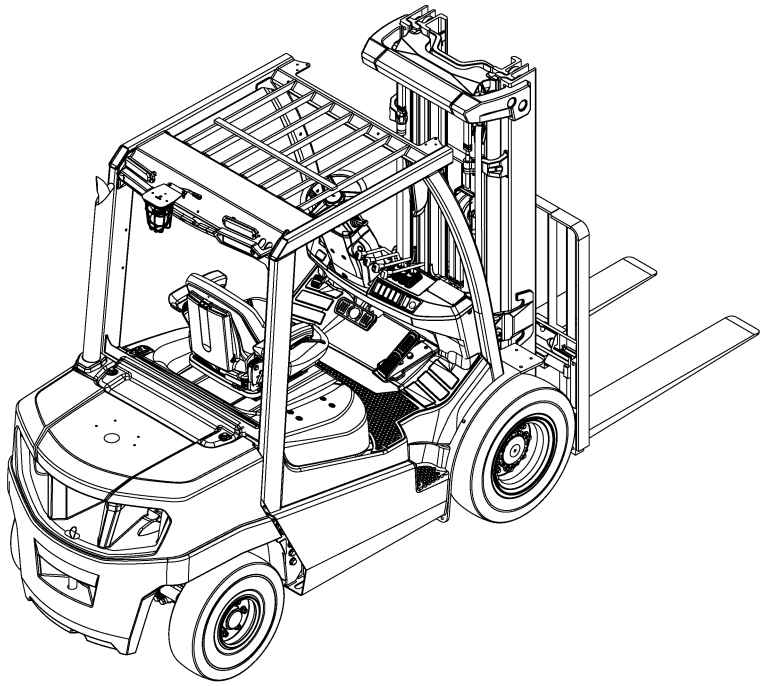
DRIVE TRAIN

H2.0A, H2.5A6, H2.5A, H3.0A, H3.5A (H40A, H50A6, H60A, H70A) [R177]



HYSTER

PART NO. 4277935

0900 SRM 2301

SAFETY PRECAUTIONS
MAINTENANCE AND REPAIR

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Hyster® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand; always use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section of the service manual.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER ® APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Strictly follow all **WARNING** and **CAUTION** notes in the operating manual, safety labels, service manual, and other instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), Hydrogen Gas (H2), and Diesel fuels are flammable and potentially explosive. Hydraulic, transmission, and other fluids and oils are also flammable. Be sure to follow the necessary safety precautions when handling these substances or working on systems containing these substances.
- Lead acid batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.
- Lithium-ion batteries should only be used in working environments where the temperature is within the recommended operating range (typically between 0 - 40°C (32 - 104°F)). Extreme temperatures, moisture, improper charging or damage to the battery can cause a fire or explosion.
- Whenever Diagnostic tools are needed for engine, only licensed or certified persons can use Diagnostic tools.

NOTE: The following symbols and words indicate safety information in this manual:



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the WARNING symbol (and word, if present) are on orange background. The CAUTION symbol (and word, if present) are on yellow background.

WARNING

Installing improper electrical accessories or installing an electrical accessory incorrectly can increase the risk of equipment damage, personal injury and fire. DO NOT install electrical accessories to the truck unless you have been trained and authorized to do so. Personnel installing the electrical accessories must document the changes made to the truck. DO NOT install accessories which affect the truck's compliance with standard ANSI/ITSDF B56.1, UL 558, or UL 583, or which otherwise affect the safe operation of the truck.

WARNING

Installing improper electrical accessories or installing an electrical accessory incorrectly can increase the risk of equipment damage, personal injury and fire. DO NOT install electrical accessories to the truck unless you have been trained and authorized to do so. Personnel installing the electrical accessories must document the changes made to the truck. DO NOT install accessories which affect the truck's compliance with standard EN 1175:2020.

WARNING

California Proposition 65 - Operating, servicing and maintaining a powered industrial truck can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.

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"THE QUALITY KEEPERS"

HYSTER APPROVED PARTS

Introduction

GENERAL
202001-001

NOTE: For any fasteners in this manual that feature standard torque specifications, please refer to **Metric and Inch (SAE) Fasteners** 8000SRM0231 for correct specifications.

DISCHARGING THE CAPACITORS

WARNING

DO NOT make repairs or adjustments unless you have been properly trained and authorized to do so. Improper repairs and adjustments can create dangerous operating conditions. DO NOT operate a lift truck that needs repairs. Report the need for repairs to your supervisor immediately. If repair is necessary, attach a DO NOT OPERATE tag on the steering wheel and disconnect the battery.

Disconnect the battery and discharge the capacitors before opening any compartment covers or inspecting or repairing the electrical system. DO NOT place tools on top of the battery. If a tool causes a short circuit, the high current flow form the battery can cause personal injury or property damage.

Some check and adjustments are performed with the battery connected. DO NOT connect the battery until the procedure instructs you to do so. Never wear any metallic items on your fingers, arms, or neck. Metal items can accidentally make an electrical connection and cause injury. Before performing any tests or adjustments, block the lift truck to prevent unexpected movement.

The capacitors in the transistor controller(s) can hold an electrical charge for about 10 minutes after the battery is disconnected. To prevent an electrical shock and personal injury, discharge the capacitor(s) before inspecting or repairing any component in the drive unit compartment. Make certain that the battery had been disconnected.

DO NOT short across the motor controller terminals with a screwdriver or jumper wire.

Make certain the Emergency-Stop Switch has not been activated. This will isolate the controller and prevent the capacitors from discharging properly. The proper way to disconnect the battery is by separating the battery connectors.

DISCHARGING THE CAPACITORS: For trucks with rapid-charge option, the horn cannot be used to discharge capacitors prior to service. Disconnect the battery, then wait five minutes before performing any service on the truck.

1. Ensure the capacitors are discharged by performing Step 2 through Step 6 below.
2. Turn the key or keyless switch to **OFF** position.
3. Disconnect the battery by separating the connector on the battery cable from the connector on the lift truck.
4. Block the drive wheels to prevent the lift truck from moving.
5. Make sure the Emergency-Stop Switch **HAS NOT** been activated. If the Emergency-Stop Switch is activated, rotate the switch to the right until it pops up.
6. Press the horn button on the steering column. Wait 30 seconds to be sure capacitors are fully discharged. If the horn does not sound when the switch is actuated, wait 10 minutes before proceeding with service.
   For lift trucks equipped with rapid-charge option, the horn cannot be used to discharge capacitors prior to service. Disconnect the battery, then wait five minutes before performing any service on the truck.

Engine removal and replacement

DIESEL ENGINE REMOVAL AND REPLACEMENT 202001-052

REMOVE

WARNING

The lift truck must be put on blocks for some types of maintenance and repairs. The removal of the following assemblies will cause large changes in the center of gravity: mast, drive axle, engine and transmission, and counterweight. When the lift truck is put on blocks, put additional blocks in the following positions to maintain stability:

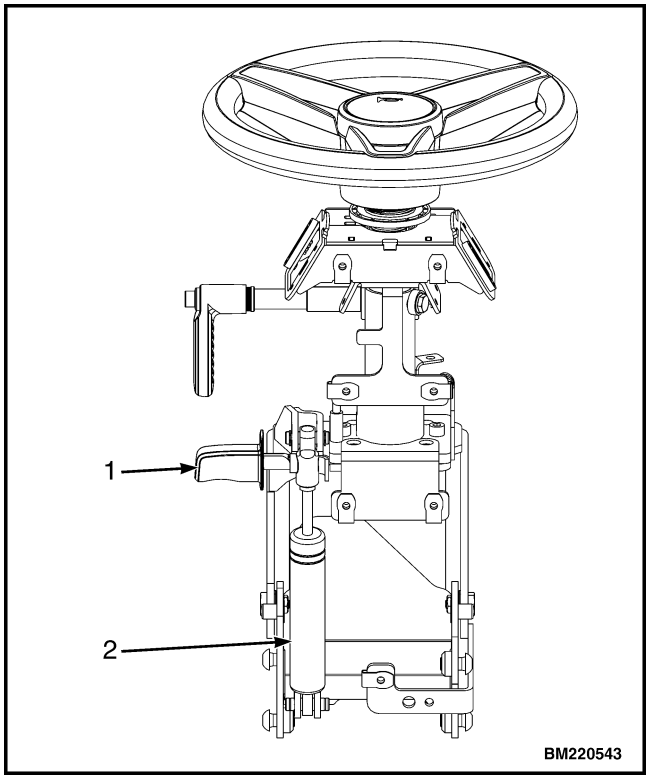
- **Before removing the mast and drive axle, put blocks under the counterweight so the lift truck cannot fall backward.**
- **Before removing the counterweight, put blocks under the mast assembly so the lift truck cannot fall forward.**

The surface must be solid, even, and level when the lift truck is put on blocks. Make sure that any blocks used to support the lift truck are solid, one-piece units. See the Operating Manual or How to put a lift truck on blocks for your lift truck.

WARNING

Always disconnect the cables at the battery before you make repairs to the engine. Disconnect the cable at the negative terminal first.

1. Use the tilt lever to fully tilt the steering column forward. See Figure 1.



1. TILT LEVER
2. GAS CYLINDER

Figure 1. Tilt steering column

2. Disconnect the negative battery cable from the battery. See **Electrical, software, and controls** 2200SRM2304.

3. Disconnect the positive battery cable from the battery. See **Electrical, software, and controls** 2200SRM2304.

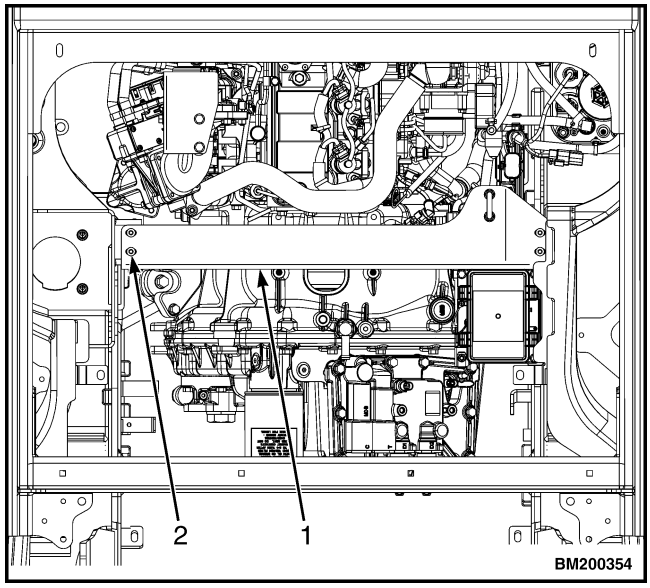
4. Disconnect the seat wire harness and remove the seat from the hood. See Seat repair-Full Suspension in **Operator's Cab** 0100SRM2298 for procedure.

5. Remove the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306.

6. Remove the rear floorplate. See Covers repair, in **Frame and Main Components** 8000SRM2306.

7. Disconnect the throttle pedal connector from the pedal. Remove the front floorplate and the throttle pedal. See Covers repair, in **Frame and Main Components** 8000SRM2306.

8. Remove the four capscrews and the hood crossmember from the operator module. See Figure 2.



1. HOOD CROSSMEMBER
2. CAPSCREW

Figure 2. Hood crossmember

9. Remove the battery from the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

10. Disconnect the battery cable support bracket or the battery cable clamps from the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304. Fold the battery cables forward, out of the way.

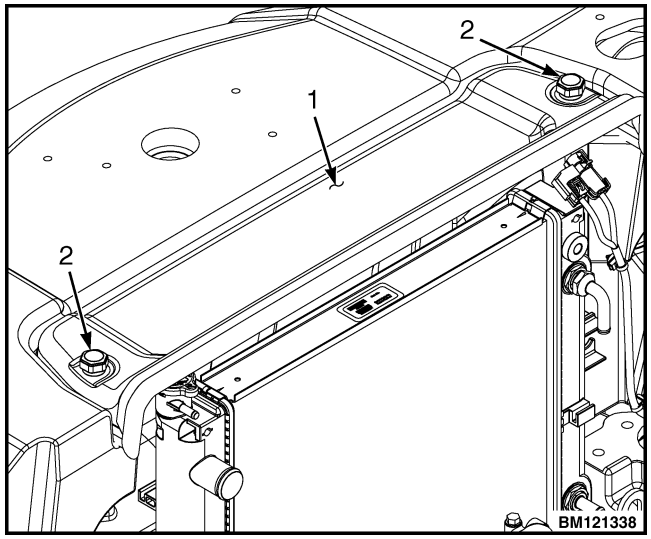
11. Remove the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

WARNING

DO NOT remove the radiator cap from the radiator when the engine is hot. When the radiator cap is removed, the pressure is released from the system. If the system is hot, the steam and coolant can cause burns.

12. Allow the coolant to cool to ambient temperature. Place a drain pan with a capacity greater than 15 liter (15.9 qt) under the radiator. Remove the radiator cap.

13. Remove the radiator cover from the rear counterweight, by turning the stand-offs counterclockwise and lifting the cover up. See Figure 3.



1. RADIATOR COVER
2. STAND-OFFS

Figure 3. Radiator cover

NOTE: If a fluid evacuator unit is available, coolant may be removed from the radiator via the radiator fill opening.

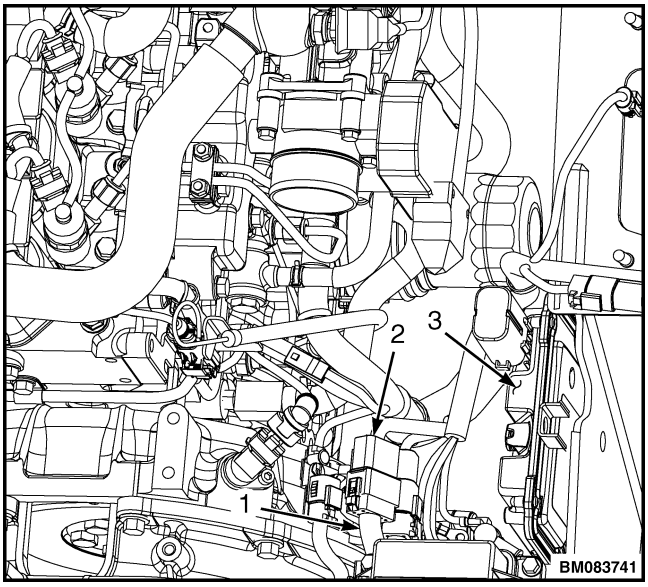
14. If not using a fluid evacuator unit, remove the drain plug to drain all coolant from the radiator and the engine. See Radiator repair, in **Cooling system** 0700SRM2300.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

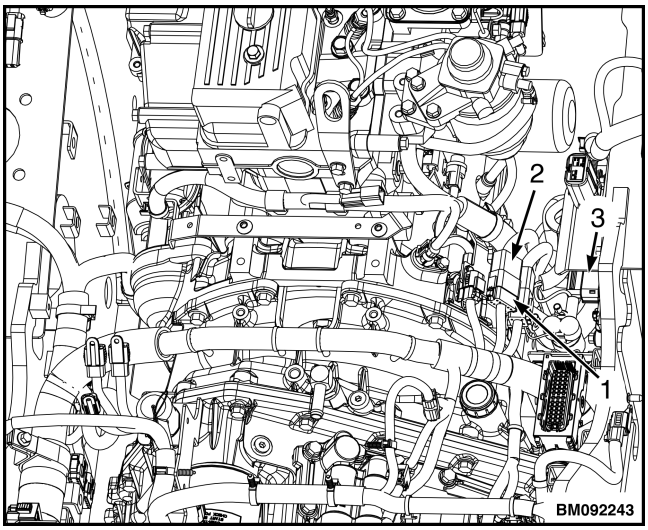
15. Remove the air intake module. See **Yanmar Engines** 0600SRM2299.

16. Disconnect the main engine harness from all connectors on the engine. See Figure 4 or Figure 5.



1. CHASSIS HARNESS
2. ENGINE HARNESS
3. ECU CONNECTOR

Figure 4. Engine harness (Yanmar 2.1L engines)

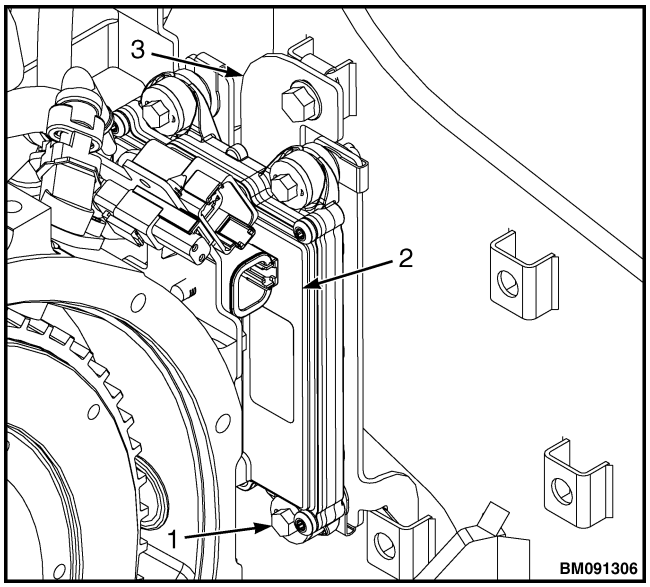


1. CHASSIS HARNESS
2. ENGINE HARNESS
3. ECU CONNECTOR

Figure 5. Engine harness (Yanmar 3.0 and 3.3L engines)

17. Disconnect the Electronic Control Unit (ECU) from the ECU connector on the engine harness. See Figure 5 or Figure 4.

18. Remove the screws to retaining the ECU to the bracket attached to the frame and remove the ECU. See Figure 6.



1. SCREW
2. ECU

Figure 6. ECU

19. Remove the fan assembly. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

20. Remove the fan pulley and spacer. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

21. Remove the top radiator coolant hose from the engine. See Figure 7. Tie the hose off to the side.

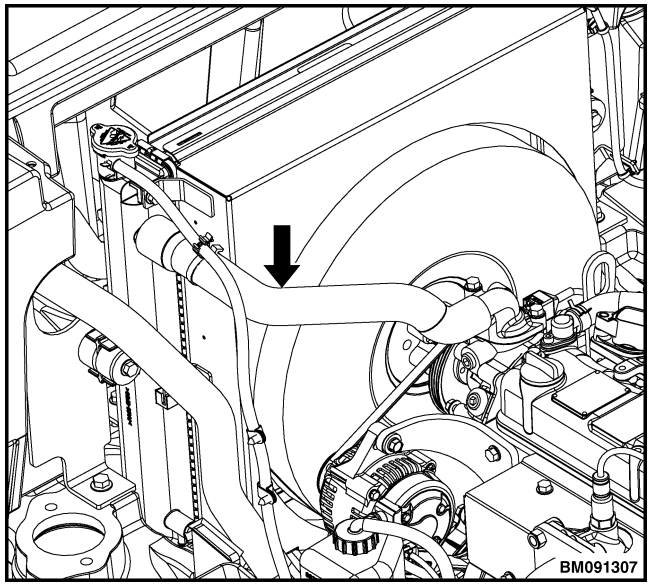


Figure 7. Upper radiator hose

22. Remove the fan shroud. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

23. Place an appropriately sized piece of plywood between the radiator and the engine to prevent damage to the radiator fins.

24. Remove the lower radiator hose from the engine, while leaving it attached to the radiator. See Figure 8. Tie the hose off to the side.

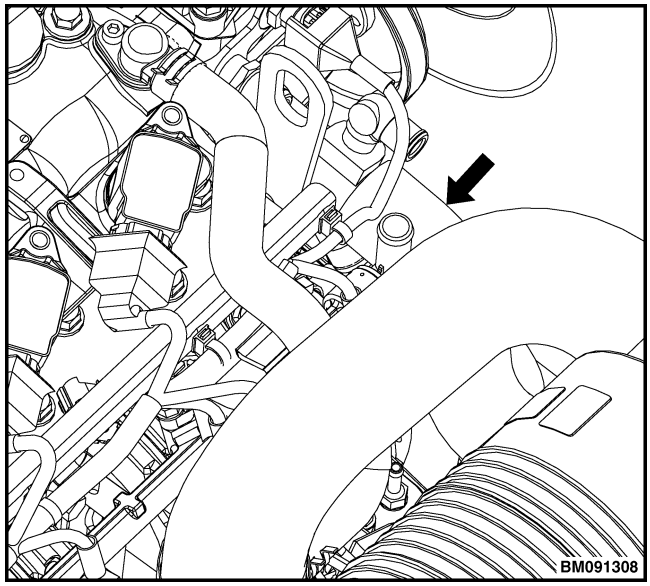
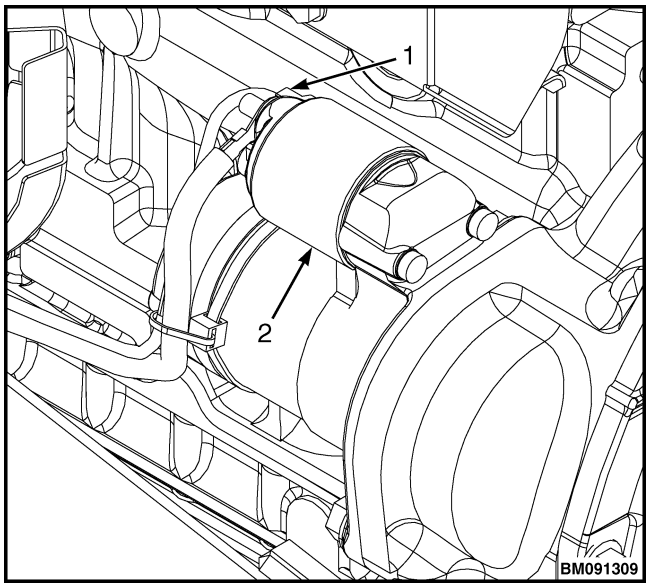


Figure 8. Lower radiator hose

25. Disconnect the wiring connector from the starter. See Figure 9.



1. STARTER CONNECTOR
2. STARTER

Figure 9. Starter connector

26. Remove the grounding strap from the engine block.

27. Disconnect the chassis harness ground bolt from the lift truck frame. See Figure 10.

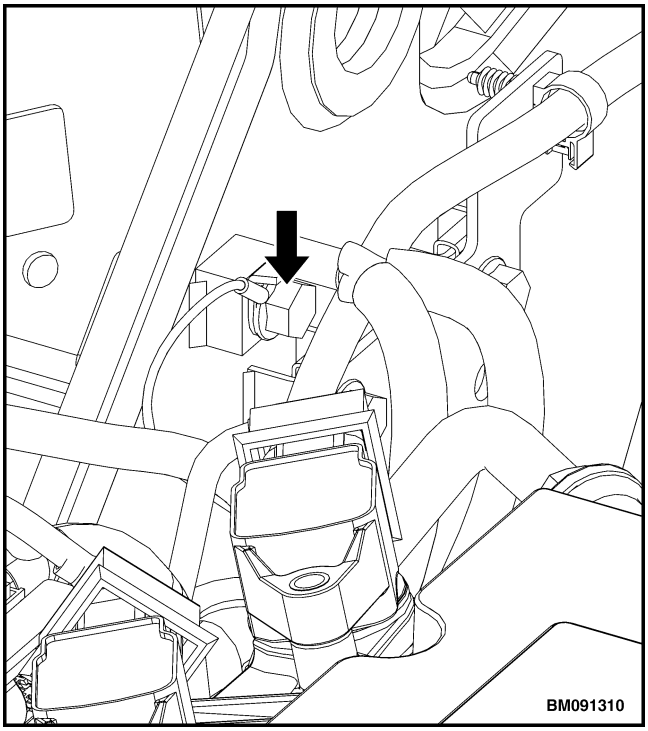


Figure 10. Chassis harness ground bolt

28. Detach the wiring and hoses mounted to the top of the flywheel housing and transmission. Fold forward, out of the way. See Figure 11.

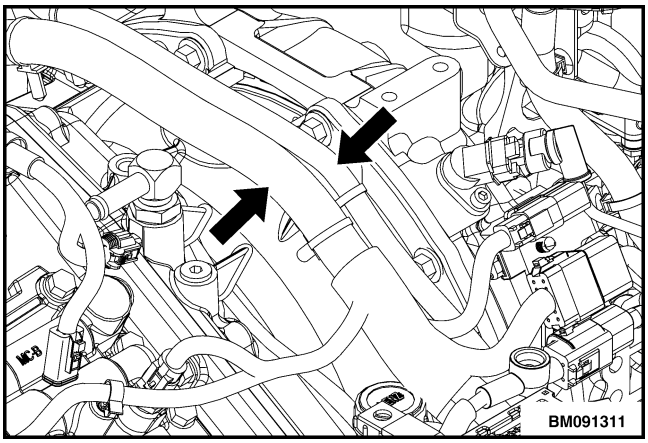
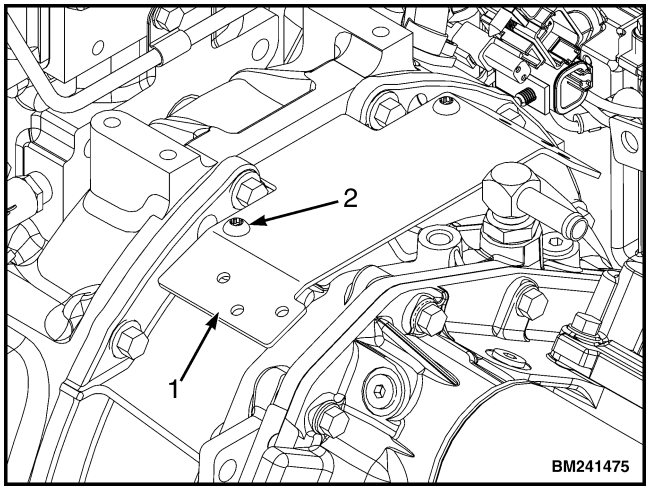


Figure 11. Wiring on the flywheel housing

29. Place the lift truck on blocks. See **Periodic Maintenance** 8000SRM2305.

30. Disconnect the engine exhaust pipe from the manifold and tie the pipe away from the engine. See Diesel exhaust and after treatment repair in **Yanmar Engines** 0600SRM2299.

31. Remove the two capscrews retaining the transmission access plate. Remove the access plate to reveal the torque converter access port. See Figure 12.



1. ACCESS PLATE
2. CAPSCREW

Figure 12. Transmission access plate

32. From the torque converter access port, rotate the torque converter by turning the fan, to access each of the six capscrews retaining the torque converter to the flywheel. Use an angled socket and wrench to remove each of the capscrews. See Figure 13.

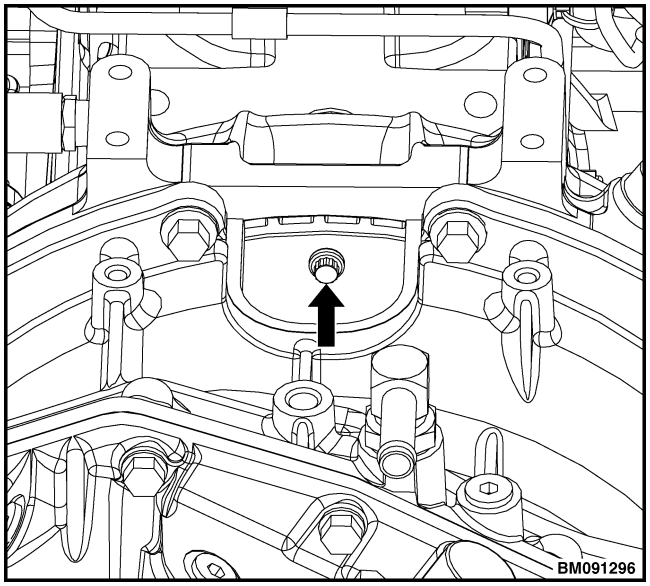


Figure 13. Torque converter mounting screws

NOTE: The engine can weigh as much as 240 kg (529.1 lb). Always use a lifting device and chains with a capacity rating higher than the weight of the engine.

33. Install a lifting eye bolt into the M12X1.75 lifting eye bolt hole on the transmission assembly. See Figure 14.

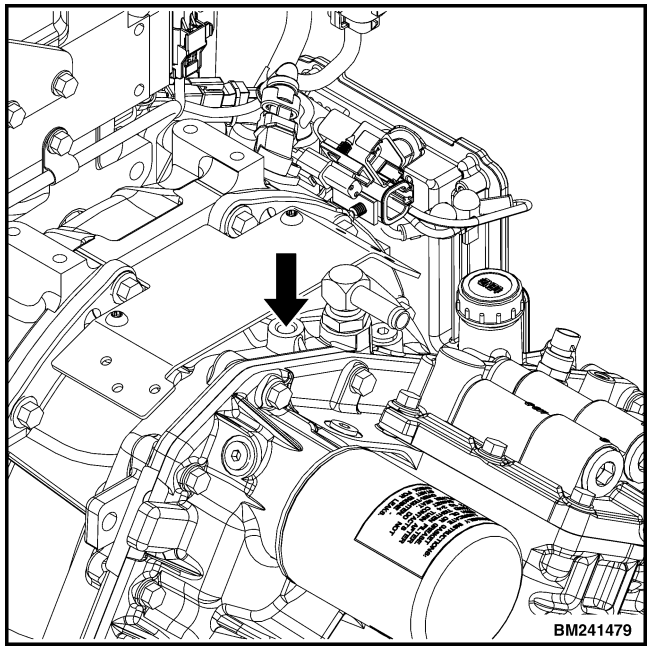


Figure 14. Lifting eye bolt hole

NOTE: The transmission and torque converter can weigh as much as 79.1 kg (174.4 lb). Make sure that any lifting device and strap has enough capacity to lift and hold the transmission.

34. Wrap a lifting strap around the overhead guard. Connect one end of a separate lifting strap to the strap around the overhead guard. Connect the other end to the lifting eye bolt on the transmission, to keep the transmission assembly stable while the engine is removed.

35. While continuing to support the transmission assembly with the overhead lifting device, place blocks or work stands beneath the transmission assembly at the surface where the two halves of the transmission assembly meet. See Figure 15.

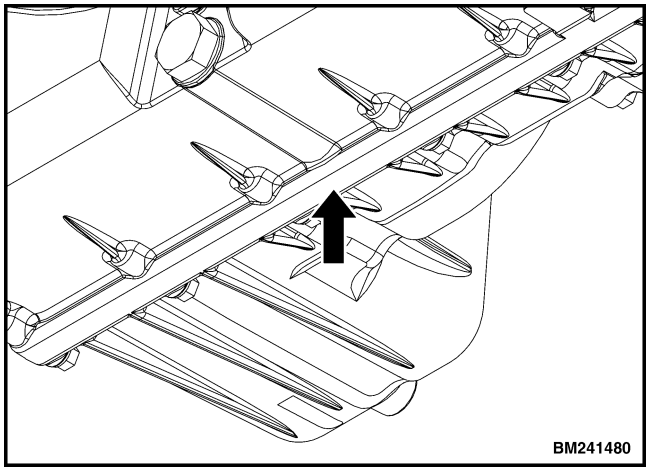


Figure 15. Blocking the transmission

WARNING

To avoid injury, confirm the transmission is fully supported before beginning to work under the suspended load.

36. With the transmission now supported, feed lifting straps through the two lifting eyes brackets on the valve cover of the engine assembly. See Figure 16. Attach the straps to a lifting device to keep engine supported. Confirm there is enough clearance between the top of the lifting device and the overhead guard to allow the engine to fully clear the frame.

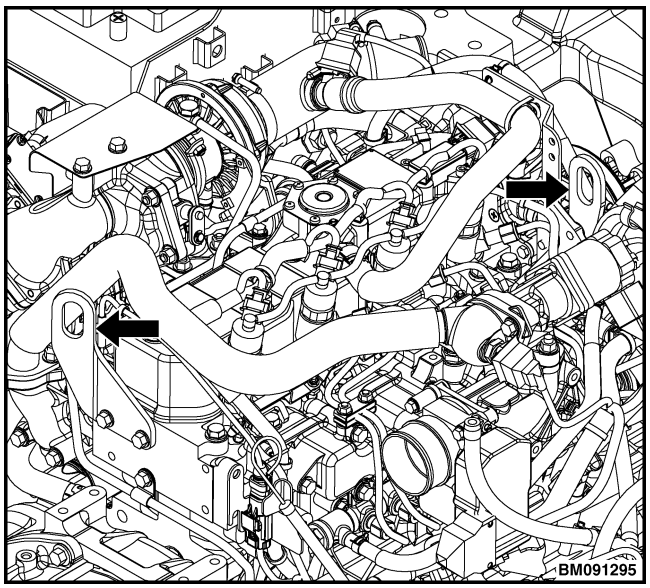
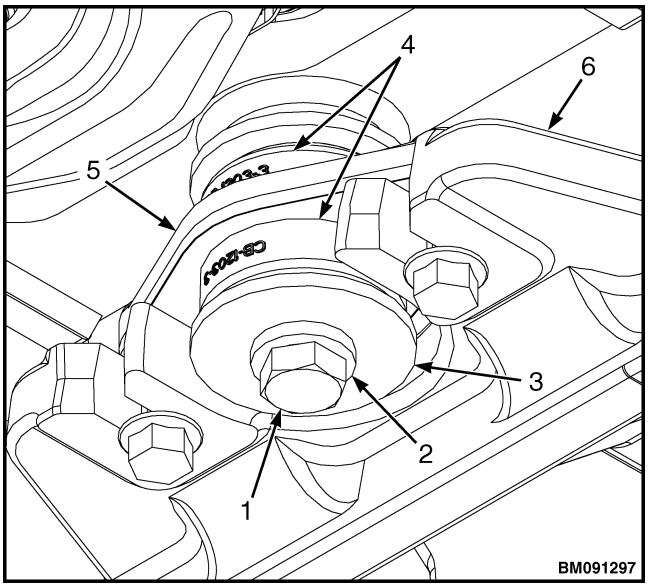


Figure 16. Lifting eyes

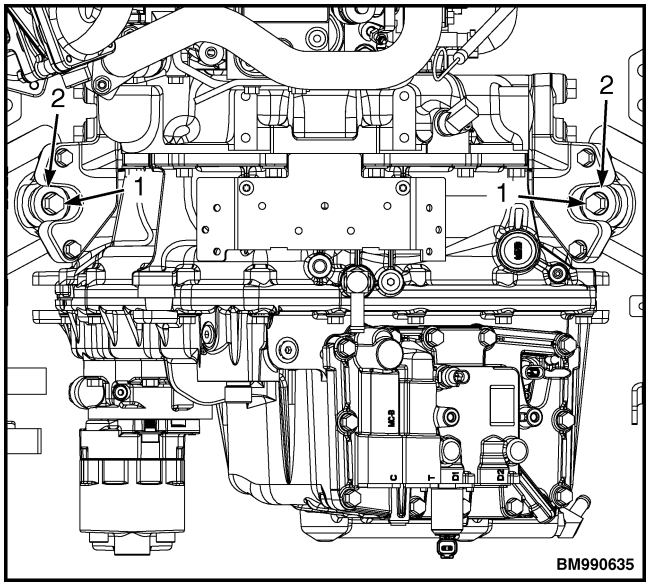
37. From underneath the lift truck, remove the rear engine mounting bolt that passes through the isolators and plate. See Figure 17.



1. REAR MOUNTING BOLT
2. WASHER
3. SPACER
4. ISOLATORS
5. PLATE
6. REAR FRAME

Figure 17. Rear mounting bolt

38. Remove the two front mounting bolts (1, Figure 18) from the engine mounts on the transmission side.



1. FRONT MOUNTING BOLT
2. WASHER

Figure 18. Front engine mount

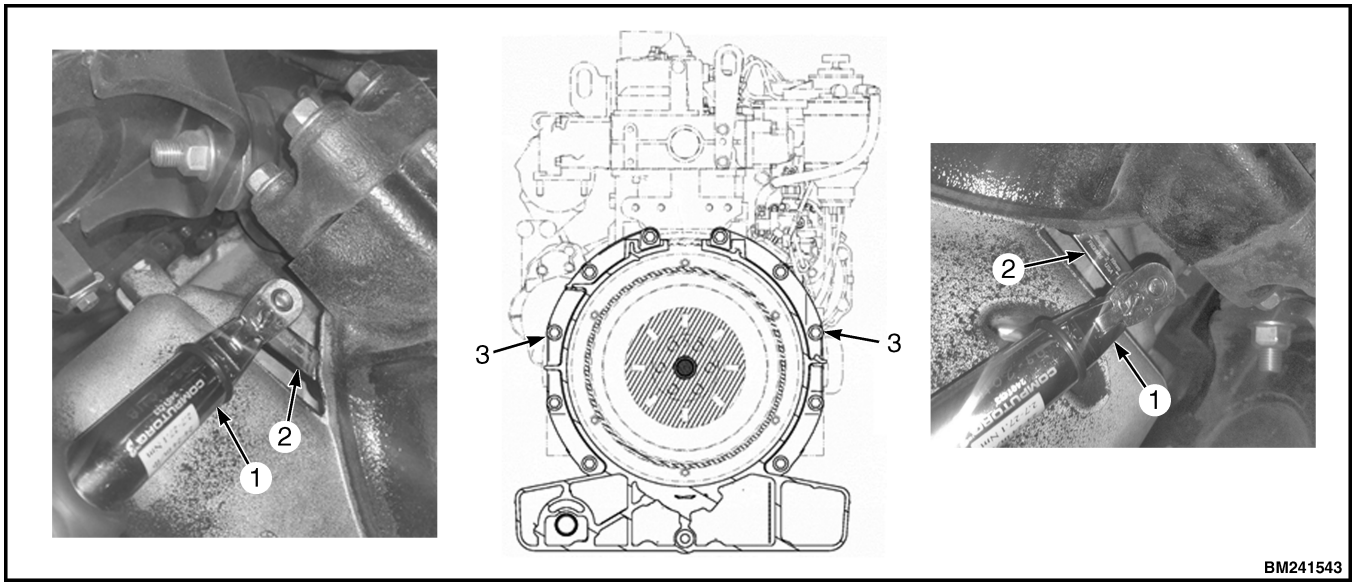
CAUTION

Keep the engine level when the engine is separated from the transmission so the drive plate is not damaged.

NOTE: Keep an equal gap on all sides when removing the engine assembly to prevent the shaft from binding. Keep the torque converter pushed against the transmission side to keep the splines and seals engaged and prevent oil leakage.

NOTE: Use of torque wrench with 2in torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool for tool specifications.

39. Using torque wrench and adapter, remove the two lowest bolts (item 6, Figure 20) attaching the transmission assembly to the engine. See Figure 19.

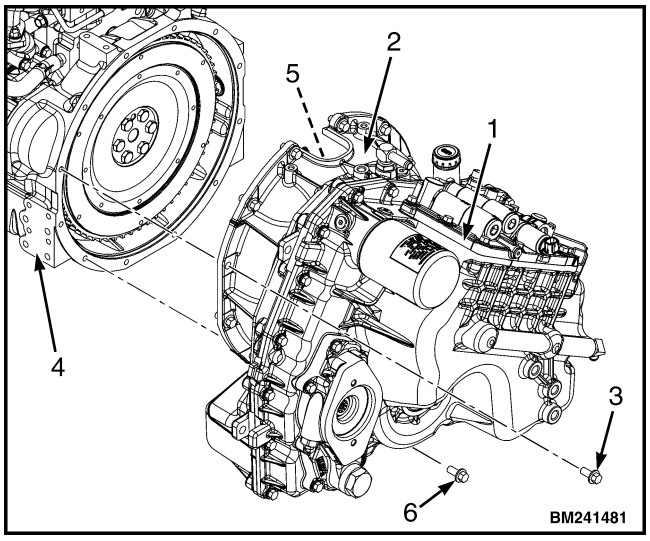


1. TORQUE WRENCH
2. DOGBONE
3. BOLT

Figure 19. Bolt Remove/Install Using Tool

40. Remove the remaining eight bolts (item 3, Figure 20).

41. Separate the engine flywheel housing from the transmission. Make sure all hoses, wires, and cables have been disconnected from the engine. Use the lifting device to carefully move the engine flywheel housing away from the torque converter housing of the transmission assembly. Take care to not damage the wire harnesses or any of the hoses that might be in the path of removal. See Figure 20. Remove the blocks or work stands.



1. TRANSMISSION HOUSING
2. TORQUE CONVERTER HOUSING
3. BOLT
4. ENGINE
5. TORQUE CONVERTER
6. BOLT

Figure 20. Electronic Powershift transmission and engine flywheel housings

42. Lift the engine from the frame and place the engine on the ground or a work bench, supported by wooden blocks under the oil pan flange bolts. See Figure 21.

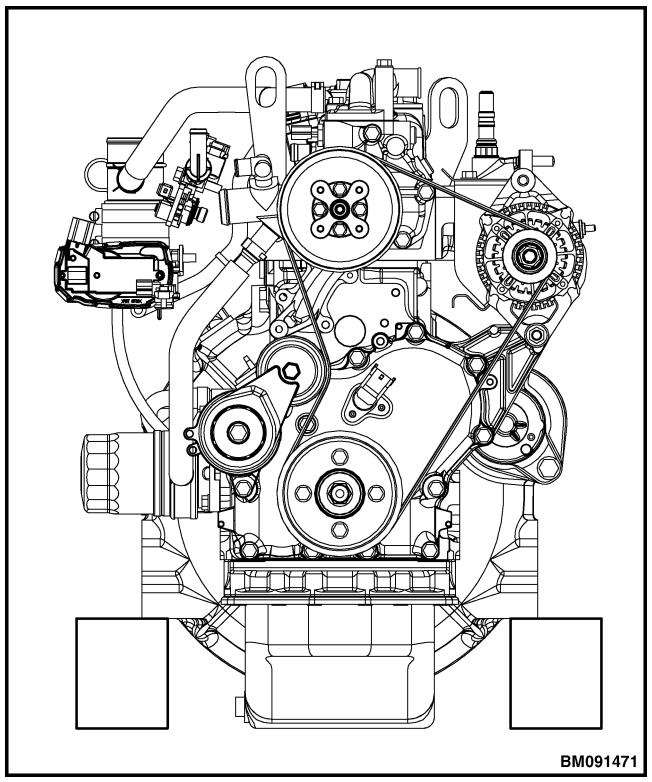


Figure 21. Blocking the engine

INSTALL

WARNING

The engine is heavy. Make sure that any lifting device has enough capacity to lift the engine. The engine can weigh as much as 240 kg (529.1 lb).

CAUTION

Keep the engine level when installing the engine to the transmission so the drive plate is not damaged.

WARNING

To avoid injury, confirm the engine and transmission are each fully supported before beginning to work under the suspended load.

1. Connect the lifting device to the two lifting eye brackets on the valve cover of the engine. Lift the engine over the engine compartment and slowly lower the engine into the frame of the lift truck, aligned with the engine mounts.

NOTE: Make sure the transmission does not shift when aligning the engine with the transmission.

2. Align the transmission assembly with the engine, making sure the stub shaft is properly engaged and install the eight capscrews on the top (item 3, Figure 20).

NOTE: Use of torque wrench with 2in torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool for tool specifications.

3. Using torque wrench and adapter, install the two bottom capscrews. See Figure 20 and Figure 19.

4. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

5. Install the rear engine mounting bolt with washers and isolator. Torque to 170 to 180 N•m (125 to 132 lbf ft).

6. Place blocks or work stands beneath the transmission assembly at the surface where the two halves of the transmission assembly meet. See Figure 15.

7. Apply Loctite® 242 to the capscrew threads and install to torque converter housing, tighten to snug all around before final torque.

8. Rotate the torque converter to access each of the six capscrews. See Figure 13. Use an angled socket and wrench to tighten each of the capscrews. Torque to 32 to 36 N•m (23.6 to 26.6 lbf ft).

9. Install the access plate back on the torque converter housing. See Figure 12. Tighten to standard torque.

10. Install front mounting bolts and washers. See Figure 18. Torque bolts to 50 to 55 N•m (37 to 41 lbf ft) initially. Torque bolts to 170 to 180 N•m (125 to 132 lbf ft) for the final torque.

11. Connect the engine exhaust pipe to the exhaust manifold. See Diesel exhaust and after treatment repair in **Yanmar Engines** 0600SRM2299.

12. Install the fan shroud. See Fan repair in **Cooling system** 0700SRM2300 for procedure.

13. Install fan assembly, fan belt and fan pulley. See **Cooling system** 0700SRM2300 for procedure.

14. Install the lower radiator hose to the engine. See Figure 8.

15. Install the top radiator coolant hose to the engine. See Figure 7.

16. Connect the engine harness to the chassis harness and all connectors and sensors. See Figure 5.

WARNING

All fuels are very flammable and can burn or cause an explosion. DO NOT use an open flame to check the fuel level or to check for leaks in the fuel system.

No smoking.

Breathing fuel vapor may cause nausea, unconsciousness or death. Long term exposure to gasoline vapors may cause liver or kidney damage and cancer. Avoid breathing vapor.

17. Remove caps from fuel lines and connect the fuel lines at the engine. See Diesel fuel system repair, in **Yanmar Engines** 0600SRM2299.

18. Connect the coolant hoses and lines to the transmission. Fill cooling system with a mixture of 50 percent deionized water and 50 percent ethylene glycol boron-free antifreeze. See Radiator repair, in **Cooling system** 0700SRM2300.

19. Install the air filter. See **Operator's Cab** 0100SRM2298.

20. Connect the ground strap to the frame. See **Frame and Main Components** 8000SRM2306.

21. Connect the wiring connector to the starter. See Figure 9.

22. Install the battery and battery holder. Connect the battery cables. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

23. Insert the four capscrews into the hood crossmember and install the hood crossmember to the operator module. See Figure 2. Tighten to standard torque.

24. Install the floorplate and throttle pedal. Connect the throttle pedal connector. See Covers repair, in **Frame and Main Components** 8000SRM2306.

25. Install the floormat. See Covers repair, in **Frame and Main Components** 8000SRM2306.

26. Install the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306.

27. Install the seat to the hood. Connect the seat harness to the seat. See Seat repair-Full Suspension, in **Operator's Cab** 0100SRM2298 for procedures.

28. Check and fill all fluid levels as described in **Periodic Maintenance** 8000SRM2305.

29. Install the radiator cover to the counterweight. See Figure 3.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

30. Empty drain pan contents.

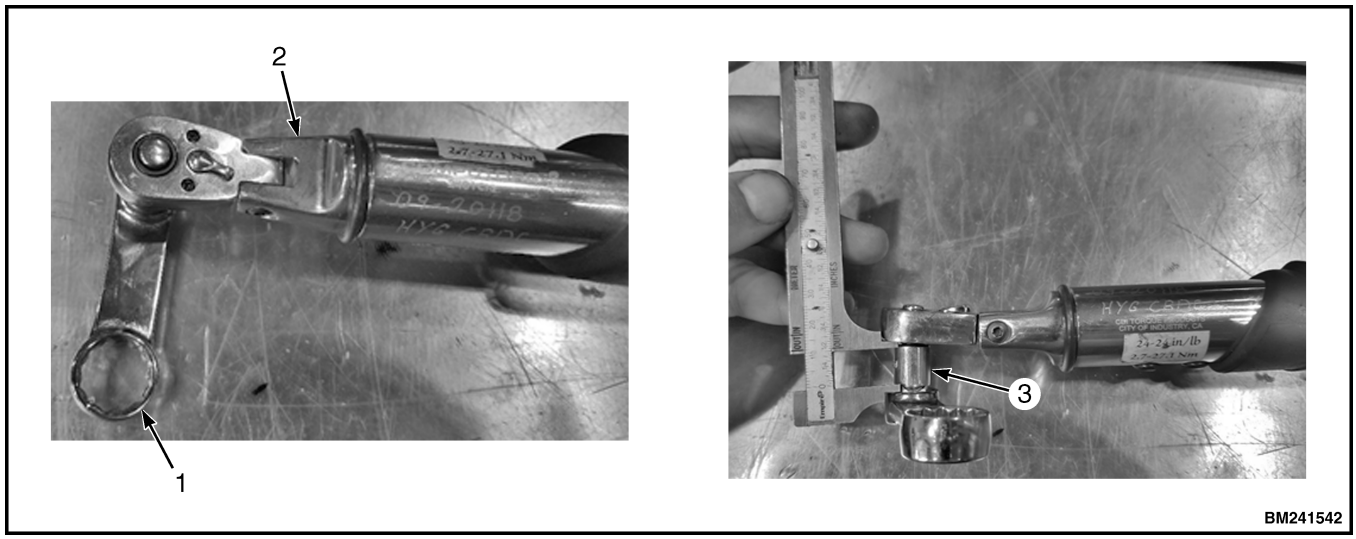
31. Connect the positive battery cable to the battery. See **Electrical, software, and controls** 2200SRM2304.

32. Connect the negative battery cable to the battery. See **Electrical, software, and controls** 2200SRM2304.

TOOL



Figure 22. Drive Torque Adapter (Dogbone)



1. DOGBONE
2. TORQUE WRENCH
3. EXTENSION ~ 12MM

Figure 23. Torque Wrench, 2" Dogbone, and Extension

LPG ENGINE REMOVAL AND REPLACEMENT 202001-053

REMOVE

WARNING

The lift truck must be put on blocks for some types of maintenance and repairs. The removal of the following assemblies will cause large changes in the center of gravity: mast, drive axle, engine and transmission, and counterweight. When the lift truck is put on blocks, put additional blocks in the following positions to maintain stability:

- **Before removing the mast and drive axle, put blocks under the counterweight so the lift truck cannot fall backward.**
- **Before removing the counterweight, put blocks under the mast assembly so the lift truck cannot fall forward.**

The surface must be solid, even, and level when the lift truck is put on blocks. Make sure that any blocks used to support the lift truck are solid, one-piece units. See the Operating Manual or How to put a lift truck on blocks for your lift truck.

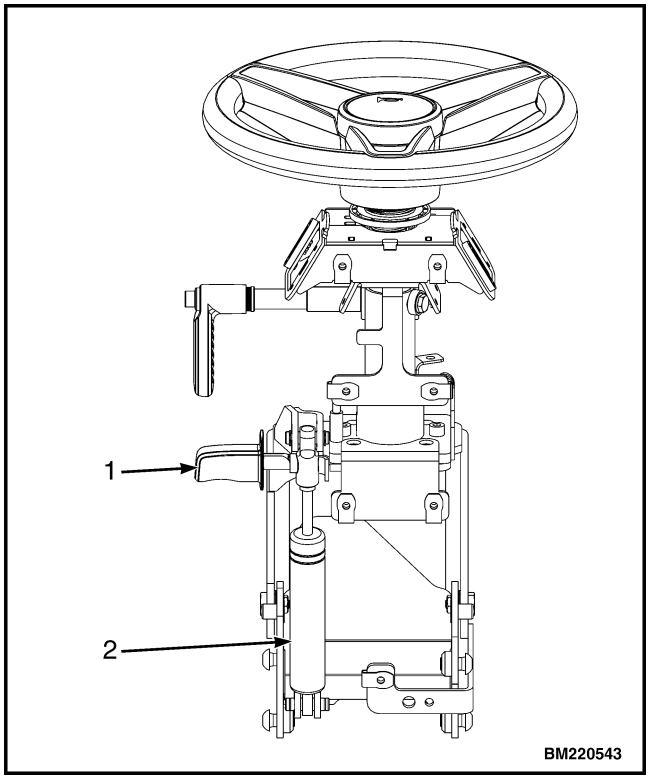
WARNING

Always disconnect the cables at the battery before you make repairs to the engine. Disconnect the cable at the negative terminal first.

WARNING

LPG can cause an explosion. DO NOT cause sparks or permit flammable material near the LPG system. LPG fuel systems can be disconnected indoors only if the lift truck is at least 8 m (26 ft) from any open flame, motor vehicles, electrical equipments, or ignition source.

1. Use the tilt lever to fully tilt the steering column forward. See Figure 24.



1. TILT LEVER
2. GAS CYLINDER

Figure 24. Tilt steering column

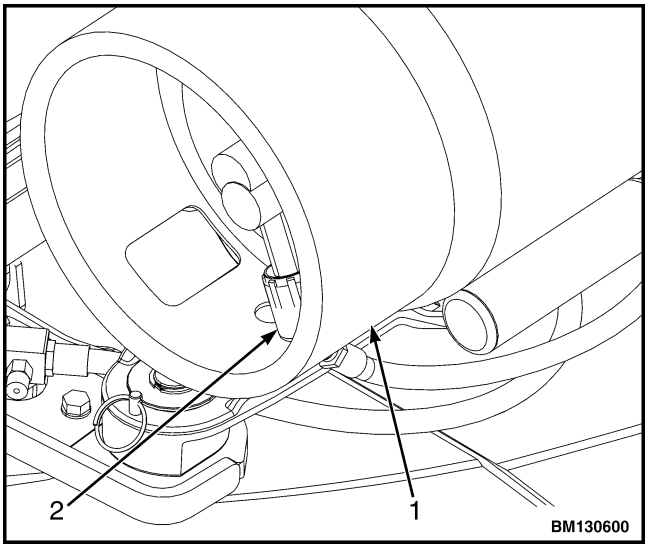
2. Disconnect the negative battery cable from the battery. See **Electrical, software, and controls** 2200SRM2304.

3. Disconnect the positive battery cable from the battery. See **Electrical, software, and controls** 2200SRM2304.

WARNING

For lift trucks equipped with an LPG fuel system, confirm the shutoff valve on the tank is closed and all fuel has been purged from the system, before disconnecting any fuel hoses.

4. Disconnect the hose connector on the main fuel line from the tank to the regulator. See Figure 25.



1. TANK
2. HOSE CONNECTOR

Figure 25. LPG tank

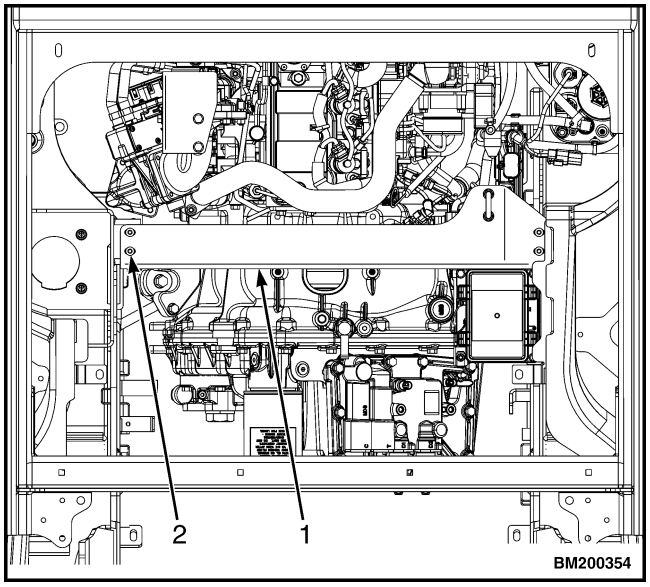
5. Disconnect the seat wire harness and remove the seat from the hood. See Seat repair-Full Suspension in **Operator's Cab** 0100SRM2298 for procedure.

6. Remove the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306.

7. Remove the rear floorplate. See Covers repair, in **Frame and Main Components** 8000SRM2306.

8. Disconnect the throttle pedal connector from the pedal. Remove the front floorplate and the throttle pedal. See Covers repair, in **Frame and Main Components** 8000SRM2306.

9. Remove the four capscrews and the hood crossmember from the operator module. See Figure 26.



1. HOOD CROSSMEMBER
2. CAPSCREW

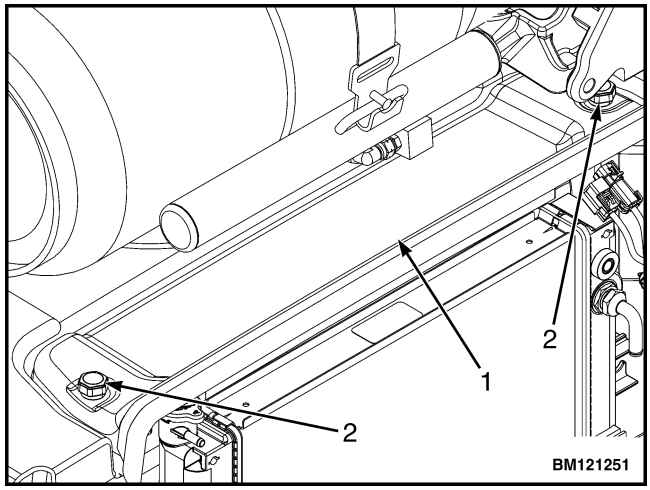
Figure 26. Hood crossmember

10. Remove the battery from the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

11. Disconnect the battery cable support bracket or the battery cable clamps from the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304. Fold the battery cables forward, out of the way.

12. Remove the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

13. Remove the radiator cover from the rear counterweight, by turning the stand-offs counterclockwise and lifting the cover up. See Figure 27.



1. RADIATOR COVER
2. STAND-OFFS

Figure 27. Radiator cover

WARNING

DO NOT remove the radiator cap from the radiator when the engine is hot. When the radiator cap is removed, the pressure is released from the system. If the system is hot, the steam and coolant can cause burns.

14. Allow the coolant to cool to ambient temperature. Place a drain pan with a capacity greater than 15 liter (15.9 qt) under the radiator. Remove the radiator cap.

NOTE: If a fluid evacuator unit is available, coolant may be removed from the radiator via the radiator fill opening.

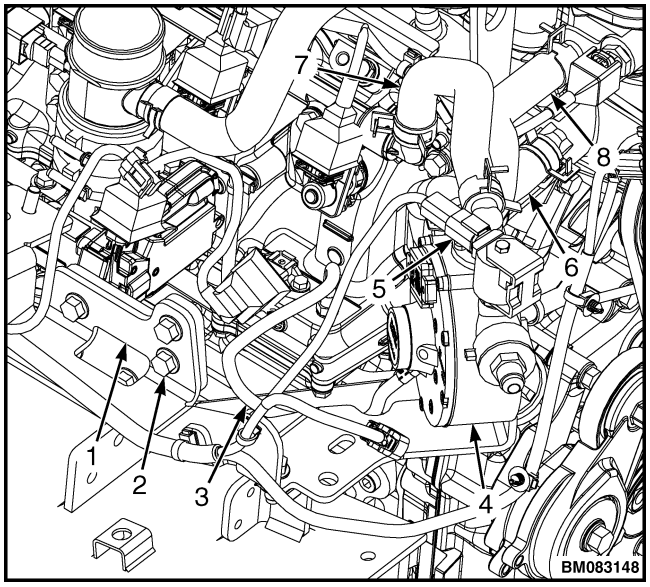
15. If not using a fluid evacuator unit, remove the drain plug to drain all coolant from the radiator and the engine. See Radiator repair, in **Cooling system** 0700SRM2300.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

16. Remove the air intake module. See **Yanmar Engines** 0600SRM2299.

17. Disconnect all hoses to the LPG regulator at the engine side and tie hoses back. See Figure 28.



1. AIR INTAKE BRACKET
2. BOLT
3. HOSE
4. LPG REGULATOR
5. SENSOR CONNECTOR
6. COOLING HOSE
7. FUEL VAPOR HOSE
8. COOLING HOSE

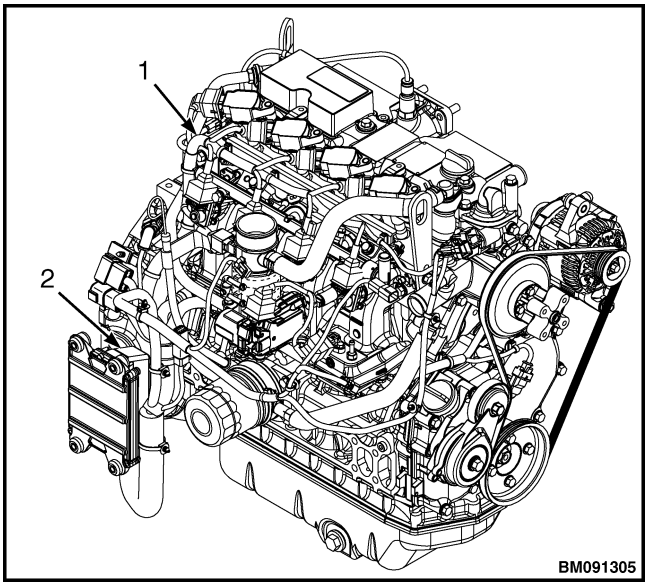
Figure 28. LPG regulator and hoses

18. Disconnect the sensor connector from the sensor on the regulator. See Figure 28.

19. Remove the capscrews retaining the air intake bracket and remove the air intake bracket and vaporizer assembly as one unit. See Figure 28.

20. Use hose caps and fit the caps to the open LPG regulator coolant hoses, engine ports, and vaporizer hoses.

21. Disconnect the main engine harness from all connectors on the engine. See Figure 29.

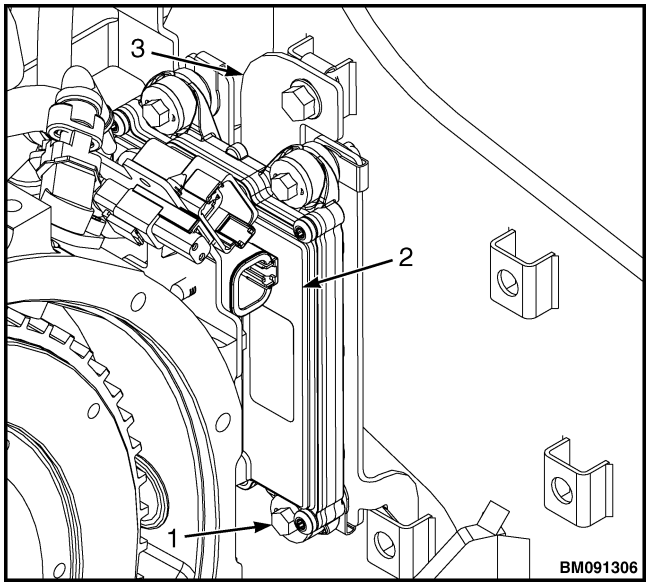


1. ENGINE HARNESS
2. ECM CONNECTOR

Figure 29. Engine harness

22. Disconnect the Electronic Control Module (ECM) from the ECM connector on the engine harness. See Figure 29.

23. Remove the ECM from the bracket attached to the frame. See Figure 30.



1. BOLT
2. ECM
3. ECM BRACKET

Figure 30. ECM and bracket

24. Remove the fan assembly. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

25. Remove the fan pulley and spacer. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

26. Remove the top radiator coolant hose from the engine. See Figure 31. Tie the hose off to the side.

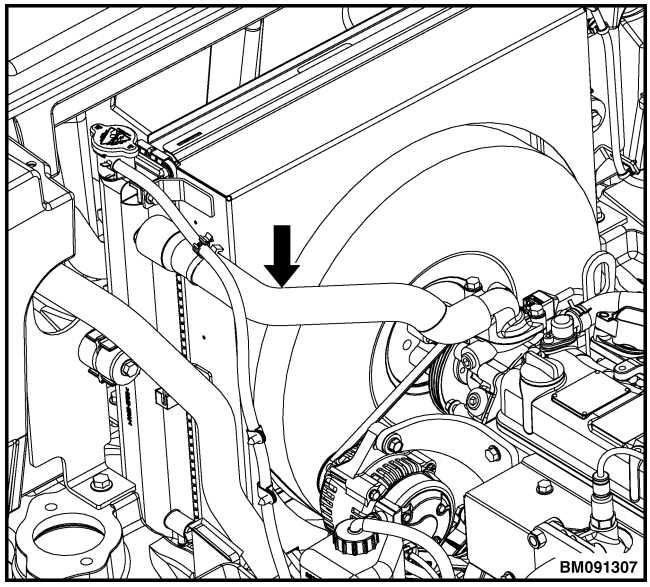


Figure 31. Upper radiator hose

27. Remove the fan shroud. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

28. Place an appropriately sized piece of plywood between the radiator and the engine to prevent damage to the radiator fins.

29. Remove the lower radiator hose from the engine, while leaving it attached to the radiator. See Figure 32. Tie the hose off to the side.

