel, split the star nut at the grooves in the shaft retaining nut. Discard the star nut (Figure 64).

**NOTE:**

Care must be exercised to prevent damage to the bearing cap or the shaft retaining nut.

**⚠ WARNING**  
WEAR SAFETY GLASSES - SHARP METAL FROM THE CHISEL OR STAR NUT CAN INJURE AN EYE!

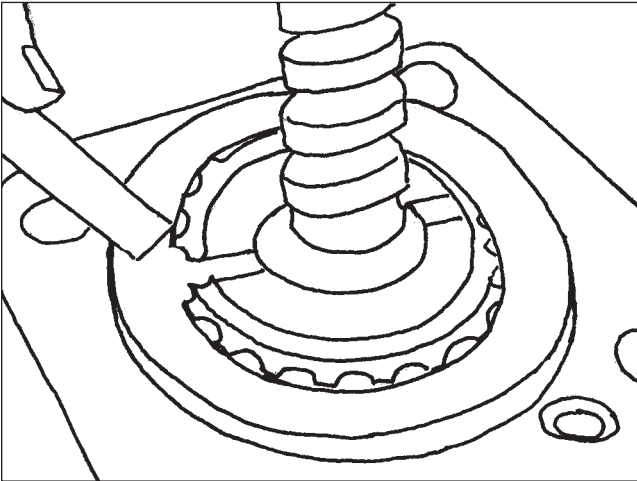


Figure 65

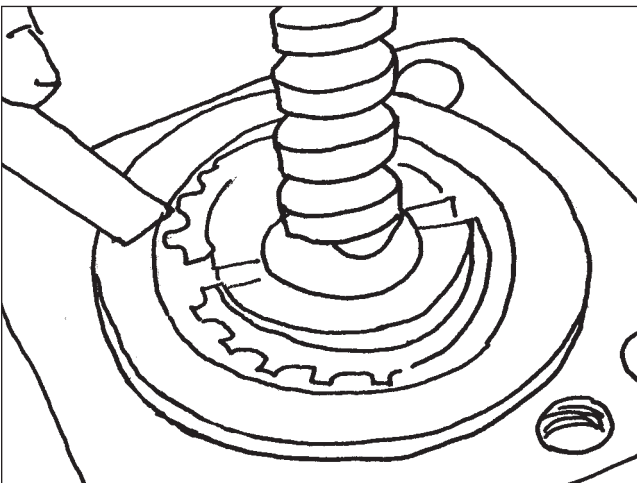


Figure 66

5. Loosen the shaft retaining nut using Tool #3563982 (Figure 66).

6. Reposition the assembly in the vise.

7. Carefully slide the valve shaft out of the bearing cap. Do not turn the shaft when removing (Figures 67 & 68).

**⚠ CAUTION**

Care must be used when removing the shaft assembly from the bearing cap to insure that rotary valve seals, thrust washers and roller bearings are not damaged.

**NOTE:**

Do not remove the rotary valve seals and energizing O-rings from the valve shaft. Replacement of these seals is not necessary, unless the original seals were damaged during shaft removal.

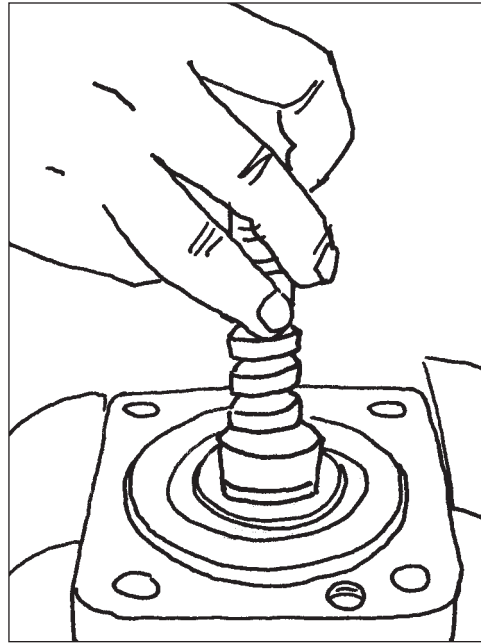


Figure 67

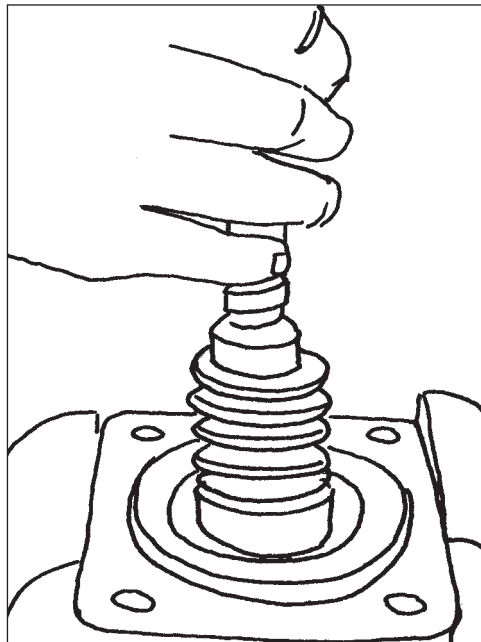


Figure 68



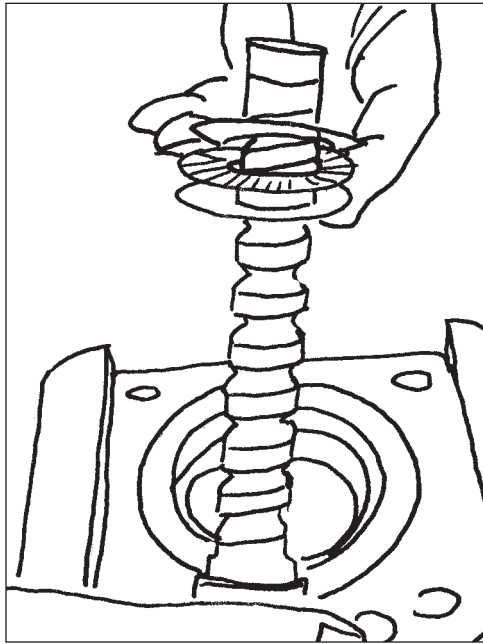


Figure 69

8. Inspect the thrust washers and thrust bearings for excessive wear or damage. Replace worn or damaged parts (**Figure 69**).

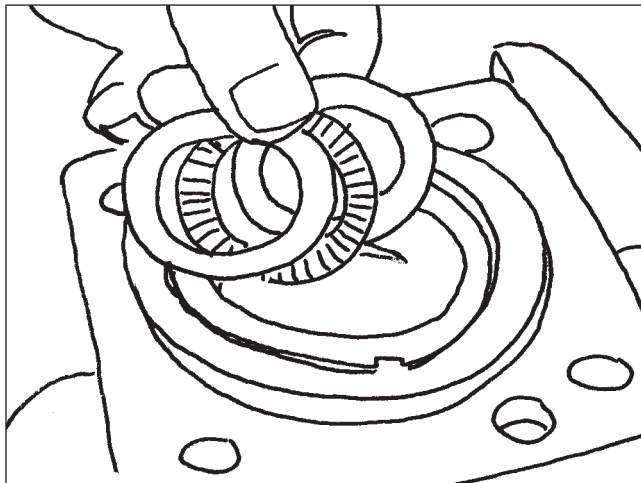


Figure 70

9. Place the input shaft assembly in a clean area.
10. Remove the bearing cap from the vise and place it on the bench with the salt seal facing you.

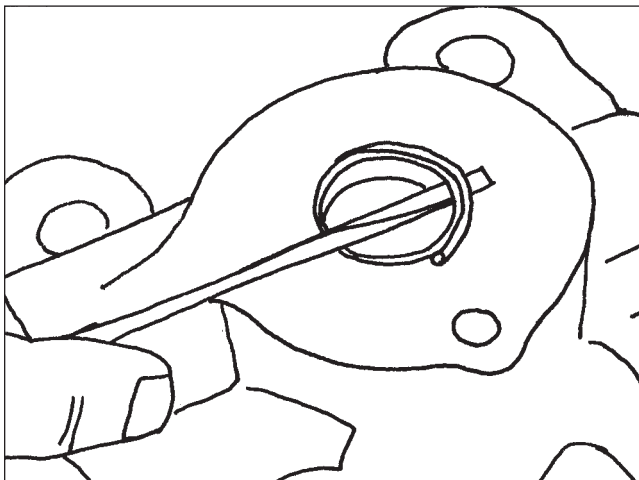


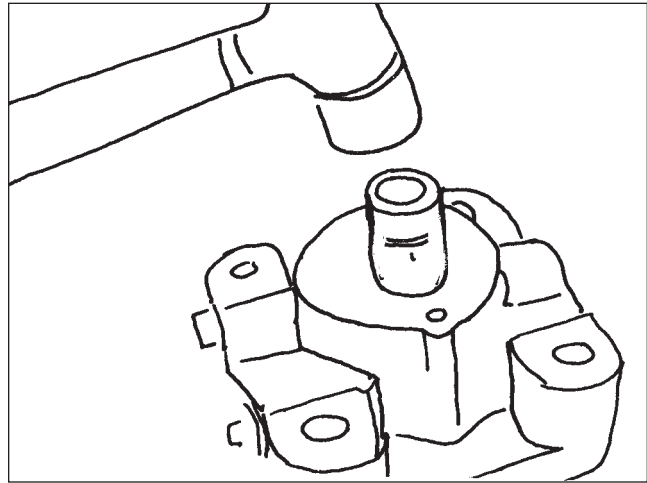
Figure 71

11. Pry the salt seal from the cap using a small screwdriver (**Figure 71**).

12. Using an appropriate-sized socket or bushing driver, remove the seals by pushing them out using light hammer blows. Discard the old seals (**Figure 72**).
13. Clean the bearing cap with an approved solvent and blow it dry with low pressure air.

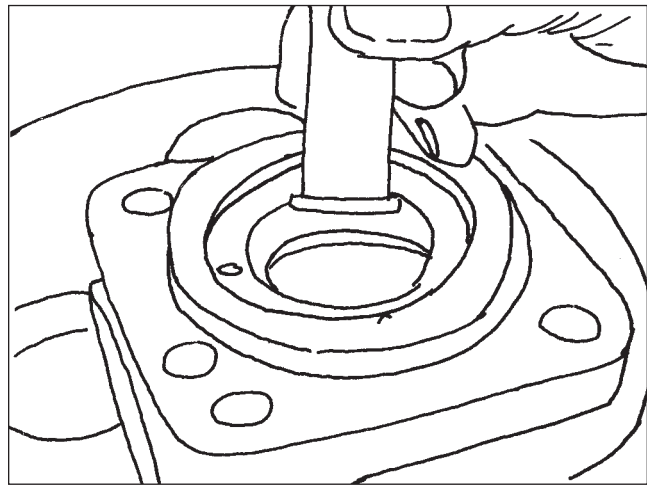
**⚠WARNING**

**ALWAYS WEAR SAFETY GLASSES AND USE LOW PRESSURE AIR ONLY TO CLEAN PARTS.**

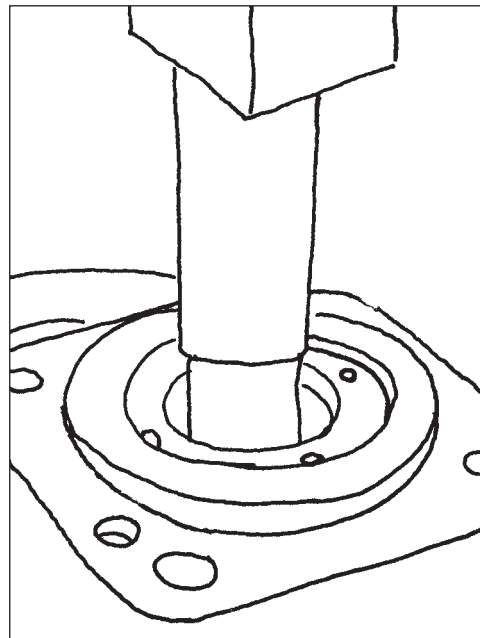


**Figure 72**

14. Turn the cap over and install the input shaft seal using a seal driver. Insure the lip of the seal is facing you (toward pressure). Press the seal in until it bottoms, using an arbor press (**Figures 73 & 74**).



**Figure 73**



**Figure 74**

**NOTE:**

A light coat of oil or grease is recommended on the outside diameter of the seal for easier installation.

15. Press the salt seal into the cap until it is flush with the bearing cap. Pack the area between the oil and salt seal with grease.(Figure 75).

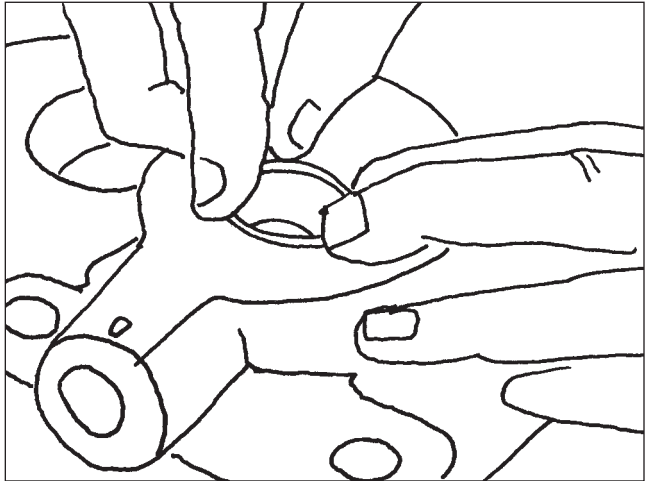


Figure 75

16. Clamp the bearing cap in the vise.
17. Inspect the rotary valve seals to insure there are no nicks or cuts. If rotary valve seal installation is necessary, refer to “Rotary Valve Seal Replacement” in the Common Procedures section of this manual. Tape the splines of the input shaft to prevent seal damage during installation.

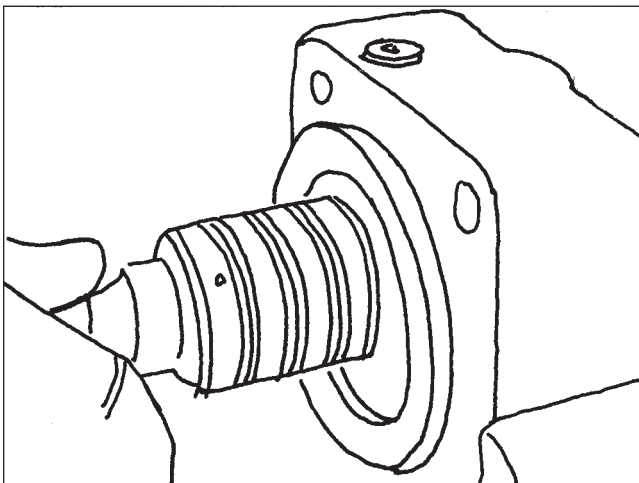


Figure 76

18. Review **Figure 76** and insure the thrust washers and roller bearings are installed on the shaft properly.

**NOTE:**

A light coat of grease on the thrust bearings and thrust washers will help to keep them in place during installation.

19. Install the input shaft assembly in the bearing cap.

**⚠ CAUTION**

Care must be taken during installation of the input shaft assembly to prevent damage to rotary valve seals, thrust washers and thrust bearings. Do not turn the shaft during installation.

21. Attach the dial-type inch pound torque wrench to Tool #3563982. Install the shaft retaining nut using Tool #3563982. Torque the nut to 25-35 inch pounds (**Figure 77**).

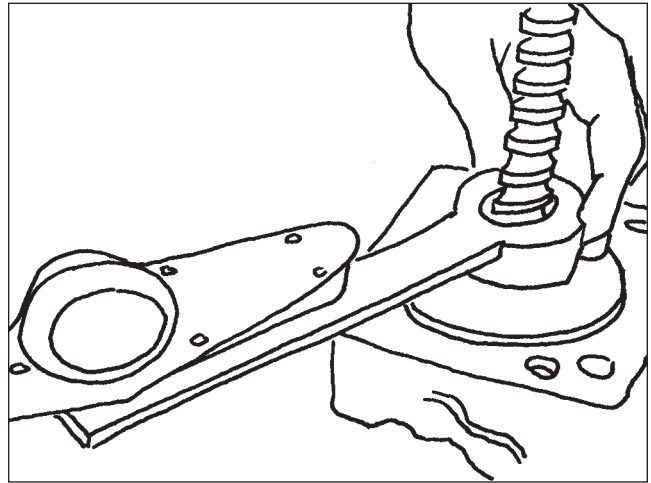


Figure 77

22. Remove the torque wrench from the tool.

23. Place a new locking star nut over the retaining nut. Use Tool #3563982 to hold the shaft retaining nut in position (**Figure 78**).

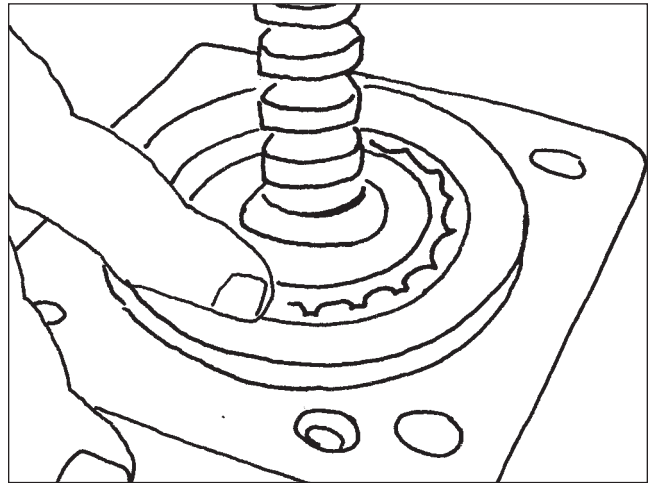


Figure 78

24. While holding the retaining nut in place, tighten the star nut to 10-12 foot pounds of torque, using the torque wrench and Tool #3563992. Do not allow the shaft retaining nut to move while torquing the star nut (**Figure 79**).

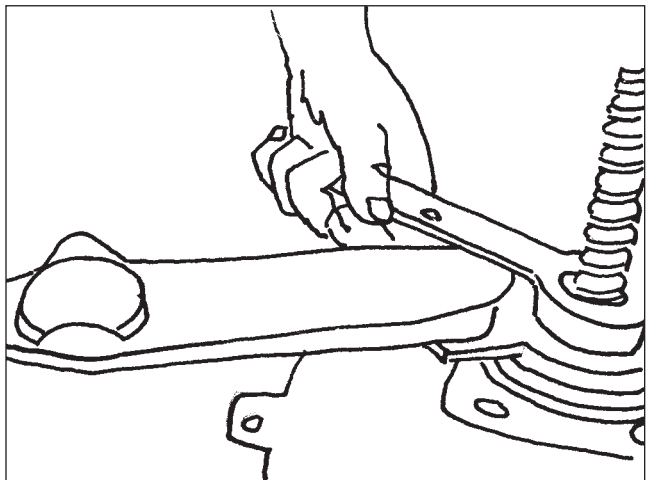


Figure 79

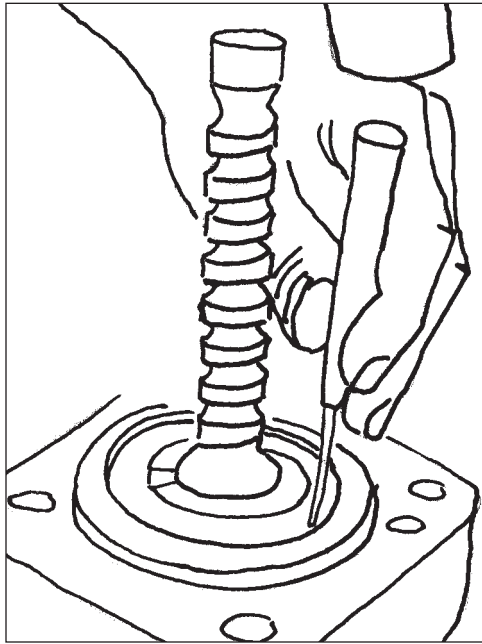


Figure 80

25. Continue to tighten the star nut until two of the tangs line up with the two holes in the bearing cap 90 degrees away from the threaded plunger hole, and bend the tangs of the star nut into the bearing cap assembly holes (Figure 80).

## ⚠ CAUTION

The threaded hole in the cap accommodates the plunger. Do not use this hole to lock the star nut.

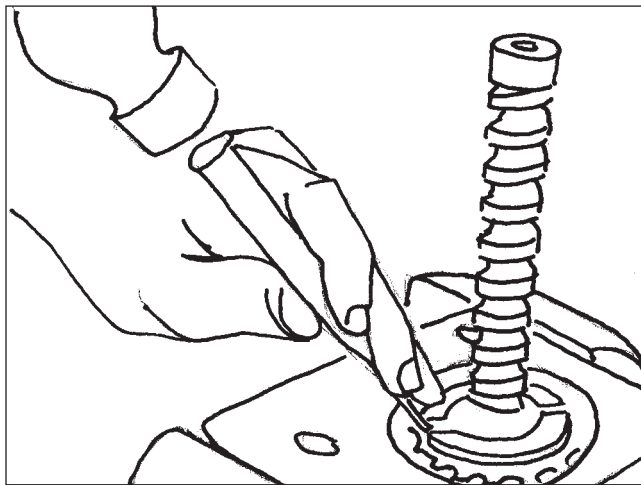


Figure 81

26. Stake the star nut at the slots in the shaft retaining nut (Figure 81).

27. Turn the bearing cap over in the vise. Turn the spline end of the shaft using the inch pound torque wrench and an appropriate-sized socket. The reading should be less than 24 inch pounds of drag.