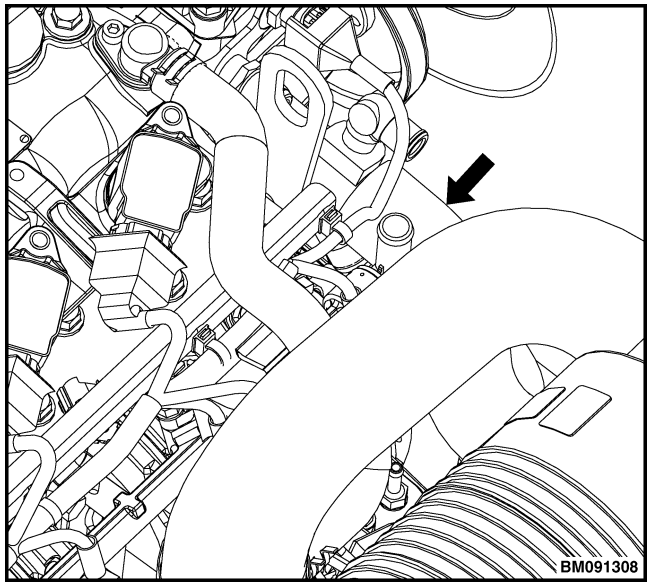
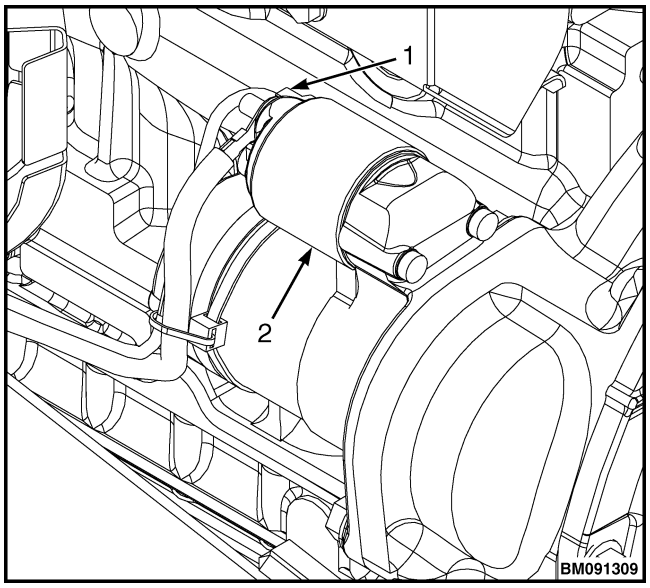


Figure 32. Lower radiator hose

30. Disconnect the wiring connector from the starter. See Figure 33.



1. STARTER CONNECTOR
2. STARTER

Figure 33. Starter connector

31. Remove the grounding strap from the engine block.

32. Disconnect the chassis harness ground bolt from the lift truck frame. See Figure 34.

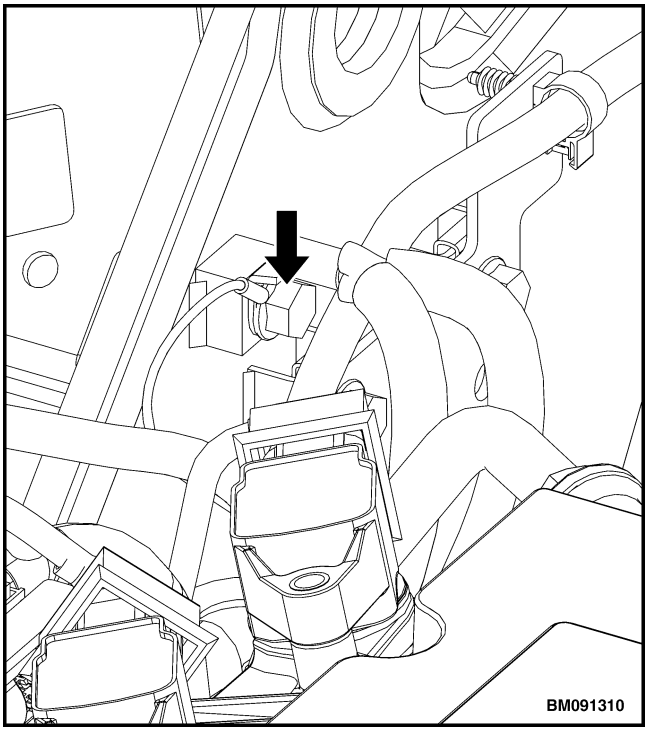


Figure 34. Chassis harness ground bolt

33. Detach the wiring and hoses mounted to the top of the flywheel housing and transmission. Fold forward, out of the way. See Figure 35.

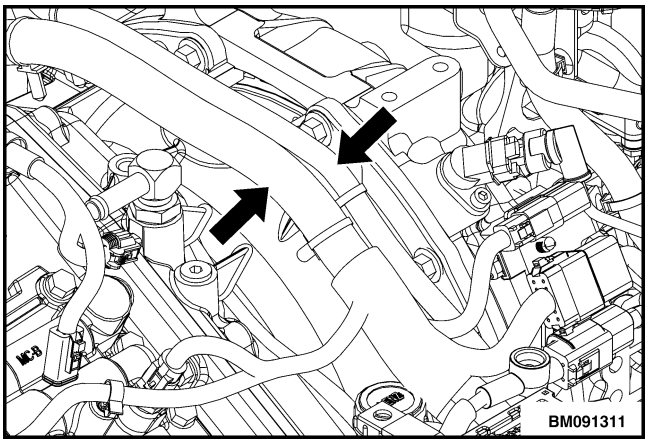
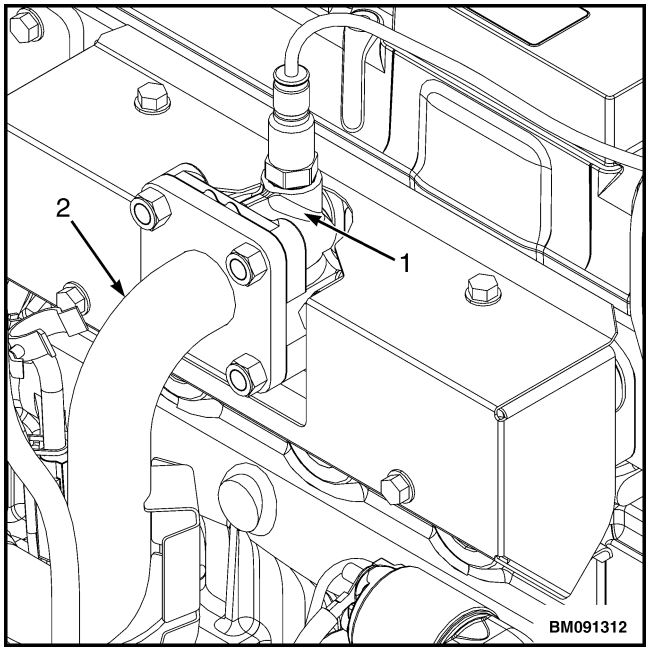


Figure 35. Wiring on the flywheel housing

34. Place the lift truck on blocks. See **Periodic Maintenance** 8000SRM2305.

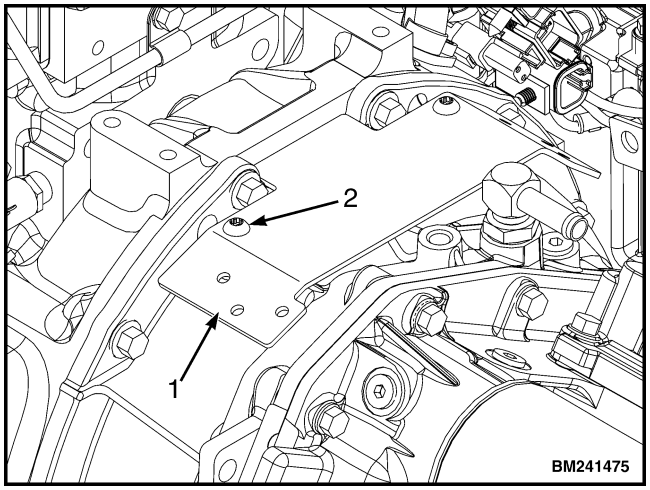
35. Disconnect the engine exhaust pipe from the manifold and tie the pipe away from the engine. See Figure 36.



1. EXHAUST MANIFOLD
2. EXHAUST PIPE

Figure 36. Exhaust manifold pipe

36. Remove the two capscrews retaining the transmission access plate. Remove the access plate to reveal the torque converter access port. See Figure 37.



1. ACCESS PLATE
2. CAPSCREW

Figure 37. Transmission access plate

37. From the torque converter access port, rotate the torque converter by turning the fan, to access each of the six capscrews retaining the torque converter to the flywheel. Use an angled socket and wrench to remove each of the capscrews. See Figure 38.

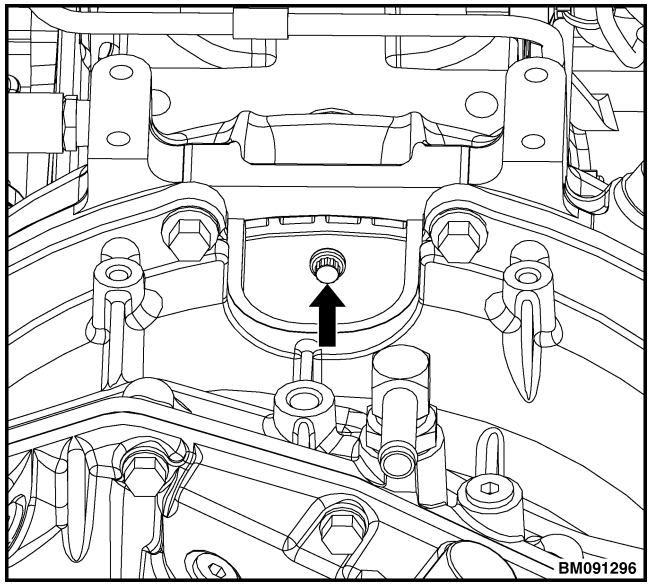


Figure 38. Torque converter mounting screws

NOTE: The transmission and torque converter can weigh as much as 79.1 kg (174.4 lb). Always use a lifting device and chains with a capacity rating higher than the weight of the transmission.

38. Install a lifting eye bolt into the M12X1.75 lifting eye bolt hole on the transmission assembly. See Figure 39.

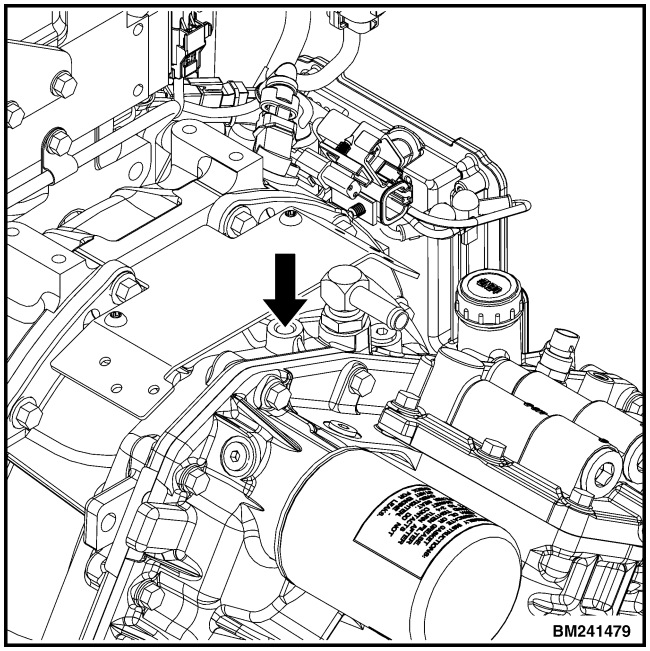


Figure 39. Lifting eye bolt hole

39. Wrap a lifting strap around the overhead guard. See Figure 40. Connect one end of a separate lifting strap to the strap around the overhead guard. Connect the other end to the lifting eye bolt on the transmission, to keep the transmission assembly stable while the engine is removed.

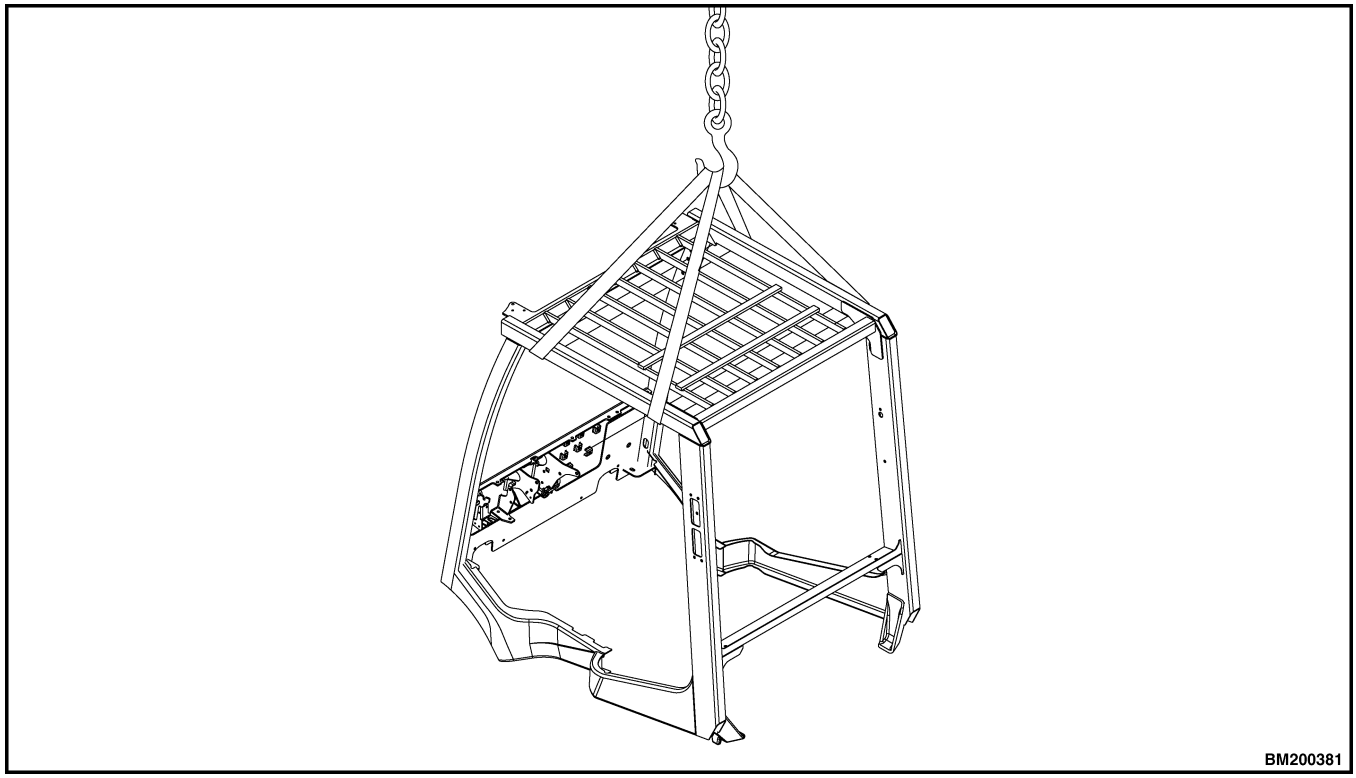


Figure 40. Overhead Guard and Lifting Strap

40. While continuing to support the transmission assembly with the overhead lifting device, place blocks or work stands beneath the transmission assembly at the surface where the two halves of the transmission assembly meet. See Figure 41.

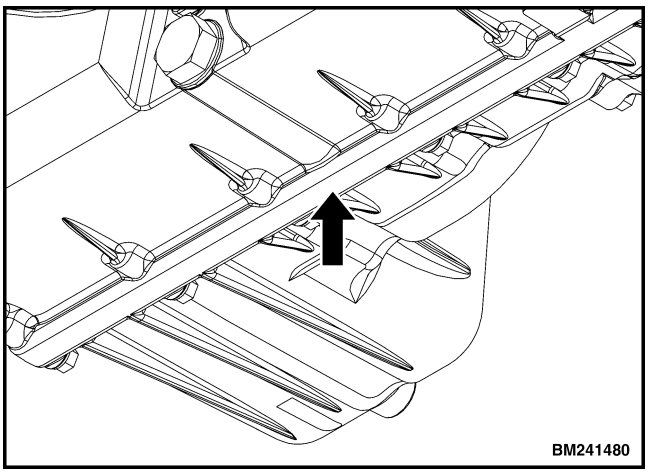


Figure 41. Blocking the transmission

NOTE: The engine can weigh approximately 215 kg (474 lb). Make sure that any lifting device has enough capacity to support the weight of the engine.

41. With the transmission now supported, feed lifting straps through the two lifting eyes brackets on the valve cover of the engine assembly. See Figure 42. Attach the straps to a lifting device to keep engine supported. Confirm there is enough clearance between the top of the lifting device and the overhead guard to allow the engine to fully clear the frame.

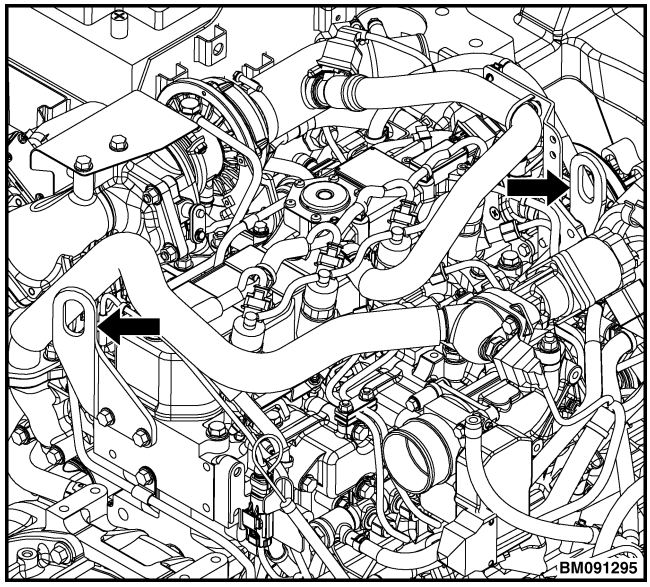
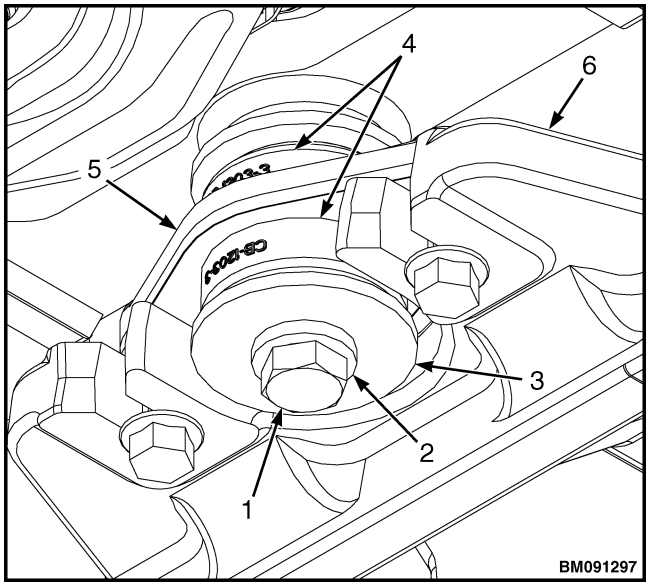


Figure 42. Lifting eyes

NOTE: On some lift trucks, the rear engine mounting bolt may be more accessible from underneath the lift truck.

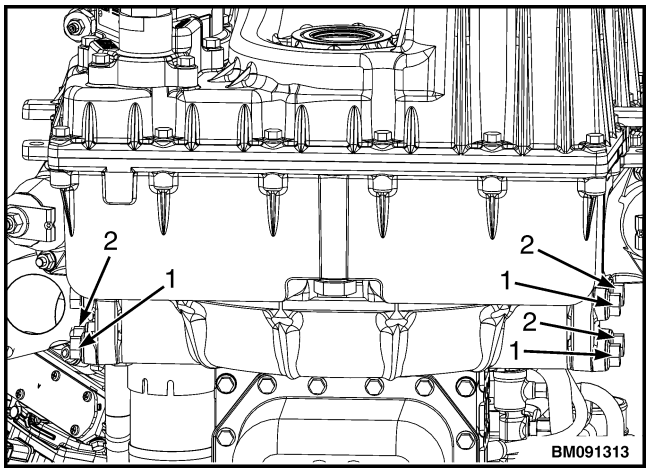
42. Remove the rear engine mounting bolt that passes through the isolators and plate. See Figure 43.



1. REAR MOUNTING BOLT
2. WASHER
3. SPACER
4. ISOLATORS
5. PLATE
6. REAR FRAME

Figure 43. Rear mounting bolt

43. Remove the four lower mounting bolts from the engine mounts on the transmission side. See Figure 44.



1. LOWER MOUNTING BOLTS
2. UPPER MOUNTING BOLTS

Figure 44. Engine Mount

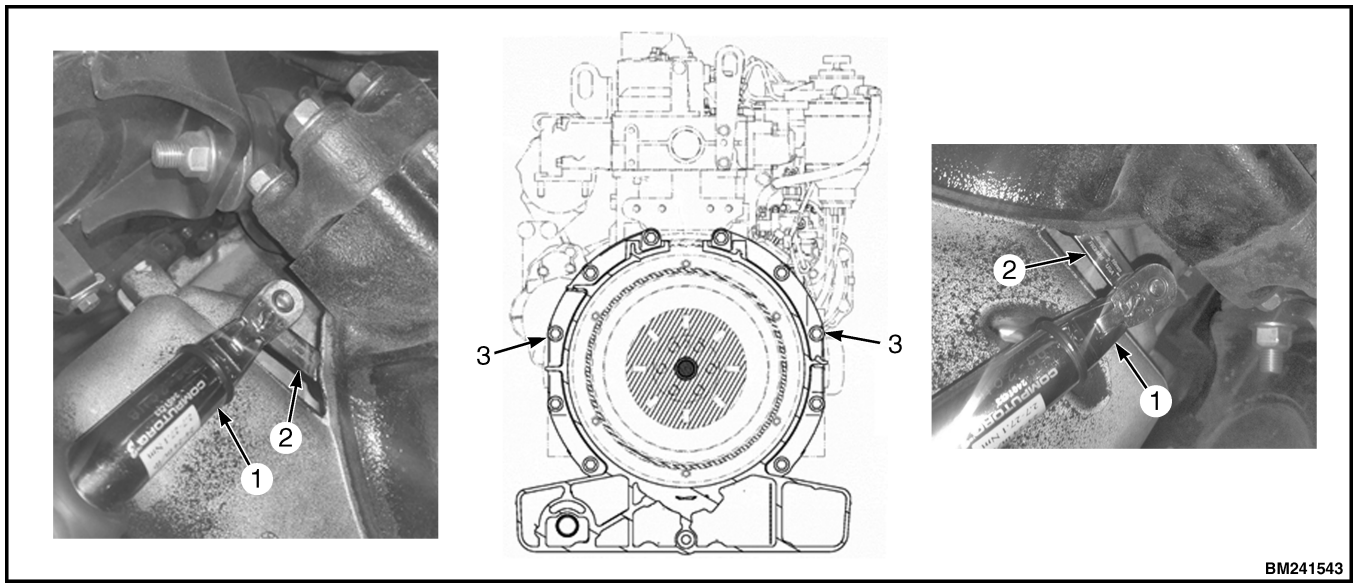
CAUTION

Keep the engine aligned with the transmission during install so the drive plate and stub shaft are not damaged.

NOTE: Keep an equal gap on all sides when removing the engine assembly to prevent the shaft from binding. Keep the torque converter pushed against the transmission side to keep the splines and seals engaged and prevent oil leakage.

NOTE: Use of torque wrench with 2" torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool for tool specifications.

44. Using torque wrence and adapter, remove the two lowest bolts (item 6, Figure 46) attaching the transmission assembly to the engine. See Figure 45.



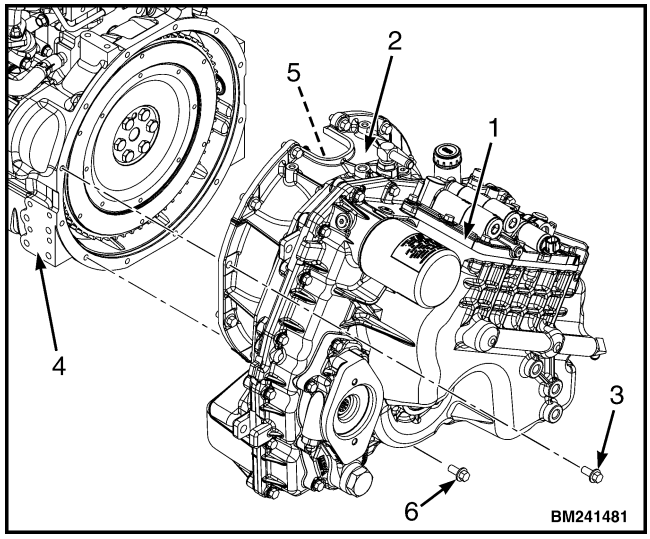
1. TORQUE WRENCH
2. DOGBONE
3. BOLT

Figure 45. Bolt Remove/Install Using Tool

45. From the top of the truck, remove the remaining bolts (2, Figure 44) and mounting arms of the engine mount.

46. Remove the remaining eight bolts (item 3, Figure 46) on the transmission side engine mounts.

47. Separate the engine flywheel housing from the transmission. Make sure all hoses, wires, and cables have been disconnected from the engine. Use the lifting device to carefully move the engine flywheel housing away from the torque converter housing of the transmission assembly. Take care to not damage the wire harnesses or any of the hoses that might be in the path of removal. See Figure 46.



1. TRANSMISSION HOUSING
2. TORQUE CONVERTER HOUSING
3. BOLT
4. ENGINE
5. TORQUE CONVERTER

Figure 46. Electronic Powershift transmission and engine flywheel housings

48. Lift the engine from the frame and place the engine on the ground or a work bench, supported by wooden blocks under the oil pan flange bolts. See Figure 47.

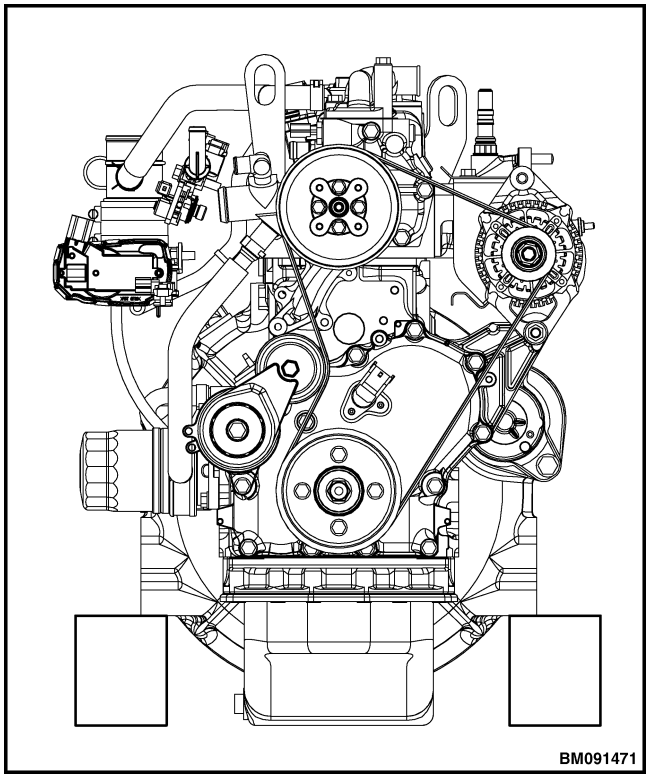


Figure 47. Blocking the engine

INSTALL

WARNING

The engine is heavy. Make sure that any lifting device has enough capacity to lift the engine. The engine can weigh approximately 215 kg (474 lb).

CAUTION

Keep the engine level when installing the engine to the transmission so the drive plate is not damaged.

1. Connect the lifting device to the two lifting eye brackets on the valve cover of the engine. Lift the engine over the engine compartment and slowly lower the engine into the frame of the lift truck, aligned with the engine mounts.

NOTE: Make sure the transmission does not shift when aligning the engine with the transmission.

2. Align the transmission assembly with the engine, making sure the stub shaft is properly engaged and install the eight top capscrews. See Figure 46. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

NOTE: Use of torque wrench with 2" torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool.

3. Using torque wrench and adapter, install the two bottom capscrews. See Figure 46 and Figure 45. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

4. Install the rear engine mounting bolt with washers and isolator. Tighten to 59 to 61 N•m (43.5 to 45.0 lbf ft).

5. Apply Loctite® 242 to the capscrew threads and install to torque converter housing, tighten to snug all around before final torque.

6. Rotate the torque converter to access each of the six capscrews. See Figure 38. Use an angled socket and wrench to tighten each of the capscrews. Torque to 32 to 36 N•m (23.6 to 26.6 lbf ft).

7. Install the access plate back on the torque converter housing. See Figure 37. Tighten to standard torque.

8. Install upper and lower mounting bolts. See Figure 44. Torque bolts to 101 to 105 N•m (74.5 to 77.4 lbf ft).

9. Connect the engine exhaust pipe to the exhaust manifold. See Figure 36.

10. Install the fan shroud. See Fan repair in **Cooling system** 0700SRM2300 for procedure.

11. Install fan assembly, fan belt and fan pulley. See Fan repair in **Cooling system** 0700SRM2300 for procedure.

12. Install the lower radiator hose to the engine. See Figure 32.

13. Install the top radiator coolant hose to the engine. See Figure 31.

14. Attach the ECM bracket to the frame. See Figure 30.

15. Install the ECM to the bracket. See Figure 30.

16. Connect the ECM to the ECM connector on the engine harness. See Figure 29.

17. Connect the engine harness to the chassis harness and all connectors and sensors. See Figure 29.

WARNING

All fuels are very flammable and can burn or cause an explosion. DO NOT use an open flame to check the fuel level or to check for leaks in the fuel system.

No smoking.

Breathing fuel vapor may cause nausea, unconsciousness or death. Long term exposure to gasoline vapors may cause liver or kidney damage and cancer. Avoid breathing vapor.

18. Remove caps from fuel lines and connect the fuel lines at the engine. See LPG fuel system repair, in **Yanmar Engines** 0600SRM2299.

19. Connect the coolant hoses and lines to the transmission. Fill cooling system with a mixture of 50 percent deionized water and 50 percent ethylene glycol boron-free antifreeze. See Radiator repair, in **Cooling system** 0700SRM2300.

20. Install the air intake bracket and LPG regulator assembly as one unit. See Figure 28.

21. Insert the capscrews to retain the air intake bracket. See Figure 28. Torque to 19.2 N•m (14.7 lbf ft).

22. Connect the sensor connector to the sensor on the regulator. See Figure 28.

23. Remove the hose caps from all hoses attached to the LPG regulator. Remove the caps from the engine ports. Connect the hoses to the engine. See Figure 28.

24. Install the air filter. See **Operator's Cab** 0100SRM2298 service manual.

25. Connect the ground strap to the frame. See **Frame and Main Components** 8000SRM2306.

26. Connect the wiring connector to the starter. See Figure 33.

27. Install the battery and battery holder. Connect the battery cables. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

28. Insert the four capscrews into the hood crossmember and install the hood crossmember to the operator module. See Figure 26. Tighten to standard torque.

29. Install the floorplate and throttle pedal. Connect the throttle pedal connector. See Covers repair, in **Frame and Main Components** 8000SRM2306.

30. Install the floormat. See Covers repair, in **Frame and Main Components** 8000SRM2306.

31. Install the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306.

32. Install the seat to the hood. Connect the seat harness to the seat. See Seat repair-Full Suspension, in **Operator's Cab** 0100SRM2298 for procedures.

33. Check and fill all fluid levels as described in **Periodic Maintenance** 8000SRM2305.

34. Install the radiator cover to the counterweight. See Figure 27.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

35. Empty drain pan contents.

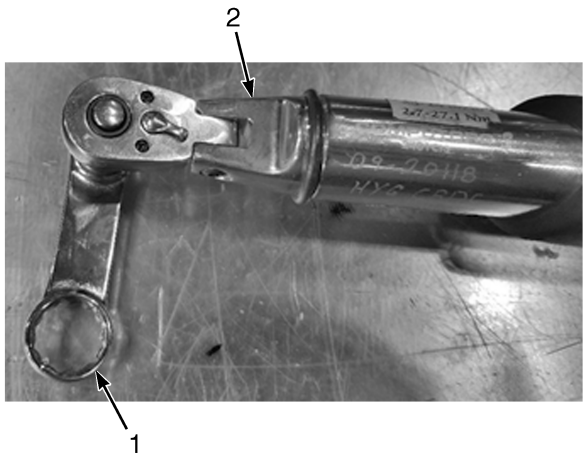
36. Connect the positive battery cable to the battery. See **Electrical, software, and controls** 2200SRM2304.

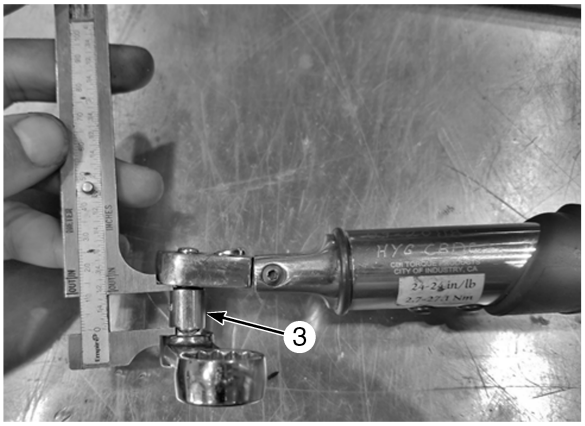
37. Connect the negative battery cable to the battery. See **Electrical, software, and controls** 2200SRM2304.

TOOL



Figure 48. Drive Torque Adapter (Dogbone)





BM241542

1. DOGBONE
2. TORQUE WRENCH
3. EXTENSION (~12MM)

Figure 49. Torque Wrench, 2" Dogbone, and Extension

BI-FUEL ENGINE REMOVAL AND REPLACEMENT 202001-054

REMOVE

WARNING

The lift truck must be put on blocks for some types of maintenance and repairs. The removal of the following assemblies will cause large changes in the center of gravity: mast, drive axle, engine and transmission, and counterweight. When the lift truck is put on blocks, put additional blocks in the following positions to maintain stability:

- **Before removing the mast and drive axle, put blocks under the counterweight so the lift truck cannot fall backward.**
- **Before removing the counterweight, put blocks under the mast assembly so the lift truck cannot fall forward.**

The surface must be solid, even, and level when the lift truck is put on blocks. Make sure that any blocks used to support the lift truck are solid, one-piece units. See the Operating Manual or How to put a lift truck on blocks for your lift truck.

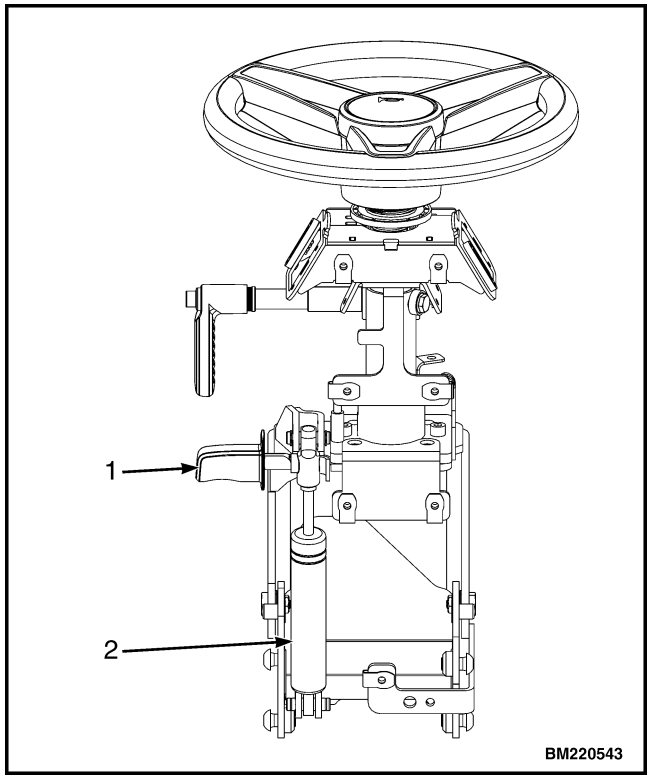
WARNING

Always disconnect the cables at the battery before you make repairs to the engine. Disconnect the cable at the negative terminal first.

WARNING

FOR LPG USE: LPG can cause an explosion. DO NOT cause sparks or permit flammable material near the LPG system. LPG fuel systems can be disconnected indoors only if the lift truck is at least 8 m (26 ft) from any open flame, motor vehicles, electrical equipments, or ignition source.

1. Use the tilt lever to fully tilt the steering column forward. See Figure 50.



1. TILT LEVER
2. GAS CYLINDER

Figure 50. Tilt steering column

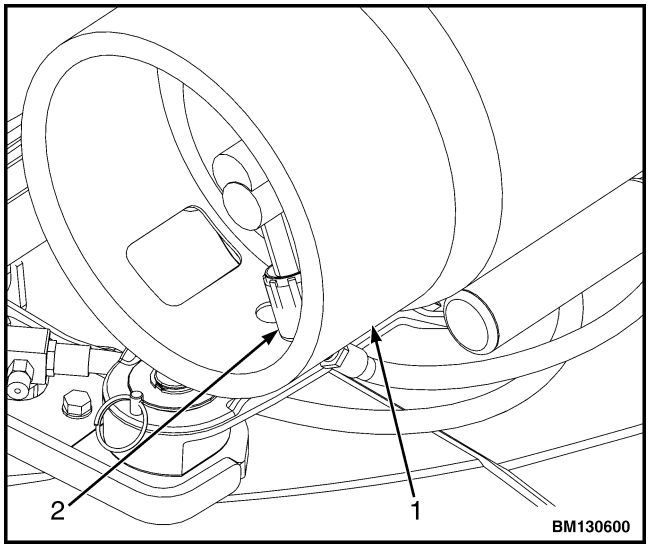
2. Disconnect the negative battery cable from the battery. See **Electrical, software, and controls** 2200SRM2304.

3. Disconnect the positive battery cable from the battery. See **Electrical, software, and controls** 2200SRM2304.

WARNING

For lift trucks equipped with an LPG fuel system, confirm the shutoff valve on the tank is closed and all fuel has been purged from the system, before disconnecting any fuel hoses.

4. Disconnect the hose connector on the main fuel line from the tank to the regulator. See Figure 51.



1. TANK
2. HOSE CONNECTOR

Figure 51. LPG tank

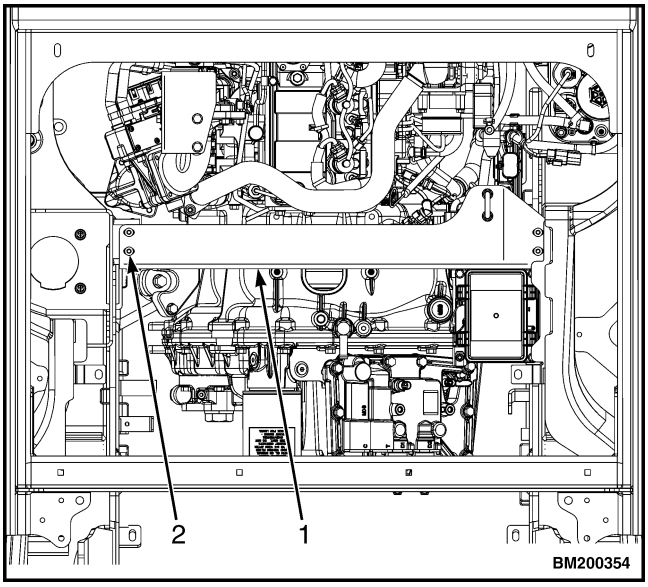
5. Disconnect the seat wire harness and remove the seat from the hood. See Seat repair-Full Suspension in **Operator's Cab** 0100SRM2298 for procedure.

6. Remove the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306.

7. Remove the rear floorplate. See Covers repair, in **Frame and Main Components** 8000SRM2306.

8. Disconnect the throttle pedal connector from the pedal. Remove the front floorplate and the throttle pedal. See Covers repair, in **Frame and Main Components** 8000SRM2306.

9. Remove the four capscrews and the hood crossmember from the operator module. See Figure 52.



1. HOOD CROSSMEMBER
2. CAPSCREW

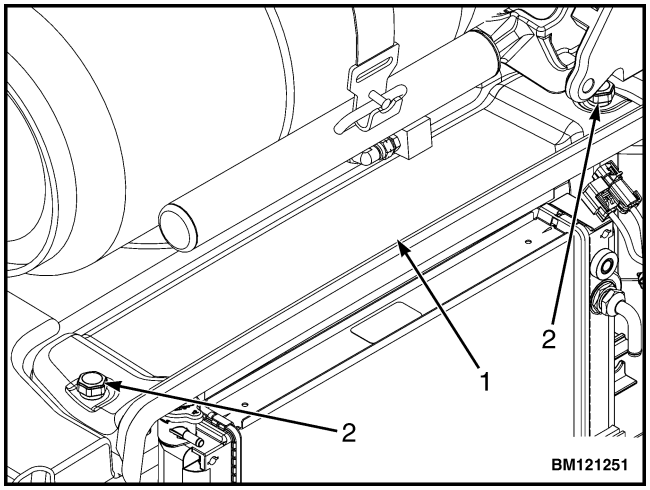
Figure 52. Hood crossmember

10. Remove the battery from the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

11. Disconnect the battery cable support bracket or the battery cable clamps from the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304. Fold the battery cables forward, out of the way.

12. Remove the battery holder. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

13. Remove the radiator cover from the rear counterweight, by turning the stand-offs counterclockwise and lifting the cover up. See Figure 53.



1. RADIATOR COVER
2. STAND-OFFS

Figure 53. Radiator cover

WARNING

DO NOT remove the radiator cap from the radiator when the engine is hot. When the radiator cap is removed, the pressure is released from the system. If the system is hot, the steam and coolant can cause burns.

14. Allow the coolant to cool to ambient temperature. Place a drain pan with a capacity greater than 15 liter (15.9 qt) under the radiator. Remove the radiator cap.

NOTE: If a fluid evacuator unit is available, coolant may be removed from the radiator via the radiator fill opening.

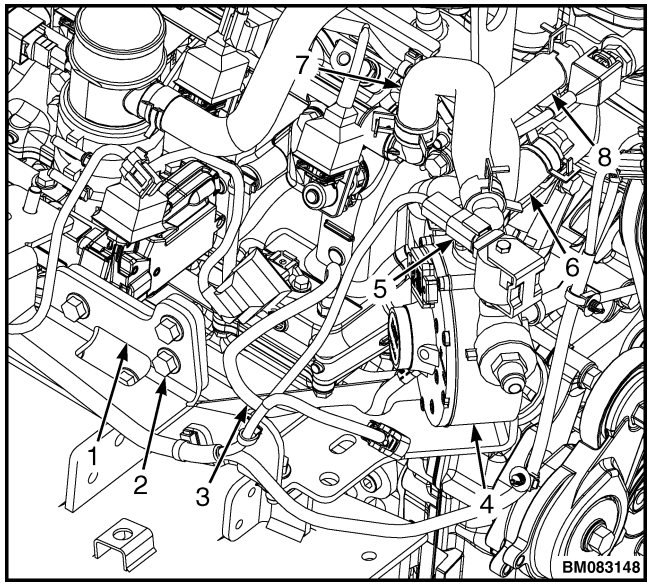
15. If not using a fluid evacuator unit, remove the drain plug to drain all coolant from the radiator and the engine. See Radiator repair, in **Cooling system** 0700SRM2300.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

16. Remove the air intake module. See **Yanmar Engines** 0600SRM2299.

17. Disconnect all hoses to the LPG regulator at the engine side and tie hoses back. See Figure 54.



1. AIR INTAKE BRACKET
2. BOLT
3. HOSE
4. LPG REGULATOR
5. SENSOR CONNECTOR
6. COOLING HOSE
7. FUEL VAPOR HOSE
8. COOLING HOSE

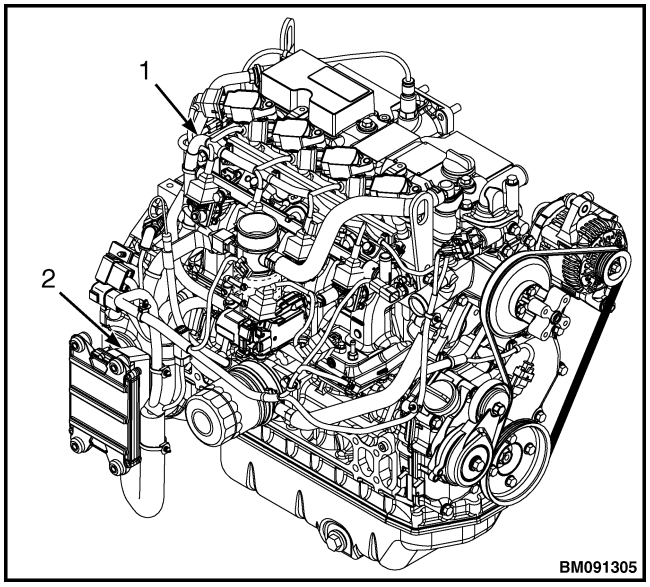
Figure 54. LPG regulator and hoses

18. Disconnect the sensor connector from the sensor on the regulator. See Figure 54.

19. Remove the capscrews retaining the air intake bracket and remove the air intake bracket and vaporizer assembly as one unit. See Figure 54.

20. Use hose caps and fit the caps to the open LPG regulator coolant hoses, engine ports, and vaporizer hoses.

21. Disconnect the main engine harness from all connectors on the engine. See Figure 55.

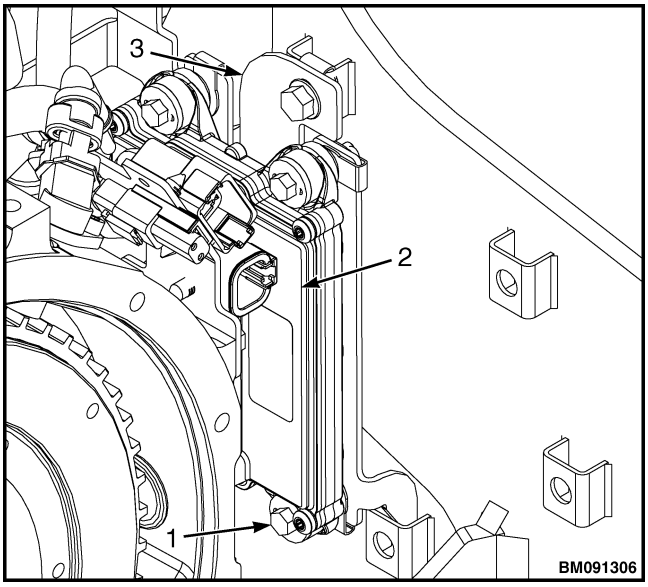


1. ENGINE HARNESS
2. ECM CONNECTOR

Figure 55. Engine harness

22. Disconnect the Electronic Control Module (ECM) from the ECM connector on the engine harness. See Figure 55.

23. Remove the ECM from the bracket attached to the frame. See Figure 56.



1. BOLT
2. ECM
3. ECM BRACKET

Figure 56. ECM and bracket

24. Remove the fan assembly. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

25. Remove the fan pulley and spacer. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

26. Remove the top radiator coolant hose from the engine. See Figure 57. Tie the hose off to the side.

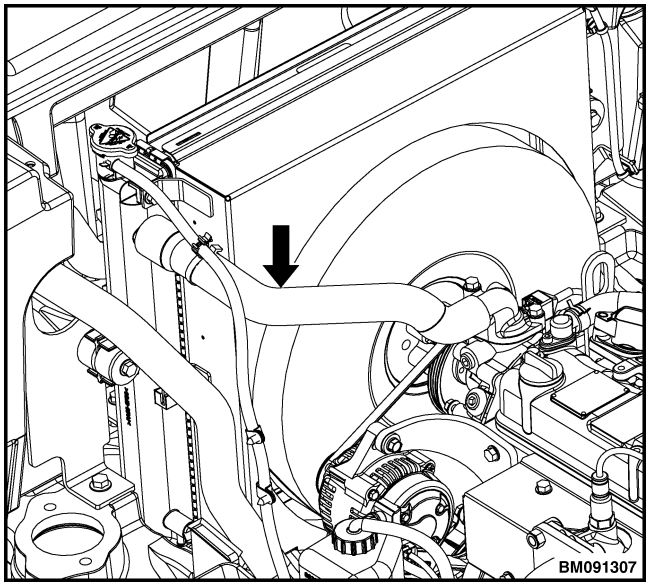


Figure 57. Upper radiator hose

27. Remove the fan shroud. See Fan repair in **Cooling system** 0700SRM2300 for the removal procedures.

28. Place an appropriately sized piece of plywood between the radiator and the engine to prevent damage to the radiator fins.

29. Remove the lower radiator hose from the engine, while leaving it attached to the radiator. See Figure 58. Tie the hose off to the side.

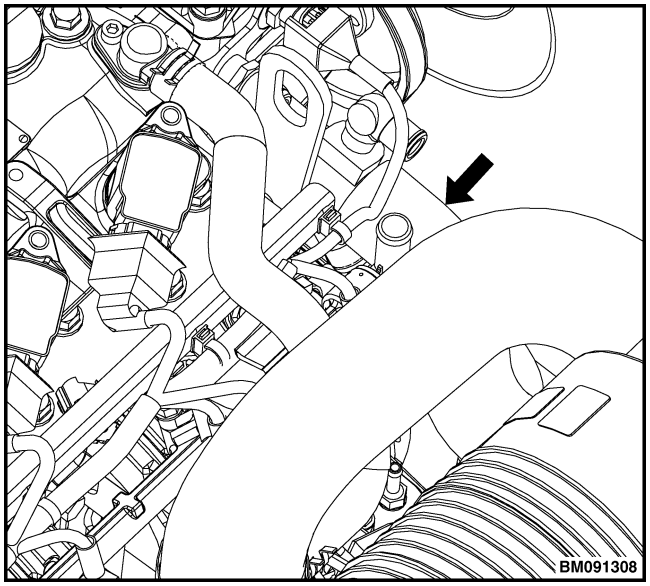
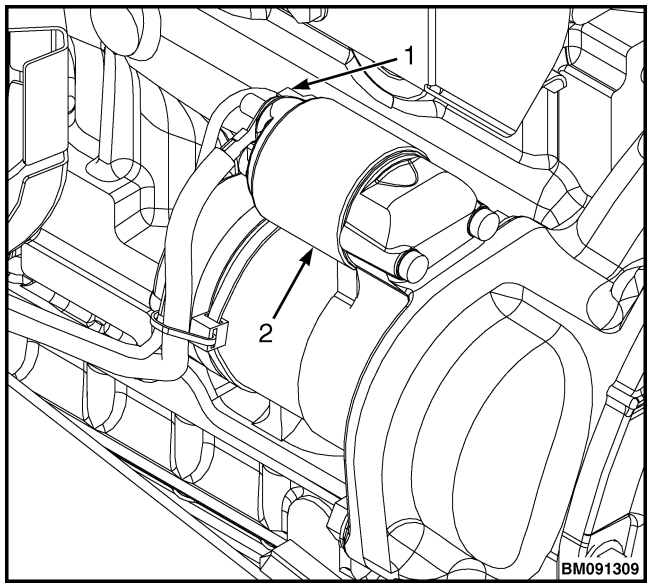


Figure 58. Lower radiator hose

30. Disconnect the wiring connector from the starter. See Figure 59.



1. STARTER CONNECTOR
2. STARTER

Figure 59. Starter connector

31. Remove the grounding strap from the engine block.

32. Disconnect the chassis harness ground bolt from the lift truck frame. See Figure 60.

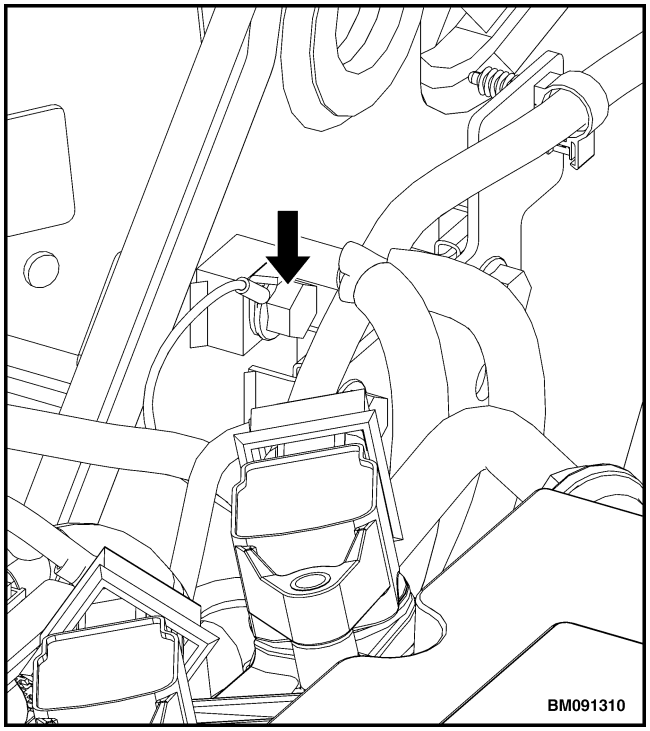


Figure 60. Chassis harness ground bolt

33. Detach the wiring and hoses mounted to the top of the flywheel housing and transmission. Fold forward, out of the way. See Figure 61.

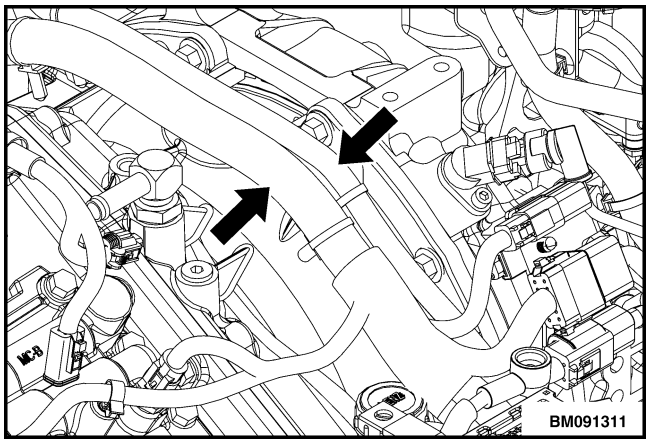
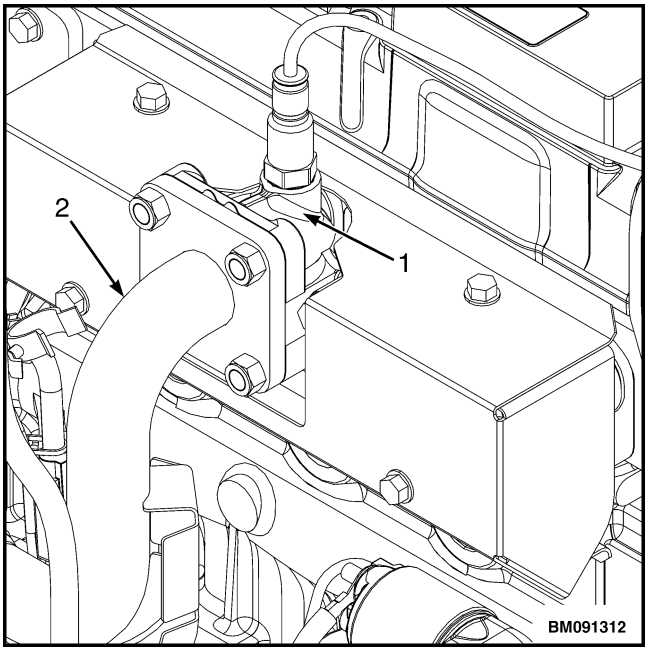


Figure 61. Wiring on the flywheel housing

34. Place the lift truck on blocks. See **Periodic Maintenance** 8000SRM2305.

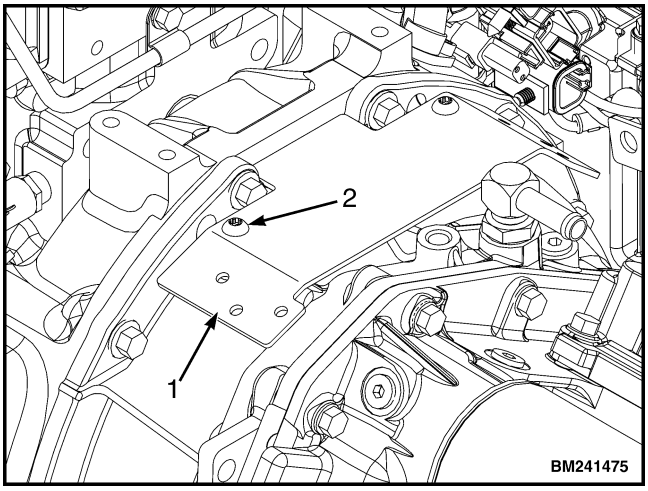
35. Disconnect the engine exhaust pipe from the manifold and tie the pipe away from the engine. See Figure 62.



1. EXHAUST MANIFOLD
2. EXHAUST PIPE

Figure 62. Exhaust manifold pipe

36. Remove the two capscrews retaining the transmission access plate. Remove the access plate to reveal the torque converter access port. See Figure 63.



1. ACCESS PLATE
2. CAPSCREW

Figure 63. Transmission access plate

37. From the torque converter access port, rotate the torque converter by turning the fan, to access each of the six capscrews retaining the torque converter to the flywheel. Use an angled socket and wrench to remove each of the capscrews. See Figure 64.

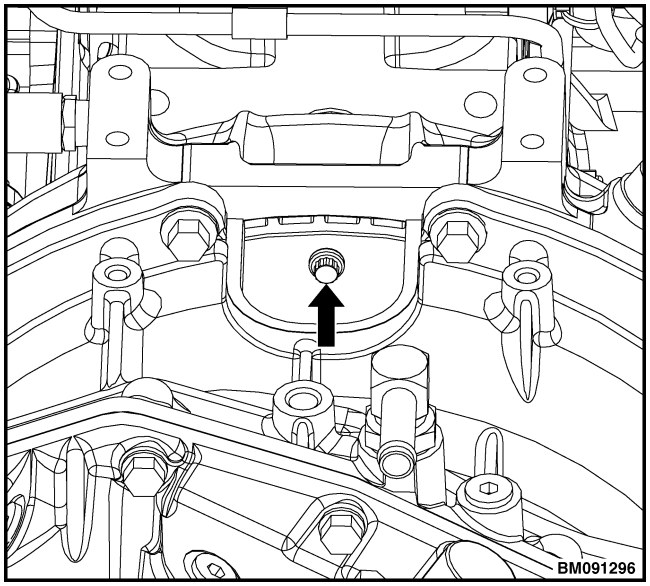


Figure 64. Torque converter mounting screws

NOTE: The transmission and torque converter can weigh as much as 79.1 kg (174.4 lb). Always use a lifting device and chains with a capacity rating higher than the weight of the transmission.

38. Install a lifting eye bolt into the M12X1.75 lifting eye bolt hole on the transmission assembly. See Figure 65.

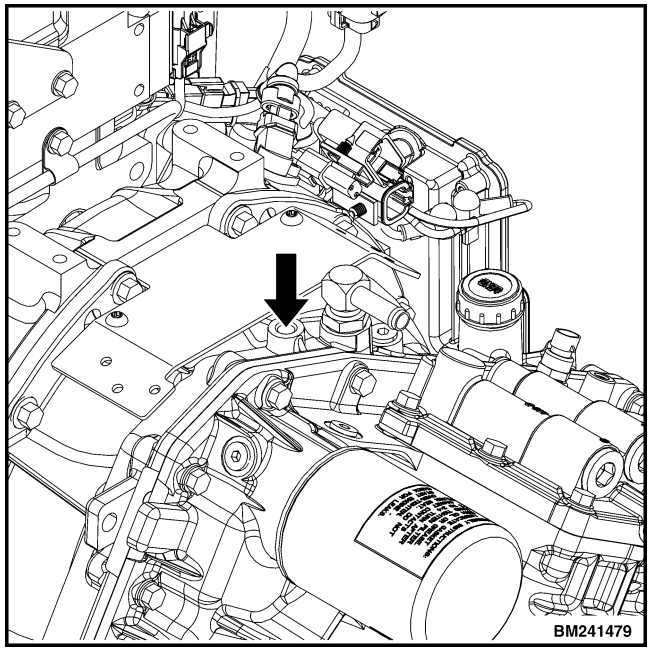


Figure 65. Lifting eye bolt hole

39. Wrap a lifting strap around the overhead guard. See Figure 66. Connect one end of a separate lifting strap to the strap around the overhead guard. Connect the other end to the lifting eye bolt on the transmission, to keep the transmission assembly stable while the engine is removed.

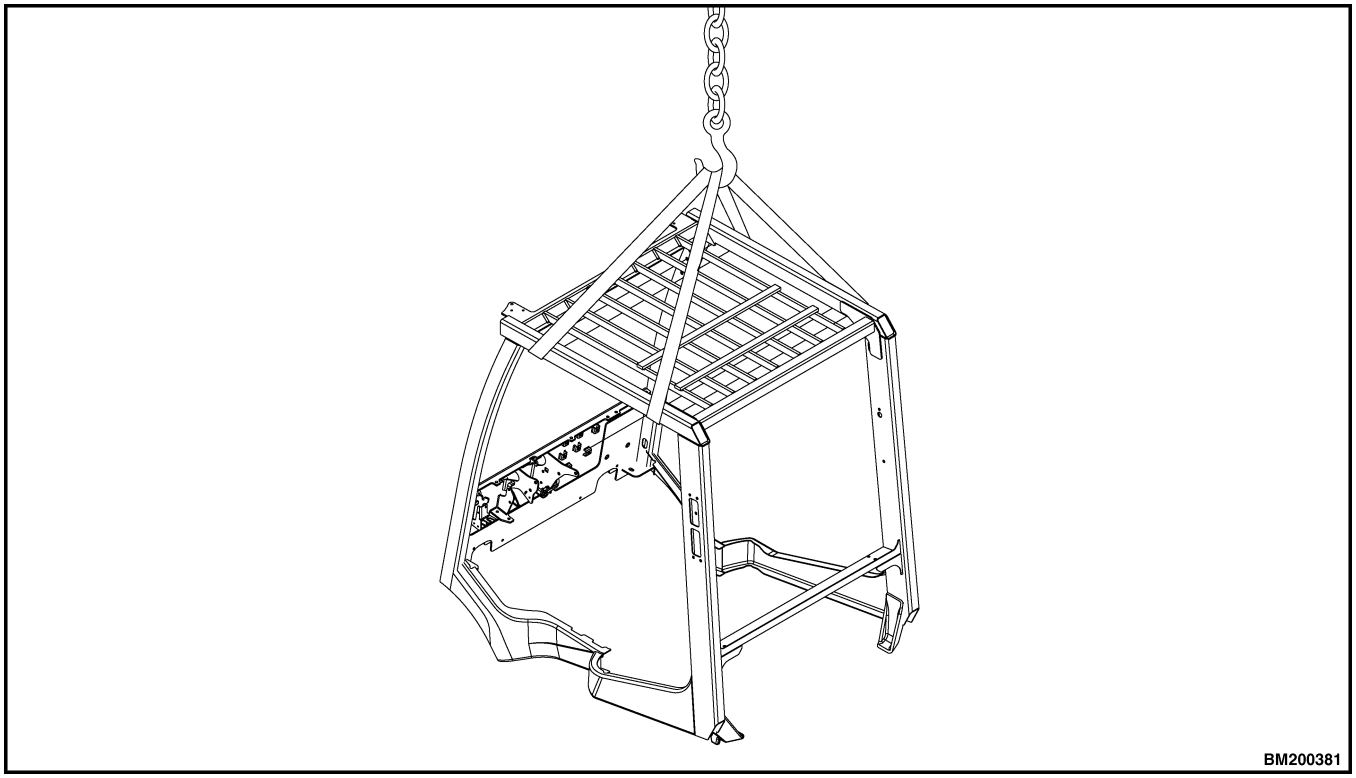


Figure 66. Overhead Guard and Lifting Strap

40. While continuing to support the transmission assembly with the overhead lifting device, place blocks or work stands beneath the transmission assembly at the surface where the two halves of the transmission assembly meet. See Figure 67.

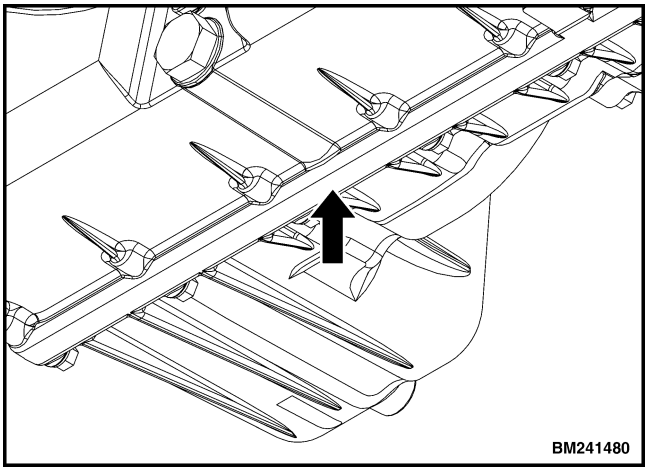


Figure 67. Blocking the transmission

NOTE: The engine can weigh approximately 215 kg (474 lb). Make sure that any lifting device has enough capacity to support the weight of the engine.

41. With the transmission now supported, feed lifting straps through the two lifting eyes brackets on the valve cover of the engine assembly. See Figure 68. Attach the straps to a lifting device to keep engine supported. Confirm there is enough clearance between the top of the lifting device and the overhead guard to allow the engine to fully clear the frame.