### NOTE:

If the reading is more than 24 inch pounds of drag, you must recheck the torque on the retaining nut.

28. Install a new tetra seal and seal ring (Figure 82).

NOTE:

Lightly coat the tetra seal and seal ring with grease to hold them in place during installation.

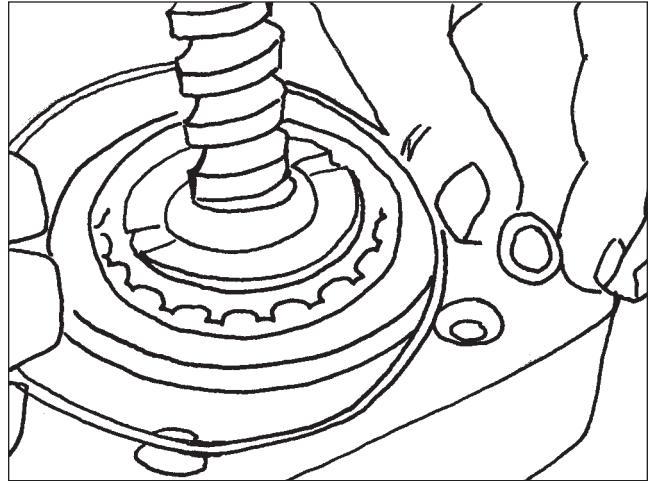


Figure 82

29. Reinstall the bearing cap assembly in the steering gear using the procedure in the “Reassembly” section of this manual.

30. Slide the rubber boot over the input shaft (Figure 83).

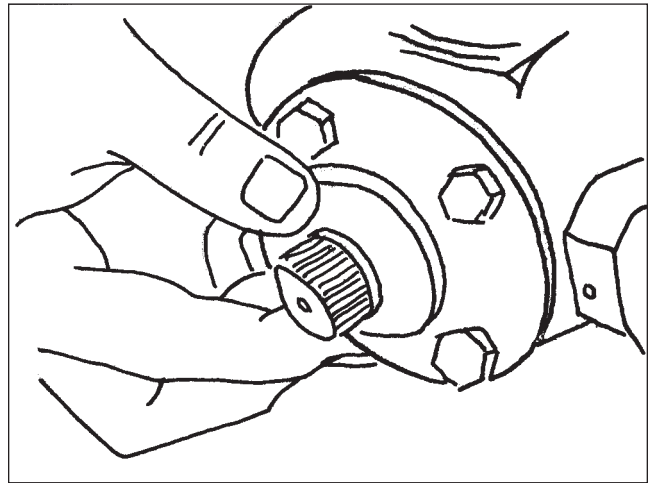


Figure 83

31. Install the plunger in the bearing cap.

NOTE:

Adjustment of the plunger will be necessary after reinstalling the steering gear. Refer to the “Common Procedures” section of this manual.

32. Remove and discard the tape from the input shaft splines.

NOTE:

If your steering gear is equipped with a grease fitting, remove the fitting and fill the hole with RTV. No further greasing is required.

## Disassembly

The diagnosis and troubleshooting section of this manual has been prepared to help with proper diagnosis. Repair time and downtime, as well as repair costs, can be reduced if needless disassembly and replacement of steering gear parts is avoided. Before removing the steering gear from the chassis, you must be certain that the hydraulic supply system is operating properly and that all mechanical components are in good repair.

### IMPORTANT:

The Sheppard integral power steering gear is a precision machined assembly and care must be taken during repair to keep it free of dirt and foreign material. All internal parts must be handled carefully to avoid damage to machined surfaces. Nicks or burrs can cause damage to mating parts and must be removed with a fine hand stone before reassembly. Working on a soft cardboard or plywood-surfaced workbench is best. Follow disassembly procedures as required.

Refer to the "Pitman Arm Removal" instructions in the "Common Procedures" section of this manual. Follow these instructions carefully and remove the tab lock retainer and pitman arm.

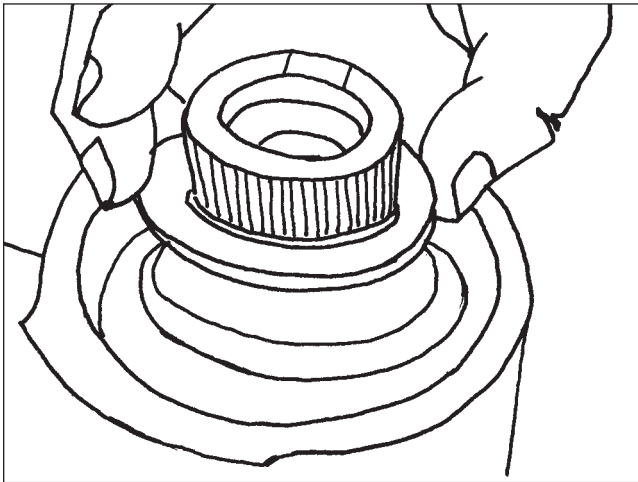


Figure 84

1. Remove the rubber sector shaft boot (Figure 84).

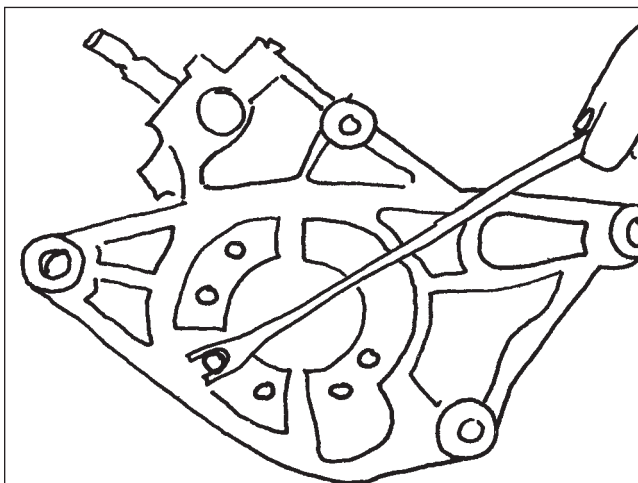


Figure 85

2. Remove the mounting bracket bolts and separate the mounting bracket from the steering gear (if equipped) (Figure 85).

3. Remove the frame side dirt shield using a gasket scraper. Some steering gears may have a screw-in dust shield. Use 1/4" allen wrench to remove screw-in dirt shields. (Figure 86).

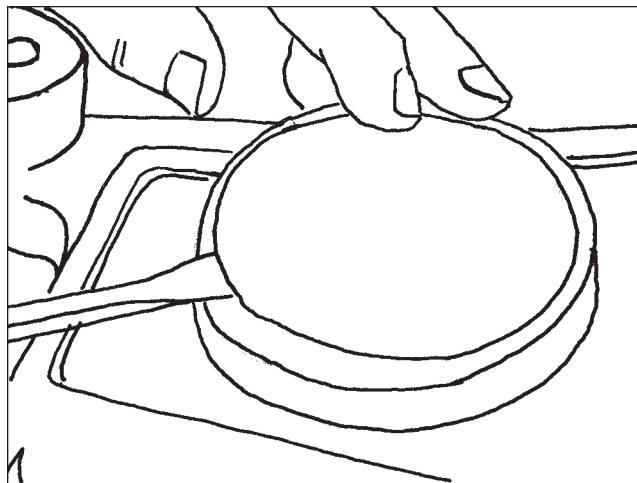


Figure 86

4. Using a center punch, make two reference marks on the bearing cap and corresponding marks on the housing. A single reference mark should be made on the cylinder head and a corresponding mark on the housing, so the gear can be reassembled in the same configuration (Figure 87).

**⚠WARNING**  
**WEAR SAFETY GLASSES. SHARP METAL FROM THE PUNCH OR HOUSING CAN INJURE AN EYE.**

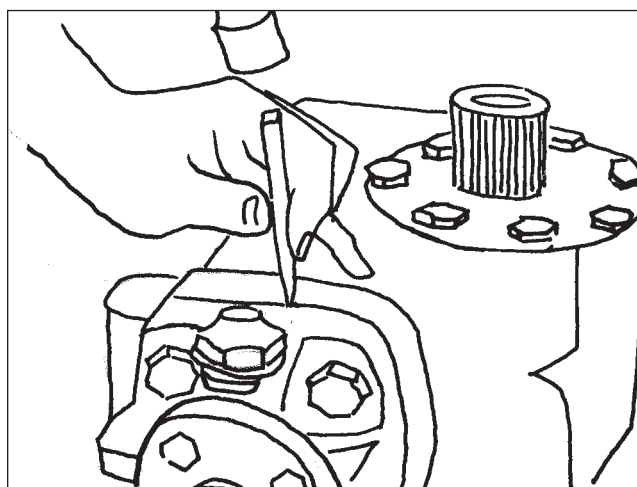


Figure 87

5. Remove the relief valve plungers from both ends of the gear. This will protect them from damage during repair (Figure 88).

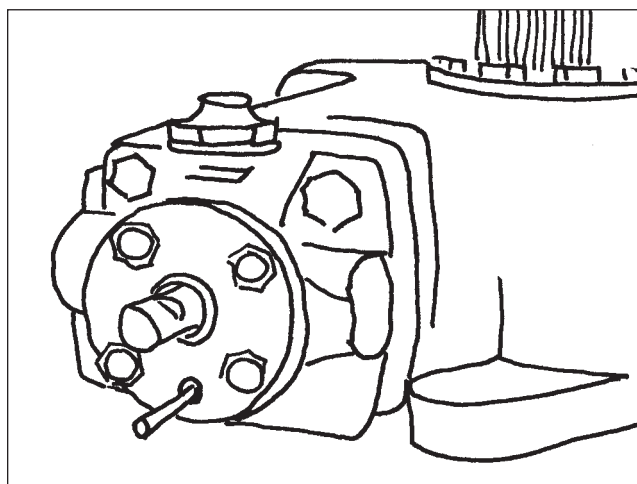


Figure 88



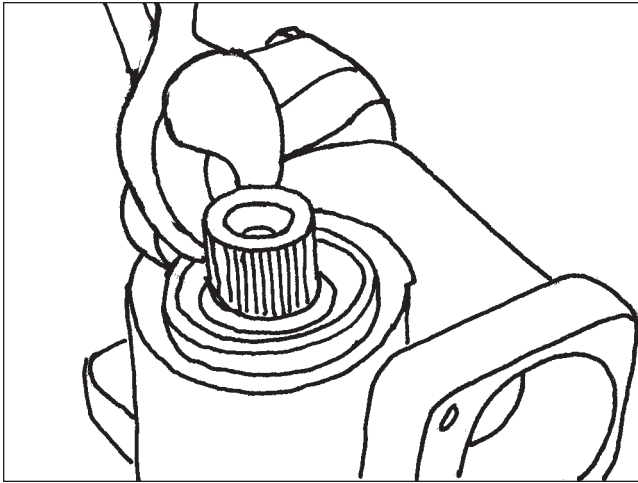


Figure 89

6. Remove the sector shaft cover using the appropriate tools for the steering gear you are working on. Either snap ring pliers or suitable size socket (**Figure 89**).

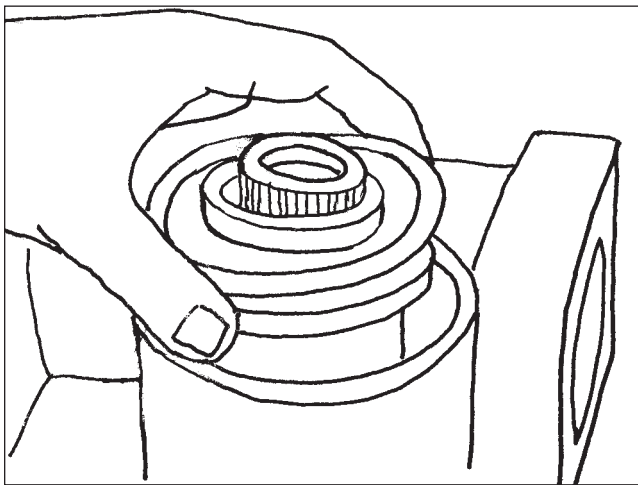


Figure 90

7. Using a soft hammer, tap on the end of the sector shaft to loosen the cover (**Figure 90**).

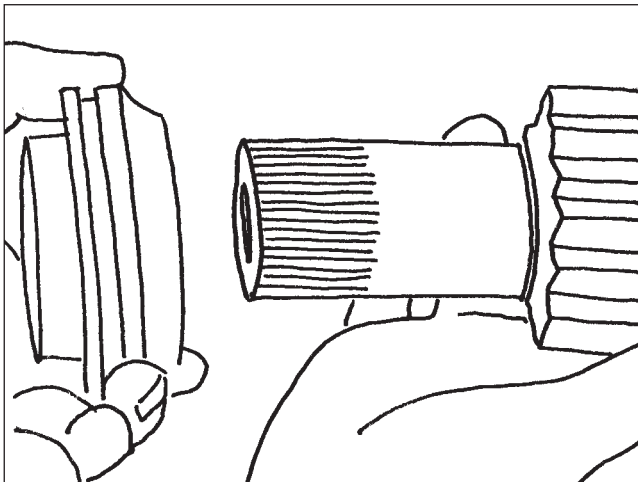


Figure 91

8. Carefully slide the sector shaft and cover out of the housing. Slide the cover off the sector shaft (**Figure 91**).

9. Remove and discard the cover O-ring and sector shaft seal (Figure) or the 3-piece seal assembly (Figure 92). (if equipped).

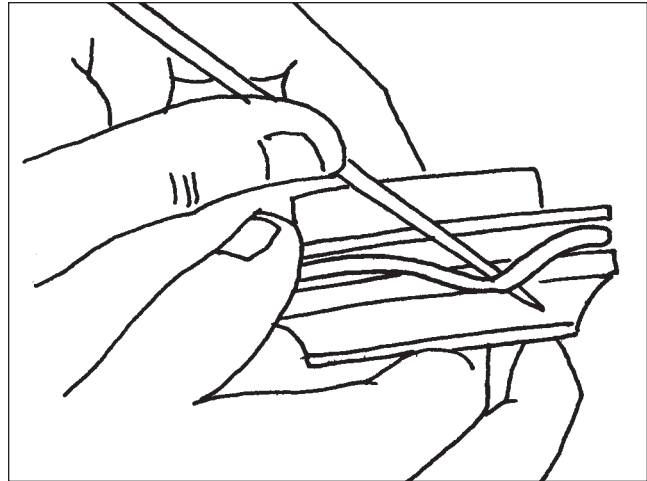


Figure 92

NOTE:

Later model steering gears may have an excluder seal pressed in the sector shaft cover. Use a screwdriver to pry the excluder seal from the cover (Figure 93).

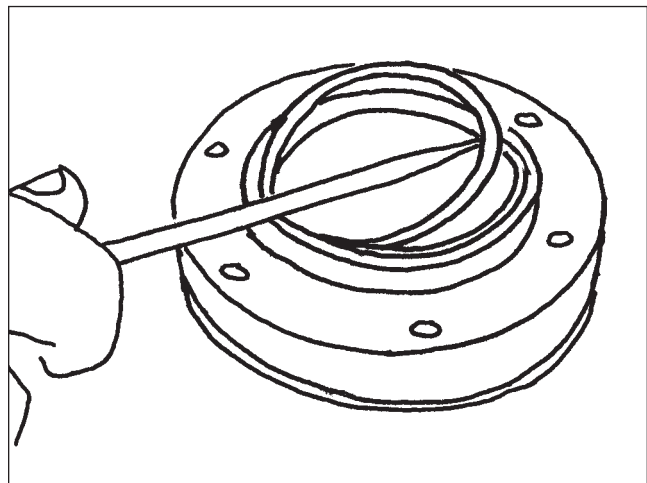


Figure 93

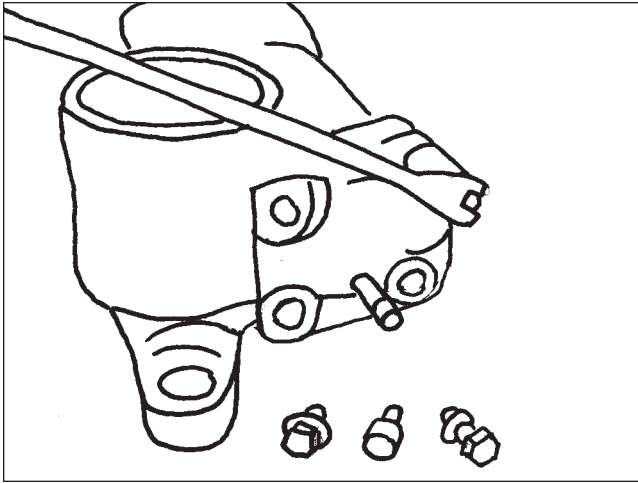


Figure 94

10. Remove the cylinder head and discard both the seal ring and the tetra seal (Figure 94 & Figure 95).

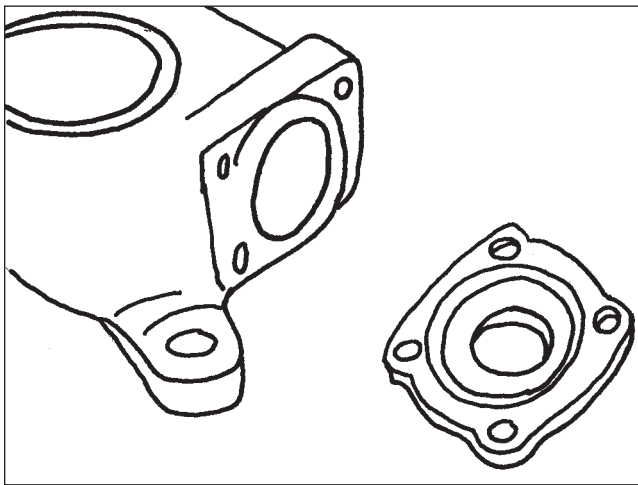


Figure 95

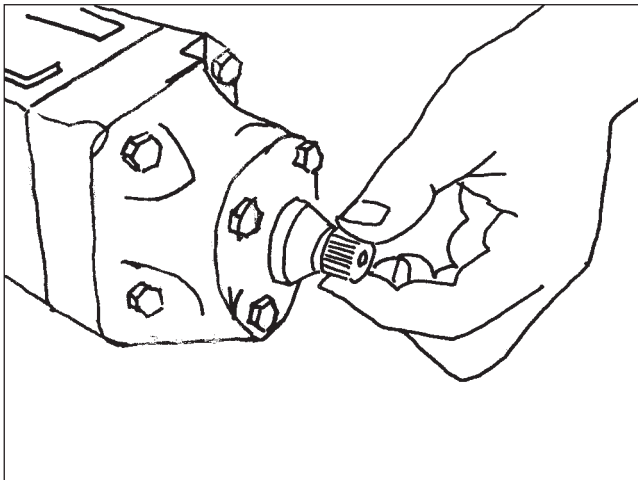


Figure 96

11. Remove the face seal from the input shaft (if equipped) (Figure 96).

12. Remove the attaching bolts from the bearing cap and turn the input shaft to free the bearing cap assembly from the housing (Figure 97).

## ⚠ CAUTION

After the bearing cap assembly is free from the housing, keep the shaft stationary. Binding of the shaft and shaft damage may occur if the shaft is removed at this time.

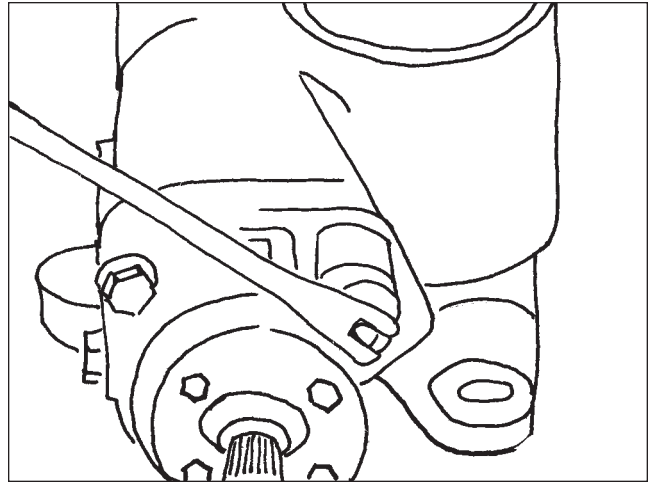


Figure 97

13. Carefully slide the piston and bearing cap assembly from the housing bore until the ball guide retainer is located (Figure 98).

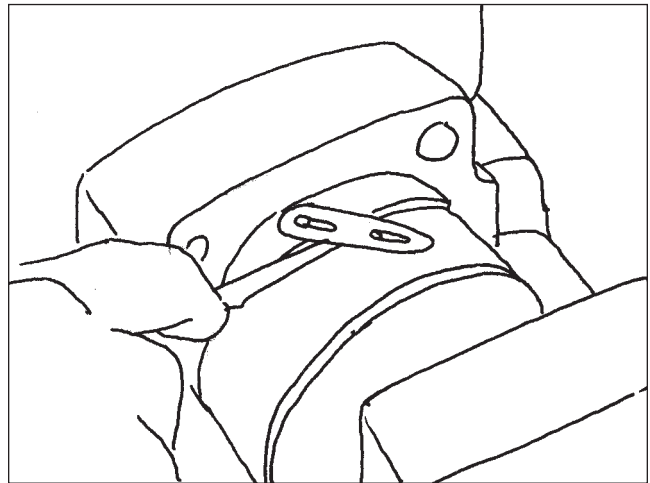


Figure 98

## ⚠ CAUTION

The ball guide retainer must be held in place while removing the piston. If not, the ball return guides and steel balls will drop out of the assembly. Loss of the steel balls may occur.

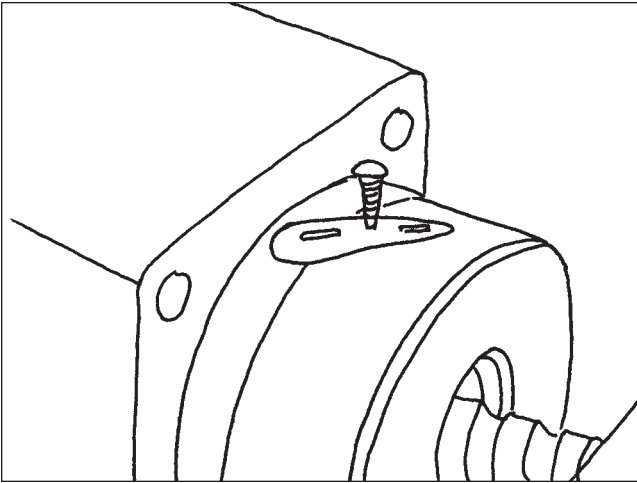


Figure 99

14. Screw a small sheet metal screw into the ball guide retainer until 2 to 3 threads are engaged. Using a pair of pliers, remove the ball guide retainer from the piston (Figures 99 & 100).

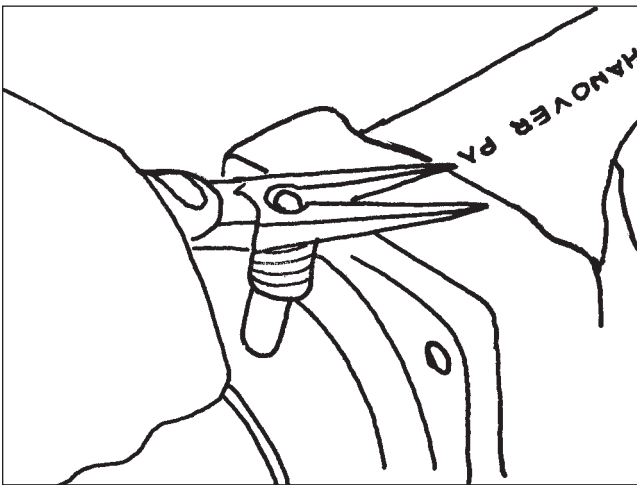


Figure 100

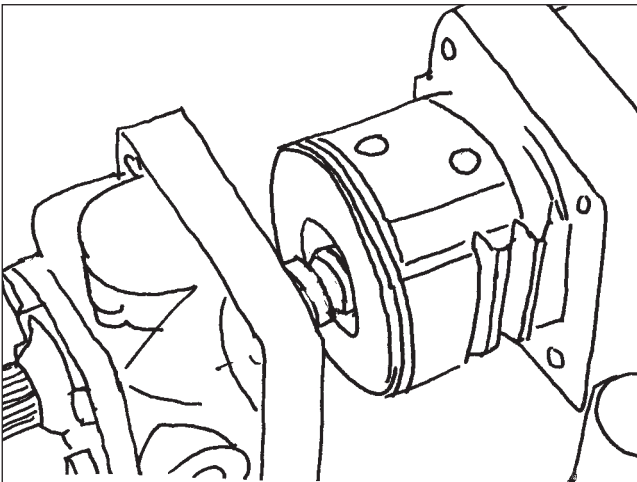


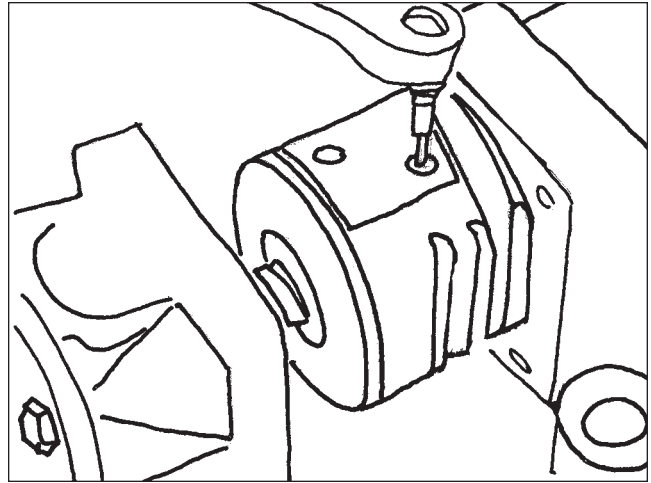
Figure 101

#### Piston Variation

Some steering gears are equipped with a bolt- on ball guide retainer. Refer to **Figure 101** for disassembly.

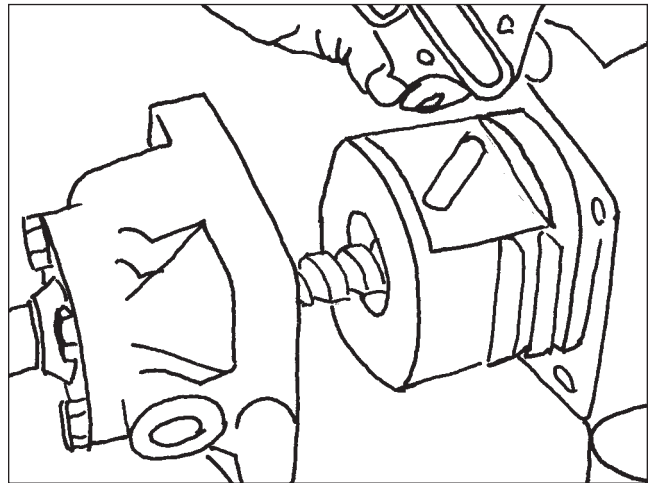
**NOTE:**

With bolt-on retainers, remove the mounting bolts and ball guide retainer. Remove and discard the seal ring from the retainer (**Figure 102**).



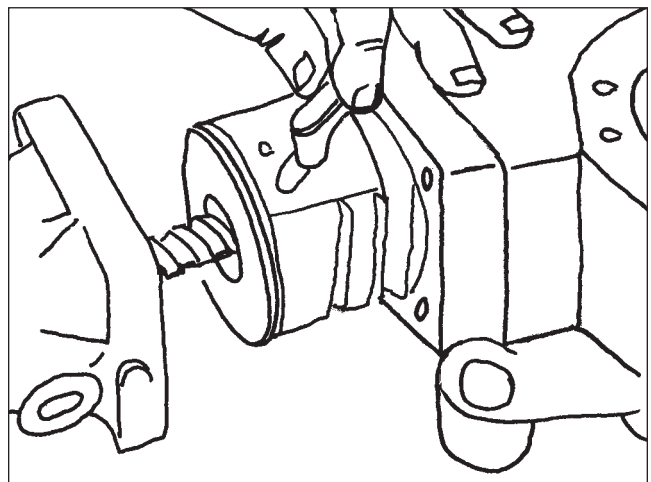
**Figure 102**

15. Do not remove the piston at this time. Leave the piston in the housing with the ball guide exposed (**Figure 103**).



**Figure 103**

16. Remove the ball return guides. The steel balls are then free to roll out of the ball cavity in the piston (**Figure 104**).



**Figure 104**

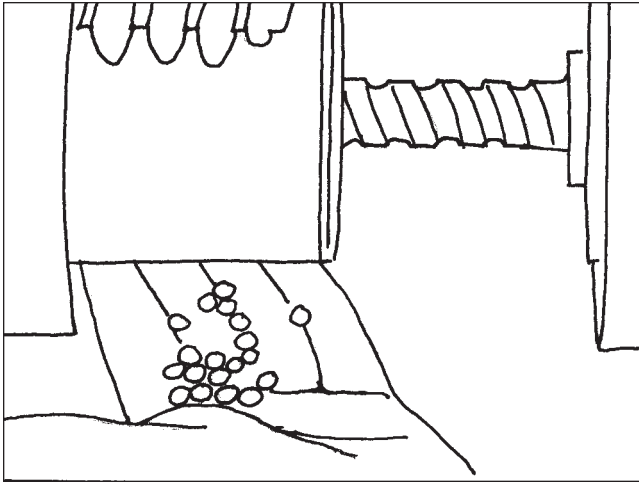


Figure 105

**IMPORTANT:**

It will be necessary to rotate the shaft in and out slightly to remove all the steel balls. 24 steel balls are contained in the piston and must be removed before the input shaft and bearing cap assembly removal can be completed.

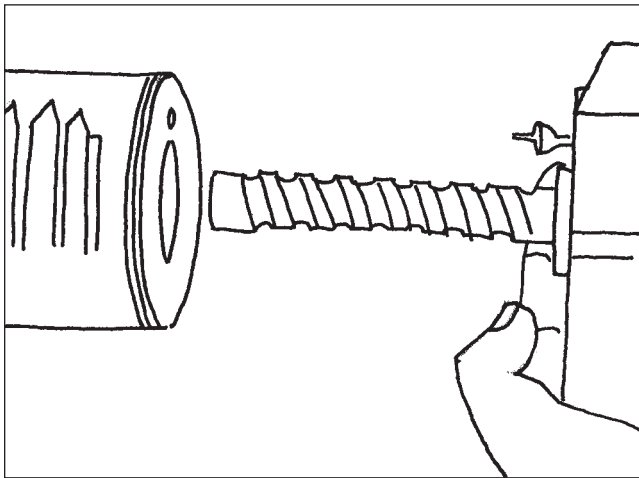


Figure 106

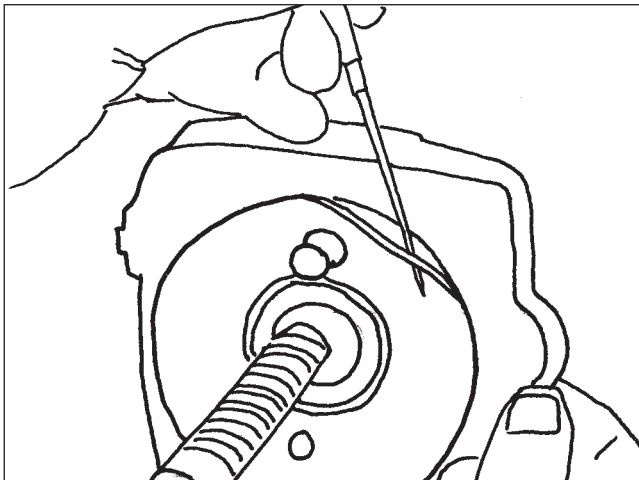


Figure 107

17. After removal of the 24 balls, the input shaft and bearing cap assembly may be removed from the piston. At this time the seal ring and tetra seal may be removed and discarded (Figure 107).

18. Carefully slide the piston from the housing (Figure 108).

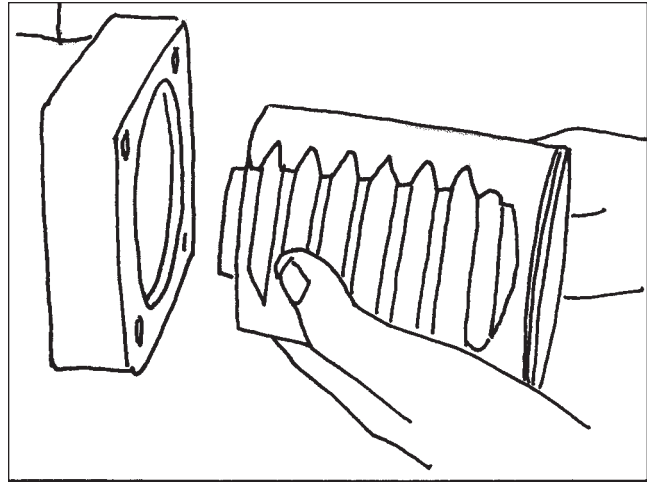


Figure 108

19. Remove and discard the sector shaft seal from the housing (Figure 109).

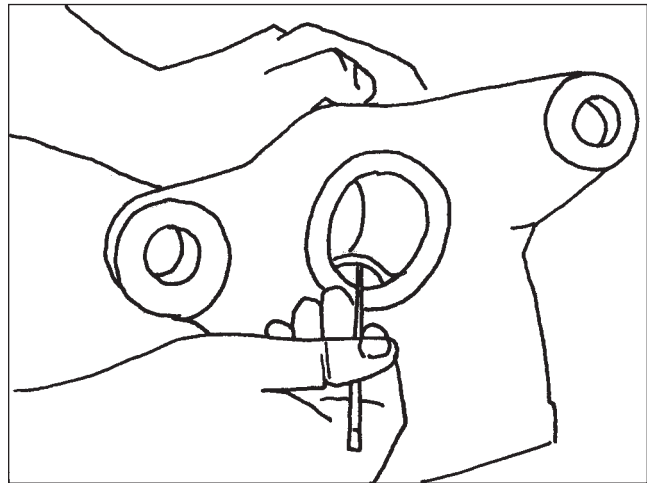


Figure 109

20. The steering gear has been disassembled. Necessary parts may be replaced as needed (Figure 110).

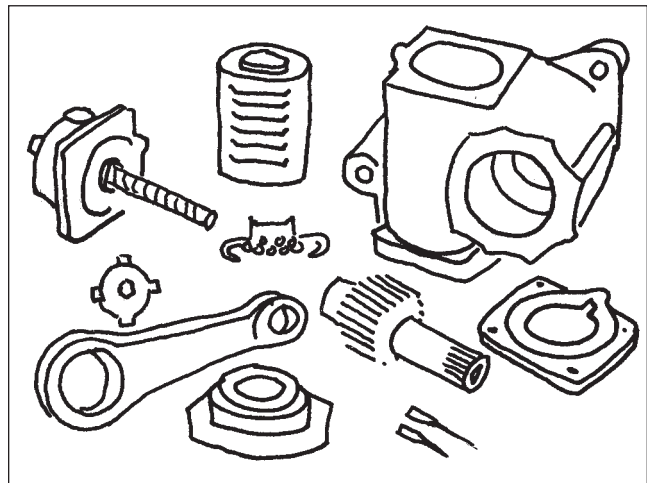


Figure 110



## SUB ASSEMBLIES

### M-SERIES OPTIONAL INTEGRAL RELIEF VALVE

An optional, integral pressure relief valve is offered with the Sheppard M-Series steering gear. The relief valve cartridge is located in the bearing cap. The valve limits the maximum operating pressure in the steering system. In most cases, the hydraulic supply pump will have a maximum relief pressure setting higher than the integral relief valve in the steering gear.

When maximum relief pressures are reached in the steering system, the excess pressure is relieved within the steering gear.

When oil pressure exceeds the maximum relief pressure setting of the pilot-operated relief valve, the valve opens. Excess pressure is bled off into the oil return circuit through the return port of the steering gear.

The relief valve cartridge can be removed for cleaning and inspection. Remove the relief valve nut and cartridge assembly. At this time the strainer can also be cleaned and inspected.

**NOTE:**

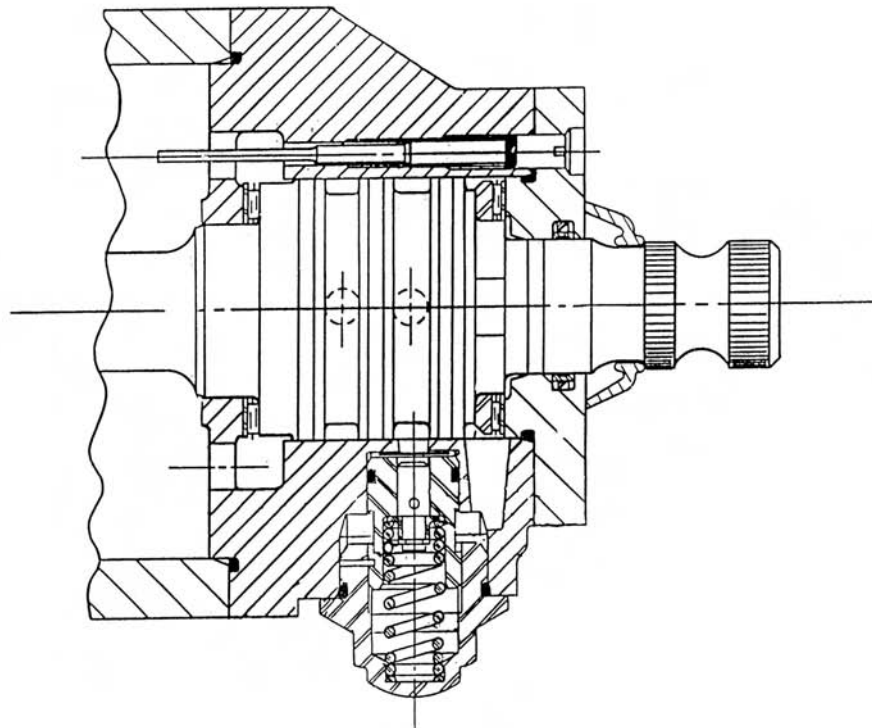
The relief valve cartridge can not be disassembled and must be replaced if bad.

The O-rings and strainer are replaceable and are included as part of the complete seal kit.

## ⚠ CAUTION

**Never use old seals or O-rings. Use the complete seal kit.**

To install the relief valve cartridge in the bearing cap, insert the cartridge assembly into the relief valve bore and torque the valve nut to 35 ft./lbs.



REPAIR OUTPUT SHAFT AND PINION (M110 ONLY)

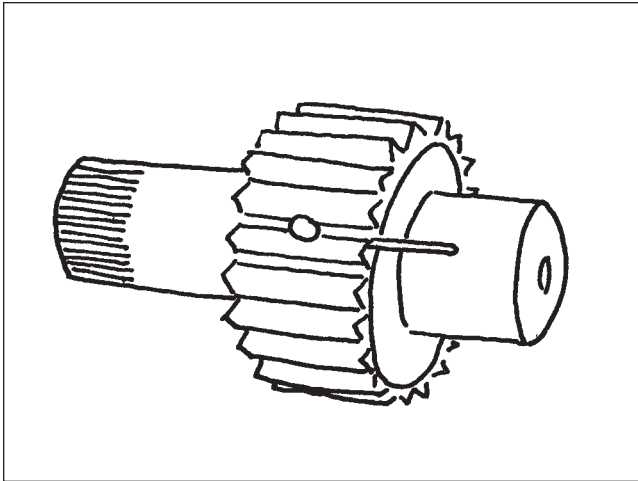


Figure 111

1. The pinion gear is located and held in place on the output shaft with a retaining pin. A roll pin through the pinion gear will keep the retaining pin from backing out of place. To remove the pinion gear, punch out the roll pin and drill out the retaining pin. Press the pinion gear off the output shaft (Figure 111).

NOTE:

If the retaining pin cannot be drilled out, it can be sheared off with approximately 10 tons of pressure on a hydraulic press. Drive half the pin out of the pinion gear and drill the remaining half out of the shaft.

**⚠WARNING**

**USING A HYDRAULIC PRESS IMPROPERLY CAN CAUSE PIECES OF METAL TO BREAK OFF OR SHATTER. PIECES OF METAL UNDER PRESSURE CAN CAUSE SERIOUS INJURY. ALWAYS WEAR SAFETY GLASSES AND FOLLOW ALL SAFETY AND OPERATING PROCEDURES PROVIDED BY THE HYDRAULIC PRESS MANUFACTURER.**

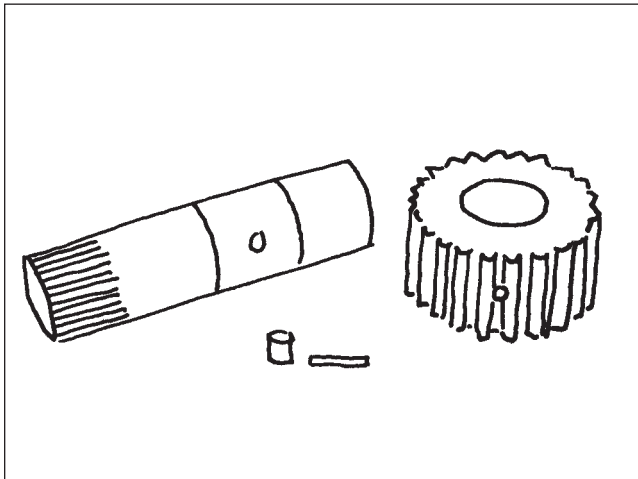


Figure 112

2. To reassemble the pinion gear to the output shaft, align the timing arrows on the output shaft to the arrow on the pinion gear. Press the gear on to the shaft splines until the locating pin can be driven through the gear and into the locating hole in the shaft. Install the roll pin through the gear (Figure 112).

## Rotary Valve Seal Replacement M110

Rotary valve seals and energizing O-ring replacement is **not** necessary unless the seals are cut or damaged. Replacement of these seals should **not** be attempted without a seal compression ring tool. Insure that your work area is clean and free of dirt and debris to prevent damage or contamination to the rotary valve seals.