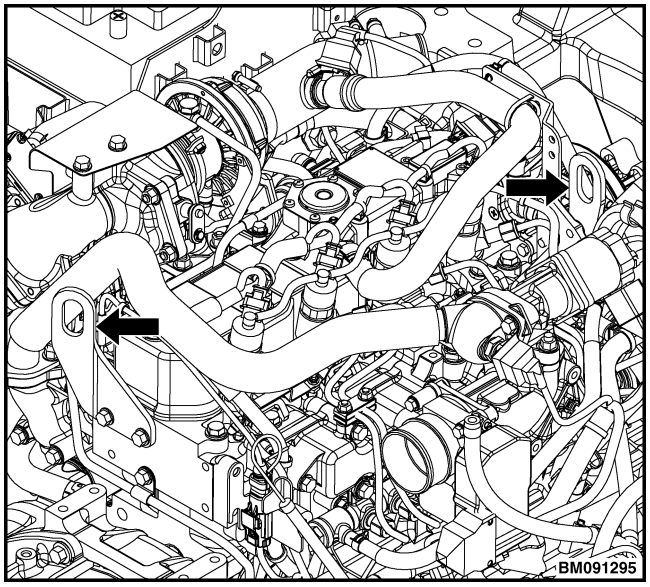
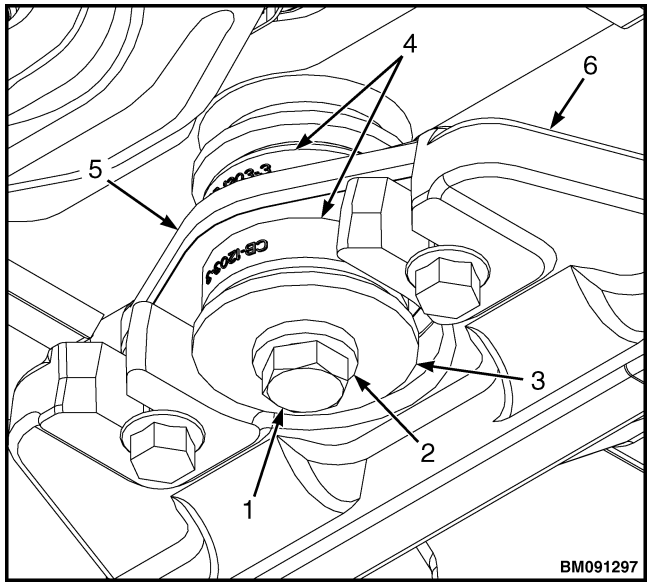


Figure 68. Lifting eyes

NOTE: On some lift trucks, the rear engine mounting bolt may be more accessible from underneath the lift truck.

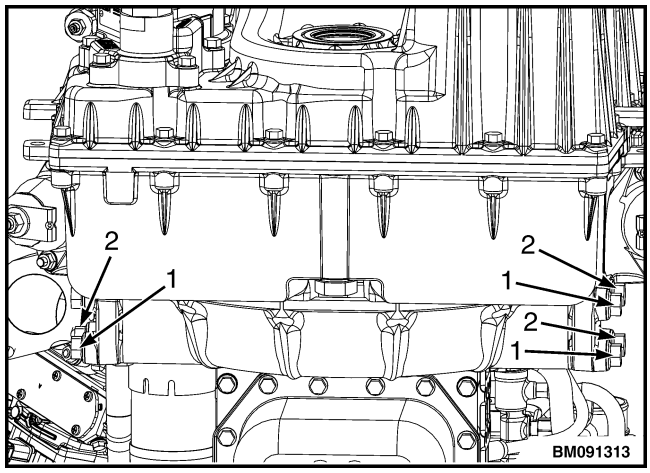
42. Remove the rear engine mounting bolt that passes through the isolators and plate. See Figure 69.



1. REAR MOUNTING BOLT
2. WASHER
3. SPACER
4. ISOLATORS
5. PLATE
6. REAR FRAME

Figure 69. Rear mounting bolt

43. Remove the four lower mounting bolts from the engine mounts on the transmission side. See Figure 70.



1. LOWER MOUNTING BOLTS
2. UPPER MOUNTING BOLTS

Figure 70. Engine Mount

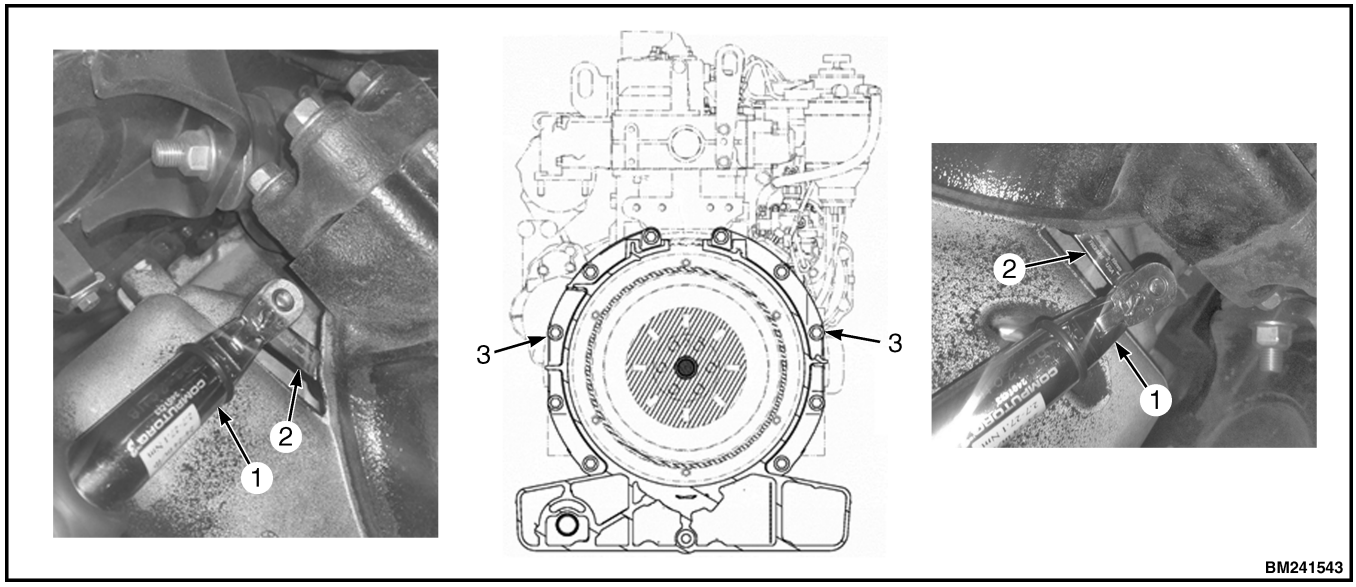
CAUTION

Keep the engine aligned with the transmission during install so the drive plate and stub shaft are not damaged.

NOTE: Keep an equal gap on all sides when removing the engine assembly to prevent the shaft from bending. Keep the torque converter pushed against the transmission side to keep the splines and seals engaged and prevent oil leakage.

NOTE: Use of torque wrench with 2" torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool for tool specifications.

44. Using torque wrence and adapter, remove the two lowest bolts (item 6, Figure 72) attaching the transmission assembly to the engine. See Figure 71.



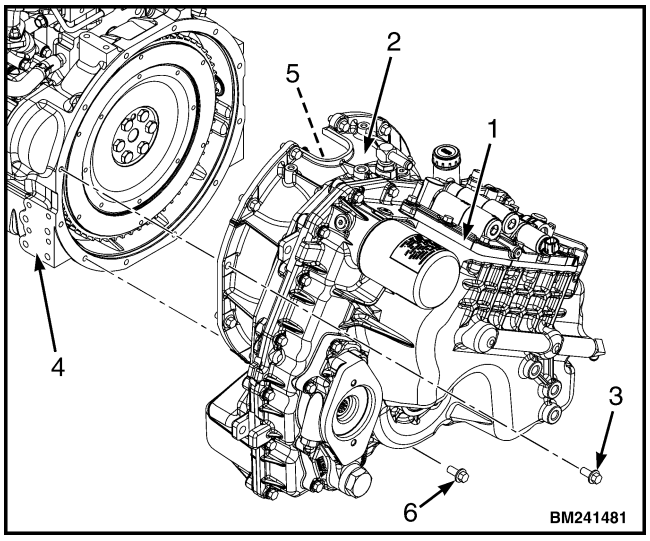
1. TORQUE WRENCH
2. DOGBONE
3. BOLT

Figure 71. Bolt Remove/Install Using Tool

45. From the top of the truck, remove the remaining bolts (2, Figure 70) and mounting arms of the engine mount.

46. Remove the remaining eight bolts (item 3, Figure 72) on the transmission side engine mounts.

47. Separate the engine flywheel housing from the transmission. Make sure all hoses, wires, and cables have been disconnected from the engine. Use the lifting device to carefully move the engine flywheel housing away from the torque converter housing of the transmission assembly. Take care to not damage the wire harnesses or any of the hoses that might be in the path of removal. See Figure 72.



1. TRANSMISSION HOUSING
2. TORQUE CONVERTER HOUSING
3. BOLT
4. ENGINE
5. TORQUE CONVERTER

Figure 72. Electronic Powershift transmission and engine flywheel housings

48. Lift the engine from the frame and place the engine on the ground or a work bench, supported by wooden blocks under the oil pan flange bolts. See Figure 73.

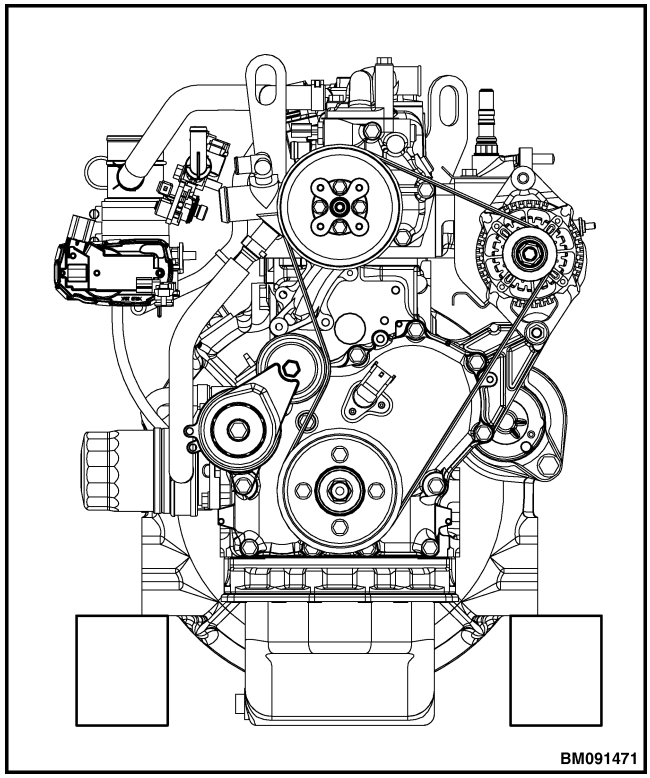


Figure 73. Blocking the engine

INSTALL

WARNING

The engine is heavy. Make sure that any lifting device has enough capacity to lift the engine. The engine can weigh approximately 215 kg (474 lb).

CAUTION

Keep the engine level when installing the engine to the transmission so the drive plate is not damaged.

WARNING

To avoid injury, confirm the engine and transmission are each fully supported before beginning to work under the suspended load.

1. Connect the lifting device to the two lifting eye brackets on the valve cover of the engine. Lift the engine over the engine compartment and slowly lower the engine into the frame of the lift truck, aligned with the engine mounts.

NOTE: Make sure the transmission does not shift when aligning the engine with the transmission.

2. Align the transmission assembly with the engine, making sure the stub shaft is properly engaged and install the eight top capscrews. See Figure 72. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

NOTE: Use of torque wrench with 2" torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool.

3. Using torque wrench and adapter, install the two bottom capscrews. See Figure 72 and Figure 71. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

4. Install the rear engine mounting bolt with washers and isolator. Tighten to 59 to 61 N•m (43.5 to 45.0 lbf ft).

5. Apply Loctite® 242 to the capscrew threads and install to torque converter housing, tighten to snug all around before final torque.

6. Rotate the torque converter to access each of the six capscrews. See Figure 64. Use an angled socket and wrench to tighten each of the capscrews. Torque to 32 to 36 N•m (23.6 to 26.6 lbf ft).

7. Install the access plate back on the torque converter housing. See Figure 63. Tighten to standard torque.

8. Install upper and lower mounting bolts. See Figure 70. Torque bolts to 101 to 105 N•m (74.5 to 77.4 lbf ft).

9. Connect the engine exhaust pipe to the exhaust manifold. See Figure 62.

10. Install the fan shroud. See Fan repair in **Cooling system** 0700SRM2300 for procedure.

11. Install fan assembly, fan belt and fan pulley. See Fan repair in **Cooling system** 0700SRM2300 for procedure.

12. Install the lower radiator hose to the engine. See Figure 58.

13. Install the top radiator coolant hose to the engine. See Figure 57.

14. Attach the ECM bracket to the frame. See Figure 56.

15. Install the ECM to the bracket. See Figure 56.

16. Connect the ECM to the ECM connector on the engine harness. See Figure 55.

17. Connect the engine harness to the chassis harness and all connectors and sensors. See Figure 55.

WARNING

All fuels are very flammable and can burn or cause an explosion. DO NOT use an open flame to check the fuel level or to check for leaks in the fuel system.

No smoking.

Breathing fuel vapor may cause nausea, unconsciousness or death. Long term exposure to gasoline vapors may cause liver or kidney damage and cancer. Avoid breathing vapor.

18. Remove caps from fuel lines and connect the fuel lines at the engine. See Bi-fuel fuel system repair, in **Yanmar Engines** 0600SRM2299.

19. Connect the coolant hoses and lines to the transmission. Fill cooling system with a mixture of 50 percent deionized water and 50 percent ethylene glycol boron-free antifreeze. See Radiator repair, in **Cooling system** 0700SRM2300.

20. Install the air intake bracket and LPG regulator assembly as one unit. See Figure 54.

21. Insert the capscrews to retain the air intake bracket. See Figure 54. Torque to 19.2 N•m (14.7 lbf ft).

22. Connect the sensor connector to the sensor on the regulator. See Figure 54.

23. Remove the hose caps from all hoses attached to the LPG regulator. Remove the caps from the engine ports. Connect the hoses to the engine. See Figure 54.

24. Install the air filter. See **Operator's Cab** 0100SRM2298.

25. Connect the ground strap to the frame. See **Frame and Main Components** 8000SRM2306.

26. Connect the wiring connector to the starter. See Figure 59.

27. Install the battery and battery holder. Connect the battery cables. See Battery service, in **Electrical, software, and controls** 2200SRM2304.

28. Insert the four capscrews into the hood crossmember and install the hood crossmember to the operator module. See Figure 52. Tighten to standard torque.

29. Install the floorplate and throttle pedal. Connect the throttle pedal connector. See Covers repair, in **Frame and Main Components** 8000SRM2306.

30. Install the floormat. See Covers repair, in **Frame and Main Components** 8000SRM2306.

31. Install the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306. **Frame and Main Components** 8000SRM2306.

32. Install the seat to the hood. Connect the seat harness to the seat. See Seat repair-Full Suspension, in **Operator's Cab** 0100SRM2298 for procedures.

33. Check and fill all fluid levels as described in **Periodic Maintenance** 8000SRM2305.

34. Install the radiator cover to the counterweight. See Figure 53.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

35. Empty drain pan contents.

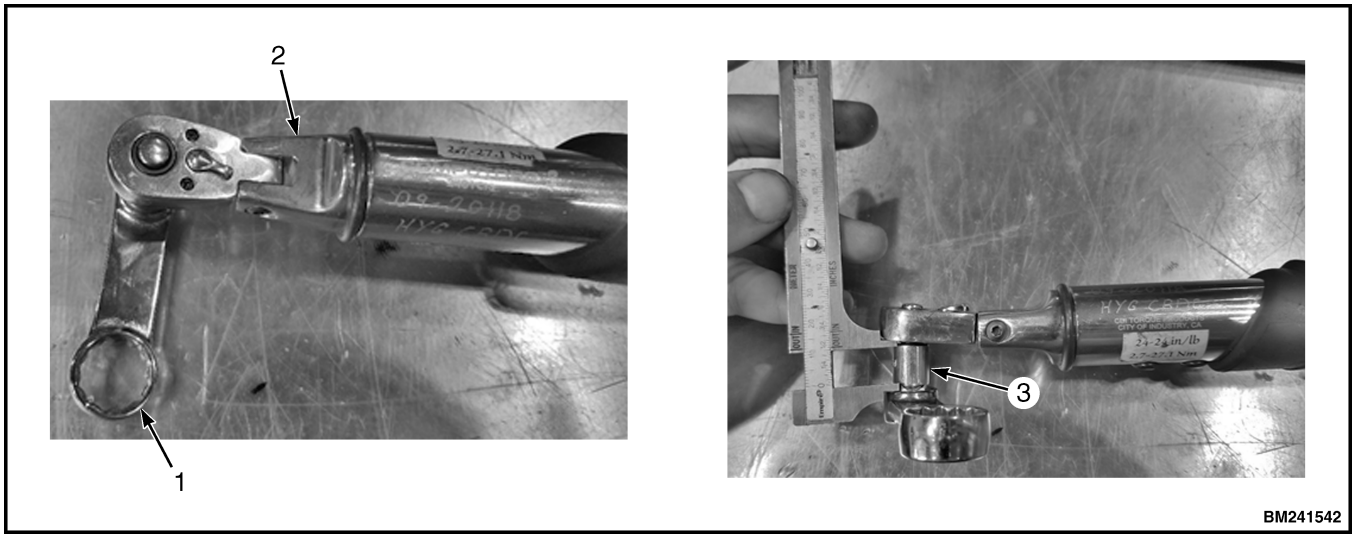
36. Connect the positive battery cable to the battery. See **Electrical, software, and controls** 2200SRM2304.

37. Connect the negative battery cable to the battery. See **Electrical, software, and controls** 2200SRM2304.

TOOL



Figure 74. Drive Torque Adapter (Dogbone)



1. DOGBONE
2. TORQUE WRENCH
3. EXTENSION (~12MM)

Figure 75. Torque Wrench, 2" Dogbone, and Extension

CNG ENGINE REMOVAL AND REPLACEMENT 202001-206

This content is under development and will be released when available.

Transmission removal and replacement

ELECTRONIC POWERSHIFT TRANSMISSION REMOVAL AND REPLACEMENT 202001-055

PREPARE

1. Before beginning any work on components under the hood, ensure the exterior of the truck has been thouroughly cleaned to avoid any contamination. See How to clean a lift truck in **Periodic Maintenance** 8000SRM2305.

NOTE: When disconnecting wiring harness connectors during disassembly, tag each connector to aid in connecting the wiring harness during reassembly.

2. Disconnect the battery. See **Electrical, software, and controls** 2200SRM2304.

3. Disconnect the seat connector. See Seat repair-Full Suspension in **Operator's Cab** 0100SRM2298.

4. Remove the hood. See Covers repair in **Frame and Main Components** 8000SRM2306.

5. Remove the floormat. Remove the floor plate with the throttle pedal attached. See Covers repair in **Frame and Main Components** 8000SRM2306.

6. Remove the crossbar. See Overhead guard and cab repair.

CAUTION

Use care when disconnecting the wiring harness connectors from electrical connectors on the transmission and control valve. The connectors on the transmission and control valve are easily damaged.

7. Disconnect the electrical connector from the park brake.
   - For lift trucks equipped with dry brake option, see Figure 76.
   - For lift trucks equipped with wet brake option, disconnect the electrical connectors from the park brake solenoid and pressure sensor. See Figure 77.

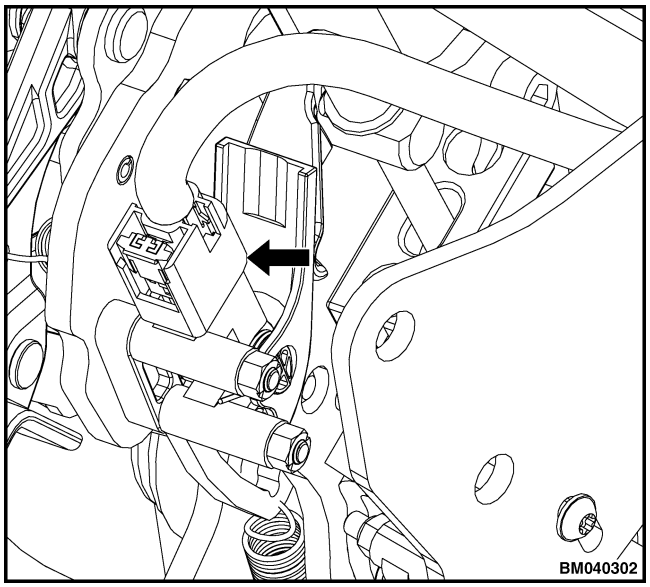
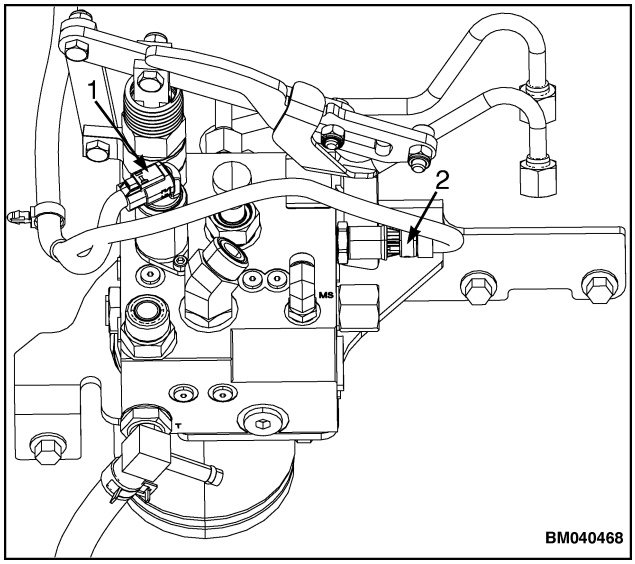


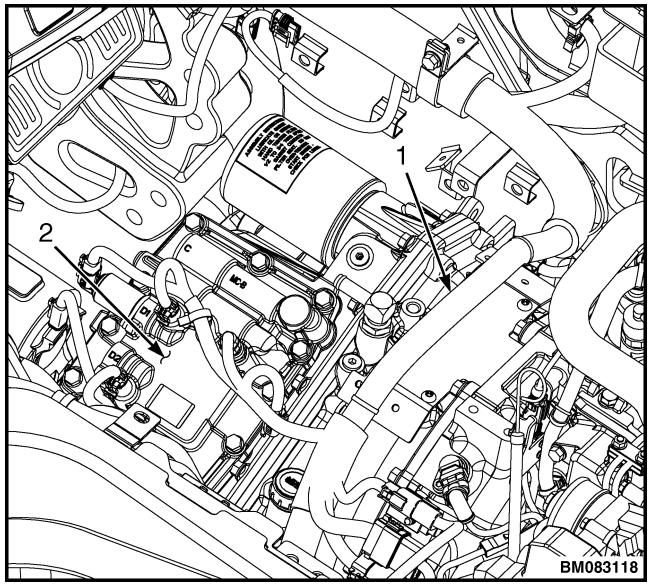
Figure 76. Park brake connector, dry brake



1. PARK BRAKE SOLENOID
2. PRESSURE SENSOR

Figure 77. Park brake connector, wet brake

8. Disconnect all connectors from the transmission chassis harness to the transmission. See Figure 78.



NOTE: DURAMATCH TRANSMISSION OPTION IS SHOWN. POWERSHIFT 1-SPEED TRANSMISSION OPTION WILL BE SIMILAR.

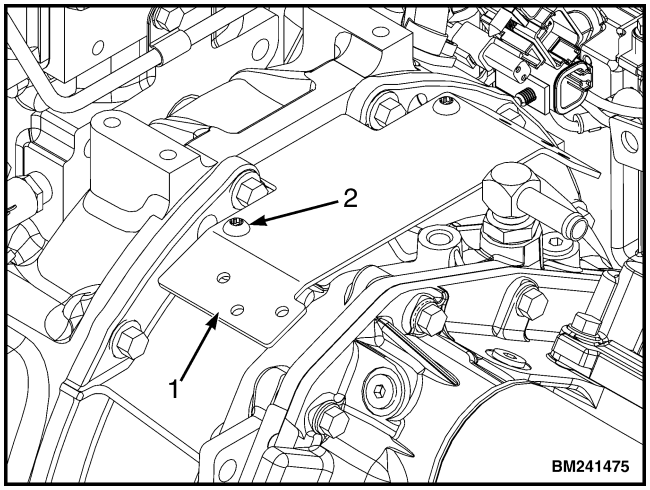
1. TRANSMISSION CHASSIS HARNESS
2. TRANSMISSION

Figure 78. Transmission harness

REMOVE TRANSMISSION

1. Remove the Power Distribution Module (PDM) and horn. See **Electrical, software, and controls** 2200SRM2304.

2. Remove the two capscrews retaining the transmission access plate. Remove the access plate to reveal the torque converter access port. See Figure 79.



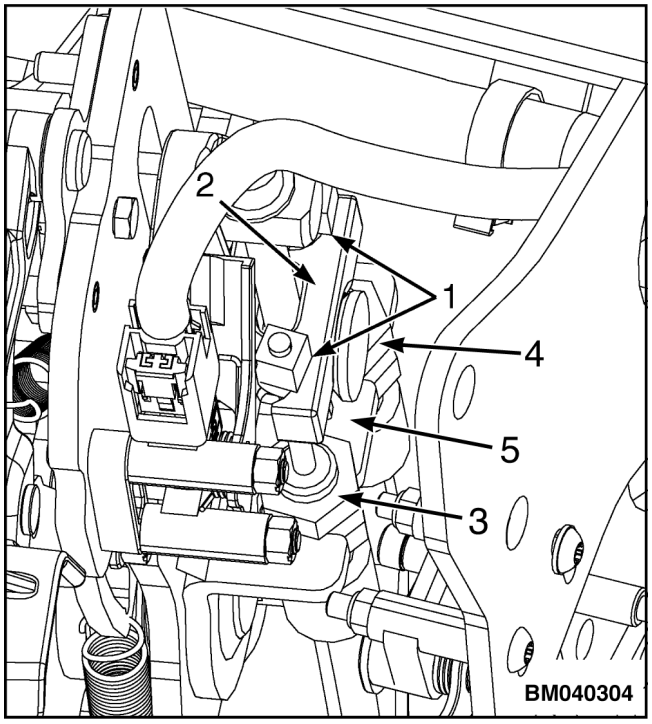
1. ACCESS PLATE
2. CAPSCREW

Figure 79. Transmission access plate

3. Move the chassis harness toward the engine, above the flywheel. Tie the chassis harness back to keep it out of the way, while all other connections remain intact.

4. Disconnect the park brake cables from the park brake assembly. Keep the park brake assembly attached to the cowl. See Figure 80.

NOTE: The following figure reflects a lift truck with a dry brake option park brake. Lift trucks equipped with wet brake option will look different.



1. JAM NUTS
2. EQUALIZER BAR
3. LEFT HAND PARK BRAKE CABLES
4. RIGHT HAND PARK BRAKE CABLES
5. CABLE BRACKET

Figure 80. Park brake cables

5. Remove the kick panel and the dash. See Covers repair in the **Frame and Main Components** 8000SRM2306 manual.

6. Disconnect the brake pedal from the linkage. See Pedals and linkage repair in **Operator's Cab** 0100SRM2298.

7. Locate the drain plug on the bottom of the transmission. See Figure 81.

a. For lift trucks equipped with dry brake option, place a container with a capacity of 10 liter (10.6 qt) or greater under the transmission drain plug.

b. For lift trucks equipped with wet brake option, place a container with a capacity of 16 liter (16.9 qt) or greater under the transmission drain plug.

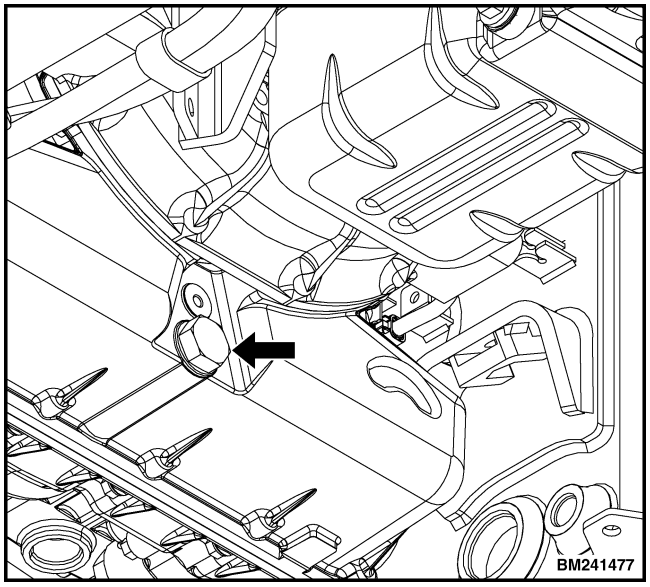
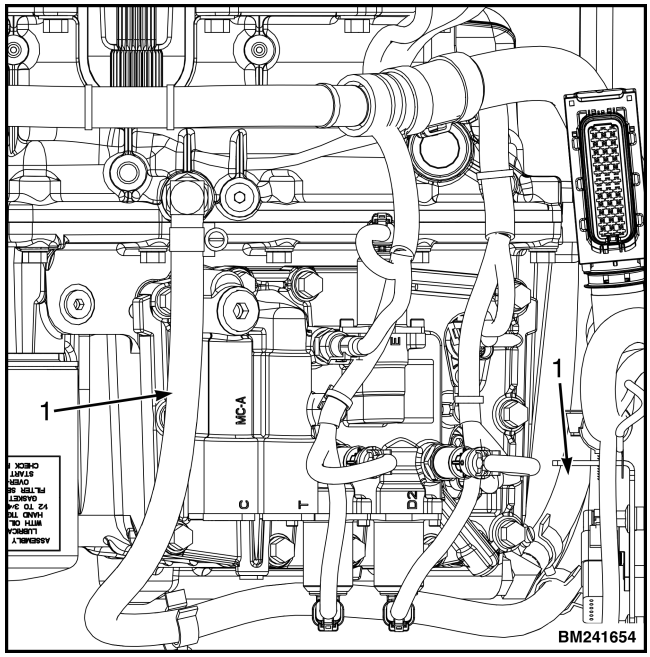


Figure 81. Transmission drain plug

8. Unthread the drain plug and drain all oil from the transmission into the container.

9. Replace the drain plug and torque to 93 to 102 N•m (68.6 to 75.2 lbf in).

10. Disconnect the two cooling lines from the transmission. See Figure 82.



NOTE: DURAMATCH TRANSMISSION OPTION IS SHOWN. POWERSHIFT 1-SPEED TRANSMISSION OPTION WILL BE SIMILAR.

1. TRANSMISSION COOLING LINES

Figure 82. Transmission cooling lines

11. If your lift truck is equipped with wet brake option, disconnect the four brake hoses from the transmission. See Figure 83 and Figure 84.

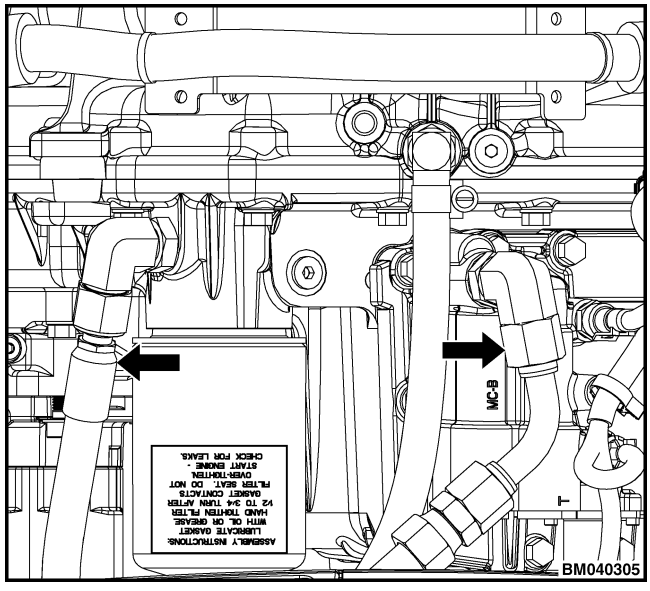


Figure 83. Park brake hoses (wet brake option)

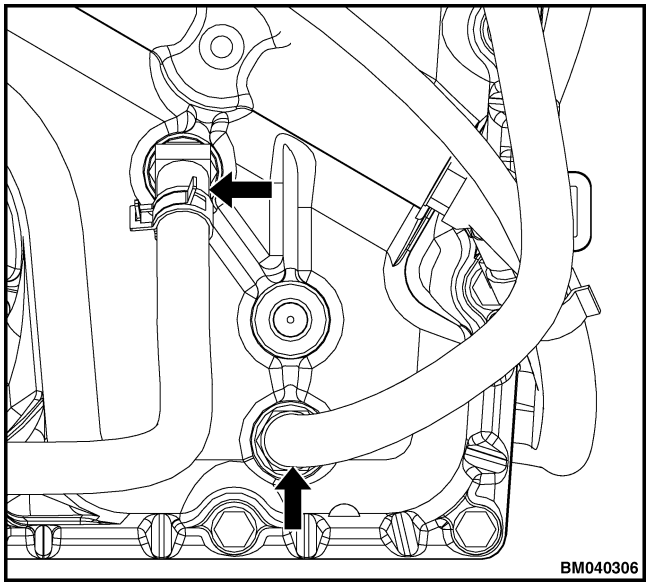
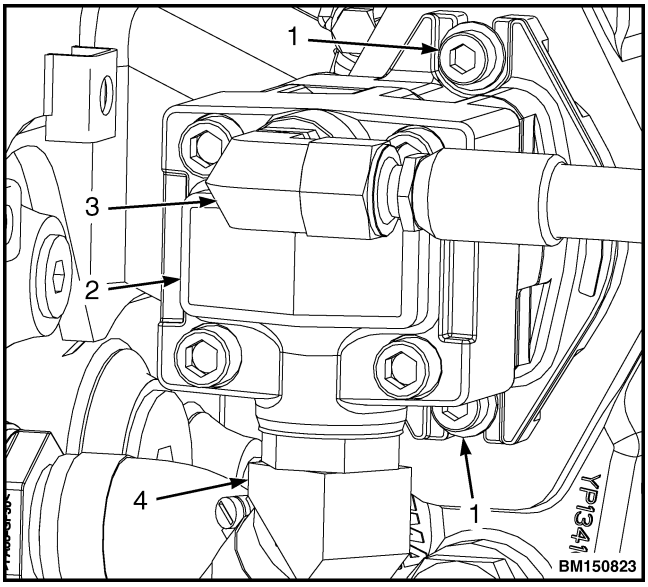


Figure 84. Park brake hoses (wet brake option), under transmission

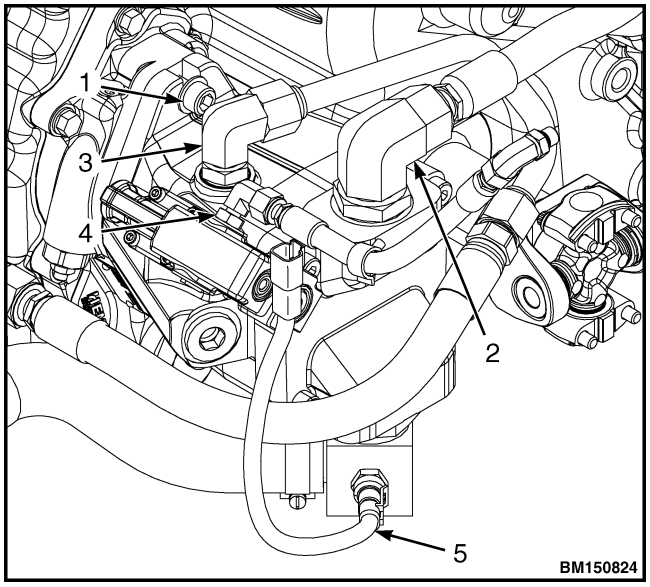
12. Place the lift truck on blocks. See How to put a lift truck on blocks in **Periodic Maintenance** 8000SRM2305.

13. If your truck is equipped with a hydraulic gear pump, leave the main hose connected to hydraulic pump. Disconnect the other hose. See Figure 85.



1. CAPSCREW
2. HYDRAULIC GEAR PUMP
3. HYDRAULIC HOSE (FROM HYDRAULIC CONTROL VALVE)
4. MAIN HOSE (TO HYDRAULIC TANK)

Figure 85. Hydraulic gear pump



1. CAPSCREW
2. VARIABLE DISPLACEMENT PUMP
3. HOSE
4. HOSE
5. MAIN HOSE

Figure 86. Variable displacement pump

If your truck is equipped with a Variable Displacement Pump (VDP), leave the main hose (item 5, Figure 86) connected to the VDP. Disconnect all other hoses.

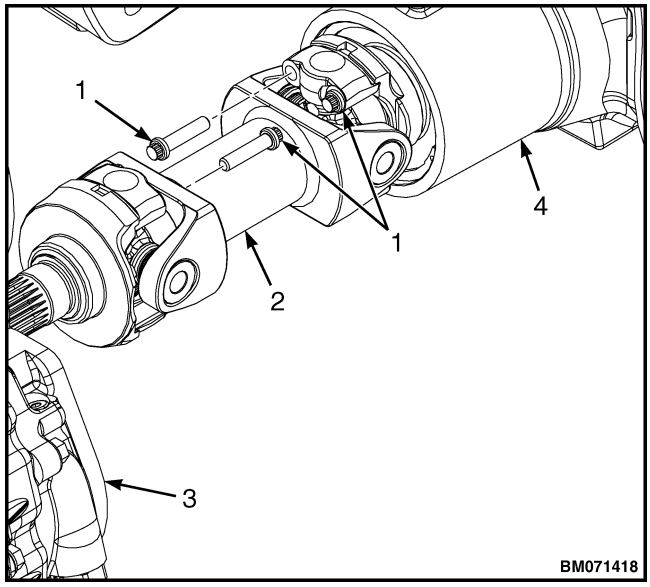
CAUTION

Prior to removing the hydraulic gear pump/VDP, cover the charge pump with liquid-proof covering to prevent damage.

14. If your truck is equipped with a hydraulic gear pump, remove the two flange head capscrews retaining the hydraulic gear pump to the transmission housing. See Figure 85. Remove the pump and let hang from hose.

If your truck is equipped with a VDP, remove the two flange head capscrews retaining the VDP to the transmission housing. See Figure 86.

15. From underneath the lift truck, disconnect the drive shaft by removing the eight bolts that attach the drive shaft to the transmission and the drive axle. See Figure 87.



1. BOLT
2. DRIVE SHAFT
3. TRANSMISSION
4. DRIVE AXLE

Figure 87. Drive shaft

NOTE: The engine can weigh as much as 240 kg (529.1 lb). Make sure that any lifting device has enough capacity to support the weight of the engine.

16. Put straps through the two lifting eyes on the engine assembly. Hook the straps to a lifting device to keep engine supported. See Figure 88.

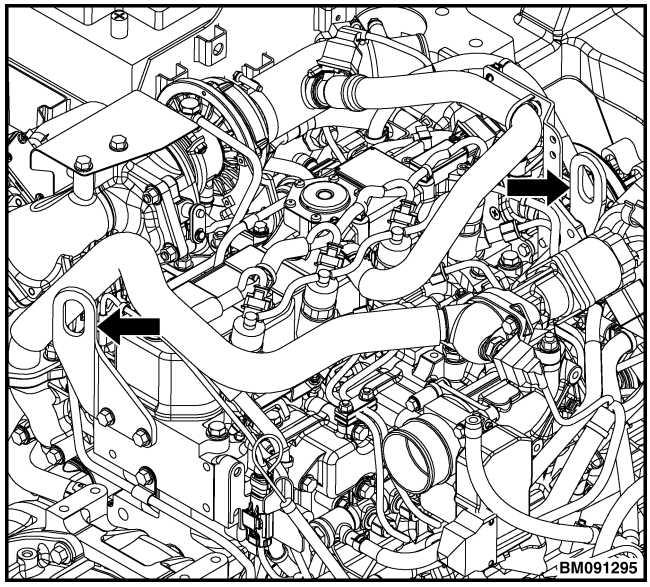


Figure 88. Lifting eyes

17. Remove the ECU to access the motor mount hardware. See **Electrical, software, and controls** 2200SRM2304.

18. From the torque converter access port, rotate the torque converter by turning the fan, to access each of the six capscrews retaining the torque converter to the flywheel. Use an angled socket and wrench to remove each of the capscrews. See Figure 89.

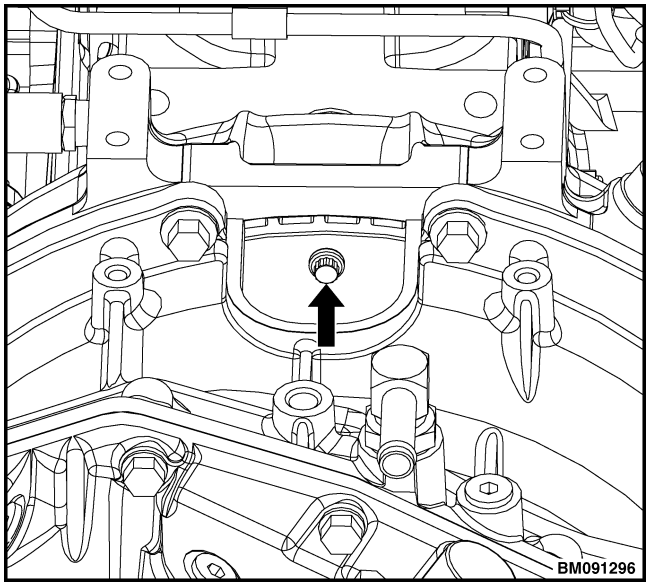
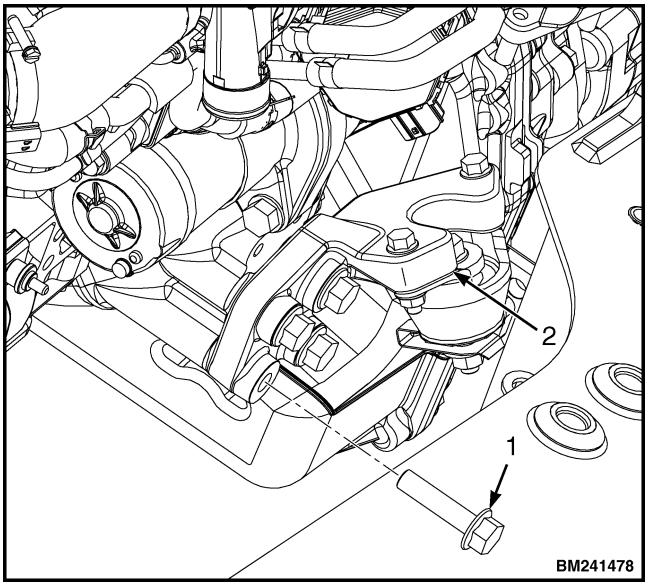


Figure 89. Torque converter mounting screws

NOTE: The transmission can weigh approximately 79.1 kg (174.4 lb) when filled with oil and including the torque converter. Always use a lifting device and chains with a capacity rating higher than the weight of the transmission.

19. Remove the four bolts attaching the left hand engine mount to the transmission. See Figure 90. Repeat for the right hand engine mount.



1. BOLT
2. ENGINE MOUNT

Figure 90. Engine mount

NOTE: Always use a lifting device and chains with a capacity rating higher than the weight of the transmission.

20. Install a lifting eye bolt (not shown) into the M12X1.75 lifting eye bolt hole on the transmission assembly. See Figure 91.

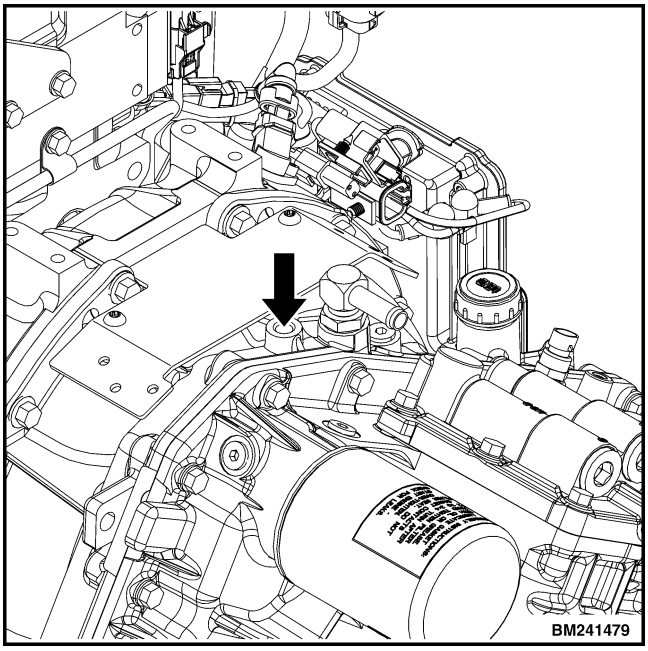


Figure 91. Lifting eye bolt hole

21. Thread a strap through the lifting eye (not shown). Attach the strap to a lifting device to keep the transmission assembly stable.

22. Remove the fitting from the left hand tilt cylinder to aid in transmission removal. See Figure 92.

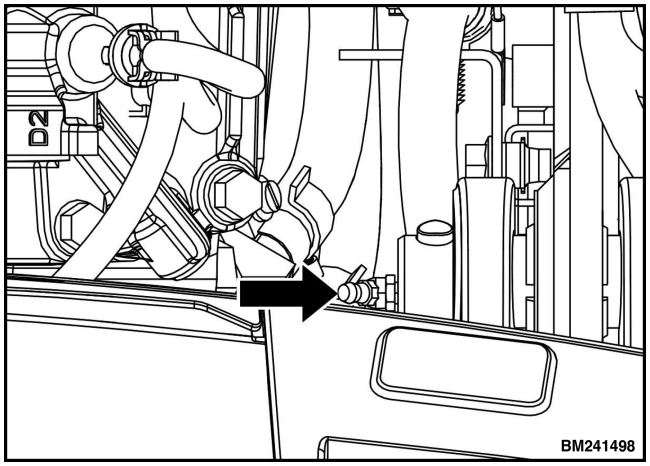


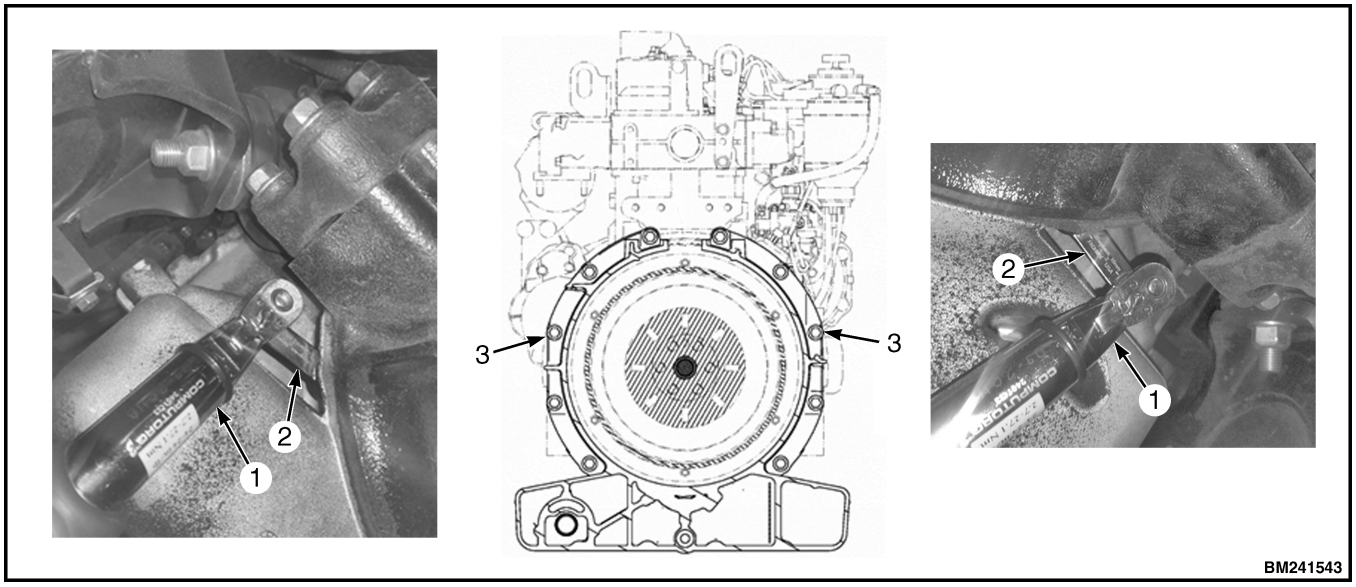
Figure 92. Tilt cylinder fitting

NOTE: There are ten capscrews attaching the torque converter housing to the engine. The two lowest capscrews on the bottom (item 6, Figure 95) must be removed first and must be removed from beneath the truck.

23. While continuing to support the transmission assembly with the overhead lifting device, place wood blocks or work stands beneath the transmission assembly at the surface where the two halves of the transmission assembly meet. See Figure 94.

NOTE: Use of torque wrench with 2" torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool for tool specifications.

24. Using torque wrench and adapter, remove the two lowest bolts (item 6, Figure 95) attaching the transmission assembly to the engine. See Figure 93.



1. TORQUE WRENCH
2. ADAPTER (DOGBONE)
3. BOLT

Figure 93. Bolt Remove/Install Using Tool

25. Remove the remaining eight capscrews (item 3, Figure 95) attaching the transmission assembly to the engine.

26. Using a flat pry bar, move the torque converter back from the flywheel to prevent damage to the torque converter during removal.

27. Carefully separate the transmission assembly from the engine, by slowly rotating the transmission assembly. Take care to not damage the wire harnesses or any of the hoses that might be in the path of removal. See Figure 95. Remove the wood blocks or work stands.

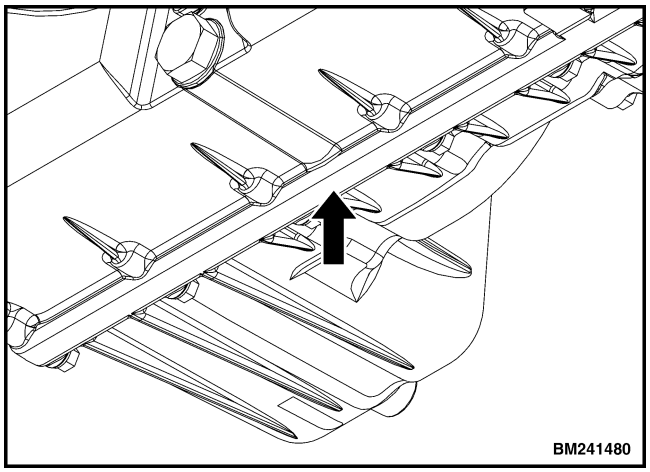
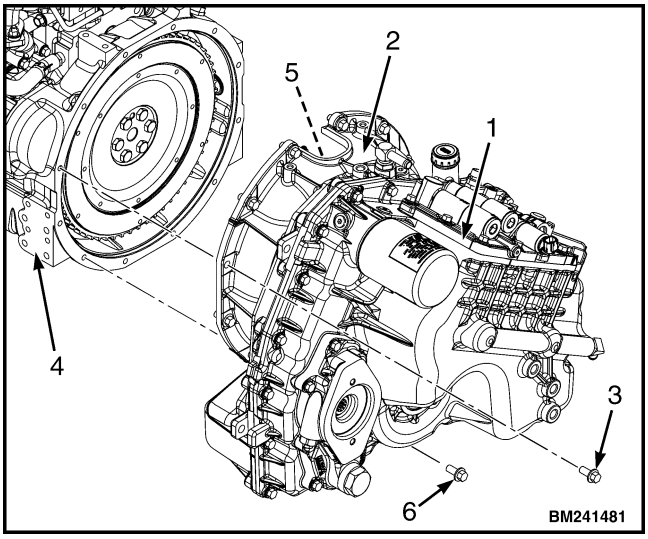


Figure 94. Blocking the transmission



1. TRANSMISSION HOUSING
2. TORQUE CONVERTER HOUSING
3. CAPSCREWS
4. ENGINE
5. TORQUE CONVERTER
6. CAPSCREWS

Figure 95. Transmission and torque converter housings

CAUTION

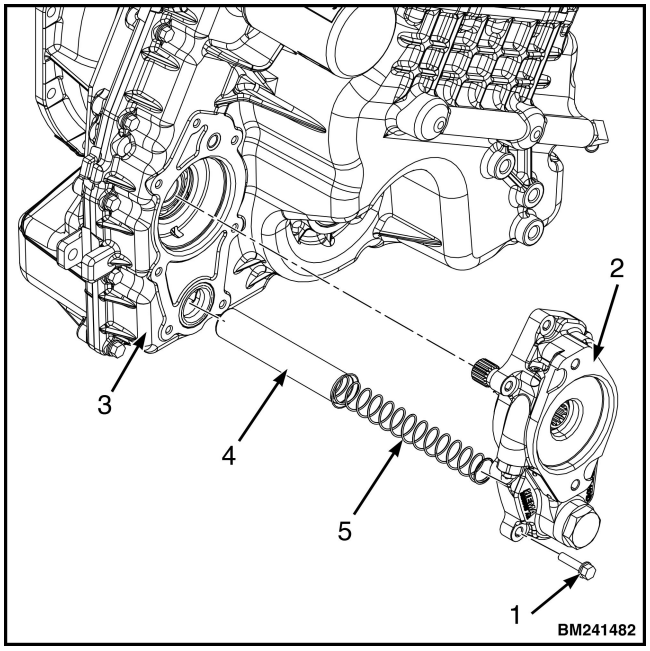
Place blocks under the back side of the transmission housing for additional support, to prevent possible damage to the transmission assembly when placing the assembly on a work surface.

28. Place the transmission assembly on a flat work surface with the torque converter housing facing down.

Charge pump remove

NOTE: The charge pump can be removed from the transmission while it is still in the lift truck. However, for the sake of clarity, illustrations in the following steps are shown with the transmission removed from the truck.

1. Remove the seven capscrews and washers retaining the charge pump to the transmission housing. See Figure 96.



1. CAPSCREW
2. CHARGE PUMP
3. TRANSMISSION HOUSING
4. SUCTION SCREEN
5. SUCTION SCREEN SPRING

Figure 96. Charge pump

2. Remove the charge pump from the transmission housing. See Figure 96.

3. Remove the suction screen spring and suction screen from the transmission housing. See Figure 96.

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

WARNING

Compressed air can move particles and make them become airborne, which may cause injury. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent eye injury.

CAUTION

DO NOT allow cleaning solvent to come in contact with rubber or plastic components as it can damage those components.

1. Clean metal components with solvent and dry with compressed air.

2. Clean rubber or plastic components with warm soapy water and dry with a lint free cloth.

Inspect

1. Inspect the splines on the shaft of charge pump for damage or worn areas that could affect the operation of the pump. Replace the charge pump if damaged. See Figure 96.

2. Inspect the capscrews for damaged threads. Replace the capscrews if threads are damaged. See Figure 96.

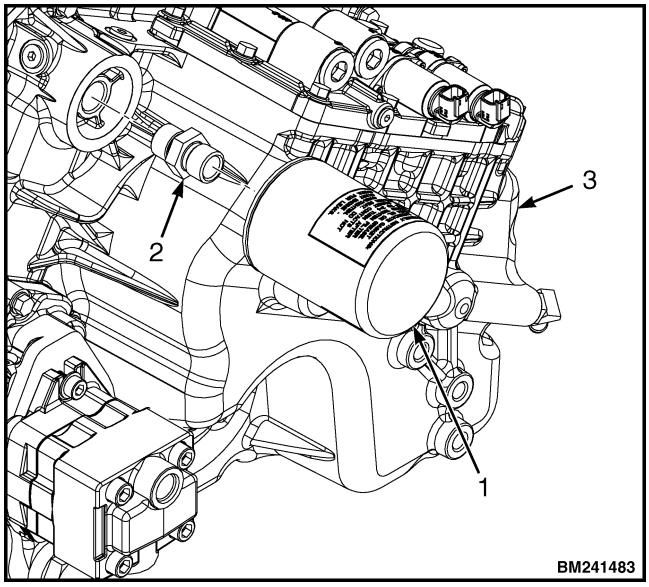
3. Inspect the suction screen for foreign material. Clean the screen or replace if damaged. See Figure 96.

Transmission filter

1. Remove the transmission filter from the transmission housing. See Figure 97.

NOTE: Only perform the following step if removing the transmission housing.

2. Remove the filter post fitting from the transmission housing. See Figure 97.



1. TRANSMISSION FILTER
2. FILTER POST FITTING
3. TRANSMISSION HOUSING

Figure 97. Transmission filter

Torque converter

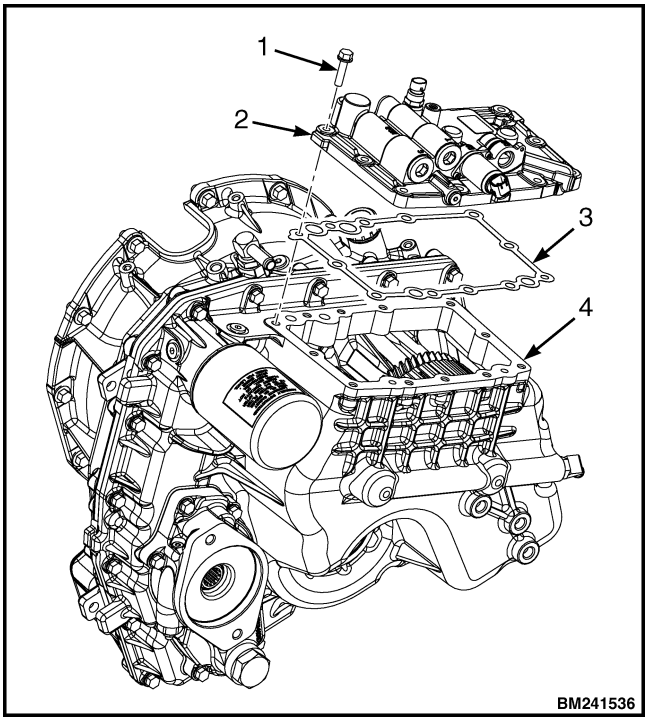
NOTE: The torque converter may not be repaired and must be replaced as a unit.

1. Follow the steps to remove the transmission assembly. See Transmission, Remove transmission in the beginning of this section.

2. Remove the torque converter from the torque converter housing on the transmission assembly.

Control valve

1. Remove 12 cap screws, control valve, and gasket from transmission housing.



NOTE: POWERSHIFT 1-SPEED TRANSMISSION OPTION IS SHOWN. DURAMATCH TRANSMISSION OPTION WILL BE SIMILAR.

1. CAPSCREW
2. CONTROL VALVE
3. GASKET
4. TRANSMISSION HOUSING

Figure 98. Control valve

Disassemble

Solenoids (Forward, Reverse, and Enable)

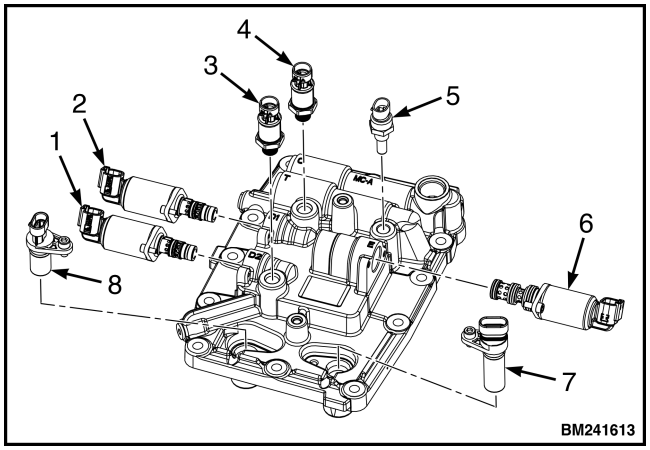
1. Remove two cap screws securing solenoid to transmission control valve. See Figure 99.

Temperature and Pressure Sensors (Forward and Reverse)

1. Remove pressure sensor from transmission control valve.

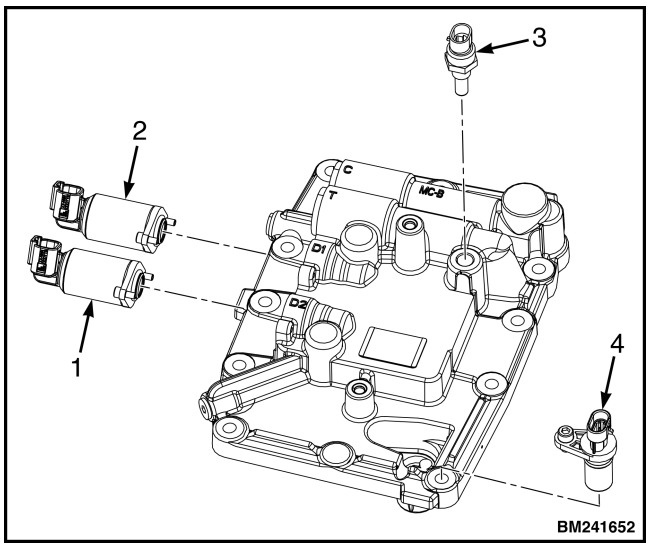
Speed Sensors (TISS and TOSS)

1. Remove one cap screw securing speed sensor to transmission control valve.



1. REVERSE SOLENOID (D2)
2. FORWARD SOLENOID (D1)
3. REVERSE PRESSURE SENSOR
4. FORWARD PRESSURE SENSOR
5. TEMPERATURE SENSOR
6. ENABLE SOLENOID
7. TOSS SPEED SENSOR
8. TISS SPEED SENSOR

Figure 99. Control Valve Assembly, DuraMatch Transmission



1. REVERSE SOLENOID (D2)
2. FORWARD SOLENOID (D1)
3. TEMPERATURE SENSOR
4. TISS SPEED SENSOR

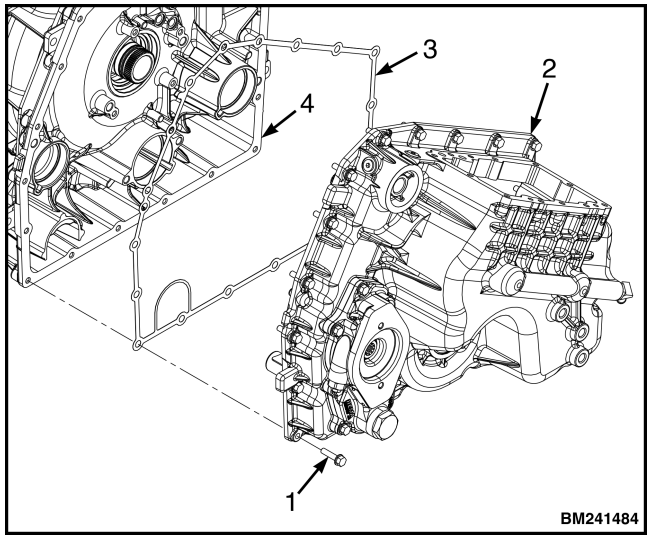
Figure 100. Control Valve Assembly, Powershift 1-speed Transmission

Clutch packs

1. Remove the hydraulic gear pump or VDP. See Figure 85 or Figure 86.
2. Remove the charge pump. See Remove transmission, Charge pump remove.
3. Remove the torque converter. See Remove transmission, Torque converter.
4. Remove control valve. See Control valve.
5. Remove the 18 flange bolts connecting the transmission housing and the torque converter housing. See Figure 101.

NOTE: When removing the torque converter housing from the transmission housing, take care not to damage the gasket.

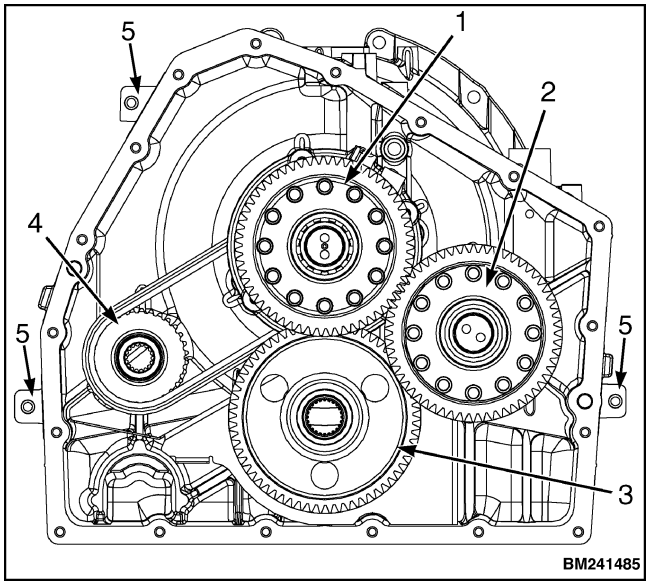
6. Using a small pry bar in the designated pry points, remove the converter housing from the transmission housing. See Figure 102.



1. FLANGE BOLT
2. TRANSMISSION HOUSING
3. GASKET
4. TORQUE CONVERTER HOUSING

Figure 101. Transmission housing

7. Remove and discard the gasket from the transmission housing. See Figure 101.
8. Lay the torque converter housing down on a bench or flat work surface, with the gears facing up. See Figure 102.