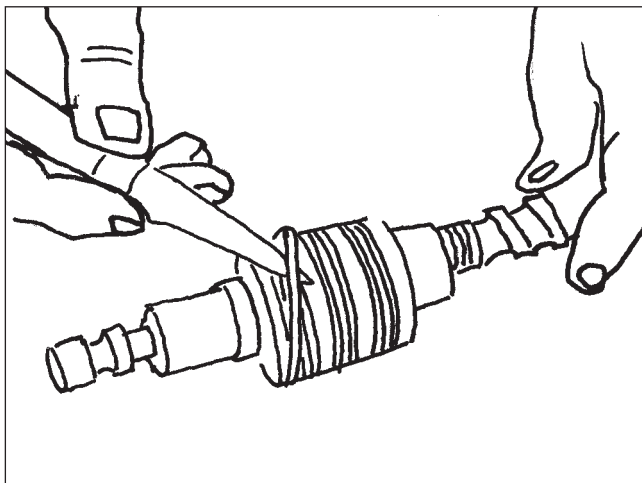


Figure 113

1. Remove the rotary valve seals and energizing O-rings (Figure 113).

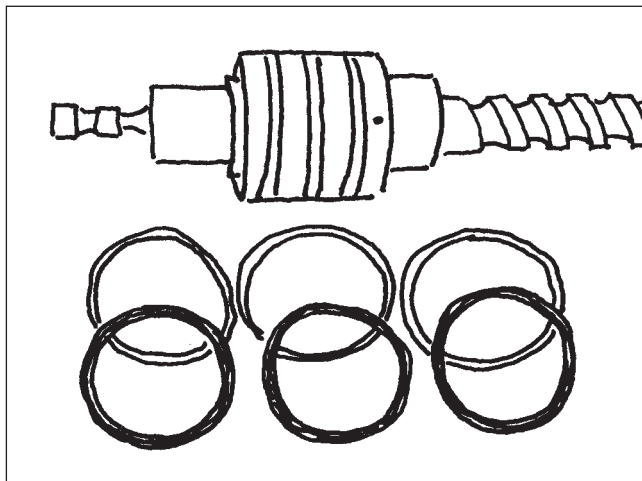


Figure 114

2. Inspect the rotary valve grooves to insure they are clean and free of nicks or burrs (Figure 114).

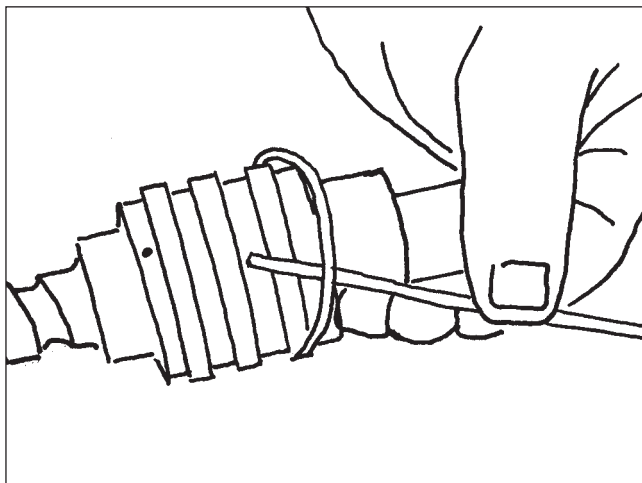


Figure 115

3. Install the 3 energizer O-rings into the rotary valve grooves (Figure 115).

**NOTE:**

These energizer O-rings will stretch over the rotary valve. Care should be used to insure the rings do not twist in the cavity.

- Carefully stretch the rotary valves seals over the energizing O-rings (Figure 116).

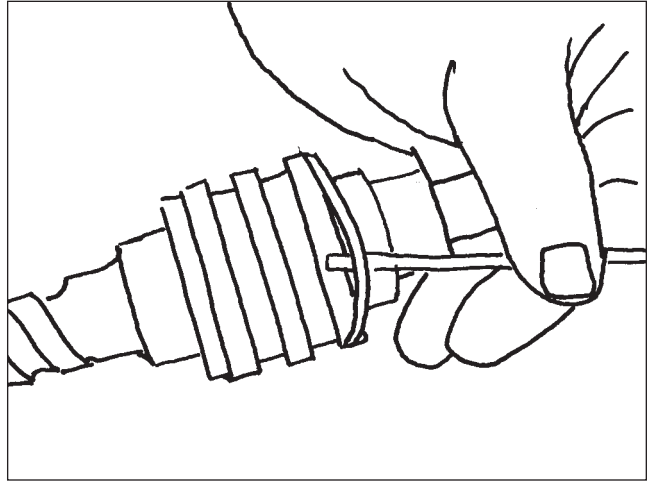


Figure 116

## **CAUTION**

A small, thin piece of flat stock can be used to work the seals over the energizing O-rings. Do not use a sharp piece of material for this job. You may cut or slice the seal (Figure 117).

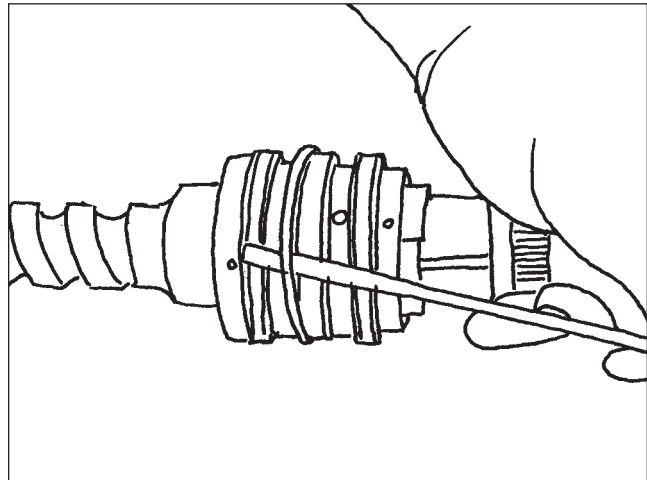


Figure 117

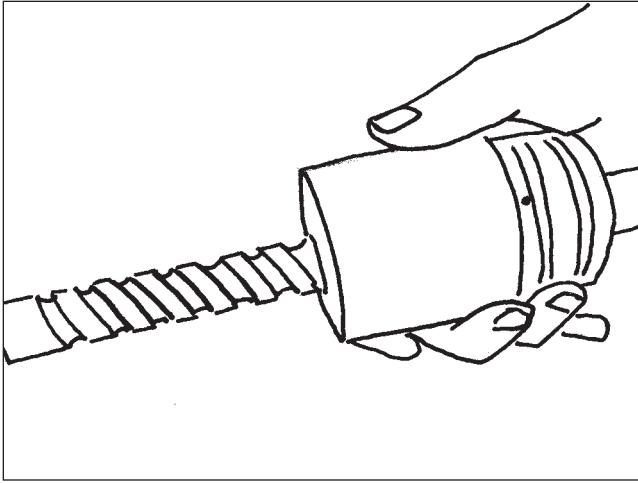


Figure 118

5. Using Tool # 3563972, compress the rotary valve seals to aid installation of the valve shaft (Figures 118 & 119).

## **⚠ CAUTION**

Attempting to install the valve shaft assembly in the bearing cap without using the compression tool could result in damage to the seal.

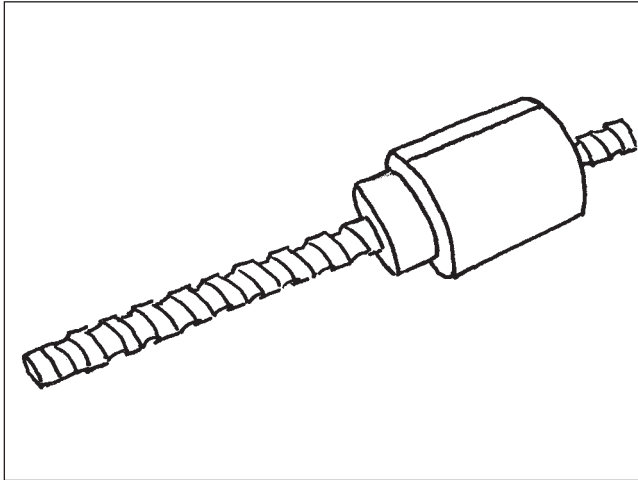


Figure 119

6. Remove the compression tool.

Refer to the M110 “Input Shaft Seal Installation” procedure (page 55) for information on installing the rotary valve in the bearing cap.

## REASSEMBLY

### CLEANING & INSPECTION

#### Cleaning

Cleanliness is important. Dirt and foreign material that gets into the steering system during repair operations can cause damage or a possible steering malfunction at a later date. Due to the close tolerances between mating parts it is best to have all parts at the same temperature for reassembly.

Clean the machined parts individually to avoid damage caused by “bumping” together. Use clean solvent to wash parts. Dry the parts with compressed air. Nicks or burrs must be removed with a fine hand stone before assembly. Use clean lubricant to coat parts for assembly.

All hoses, lines and the reservoir should be cleaned before reinstalling a repaired steering gear or after pump replacement. Replace the filter element or cartridge.

#### Inspection

Make a careful visual inspection of all steering gear parts. Replace worn parts as well as any parts that show signs of stress or fatigue.

### ⚠ DANGER

**STEERING GEARS THAT HAVE BEEN DAMAGED IN AN ACCIDENT MUST BE REPLACED. IMPACT LOADS TRANSMITTED THROUGH THE FRONT AXLE AND STEERING LINKAGE INTO THE STEERING GEAR CAN STRESS PARTS TO A POINT JUST SHORT OF FAILURE. FURTHER USE IS UNSAFE AND THE STEERING GEAR ASSEMBLY AND PITMAN ARM MUST BE REPLACED. DISTORTED PITMAN ARMS, TWISTED SECTOR SHAFTS, BROKEN OR CRACKED RACK AND PINION GEAR TEETH ARE SOME SIGNS OF IMPACT DAMAGE. BROKEN OR DAMAGED MOUNTING BRACKETS MUST BE REPLACED.**

Steering gear parts inspection may show problems in other areas of the steering system. To avoid repeat problems inspect all parts carefully. Listed below are the more common problems you may see during steering gear inspection along with their possible cause. This information should be considered carefully when repairing low mileage vehicles. Remember it is more important to repair the cause than the results.

<b>Parts Discolored (blue)</b>	<ol style="list-style-type: none"> <li>1. Operating temperatures too high</li> <li>2. Steering column binding</li> <li>3. Hydraulic supply pump malfunctioning</li> </ol>	<b>Broken Housing</b>	<ol style="list-style-type: none"> <li>1. Accident damaged</li> </ol>
<b>Sector Shaft (Roller bearing wear)</b>	<ol style="list-style-type: none"> <li>1. Incorrect lubricant use</li> <li>2. Excessive temperature</li> <li>3. Overloading the axle</li> <li>4. Contaminated lubricant</li> <li>5. Impact damage</li> </ol>	<b>Housing or Piston Scoring (Also see following NOTE)</b>	<ol style="list-style-type: none"> <li>1. Foreign material entry</li> <li>2. Severe overloading</li> <li>3. Incorrect lubricant used</li> <li>4. Excessive temperature (over 250)</li> <li>5. Pump damaged</li> </ol>
<b>Actuating Shaft (ball thread brinelled or dented)</b>	<ol style="list-style-type: none"> <li>1. Impact damages</li> </ol>	<b>Thrust Bearings (pitted, rough)</b>	<ol style="list-style-type: none"> <li>1. Foreign material in system</li> <li>2. Excessive overloading</li> </ol>
<b>Actuating Shaft (thread wear)</b>	<ol style="list-style-type: none"> <li>1. Incorrect lubricant used</li> <li>2. Overloading</li> <li>3. Insufficient operating pressure</li> <li>4. Insufficient oil flow</li> <li>5. Continued operation at high temperature</li> </ol>	<b>Thrust Bearings (broken or distorted)</b>	<ol style="list-style-type: none"> <li>1. Impact damage</li> <li>2. Incorrect repairs</li> </ol>
		<b>Piston Rings (cut, pinched, sheared or worn)</b>	<ol style="list-style-type: none"> <li>1. Incorrect installation</li> <li>2. Incorrect assembly</li> </ol>

#### Note on scoring

Minor scoring and scuffing of the piston and housing of the steering gear is normal. During operation at relatively high pressure and flow rates, this minor scoring will not affect the safety or operation of the steering gear. Minor scoring should be polished with a fine hand stone or crocus cloth.

### ⚠ CAUTION

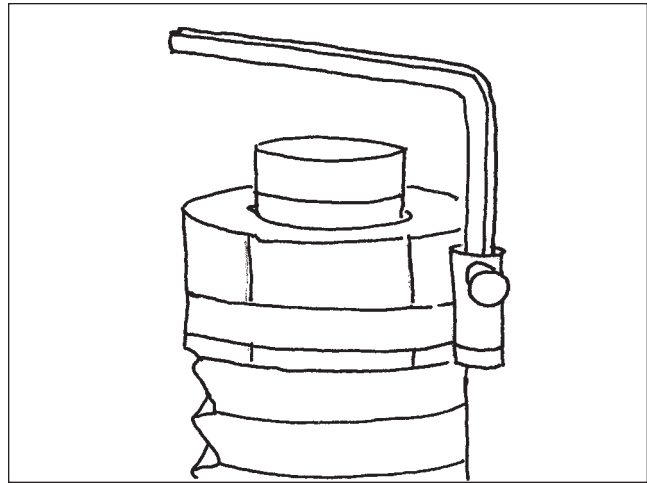
**The cylinder bore should not be honed or bored out. This will increase internal leakage.**

## REASSEMBLY

1. The M-Series models use a seal ring on the end of the power piston. A new seal is installed by placing the back-up O-ring in the piston groove and installing the square cut seal ring over it (**Figure 120**).

**NOTE:**

The seal material will stretch as it is fitted to the ring groove. If you let the piston sit with the seal rings in place it will become easier to install it in the piston bore. Use of a ring compressor is advised to limit damage to the piston ring.



**Figure 120**

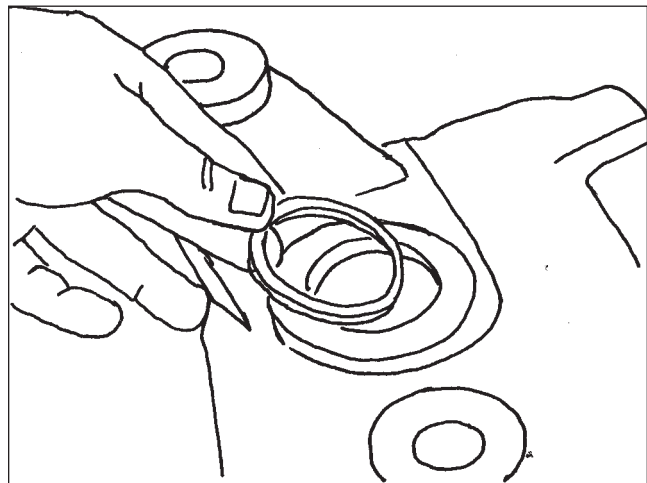
2. Install a new sector shaft seal in the housing (**Figure 121**).

**IMPORTANT:**

When installing the sector shaft seals, insure the lip of the seal is toward the housing. The blue side of the seal is toward you.

**NOTE:**

The housing will have a beveled chamfer on one end of the piston housing only. The piston will be installed through that end of the housing.

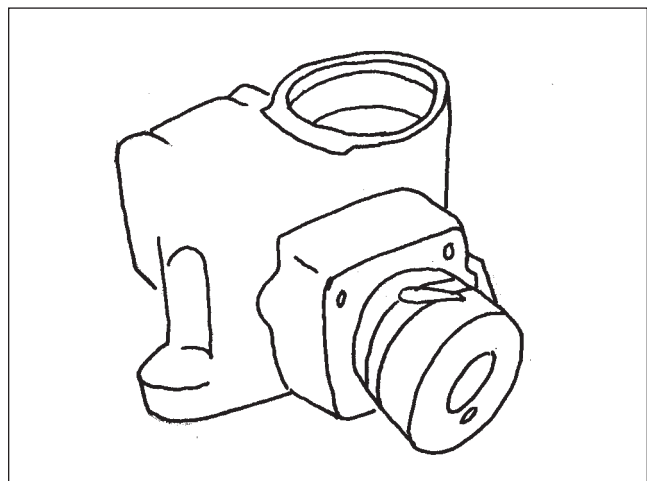


**Figure 121**

3. At this time, you can reassemble the gear. Before installation of the piston into the piston bore of the housing, check for burrs on either the piston or piston bore. If burrs are present, they may be removed by polishing with a fine hand stone or crocus cloth.

Coat both the piston and piston bore of the housing with a light coat of motor oil.

Carefully insert the piston into the piston bore of the housing, keeping the ball guide cavity exposed as shown (**Figure 122**).



**Figure 122**

## ⚠ CAUTION

Care must be taken when installing the piston in the housing. Close tolerances may cause the piston to jam in the housing bore. Any attempt to force the piston at that time could cause nicking or gouging of the housing bore.

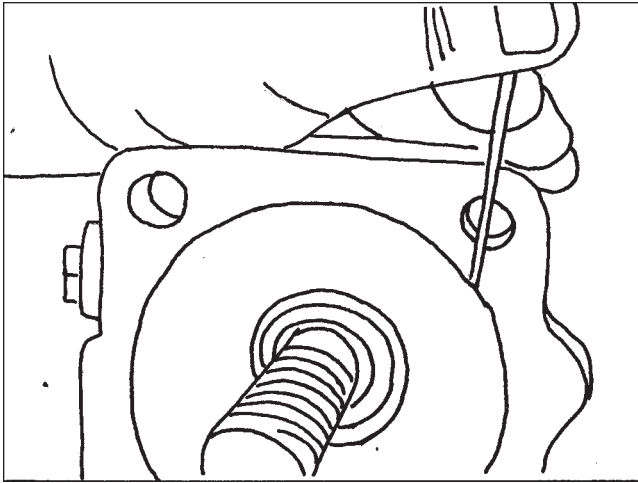


Figure 123

4. Install a new seal ring on the bearing cap and actuating shaft assembly (**Figure 123**).

**NOTE:**

Cover the new seal ring with a light coat of grease to keep it in place during assembly.

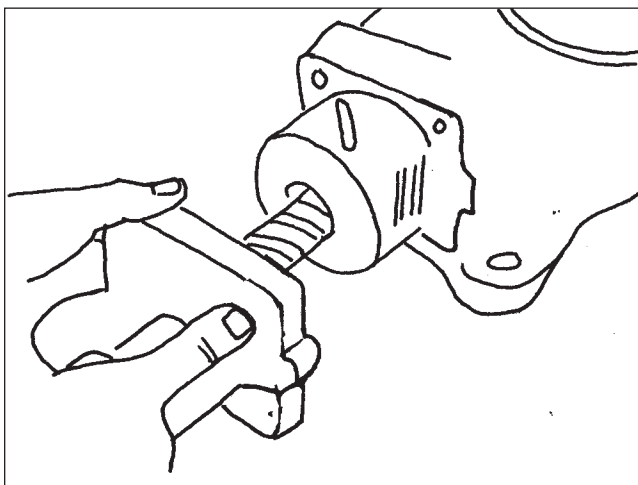


Figure 124

5. Insert the bearing cap and actuating shaft assembly into the piston as shown (**Figure 124**).

**NOTE:**

Do not insert the bearing cap assembly completely. The bearing cap must be inserted to within 3" of the end of the piston.

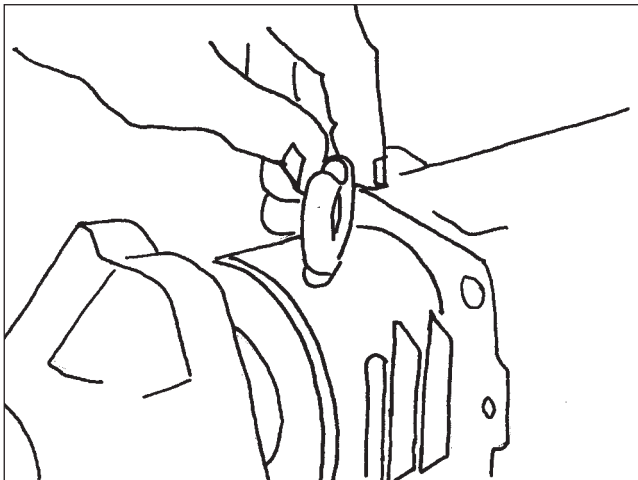


Figure 125

6. Install both halves of the ball guide into the ball guide cavity (**Figure 125**).

**⚠ CAUTION**

Make sure the ball guides are pushed into the cavity all the way. Failure to do so during installation will result in the ball guides being pushed out of the piston during assembly. This will cause the balls to come out of their track and binding will result.



7. While supporting the bearing cap assembly with your hand, load the 24 steel balls in the ball guide. Slowly turn the bearing cap assembly inward while feeding the steel balls until all the steel balls are used (Figure 126).

**CAUTION**

Do not attempt to back the actuating shaft out of the piston during this process. This will cause the steel balls to bind on the actuating shaft and shaft damage may result.

**IMPORTANT:**

Both halves of the ball guide must be held down when loading the balls to prevent the balls from coming out of their track.

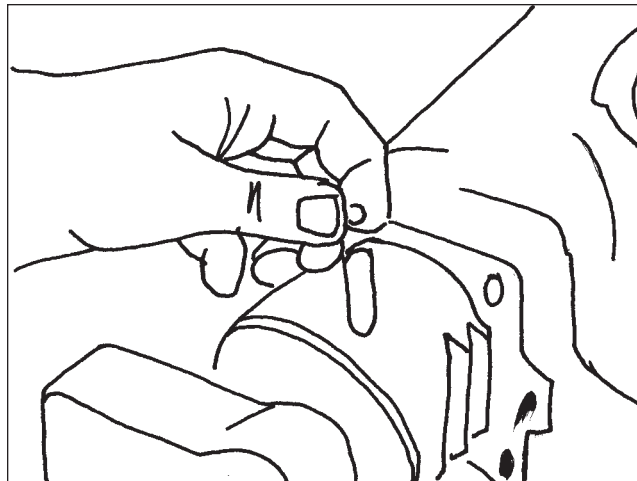


Figure 126

8. Install a new O-ring on the ball guide retainer and coat it with a small amount of grease. Insert the retainer over the ball return guide and into the ball guide cavity (Figure 127).