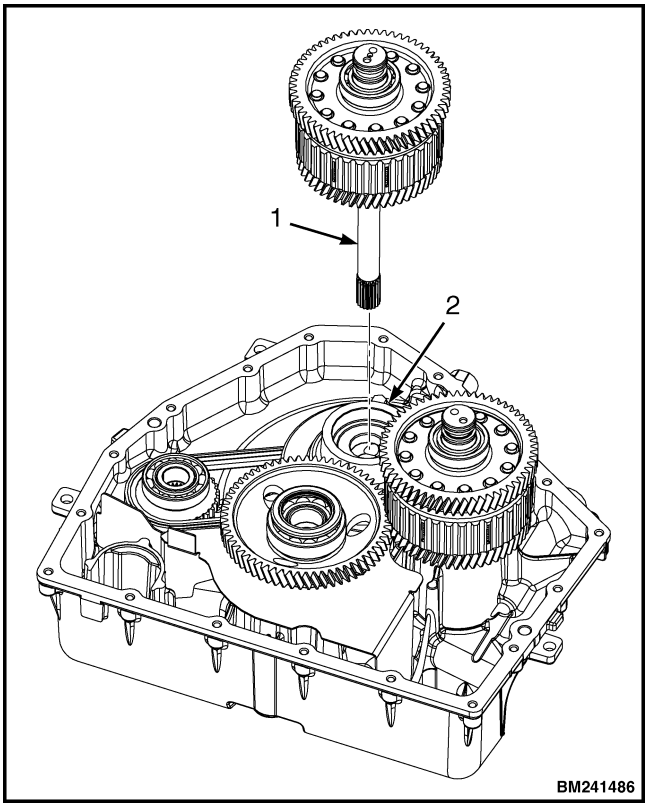
1. FORWARD CLUTCH
2. REVERSE CLUTCH
3. OUTPUT GEAR
4. CHARGE PUMP GEAR
5. PRY POINT

Figure 102. Forward and reverse clutch and output gear

Disassemble

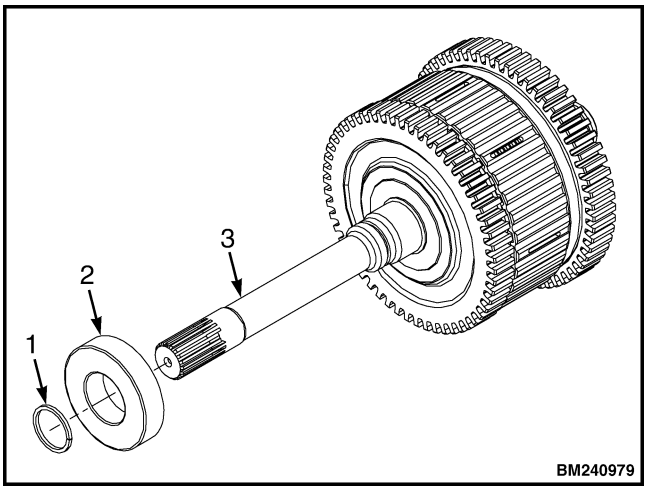
Forward Clutch Pack

STEP 1.
Place converter housing face down on a bench or work surface as shown. Pull the forward clutch assembly straight out of the stator support assembly.



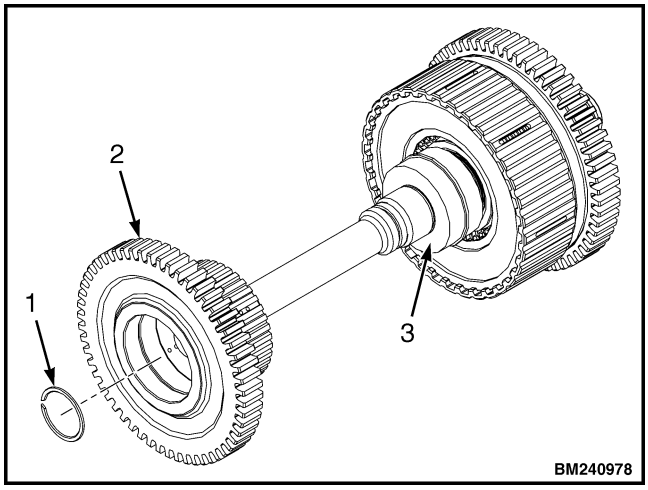
1. FORWARD CLUTCH ASSEMBLY
2. STATOR SUPPORT ASSEMBLY

STEP 2.
Remove shaft seal and bearing from input shaft. Discard shaft seal.



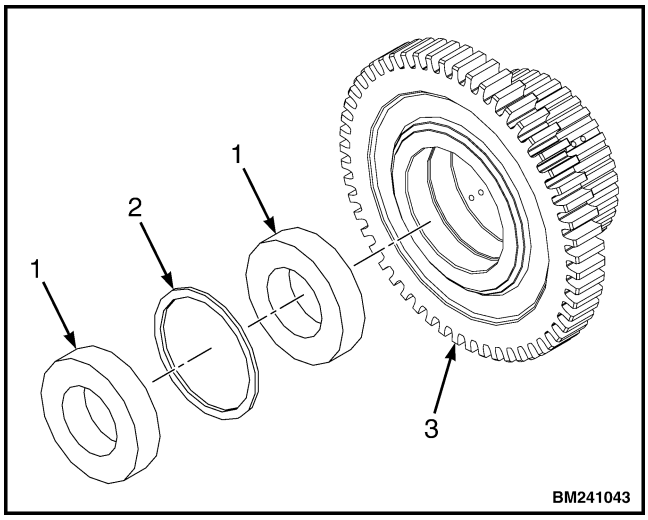
1. SHAFT SEAL
2. BEARING
3. INPUT SHAFT

STEP 3.
Remove snap ring from output gear. Remove output gear from input shaft.



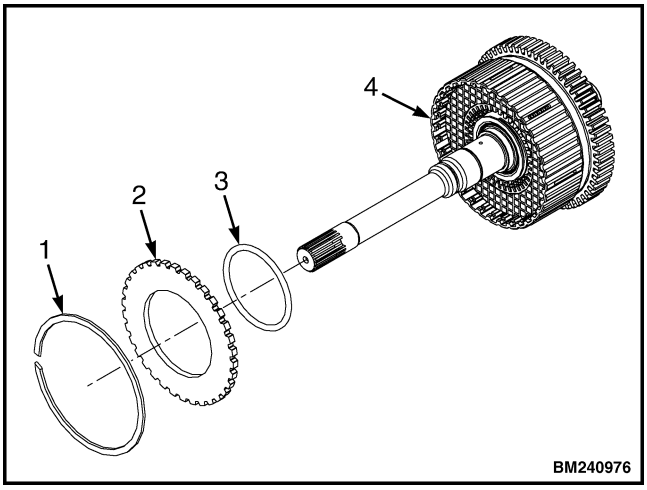
1. SNAP RING
2. OUTPUT GEAR
3. BEARING

STEP 4.
Remove bearing, snap ring, and bearing from output gear.



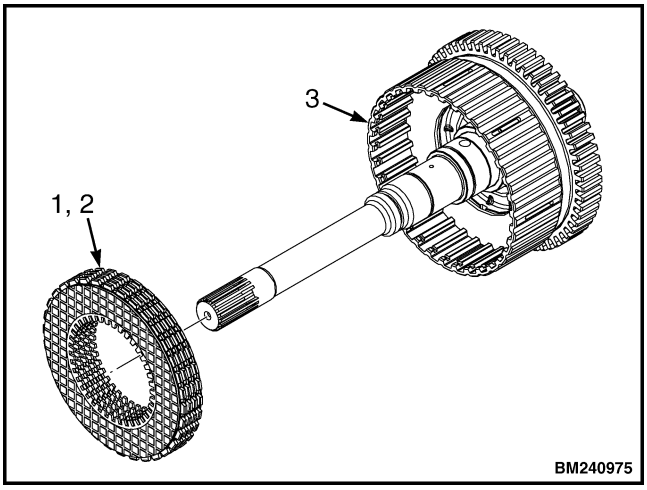
1. BEARING
2. SNAP RING
3. OUTPUT GEAR

STEP 5.
Remove snap ring and pressure plate from gear assembly drum. Remove and discard O-ring from pressure plate.



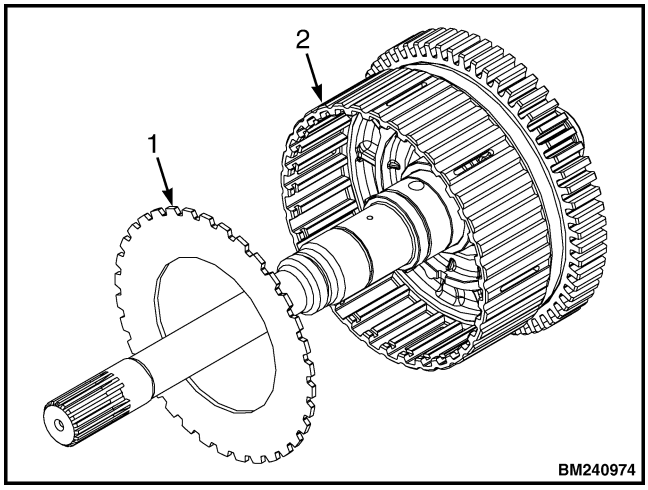
1. SNAP RING
2. PRESSURE PLATE
3. O-RING
4. GEAR ASSEMBLY DRUM

STEP 6.
Remove friction disks and separator plates alternately until all have been removed from gear assembly drum.



1. FRICTION DISK
2. SEPARATOR PLATE
3. GEAR ASSEMBLY DRUM

STEP 7.
Remove conical plate from gear assembly drum.



1. CONICAL PLATE
2. GEAR ASSEMBLY DRUM (FORWARD CLUTCH PACK)

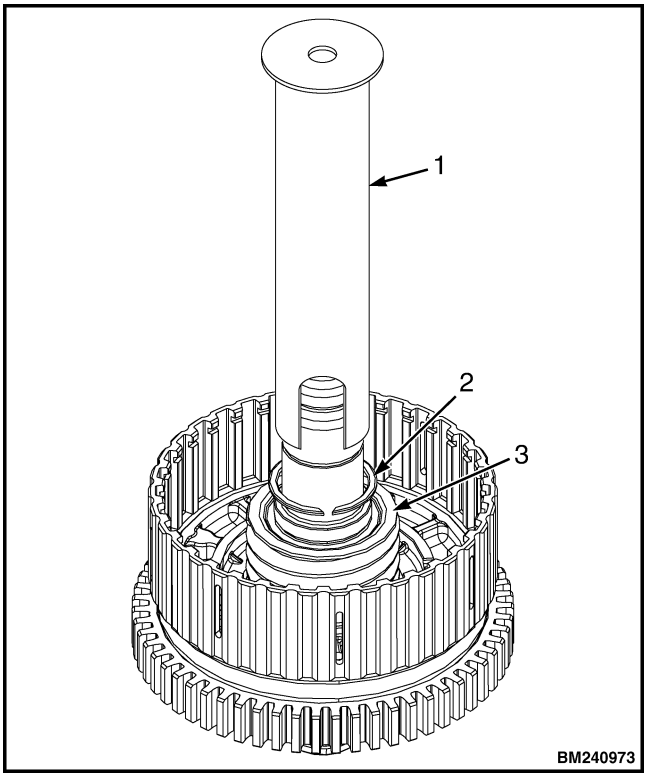
WARNING

The springs for the piston are compressed. Make sure the springs and spring retainer cannot cause injury when the snap ring is removed.

WARNING

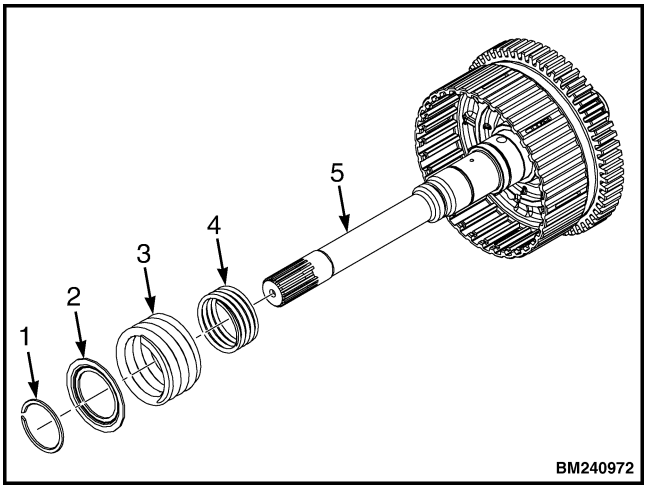
Use caution when removing the springs. Springs are held by compression and may become projectiles when released. Make sure the springs and spring retainer cannot cause injury when the snap ring is removed.

STEP 8.
Using spring compression tool, Hyster P/N 867890 , and a press, place spring compression tool on spring guide with opening of tool above opening of snap ring, and compress large and small springs just enough to allow removal of snap ring from spring guide. Slowly release press to compress springs.



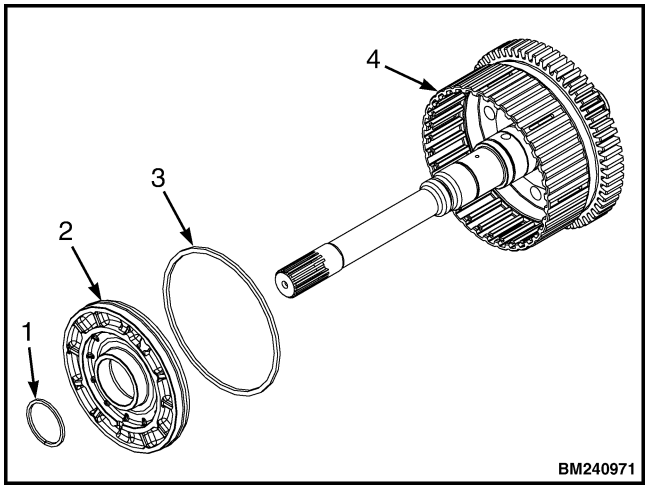
1. SPRING COMPRESSION TOOL
2. SNAP RING
3. SPRING GUIDE

STEP 9.
Remove snap ring, spring guide, large spring, and small spring from input shaft.



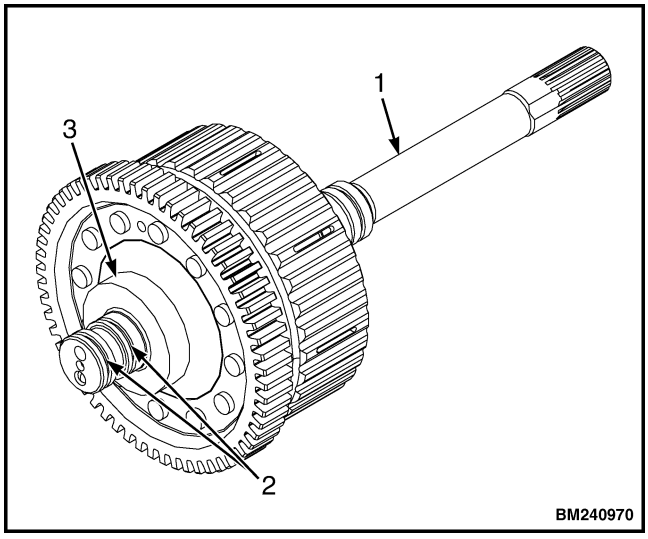
1. SNAP RING
2. SPRING GUIDE
3. LARGE SPRING
4. SMALL SPRING
5. INPUT SHAFT

STEP 10.
Remove shaft seal and piston from gear assembly drum. Remove piston seal from piston. Discard shaft seal and piston seal.



1. SHAFT SEAL
2. PISTON
3. PISTON SEAL
4. GEAR ASSEMBLY DRUM

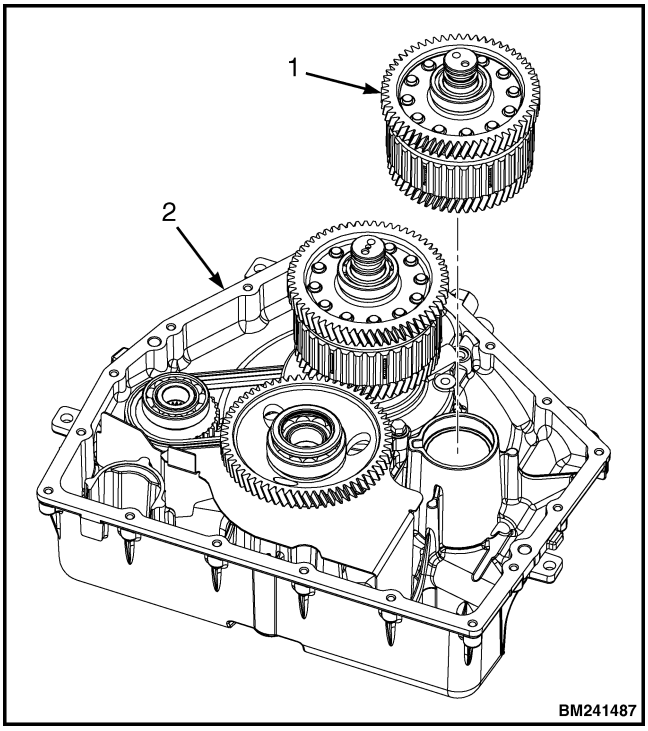
STEP 11.
Remove shaft seals and bearing from input shaft. Discard shaft seals.



1. INPUT SHAFT
2. SHAFT SEAL
3. BEARING

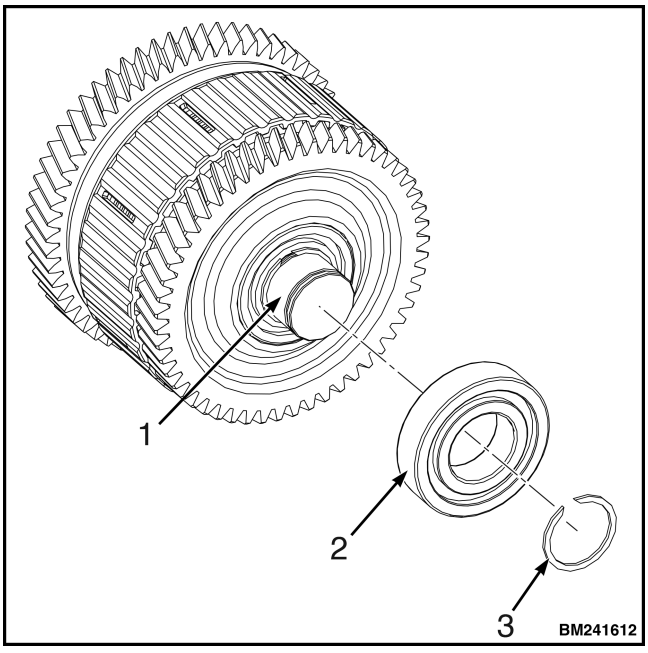
Reverse Clutch Pack

STEP 1.
Converter housing to be face down on a bench or work surface as shown. Pull reverse clutch assembly straight out of converter housing.



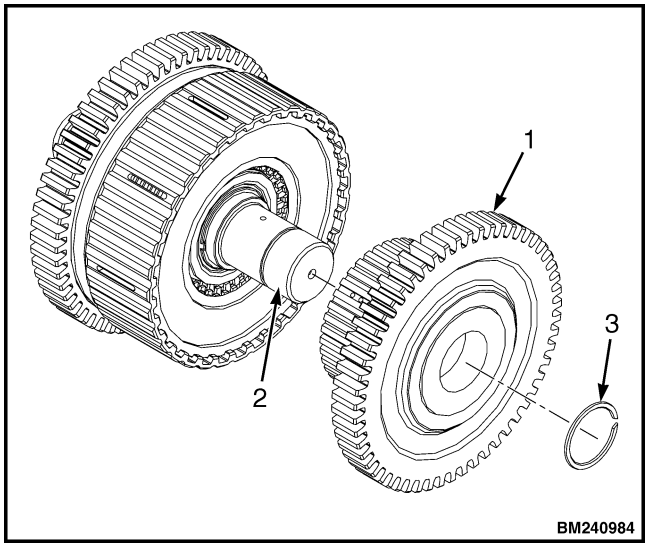
1. REVERSE CLUTCH ASSEMBLY
2. CONVERTER HOUSING

STEP 2.
Remove snap ring from center shaft. Remove bearing from center shaft.



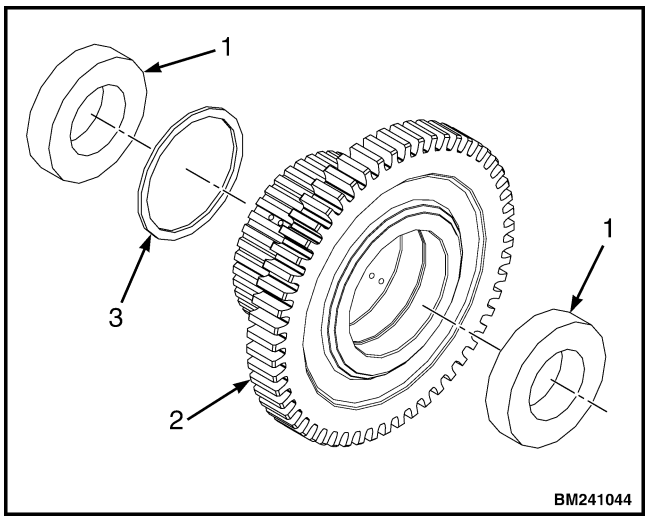
1. CENTER SHAFT
2. BEARING
3. SNAP RING

STEP 3.
Remove snap ring from output gear. Remove output gear from center shaft.



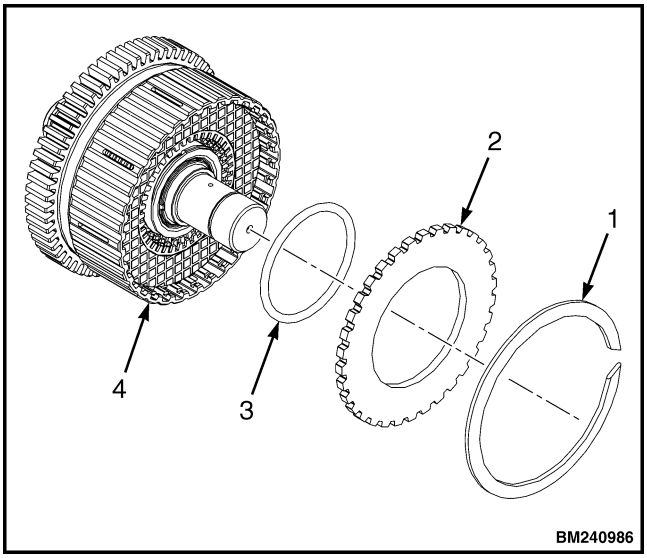
1. OUTPUT GEAR
2. CENTER SHAFT
3. SNAP RING

STEP 4.
Remove bearings and snap ring from output gear.



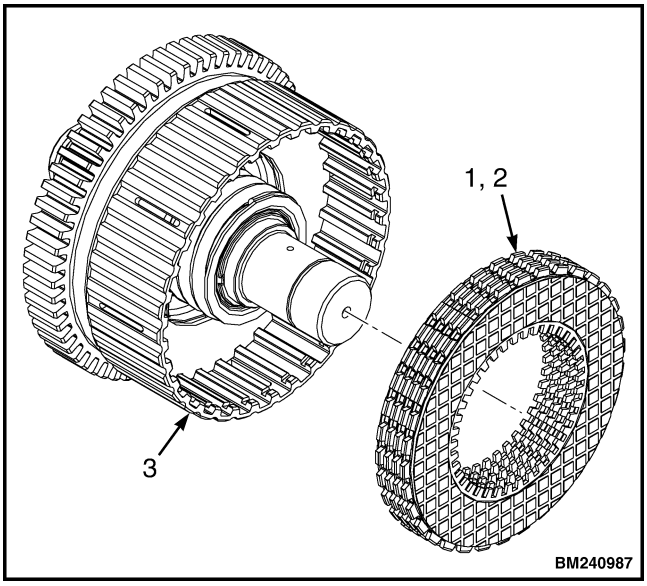
1. BEARING
2. OUTPUT GEAR
3. SNAP RING

STEP 5.
Remove snap ring and pressure plate from gear assembly drum. Remove and discard O-ring from pressure plate.



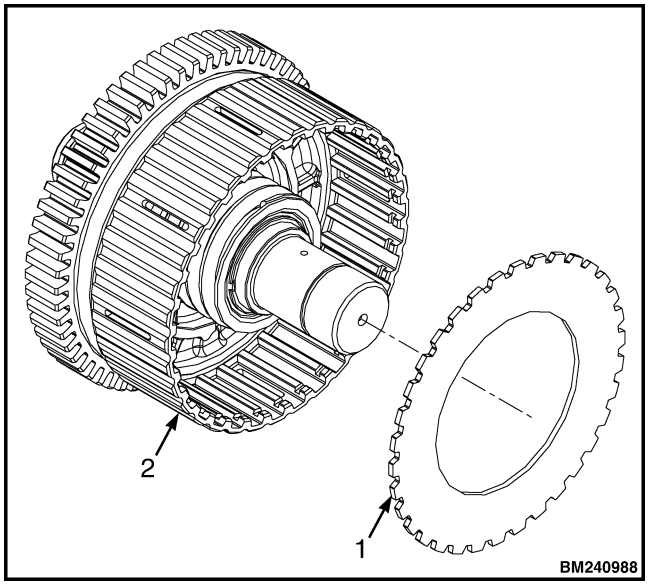
1. SNAP RING
2. PRESSURE PLATE
3. O-RING
4. GEAR ASSEMBLY DRUM

STEP 6.
Remove friction disks and separator plates alternately until all have been removed from gear assembly drum.



1. FRICTION DISK
2. SEPARATOR PLATE
3. GEAR ASSEMBLY DRUM

STEP 7.
Remove plate from gear assembly drum.



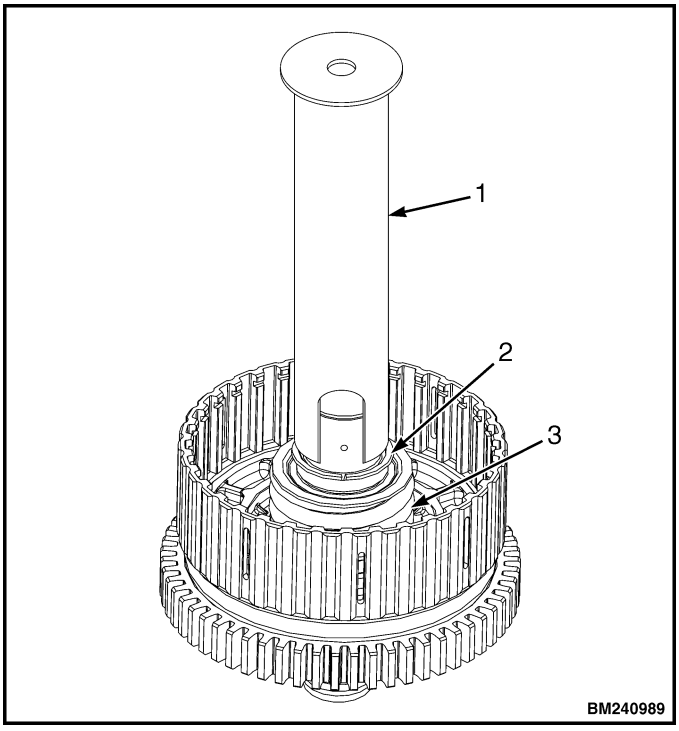
1. PLATE
2. GEAR ASSEMBLY DRUM

WARNING
The springs for the piston are compressed. Make sure the springs and spring retainer cannot cause injury when the snap ring is removed.

WARNING

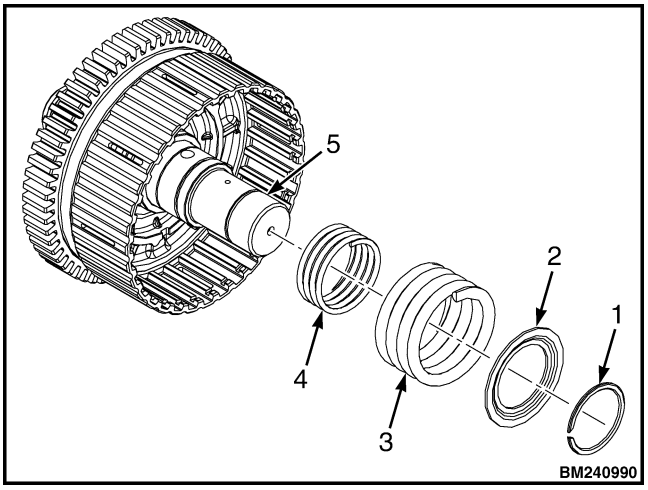
Use caution when removing the springs. Springs are held by compression and may become projectile when released. Make sure the springs and spring retainer cannot cause injury when the snap ring is removed.

STEP 8.
Using spring compression tool, Hyster P/N 867890 , and a press, place spring compression tool on spring guide with the opening of the tool above the opening of snap ring, and compress large and small springs just enough to allow removal of snap ring from spring guide. Slowly release the press to decompress springs.



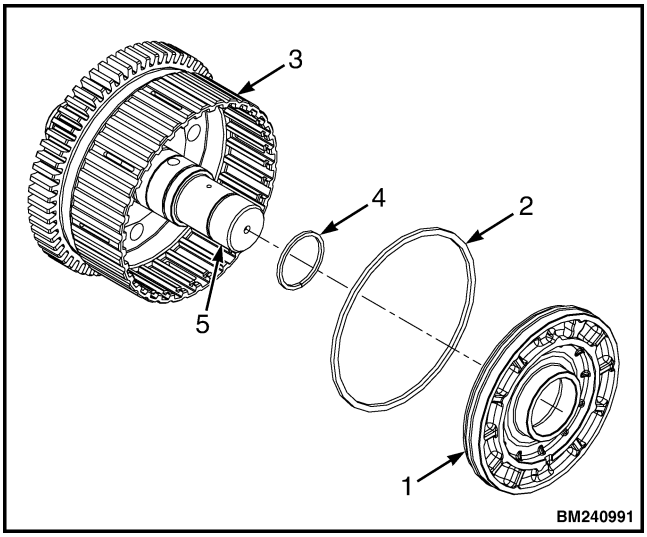
1. SPRING COMPRESSION TOOL
2. SNAP RING
3. SPRING GUIDE

STEP 9.
Remove snap ring, spring guide, large spring, and small spring from center shaft.



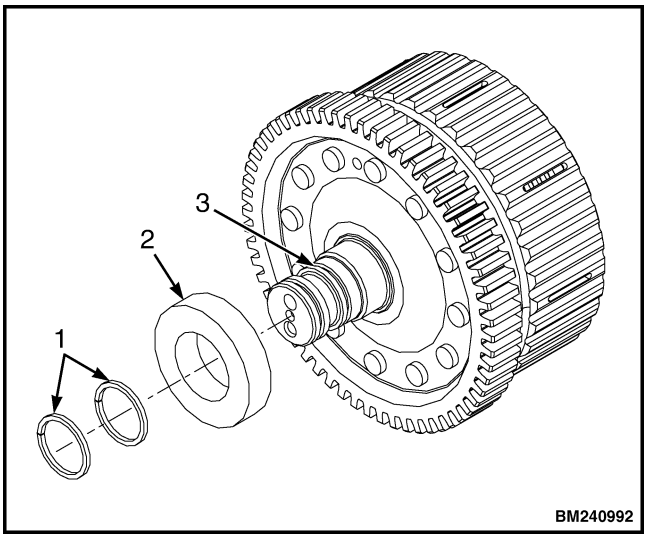
1. SNAP RING
2. SPRING GUIDE
3. LARGE SPRING
4. SMALL SPRING
5. CENTER SHAFT

STEP 10.
Remove piston from gear assembly drum. Remove and discard piston seal from piston. Remove and discard shaft seal from center shaft.



1. PISTON
2. PISTON SEAL
3. GEAR ASSEMBLY DRUM
4. SHAFT SEAL
5. CENTER SHAFT

STEP 11.
Remove shaft seals and bearing from center shaft. Discard shaft seals.



1. SHAFT SEAL
2. BEARING
3. CENTER SHAFT

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

1. Clean all metal parts with cleaning solvent and place on a lint-free cloth to dry. Ensure that the cleaning and assembly environment is free of dust, dirt, and any other foreign matter that would affect the performance of the parts.

Inspect

1. Inspect gear teeth on clutch assemblies and all other gears for wear or damage. Replace gears if damaged.

2. Check all parts that have splines for damage to splines. Check for notches worn in splines. Replace clutch pack or gears if damaged.

3. Inspect friction disks for burned lining or bent surfaces. Check for small holes in lining. Replace friction disks if one-half the depth of the oil grooves is worn away or the disks are damaged. Discard a friction disk that has a thickness less than 2.3 mm (0.09 in.).

4. The conical plate and separator plates must not be bent, have damaged surfaces, or have large blue areas from too much heat. If any of the above conditions exist, replace the damaged component.

5. Check the "H" dimensions of the conical plate as shown in Figure 103. If dimension is less than 3.2 mm (0.126 in.), replace conical plate.

6. Check the "t" dimension of the conical plate as shown in Figure 103. If dimension is less than 2.5 mm (0.098 in.), replace conical plate.

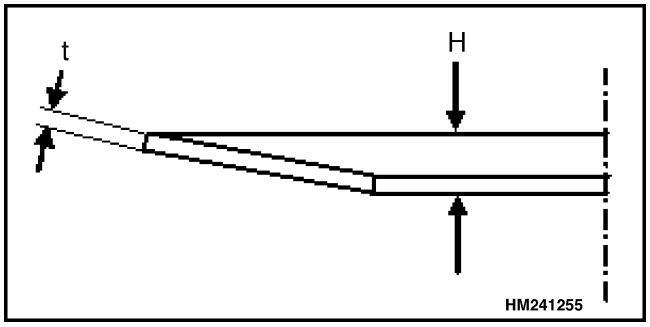


Figure 103. Conical Plate Inspection

7. Inspect bearings for wear or damage. Replace if damaged.

8. Inspect piston for damage. Make sure that sealing surfaces are good. Make sure orifice is clean.

9. Check for grooves or other damage on machined surfaces of clutch pack shafts and transmission housing. Check mounting and sealing surfaces in housing for damage. Replace housing if damaged. Replace clutch pack if clutch pack shaft is damaged.

10. Inspect all hardware and mounting surfaces for presence of rust, sealing compounds, and usable condition. If hardware is to be reused, clean all rust and sealing compounds from threaded areas. If hardware is not in usable condition, replace hardware.

CAUTION

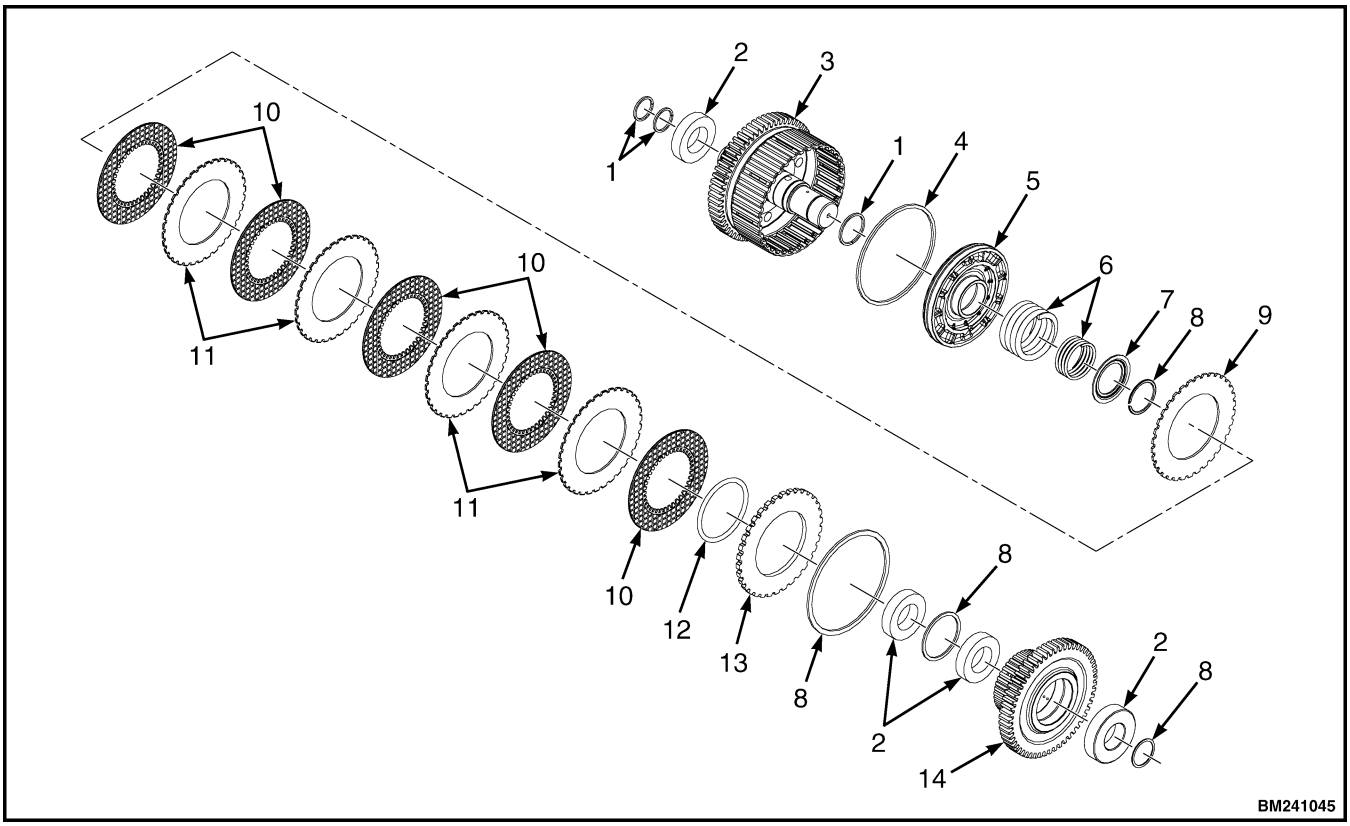
The dowel pins are used to properly align the housings for proper mating to each other. If the alignment is not correct, damage to the transmission assembly could occur.

11. Inspect dowel pins and dowel pin holes. If any dowel pin is damaged at all, replace the dowel pin. If a dowel pin hole is damaged, replace housing.

12. Check fit of bearings in transmission housings. If bearings fit too loosely into housings, this could mean that the bores are oversized. Replace housing as necessary.

Assemble

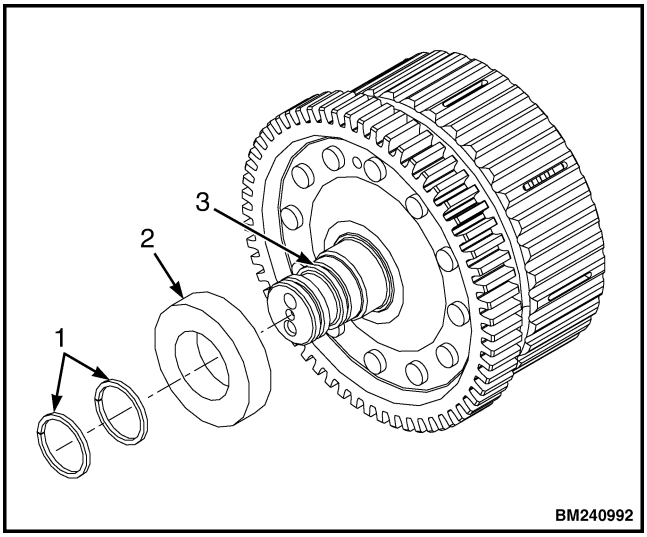
Reverse Clutch Pack



1. SEAL
2. BEARING
3. GEAR ASSEMBLY DRUM
4. PISTON SEAL
5. PISTON
6. SPRINGS
7. SPRING GUIDE
8. SNAP RING
9. CONICAL PLATE
10. FRICTION DISK
11. SEPARATOR PLATE
12. PRESSURE PLATE O-RING
13. PRESSURE PLATE
14. OUTPUT GEAR

Figure 104. Reverse Clutch Pack Assembly

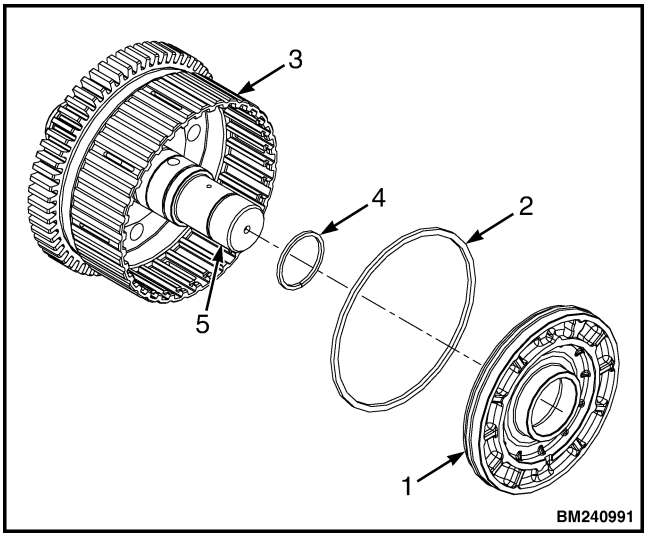
STEP 1.
Lubricate shaft seals with clean transmission oil. Install bearing and new shaft seals on center shaft.



1. SHAFT SEAL
2. BEARING
3. CENTER SHAFT

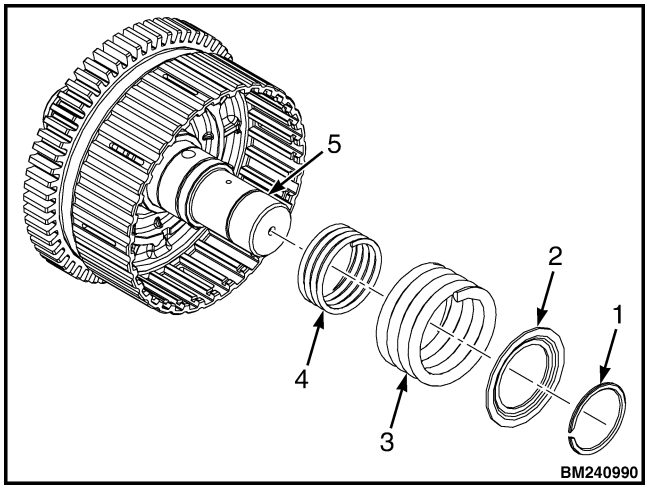
NOTE: Perform Step 2 through Step 4 only if piston was removed.

STEP 2.
Lubricate all parts with clean transmission oil. Install new shaft seal on center shaft. Install new piston seal on piston. Install piston into gear assembly drum.



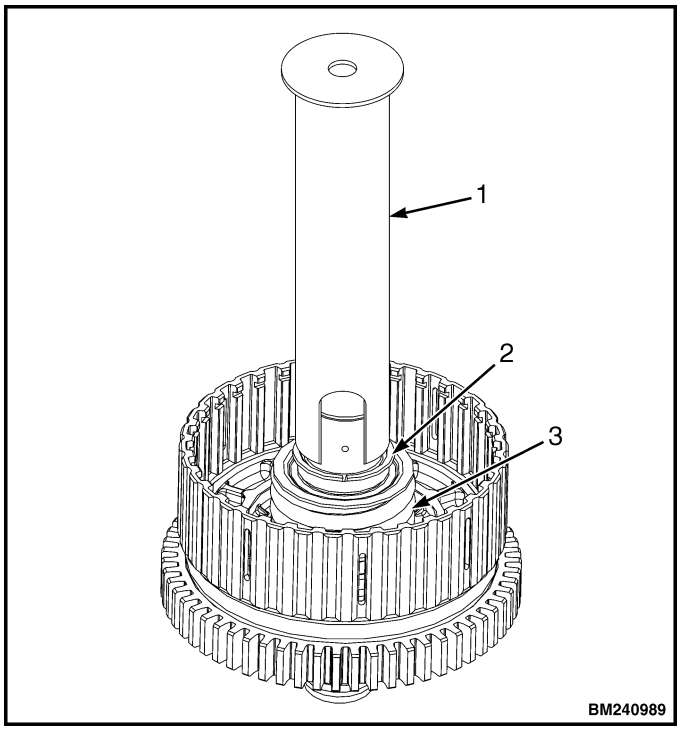
1. PISTON
2. PISTON SEAL
3. GEAR ASSEMBLY DRUM
4. SHAFT SEAL
5. CENTER SHAFT

STEP 3.
Install small spring, large spring, spring guide, and snap ring on center shaft.



1. SNAP RING
2. SPRING GUIDE
3. LARGE SPRING
4. SMALL SPRING
5. CENTER SHAFT

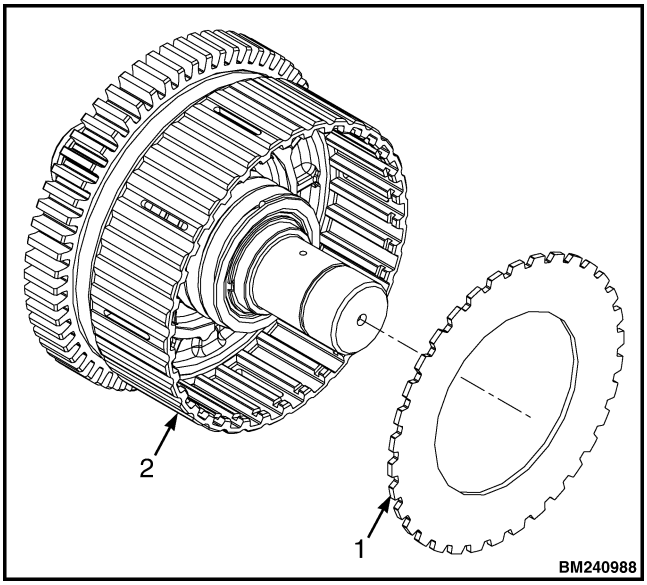
STEP 4.
Using spring compression tool, Hyster P/N 867890 , and a press, place spring compression tool on spring guide with the opening of tool above opening of snap ring, and compress the large and small springs just enough to allow installation of snap ring in spring guide. Slowly release press.



1. SPRING COMPRESSION TOOL
2. SNAP RING
3. SPRING GUIDE

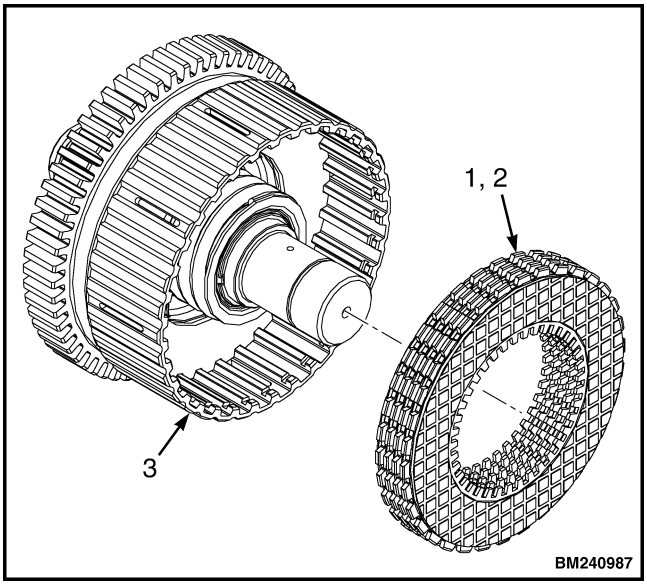
NOTE: The conical plate is properly installed when the inner diameter is touching the piston, and the outer diameter of the conical plate is touching the outer diameter of the friction disk.

STEP 5.
Install conical plate in gear assembly drum.



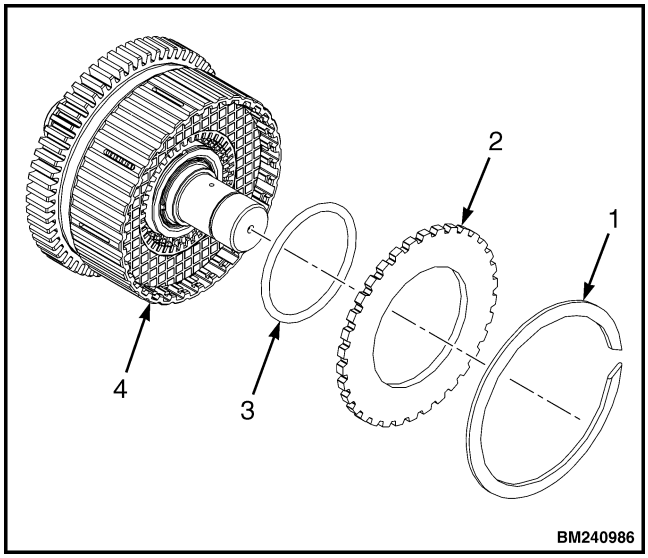
1. CONICAL PLATE
2. GEAR ASSEMBLY DRUM (REVERSE CLUTCH PACK)

STEP 6.
Install friction disks and separator plates alternately until all have been installed in gear assembly drum. See Figure 104 for installation order.



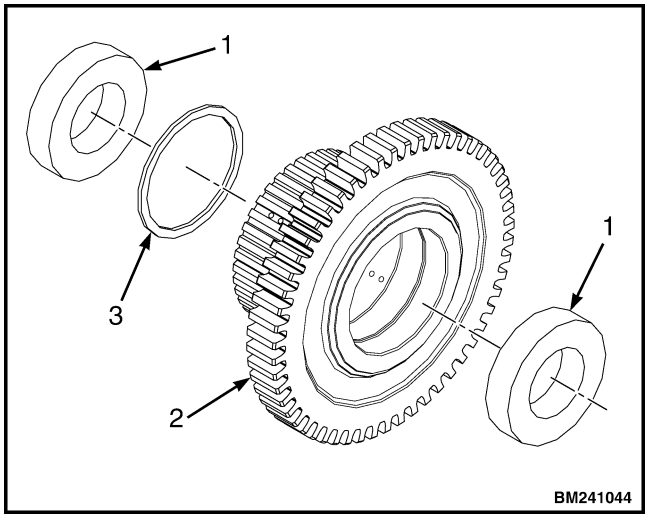
1. FRICTION DISK
2. SEPARATOR PLATE
3. GEAR ASSEMBLY DRUM

STEP 7.
Lubricate O-ring and install in pressure plate. Install pressure plate and snap ring in gear assembly drum. Using a dial indicator or feeler gauge, check the clearance between snap ring and pressure plate. There must be 1.8 ±0.2 mm (0.071 ±0.008 in.) of clearance. If clearance is not correct, see the **Parts Manual** for correct pressure plate.



1. SNAP RING
2. PRESSURE PLATE
3. O-RING
4. GEAR ASSEMBLY DRUM

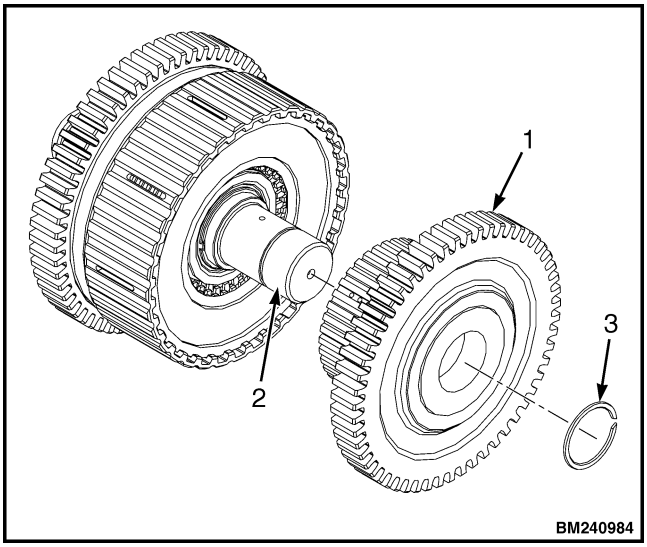
STEP 8.
Install bearing, snap ring, and bearing in output gear.



1. BEARING
2. OUTPUT GEAR
3. SNAP RING

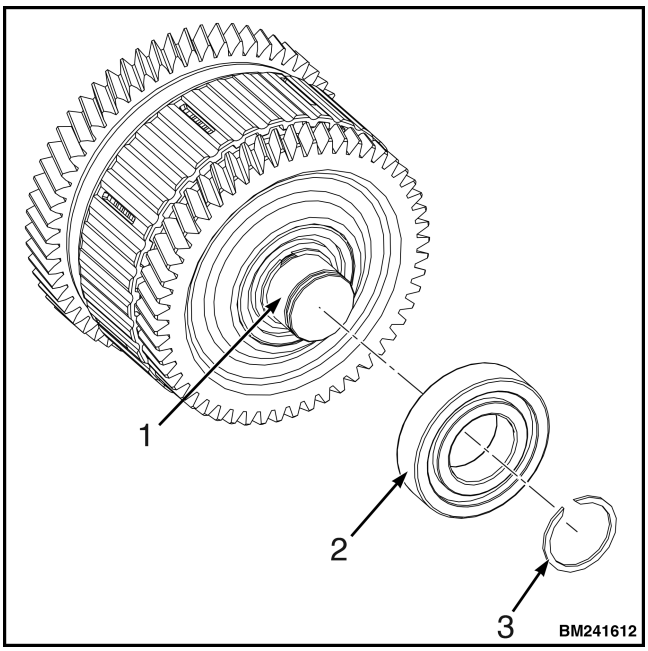
STEP 9.
Install output gear and snap ring on center shaft.

NOTE: Alignment tool is needed for disk alignment.



1. OUTPUT GEAR
2. CENTER SHAFT
3. SNAP RING

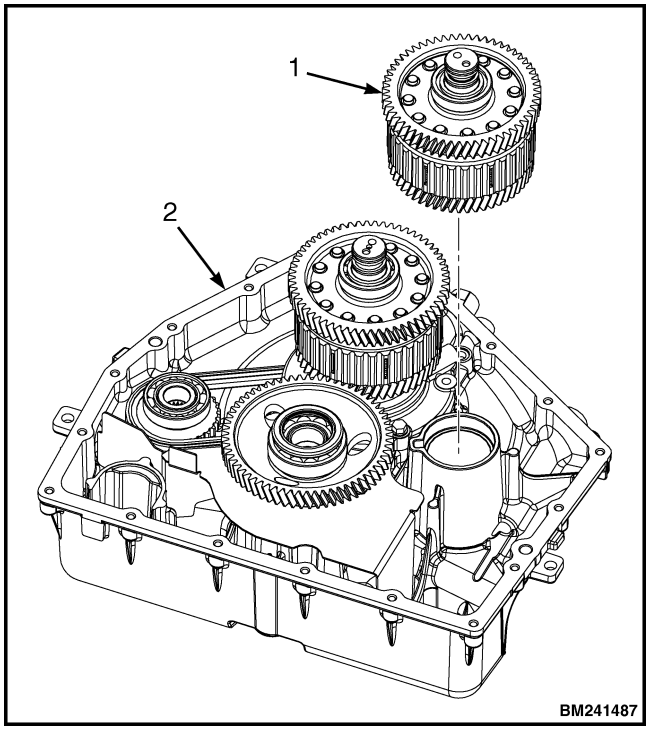
STEP 10.
Install bearing and snap ring on center shaft.



1. CENTER SHAFT
2. BEARING
3. SNAP RING

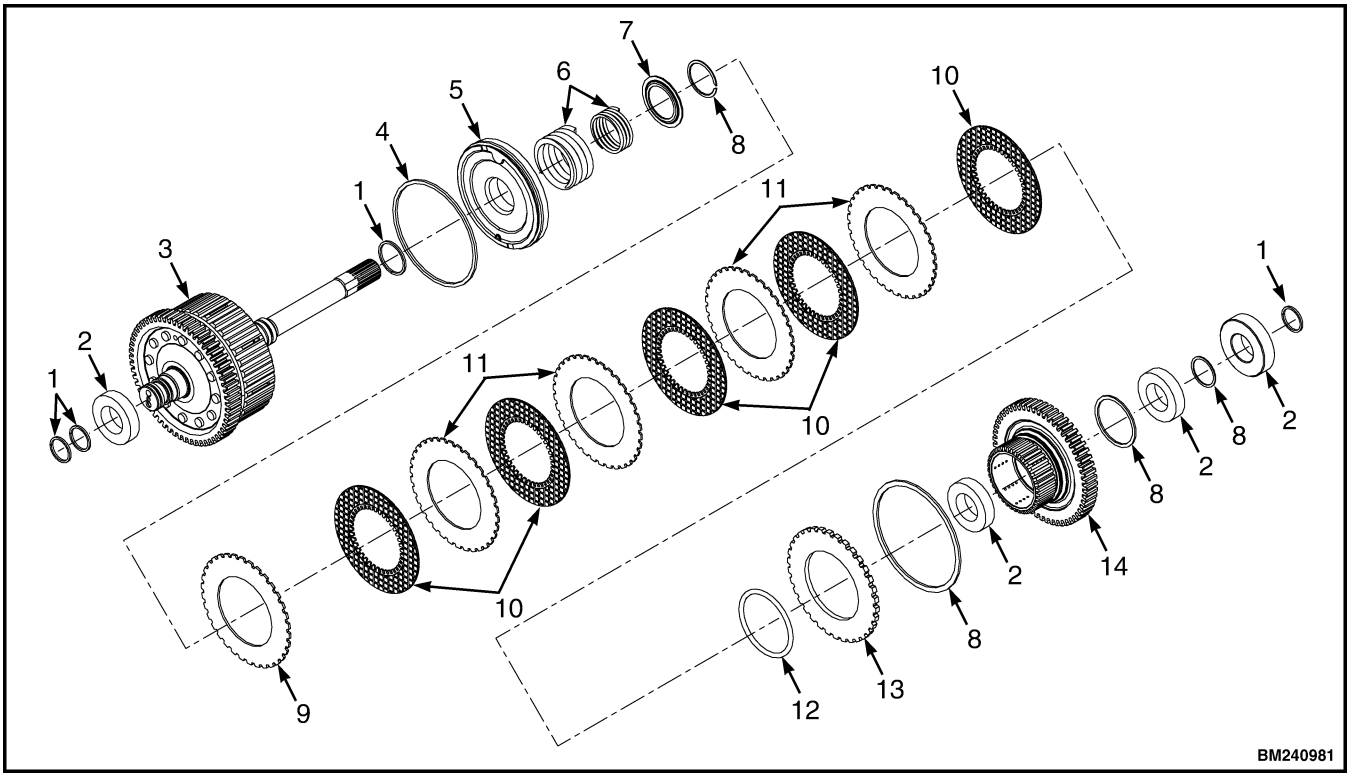
NOTE: Make sure output gear is installed before clutch pack installation.

STEP 11.
Torque converter housing to be face down on a bench or work surface as shown. Install reverse clutch assembly straight into converter housing.



1. REVERSE CLUTCH ASSEMBLY
2. CONVERTER HOUSING

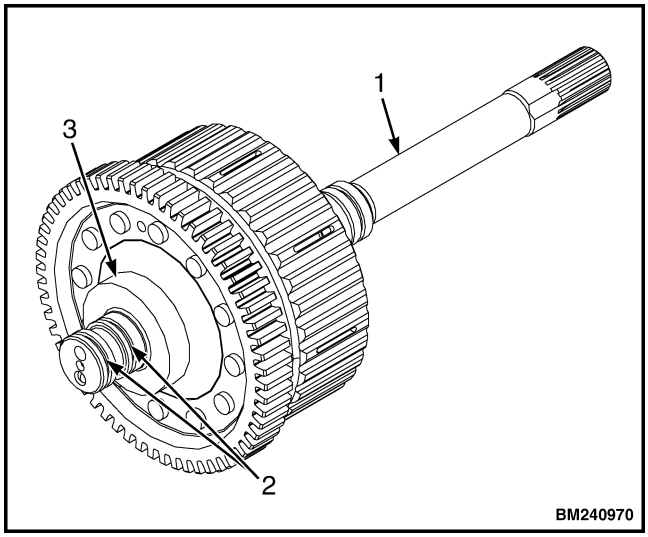
Forward Clutch Pack



1. SEAL
2. BEARING
3. GEAR ASSEMBLY DRUM
4. PISTON SEAL
5. PISTONS
6. SPRING
7. SPRING GUIDE
8. SNAP RING
9. CONICAL PLATE
10. FRICTION DISK
11. SEPARATOR PLATE
12. PRESSURE PLATE O-RING
13. PRESSURE PLATE
14. OUTPUT GEAR

Figure 105. Forward Clutch Pack Assembly

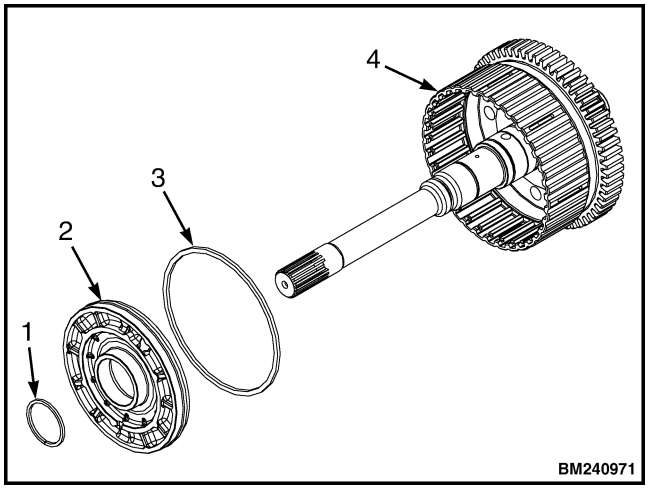
STEP 1.
Lubricate shaft seals with clean transmission oil. Install bearing and shaft seals on input shaft.



1. INPUT SHAFT
2. SHAFT SEAL
3. BEARING

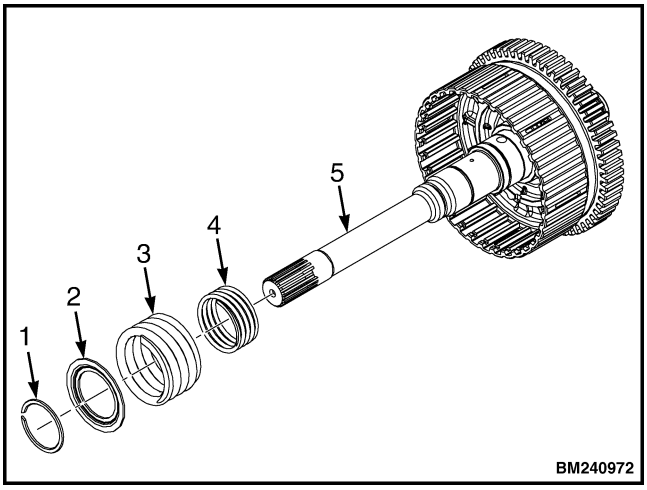
NOTE: Perform Step 2 through Step 4 only if piston was removed.

STEP 2.
Lubricate all parts with clean transmission oil. Install new piston seal on piston. Install piston and new shaft seal into gear assembly drum.



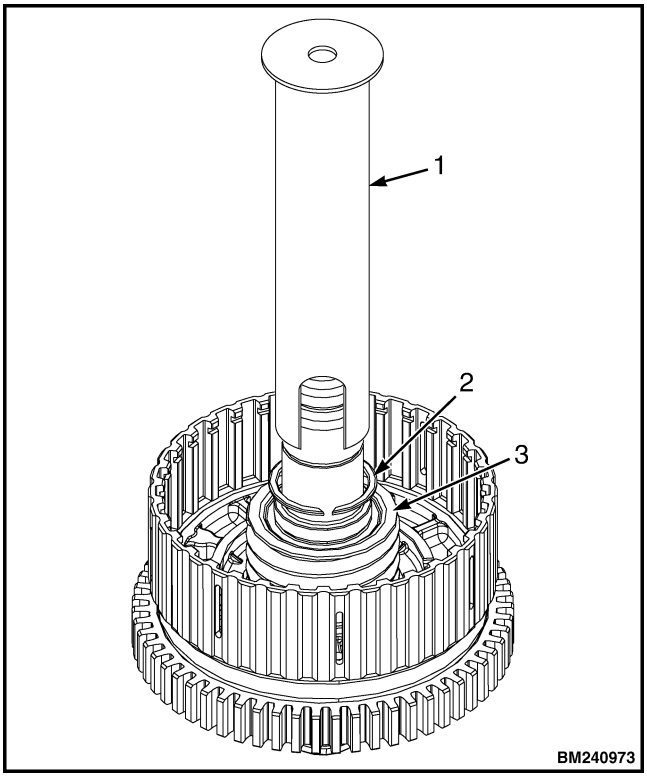
1. SHAFT SEAL
2. PISTON
3. PISTON SEAL
4. GEAR ASSEMBLY DRUM

STEP 3.
Install small spring, large spring, spring guide, and snap ring on input shaft.