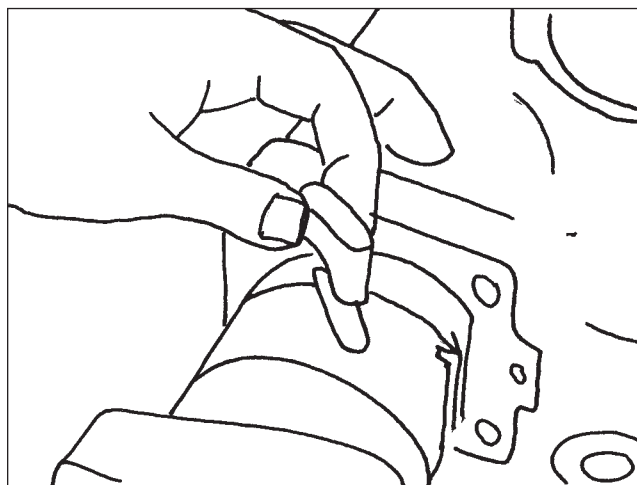


Figure 127

9. It will be necessary to tap the ball guide retainer into place with a soft hammer (Figure 128).

**NOTE:**

When properly installed the retainer will be flush with the piston contour.

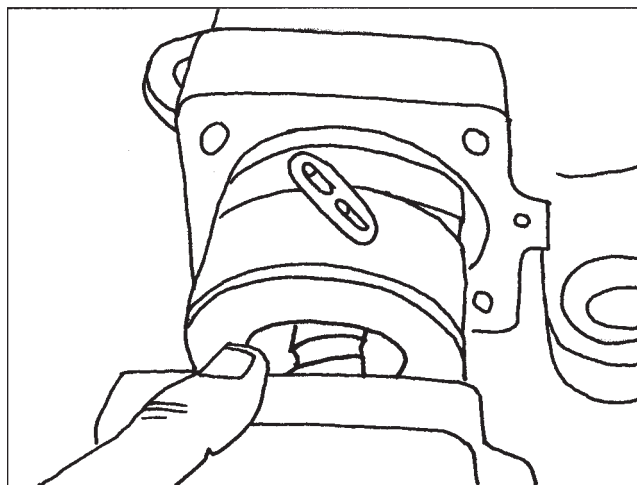


Figure 128

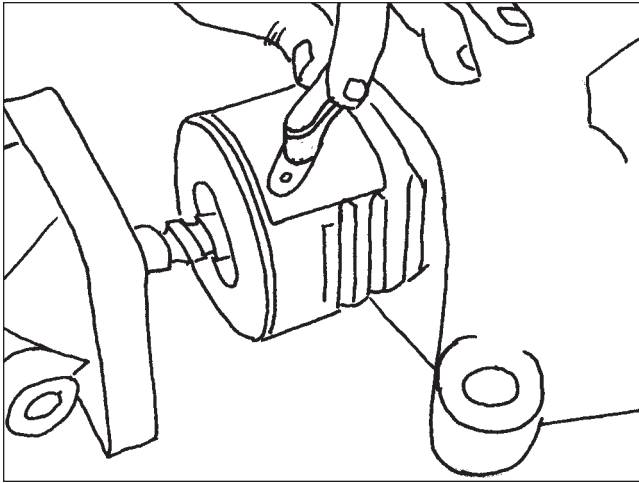


Figure 129

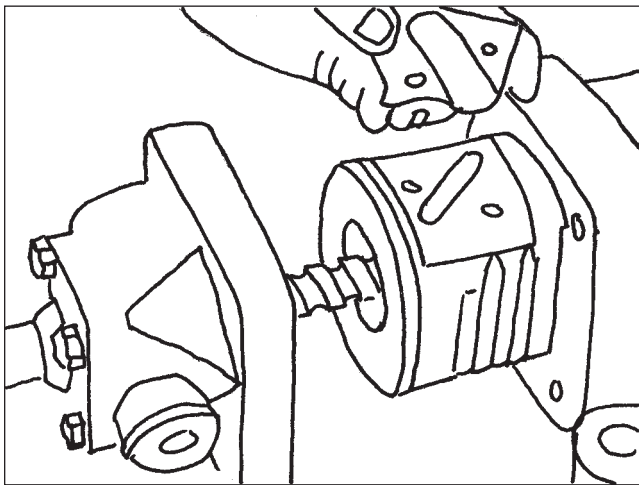


Figure 130

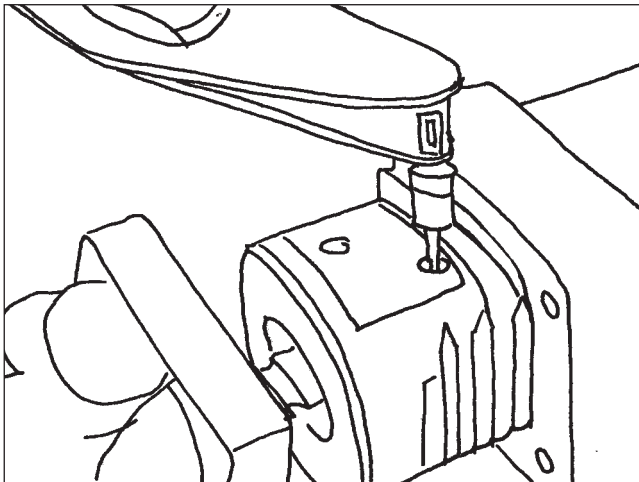


Figure 131

**Early Production Variation**

10. If a bolt-on retainer is used, replace the seal ring on the retainer and install it in the piston cavity. Install the mounting bolts (Figures 129 & 130).

**⚠WARNING**

THE INTERNAL TOOTH LOCK WASHERS MUST BE INSTALLED ON THE MOUNTING BOLTS. FAILURE TO USE THESE WASHERS WILL RESULT IN A LOSS OF TORQUE AND A POSSIBLE LOSS OF POWER ASSIST.

Tighten bolts to 12 Ft./Lbs. (Figure 131).

11. To install the piston, carefully work the piston ring past the sector shaft opening in the cylinder bore. While maintaining pressure on the end of the piston, press the piston seal into the ring groove. As the piston ring is compressed into the ring groove, the piston will slide further into the bore until the piston ring has passed the sector shaft opening (Figure 132).

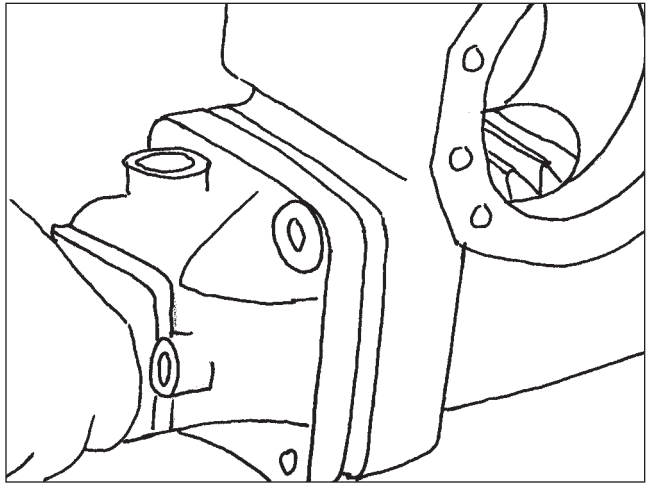


Figure 132

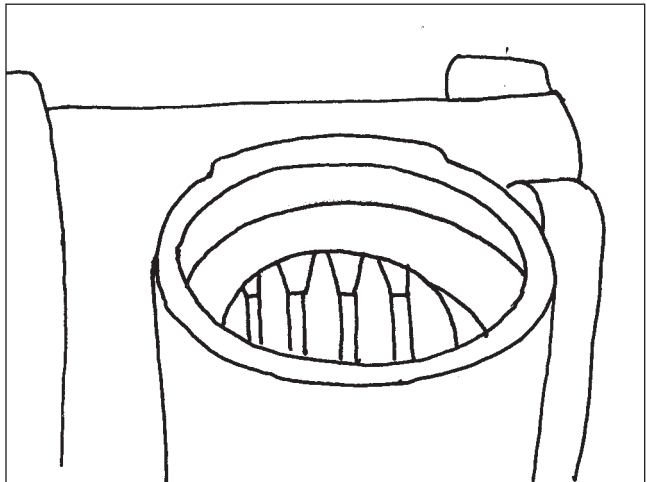


Figure 133

12. Install a new tetra seal on the bearing cap assembly and attach the bearing cap to the housing (Figure 134).

**NOTE:**

A small amount of grease on the tetra seal will help hold it in place.

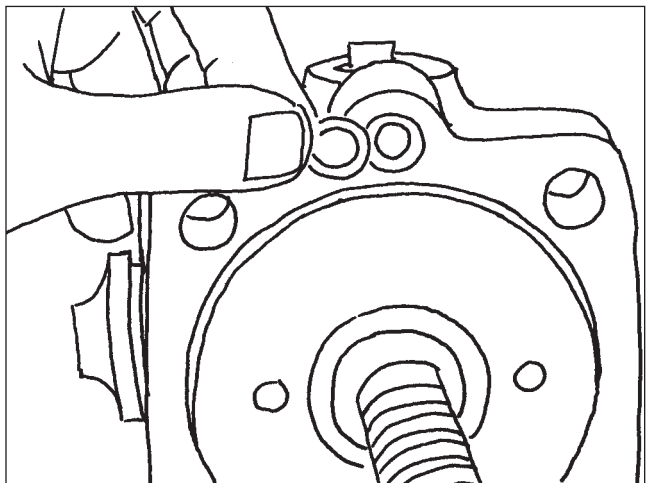


Figure 134

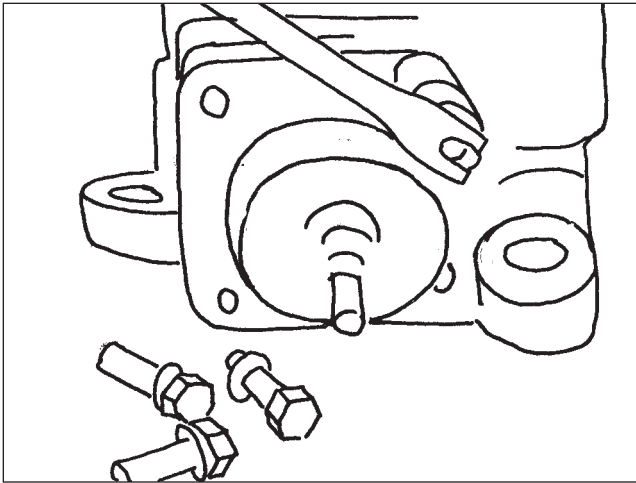


Figure 135

13. Using the four (4) longest mounting bolts, tighten the bearing cap to the housing and torque to specifications (**Figure 135**).

**IMPORTANT:**

If the bearing cap will not sit flush on the housing, be sure the bearing cap seal ring or tetra seal has not slipped out of place.

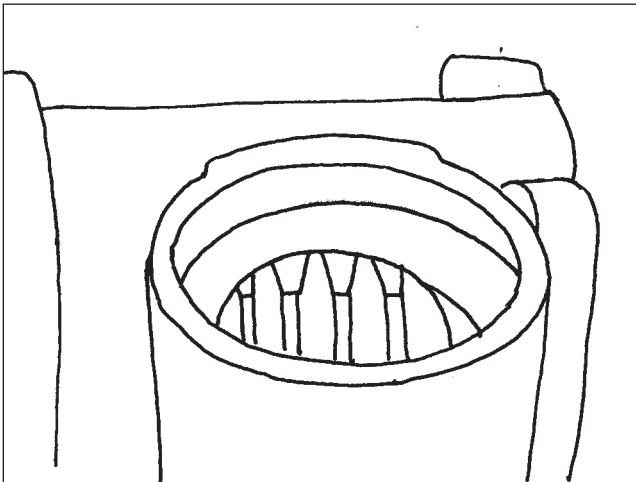


Figure 136

14. Locate the timing mark on the piston rack and center the timing mark in the pinion bore of the housing by turning the actuating shaft. (**Figure 136**).

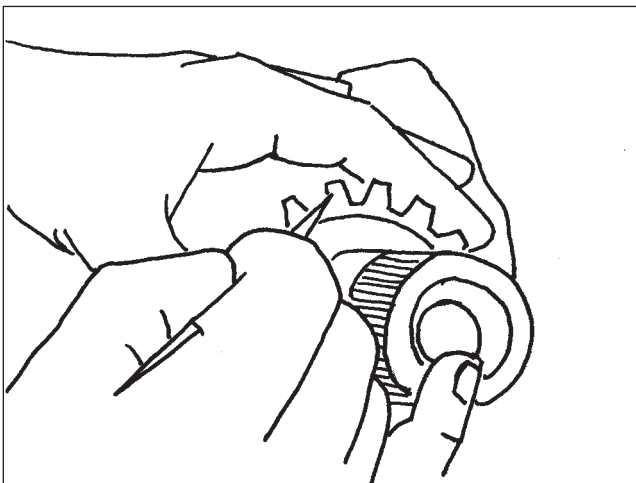


Figure 137

15. Install the sector shaft in the piston rack in the pinion bore. Coat the end of the sector shaft with grease to prevent seal damage.

**IMPORTANT:**

The single timing mark on the sector shaft must line up between the two timing marks on the piston rack (**Figure 137**).

16. It will be necessary to tap the end of the sector shaft with a soft hammer to make sure you have full rack and pinion engagement (**Figure 138**).

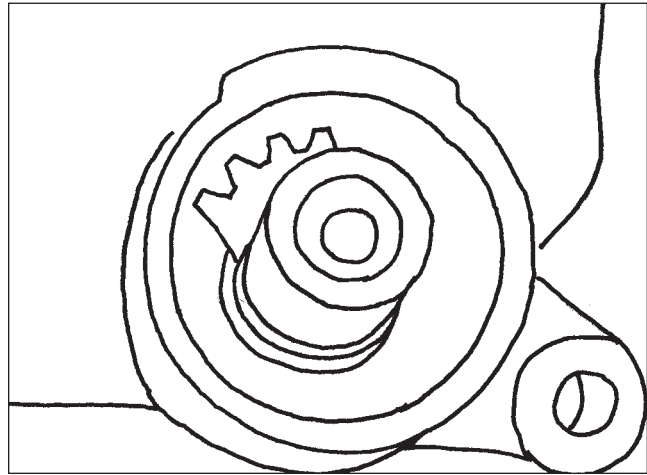


Figure 138

17. Install a new sector shaft seal in the sector shaft cover (**Figure 139**).

**NOTE:**

A light coat of oil on the sector shaft seal and cover seal ring will make installation easier.

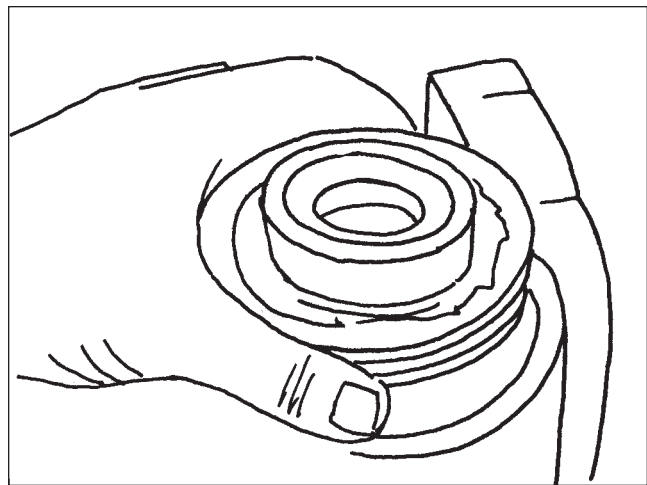


Figure 139

18. Install the sector shaft cover. Use the appropriate tools for the steering gear you are working on. Either snap ring pliers or suitable size socket. Torque to specifications (**Figure 140**).

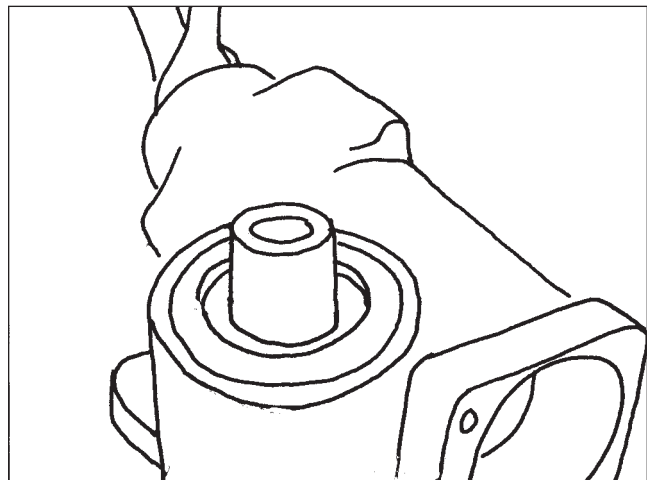


Figure 140

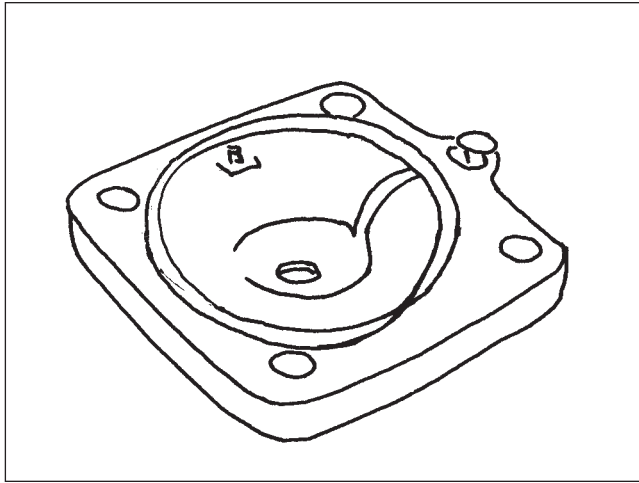


Figure 141

19. Place a new seal ring and tetra seal on the cylinder head.

**NOTE:**

A light coat of grease on the seal ring and tetra seal will hold them in place during mounting (Figure 141).

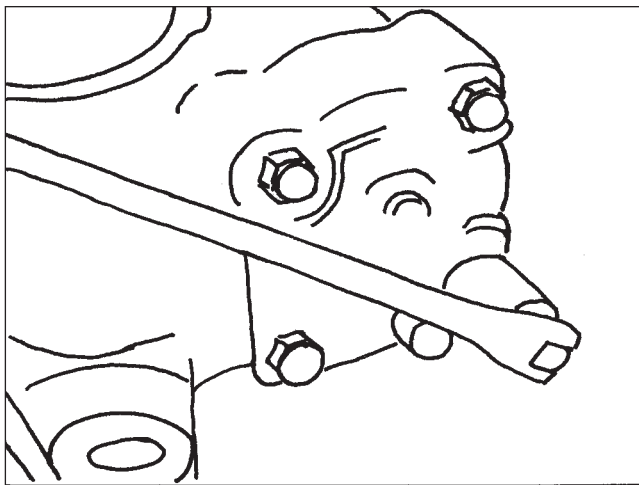


Figure 142

20. Attach the cylinder head to the housing using the four (4) remaining bolts. Torque to manufacturer's specifications (Figure 142). Specifications on page 104 of this manual.

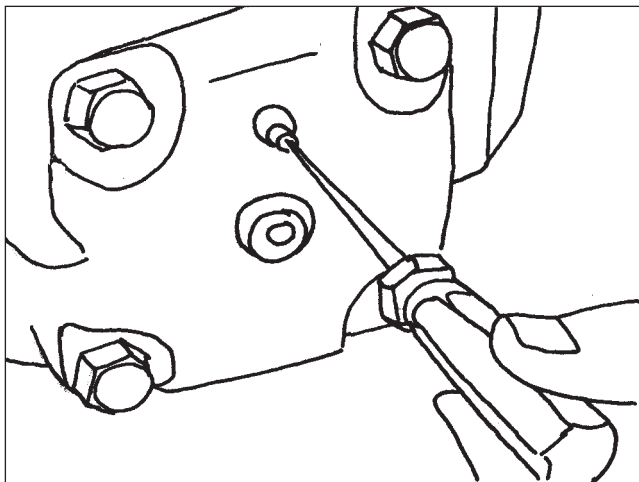


Figure 143

21. Install the relief plungers in the cylinder head and bearing cap. Screw in the relief plungers until they are 1/8" below flush with the end caps (Figure 143).

22. Further adjustments are required. Refer to the “Plunger Adjustment” section of the “Common Procedures” section in this manual (Figure 144).