1. SNAP RING
2. SPRING GUIDE
3. LARGE SPRING
4. SMALL SPRING
5. INPUT SHAFT

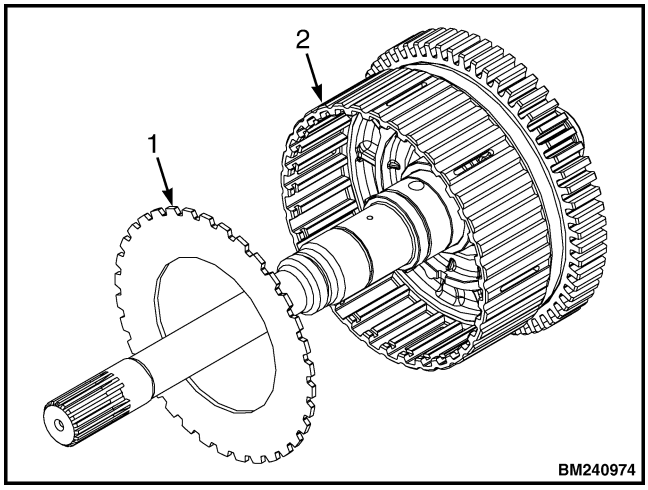
STEP 4.
Using spring compression tool, Hyster P/N 867890 , and a press, place spring compression tool on spring guide with the opening of the tool above opening of snap ring, and compress the large and small springs just enough to allow installation of snap ring in spring guide. Slowly release press.



1. SPRING COMPRESSION TOOL
2. SNAP RING
3. SPRING GUIDE

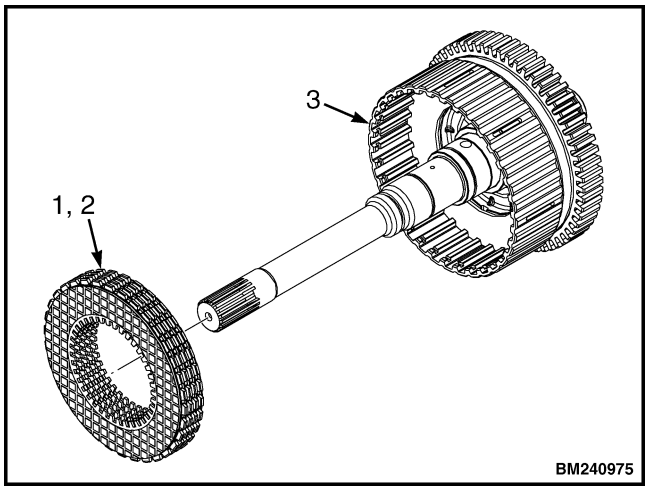
NOTE: The conical plate is properly installed when the inner diameter is touching the piston, and the outer diameter of the conical plate is touching the outer diameter of the friction disk.

STEP 5.
Install conical plate in gear assembly drum.



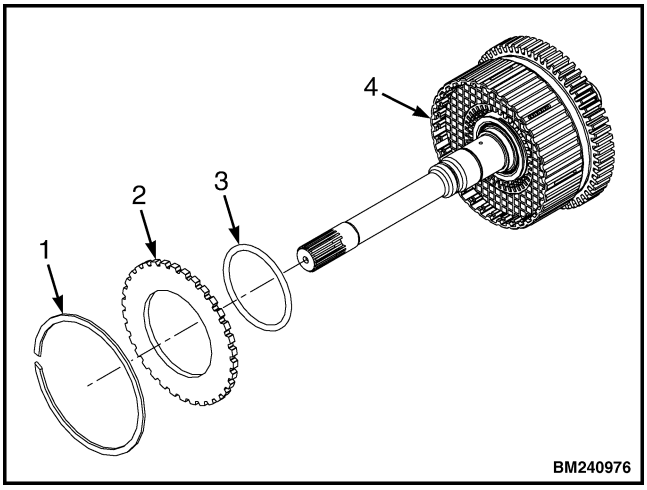
1. CONICAL PLATE
2. GEAR ASSEMBLY DRUM (REVERSE CLUTCH PACK)

STEP 6.
Install friction disks and separator plates alternately until all have been installed in gear assembly drum. See Figure 105 for installation order.



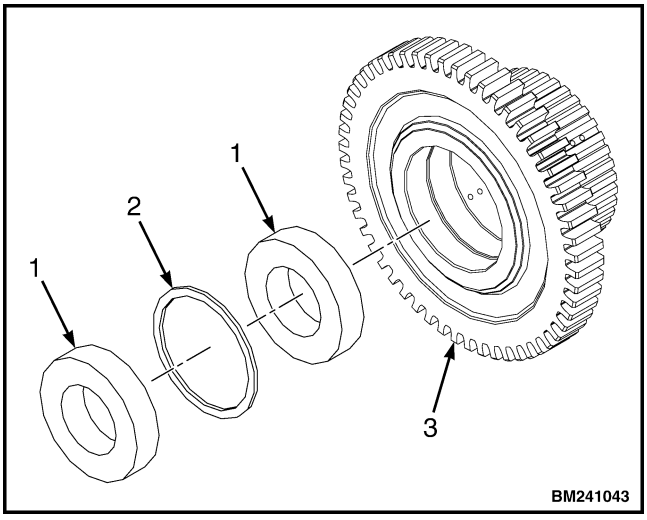
1. FRICTION DISK
2. SEPARATOR PLATE
3. GEAR ASSEMBLY DRUM

STEP 7.
Lubricate O-ring and install into pressure plate. Install pressure plate and snap ring into gear assembly drum. Using a dial indicator or feeler gauge, check the clearance between snap ring and pressure plate. There must be 1.8 ±0.2 mm (0.071 ±0.008 in.) of clearance. If clearance is not correct, see **Parts Manual** for correct pressure plate.



1. SNAP RING
2. PRESSURE PLATE
3. O-RING
4. GEAR ASSEMBLY DRUM

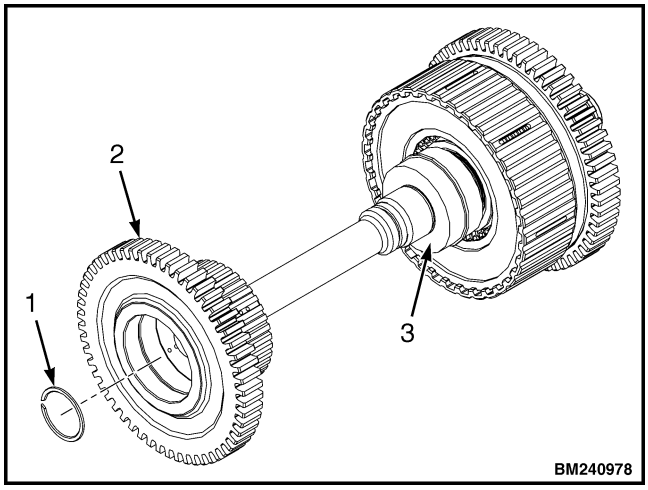
STEP 8.
Install bearing, snap ring, and bearing into output gear.



1. BEARING
2. SNAP RING
3. OUTPUT GEAR

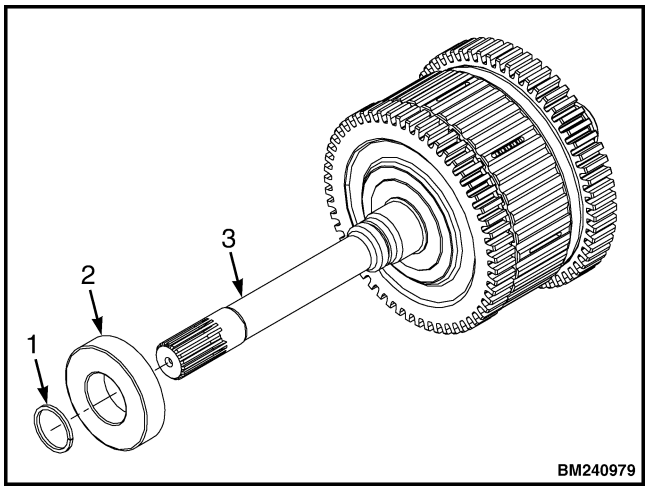
STEP 9.
Install output gear and snap ring on input shaft.

NOTE: Alignment tool is needed for disk alignment.



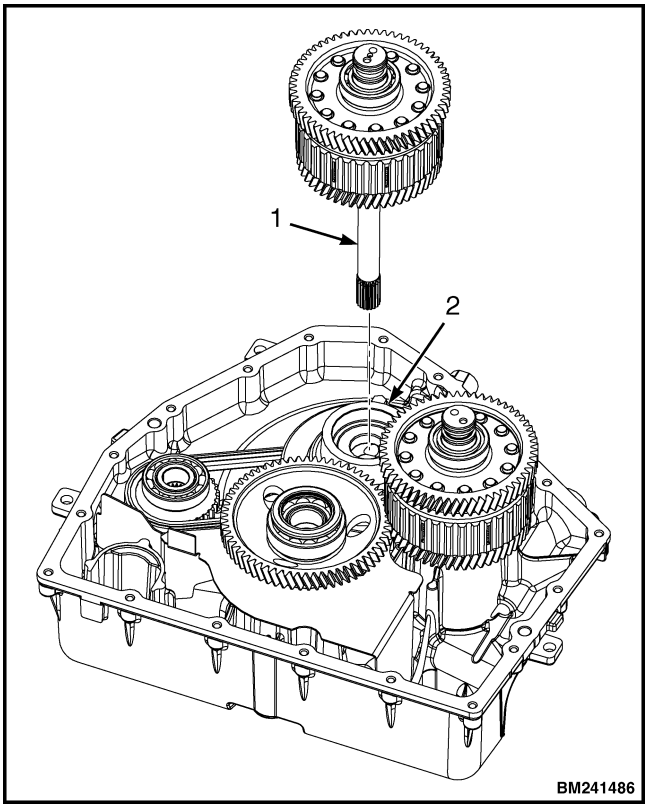
1. SNAP RING
2. OUTPUT GEAR
3. BEARING

STEP 10.
Lubricate new shaft seal with clean transmission oil. Install bearing and shaft seal on input shaft.



1. SHAFT SEAL
2. BEARING
3. INPUT SHAFT

STEP 11.
Torque converter housing to be face down on a bench or work surface as shown. Install forward clutch assembly straight into stator support assembly.



1. FORWARD CLUTCH ASSEMBLY
2. STATOR SUPPORT ASSEMBLY

Stator support assembly

1. Remove the pump.

- If your truck is equipped with a hydraulic gear pump, remove the two flange head capscrews retaining the hydraulic gear pump to the transmission housing. See Figure 85.
- If your truck is equipped with a VDP, remove the two flange head capscrews retaining the VDP to the transmission housing. See Figure 86.

2. Remove the charge pump. See Remove transmission, Charge pump remove.

3. Remove the torque converter. See Remove transmission.

4. Remove the forward and reverse clutch packs. See Remove transmission, Clutch packs.

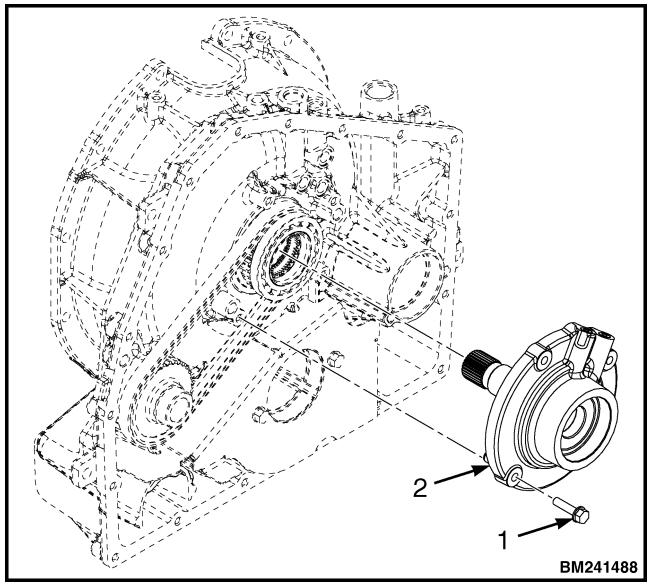
5. Remove output gear. See Disassemble.

.

6. Remove the four capscrews retaining the stator support assembly to the torque converter housing. See Figure 106.

NOTE: Be careful when removing the stator support, as input gear my hang up.

7. Remove the stator support assembly from the input gear. See Figure 106.



1. CAPSCREW
2. STATOR SUPPORT ASSEMBLY

Figure 106. Stator support assembly

8. Remove and discard the sealing ring from stator support assembly. See Figure 107.

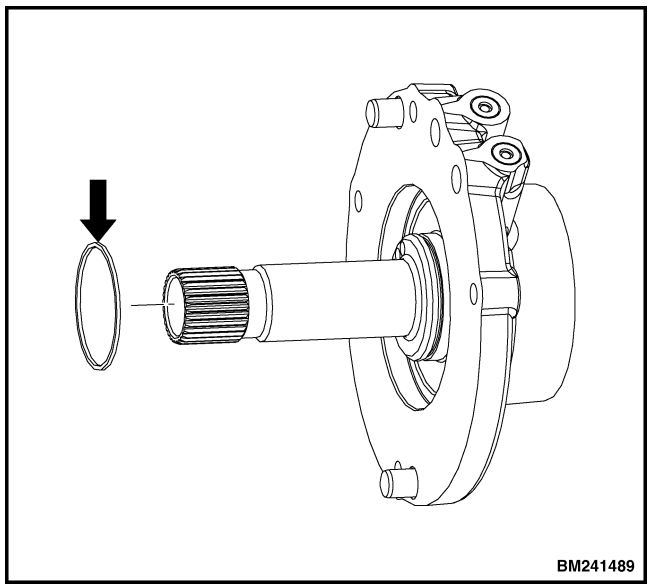


Figure 107. Stator seal ring

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

CAUTION

DO NOT allow cleaning solvent to come in contact with rubber or plastic components as it can damage those components.

WARNING

Compressed air can move particles and make them become airborne, which may cause injury. Make sure the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent eye injury.

1. Clean metal components with solvent and dry with compressed air.

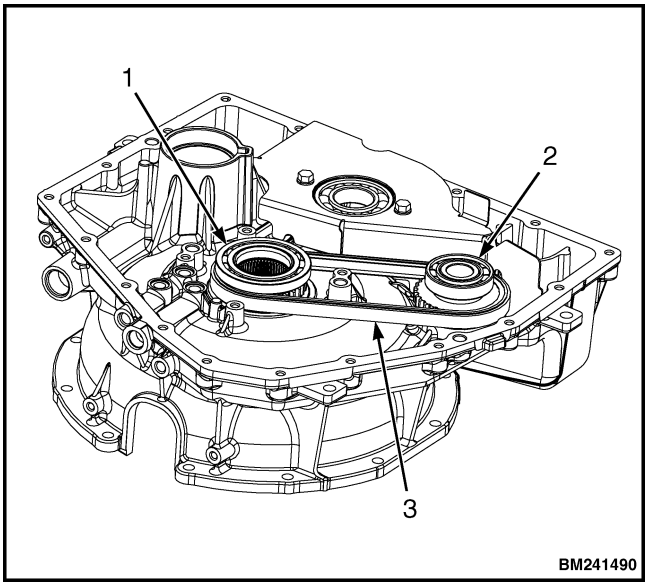
2. Clean rubber or plastic components with warm soapy water and dry with a lint free cloth.

Drive chains and sprockets

1. Remove clutch packs and stator support. See **Remove**, Clutch packs and **Remove**, Stator support assembly of this manual.

NOTE: Take note of placement and orientation of components during removal to aid in installation.

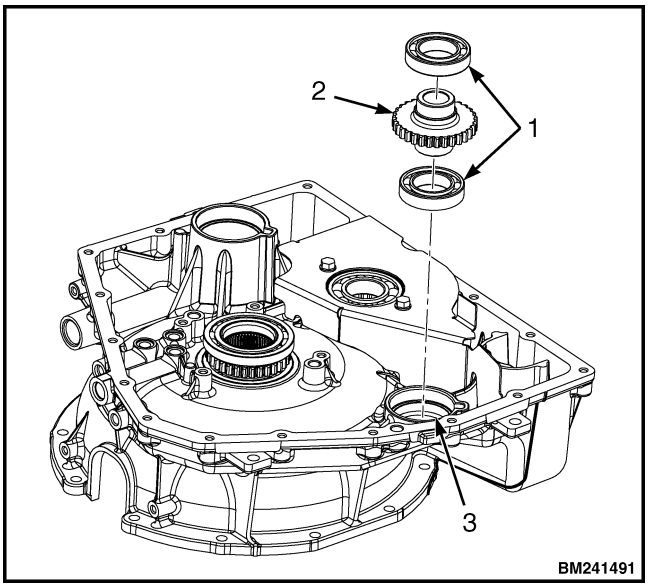
2. Remove the drive chain from drive sprocket and driven sprocket assemblies. See Figure 108.



1. DRIVE SPROCKET ASSEMBLY
2. LOWER DRIVEN SPROCKET ASSEMBLY
3. DRIVE CHAIN

Figure 108. Drive Chain

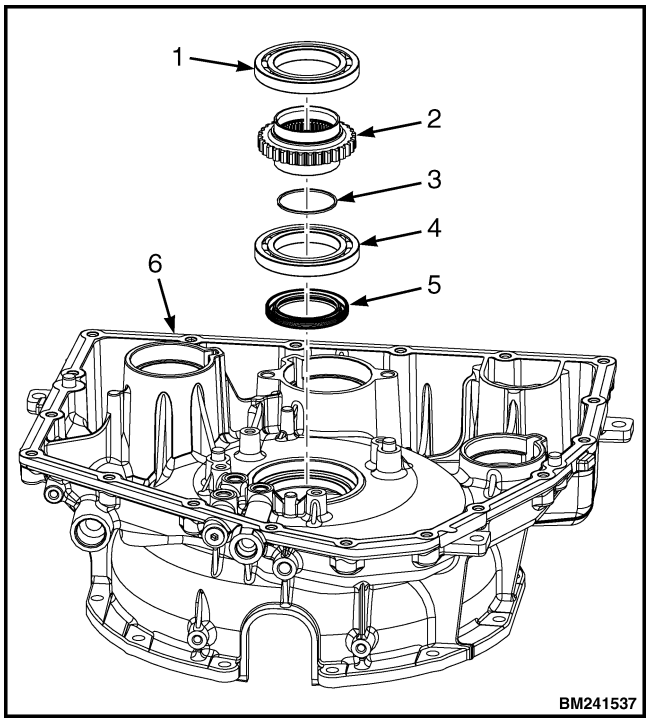
3. Remove the driven sprocket assembly from the torque converter housing. See Figure 109.



1. BEARING
2. DRIVEN SPROCKET
3. TORQUE CONVERTER HOUSING

Figure 109. Driven sprocket assembly

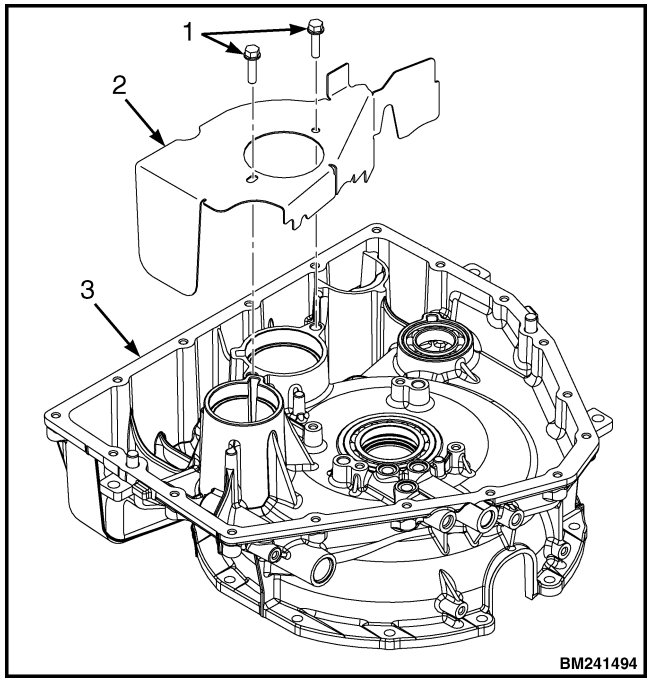
4. Remove two bearings, driving sprocket, PTFE ring seal, and transmission seal from the torque converter housing. See Figure 110.



1. BEARING
2. DRIVING SPROCKET
3. PTFE RING SEAL
4. BEARING
5. TRANSMISSION SEAL
6. TORQUE CONVERTER HOUSING

Figure 110. Driving Sprocket Assembly

5. If necessary, remove the two capscrews and baffle plate from the torque converter housing. See Figure 111.



1. CAPSCREW
2. BAFFLE PLATE
3. TORQUE CONVERTER HOUSING

Figure 111. Baffle Plate

Clean

1. Inspect bearings for wear or damage. Replace if damaged.

2. Inspect sprocket teeth for wear or breakage. Replace if worn or broken.

3. Check fit of bearings in converter housing. If bearings fit too loosely, housing bores, may be oversized. Replace housings as necessary.

INSTALL TRANSMISSION

Drive chains and sprockets

1. If removed, install baffle plate and two capscrews. See Figure 111. Tighten capscrews to 19 to 25 N•m (14.01 to 18.44 lbf ft).

2. Install new transmission seal on torque converter housing. See Figure 110.

3. Install stator support and clutch packs. See **Install**, Stator support assembly and **Install**, of this manual.

Stator support assembly

1. Install new sealing ring on the stator support assembly. See Figure 107.

2. Install stator support assembly and four capscrews onto input gear. See Figure 106.

3. Follow the instructions below to tighten the capscrews in the sequence as shown in: Figure 112.

a. First pass - Torque to 18 to 20 N•m (13.3 to 14.6 lbf ft).

b. Second pass - Torque to 24 to 26 N•m (17.7 to 19.2 lbf ft).

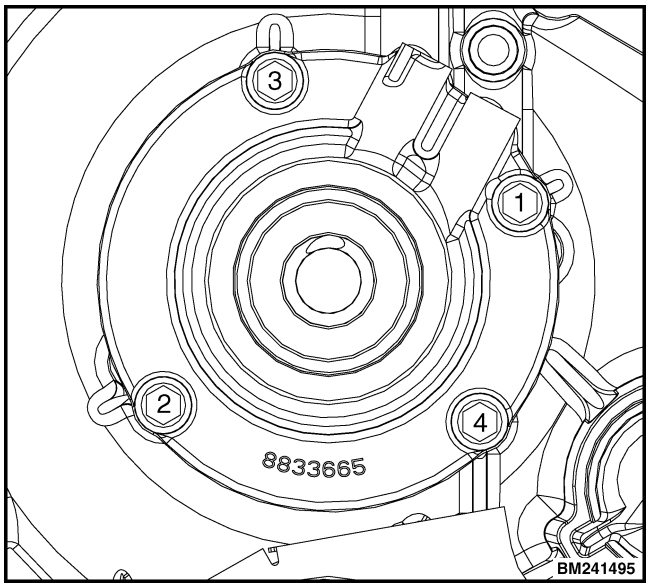


Figure 112. Stator support capscrews tightening sequence

Clutch pack assemblies

1. Install stator support assembly and tighten capscrews. See **Install**, Stator support assembly.

2. Push reverse clutch assembly straight into converter housing. See Reverse Clutch Pack.

3. Push forward clutch assembly straight into stator support assembly. See Forward Clutch Pack.

4. Install new gasket on torque converter housing. See Figure 101.

5. Install O-ring.

NOTE: Ensure torque converter housing is seated before installing capscrews. Do not use hardware to seat torque converter housing

6. Install transmission housing on torque converter housing. Install 18 flange bolts to attach transmission housing and converter housing.

7. Follow the instructions below to tighten the flange bolts in the sequence as shown in: Figure 113.
   a. First pass - Torque to 16 N•m (11.8 lbf ft).
   b. Second pass - Torque to 22 N•m (16.2 lbf ft).

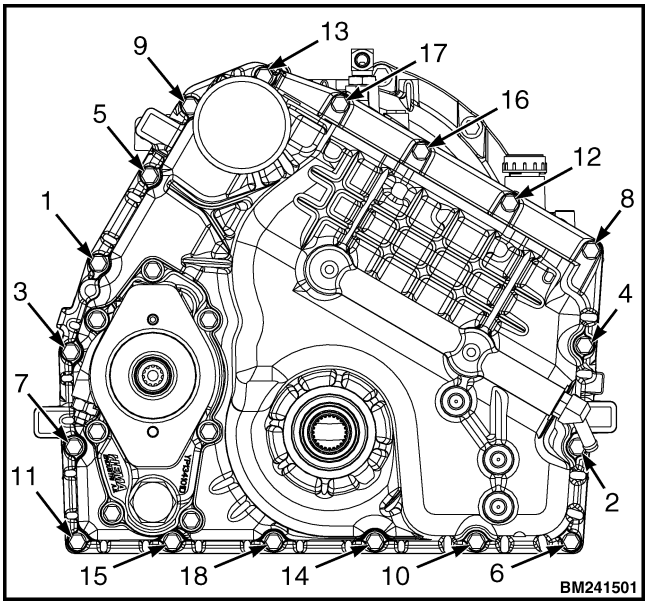


Figure 113. Transmission housing torque sequence

Control Valve

Assemble

NOTE: Ensure all surfaces are clean and free of loose debris.

Solenoids (Forward, Reverse, and Enable)

1. Install two cap screws to secure solenoid to transmission control valve. See Figure 99.

   a. For Forward and Reverse solenoids, torque cap screws to 2.7 ±0.7 N•m (2.0 ±0.5 lbf ft).

   b. For Enable solenoid, torque cap screws to 4.0 ±0.4 N•m (3.0 ±0.3 lbf ft).

Temperature and Pressure Sensors (Forward and Reverse)

1. Install sensor to transmission control valve. Torque sensor to 20.3 ±2.0 N•m (15.0 ±1.5 lbf ft).

Speed Sensors (TISS and TOSS)

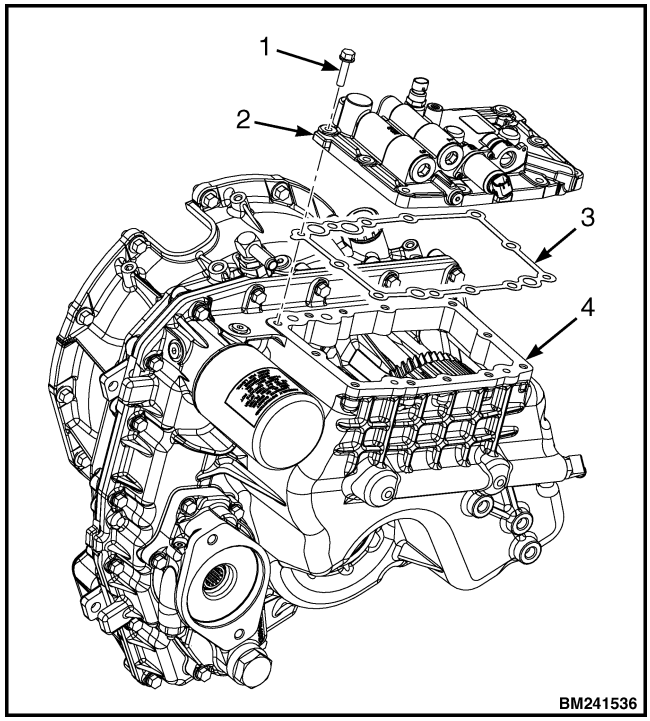
1. Install one cap screw to secure speed sensor to transmission control valve. Torque cap screw to 9.0 ±0.9 N•m (6.6 ±0.7 lbf ft).

Install

NOTE: The control valve capscrews will be torqued in sequence in two passes with different torque values.

1. Install new gasket and control valve on transmission housing. See Figure 114.

2. Align the holes in the gasket with the holes in the transmission and the control valve. See Figure 114.



NOTE: POWERSHIFT 1-SPEED TRANSMISSION OPTION IS SHOWN. DURAMATCH TRANSMISSION OPTION WILL BE SIMILAR.

1. CAPSCREW
2. CONTROL VALVE
3. GASKET
4. TRANSMISSION HOUSING

Figure 114. Control valve

3. Insert capscrews 11 and 12 to secure the control valve in position and tighten by hand. See Figure 115.

4. Install the remaining capscrews and tighten by hand.

5. Torque all capscrews.

a. First pass - Torque to 18 N•m (13.3 lbf ft) to 20 N•m (14.8 lbf ft).

b. Second pass - Torque to 24 N•m (17.8 lbf ft) to 26 N•m (19.2 lbf ft).

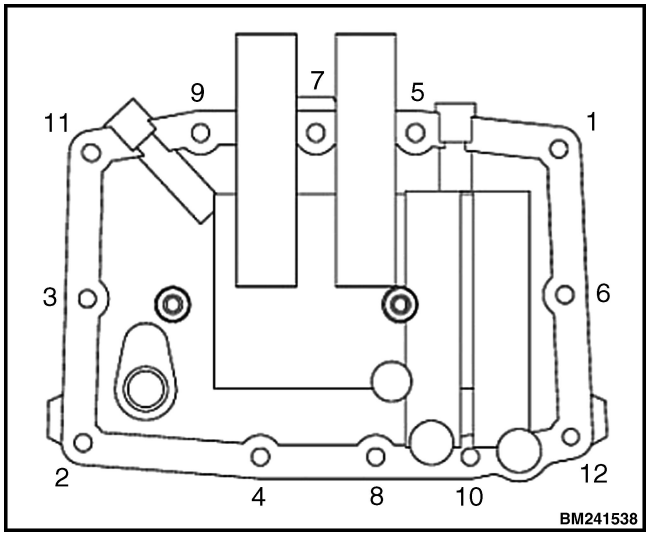
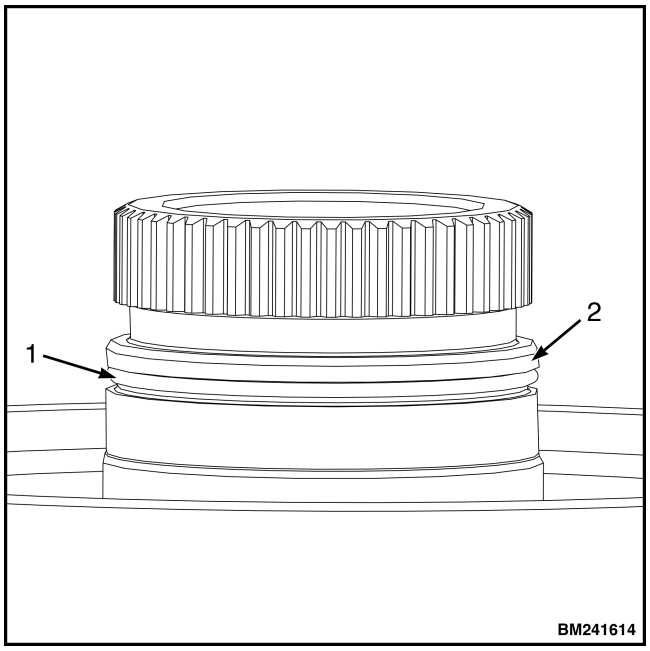


Figure 115. Torque sequence

Torque converter

1. Lubricate the impeller hub seal and carefully install seal onto impeller hub ensuring not to damage seal on splines. See Figure 116.

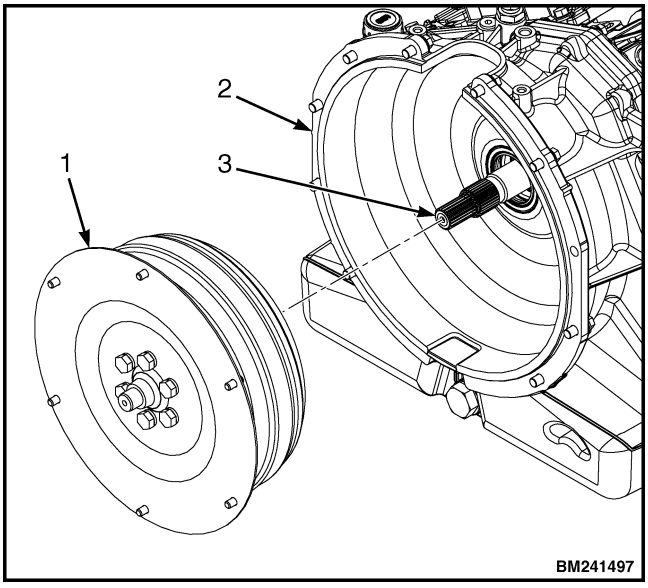


1. IMPELLER HUB SEAL
2. IMPELLER HUB

Figure 116. Impeller hub seal

NOTE: Flex plate is fully seated when 20 mm (0.79 in.) from flange.

2. Carefully install the torque converter on the stator support in the torque converter housing. Confirm the torque converter is fully seated by gently pressing against flex plate until it is almost completely inside the torque converter housing.



1. TORQUE CONVERTER
2. TORQUE CONVERTER HOUSING
3. STATOR

Figure 117. Torque converter and stator

Transmission filter

1. Install the filter post fitting to the transmission housing (only if housing was removed). See Figure 97.

2. Coat the gasket located on the top of the transmission oil filter with a light coat of transmission oil. Install transmission oil filter on the transmission oil filter head, by hand, until the gasket fully contacts the transmission oil filter head and then tighten ½ to ¾ turn more.

3. Install the transmission filter to the transmission housing. See Figure 97.

Charge pump install

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

1. Install the suction screen and suction screen spring into the transmission housing. See Figure 96.

2. Inspect the three O-rings.

3. Align the charge pump in place on the transmission housing. See Figure 96.

4. Insert the seven capscrews to retain the charge pump on the transmission housing. See Figure 96.

5. Follow the instructions below to tighten the capscrews in the sequence as shown in: Figure 118.
   a. First pass - Torque to 18 to 20 N•m (13.3 to 14.6 lbf ft).
   b. Second pass - Torque to 24 to 26 N•m (17.7 to 19.2 lbf ft).

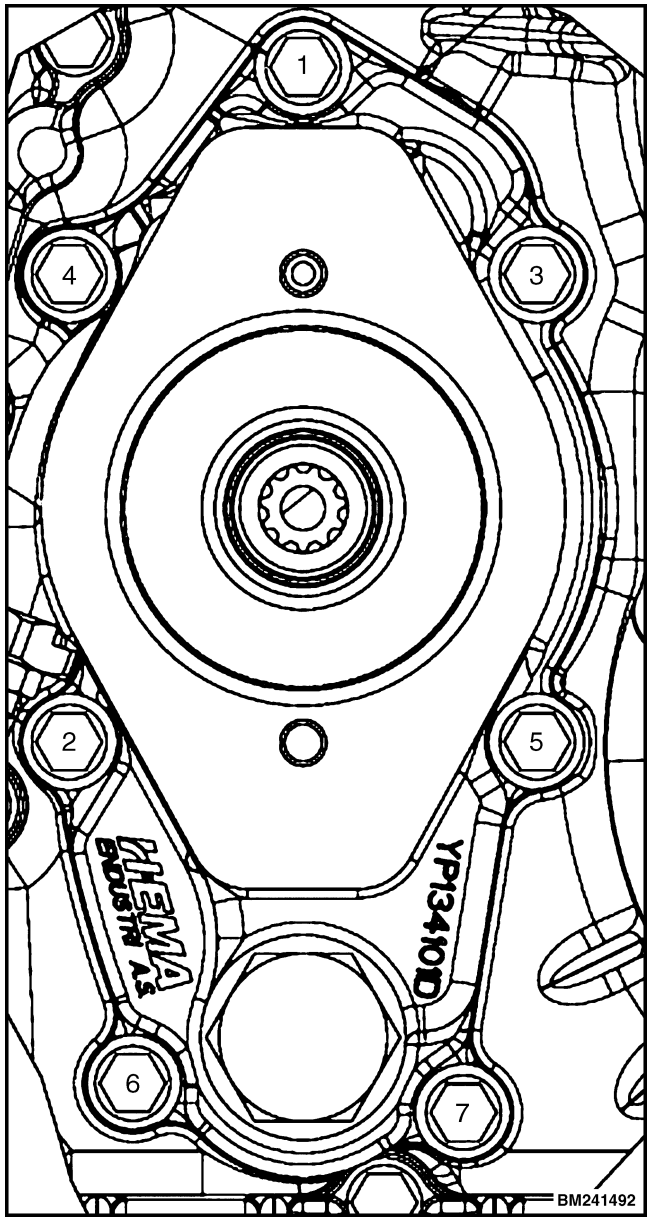


Figure 118. Charge bolt tightening sequence

Install transmission

1. Before installing the transmission, confirm that the drain plug is installed and properly torqued. See Figure 81.

2. Carefully lower the transmission assembly into the truck. Take care to not damage any of the wire harnesses or hoses. Make sure the torque converter is aligned with the flywheel on the engine. See Figure 95.

3. Use the torque converter screw access port, and insert the capscrews to attach the torque converter. See Figure 89.

4. Apply Loctite® 242 to the capscrew threads installed on torque converter housing, tighten to snug all around before final torque.

5. Rotate the torque converter to access each of the six capscrews. See Figure 89. Use an angled socket and wrench to tighten each of the capscrews. Torque to
32 to 36 N•m (23.6 to 26.6 lbf ft).

6. Align the ten holes on the torque converter housing of the transmission assembly with the ten holes on the engine. See Figure 95.

7. Insert the eight top capscrews (3, Figure 95) to attach the torque converter housing of the transmission assembly to the engine. Tighten the capscrews to
41 to 49 N•m (30.2 to 36.1 lbf ft).

8. While continuing to support the transmission assembly with the overhead lifting device, place wood blocks or works stands beneath the transmission assembly at the surface where the two halves of the transmission assembly meet.

NOTE: Use of torque wrench with 2" torque adapter (dogbone) along with ~12mm (or slightly longer) extension needed to allow clearance of back of transmission. See Tool for tool specifications.

9. Using torque wrench and adapter, install the two bottom capscrews (item 6, Figure 95) to attach the torque converter housing of the transmission assembly to the engine. See Figure 93. Torque the capscrews to
41 to 49 N•m (30.2 to 36.1 lbf ft).

10. Insert the four bolts through the left hand engine mount and into the transmission. Torque the bolts to
101 to 105 N•m (74 to 77 lbf ft). Repeat for the right hand engine mount.

11. Remove lifting device from eye bolt and remove the eye bolt.

12. Install the ECU. See **Electrical, software, and controls** 2200SRM2304.

13. Insert the eight bolts to attach the drive shaft to the transmission and drive axle. See Figure 87.

NOTE: Apply a 3 to 5 mm (0.12 to 0.20 in.) bead of sealant Hyster p/n 264159 to either the hydraulic gear pump/VDP or transmission housing face at insertion point of flange head capscrews.

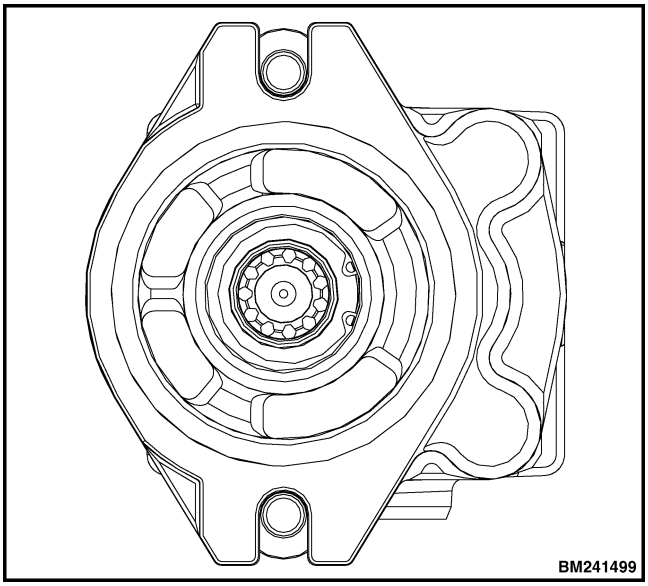


Figure 119. Pump sealant

a. If your truck is equipped with a hydraulic gear pump, install the hydraulic gear pump to the transmission housing and insert the two flange head capscrews to retain the pump. See Figure 85. Tighten to standard torque.

14. Remove the strap supporting the engine.

- If your truck is equipped with a hydraulic gear pump, connect the hose to the hydraulic gear pump. See Figure 85.
- If your truck is equipped with a VDP, connect all hoses to the VDP. See Figure 86.

15. Connect the two cooling lines to the transmission. See Figure 82.

16. If your truck is equipped with wet brake option, connect the park brake hoses. See Figure 83 and Figure 84.

17. Connect the brake pedal to the linkage. See Pedals and linkage repair in **Operator's Cab** 0100SRM2298.

18. Install the kick panel and dash. See **Frame and Main Components** 8000SRM2306.

19. Connect the park brake cables to the park brake assembly. See Figure 80.

20. Install the transmission access plate and insert the two capscrews to retain the access plate to the transmission housing. See Figure 79. Tighten to standard torque.

21. Install the PDM and horn. See **Electrical, software, and controls** 2200SRM2304.

22. Connect the electrical connectors to the park brake.

- For lift trucks equipped with dry brake option, see Figure 76.
- For lift trucks equipped with wet brake option, see Figure 77.

23. Connect the electrical connector to the transmission. See Figure 78

24. Install the crossbar. See Overhead guard and cab repair in **Operator's Cab** 0100SRM2298.

25. Install the floor plate with the throttle pedal attached. See **Frame and Main Components** 8000SRM2306. Install the floormat.

26. Install the hood. See Covers repair, in **Frame and Main Components** 8000SRM2306.

27. Connect the seat connector. See Seat repair-Full Suspension in **Operator's Cab** 0100SRM2298.

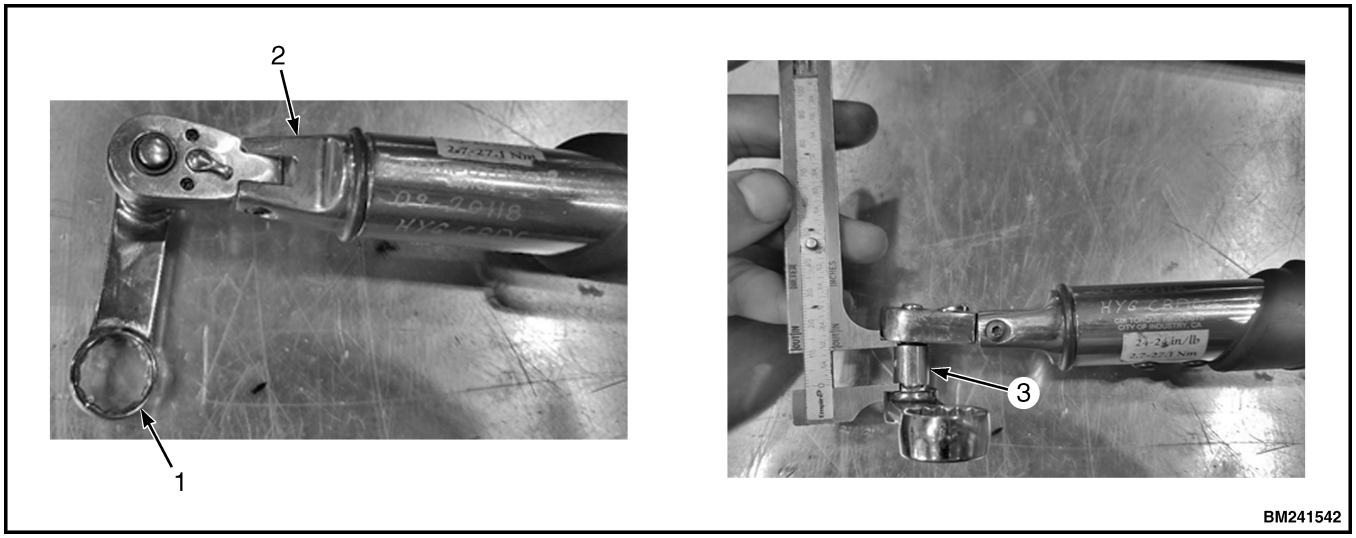
28. Connect the battery. See **Electrical, software, and controls** 2200SRM2304.

29. Fill the transmission with transmission oil as described in **Periodic Maintenance** 8000SRM2305.

TOOL



Figure 120. Drive Torque Adapter (Dogbone)



1. DOGBONE
2. TORQUE WRENCH
3. EXTENSION ~ 12MM

Figure 121. Torque Wrench, 2" Dogbone, and Extension

CALIBRATION

Any time the forward or reverse solenoid is replaced it must then be calibrated. See Transmission calibration (Basic) in **Electrical, software, and controls** 2200SRM2304.

HYDROSTATIC TRANSMISSION (HST) REMOVAL AND REPLACEMENT 202001-056

PREPARE

1. Before beginning any work on components under the hood, ensure the exterior of the truck has been thouroughly cleaned to avoid any contamination. See How to clean a lift truck in **Periodic Maintenance** 8000SRM2305.

NOTE: When disconnecting wiring harness connectors during disassembly, tag each connector to aid in connecting the wiring harness during reassembly.

2. Disconnect the battery. See Battery service in **Electrical, software, and controls** 2200SRM2304.

3. Open and lift the hood. See Covers repair.

4. Remove the floormat and remove the floor plate with the throttle pedal attached. See Covers repair in **Frame and Main Components** 8000SRM2306.

5. Disconnect the throttle pedal connector(s). See Pedals and linkage repair in **Operator's Cab** 0100SRM2298.

6. Remove the crossbar. See Power distribution module (PDM) repair in **Electrical, software, and controls** 2200SRM2304.

7. Remove the PDM. See Power distribution module (PDM) repair in **Electrical, software, and controls** 2200SRM2304.

8. Remove the SAHR valve. See Replacing the SAHR valve (wet brake drive axle with Hydrostatic transmission) in **Hydraulics** 1900SRM2302.

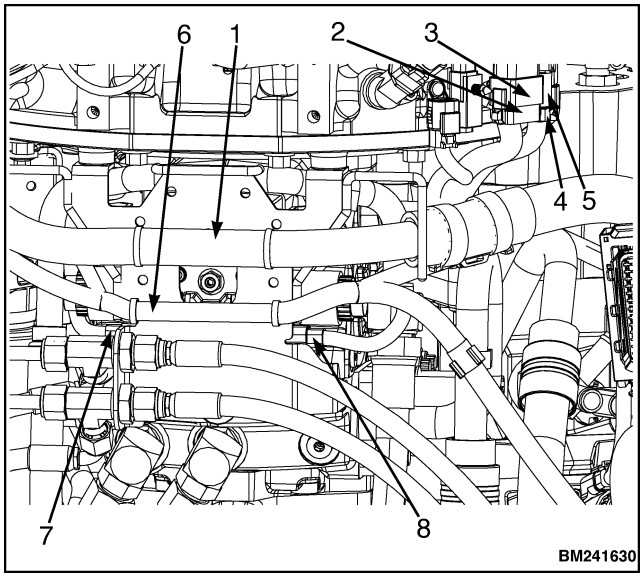
9. Remove the brake pump. Cap the hoses.

10. Remove all hydraulic oil from the hydraulic tank.

REMOVE TRANSMISSION

1. Disconnect connectors CPS510 (item 2, Figure 122) and CPS511 (item 4) on the chassis harness from the connectors on the engine harness.

2. Disconnect connector CPS1456 (item 7, Figure 122) and CPS1455 (item 8) on the HST harness from the HST pump.

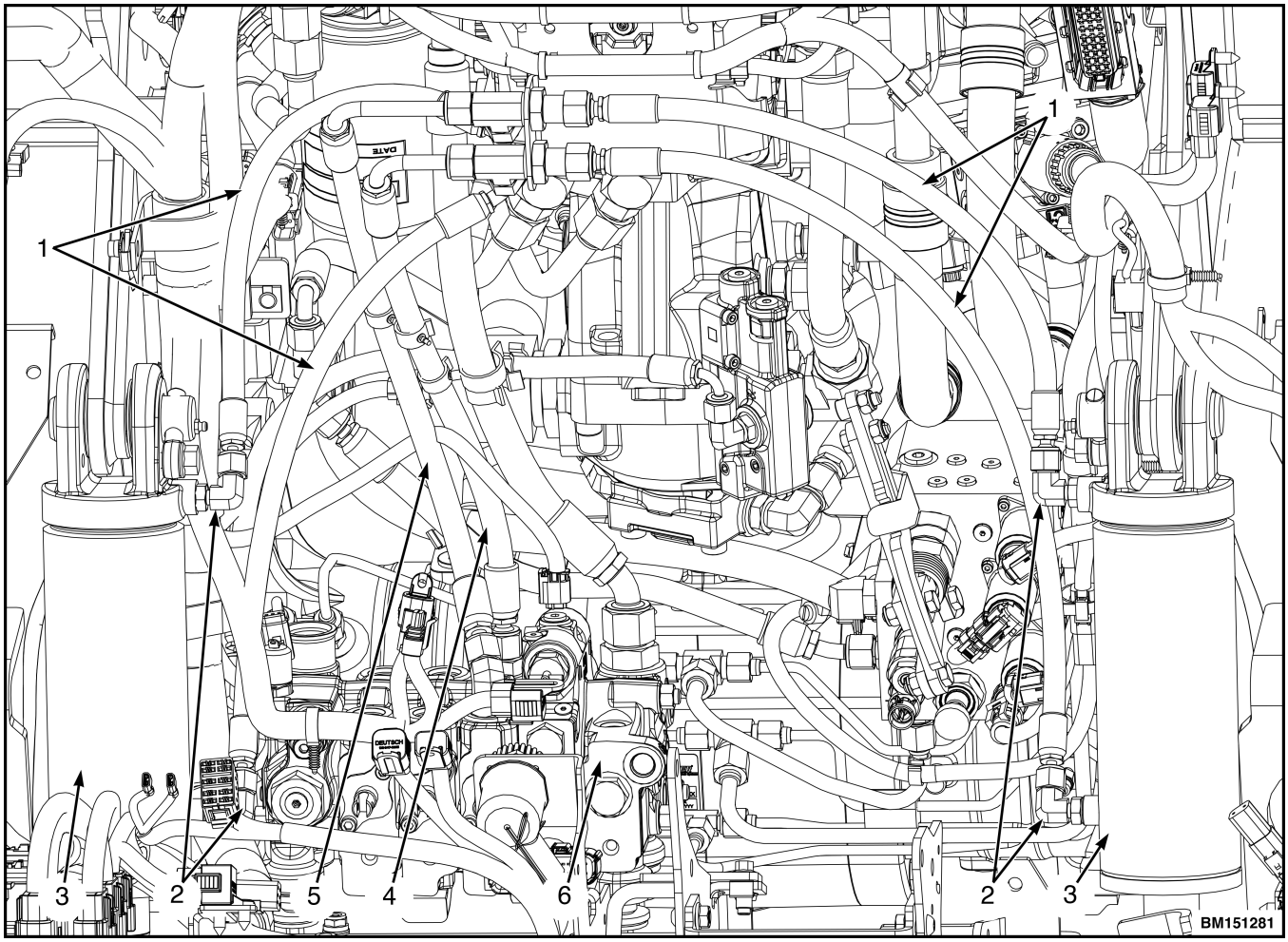


1. CHASSIS HARNESS
2. CPS510
3. CRP510
4. CPS511
5. CRP511
6. HST HARNESS
7. CPS1456
8. CPS1455

Figure 122. Chassis harness and HST harness

3. Drain all fluid from the hydraulic tank. See Every 4000 hours or Two Years periodic maintenance (PM) procedures in **Periodic Maintenance** 8000SRM2305.

4. Disconnect the hydraulic tilt hoses (item 1, Figure 123) from the fittings (item 2) on both tilt cylinders (item 3).

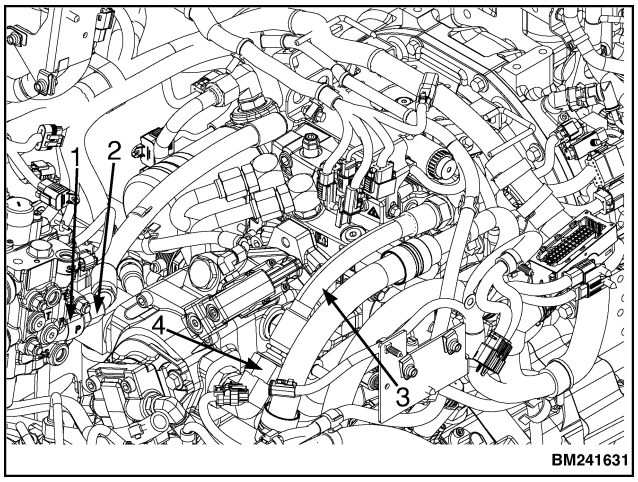


1. TILT HOSES
2. TILT HOSE FITTINGS
3. TILT CYLINDERS
4. HOSE
5. HOSE
6. CONTROL VALVE

Figure 123. Tilt hoses

5. Disconnect the hose (item 4, Figure 123) and hose (item 5) from the hydraulic control valve (item 6).

6. Disconnect the hydraulic supply hose (item 3, Figure 124) from the fitting (item 2) on the hydraulic control valve (item 1). Cap the hose.

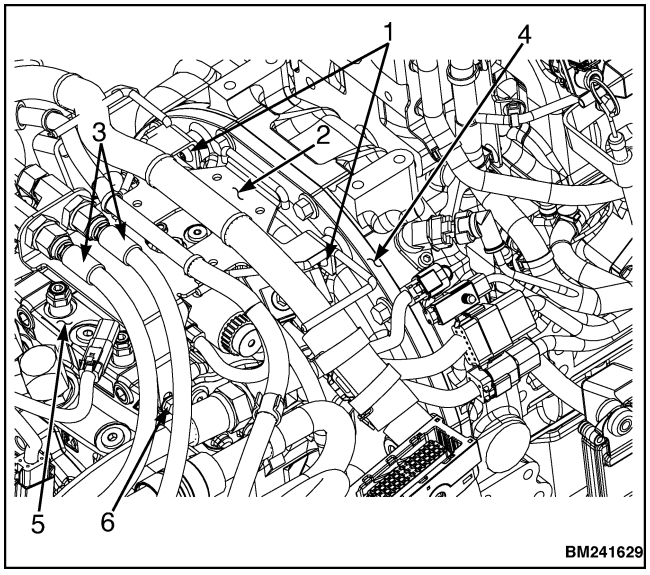


1. HYDRAULIC CONTROL VALVE
2. FITTING
3. HYDRAULIC SUPPLY HOSE
4. FITTING

Figure 124. Supply hoses

7. Remove the capscrew (item 6, Figure 125) attaching the mounting bracket to the HST pump.

8. Remove the two capscrews (item 1, Figure 125) attaching the mounting bracket to the HST housing.



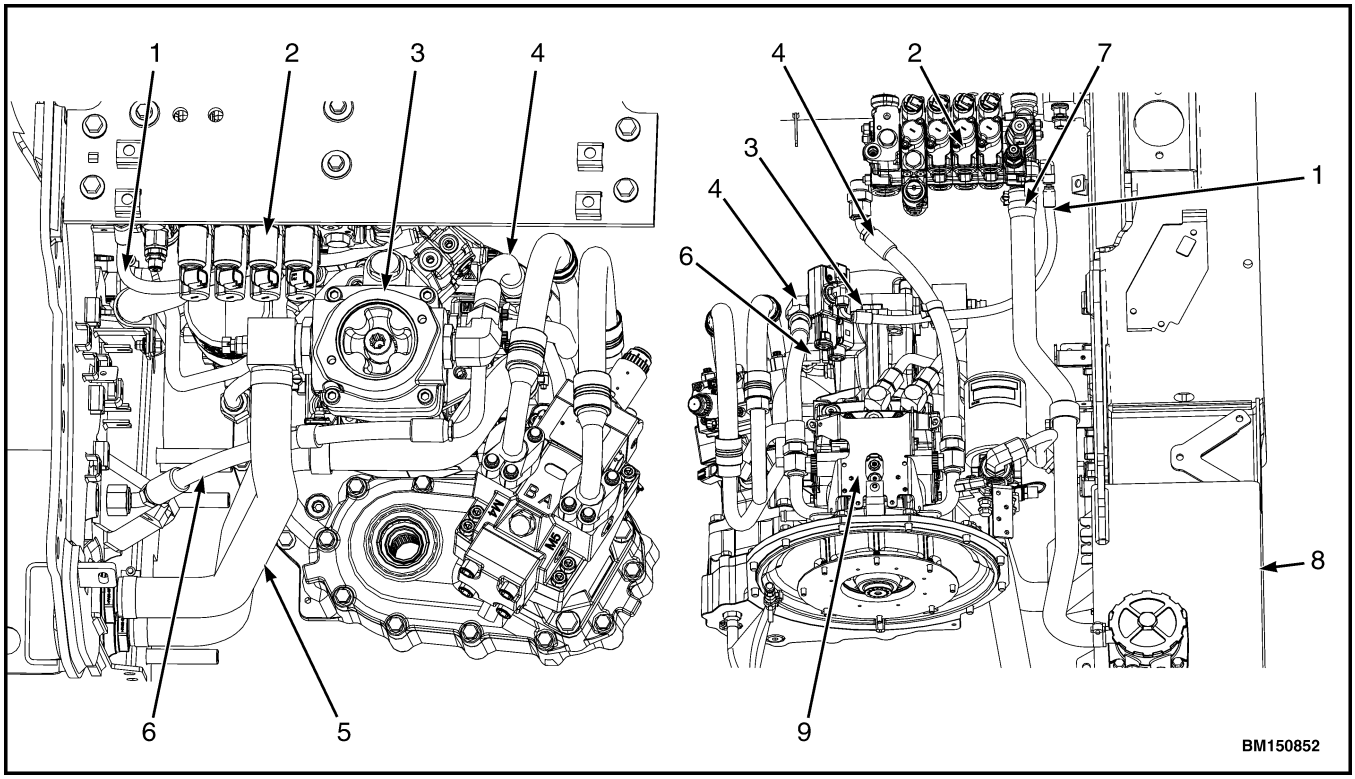
1. CAPSCREW
2. MOUNTING BRACKET
3. HYDRAULIC TILT HOSES
4. HST HOUSING
5. HST PUMP
6. CAPSCREW

Figure 125. Mounting bracket

9. Remove the mounting bracket with the hoses and harnesses still attached and rest the bracket with hoses and harnesses on the engine.

10. Disconnect the load sense hose (item 1, Figure 126) from the hydraulic function pump (VDP) (item 3).

11. Disconnect the suction hoses (item 5, Figure 126) and hydraulic function pump (VDP) drain hose (item 6) from the hydraulic tank.

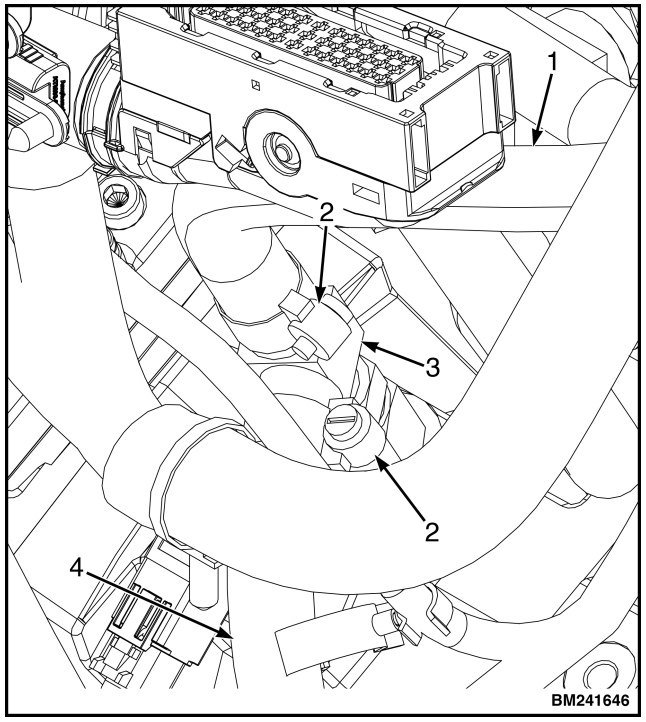


1. PUMP LOAD SENSE HOSE
2. HYDRAULIC CONTROL VALVE
3. HYDRAULIC FUNCTION PUMP (VDP)
4. SYSTEM SUPPLY HOSE
5. PUMP SUCTION HOSE
6. PUMP DRAIN HOSE
7. SYSTEM RETURN HOSE
8. HYDRAULIC TANK
9. TRANSMISSION

Figure 126. HST hydraulic hoses

12. Loosen the hose clamp and disconnect the pump-motor cooling hose (item 1, Figure 127).

13. Loosen the hose clamp and disconnect the HST cooler cooling hose (item 4, Figure 127).



1. PUMP-MOTOR COOLING HOSE
2. HOSE CLAMP
3. FITTING
4. HST COOLER COOLING HOSE

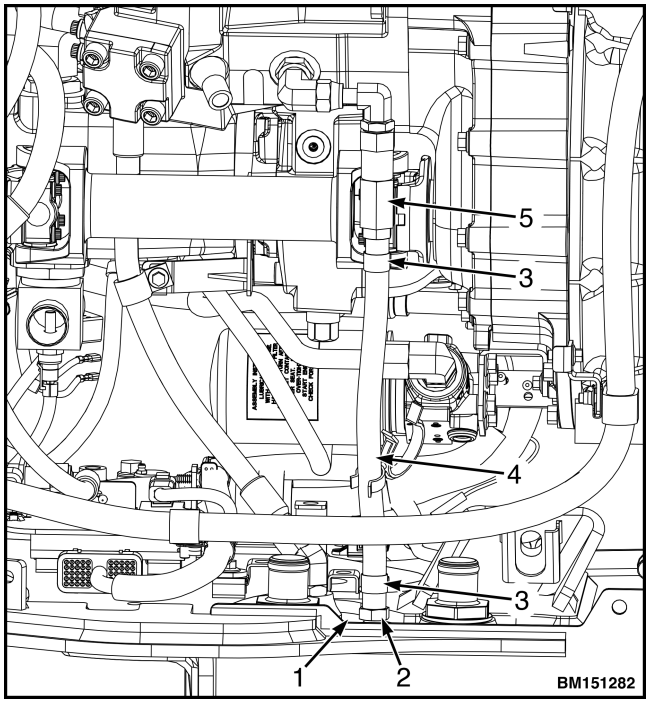
Figure 127. HST cooling hoses

14. Loosen the hose clamp and disconnect the pump-motor cooling hose (item 1, Figure 127).

CAUTION

There may residual oil in the hydraulic tank. Use caution when removing hydraulic hoses.

15. From underneath, loosen the hose clamp (item 3, Figure 128) and disconnect the cooler bypass hose (item 4) from the check valve.



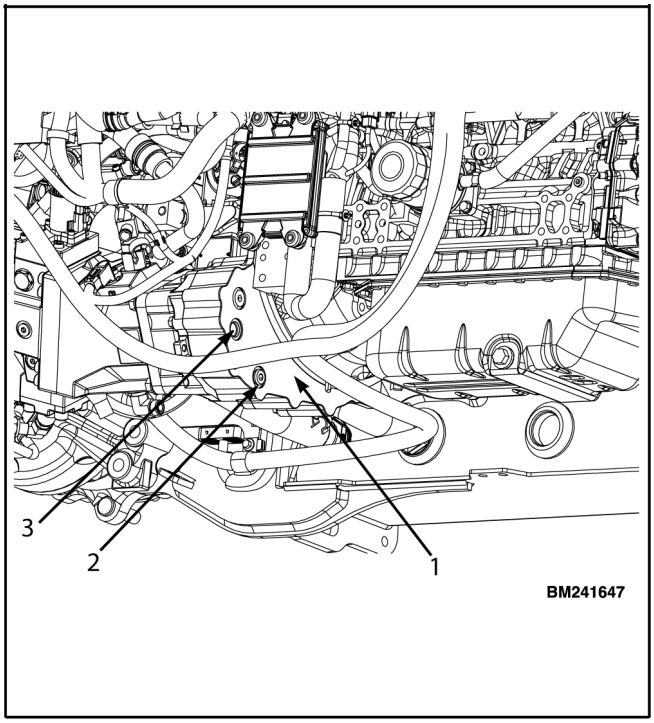
1. HYDRAULIC TANK
2. FITTING
3. HOSE CLAMP
4. COOLER BYPASS HOSE
5. CHECK VALVE
6. HOSE CLAMP

Figure 128. Cooler bypass hose

16. Remove connectors from HST motor coil and speed sensor.

17. Disconnect the other end of the cooler bypass hose from the check valve (item 5, Figure 128).

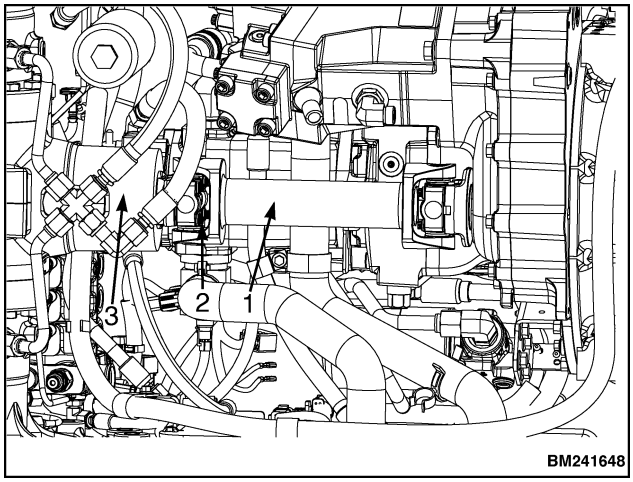
18. Remove the drain plug from the chain case and drain all oil from the chain case. Clean and reinstall the drain plug.