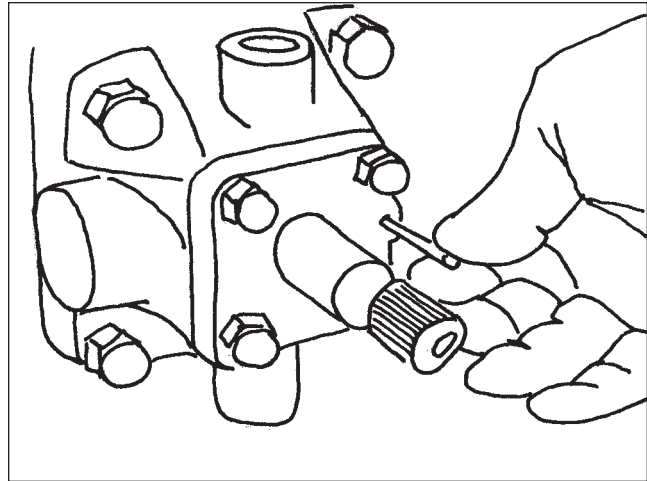


Figure 144

23. When installing the stick-on dirt shield, it is important to thoroughly clean the housing with a suitable solvent. Apply a thin coat of RTV to the edge of the dirt shield and place it over the end of the sector shaft. Allow adequate time for the RTV to set.

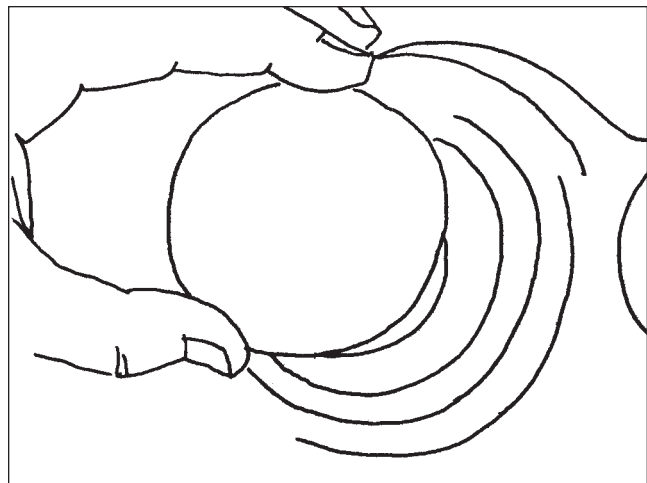


Figure 145

24. Attach the mounting bracket to the gear housing using the attaching bolts, and torque to manufacturer's specifications (Figure 146) (if equipped).

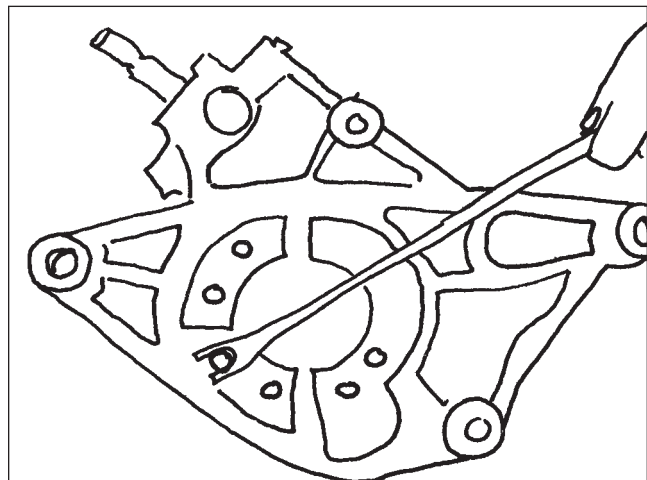


Figure 146

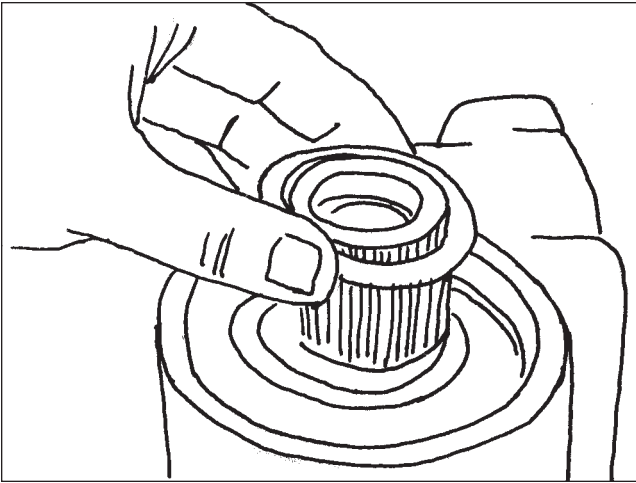


Figure 147

25. If your steering gear has a pressed-in excluder seal, pack the lip area with grease. Slide the excluder seal over the sector shaft with the lip facing out. Use a 2 1/4" seal driver to press the excluder into the cover. Clean the sector shaft splines before installing the pitman arm.

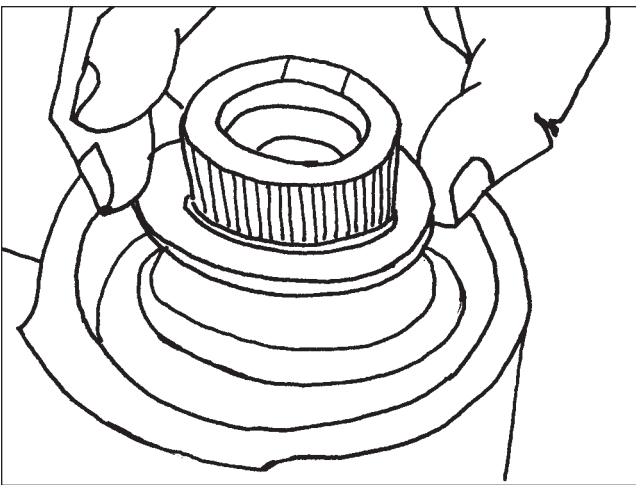


Figure 148

26. Pack the lip area of the sector shaft boot with grease and install it over the sector shaft. Install the rubber boot on the input shaft and lubricate the grease fitting (**Figure 148**).

The steering gear may now be reinstalled on the vehicle following the vehicle manufacturer's procedures.

Install the pitman arm on the steering gear. Refer to the "Pitman Arm Installation" instructions in the "Common Procedures" section of this manual.

After installation of the gear on the vehicle, bleeding of the system may be necessary. Refer to the "Bleeding Procedure" in the "Common Procedures" section of this manual.



## DUAL STEERING SYSTEM

Two or more integral steering gears are sometimes used where high front axle loads or space limits exist.

The secondary (slave) gear assembly is different from the master gear. It does not have an actuating shaft or an actuating valve. The steering gears in a dual system are not mechanically connected. Each gear has its own steering linkage and pitman arm.

Pressure to operate the secondary, or slave, gear is passed through ports in either the cylinder head, sector shaft bore or bearing cap of the master gear. It is routed through high pressure lines to the proper end of the slave gear. When the actuating shaft of the master gear is moved, it causes a pressure build-up on the piston of the master gear. This same pressure is directed to the opposite end of the slave gear piston.

**Figure** illustrates a typical dual M-Series master gear layout. Fluid from the slave gear is returned to the master gear and back to the reservoir. The lines between the master gear and slave gear act as both pressure and return lines.

**Figure** illustrates an M-Series master gear and a 92-Series slave gear used in a dual steering installation. Fluid from the master gear is routed through the pinion gear area of the slave gear and then to the reservoir. This system requires the use of more hoses than the dual M-Series system.

Pressure relief plungers are not required on slave gears. Pressure relief is in the master gear.

### **⚠ WARNING**

**BLEEDING OF THE DUAL SYSTEM IS CRITICAL WHENEVER THE OIL HAS BEEN CHANGED, THE SYSTEM HAS BEEN OPENED, OR A STEERING GEAR HAS BEEN REPLACED. FOLLOW THE “DUAL SYSTEM BLEEDING PROCEDURES” OUTLINED IN THE “COMMON PROCEDURES” SECTION OF THIS MANUAL.**

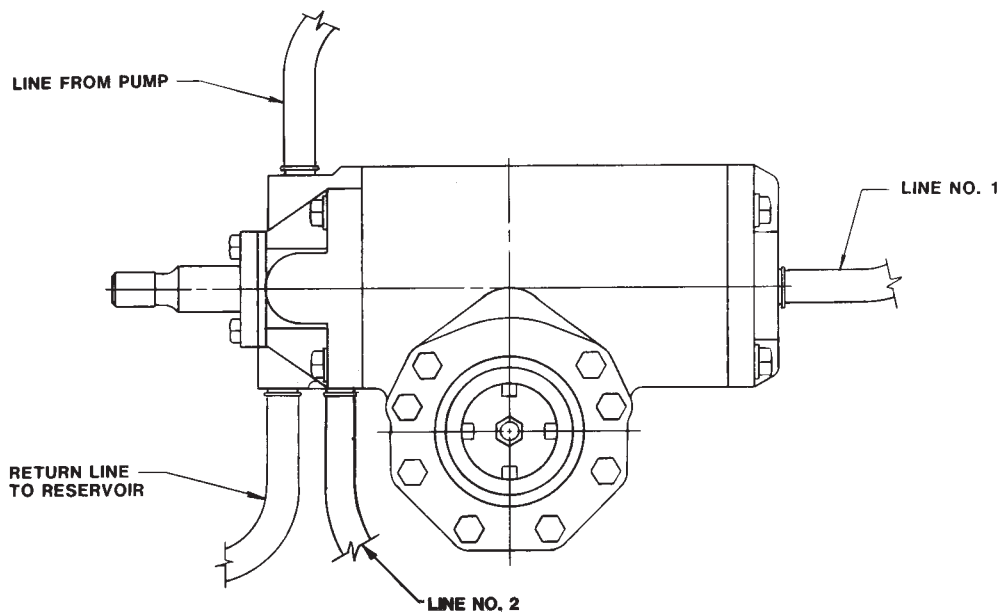
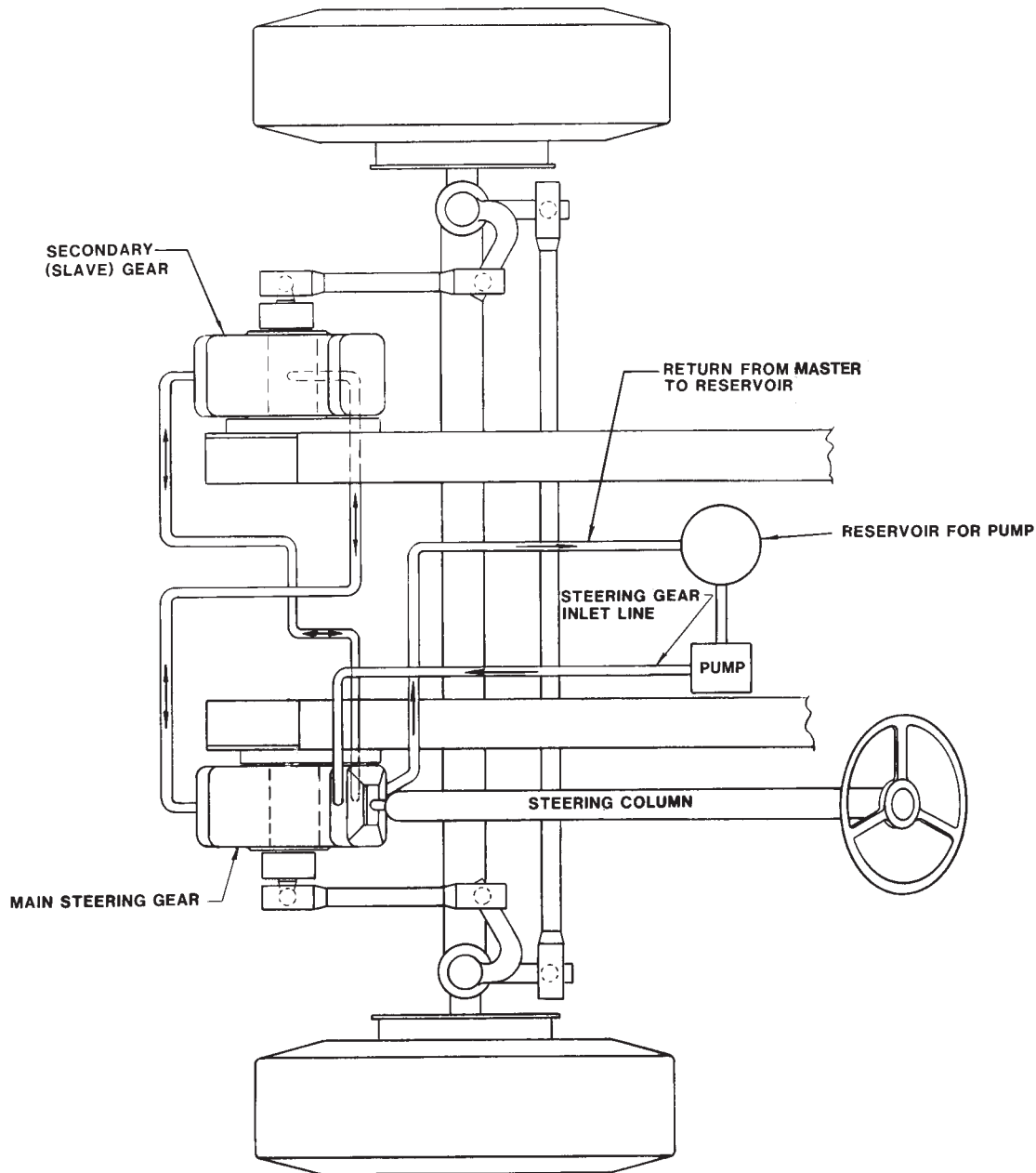


Figure 149

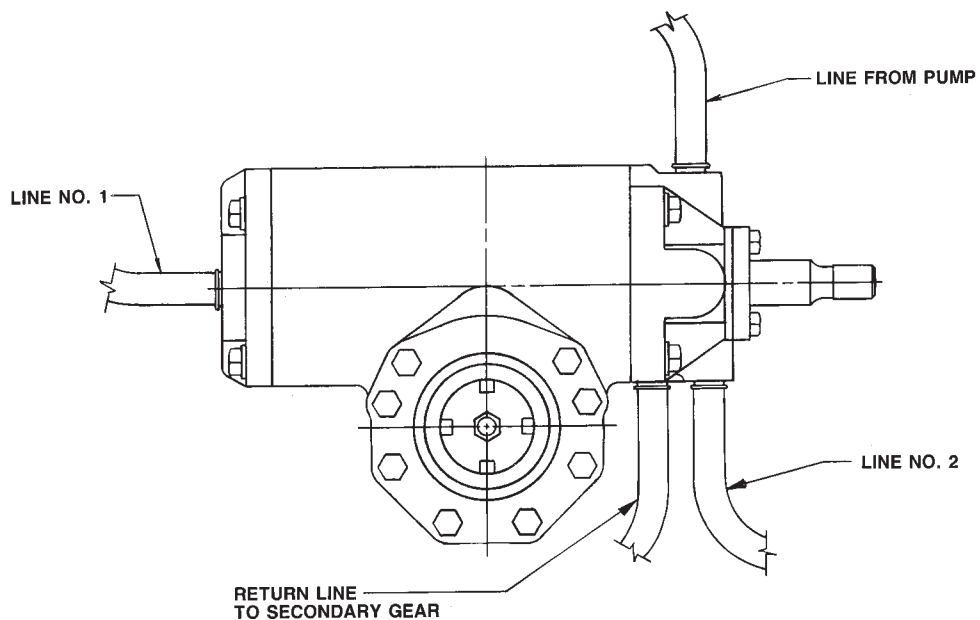
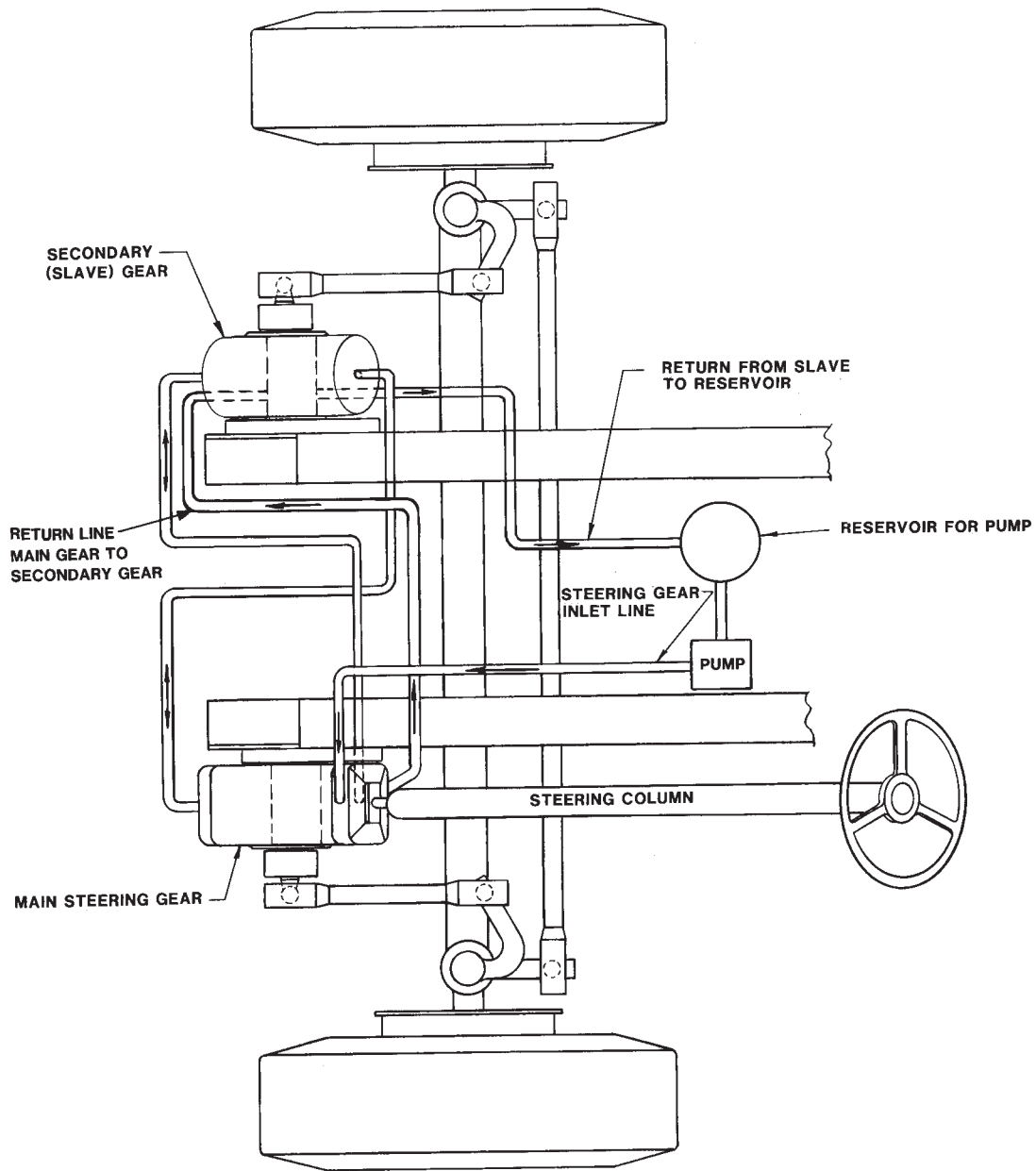


Figure 150

## INTEGRAL SLAVE GEAR (M-SERIES)

The Sheppard M-Series integral slave gear is simple in operation and requires few repairs.

The major components in the slave gear are the power piston and the sector shaft assembly.

Disassembly of the slave gear requires the removal of the cylinder head and the sector shaft cover.

The sector shaft assembly is removed and the piston is pulled out of the housing bore.

The sector shaft bearings and the various seals are serviced using the same procedures as the master gear.

On reassembly, the timing marks on the piston rack and the sector shaft must be carefully timed.

The M-Series models use a seal ring on one end of the power piston. A new seal is installed by placing the back-up O-ring in the piston groove and installing the teflon seal ring over it.

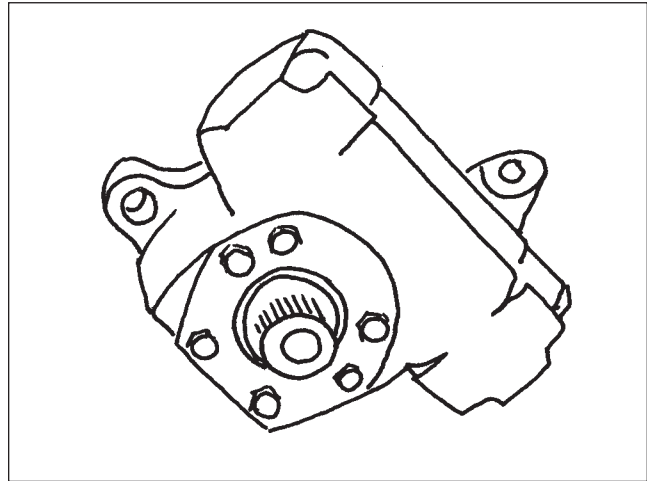


Figure 151

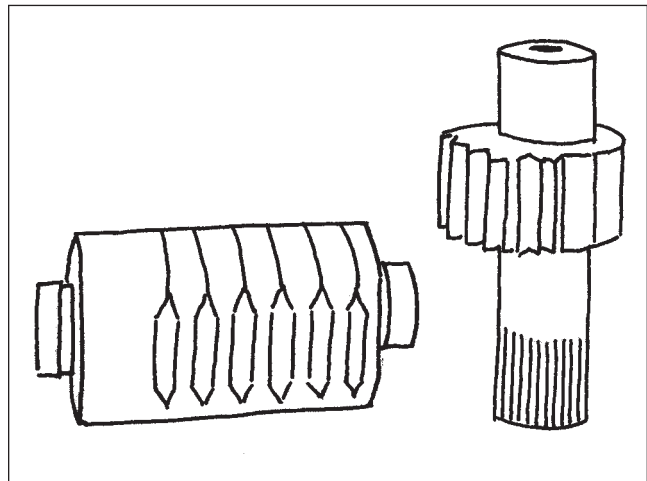


Figure 152

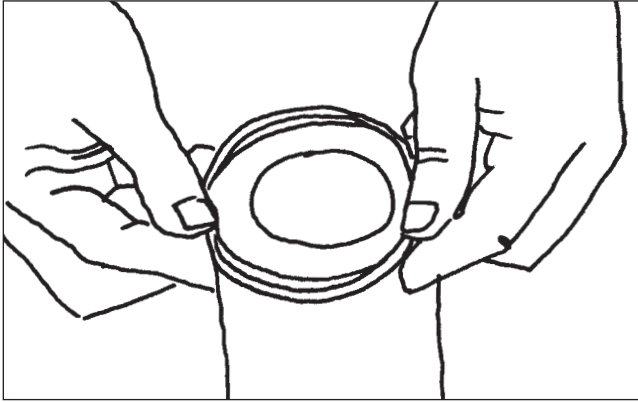


Figure 153

**NOTE:**

The seal material will stretch as it is fitted to the ring groove. If you let the piston sit with the seal rings in place, it will become easier to install it in the piston bore. Use of a ring compressor is best to limit damage to the piston ring.