1. CHAIN CASE
2. DRAIN PLUG
3. FILL PORT

Figure 129. Drain the chain case

19. Remove the four screws connecting the drive shaft to the drive axle. See Figure 130.



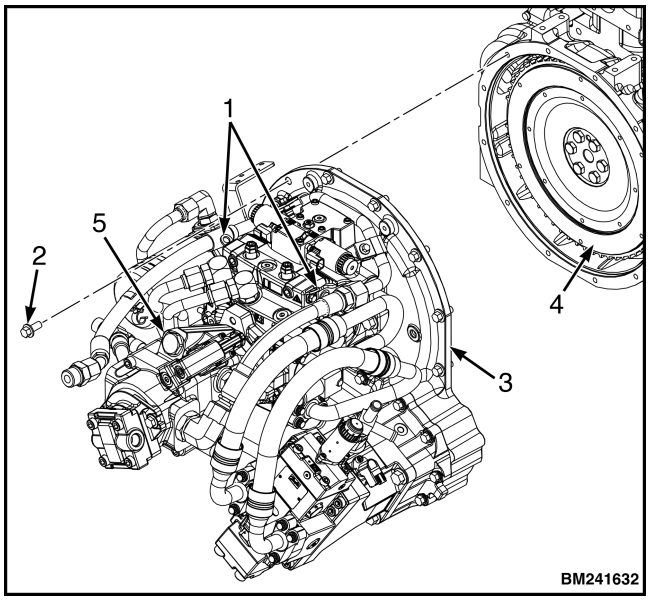
1. DRIVE SHAFT
2. CAPSCREW
3. DRIVE AXLE

Figure 130. Drive shaft

20. Pull the yoke of the drive shaft free and remove from the transmission.

21. Attach a chain and a lifting device to the three lifting eyes (item 1, Figure 131) and raise until the chains are snug.

22. Remove the nine capscrews (item 2, Figure 131) securing the transmission to the engine assembly.



1. HST PUMP LIFTING EYES
2. CAPSCREWS
3. TRANSMISSION
4. ENGINE
5. VDP LIFTING EYES

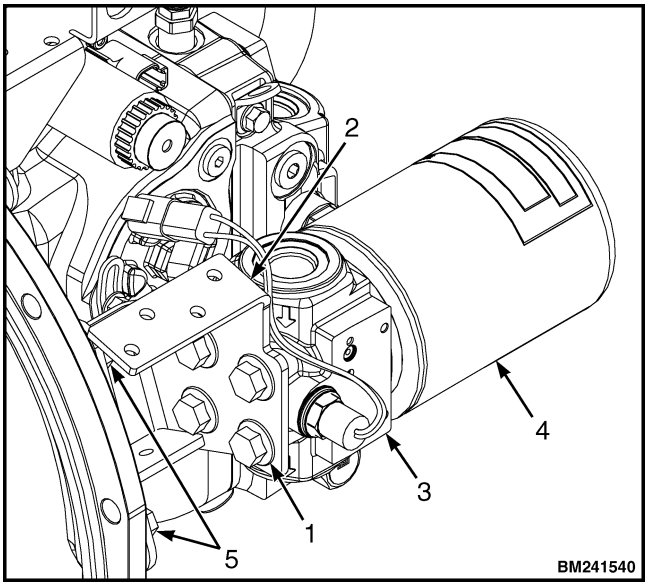
Figure 131. Remove/install transmission

23. Use the lifting device to lift the transmission assembly and remove from the lift truck. Place the transmission assembly on a suitable workstation. Do not rest the transmission on high pressure loop hoses.

HST filter, remove

1. Turn the HST filter counterclockwise to loosen and remove. See Figure 132.

2. Remove the two capscrews (item 5, Figure 132) retaining the filter bracket to the transmission housing.

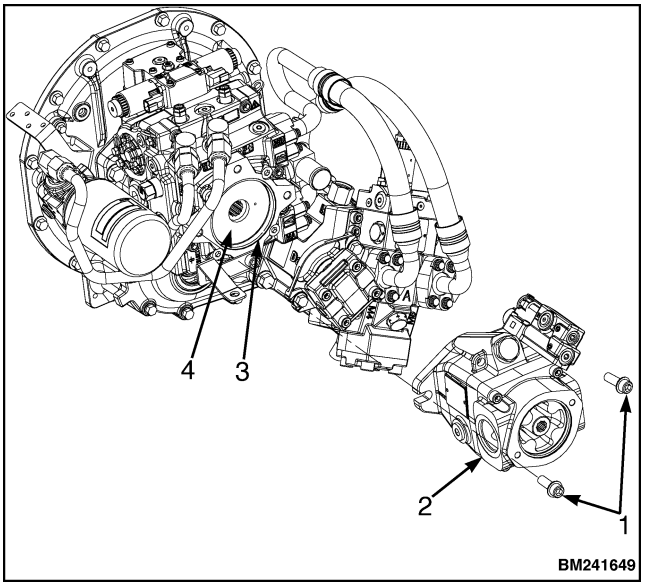


1. CAPSCREW
2. BRACKET
3. TRANSMISSION FILTER
4. FILTER HEAD
5. CAPSCREW

Figure 132. Transmission filter

VDP, remove

1. Remove the two capscrews (item 1, Figure 133) retaining the VDP to the HST pump.



1. CAPSCREW
2. VDP
3. O-RING
4. HST PUMP

Figure 133. Variable Displacement Pump (VDP)

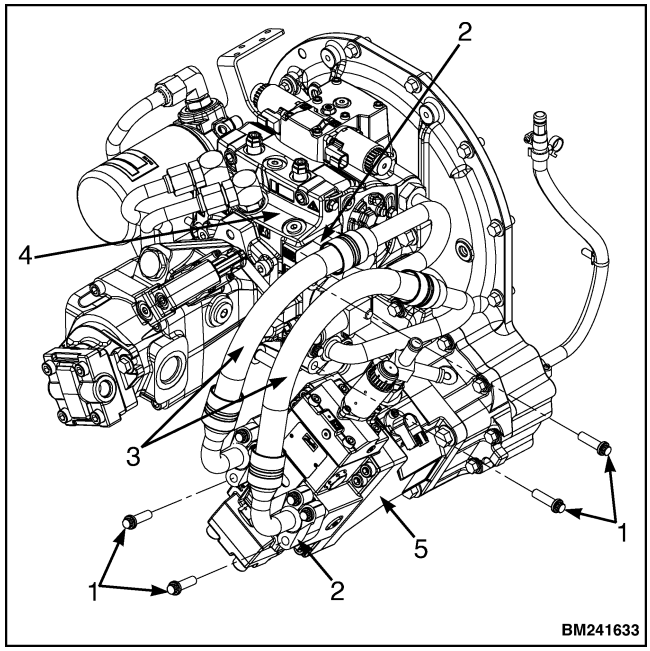
2. Remove the O-ring (item 3, Figure 133) from the HST pump.

Transmission motor, remove

1. Remove the capscrews securing the hose clamps. See Figure 134.

2. Remove the hose clamps. See Figure 134.

3. Remove the two hose and tube assemblies. See Figure 134.

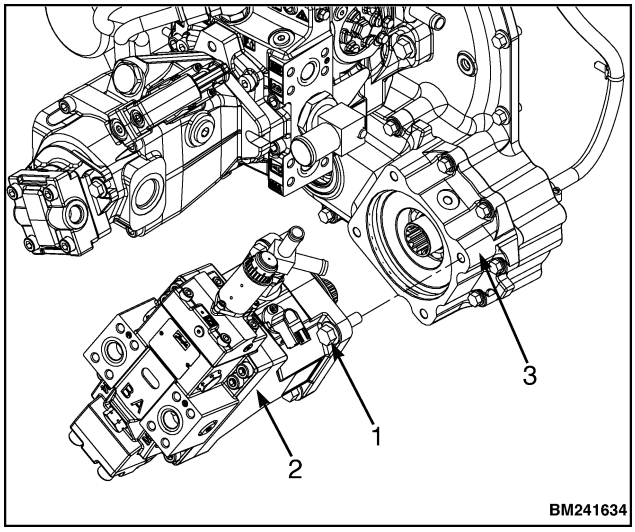


1. CAPSCREW
2. HOSE CLAMP
3. HOSE AND TUBE ASSEMBLY
4. HYDRAULIC PUMP
5. TRANSMISSION MOTOR

Figure 134. Hose and tube assemblies

4. Remove the four capscrews securing the hydraulic transmission motor to the chain cover. See Figure 135.

5. Remove the transmission motor. See Figure 135.



1. CAPSCREW
2. MOTOR
3. CHAIN DRIVE COVER

Figure 135. Transmission motor

HST pump, remove

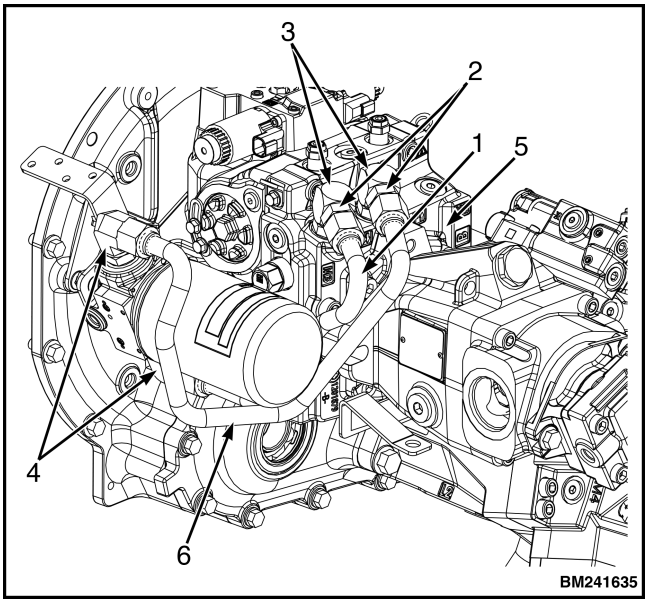
1. Remove the capscrews (item 1, Figure 134) securing the hose clamps.

2. Remove the hose clamps. See Figure 134.

3. Remove the two hose and tube assemblies. See Figure 134.

4. Disconnect the filter tube (item 6, Figure 136) and fitting (item 4) from the pump.

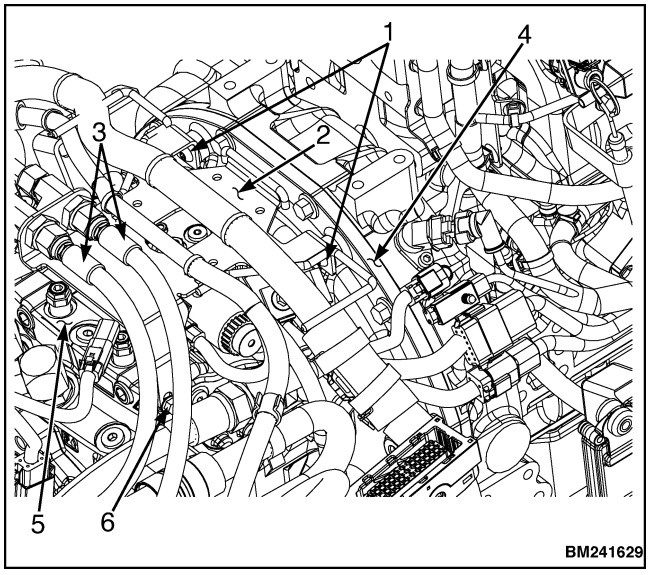
5. Disconnect the filter tube (item 1, Figure 136) and fitting (item 4) from the pump.



1. FILTER TUBE
2. ADAPTOR
3. FITTING
4. FITTING
5. PUMP
6. FILTER TUBE

Figure 136. Filter tubes and fittings

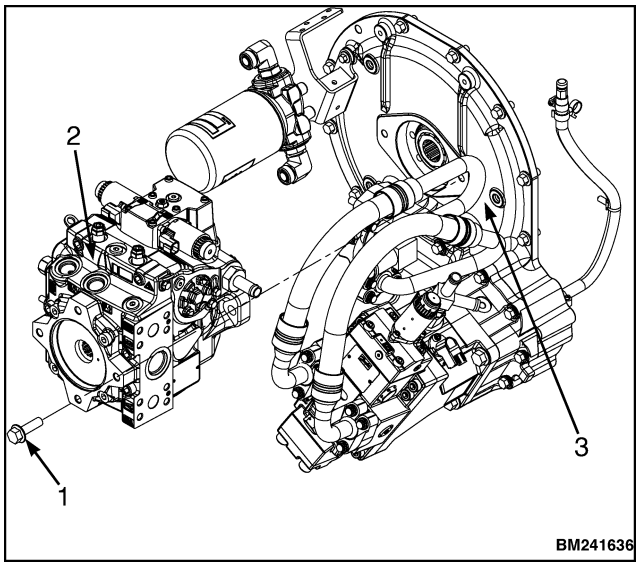
6. If the bracket holding the tilt hoses was not already removed, remove the two capscrews (item 1, Figure 137) from the bracket to the HST housing.



1. CAPSCREW
2. MOUNTING BRACKET
3. HYDRAULIC TILT HOSES
4. HST HOUSING
5. HST PUMP
6. CAPSCREW

Figure 137. Mounting bracket

7. Remove the screws (item 1, Figure 138) securing the pump to the transmission housing. Remove the pump.



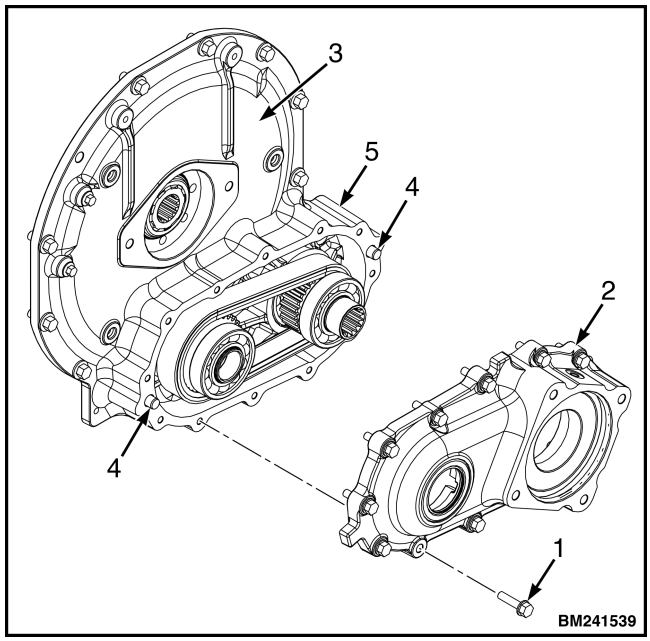
1. CAPSCREW
2. PUMP
3. TRANSMISSION HOUSING

Figure 138. Remove the pump

Drive chain and sprockets, remove

1. Rotate the assembly so the housing sits flat on the workstation.

2. Remove the twelve capscrews retaining the drive chain cover to the transmission housing. See Figure 139.



1. CAPSCREW
2. CHAIN COVER
3. TRANSMISSION HOUSING
4. DOWEL PINS
5. GASKET

Figure 139. Drive chain cover

CAUTION

The chain assembly may come off when the drive chain cover is removed.

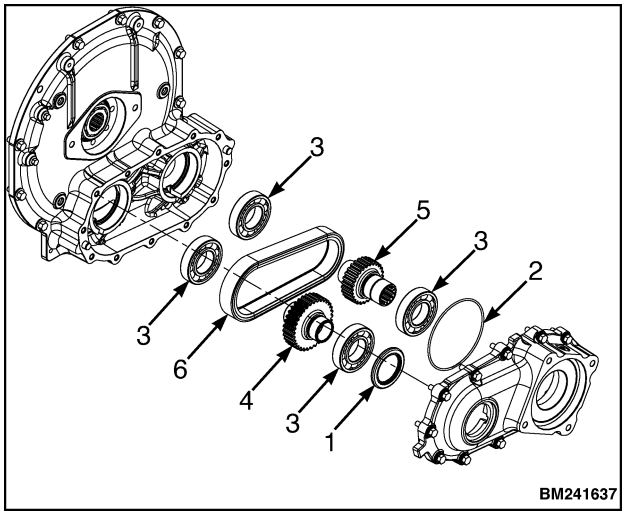
3. Remove the drive chain cover from the transmission housing. See Figure 139.

4. Pull on the input and output sprocket simultaneously to remove both assemblies. See Figure 140.

5. Remove the drive chain from the two sprockets. See Figure 140.

6. If replacing any part of the sprocket assemblies, remove the bearings from each side of the input and output sprockets. See Figure 140.

7. Remove the output seal and O-ring. See Figure 140.



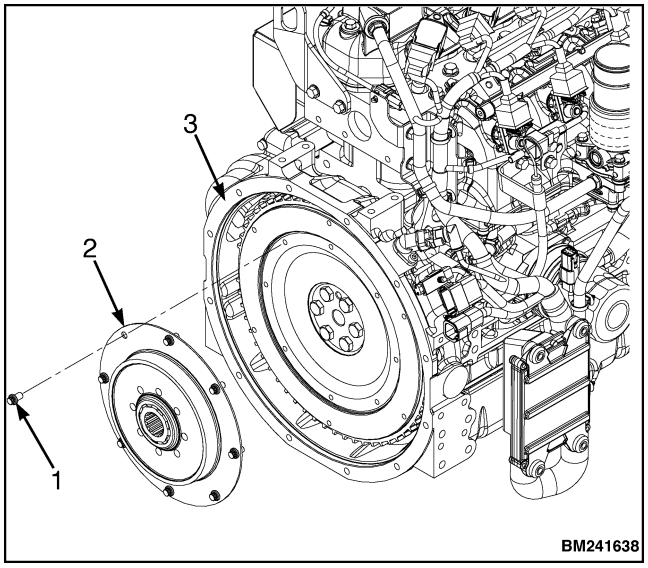
1. OUTPUT SEAL
2. O-RING
3. BEARING CUPS
4. OUTPUT SPROCKET
5. INPUT SPROCKET
6. DRIVE CHAIN

Figure 140. Drive chain and sprockets

Coupling, remove

1. Loosen the eight screws retaining the coupling to the engine assembly. See Figure 141.

2. Remove the coupling from the engine assembly. See Figure 141.



1. CAPSCREW
2. COUPLING
3. ENGINE ASSEMBLY

Figure 141. Coupling

INSTALL HST COMPONENTS

Coupling, install

1. Align the coupling on the engine assembly. See Figure 141.

2. Coat the eight capscrews with Loctite® 242 and insert the capscrews to secure the coupling to the engine assembly. See Figure 141.

3. Tighten the capscrews to 32 to 36 N•m (23.6 to 26.6 lbf ft).

Drive chain and sprockets, install

1. Install the bearings onto each side of the input and output sprockets. See Figure 140.

2. Install the drive chain onto the two sprockets. See Figure 140.

3. Lower the input and output sprocket assemblies at the same time into the transmission housing assembly by hand. Do not use a hammer. See Figure 140.

4. Ensure the HST housing surface is clean. Lubricate new gasket with HCE-102 and install the new gasket. See Figure 139.

5. Align the chain cover with the dowel pins on the transmission housing and bearings. See Figure 139.

6. Insert the twelve capscrews to retain the drive chain cover to the transmission housing. See Figure 139.

7. Install the ouput seal. See Figure 140.

8. Lubricate new O-ring with HCE-102 and install new O-ring onto the HST motor. See Figure 140.

9. Tighten the twelve capscrews in sequential pattern. See Figure 142.

Torque to 18 to 20 N•m (13.3 to 14.8 lbf ft).

Torque to 24 to 26 N•m (17.7 to 19.2 lbf ft).

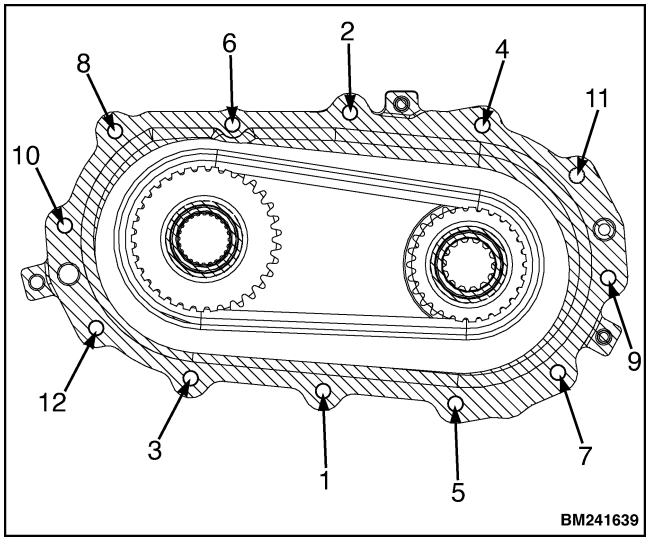


Figure 142. Torque sequence

Transmission pump, install

1. Align the transmission pump in place on the transmission housing. See Figure 138.

2. Insert the two capscrews (item 1, Figure 138) to secure the transmission pump in place on the transmission housing.

3. Tighten the capscrews to 32 to 36 N•m (23.6 to 26.6 lbf ft).

4. Connect the filter fittings (item 3, Figure 136) and tubes (item 4) to the pump.

5. Connect the two hose and tube assemblies (item 3, Figure 134) to the transmission pump.

6. Install the hose clamps. See Figure 134.

CAUTION

Do not reuse the same capscrews when installing the high pressure hydraulic hoses. Use only new capscrews. See Parts Manual for more information.

7. Install new capscrews (item 1, Figure 134) to secure the hose clamps.

8. Tighten the capscrews to standard torque.

HST motor, install

1. Instal the O-ring onto the transmission motor.

2. Align the transmission motor in place on the chain cover. See Figure 135.

3. Insert the four capscrews (item 1, Figure 135) to secure the HST motor to the HST housing.

4. Tighten the capscrews to standard torque.

5. Install one end of each of the two hose and tube assemblies to the motor. See Figure 134.

6. Install the hose clamps to retain the hose and tube assemblies. See Figure 134.

7. Insert the capscrews to secure the hose clamps. See Figure 134.

8. Tighten the capscrews to standard torque.

9. Install the other end of the two hose and tube assemblies to the pump. See Figure 134.

10. Install the hose clamps to retain the hose and tube assemblies. See Figure 134.

11. Insert the capscrews to secure the hose clamps. See Figure 134.

12. Tighten the capscrews to standard torque.

VDP, install

1. Install new O-ring (item 3, Figure 133) onto the VDP.

2. Install the two capscrews (item 1, Figure 133) to secure the VDP to the HST pump.

Transmission filter, install

1. Insert the two capscrews (item 5, Figure 132) to retain the filter bracket to the transmission housing. Tighten to standard torque.

2. Install the transmission filter into the filter head and turn the tranmission filter clockwise to tighten. See Figure 132.

INSTALL HST ASSEMBLY

1. Use the lifting device to move the HST assembly and lower it into the lift truck, aligned with the nine holes in the bell of the engine assembly. See Figure 131.

2. Insert the nine capscrews (item 2, Figure 131) to secure the HST assembly to the engine assembly.

3. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

4. Disconnect the lifting device from the HST assembly.

5. Install the yoke of the drive shaft into drive shaft mounting attached to the chain case. See Figure 130.

6. Attach the other end of the drive shaft yoke to the mounting on the drive axle. See Figure 130. Insert the four capscrews to secure.

7. From underneath, install the check valve. See Figure 128.

8. Connect one end of the cooler bypass hose to the check valve (item 5, Figure 128).

9. Connect the other end of the cooler bypass hose (item 4, Figure 128) to the hydraulic tank.

10. Connect the pump-motor cooling hose (item 1, Figure 127).

11. Connect the HST cooler cooling hose (item 4, Figure 127).

12. Connect the suction hoses (item 5, Figure 126) and VDP drain hose (item 6) to the hydraulic tank.

13. Connect the load sense hose (item 1, Figure 126) to the VDP.

14. Install the mounting bracket with the hoses and harnesses still attached. See Figure 125.

15. Insert the capscrew (item 6, Figure 125) to attach the mounting bracket to the HST pump.

16. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

17. Insert the two capscrews (item 1, Figure 125) to attach the mounting bracket to the HST housing.

18. Tighten the capscrews to 41 to 49 N•m (30.2 to 36.1 lbf ft).

19. Connect the hydraulic supply hose (item 3, Figure 124) to the fitting (item 2) on the hydraulic control valve (item 1).

20. Connect the hose (item 4, Figure 123) and hose (item 5) to the hydraulic control valve (item 6).

21. Connect the hydraulic tilt hoses (item 1, Figure 123) to the fittings (item 2) on both tilt cylinders (item 3).

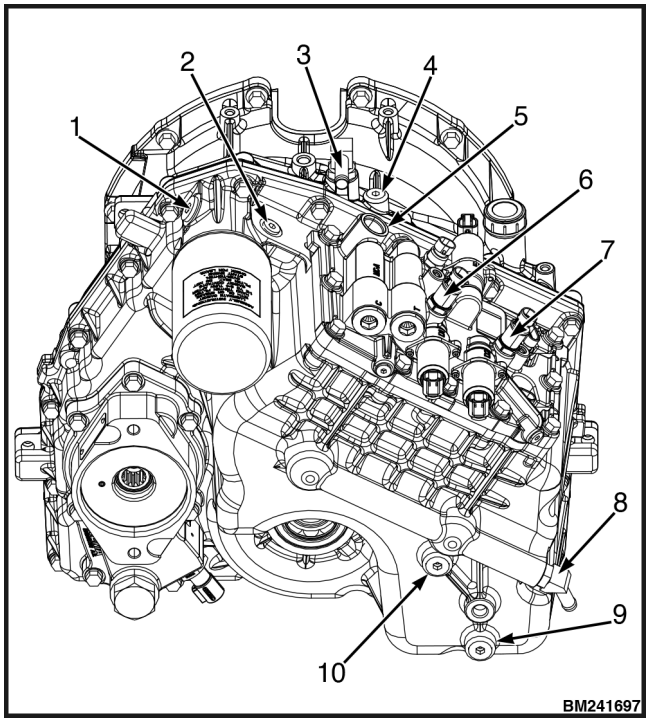
22. Connect connectors CPS510 (item 2, Figure 122) and CPS511 (item 4) on the chassis harness to the connectors on the engine harness.

23. Connect connectors CPS1456 (item 7, Figure 122) and CPS1455 (item 8) on the HST harness from the HST pump.

24. Connect the motor coil and temperature sensor to the motor.

TRANSMISSION PORTS

ELECTRONIC POWERSHIFT TRANSMISSION



NOTE: * FOR POWERSHIFT TRANSMISSIONS EQUIPPED WITH ELECTRONIC TRANSMISSION CONTROL.

1. PARK BRAKE SUPPLY PORT (WBA)
2. CHARGE PUMP CHECK PORT (DBA)
3. COOLER SUPPLY PORT
4. TORQUE CONVERTER CHECK PORT
5. TRANSMISSION SUPPLY PORT (WBA)
6. FWD PRESSURE TRANSDUCER SENSOR *
7. REV PRESSURE TRANSDUCER SENSOR *
8. COOLER RETURN PORT
9. PARK BRAKE RETURN PORT
10. AXLE COOLING RETURN PORT

Figure 143. Electronic Powershift Transmission Ports

Table 1. Powershift Transmission (Dry Brake Axle)

TC Speed	Charge Pressure	FWD/REV Packs	Cooler Flow	TC Pressure	Cold Pressure Relief
800 RPM	>850 kPa (123.3 psi)	800-1000 kPa (116-145 psi)	>8.7 liter/min (2.3 gal/min)	120-200 kPa (17.4-29 psi)	1750 kPa (254 psi)
2500 RPM	<1100 kPa (160 psi)	800-1350 kPa (116-196 psi)	>21 liter/min (5.5 gal/min)	500-600 kPa (73-87 psi)	1750 kPa (254 psi)

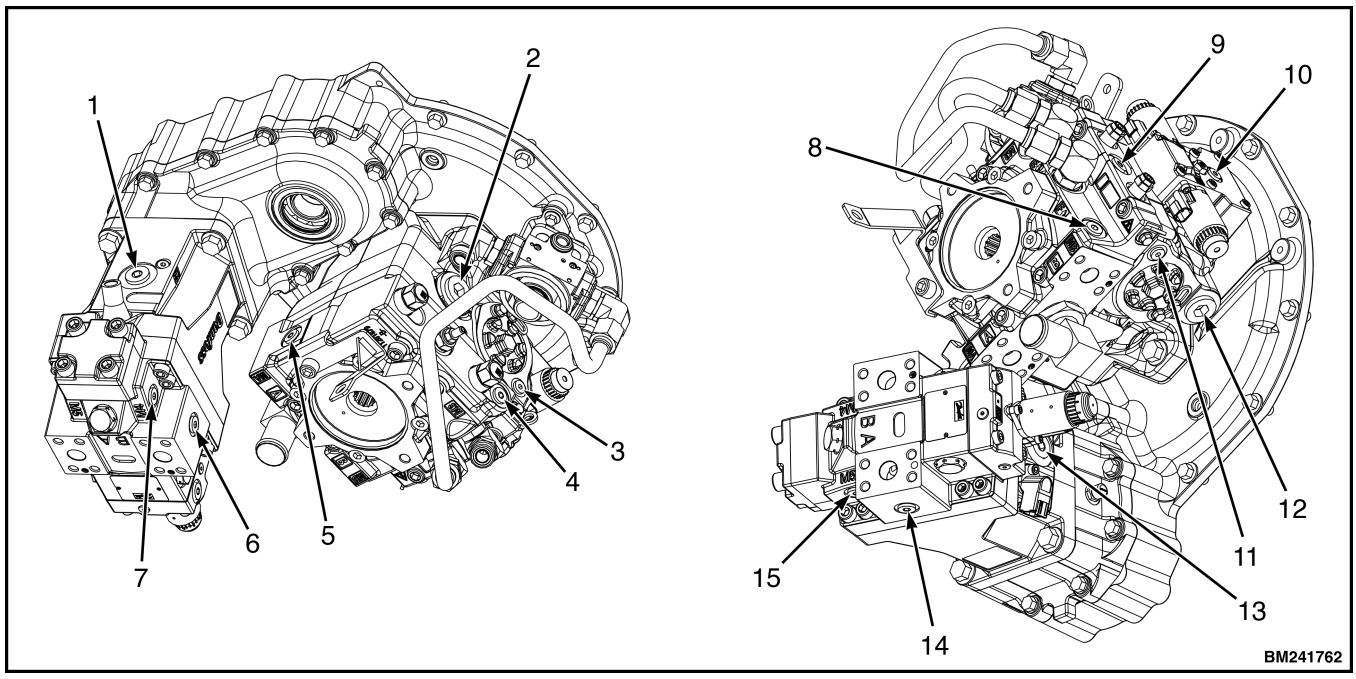
Table 2. Powershift Transmission (Wet Brake Axle)

System	TC Speed	Charge Pressure	FWD/REV Packs	Cooler Flow	TC Pressure	Cold Pressure Relief
Low Pressure	800 RPM	>850 kPa (123.3 psi)	800-1000 kPa (116-145 psi)	>12 liter/min (3.2 gal/min)	120-200 kPa (17.4-29 psi)	6500 kPa (943 psi)
	2500 RPM	<1300 kPa (123.3 psi)	800-1450 kPa (116-210.3 psi)	31 liter/min (8.2 gal/min)	500-600 kPa (73-87 psi)	6500 kPa (943 psi)
High Pressure	800 RPM	>5700 kPa (827 psi)	800-1000 kPa (116-145 psi)	>8 liter/min (2.1 gal/min)	80-200 kPa (12-29 psi)	6500 kPa (943 psi)
	2500 RPM	<6300 kPa (914 psi)	800-1350 kPa (116-196 psi)	27 liter/min (7.1 gal/min)	500-600 kPa (73-87 psi)	6500 kPa (943 psi)

Table 3. Powershift Transmission

Park Brake Supply (WBA)	Transmission Supply (WBA)	Cooler Supply	Cooler Return	Park Brake Return	Axle Cooling Return
850-1400 kPa (123.3-203.1 psi) *	850-1400 kPa (123.3-203.1 psi)	300 kPa (44 psi)	100 kPa (15 psi)	0 kPa (0 psi)	0 kPa (0 psi)
* (up to 6300 kPa (914 psi) periodically)					

HYDROSTATIC TRANSMISSION



1. L2
2. PL2
3. PM5
4. M3
5. PMA
6. PMB
7. MM4
8. MMB
9. AM3
10. M14
11. PM4
12. L4
13. L1
14. MMA
15. MM5

Figure 144. Hydrostatic Transmission Ports

Table 4. Hydrostatic Transmission

Item	Port	Description	Pressure
1	L2	Case Drain	1000 kPa (145 psi)
2	PL2	Case Drain	1000 kPa (145 psi)
3	PM5	Servo Pressure	5000 kPa (725.2 psi)
4	M3	Charge Pressure after Filter	5000 kPa (725.2 psi)
5	PMA	A Loop System Pressure	60000 kPa (8702.3 psi)
6	PMB	B Loop System Pressure	60000 kPa (8702.3 psi)
7	MM4	Servo Pressure	5000 kPa (725.2 psi)
8	MMB	B Loop System Pressure	1000 kPa (145 psi)
9	AM3	Charge Pressure after Filter	1000 kPa (145 psi)
10	M14	Air Bleed Port - Tank	1000 kPa (145 psi)
11	PM4	Servo Pressure	5000 kPa (725.2 psi)

Table 4. Hydrostatic Transmission (Continued)

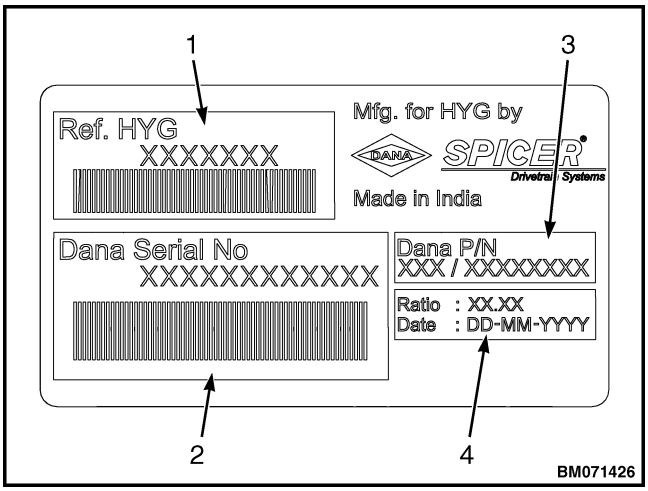
Item	Port	Description	Pressure
12	L4	Pump Case Drain to Cooler	1000 kPa (145 psi)
13	L1	Motor Case Drain to Cooler	1000 kPa (145 psi)
14	MMA	A Loop System Pressure	60000 kPa (8702.3 psi)
15	MM5	Servo Pressure	5000 kPa (725.2 psi)

Drive axle repair (dry brakes)

DRY BRAKE AXLE REMOVE AND INSTALL 202001-254

IDENTIFICATION PLATE

See Figure 145.



1. HYSTER-YALE REFERENCE
2. DANA SERIAL NUMBER
3. DANA PART NUMBER
4. RATIO/DATE OF PRODUCTION

Figure 145. Data Plate

REMOVE

1. Remove the mast assembly as described in section **Front End** 4000SRM2303.

WARNING

When putting the truck on blocks, make sure the surface is solid, even, and level. Any blocks used to support the truck must be solid, one-piece units.

CAUTION

Because the truck is modular, the drive axle assembly is a structural part of the truck frame. The frame width tolerance at the drive axle is 5.0 mm (0.2 in.). Note the frame width at the drive axle to be maintained when re-installing the axle.

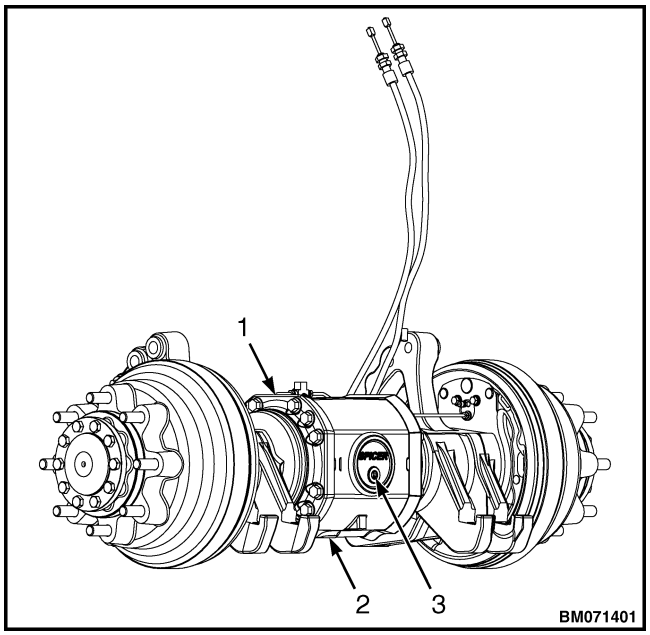
2. Put blocks on each side (front and back) of the steer tires to prevent movement of the truck.

3. Raise the truck and put blocks under the frame so that the drive wheels do not touch the floor. Put blocks under the counterweight and on both sides of the frame for stability. See How to put a lift truck on blocks in **Periodic Maintenance** 8000SRM2305.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

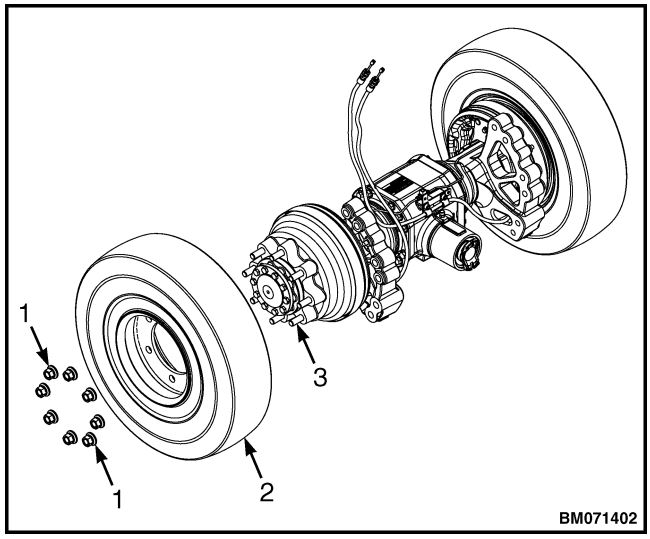
4. Place a suitable container under the drive axle. Remove drain plug to drain oil from the drive axle into the container. See Figure 146.



1. DRIVE AXLE CENTER SECTION
2. DRAIN PLUG
3. FILL PLUG/PORT

Figure 146. Drive Axle Drain Plug

5. Remove wheel nuts from wheel studs then remove tire and wheel from hub on both sides of drive axle. See Figure 147.

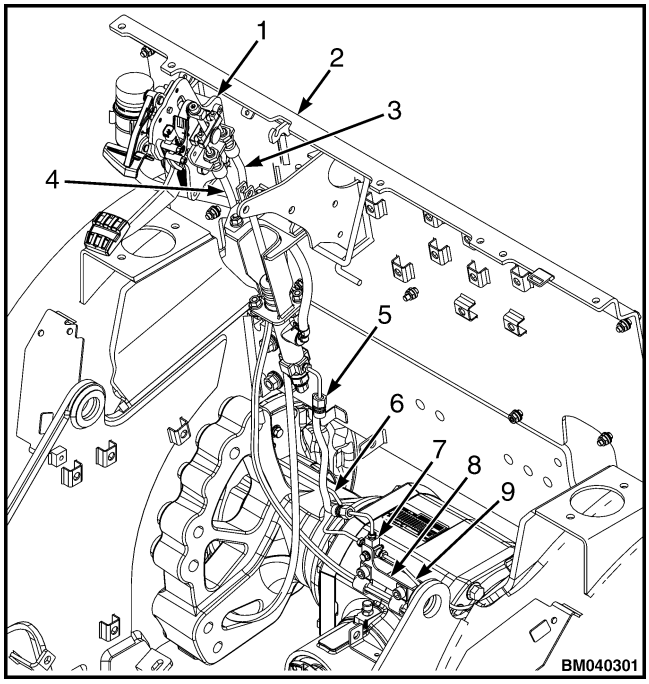


1. WHEEL NUT
2. WHEEL AND TIRE
3. STUD

Figure 147. Wheel Nuts

6. Disconnect brake hose assembly from t-fitting. Plug brake hose assembly. See Figure 148.

7. Loosen jam nuts and disconnect park brake cables from bracket on cowl. See Figure 148.



1. PARK BRAKE ASSEMBLY
2. COWL
3. RIGHT PARK BRAKE CABLE
4. LEFT PARK BRAKE CABLE
5. BRAKE HOSE ASSEMBLY
6. LEFT-HAND TUBE ASSEMBLY
7. BRAKE T-FITTING
8. MANIFOLD BLOCK
9. RIGHT TUBE ASSEMBLY

Figure 148. Brake Hose, Tubes, and Cables

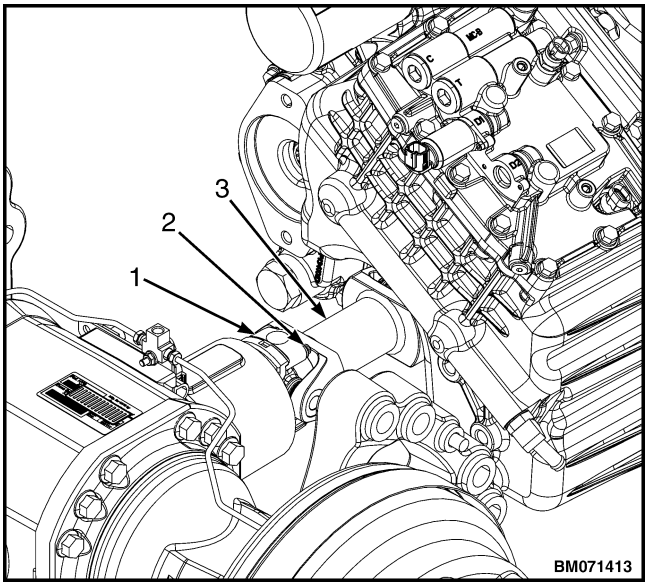
WARNING

The drive axle is heavy. Make sure any lifting device has enough capacity to lift the drive axle. The drive axle can weight approximately 267 kg (589 lb).

8. Place blocks under the axle assembly and connect slings and lifting devices.

9. Place blocks under the transmission to support the transmission while drive axle is removed.

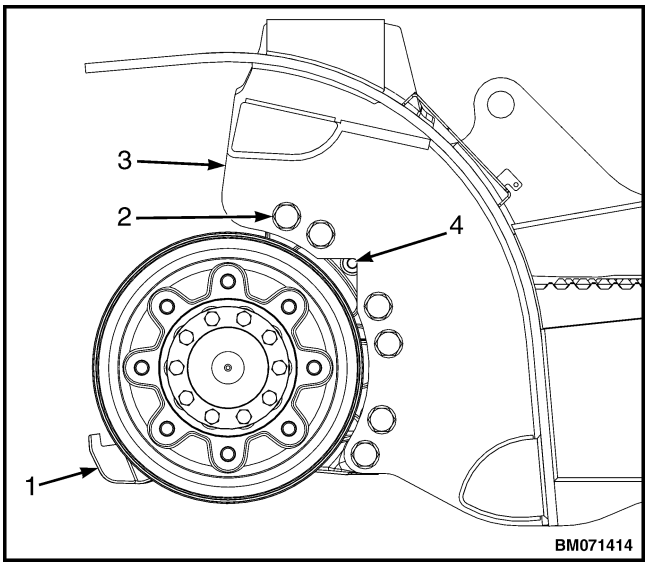
10. Remove the four capscrews from the axle yoke and drive shaft. Push the yoke all the way into the axle for clearance. Drive shaft stays bolted to transmission, and yoke stays in the axle. See Figure 149.



1. AXLE YOKE
2. CAPSCREW
3. DRIVE SHAFT

Figure 149. Axle Yoke

11. Remove all but one of the mounting capscrews attaching the drive axle to the frame. Repeat for the opposite side of the axle. See Figure 150.



1. MAST HANGER
2. MOUNTING CAPSCREW
3. FRAME
4. DOWEL PIN

Figure 150. Drive Axle Remove/Install

12. Connect a sling with a lifting device to the axle. Make sure sling and lifting device are secure. Remove the last mounting capscrew from frame and drive axle on each side. Remove drive axle from frame.

13. Place blocks under the differential assembly and lower the axle onto the blocks.

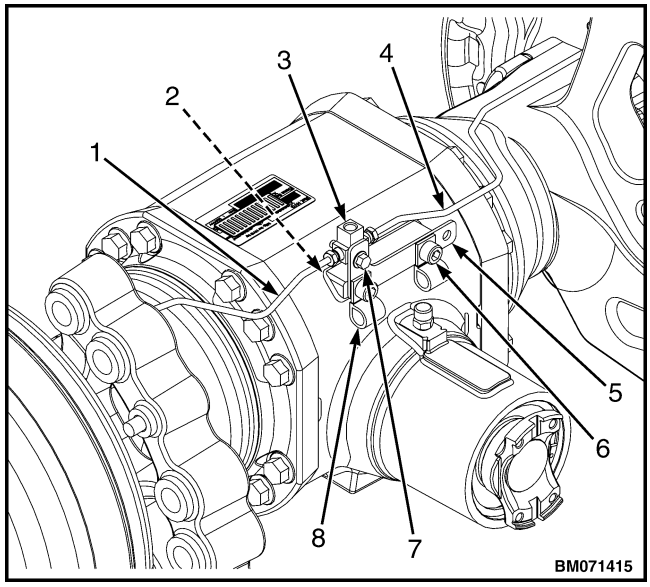
14. Disconnect the brake lines at the wheel cylinders (leave them connect to T-fitting).

15. Remove the two sockethead capscrews, two clamps, and bracket with brake lines and t-fitting attached from center section of drive axle. See Figure 151.

CAUTION

Any time the hub is removed from the axle, the inner seal MUST be removed and replaced with a new seal. See Parts Manual for correct part number of replacement seal. See Install section of Wheel ends for procedure.

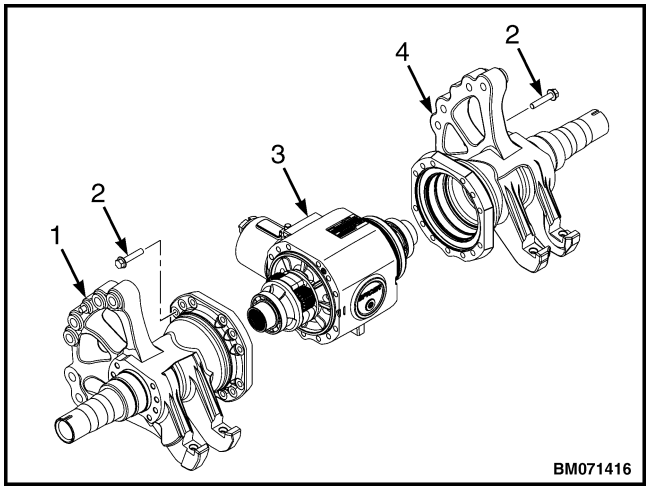
16. Remove axle shafts, hub/brake drum assemblies, and back plates. See following sections for procedures.



1. LEFT-HAND BRAKE LINE
2. NUT
3. T-FITTING
4. RIGHT-HAND BRAKE LINE
5. BRACKET
6. SOCKETHEAD CAPSCREW
7. CAPSCREW
8. HOSE KEEPER

Figure 151. T-Fitting and Bracket

17. Remove the thirteen capscrews and left-hand hanger assembly from drive axle center section. Remove the thirteen capscrews and right-hand hanger assembly from drive axle center section. See Figure 152.



1. RIGHT-HAND HANGER ASSEMBLY
2. CAPSCREW
3. DRIVE AXLE CENTER SECTION
4. LEFT-HAND HANGER ASSEMBLY

Figure 152. Hanger Remove/Install

INSTALL

1. Place the right-hand hanger assembly in position on the center section housing. Apply Loctite® 242 to the capscrews and install capscrews to retain hanger assembly. Tighten capscrews in sequence to 90 to 108 N•m (66 to 80 lbf ft). See Figure 153.

2. Place the left-hand hanger assembly in position on the center section housing. Apply Loctite® 242 to the capscrews and install capscrews to retain hanger assembly. Tighten capscrews in sequence to 90 to 108 N•m (66 to 80 lbf ft). See Figure 153.

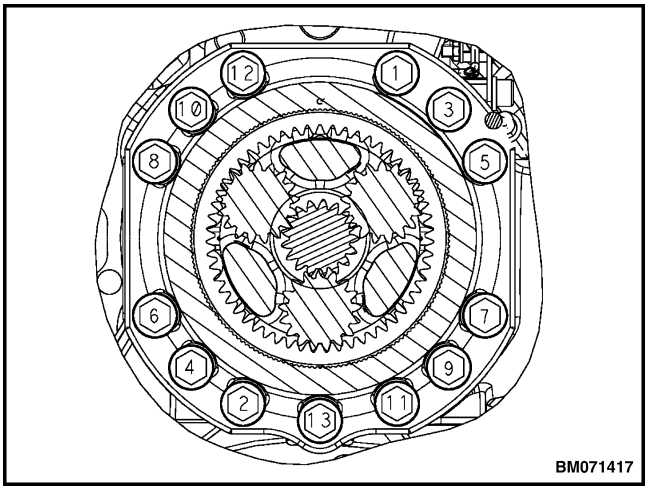


Figure 153. Hanger Assembly Tightening Sequence

NOTE: Ensure t-fitting and brake lines are still attached to the bracket prior to installation.

3. Install right park brake cable through one clamp. Install bracket, two clamps and two sockethead capscrews on drive axle center section. See Figure 148.

NOTE: Ensure t-fitting and brake lines are still attached to the bracket prior to installation.

4. Install bracket and two sockethead capscrews on drive axle center section. See Figure 151.

5. Install backplates, hub/brake drum assemblies, and axle shafts. See following sections for procedures.

6. Connect both brake lines at wheel cylinders.

WARNING

The drive axle is heavy. Make sure any lifting device has enough capacity to lift the drive axle. The drive axle can weight approximately 267 kg (589 lb).

7. Place blocks under the entire axle assembly and connect slings and lifting devices.

NOTE: Ensure the dowel pins are fully seated into the notch on the frame to ensure proper drive axle alignment. See Figure 150.

8. Position the drive axle in the lift truck. Place blocks under drive axle assembly. Install two mounting capscrews, one on each side, on frame and axle to hold axle in position.

9. Slide axle yoke outward to contact drive shaft and install four capscrews. Tighten capscrews to 32 to 36 N•m (23.6 to 26.6 lbf ft). See Figure 149.

10. Remove plug and connect brake hose assembly to t-fitting. See Figure 148.

11. Install the tires and wheels and nuts on drive axle. Tighten nuts to 339 to 380 N•m (250 to 280 lbf ft). See Figure 147.

12. Ensure drain plug is installed and tightened to 35 to 50 N•m (25.8 to 36.9 lbf ft).

13. Remove the fill plug and fill the drive axle to the proper level as shown in **Periodic Maintenance** 8000SRM2305 , with SAE 85W-140 GIL-5 gear oil through the fill hole. Install the fill plug and tighten to 35 to 50 N•m (25.8 to 36.9 lbf ft).

14. Raise the truck and remove blocks from under the frame and counterweight. Lower the truck.

15. Remove the blocks on each side (front and back) of the steering tires.

16. Install mast assembly as described in **Front End** 4000SRM2303.

17. Operate the truck and check for proper operation and leaks.

WHEEL ENDS 202001-255

SERVICING WHEEL ENDS

Remove

WARNING

When putting the truck on blocks, make sure the surface is solid, even, and level. Any blocks used to support the truck must be solid, one-piece units.

CAUTION

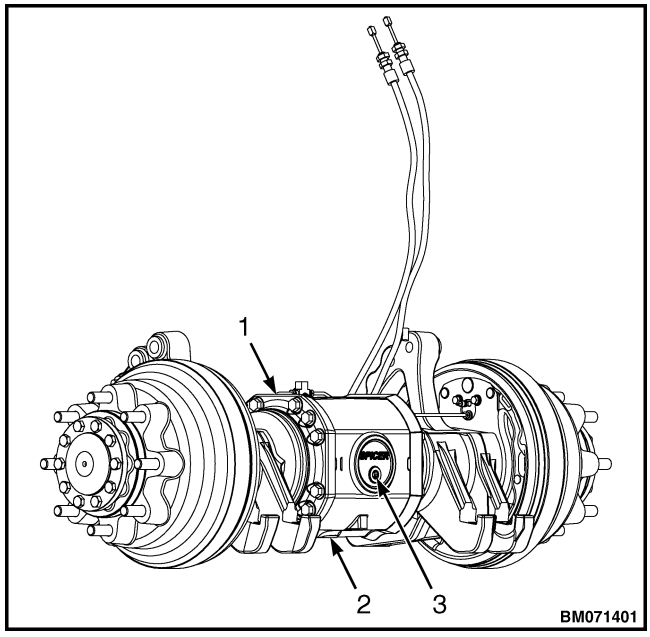
Because the truck is modular, the drive axle assembly is a structural part of the truck frame. The frame width tolerance at the drive axle is 5.0 mm (0.2 in.). Note the frame width at the drive axle to be maintained when re-installing the axle.

1. Put blocks on each side (front and back) of the steering tires to prevent movement of the lift truck. See How to put a lift truck on blocks in **Periodic Maintenance** 8000SRM2305.

CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

2. Place a suitable container under the drive axle. Remove drain plug and drain oil from axle center section into container. See Figure 154.



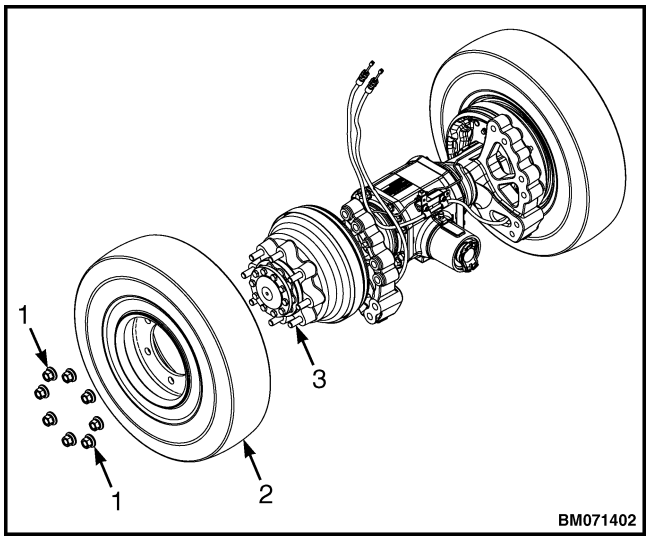
1. CENTER SECTION
2. DRAIN PLUG
3. FILL PLUG/PORT

Figure 154. Drive Axle Drain and Fill Plug

WARNING

On lift trucks with pneumatic tires, completely remove air from tires before removing them from the lift truck. Air pressure in tires can cause tire and rim parts to explode, which can cause serious injury or death. Never loosen nuts that hold together inner and outer wheels halves when there is air pressure in tires.

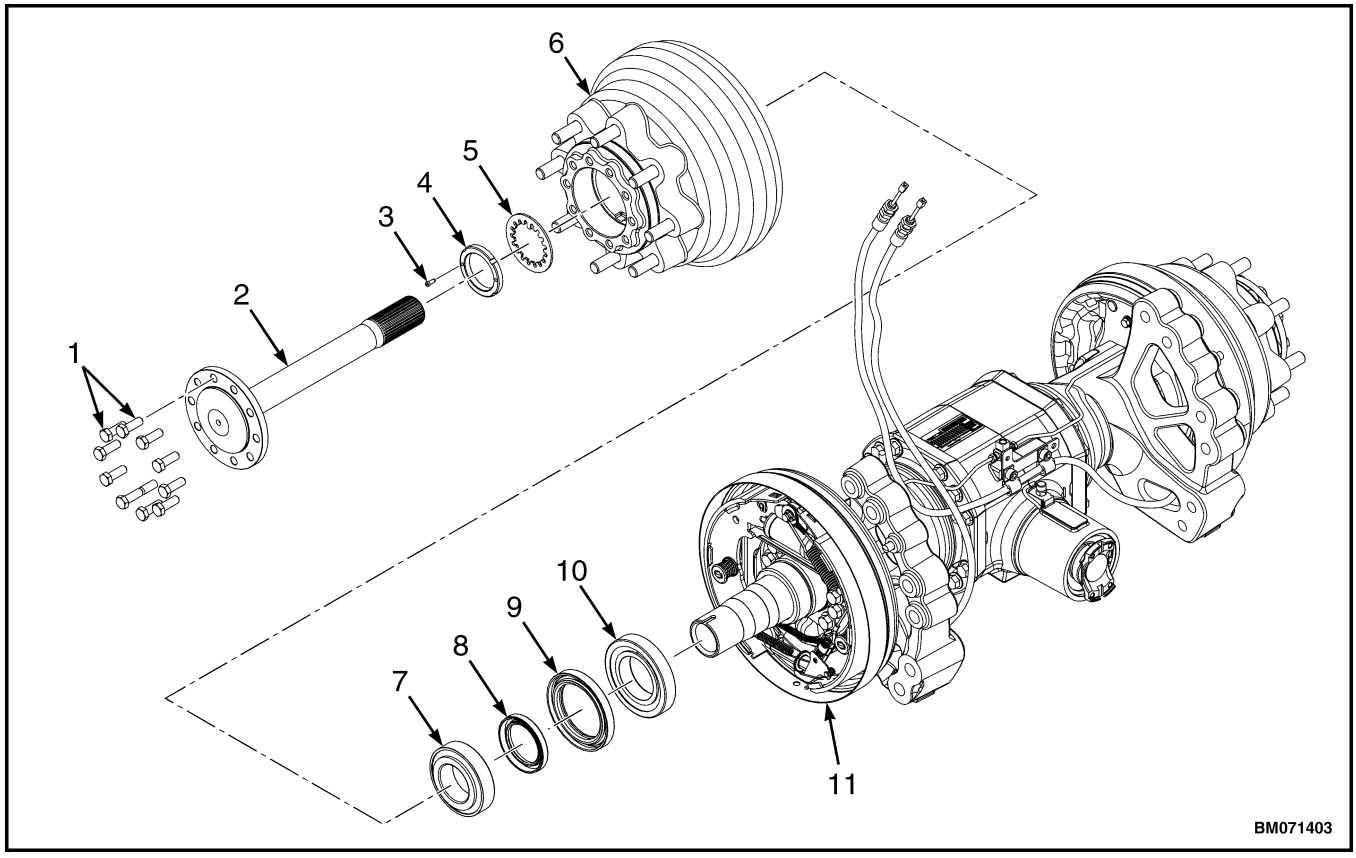
3. Remove wheel nuts from studs. Remove tire and wheel from hub. See Figure 155.



1. WHEEL NUT
2. WHEEL AND TIRE
3. STUD

Figure 155. Wheel Nuts

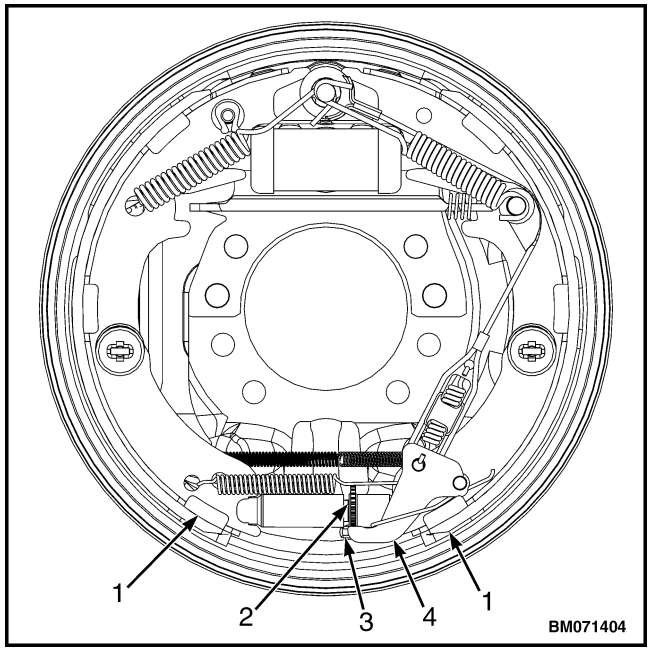
4. Remove capscrews, drive axle shaft, set screw, locknut, and lock washer from wheel hub. See Figure 156.



1. CAPSCREW
2. AXLE SHAFT
3. SET SCREW
4. NUT - LOCK BEARING
5. LOCK WASHER
6. WHEEL HUB
7. OUTER BEARING
8. OUTER SEAL
9. INNER SEAL
10. INNER BEARING
11. BRAKE ASSEMBLY

Figure 156. Wheel End Assembly

5. Use a brake adjustment tool or screwdriver to turn adjuster wheel (item 2, Figure 157) to loosen tension on brake shoes until 70 to 100 N•m (51.6 to 73.8 lbf ft) of torque is needed to rotate the hub.



1. BRAKE SHOE ADJUSTER
2. ADJUSTER WHEEL
3. SLOT
4. BRAKE SHOE ADJUSTER STOP

Figure 157. Brake Shoe Clearance Adjustment

6. Remove hub and drum assembly. DO NOT damage grease seal when removing hub.

CAUTION

Any time the hub is removed from the axle, the inner seal MUST be removed and replaced with a new seal. See Parts Manual for correct part number of replacement seal. See Step 1 of Install for procedure.

7. Remove roller bearing, outer seal, inner bearing, and inner seal from wheel hub. See Figure 156.

Clean and Inspect

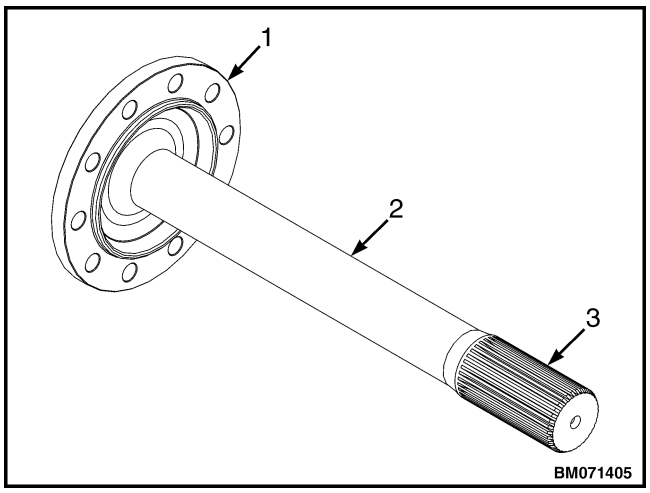
WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

1. Clean all the parts of the drive axle with solvent.

2. Inspect the bearings and seals for damage.

3. Inspect the axle shafts for wear and cracks at the flange, shaft, and splines. See Figure 158. If axle shafts show signs of wear of damage, replace the axle shafts. The splines for the axles shafts must not be damaged.



1. FLANGE
2. SHAFT
3. SPLINES

Figure 158. Axle Shaft Inspection

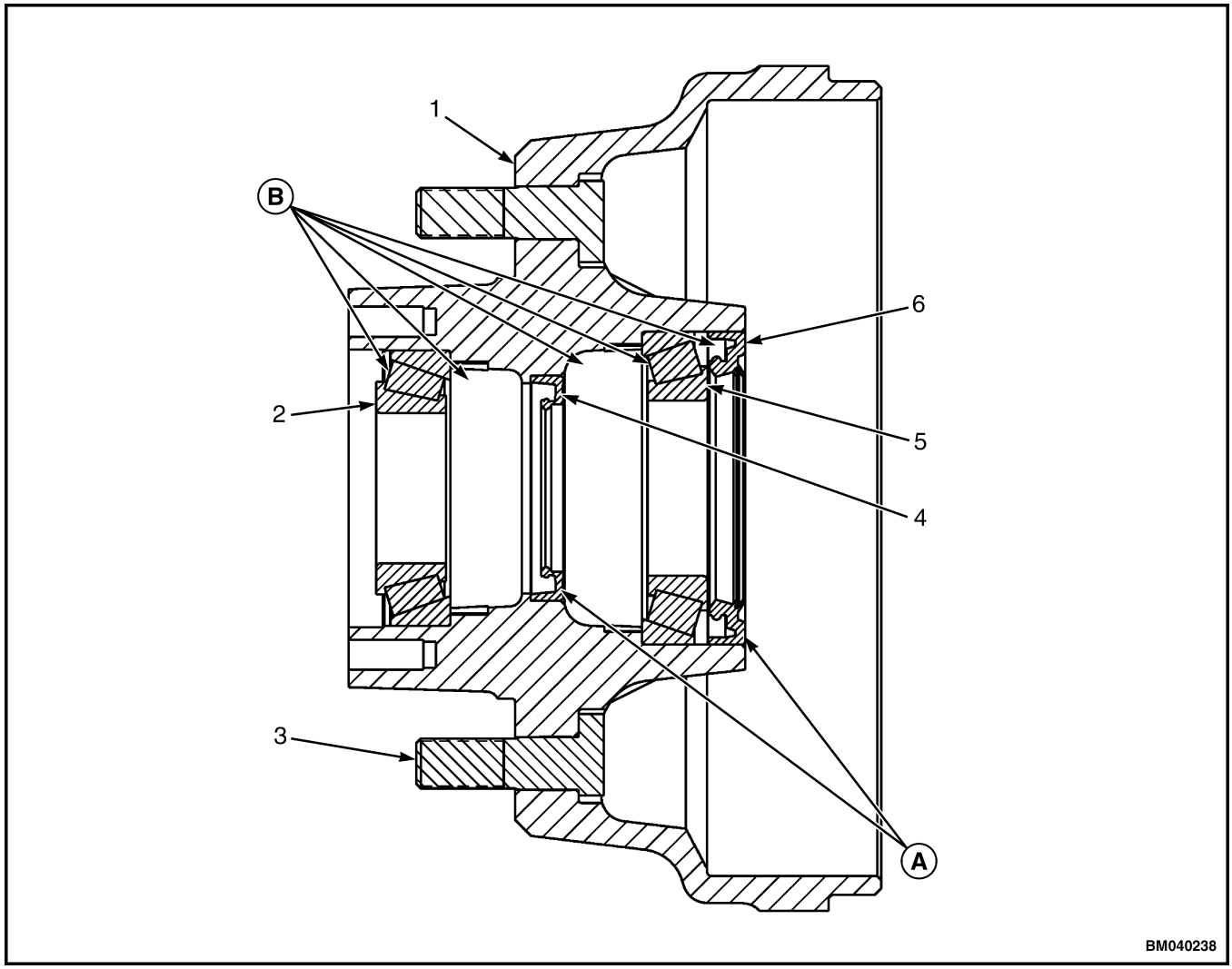
4. Check grease seals and surfaces of seals for wear or damage.

5. Clean bearings and lubricate them with wheel bearing grease. Refer to **Periodic Maintenance** 8000SRM2305.

Install

NOTE: To prevent damage to inner oil seal when installing hub, hub and drum assembly can be temporarily fastened to the wheel. Align height of axle housing with hub bearings. Put grease under wheel and slide wheel toward axle housing.

1. Install roller bearing and nut. Install inner oil seal, inner bearing, outer oil seal, and roller bearing into wheel hub. See Figure 159 and Figure 160.



A. SEAL SURFACE TO BE FLUSH WITH HUB SURFACE
B. PACK WITH GREASE

1. HUB
2. ROLLER BEARING
3. STUD
4. OUTER OIL SEAL
5. INNER BEARING
6. INNER OIL SEAL

Figure 159. Oil Seals and Bearing Locations

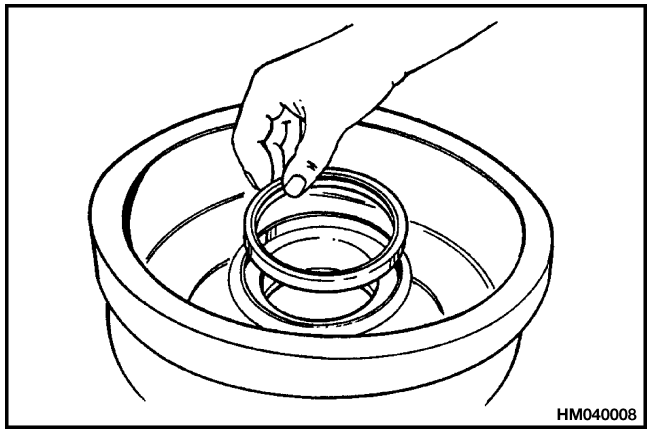


Figure 160. Inner Oil Seal Installation

2. Install washer and wheel adjustment nut (see Figure 161).

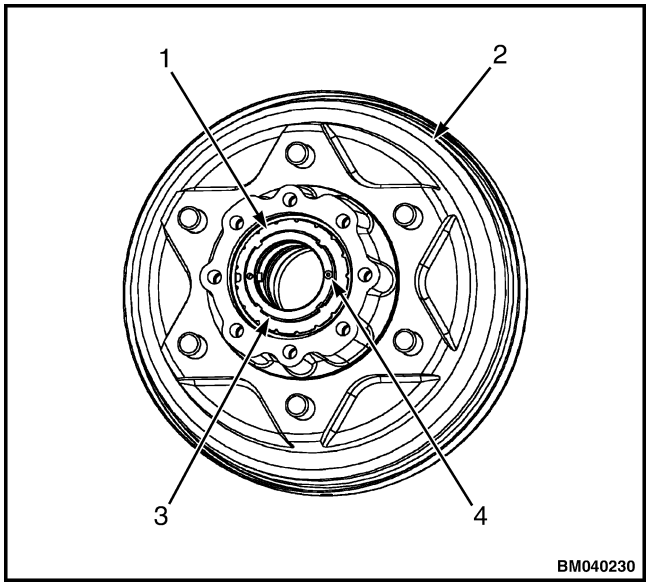
a. To align bearing rollers, tighten wheel adjust nut to 14 to 18 N•m (124 to 159 lbf in) and rotate hub 2 revolutions in both directions.

b. To seat wheel bearings, tighten wheel adjustment nut to 175 to 215 N•m (129 to 159 lbf ft).

c. Back off wheel adjustment nut to zero end play.

d. Preload wheel bearings by tightening wheel adjustment nut to 14 to 18 N•m (124 to 159 lbf in). Rotate hub 3 complete revolutions in both directions.

e. Verify wheel adjustment nut torque is 14 to 18 N•m (124 to 159 lbf in) and that torque stabilizes at that specification.



1. WASHER
2. BRAKE DRUM ASSEMBLY
3. SPINDLE NUT
4. SET SCREW

Figure 161. Lock Plate

3. Apply Loctite® to threads of set screw and install, aligning with groove in washer. Tighten set screw to 3 N•m (26.55 lbf in).

CAUTION

If there is too much clearance, the automatic adjuster will not operate. If the clearance is too small, the automatic adjuster cannot turn the adjuster wheel to increase the clearance, and the adjuster wheel will not turn until the brake shoes wear. If the adjuster wheel does not move for a long operating period, the adjuster link can wear a spot on the adjuster wheel so that it will not turn correctly.

NOTE: If brake shoes were not replaced, loosen adjuster wheel approximately 10 teeth.

4. Adjust clearance of brake shoes using steps below. See Figure 157.

a. If present, remove rubber plug from backing plate slot. Put a brake adjustment tool or a screwdriver through slot in back plate.

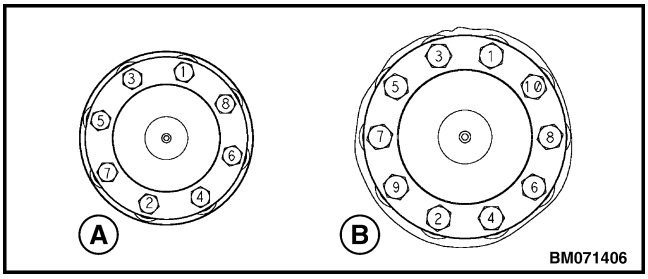
b. Use a tool to rotate adjuster wheel. Actuator for adjuster wheel will only permit rotation in one direction. Movement of adjuster wheel: tightening direction allowed, loosening required disengaging adjuster mechanism first. Viewed from axle center line out to brake assembly, tightening shoes is adjuster wheel teeth move downwards.

c. Turn adjuster wheel until brake shoes have expanded against brake drum and hub will not turn.

d. Use a small screwdriver to lift actuator away from adjuster wheel and turn adjuster wheel approximately 10 teeth in the opposite direction, viewed from axle center line out toward brake assemblies.

e. Brakes will adjust to correct clearance when they are applied while lift truck is traveling in reverse direction.

5. Put liquid sealant, Hyster Part Number 264159, on flange of axle shaft. Install axle shaft and capscrews. Tighten capscrews in cross pattern (see Figure 162) to 90 to 108 N•m (66 to 80 lbf ft).



A. AXLE
B. AXLE

Figure 162. Axle Shaft Tightening Sequence (Powershift Transmission)

SERVICE BRAKE 202001-256

SERVICE BRAKE REPAIR

Remove and Disassemble

WARNING

Brake linings can contain dangerous fibers. Breathing the dust from these brake linings is a cancer or lung disease hazard. DO NOT create dust! DO NOT clean brake parts with compressed air or by brushing. Use vacuum equipment approved for brake dust or follow the cleaning procedure in this section. When the brake drums are removed, DO NOT create dust. DO NOT sand, grind, chisel, hammer, or change linings in any way that will create dust. Any changes to brake linings must be done in a restricted area with special ventilation. Protective clothing and a respirator must be used.

When the brake shoes are removed, do not create dust in the air. See the CLEAN procedure in this section.

NOTE: See Figure 163 and Figure 164 for steps below.

NOTE: Note arrangement of brake parts during disassembly to aid in assembly.

1. Remove return springs with spring pliers.

2. Remove retainers, springs, and anchor pins that hold brake shoes to back plate.

3. Disengage spring and cable assembly from adjuster wheel actuator. Remove link, washer, and pivot plate. Remove anchor guide.

4. Move brake shoes away from each other to disengage brake shoes from wheel cylinder. Disconnect park brake lever from park brake cable as brake assembly is removed from back plate. Park brake lever has a hook that engages park brake cable.

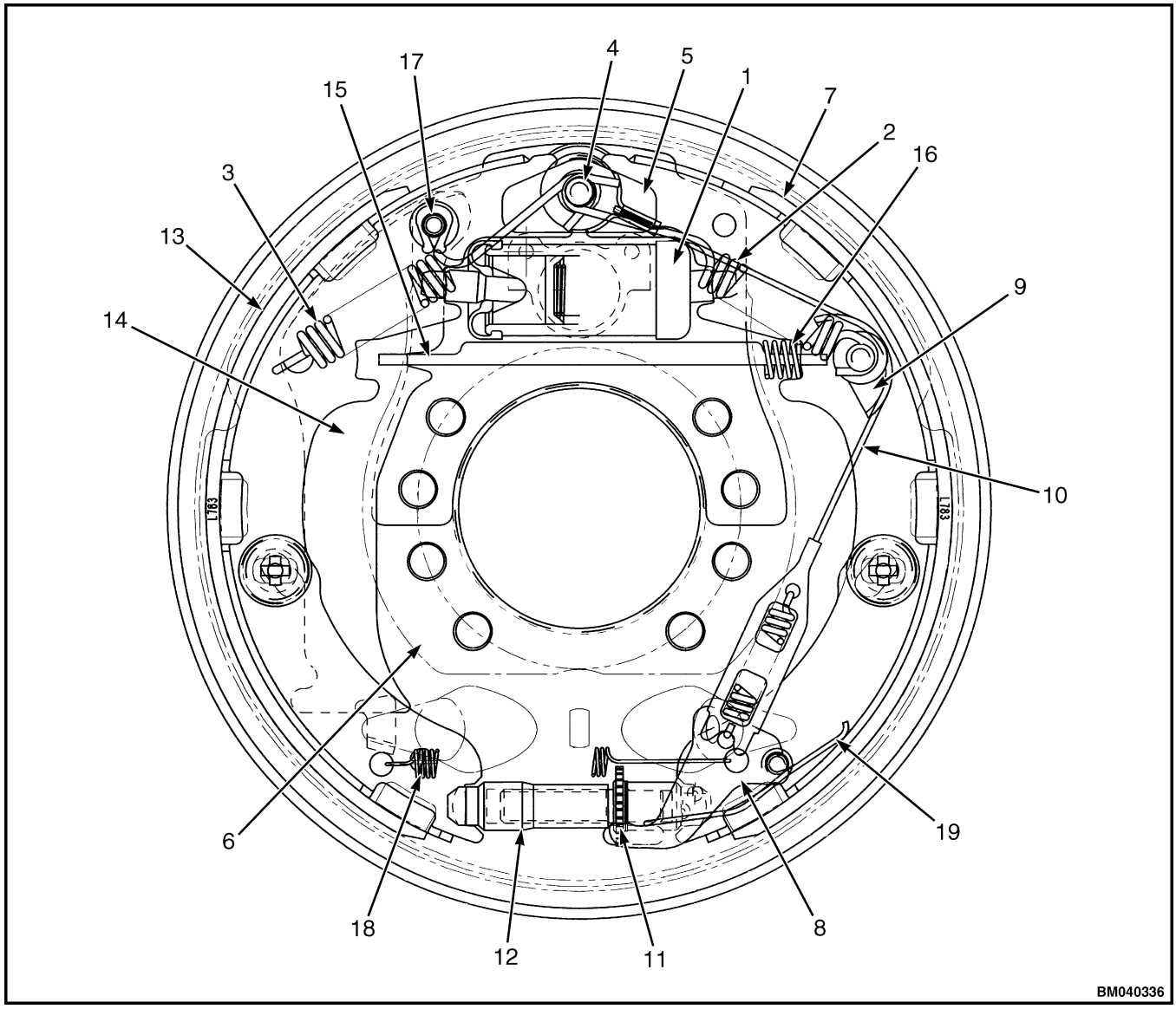
NOTE: Adjuster wheel for left brake is not the same as adjuster wheel for the right brake. Adjuster wheel for left brake has left-hand threads.

5. Remove park brake link and spring if they are still engaged with brake shoes. Park brake link and spring will often fall from brake assembly when brake assembly is removed from back plate. Adjuster wheel will also disengage from brake shoes after brake assembly is removed.

6. Remove spring for adjuster wheel actuator. Remove adjuster wheel actuator from brake shoe.

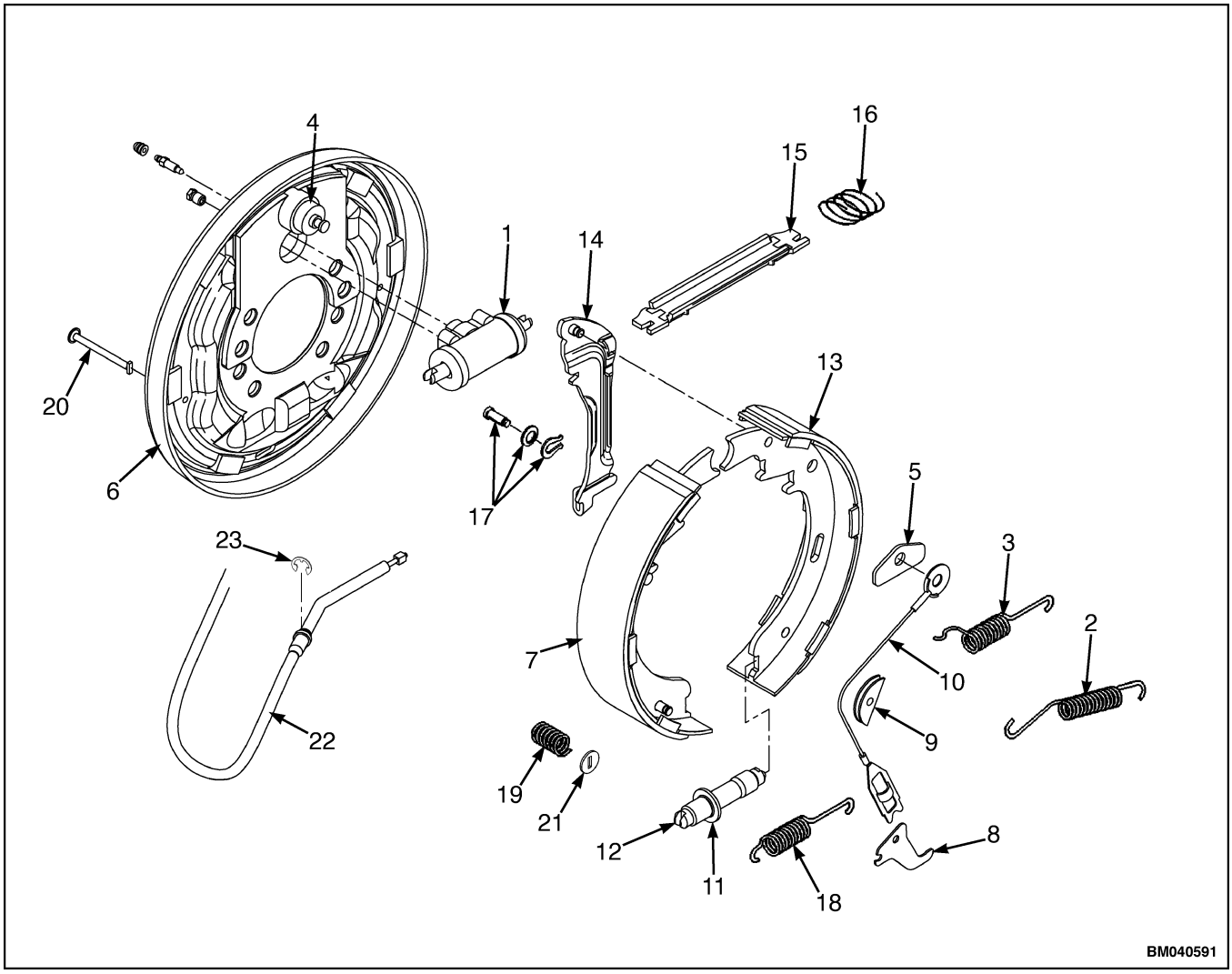
7. Use a screwdriver or small pry bar to move apart ends of retainer. Remove spring washer and pivot pin to remove park brake lever from brake shoe.

8. Disconnect brake line from wheel cylinder. Remove capscrews that hold wheel cylinder to back plate and remove wheel cylinder.



1. WHEEL CYLINDER
2. RETURN SPRING
3. RETURN SPRING
4. ANCHOR PIN
5. ANCHOR GUIDE
6. BACKPLATE
7. BRAKE SHOE
8. BRAKE SHOE ADJUSTER STOP
9. PIVOT PLATE
10. SPRING AND CABLE ASSEMBLY
11. BRAKE SHOE ADJUSTER WHEEL
12. BRAKE SHOE ADJUSTER ASSEMBLY
13. BRAKE SHOE
14. PARK BRAKE LEVER
15. PARK BRAKE LINK
16. PARK BRAKE SPRING
17. RETAINER AND SPRING WASHER
18. ADJUSTER ACTUATOR SPRING
19. SPRING

Figure 163. Brake Assembly (Left-Hand Shown)



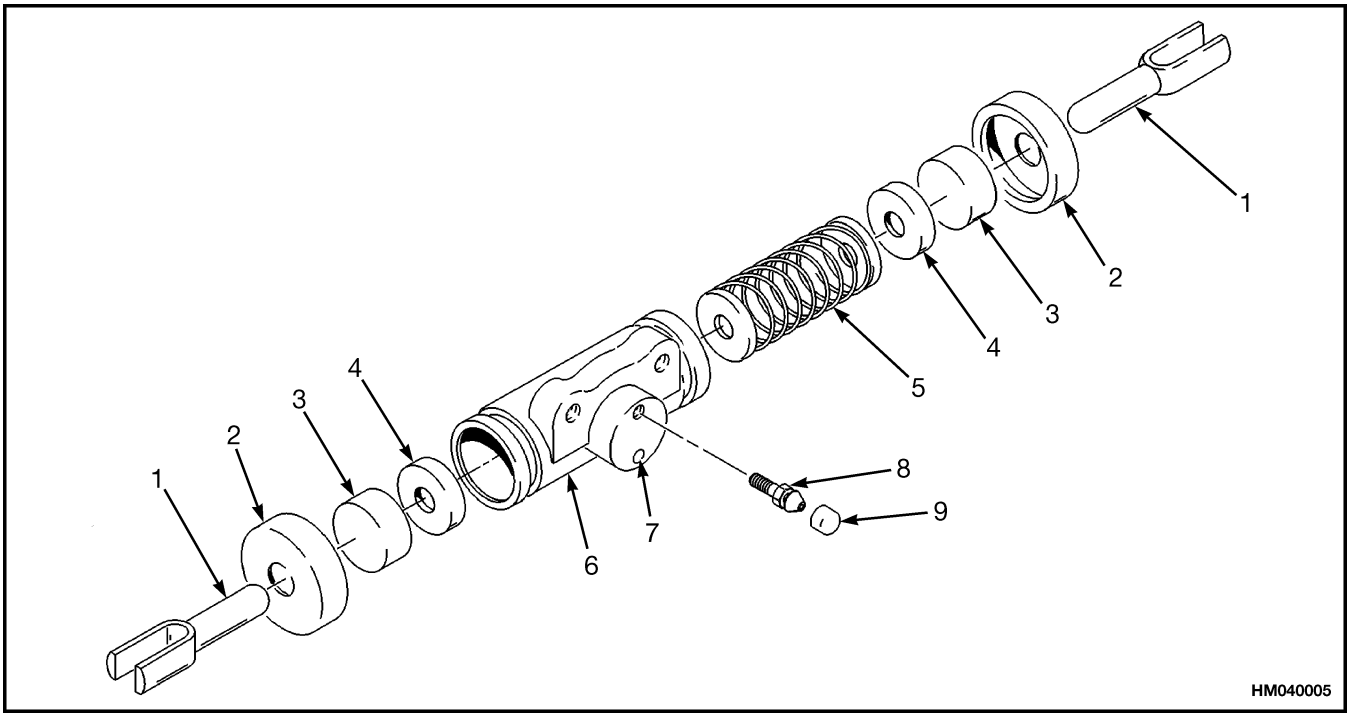
1. WHEEL CYLINDER
2. RETURN SPRING
3. RETURN SPRING
4. ANCHOR PIN
5. ANCHOR GUIDE
6. BACKPLATE
7. SECONDARY BRAKE SHOE
8. BRAKE SHOE ADJUSTER STOP
9. PIVOT PLATE
10. SPRING AND CABLE ASSEMBLY
11. ADJUSTER WHEEL
12. ADJUSTER ASSEMBLY
13. PRIMARY BRAKE SHOE
14. PARK BRAKE LEVER
15. PARK BRAKE LINK
16. PARK BRAKE SPRING
17. RETAINER AND SPRING WASHER
18. ADJUSTER ACTUATOR SPRING
19. SPRING
20. RETAINER PIN
21. RETAINER WASHER
22. PARK BRAKE CABLE
23. SNAP RING

Figure 164. Service Brake Parts (Right-Hand Shown)

NOTE: Back plate is not normally removed from axle housing for brake repairs. Special capscrews are used to fasten back plate to axle mount, and locking function of capscrews is reduced if they are removed.

9. Remove special capscrews if necessary.

10. Remove push rods, dust covers, pistons, cups, and spring from wheel cylinder. See Figure 165.



1. PUSHROD (2)
2. DUST COVER (2)
3. PISTON (2)
4. CUP (2)
5. SPRING
6. WHEEL CYLINDER BODY
7. INLET PORT
8. PRESSURE BLEEDER
9. DUST COVER

Figure 165. Wheel Cylinder

Clean

WARNING

DO NOT use an oil solvent to clean the master cylinder, wheel cylinder, or brake linings. Us a solvent approved for cleaning of brake parts. DO NOT permit oil or grease in the brake fluid or on the brake linings. Oil and grease will cause damage and leaks in the seals of a brake system. The brakes will not operate correctly if oil, grease, or brake fluid is on the brake linings.

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the safety instructions of the solvent manufacturer.

1. DO NOT release brake lining dust into the air when brake drum is removed.

2. Use a solvent approved for cleaning of brake parts to moisten brake lining dust. Follow instructions and cautions of manufacturer for use of solvent. If a solvent spray is used, spray at a distance so that dust is not released into the air.

3. When brake lining dust is wet, clean parts. Put any cloth or towels in a plastic bag or an airtight container while they are still wet. Put a DANGEROUS FIBERS warning label on plastic bag or airtight container.

4. Any cleaning cloths that will be washed must be cleaned so that fibers are not released into the air.

Inspect

1. Inspect the bore of wheel cylinder for pitting or scratches. Replace wheel cylinder assembly if there is any damage.

2. Inspect return springs for wear and damage. Inspect back plate for wear where brake shoes touch back plate. Buff or grind out any grooves or replace a worn or damaged back plate.

WARNING

The brake shoes on both wheels must be replaced if any shoe is damaged. The brake performance on both ends of an axle must be equal, or the lift truck can be difficult to steer when the brakes are applied.

3. Inspect brake shoes for cracks or damage. If linings or shoes are worn or damaged, replace brake shoes on both sides. Maximum wear is to within 1 mm (0.039 in.) of contact with rivets, or metal shoe on bonded linings. Brake shoes must be replaced in complete sets. Inspect brake drums for cracks or damage. Replace any damaged parts.

4. Inspect brake drum for deep grooves or other damage.

NOTE: If grooves must be removed from brake drums, DO NOT grind more than 1.5 mm (0.060 in.) from internal diameter of brake drum.

Maximum limit of internal diameter of the brake drum is 312 mm (12.28 in.).

If internal diameter is larger than the limit, replace brake drum.

5. The teeth of adjuster wheel must not be worn. Adjuster wheel must turn freely. Check adjuster links for damage.

6. Make sure park brake cables are in good condition.

Assemble and Install

1. If removed, install back plate to drive axle. Apply Loctite to threads and tighten special screws to 255 to 306 N•m (188 to 226 lbf ft). See Figure 166.

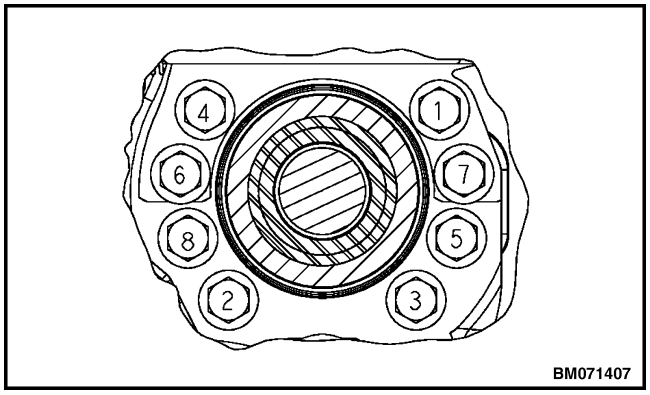


Figure 166. Special Screws Tightening Sequence

2. If wheel cylinder was disassembled for repair, assemble wheel cylinder. See Figure 165. Use only **HYSTER APPROVED** parts.

3. Install wheel cylinder on back plate and tighten two capscrews to 18 to 27 N•m (13 to 20 lbf ft). Connect brake line to wheel cylinder.

4. Install park brake cable. Use spring washer and retainer to fasten park brake lever to brake shoe. Close ends of retainer to fasten pivot pin in position.

5. Fasten adjuster actuator spring to adjuster wheel actuator and brake shoe.

6. Put anti-seize compound on threads of adjuster wheel. Turn the adjuster wheel into adjuster nut so that adjuster assembly is in its shortest position. This action permits brake drum to be easily installed over brake shoes.

WARNING

The threads of the adjuster wheel are not the same for each side, If the adjuster assemblies are installed on the wrong side, the brake shoe clearance will increase each time the brakes are applied. The adjuster wheel for the right brake has right-hand threads. The adjuster wheel for the left brake has left-hand threads.

7. Install adjuster wheel between two brake shoes. Make sure adjuster wheel will be toward rear of lift truck. Move brake shoes apart so that adjuster wheel is held in position and adjuster actuator spring is in tension.

8. Lubricate back plate with a small amount of lithium grease where brake shoes touch. Install brake shoes on anchor and engage the push rods of wheel cylinder. Engage the park brake lever in slot in park brake cable as brake shoes are installed on back plate.

9. Put an anchor pin, that holds brake shoes, through back plate. Put a spring seat, spring, and retainer on anchor pin. Push retainer onto anchor pin and rotate retainer 90 degrees. Make sure retainer is in correct position.

10. Install link, park brake, and spring between park brake lever and brake shoe.

11. Install other spring retainer, that holds brake shoes. Make sure park brake link and spring are correctly engaged after spring retainers are installed.

12. Install anchor guide on anchor. Install pivot plate on its anchor.

13. Lubricate adjuster cable where it slides in pivot plate groove.

14. Fasten spring and cable assembly to adjuster wheel actuator and put cable around pivot plate. Raise adjuster wheel actuator against spring tension and connect spring and cable assembly to anchor.

WARNING

Be sure to install the springs in order specified. See Figure 168. Improper assembly can result in brake failure and/or component damage.

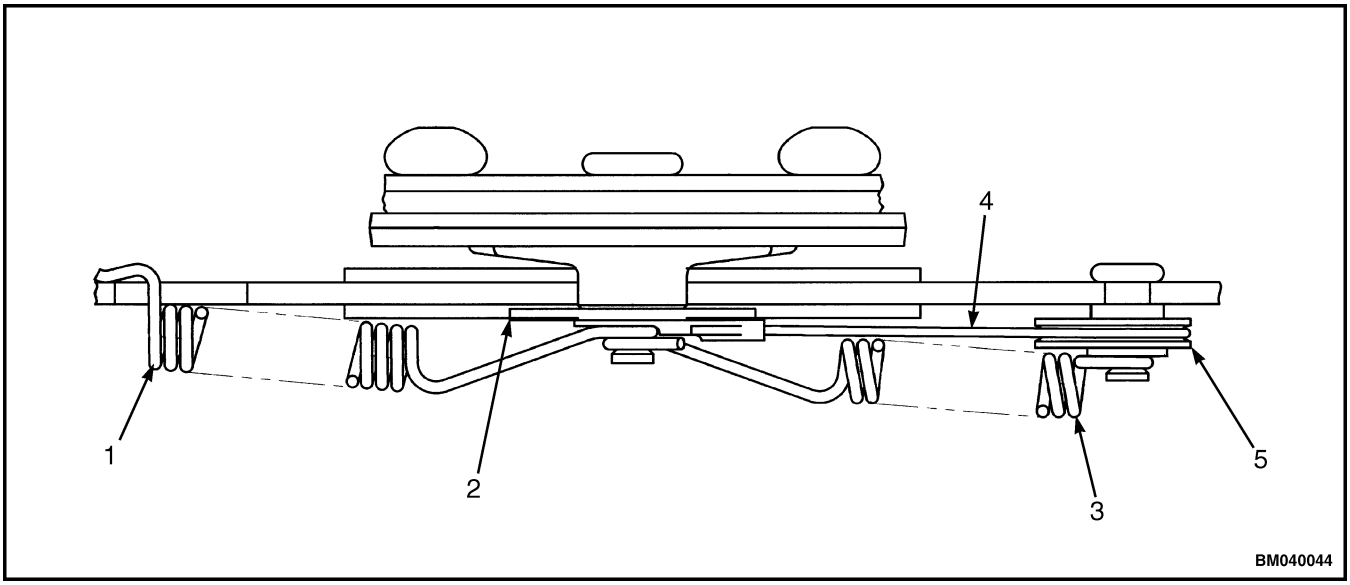
NOTE: The shape of return springs permits them to be installed correctly in only one position. The arrangement of return spring on anchors is shown in Figure 167 and Figure 168.

15. Using correct tools, install return springs as follows:

    a. Install return spring, item 1, Figure 167 or item 1, Figure 168.

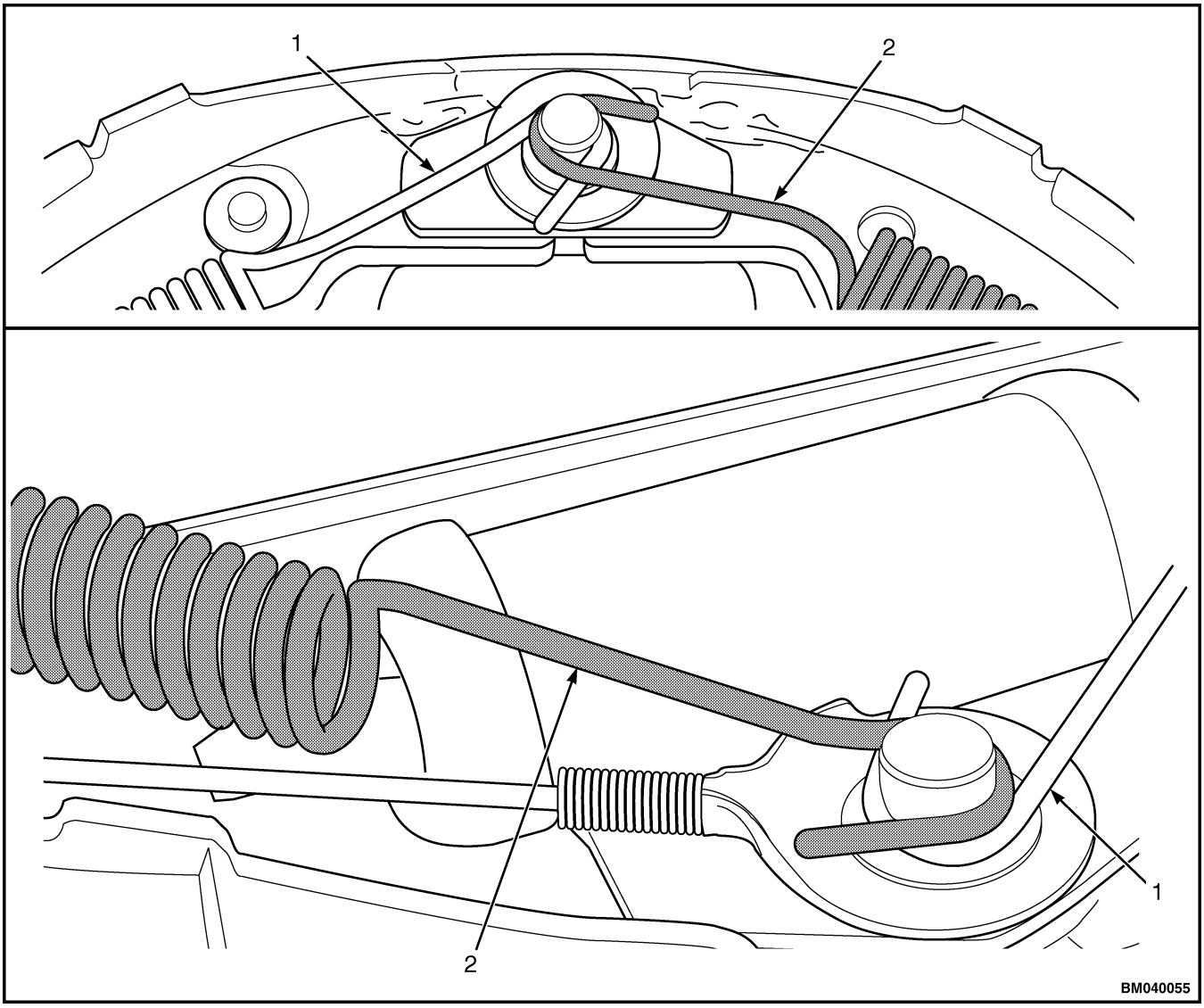
    b. Install return spring, item 3, Figure 167 or item 2, Figure 168.

    c. Verify that return springs are properly installed as shown in Figure 168.



1. RETURN SPRING
2. ANCHOR GUIDE
3. RETURN SPRING
4. SPRING AND CABLE ASSEMBLY
5. PIVOT PLATE

Figure 167. Return Springs

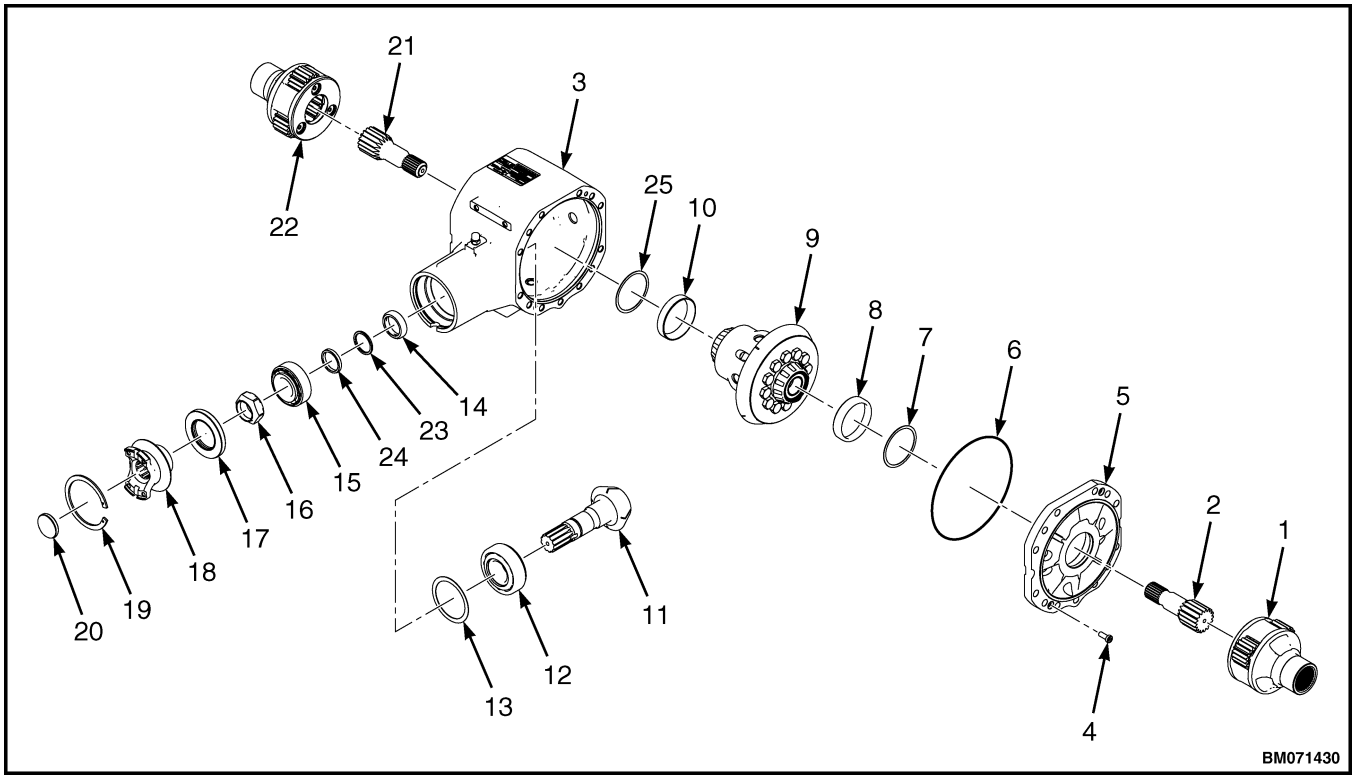


1. RETURN SPRING
2. RETURN SPRING

Figure 168. Correct Installation of Return Springs

CENTER SECTION
202001-257

CENTER SECTION REPAIR



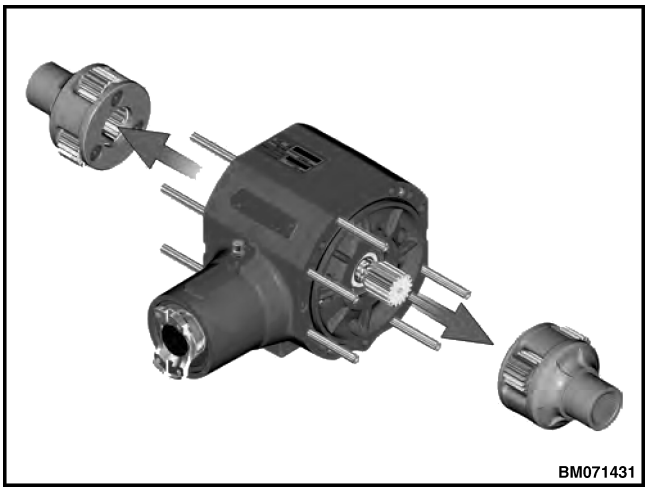
1. PLANETARY CARRIER (RIGHT)
2. AXLE HALF SHAFT (RIGHT)
3. CENTER SECTION HOUSING
4. CAPSCREW
5. MIDDLE COVER
6. O-RING
7. SHIM
8. OUTER THRUST BLOCK BEARING
9. DIFFERENTIAL
10. EXTERNAL THRUST BLOCK BEARING
11. PINION
12. INNER BEARING
13. WASHER
14. SPACER
15. BEARING
16. PINION NUT
17. SEAL RING
18. AXLE INPUT YOKE
19. SNAP RING
20. CAP
21. AXLE HALF SHAFT (LEFT)
22. PLANETARY CARRIER (LEFT)
23. SHIM
24. SHIM
25. SHIM

Figure 169. Bevel Pinion Exploded View

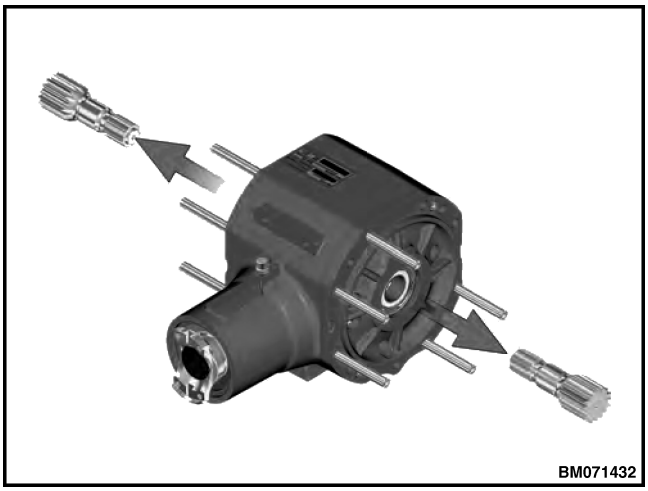
Center Section Disassemble

NOTE: See Figure 169 for complete view of disassembly.

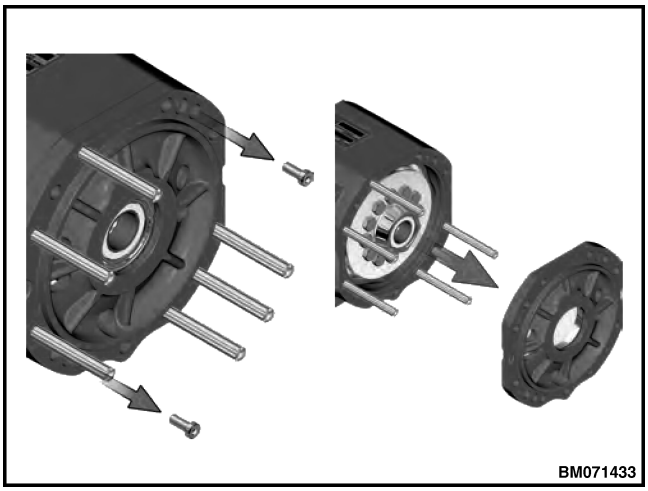
STEP 1.
Remove the complete planetary carriers from center section housing.



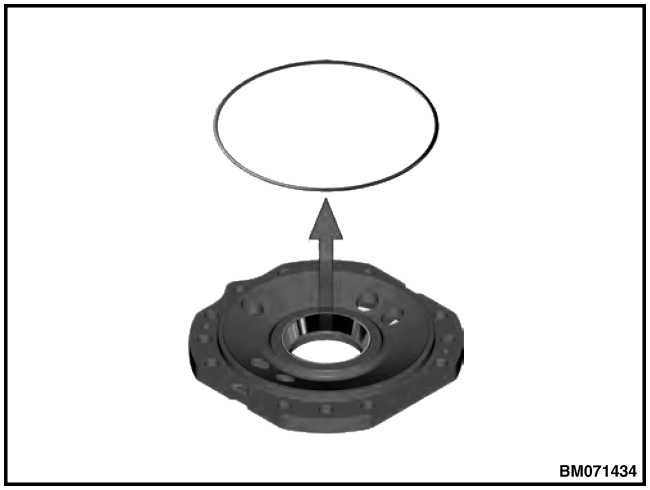
STEP 2.
Remove the axle half shafts from center section housing.



STEP 3.
Remove the capscrews from the middle cover from center section housing. Insert a screw driver in the opposing slots of middle cover, then using force remove the middle cover from the center section housing. Repeat for opposite middle cover.



STEP 4.
Use a screwdriver to remove the O-ring from middle cover. Repeat for opposite middle cover.

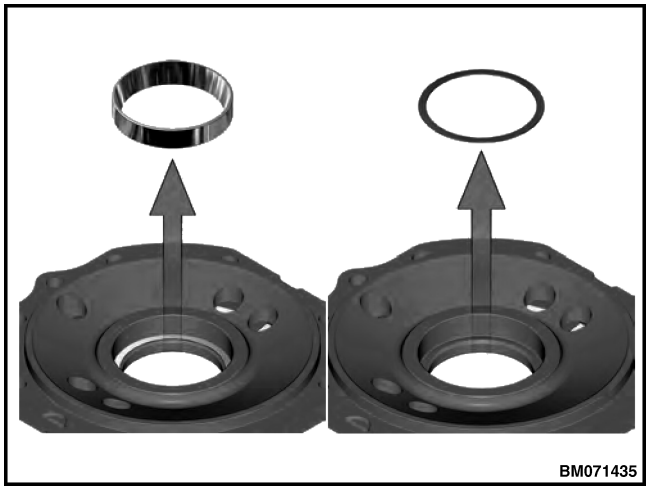


CAUTION

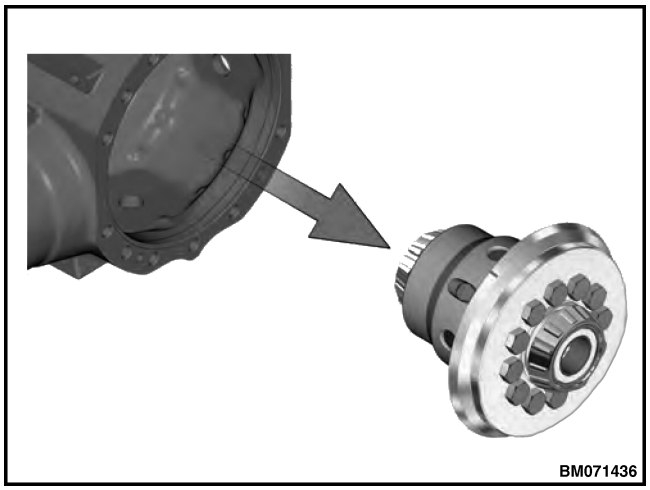
Be careful to not damage the bearing surfaces.

NOTE: Check the thickness of the shims. Example: 1.2 mm (0.047 in.).

STEP 5.
If replacing bearings, extract the outer thrust block bearings from the middle cover. Remove shims under the outer thrust block bearing. Repeat for opposite middle cover.



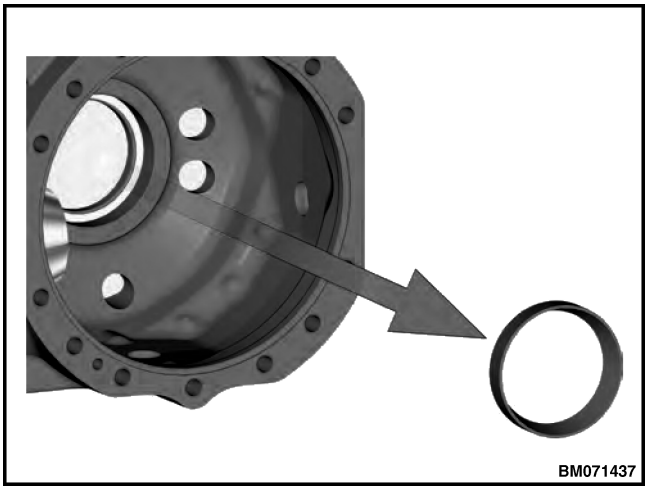
STEP 6.
Extract the differentials from the either side of the center section housing.



CAUTION

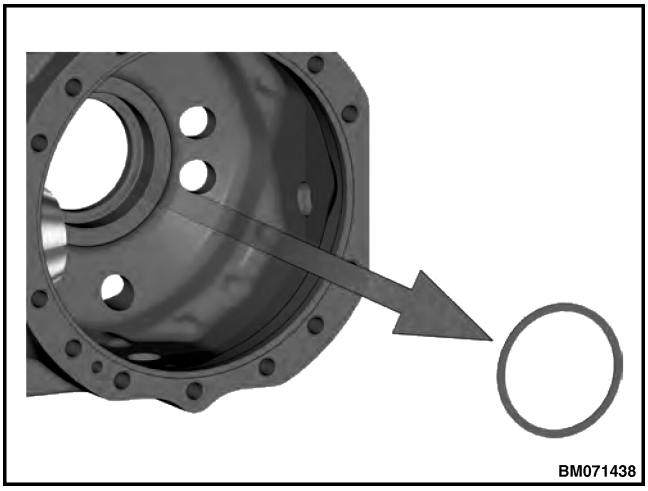
Be careful to not damage the bearing surfaces.

STEP 7.
If replacing bearings, extract the external thrust block bearing from the center section housing. Repeat for opposite side of housing.



NOTE: Check the thickness of the shims. Example: 1.2 mm (0.047 in.).

STEP 8.
Remove the shims located under the external thrust block bearing from center section housing. Repeat for opposite side of housing.

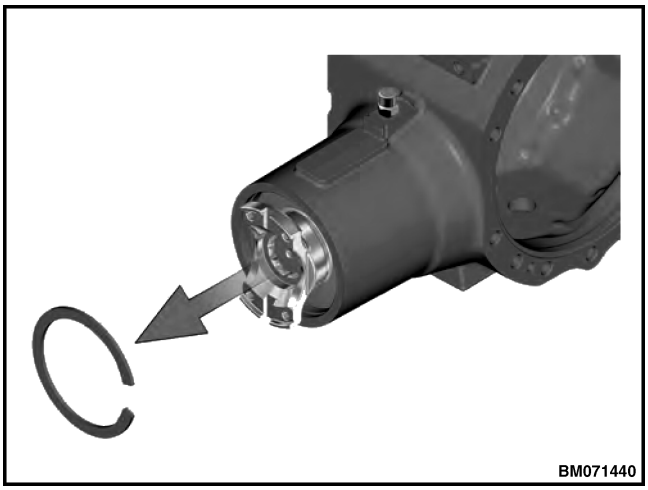


WARNING

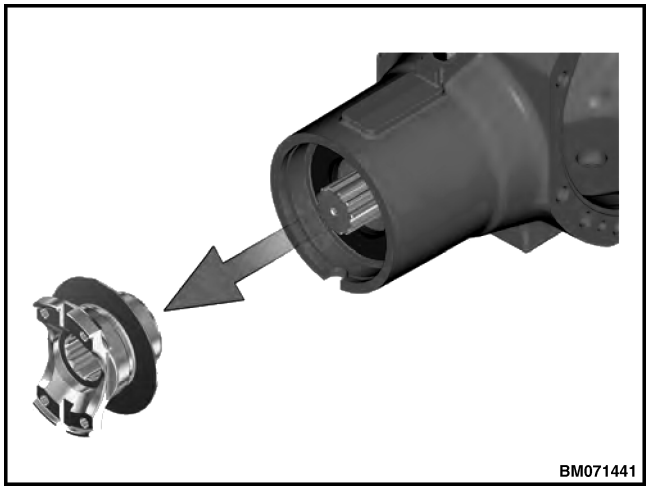
Be careful when removing or installing snap rings. These snap rings can come loose during removal or installation with enough force to cause injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

NOTE: See End-Stop Plier Settings section for procedures to set up suitable pliers.

STEP 9.
Using suitable pliers, remove the snap ring from the axle input yoke.

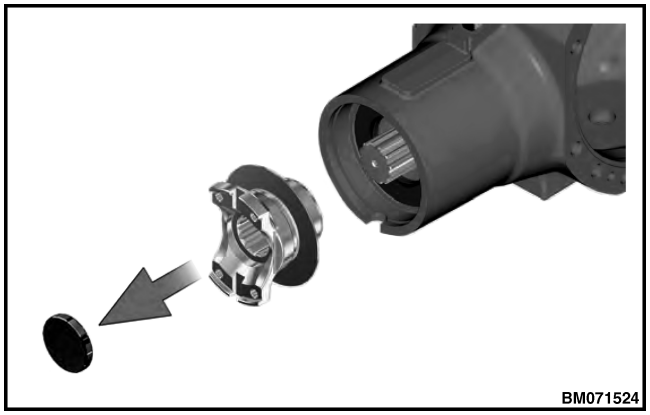


STEP 10.
Remove the axle input yoke from the pinion.



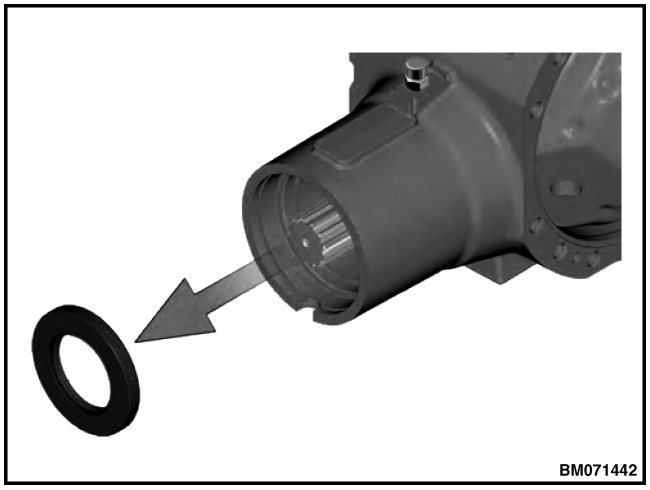
NOTE: The cap must be replaced, if removed.

STEP 11.
Remove and discard the cap from the axle input yoke.

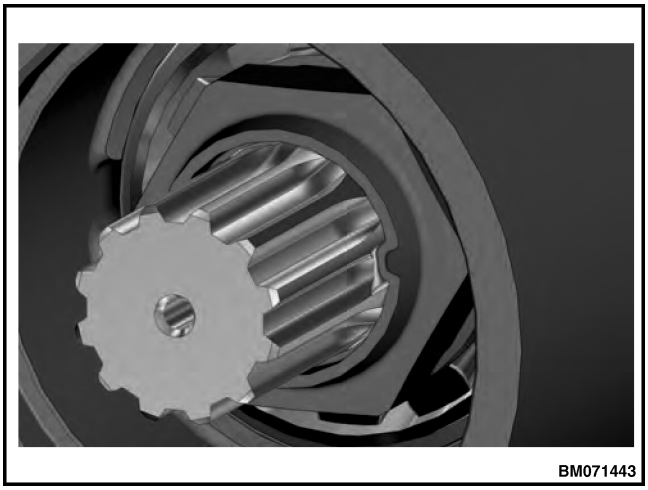


CAUTION
Be careful to not damage the bearing surfaces.

STEP 12.
Using an extractor, remove the seal ring from the pinion.



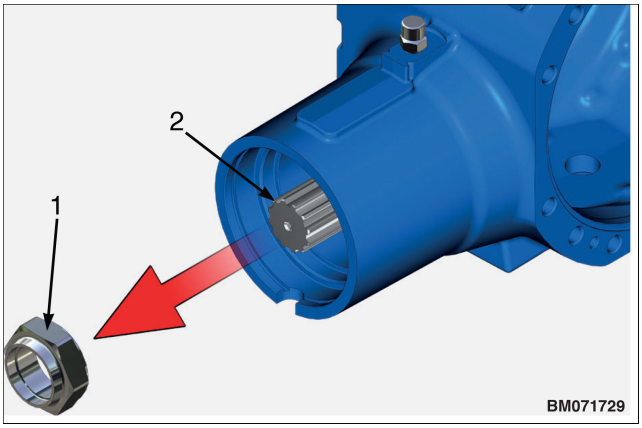
STEP 13.
Remove the staking in order to avoid damaging the pinion during the removal of ring nut.



NOTE: If disassembly is difficult, heat the ring nut to approximately 80°C (176°F).

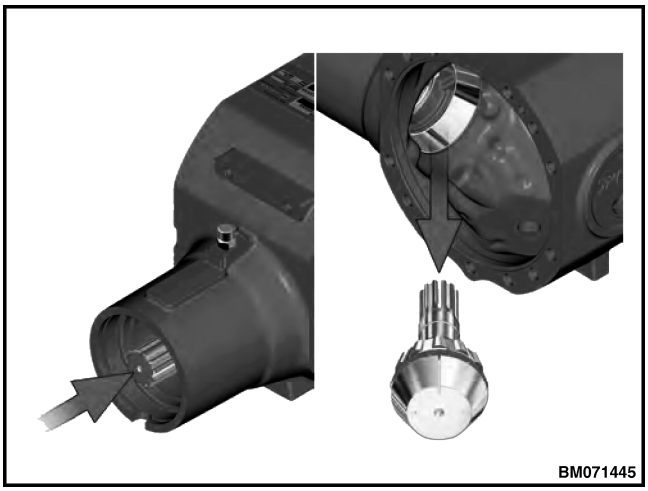
STEP 14.
Locate special tool T1, see Special Tools in the Dry Brake Axle Special tools of this manual.

Apply the special wrench T1 to the pinion, engaging the splined profile of the pinion (item 2, in the following illustration) and the hexagon of the nut (item 1). Rotate the pinion socket wrench clockwise to loosen the nut.



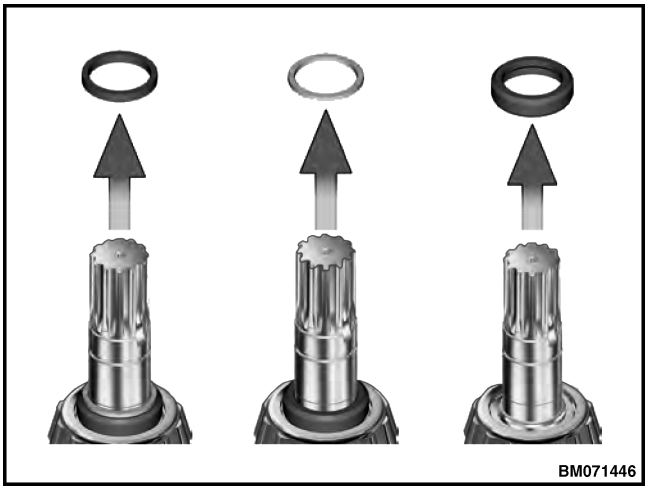
1. HEX NUT
2. PINION NUT

STEP 15.
Using a plastic hammer, remove the pinion from the center section housing.



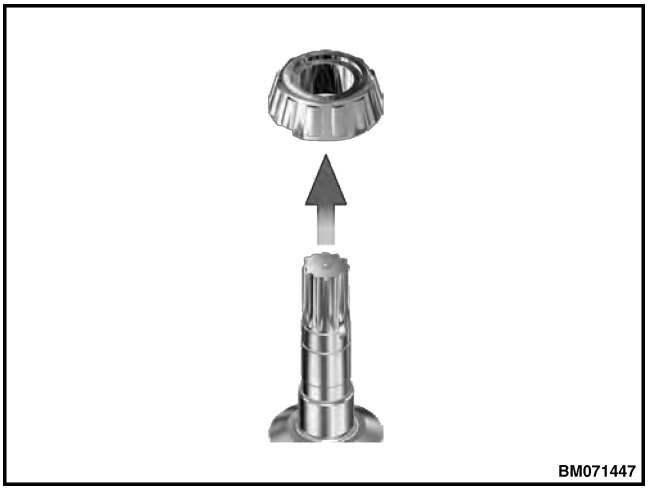
NOTE: Check the thickness of the shims. Example: = 3 + 5.8 = 8.8 mm (0.12 + 0.23 = 0.35 in.).

STEP 16.
Remove shims and spacer from the pinion.

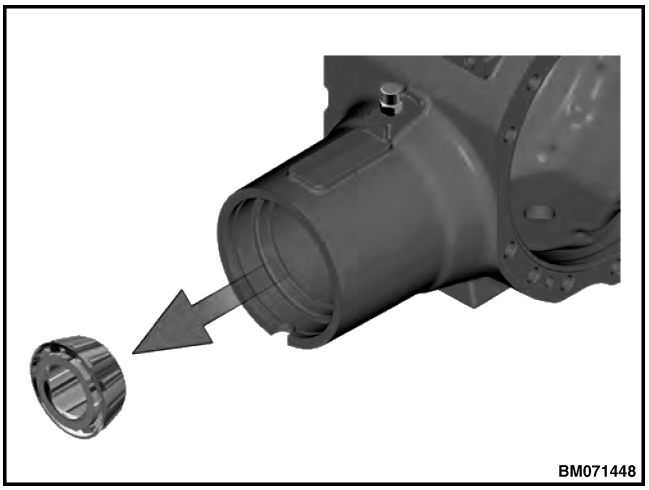

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NOTE: The inner bearing may fall out, unless pinion is vertical as shown below.

STEP 17.
Using a puller and a press, remove the inner bearing from the pinion from center section housing.


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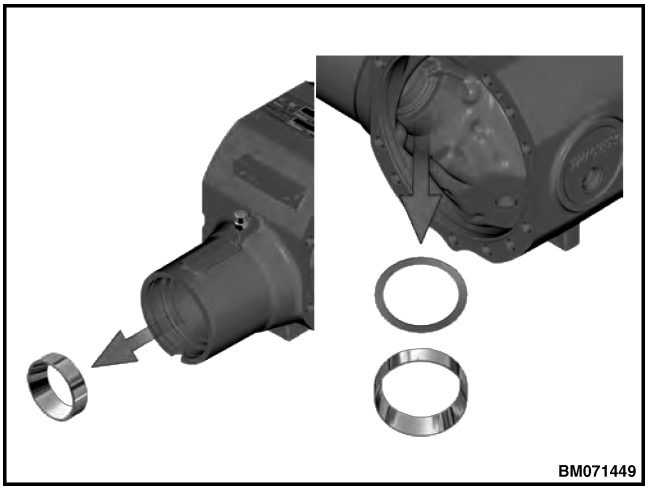
STEP 18.
Remove bearing from center section housing.


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CAUTION

Be careful to not damage the bearing surfaces.

STEP 19.
Using an internal extractor, shims from the center section housing.

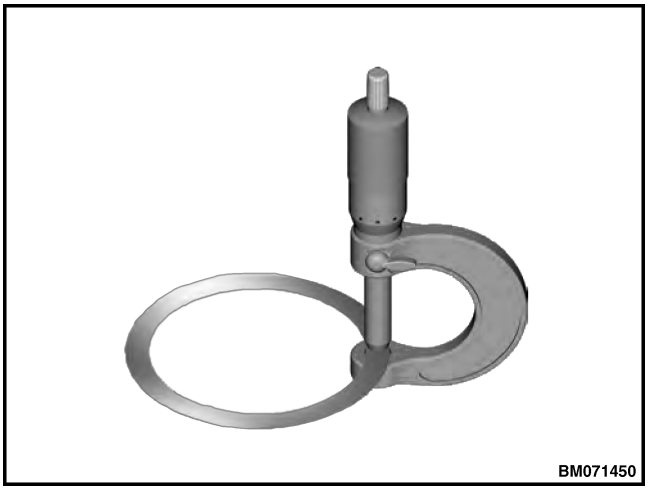


Center Section Assemble

NOTE: See Figure 169 for complete view of disassembly.

NOTE: Check the thickness of the shims. Example: = 1.1 mm (0.043 in.).

STEP 1.
Check the thickness of pinion shims.



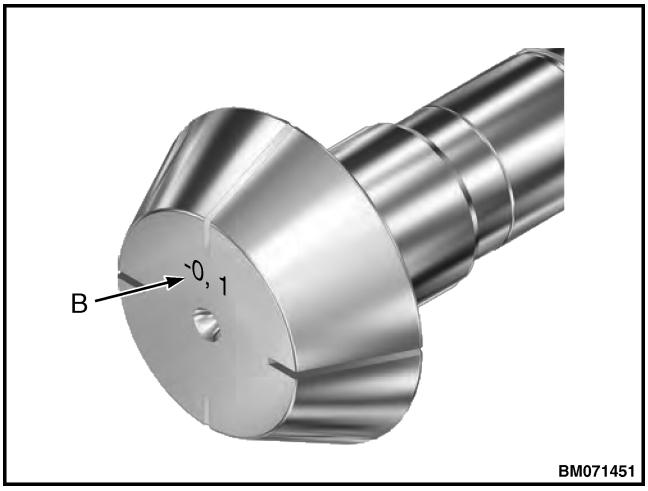
STEP 2.
Check nominal dimension "B" as marked on the old pinion.

Execute the calculation following the indicated formula to obtain the necessary value to the successive calculation.

C = A ± B

EXAMPLE: C = 1.1 - 0.1 = 1 mm (0.04 in.).

C =1 mm (0.04 in.)



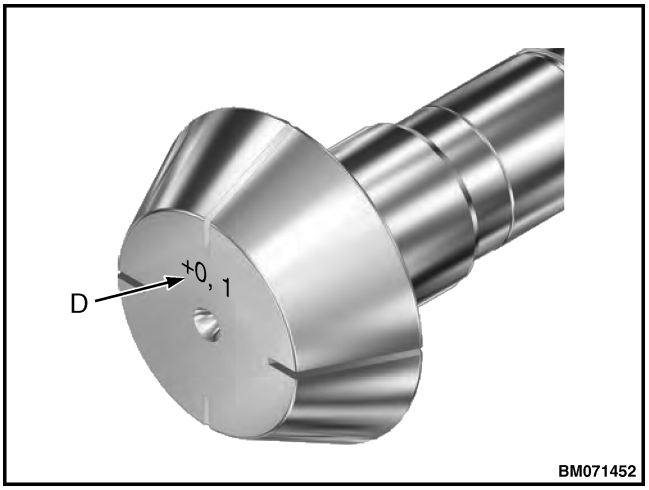
STEP 3.
Check nominal dimension "D" as marked on the new pinion.