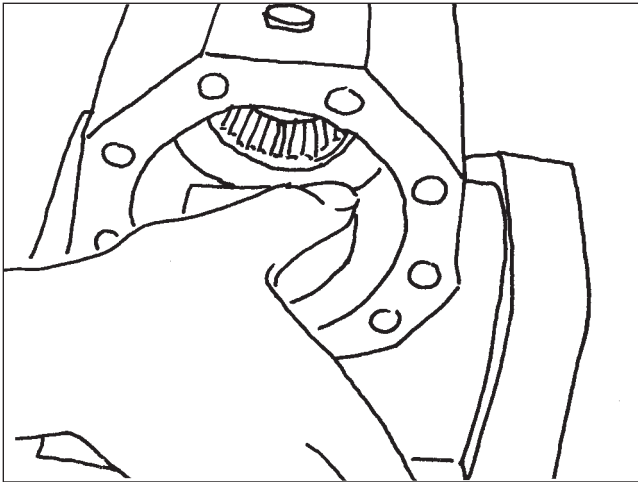


Figure 154

**NOTE:**

The housing will have a beveled chamfer on one end of the piston housing. The piston is installed through that end of the housing. Light taps with a soft hammer may be required on the end of the piston to move it into the housing.

To reinstall the piston, carefully work the piston ring past the pinion gear opening in the cylinder bore. While maintaining pressure on the end of the piston, press the piston seal into the ring groove. As the piston ring is compressed into the ring groove, the piston will slide further into the bore until the piston ring has passed through the pinion gear opening (Figure 154).

## INTEGRAL SLAVE GEAR (92-SERIES)

The Sheppard 92-Series integral slave gear is simple in operation and requires few repairs.

The major components in the slave gear are the power piston and the pinion gear/sector shaft assembly.

Disassembly of the slave gear requires the removal of the cylinder head and the pinion cover/mounting bracket.

The sector shaft assembly is removed and the piston is pulled out of the housing bore.

The sector shaft bearings and seals are serviced using the same procedures outlined in the 92-Series Service Manual #1000485.

On reassembly, the timing marks on the piston rack and the sector shaft must be carefully timed using the same procedure as the master gear.

92-Series slave gear models use seal rings on the ends of the power piston.

New seals are installed by placing the back-up O-ring in the piston groove and installing the teflon seal ring over it.

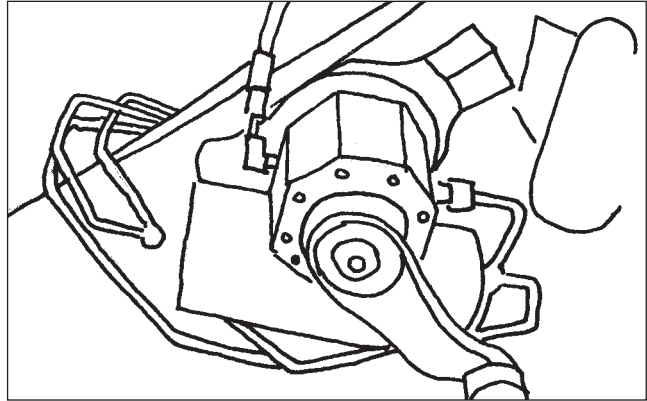


Figure 155

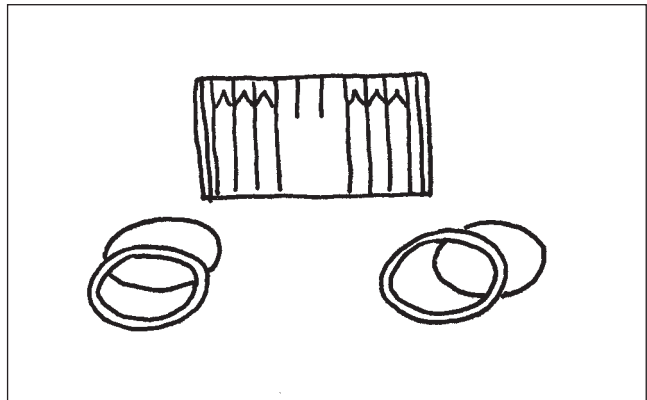


Figure 156

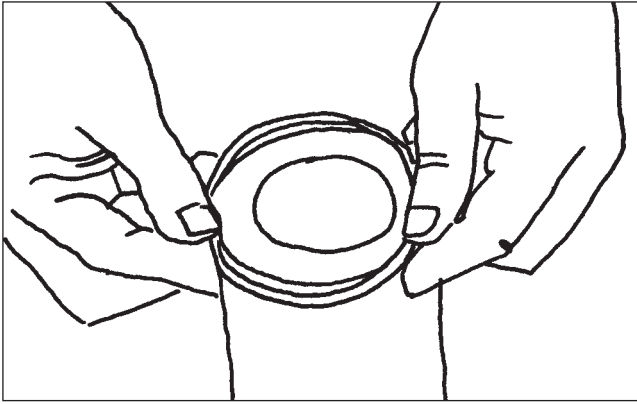


Figure 157

**NOTE:**

Seal material will stretch as it is fitted to the ring groove. If you let the piston sit with the seal rings in place, it will become easier to install it in the piston bore. Use of a ring compressor is best to limit damage to the piston ring (**Figure 157**).

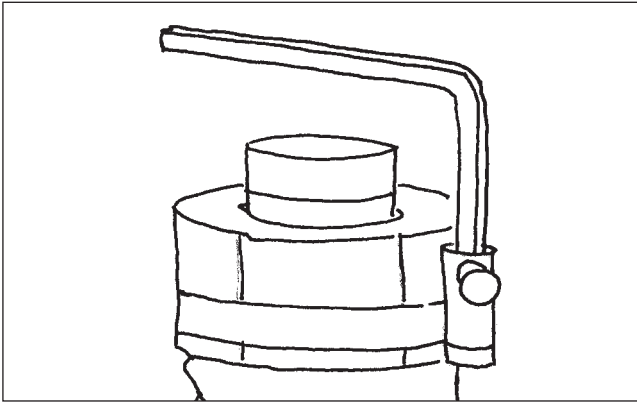


Figure 158

**NOTE:**

The housing will have a beveled chamfer on one end of the piston housing. The piston is installed through that end of the housing. Light taps with a soft hammer may be required on the end of the piston to move it into the housing (**Figure 158**).

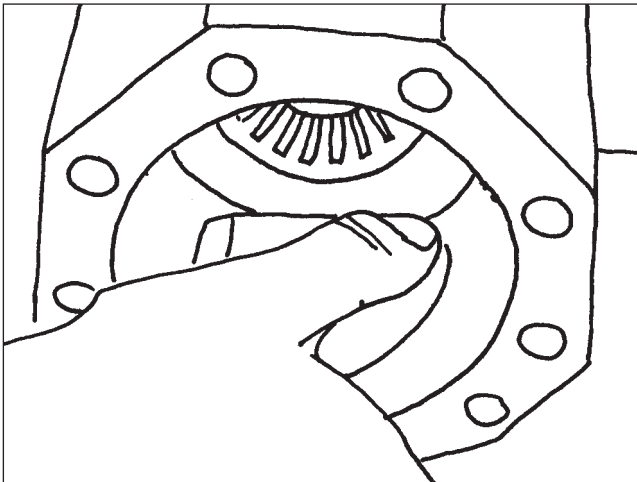


Figure 159

You will have to work the piston ring past the pi-nion gear opening in the cylinder bore carefully. While maintaining pressure on the end of the piston, press the piston seal into the ring groove. As the piston ring is compressed into the ring groove the piston will slide further into the bore until the piston ring has passed the pinion gear opening (**Figure 159**).

## FINAL ADJUSTMENTS

The Sheppard M-Series power steering gear has no external adjustments. It is important to check and adjust other components in the system when necessary.

After steering gear replacement or reinstallation, you should check all fasteners for proper torque. The torque specifications for the steering gear fasteners are listed on page 104. Consult the Vehicle Manufacturer's Service Manual for proper torque values on mounting bolts.

Check the connection between the steering column U-joint and the steering gear input shaft. Consult the Vehicle Manufacturer's Service Manual for proper torque to the pinch bolt.

Check to be sure proper torque has been applied to the tab-lock retainer and the locking tabs are bent into the retainer slots. If torquing is required, refer to the "Pitman Arm Installation" directions in the "Common Procedures" section of this manual.

### **⚠ DANGER**

**FAILURE TO INSTALL THE PITMAN ARM AND RETAINER PROPERLY, OR USING THE WRONG PITMAN ARM OR ATTACHING METHOD, COULD LEAD TO AN ACCIDENT OR SERIOUS PERSONAL INJURY.**

Bleeding of a single gear system is necessary only when the steering gear is mounted with the sector shaft above the piston bore. Bleeding of the dual steering gear system is always necessary. Refer to the "Bleeding Dual Steering Gears" directions in the "Common Procedures" section of this manual.

It will be necessary to set the relief plungers in each end of the steering gear. Refer to "Setting Relief Plungers" in the "Common Procedures" section of this manual.

Finally, if the steering gear has been changed, it may be necessary to center the wheel. Refer to the Vehicle Manufacturer's Service Manual for the proper procedure.

### **⚠ WARNING**

**NEVER CENTER THE STEERING WHEEL BY RE-INDEXING SPLINES ON THE STEERING COLUMN SLIP SHAFT. THIS WILL TAKE THE COLUMN OUT OF PHASE AND CAUSE LUMPY STEERING.**



**TORQUE SPECIFICATIONS**  
(M-SERIES MASTER AND SLAVE)

<b>APPLICATION</b>	<b>SIZE</b>	<b>GRADE</b>	<b>FT./LBS.</b>	<b>(Nm)</b>
Bearing Cap Cover (M80, 90 & 100)	M10 x 1.5	10.9	53-63	(72-85)
Bearing Cap (M80)	M10 x 1.5	10.9	53-63	(72-85)
(M90)	M12 x 1.75	8.8	72-81	(97-111)
(M100)	M14 x 2.0	8.8	114-124	(154-168)
(M110)	M16 x 2.0	8.8	184-194	(249-263)
Cylinder Head (M80)	M10 x 1.5	10.9	53-63	(72-85)
(M90)	M12 x 1.75	8.8	72-81	(97-111)
(M100)	M12 x 1.75	8.8	72-81	(97-111)
(M110)	M16 x 2.0	8.8	184-194	(249-263)
Sector Cover	M12 x 1.75	8.8	72-81	(97-111)

**TORQUE SPECIFICATIONS**  
(92-SERIES SLAVE GEAR)

<b>APPLICATION</b>	<b>SIZE</b>	<b>FT./LBS.</b>	<b>(NM)</b>
CYLINDER HEAD AND BEARING CAP	5/16 - 24NF	20-30	(27-41)
STEERING GEAR COVER (MOUNTED)	1/2 - 20NF	85-95	(116-129)
STEERING GEAR COVER (STANDARD)	1/2 - 20NF	50-55	(68-75)

## TROUBLESHOOTING CHECKLIST

Before proceeding with the following tests, be sure to read the "Diagnosis and Troubleshooting" section of this manual. Many factors outside of the steering system will affect vehicle steering. Check all mechanical and external conditions before hydraulic testing. **DO NOT REMOVE THE STEERING GEAR!**

Date: \_\_\_\_\_

Servicing Dealer: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Customer: \_\_\_\_\_

Description of Steering Complaint:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Preliminary Information:**

Vehicle Model \_\_\_\_\_ Mileage \_\_\_\_\_

Steering Gear Model \_\_\_\_\_ Serial # \_\_\_\_\_

Slave Gear Model (if equipped) \_\_\_\_\_ Serial # \_\_\_\_\_

Pump Manufacturer \_\_\_\_\_

Front Axle Weight \_\_\_\_\_

**Test Information:**

**DO NOT REMOVE THE STEERING GEAR!** Install a pressure and flow tester in series with the pressure line of the pump as outlined in the "Hydraulic Diagnosis Section" of this manual. Record the following information.

Stabilized Oil Temperature \_\_\_\_\_

System Backpressure @ Idle \_\_\_\_\_ @ Full Governed RPM \_\_\_\_\_

Maximum System Pressure \_\_\_\_\_ PSI

Flow @ Idle Back Pressure Only \_\_\_\_\_ GPM

Flow @ Idle With 1500psi Load Applied \_\_\_\_\_ GPM

Flow @ Full Governed RPM With 1500psi Load Applied \_\_\_\_\_ GPM

Static Steering Pressure -

Right Turn \_\_\_\_\_ PSI

Left Turn \_\_\_\_\_ PSI

Static Steering Input Measured at the Steering Wheel Retaining Nut in Inch Pounds -

Right Turn \_\_\_\_\_ in. lbs.

Left Turn \_\_\_\_\_ in. lbs.

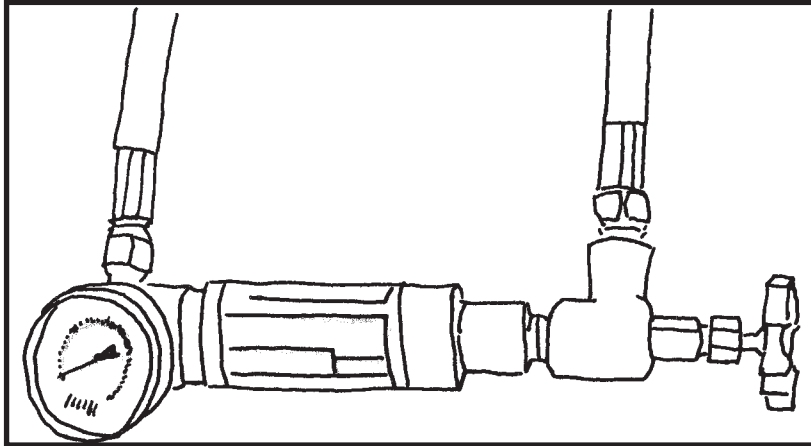
If, after completing the above information you are unsure of your diagnosis, contact the Field Service Department of the R. H. Sheppard Co. at 717-633-4111.

**MISCELLANEOUS**

**R. H. SHEPPARD CO., INC., HANOVER, PA** 17331-0877

Phone Area Code 717-633-4111

## Heavy Duty Power Steering Test Kit



S-174

This tester is a self contained, direct reading device to check system flow, pressure or both simultaneously. Requiring no electrical connections, it can detect worn components, verify flow and pressure control settings or monitor overall system performance.

**LOW COST –**

**EASY TO USE –**

Only one hose connection is broken, either at the pump output or at the pressure input to the power steering gear housing.

- ★ **SHIPMENT FROM STOCK**
- ★ **INCLUDES SHEPPARD SERVICE MANUAL**

- ★ **Installs between pump and steering gear**
- ★ **Shutoff valve isolates pump from gear**
- ★ **Pressure and flow can be read simultaneously**
- ★ **0-3000 P.S.I. pressure gauge**
- ★ **1-10 G.P.M. flow meter**
- ★ **Complete with hoses & standard swivel fitting**

*PHOTO COPY AND USE FOR ORDER FORM.*

CUSTOMER'S ORDER NO.	DATE	OUR ORDER NO.
----------------------	------	---------------

SOLD TO:	SHIPPED TO:
----------	-------------

ITEM NO.	QTY. ORDERED	PART NUMBER	PART DESCRIPTION	UNIT PRICE	TOTAL
		5517641	Pressure and Flow Test Kit		

Includes Sheppard service manual with operating instructions

From:

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



**R.H. Sheppard Co., Inc.  
P.O. Box 877  
101 Philadelphia Street  
Hanover, Pennsylvania 17331-0877**

**Attn: Customer Service**

## ALPHABETICAL INDEX

<u>Subject</u>	<u>Page</u>
<b>Numerics</b>	
1st Speed Clutch (Low) Repair.....	F-5
4-in-1 Bucket Cylinder Maintenance.....	10-54
4-in-1 Bucket Repair.....	17-15
4th Speed Clutch Repair.....	F-18
8-Speed Output Repair.....	F-16
<b>A</b>	
A/C Compressor Replacement.....	19-15
A/C Condenser Replacement.....	19-14
A/C Cover Replacement.....	19-11
A/C Evaporator Assembly Maintenance.....	19-19
A/C Filter Replacement.....	13-55
A/C Precleaner Replacement.....	13-57
A/C Pressurizer Replacement.....	19-12
A/C Receiver-Drier Replacement.....	19-18
A/C System Servicing.....	19-3
Accelerator Pedal Replacement.....	13-2
ADI-Recommended Torque Tables.....	E-3
Aftercooler Replacement.....	L-19
Air Chamber Replacement, Front Axle.....	J-10
Air Chamber Replacement, Rear Axle.....	J-16
Air Cleaner Filter Replacement.....	13-54
Air Cleaner/Stowage Box Repair.....	13-59
Air Compressor Replacement.....	15-15
Air Drier Desiccant Replacement.....	15-18
Air Drier Replacement.....	15-16
Air Governor Replacement.....	15-13
Air Line Replacement.....	15-12
Air Tank Replacement.....	15-5
Air Valve Replacement.....	15-4
Airbag Replacement.....	6-4
Alarm Module Replacement.....	12-27
Alternator Replacement.....	12-13
Alternator Testing.....	12-3
Arctic Heater Assembly Maintenance.....	20-18
Army Maintenance System MAC, The.....	B-1
Army Publications Web Sites.....	A-2
Auxiliary Defroster Ducting Replacement.....	13-71
Auxiliary Defroster Heater Maintenance.....	13-73
Auxiliary Defroster Switch Replacement.....	12-25

<u>Subject</u>	<u>Page</u>
Auxiliary Hydraulics Backhoe Flow Rates.....	3-37
Axle Assembly Replacement, Front .....	14-9
Axle Assembly Replacement, Rear .....	14-11
Axle Housing Breather Replacement.....	14-13
Axle Hub and Differential Oil Servicing.....	14-2
Axle Stop Adjustment.....	K-3

**B**

Backhoe Valve Block Maintenance.....	10-27
Battery Cable Replacement.....	12-7
Battery Equalizer Testing. ....	12-4
Battery Explosions.....	2-13
Battery Replacement.....	12-5
Battery Stowage Box Maintenance.....	13-47
Battery Trickle Charger Replacement .....	20-55
Belt Tensioner Replacement, Engine.....	L-10
Bleeding Fuel System. ....	7-2
Bleeding Single Gear System. ....	K-2
Boom Cylinder Maintenance.....	10-36
Boom Hydraulic Cylinder Repair .....	H-8.2
Boom Lock Pedal and Cable Replacement.....	13-5
Boom Replacement.....	H-4
Brake Assembly Repair, Front Axle.....	J-4
Brake Control Valve Replacement. ....	15-10
Brake Drum Replacement.....	8-4
Brake Shoe Replacement, Front .....	J-5
Brake Shoe Replacement, Rear.....	J-13
Breather Replacement, Axle Housing.....	14-13
Breather Replacement, Front Axle Hub.....	14-15
Breather Replacement, Fuel Tank.....	7-6
Bucket and Dipper Hydraulic Cylinder Repair.....	H-8
Bucket Cylinder Maintenance.....	10-33
Bump Stop Replacement. ....	6-7
Bushing Replacement, General.....	17-13

**C**

Caging, Spring Brake Chamber .....	8-10
Camshaft Gear Replacement, Engine .....	L-50
Camshaft Replacement. ....	L-39
Carbon Monoxide Hazard.....	2-16
Charge Equalizer Replacement.....	12-37
Charging Pump Replacement. ....	4-38
Check Strap Replacement.....	6-2

<u>Subject</u>	<u>Page</u>
Cleanliness.....	2-11
Cold Weather Kit Initial Installation .....	20-3
Cold Weather Kit.....	1-11
Combustion Air Blower Replacement.....	20-26
Control Arm Replacement.....	6-12
Control Unit Replacement .....	20-28
Coolant Reservoir Replacement. ....	9-11
Cooling System Servicing. ....	9-2
Crankshaft Gear Replacement, Engine.....	L-49
Crankshaft Pulley/Vibration Damper Replacement (Engine).....	L-9
Crankshaft Replacement.....	L-46
Crush Hazard. ....	2-14
Cutting Edge Replacement. ....	17-12
Cylinder Block Repair. ....	L-47
Cylinder Head Repair. ....	L-51
Cylinder Head Maintenance. ....	L-25
Cylinder Maintenance, 4-In-1 Bucket .....	10-54
Cylinder Maintenance, Boom.....	10-36
Cylinder Maintenance, Bucket .....	10-33
Cylinder Maintenance, Dipper.....	10-39
Cylinder Maintenance, Tilt.....	10-50
Cylinder Replacement, FEL Lift .....	10-47
Cylinder Replacement, Stabilizer .....	10-44
Cylinder Replacement, Swing .....	10-42

**D**

Dash Panel Wiring Harness Replacement.....	12-85
Data Plate Replacement.....	13-19
Destruction of Army Material to Prevent Enemy Use.....	1-2
Differential Assembly Repair, Front .....	J-9
Differential Assembly Repair, Rear.....	J-15
Dipper Cylinder Maintenance.....	10-39
Dipper Replacement. ....	H-6
Dipstick Replacement, Engine.....	L-18
Disposal of Waste. ....	2-15
Door Assembly Replacement. ....	13-62
Door Gas Strut Replacement. ....	13-68
Door Handle Replacement.....	13-66
Door Hinge Replacement.....	13-65
Drag Link Replacement.....	5-34
Draining Air System. ....	15-2
Drive Belt Replacement.....	4-6
Drive Head Replacement, Front Axle.....	J-8
Drive Head Replacement, Rear Axle.....	J-14

<u>Subject</u>	<u>Page</u>
Drive Plate Installation .....	F-21
Drive Shaft and U-Joint Maintenance.....	14-5

**E**

EGS Self-Test Function .....	G-2
Electrical Master Switch Replacement .....	12-9
Electrical Outlet Replacement .....	20-58
Electrical System .....	1-7
Electromagnetic Interference.....	2-15
Electronic Control Unit (ECU) Replacement .....	12-66
Electronic Gear Shift (EGS) Replacement .....	12-45
Engine Block Heater Replacement .....	20-53
Engine Component Replacement.....	4-22
Engine Hood Maintenance.....	13-31
Engine Mount Replacement.....	4-48
Engine Mounting .....	L-5
Engine Oil Cooler Repair .....	L-54
Engine Oil Cooler Replacement .....	L-34
Engine Oil Sampling Valve Assembly Replacement .....	4-42
Engine Oil Service and Filter Replacement.....	4-2
Engine Repair (Belt Tensioner Replacement) .....	L-10
Engine Repair (Camshaft Gear Replacement).....	L-50
Engine Repair (Crankshaft Gear Replacement).....	L-49
Engine Repair (Dipstick Replacement) .....	L-18
Engine Repair (Fan Hub Maintenance) .....	L-55
Engine Repair (Fan Hub Replacement).....	L-11
Engine Repair (Fan Pulley Replacement).....	L-8
Engine Repair (Front Cover Replacement).....	L-27
Engine Repair (Fuel Lines Replacement).....	L-16
Engine Repair (Gear Housing Replacement).....	L-43
Engine Repair (Mechanical Tachmeter Drive Cover Replacement) .....	L-57
Engine Repair (Push Rods Replacement).....	L-24
Engine Repair (Rear Lifting Bracket Replacement).....	L-7
Engine Repair (Rear Seal Housing Replacement).....	L-38
Engine Repair (Rocker Lever Repair) .....	L-53
Engine Repair (Rocker Levers Replacement).....	L-23
Engine Repair (Tappet Cover Replacement) .....	L-33
Engine Repair (Thermostat Replacement).....	L-12
Engine Repair (Turbocharger Mounting Stud Replacement).....	L-56
Engine Repair (Valve Tappets Replacement).....	L-41
Engine Repair (Vibration Damper/Crankshaft Pulley Replacement).....	L-9
Engine Repair (Water Inlet Connection Replacement) .....	L-35
Engine Repair .....	L-3
Engine System .....	1-6



<u>Subject</u>	<u>Page</u>
Front Cover Replacement, Engine.....	L-27
Front Differential Assembly Repair.....	J-9
Front Fender Replacement.....	13-23
Front Wheel Alignment.....	5-37
Front Wheel Hub Repair, Front Axle.....	J-2
Front Wiper Motor Replacement.....	12-58
Front-End Loader (FEL) Arm Maintenance.....	17-2
Fuel Filter Replacement.....	7-4
Fuel Lines Replacement, Engine.....	L-16
Fuel Metering Pump Replacement.....	20-31
Fuel Sending Unit Replacement.....	12-83
Fuel Shut-Off Valve Replacement.....	7-11
Fuel Tank Breather Replacement.....	7-6
Fuel Tank Maintenance.....	7-8
Fuel Tank Step Plate Replacement.....	13-21
Fuel Transfer Pump Replacement.....	L-32

**G**

Gauge/Dash Panel Replacement.....	12-42
Gear Housing Replacement, Engine.....	L-43
General Bushing Replacement.....	17-13
General Hydraulic Cylinder Repair.....	10-63
General Hydraulic Hose Replacement.....	10-21
General Lubrication Instructions.....	3-19
General Maintenance Procedures.....	3-2
General Preparation for Storage or Shipment.....	3-24
General Sensor and Sending Units Replacement.....	12-77
General Sheet Metal Repair.....	13-32
General Wire Harness Repair.....	12-50
General Wiring Harness Replacement.....	12-48
Glass Replacement.....	13-34
Glow Pin Replacement.....	20-37

**H**

Hand Control Pod Assembly Replacement.....	13-13
Hand Throttle Replacement.....	13-3
Handholds and Steps.....	2-4
Headlight Assembly Repair.....	12-88
Heating, Ventilation, and Air-Conditioning (HVAC).....	1-10
Hitch Assembly Replacement.....	16-6
Hose Reel Assembly Maintenance.....	10-67
Hose Reel Hose Assembly Replacement.....	10-85
Hose Reel Roller Replacement.....	10-74

<u>Subject</u>	<u>Page</u>
Front Cover Replacement, Engine.....	L-27
Front Differential Assembly Repair.....	J-9
Front Fender Replacement.....	13-23
Front Wheel Alignment.....	5-37
Front Wheel Hub Repair.....	J-2
Front Wiper Motor Replacement.....	12-58
Front-End Loader (FEL) Arm Maintenance.....	17-2
Fuel Filter Replacement.....	7-4
Fuel Lines Replacement, Engine.....	L-16
Fuel Metering Pump Replacement.....	20-31
Fuel Sending Unit Replacement.....	12-83
Fuel Shut-Off Valve Replacement.....	7-11
Fuel Tank Breather Replacement.....	7-6
Fuel Tank Maintenance.....	7-8
Fuel Tank Step Plate Replacement.....	13-21
Fuel Transfer Pump Replacement.....	L-32

**G**

Gauge/Dash Panel Replacement.....	12-42
Gear Housing Replacement, Engine.....	L-43
General Bushing Replacement.....	17-13
General Hydraulic Cylinder Repair.....	10-63
General Hydraulic Hose Replacement.....	10-21
General Lubrication Instructions.....	3-19
General Maintenance Procedures.....	3-2
General Preparation for Storage or Shipment.....	3-24
General Sensor and Sending Units Replacement.....	12-77
General Sheet Metal Repair.....	13-32
General Wire Harness Repair.....	12-50
General Wiring Harness Replacement.....	12-48
Glass Replacement.....	13-34
Glow Pin Replacement.....	20-37

**H**

Hand Control Pod Assembly Replacement.....	13-13
Hand Throttle Replacement.....	13-3
Handholds and Steps.....	2-4
Headlight Assembly Repair.....	12-88
Heating, Ventilation, and Air-Conditioning (HVAC).....	1-10
Hitch Assembly Replacement.....	16-6
Hose Reel Assembly Maintenance.....	10-67
Hose Reel Hose Assembly Replacement.....	10-85
Hose Reel Roller Replacement.....	10-74

<b><u>Subject</u></b>	<b><u>Page</u></b>
Hose Reel Spring Motor Replacement .....	10-77
Hose Reel Switch Replacement.....	10-80
Hose Reel Valve Replacement .....	10-83
How to Use the Torque Tables. ....	E-1
How to Use This Manual .....	page iv
HR32000 Transmission Repair.....	F-2
Hydraulic Calibration Procedure. ....	10-56
Hydraulic Controls Error Codes Specification. ....	3-35
Hydraulic Flow Testing. ....	10-8
Hydraulic Hose Replacement, General.....	10-21
Hydraulic Oil Cooler Replacement.....	9-10
Hydraulic Oil Filter Replacement. ....	10-13
Hydraulic Oil Pump Replacement. ....	10-19
Hydraulic Oil Sampling Valve Replacement.....	10-61
Hydraulic Oil Servicing. ....	10-12
Hydraulic Pressure Testing. ....	10-6
Hydraulic Reservoir Maintenance. ....	10-15
Hydraulic Reservoir Sight Glass Replacement.....	10-18
Hydraulic Reservoir Step Plate Replacement. ....	13-22
Hydraulic Solenoid Valve Replacement.....	12-68
Hydraulic System.....	1-9
<b>I</b>	
Idle Adjustment.....	L-58
Ignition Switch Replacement.....	12-33
Impeller and Baffle Repair. ....	F-12
Inclinometer Replacement .....	13-10
Indicator Arm Replacement.....	12-46
Injection Pump Replacement. ....	L-31
Injector Nozzles Replacement. ....	L-22
Installation of Non-Metallic Seal Rings. ....	F-4
<b>J</b>	
Jacking and Jack Stand Placement.....	2-11
Joystick Replacement. ....	12-43
<b>L</b>	
Light Bulb Replacement. ....	12-95
Location and Description of Major Components. ....	1-4
Lubrication Instructions, General .....	3-19

<u>Subject</u>	<u>Page</u>
<b>M</b>	
Main Hydraulic Master Switch Replacement .....	12-38
Maintaining Lubricant Levels .....	3-19
Maintenance Forms and Records .....	3-1
Maintenance Forms, Records, and Reports .....	1-1
Maintenance Functions .....	B-1
Mandatory Replacement Parts .....	D-1
Manual Handling .....	2-14
Marker Light Assembly Replacement .....	12-91
Master Light Switch Replacement .....	12-17
Mechanical Tachometer Drive Cover Replacement, Engine .....	L-57
Metric System .....	1-3
Military Load Classification (MLC) Placard Replacement .....	13-81
Mirror Bracket Replacement .....	13-46
Mirror Clearance Light Replacement .....	12-92
Mirror Replacement .....	13-44
Mirrors .....	2-5
Miscellaneous .....	A-2
Moving Parts Hazard .....	2-13
Mudflap Replacement, Rear Fender and .....	13-25
Muffler Heat Shield Replacement .....	11-2
Muffler Replacement .....	11-3
<b>N</b>	
NATO Slave Receptacle Replacement .....	12-11
Noise Protection .....	2-3
Nomenclature Cross-Reference .....	1-2
Nose Cone Maintenance .....	13-27
<b>O</b>	
Oil Pan Replacement .....	L-36
Oil Pump Replacement .....	L-42
Oil Seal Ring Sleeve Replacement .....	F-10
Operating on Slopes .....	2-7
Operator's Seat Anchor Replacement .....	13-11
Operator's Seat Belt Replacement .....	13-16
Operator's Seat Replacement .....	13-14
Overheat and Temperature Sensors Replacement .....	20-40

**Subject**

**Page**

**P**

Pamphlets.....	A-1
Panhard Rod Replacement.....	5-23
Parking Brake Control Replacement. ....	8-13
Passengers.....	2-6
Piston and Rod Assemblies Replacement.....	L-45
Pitman Arm Replacement. ....	K-3
PMCS Introduction.....	3-1
Pneumatic Solenoid Valve Replacement.....	12-71
Pneumatic System.....	1-8
Pneumatic Valve Island Replacement.....	12-73
Potentiometer Replacement, FEL Arm Lift.....	12-81
Potentiometer Replacement, Tilt-Position.....	12-79
Power Distribution Panel (PDP) Assembly Replacement.....	12-35
Power Lines.....	2-6
Power Pack Replacement.....	4-8
Power Steering Gear Box Replacement.....	5-16
Power Steering Oil Service and Filter Replacement.....	5-4
Power Steering Pressure and Flow Testing.....	K-4.1
Power Steering Pump Replacement.....	5-13
Power Steering Reservoir Replacement.....	5-11
Powertrain.....	1-5
Precautions.....	2-2
Preparation and Isolation.....	14-1
Preparation for Storage or Shipment.....	1-2
Pressure Hazards.....	2-12
Preventive Maintenance Checks and Services (PMCS) Table.....	3-3
Preventive Maintenance Checks and Services.....	3-1
Protective Clothing.....	2-2
Purpose of Manual.....	page iv
Push Rods Replacement, Engine.....	L-24

**R**

Radiator Replacement.....	9-4
Radio Mount Replacement.....	13-7
Rear Axle Assembly Replacement.....	14-11
Rear Axle Repair (Complete Rear Brake Assembly Repair).....	J-12.1
Rear Axle Repair (Drive Head Replacement).....	J-14
Rear Axle Repair (Rear Wheel Hub Repair).....	J-11
Rear Axle Repair (Rear Air Chamber Replacement).....	J-16
Rear Blackout Light Replacement.....	12-90
Rear Brake Assembly Repair, Rear Axle.....	J-12.1
Rear Brake Shoe Replacement.....	J-13

<u>Subject</u>	<u>Page</u>
Rear Differential Assembly Repair.....	J-15
Rear Fender and Mudflap Replacement. ....	13-25
Rear Lifting Bracket Replacement, Engine .....	L-7
Rear Seal Housing Replacement, Engine .....	L-38
Rear Wheel Hub Repair, Rear Axle.....	J-11
Rear Wiper Motor Replacement. ....	12-61
Regulations. ....	A-1
Relay Replacement. ....	12-22
Releasing Hydraulic Pressure. ....	10-3
Remote Shift Solenoid Coil Replacement .....	12-75
Remote Shift Valve Replacement. ....	4-45
Reporting Equipment Improvement Recommendations (EIRs).....	1-2
Restore IHMEE to Operational Readiness. ....	14-2
Reverse Alarm Replacement.....	12-84
Reverse and 3rd Clutch Repair. ....	F-6
Ride Level Valve (RLV) and Linkage Replacement.....	6-8
Rifle Rack and Mount Replacement. ....	13-8
Rocker Lever Repair, Engine.....	L-53
Rocker Levers Replacement, Engine.....	L-23
Rocker Switch Replacement. ....	12-21
Rollover Protection Structure (ROPS)/Falling Object Protection Structure (FOPS). ....	2-3
Rollover. ....	2-6
Runaway Accidents. ....	2-8

**S**

Safe Operation. ....	2-5
Safe Servicing and Maintenance.....	2-9
Safety Decals. ....	2-3
Safety, Care, and Handling. ....	1-4
Sampling Valve Assembly Replacement, Engine Oil .....	4-42
Sampling Valve Assembly Replacement, Transmission Oil .....	4-43
Sampling Valve Replacement, Hydraulic Oil.....	10-61
Scald/Burn Hazard. ....	2-13
Seat Adjustment. ....	2-5
Seat Belt Replacement, Operator's.....	13-16
Seat Belt Use and Maintenance. ....	2-5
Separate Engine From Transmission. ....	4-34
Servicing Machine After Transmission Overhaul. ....	F-20
Sheet Metal Repair, General .....	13-32
Shock Absorber Maintenance. ....	6-11
Sight Glass Replacement, Hydraulic Reservoir.....	10-18
Slack Adjuster Replacement. ....	8-3
Spring Brake Chamber Caging. ....	8-10
Spring Brake Chamber Replacement.....	8-7

<u>Subject</u>	<u>Page</u>
Stabilizer Arm Maintenance .....	16-2
Stabilizer Cylinder Replacement .....	10-44
Standard Hydraulic Procedures .....	10-2
Starter Button Replacement .....	12-40
Starter Motor Replacement .....	12-15
Starter Solenoid Replacement .....	12-24
Starting Fluid (Ether) Cylinder Replacement .....	20-49
Steam Cleaning the Engine .....	L-4
Steering Column Replacement .....	5-22
Steering Damper Replacement .....	5-42
Steering Head and Axle Stub, Front Axle .....	J-6
Steering Lines and Hoses Replacement .....	5-6
Steering Miter Box Replacement .....	5-35
Steering Shaft Maintenance .....	5-26
Steering System .....	1-9
Steering Wheel Replacement .....	5-21
Storage Maintenance Procedures .....	3-24
Storage or Shipment, General Preparation for .....	3-24
Suction Tube Replacement .....	L-37
Sun Visor Replacement .....	13-42
Sway Bar Replacement .....	6-14
Swing Cylinder Replacement .....	10-42
Swing Hydraulic Cylinder Repair .....	H-8.4
Swing Tower Replacement .....	H-2
Switch Replacement .....	12-19
System Operation .....	5-2
Systems Introduction .....	1-4

**T**

Taillight Replacement .....	12-94
Tappet Cover Replacement, Engine .....	L-33
Technical Bulletins .....	A-1
Technical Manuals .....	A-2
Thermostat Replacement, Engine .....	L-12
Tie-Rod End Replacement .....	5-25
Tilt Cylinder Maintenance .....	10-50
Tilt Linkages Replacement .....	10-53
Tilt-Position Potentiometer Replacement .....	12-79
Tire and Wheel Repair .....	13-69
Torque Limits .....	E-1
Tow Pintle Replacement .....	16-5
Transmission 2/4WD Control Cylinder Replacement .....	4-52
Transmission Component Replacement .....	4-30
Transmission High/Low Control Cylinder Replacement .....	4-54

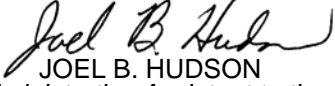
<u>Subject</u>	<u>Page</u>
Transmission Mount Replacement .....	4-49
Transmission Oil Cooler Replacement .....	9-8
Transmission Oil Sampling Valve Assembly Replacement .....	4-43
Transmission Oil Service and Filters Replacement .....	4-4
Transmission Repair, HR32000.....	F-2
Transporting.....	2-9
Traveling .....	2-7
Troubleshooting Introduction. ....	3-31
Troubleshooting Procedures. ....	3-31
Troubleshooting Table.....	3-38
Turbine and Impeller Cover Repair.....	F-14
Turbocharger Mounting Stud Replacement, Engine .....	L-56
Turbocharger Replacement.....	L-13
Types of Reaction of ECU to Failures Detected.....	3-36
 <b>U</b> 	
U.S. Army Standard Torque Tables.....	E-8
U-Joint Maintenance, Drive Shaft .....	14-5
U-Joint Maintenance, Steering Shaft .....	5-26
 <b>V</b> 	
Valve Block Service. ....	10-10
Valve Cover Replacement. ....	L-21
Valve Tappets Replacement, Engine .....	L-41
Vehicle Description. ....	1-3
Vehicle Inspection. ....	2-3
Vehicle Preparation and Isolation.....	4-1
Vibration Damper/Crankshaft Pulley Replacement, Engine .....	L-9
 <b>W</b> 	
Warranty Information. ....	1-3
Washer Bottle Assembly and Bracket Replacement. ....	12-63
Water Inlet Connection Replacement, Engine.....	L-35
Water Pump Replacement (Cold Weather Kit) .....	20-42
Water Pump Replacement (Engine).....	9-14, L-28
Web Sites, Army Publications .....	A-2
Wheel and Tire Repair.....	13-69
Wheels and Tires.....	1-10
Windshield Defrost Cover Replacement. ....	13-43
Wiper Blade and Arm Replacement. ....	13-39
Wiper Intermittent Relay Replacement. ....	12-32
Wire Harness Repair, General .....	12-50
Wiring Harness Replacement, Dash Panel .....	12-85
Wiring Harness Replacement, General.....	12-48



By Order of the Secretary of the Army:

JOHN M. KEANE  
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*Acting Chief of Staff*

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ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON <i>(Provide exact wording of recommended changes, if possible.)</i>	
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## THE METRIC SYSTEM AND EQUIVALENTS

### LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches  
 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches  
 1 Kilometer = 1000 Meters = 0.621 Miles

### SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches  
 1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet  
 1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

### WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces  
 1 Kilogram = 1000 Grams = 2.2 Lb  
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

### CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches  
 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces  
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

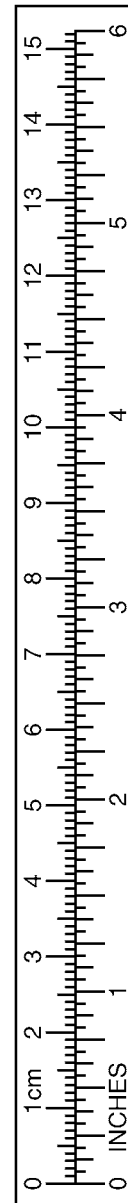
### TEMPERATURE

$5/9 (°F - 32) = °C$   
 212° Fahrenheit is equivalent to 100° Celsius  
 90° Fahrenheit is equivalent to 32.2° Celsius  
 32° Fahrenheit is equivalent to 0° Celsius  
 $9/5 C° + 32) = F°$

### APPROXIMATE CONVERSION FACTORS

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

<u>TO CHANGE</u>	<u>TO</u>	<u>MULTIPLY BY</u>
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621



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