Execute the calculation following the indicated formula to obtain the value of necessary shims.

S = C - (D)

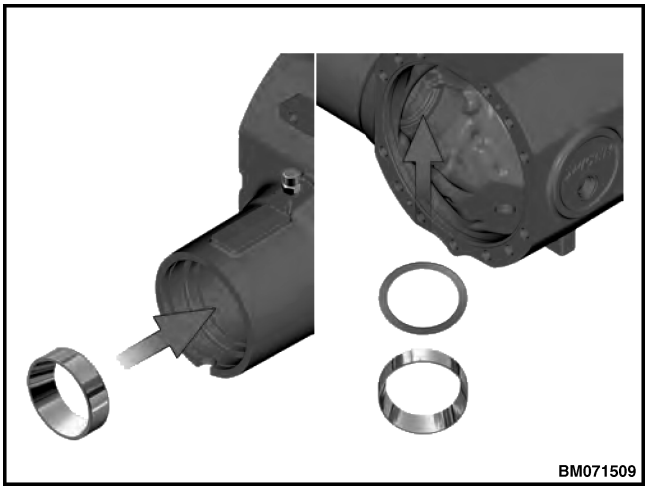
EXAMPLE: S = 1 (+0,1) = 0.9 mm (0.04 in.).

S =0.9 mm (0.04 in.)

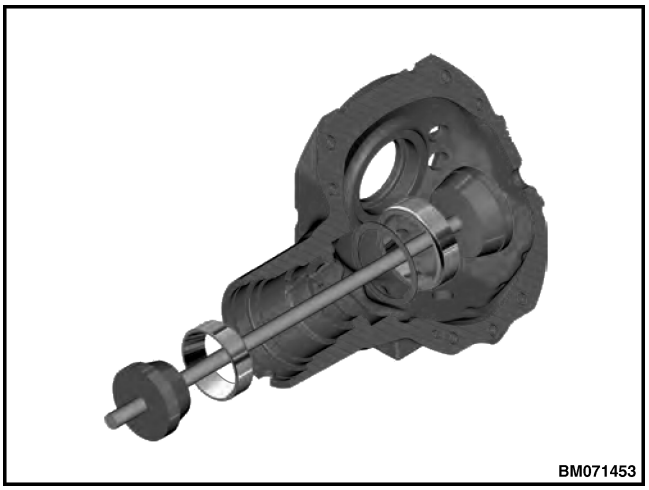


NOTE: The thinner shims must be placed in between the thicker ones.

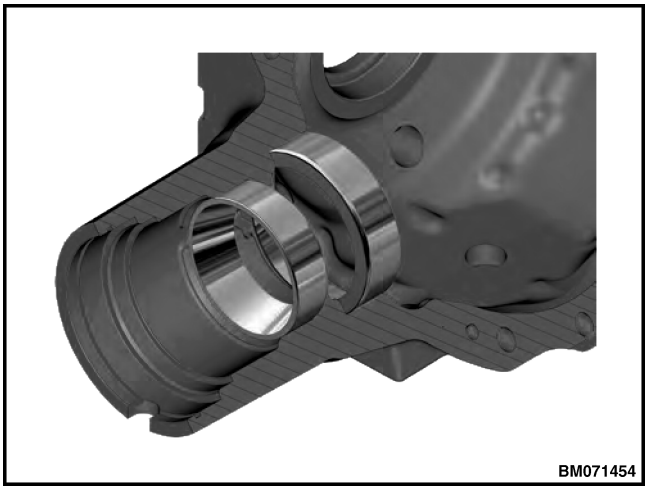
STEP 4.
Partially insert the thrust block bearing with the shims into the center section housing.



STEP 5.
Install tension rod and guide tool, Special Tool T2, on the external thrust block bearing and inner thrust block bearing. See T2.



STEP 6.
Connect the tension rod to the press and move the thrust block bearing into its seat. Disconnect the press and remove the tension rod.


BM071454

WARNING

Be careful when handling heated parts. Always wear the proper protective clothing, gloved, and eye protection.

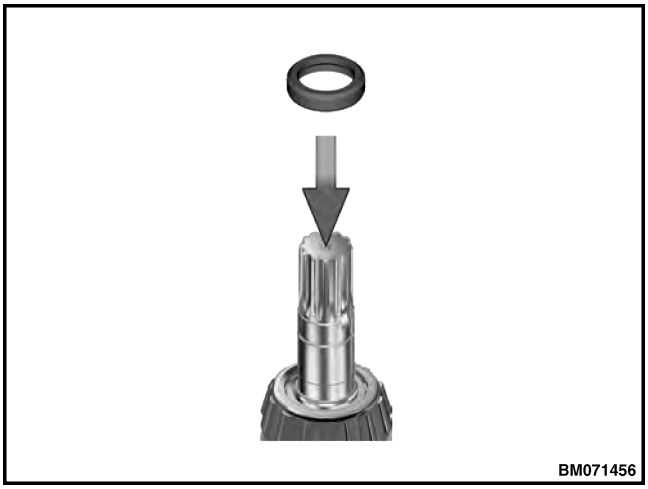
NOTE: Before proceeding to the next step, ensure that the thrust blocks have been completely inserted into the seat.

STEP 7.
Heat the inner bearing to approximately 100°C (212°F) and fit it on the pinion.


BM071455

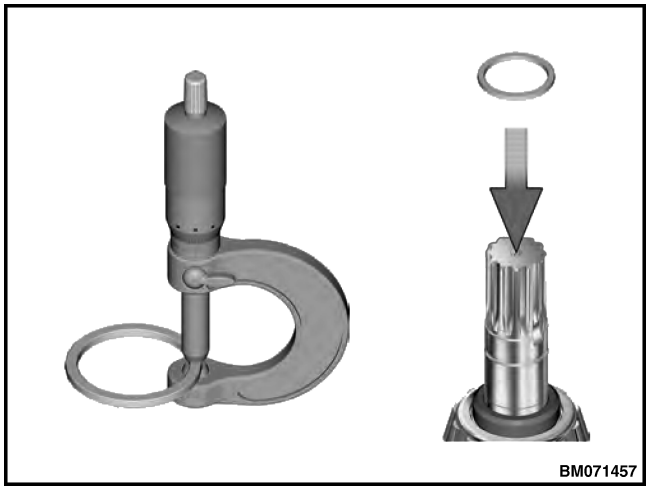
NOTE: Check the tapered roller bearing installation at end of stroke.

STEP 8.
Install the spacer onto the pinion.


BM071456

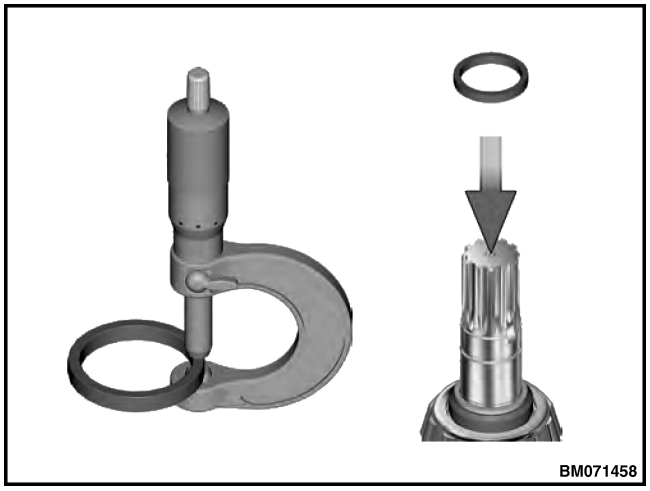
NOTE: Calibrated shim thickness. Example: 3 mm (0.12 in.).

STEP 9.
Install calibrated shim on pinion.

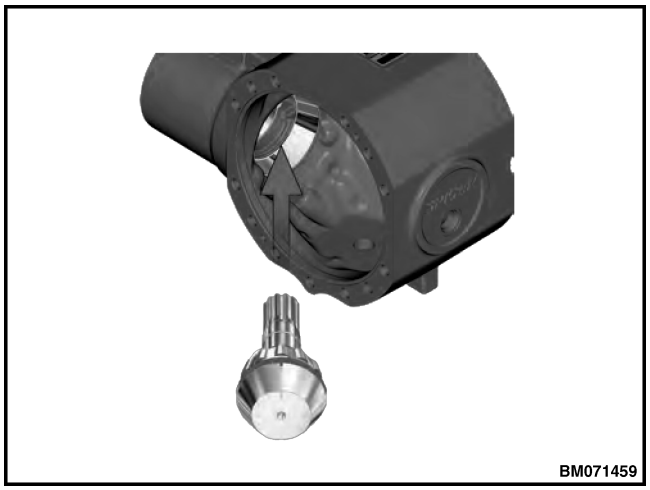

BM071457

NOTE: Calibrated shim thickness. Example: 5.8 mm (0.23 in.).

STEP 10.
Install calibrated shim on pinion.


BM071458

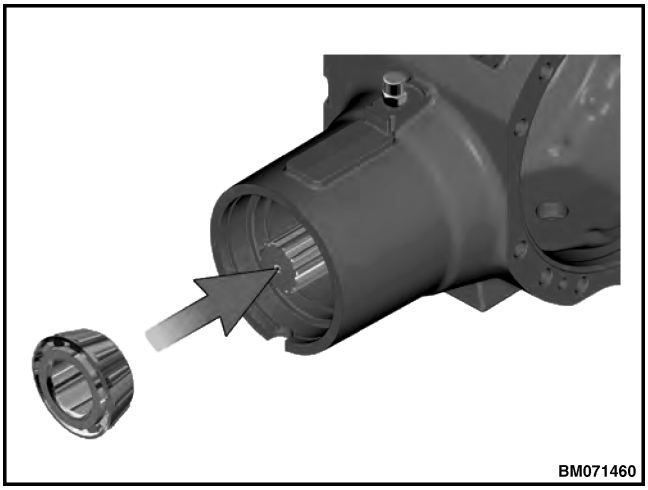
STEP 11.
Fit the pinion into the center housing.


BM071459

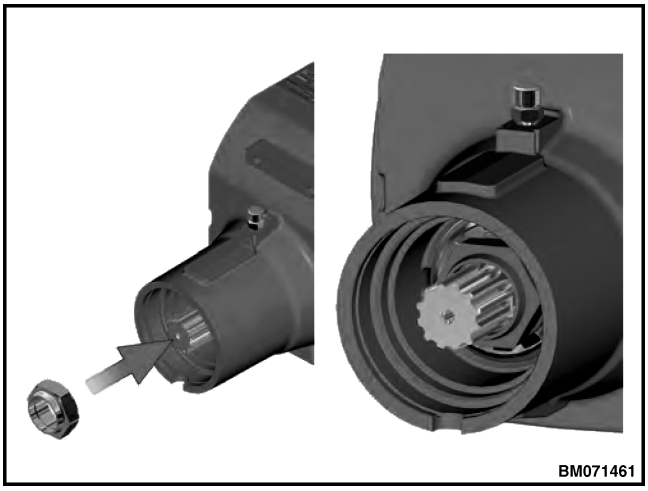
WARNING

Be careful when handling heated parts. Always wear the proper protective clothing, gloved, and eye protection.

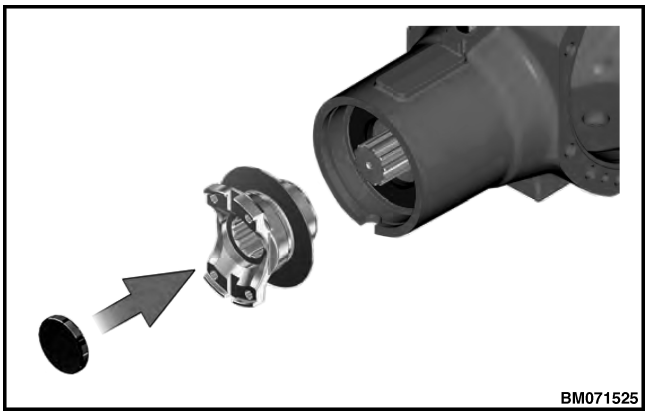
STEP 12.
Heat the outer bearing to approximately 100°C (212°F) and fit it on the pinion.



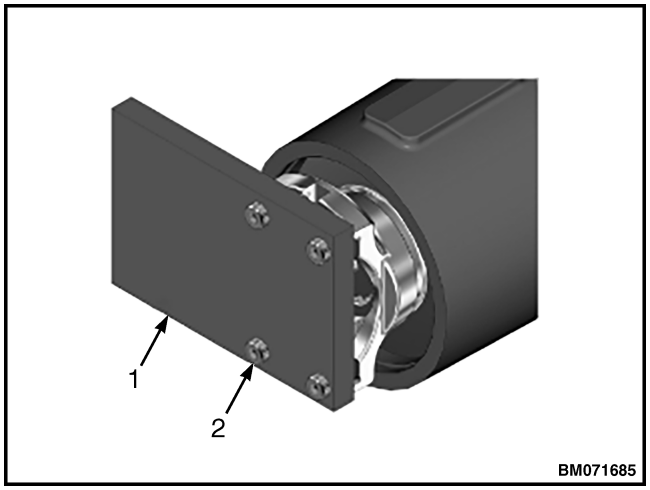
STEP 13.
Locate a new hex nut (see Parts Manual for correct part number). Coat the nut with Loctite® 270 and hand tighten. Apply special tool T1 (see Dry Brake Axle Special tools) on pinion, engaging the splined profile of the pinion and the hexagon of the nut. Tighten the nut using a torque wrench to 400 to 500 N•m (295 to 369 lbf ft).



STEP 14.
Install the flange and input yoke onto the pinion.



STEP 15.
Install special tool T3 (see T3 in Dry Brake Axle Special tools section of this manual) on the yoke. Secure the special tool with four screws.



1. T3
2. SCREW

CAUTION

If torque exceed the maximum value, the size of calibrated shim needs to be increased.

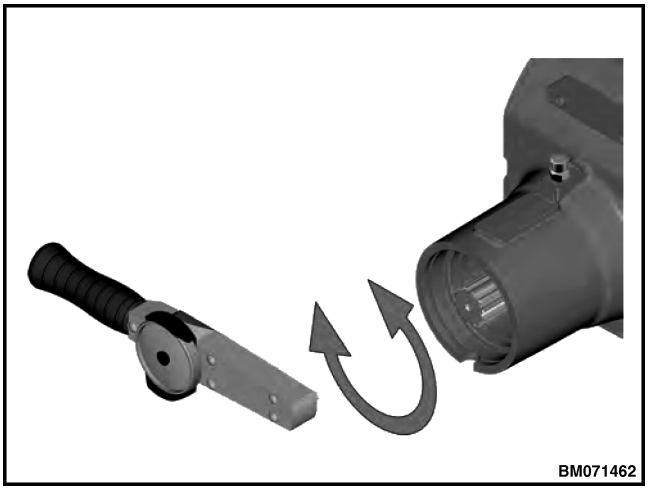
If torque does not reach the minimum value, the size of calibrated shim needs to be decreased.

CAUTION

If bearings are not new, check static torque; if bearings are new, check continuous torque.

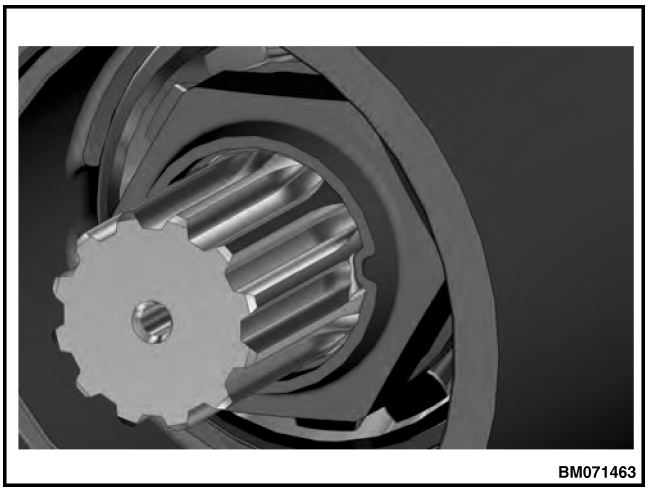
Table 5. Rolling Torques

Model	Rolling Torque
141/10137767	1.2 to 2.7 N•m (0.89 to 1.99 lbf ft)
141/10137851	1.4 to 3.0 N•m (1.03 to 2.21 lbf ft)
141/10144088	1.4 to 3.0 N•m (1.03 to 2.21 lbf ft)
141/10144764	1.2 to 2.7 N•m (0.89 to 1.99 lbf ft)
141/10144774	1.2 to 2.7 N•m (0.89 to 1.99 lbf ft)
141/10144777	1.2 to 2.7 N•m (0.89 to 1.99 lbf ft)


BM071462

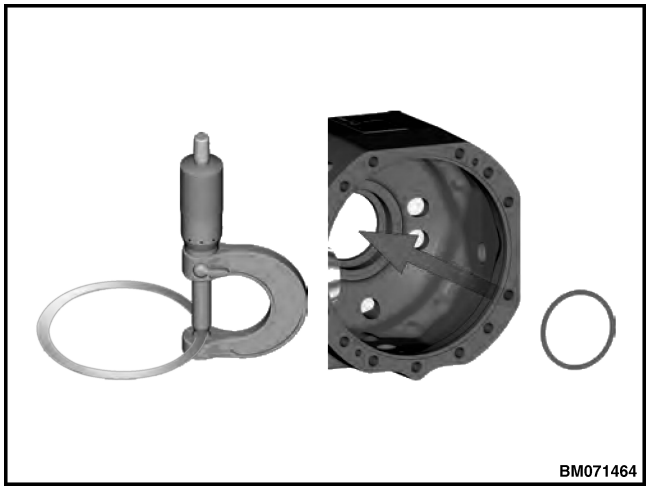
STEP 16.
Using a torque meter, check the torque of the pinion.

STEP 17.
Stake the nut.

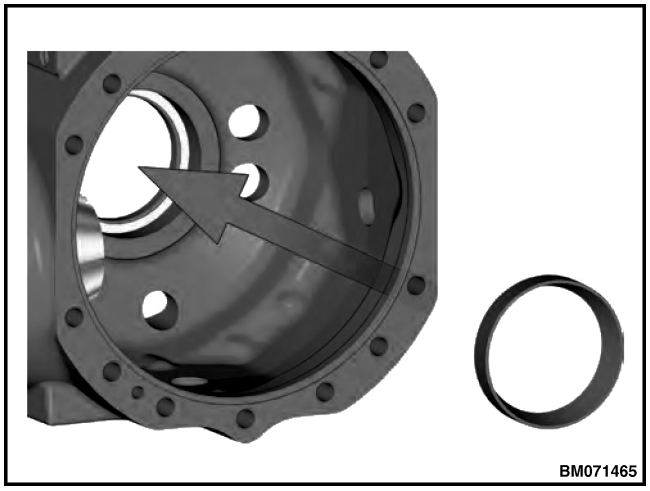

BM071463

NOTE: Shim thickness. Example: 1.2 mm (0.05 in.).

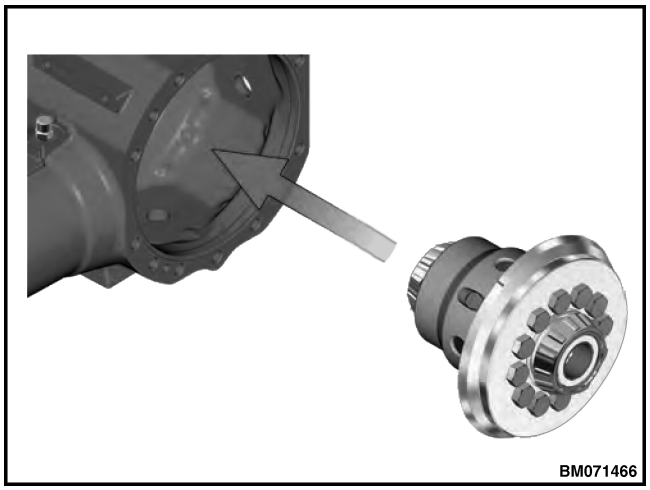
STEP 18.
Install the shims into the central housing body.



STEP 19.
If the bearings are replaced, insert the external thrust block bearing in the central section housing.

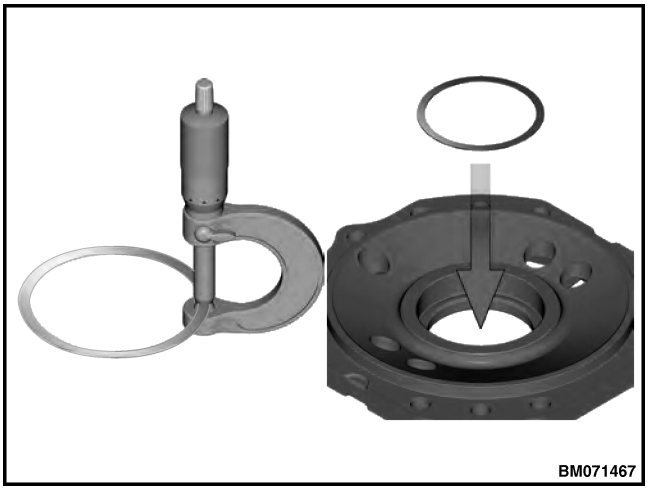


STEP 20.
Install the complete differential into the center section housing.

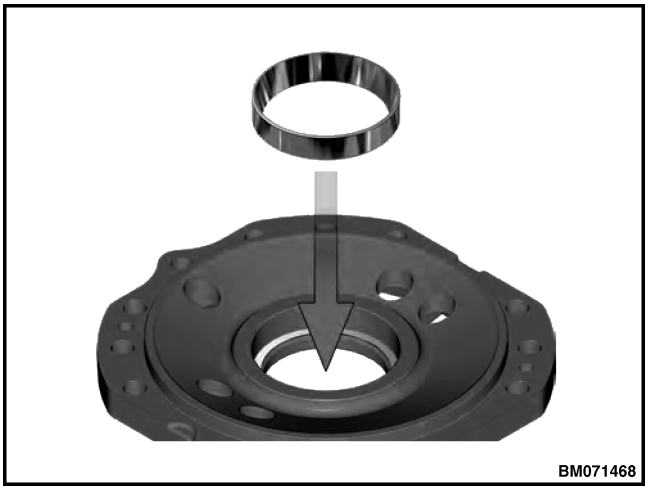


NOTE: Shim thickness. Example: 1.2 mm (0.05 in.).

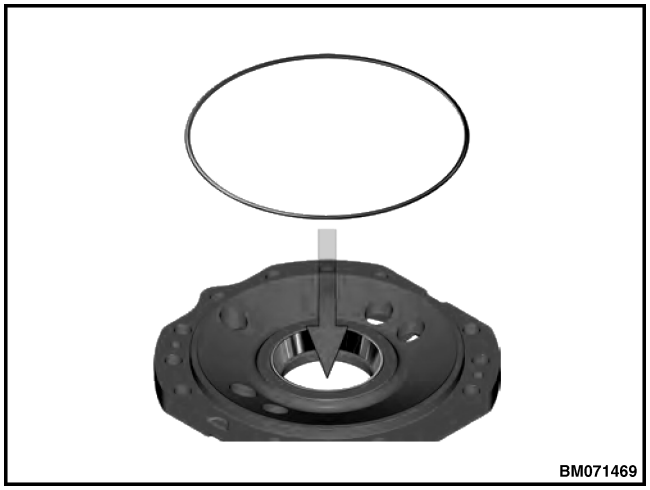
STEP 21.
Install the shims into middle cover.

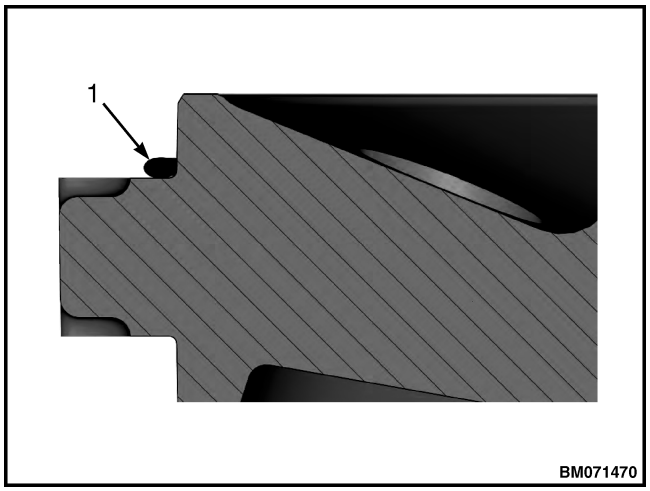


STEP 22.
If the bearings are replaced, insert the outer thrust block bearing into the middle cover.



STEP 23.
Lubricate with grease and replace the outer O-ring onto the middle cover.

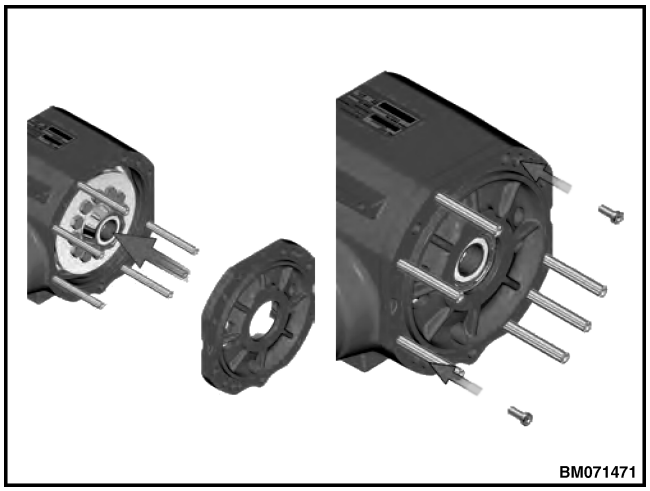




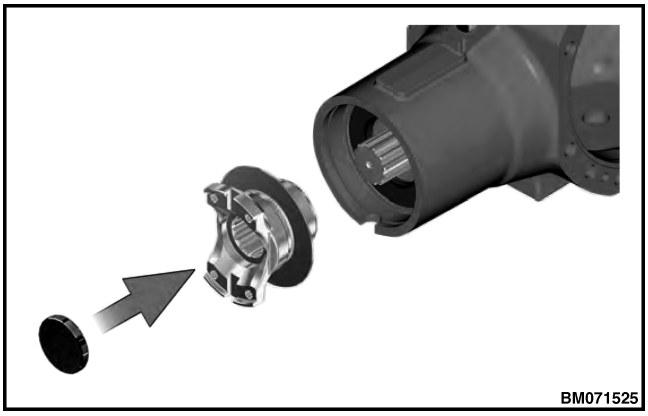
1. O-RING

NOTE: Use only new screws pre-treated with Driloc locking adhesive. Threads must be clean from oil. Degrease only non pre-treated threads.

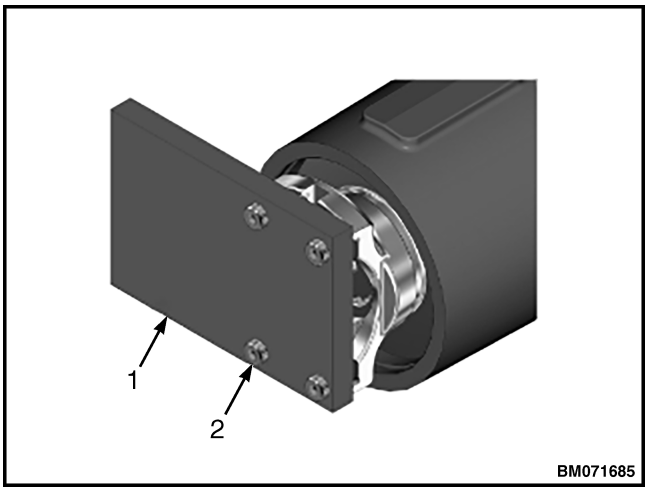
STEP 24.
Install the middle cover onto the center section housing. Install the capscrews on middle cover and center section housing. Tighten capscrews to 16.3 to 26.2 N•m (144.3 to 231.9 lbf in).



STEP 25.
Install the flange onto the pinion.



STEP 26.
Install special tool T3 (see T3 in Dry Brake Axle Special tools section of this manual) on the flange. Secure the special tool with four screws.



1. T3
2. SCREW

CAUTION

If torque exceed the maximum value, the size of calibrated shim (items 23 and 24, Figure 169) needs to be increased.

If torque does not reach the minimum value, the size of calibrated shim (items 23 and 24, Figure 169) needs to be decreased.

CAUTION

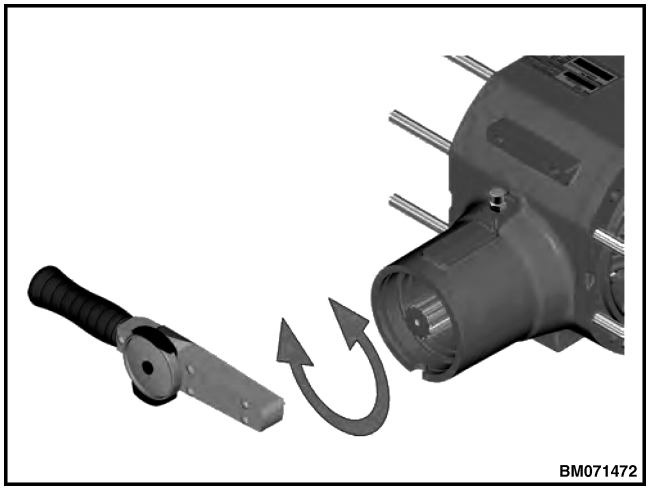
If bearings are not new, check static torque; if bearings are new, check continuous torque.

STEP 27.

Attach a torque meter to check the rolling torque increases by 0.46 to 0.71 N•m (0.34 to 0.52 lbf in) relative to the roiling torque for pinion bearings measured previously, as a result of the preload of the differential bearings.

Pinion torque: 1.8 N•m (15.9 lbf in)

Pinion + differential torque: 2.0 N•m (17.7 lbf in).



CAUTION

In order to increase the gap while keeping the load on the bearing unchanged, remove shims from the crown wheel side and insert them on the opposite side. In order to decrease the gap, move them the other way round.

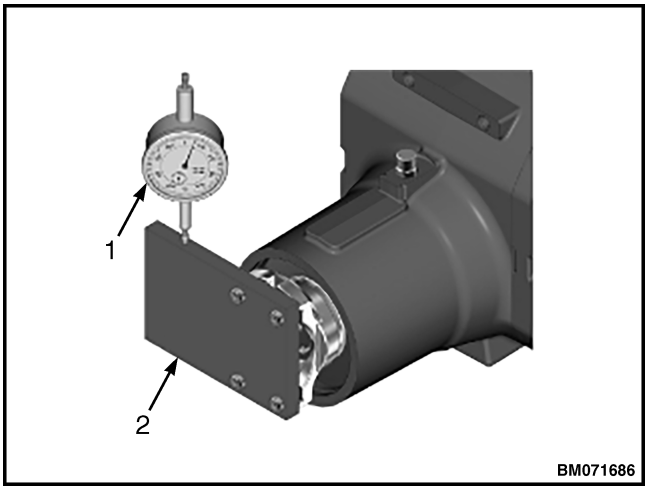
NOTE: Measure the backlash at a distance of 85 mm (3.35 in.) from the pinion axis.

STEP 28.
Install a dial gauge to check the tolerance between the bevel gear teeth.

Backlash: See Table 6.

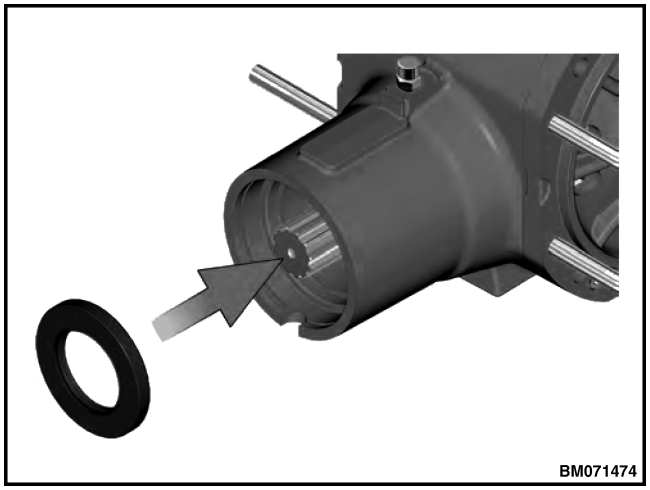
Table 6. Backlash

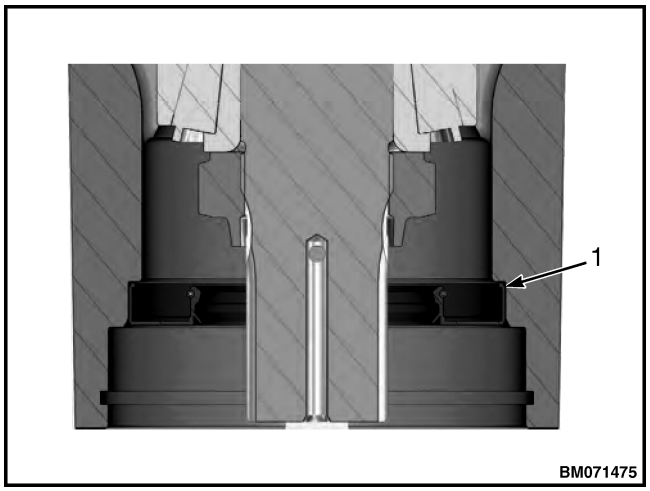
Model	Ratio	Backlash
141/10137767	16.55:1	0.82 to 1.09 mm (0.032 to 0.043 in.)
141/10137851	14.82:1	0.55 to 0.77 mm (0.022 to 0.03 in.)
141/10144088	13.68:1	0.51 to 0.71 mm (0.02 to 0.027 in.)
141/10144764	12.05:1	0.56 to 0.77 mm (0.022 to 0.03 in.)
141/10144774	10.42:1	0.57 to 0.75 mm (0.022 to 0.029 in.)
141/10144777	9.68:1	0.50 to 0.67 mm (0.02 to 0.026 in.)



1. DIAL GUAGE
2. T3

STEP 29.
Position the sealing ring in the special tool T4 (see T4 in Dry Brake Axle Special tools section of this manual). Press the pinion seal into its seat.



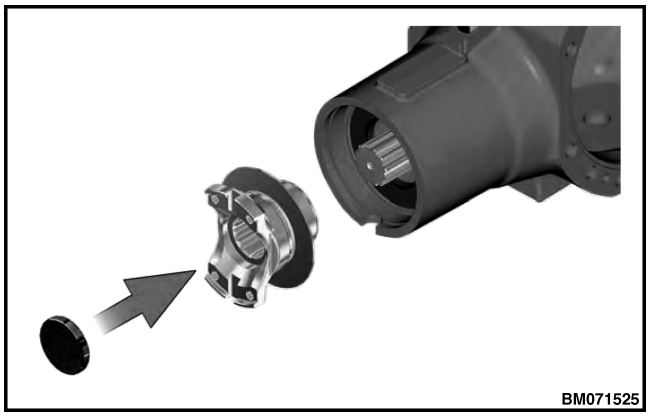


1. PINION SEAL

NOTE: The cap must be replaced if removed.

STEP 30.
If removed, coat cap with Loctite® 510 and install the cap (item 20, Figure 169).

Install the flange (item 18, Figure 169) onto the pinion (item 11, Figure 169).

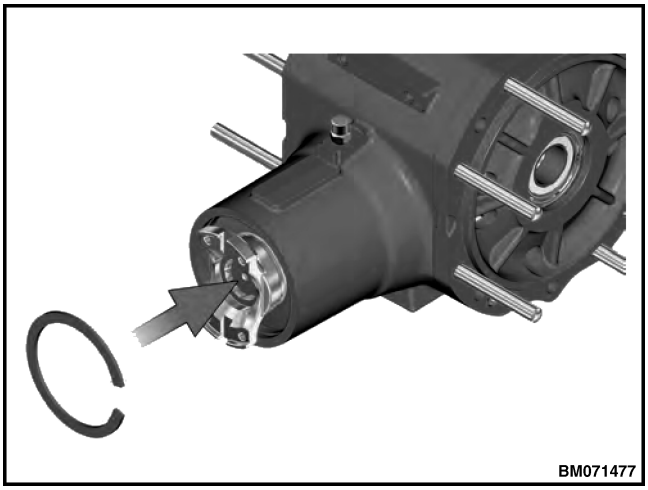


WARNING

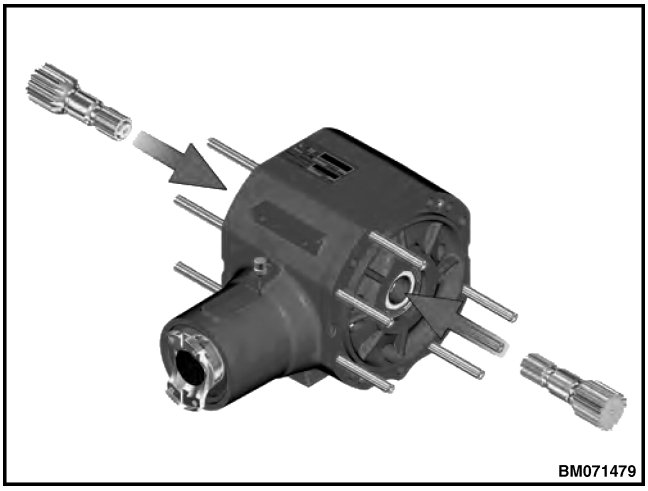
Be careful when removing or installing snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

NOTE: See End-Stop Plier Settings section for procedures to set up suitable pliers.

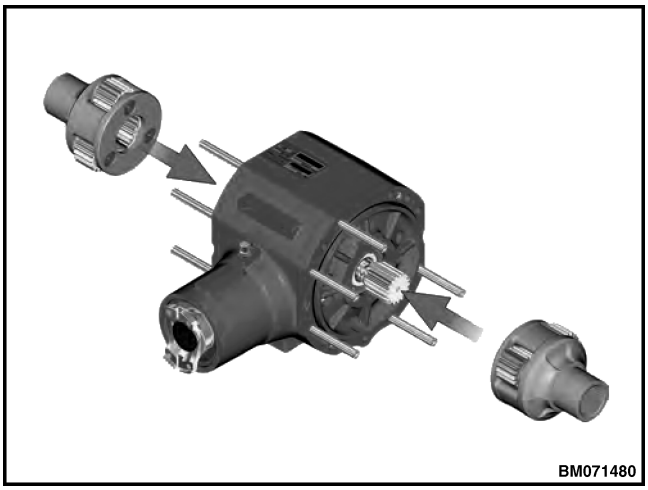
STEP 31.
Install the snap ring.



STEP 32.
Install axle shaft, making sure that it is properly inserted into differential. Repeat for opposite side.

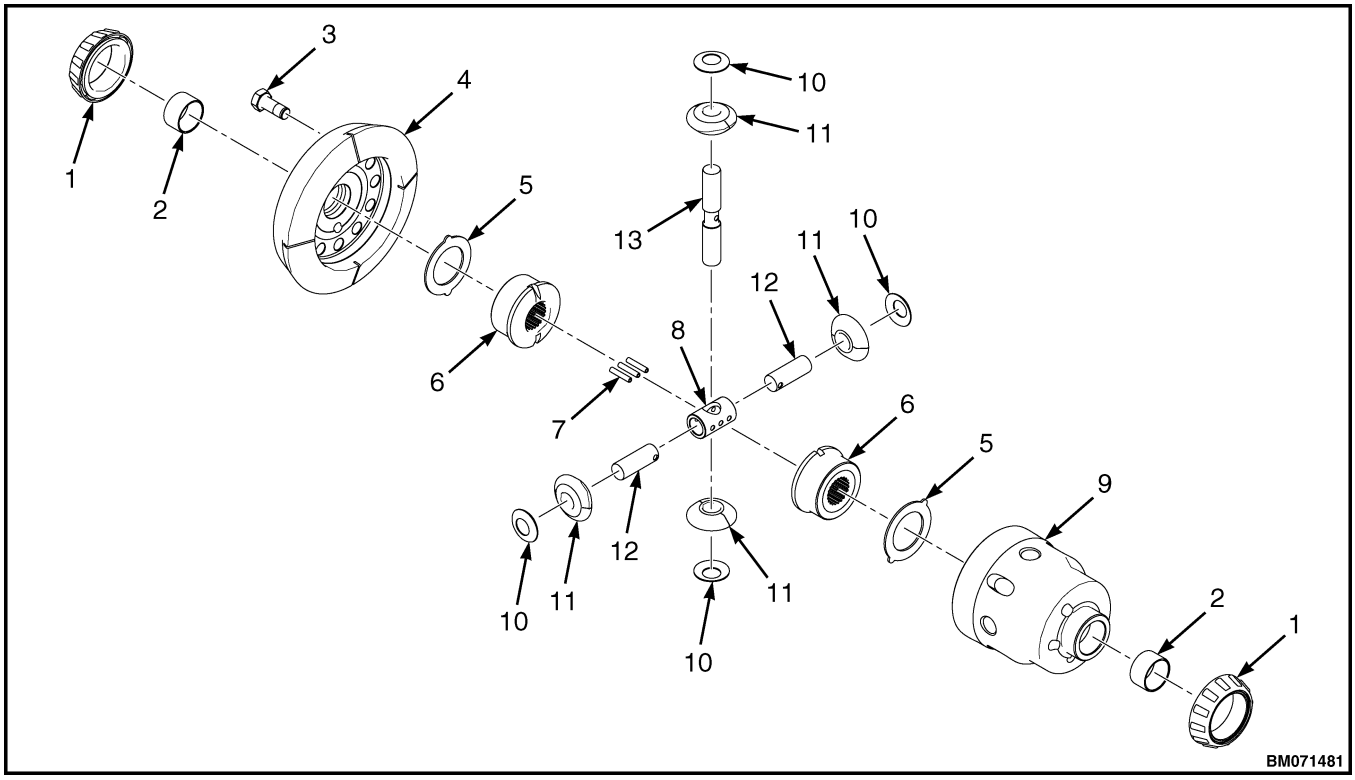


STEP 33.
Install the complete planetary carrier train into center section housing. Repeat for opposite side.



DIFFERENTIAL
202001-258

DIFFERENTIAL REPAIR



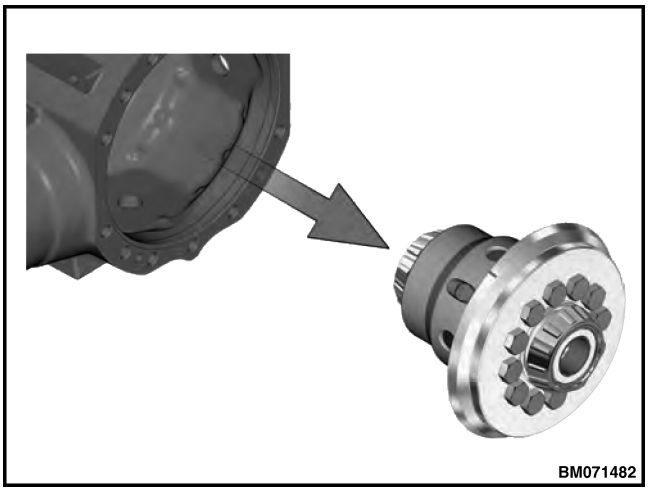
1. BEARING
2. BUSHING
3. CAPSCREW
4. RING GEAR
5. THRUST WASHER
6. SIDE GEAR
7. SPIDER ROLL PINS
8. SPIDER SLEEVE
9. DIFFERENTIAL HOUSING
10. SPHERICAL WASHERS
11. SATELLITE GEARS
12. DIFFERENTIAL SPIDER PINS
13. DIFFERENTIAL SPIDER

Figure 170. Differential Exploded View

Disassemble Differential

NOTE: See Differential Repair for complete view of disassembly.

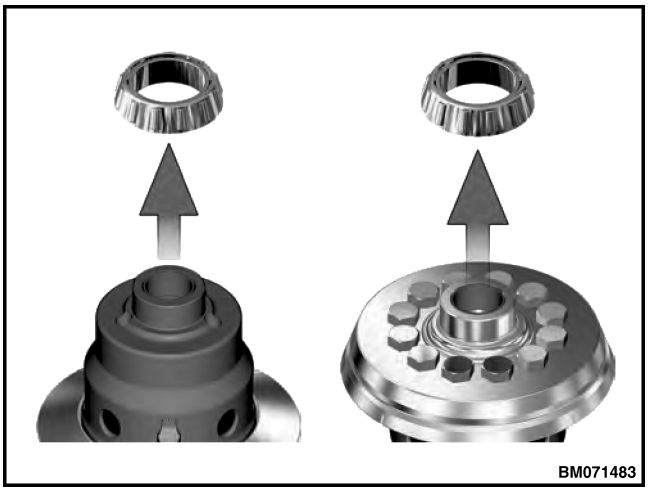
STEP 1.
Extract the differential.



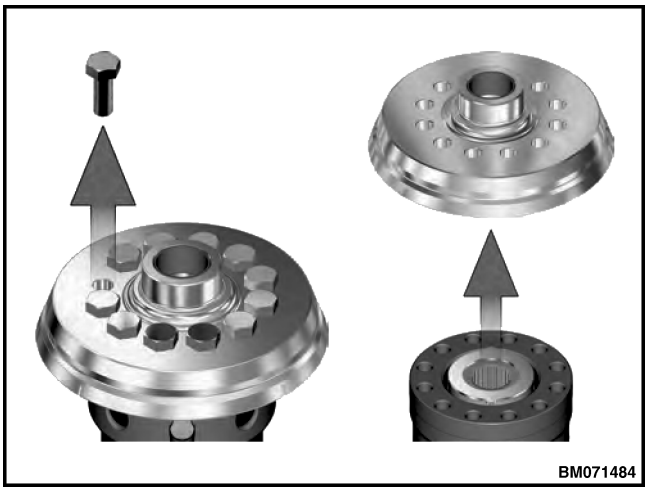
CAUTION

If disassembly is carried out in order to replace ring gear and pinion, bearings, or side gear, break up distance washers and calculate clearances as indicated in the sections regarding removal, disassembly, assembly, and installation of differential until and bevel pinion.

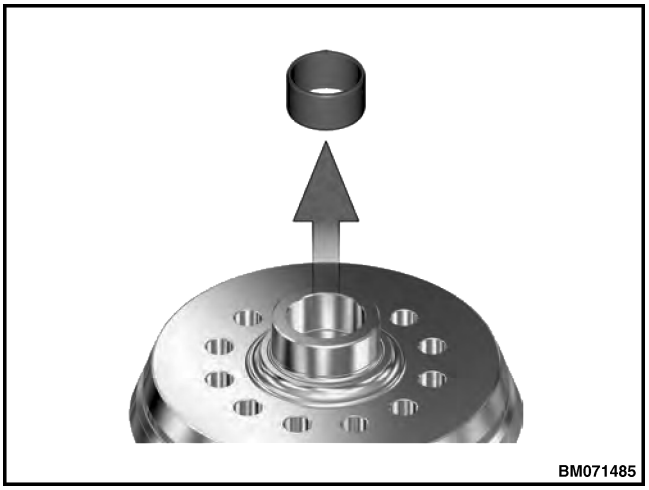
STEP 2.
If bearing replacement is required, extract the bearing from the differential housing and the ring gear.



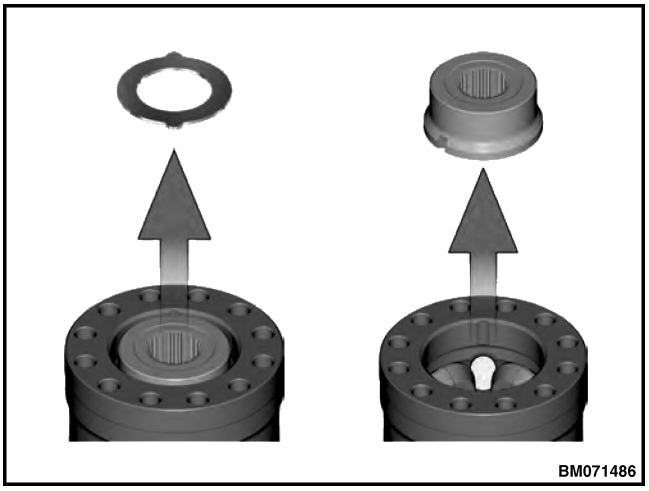
STEP 3.
Remove the capscrews in the ring gear. With the help of a plastic or rubber hammer or brass punch, remove the ring gear.



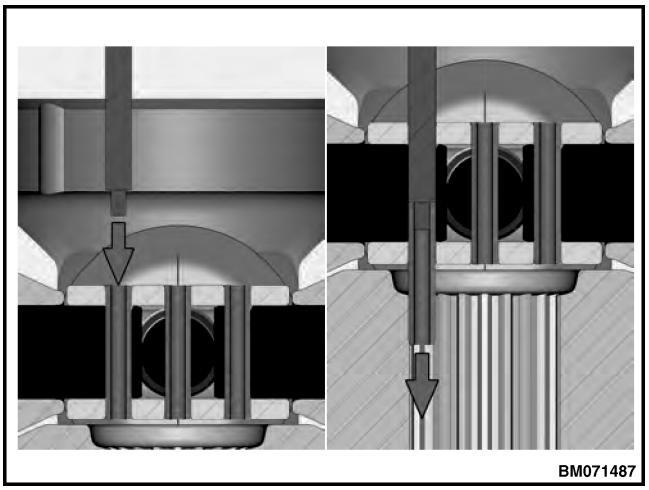
STEP 4.
Using an extractor remove the bushings from ring gear.



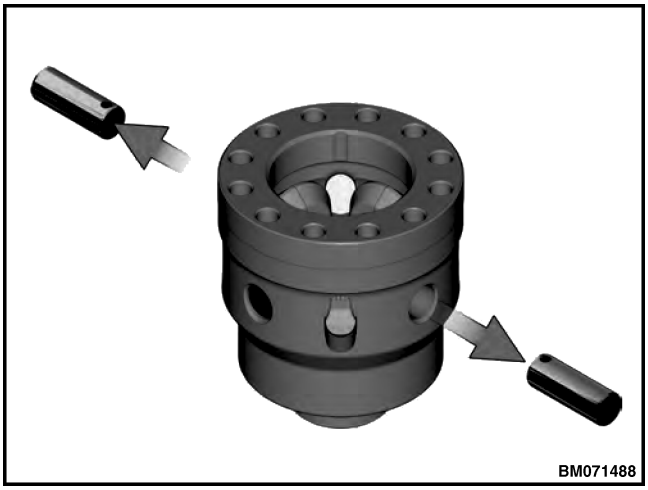
STEP 5.
Remove the thrust washer and the side gear from differential housing.



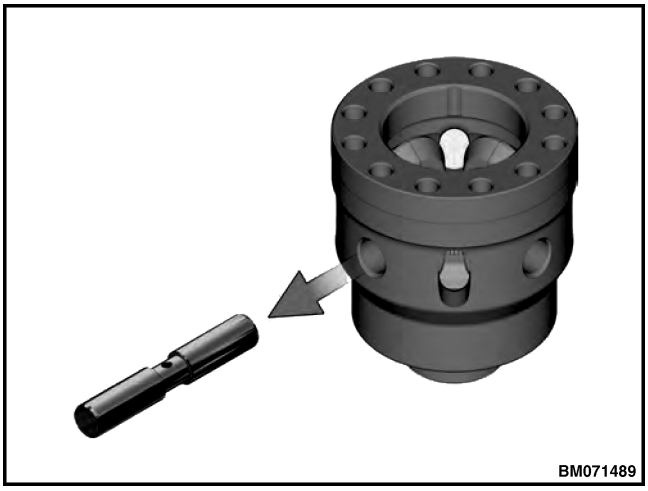
STEP 6.
Remove the three spider roll pins from differential housing using a pin driver.



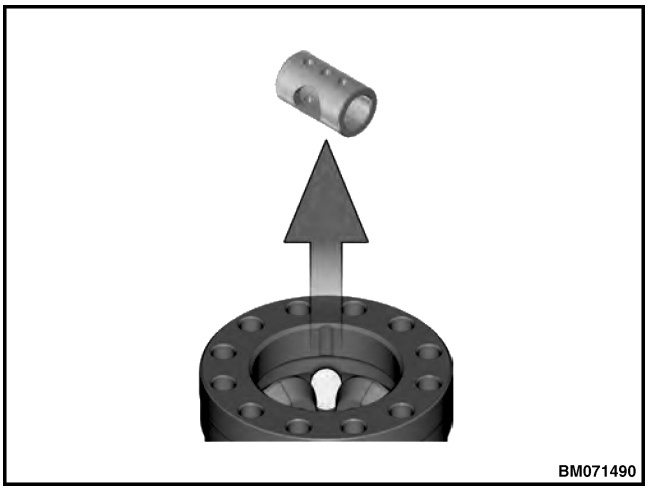
STEP 7.
Remove two differential spider pins from differential housing.



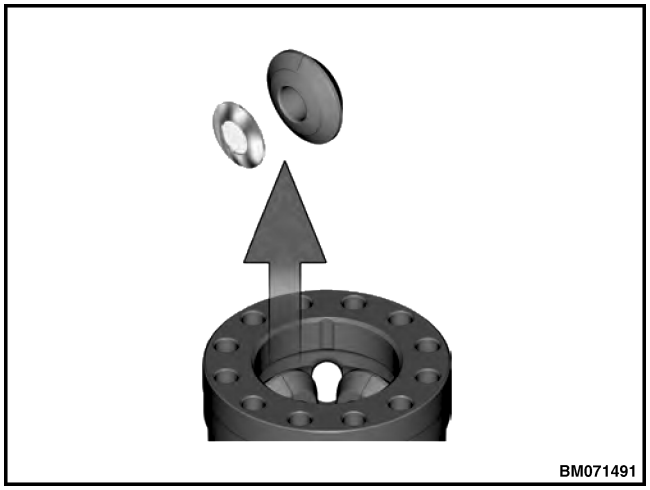
STEP 8.
Remove the differential spider from differential housing with the help of a drift.



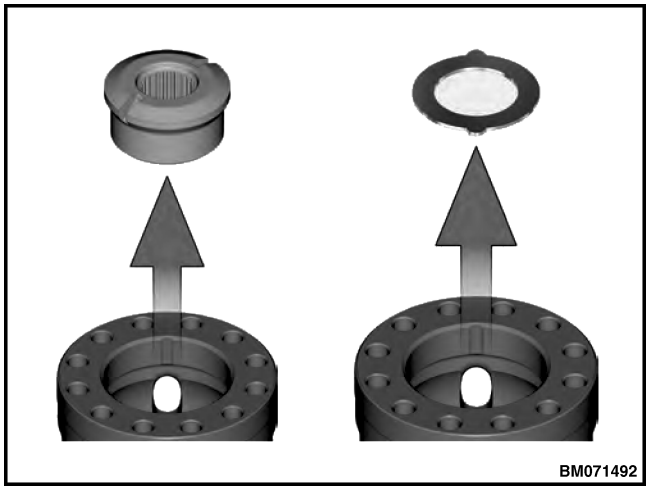
STEP 9.
Remove the spider sleeve from differential housing.



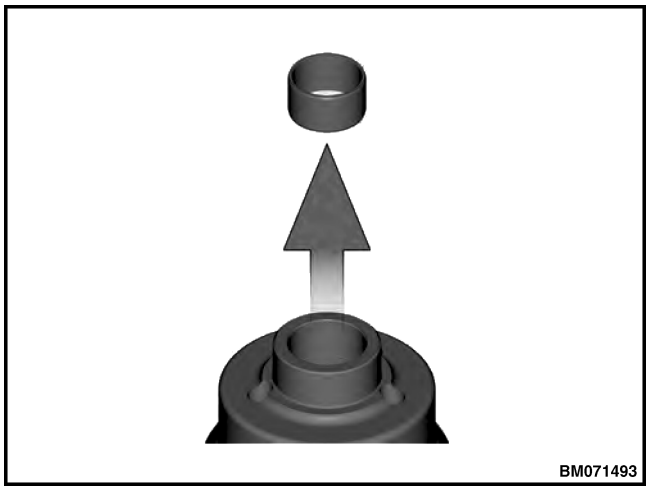
STEP 10.
Remove four spherical washers and four satellite gears from differential housing.



STEP 11.
Remove the side gear and thrust washer from differential housing.



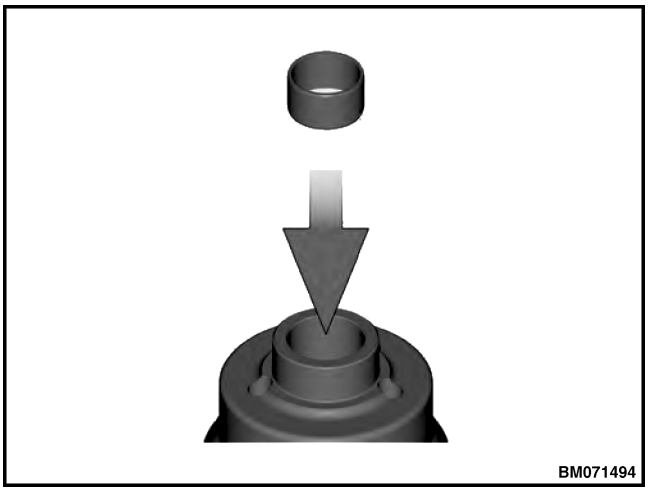
STEP 12.
Using an extractor remove the bushing from differential housing.



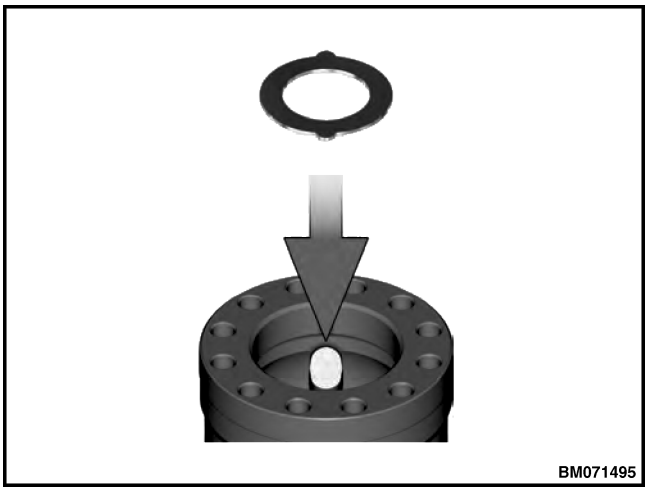
Assemble Differential

NOTE: See Differential Repair for complete view of disassembly.

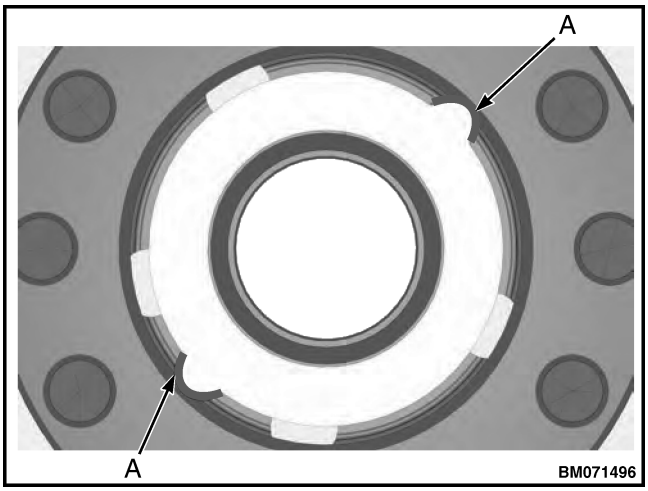
STEP 1.
Press the bushing into its seated position in the differential housing.



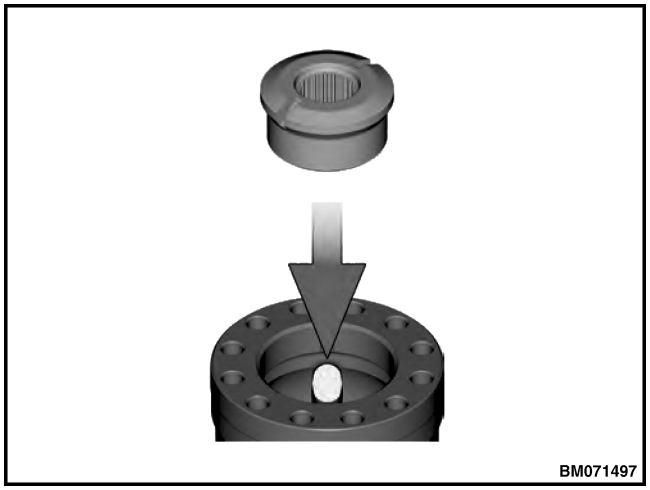
STEP 2.
Insert the thrust washer into position into the differential housing.



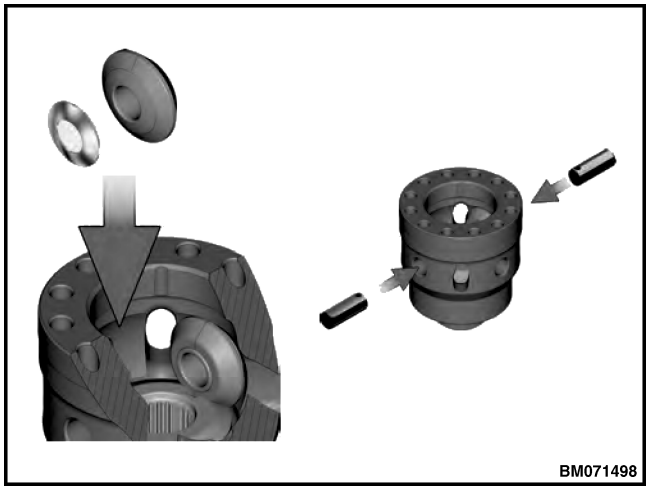
STEP 3.
Install the thrust washer engaging the anti-rotation keys "A" in their seats in the differential housing.



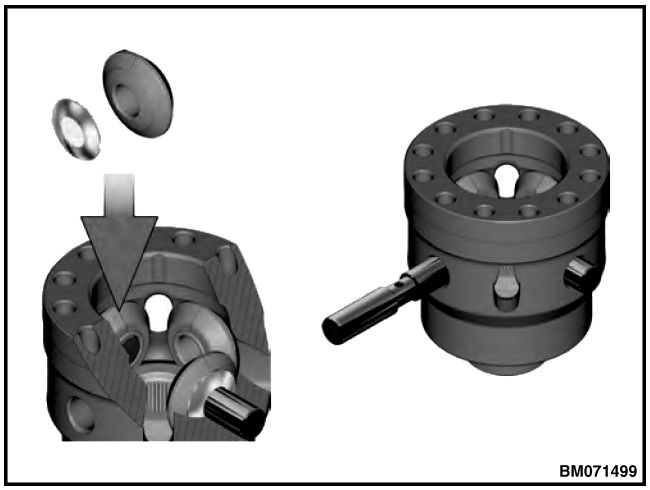
STEP 4.
Insert side gear into differential housing.



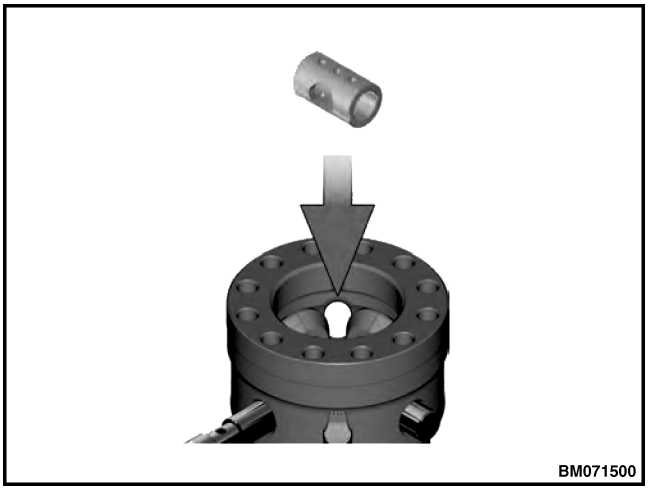
STEP 5.
Insert the two differential spider pins, two satellite gears, and two spherical washers into differential housing.



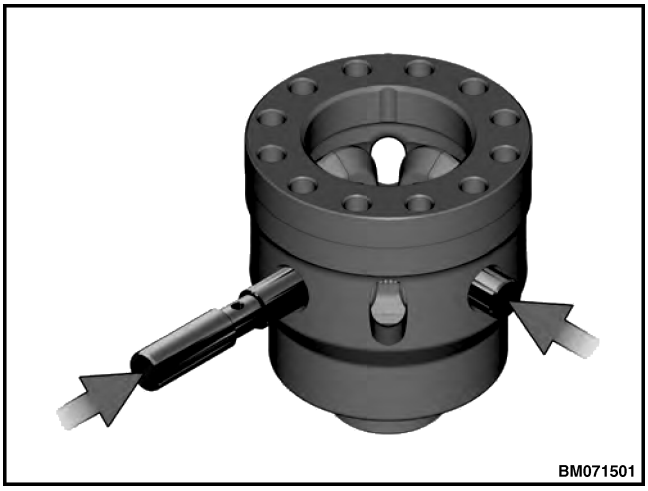
STEP 6.
Partially insert differential spider, two satellite gears, and two spherical washers.



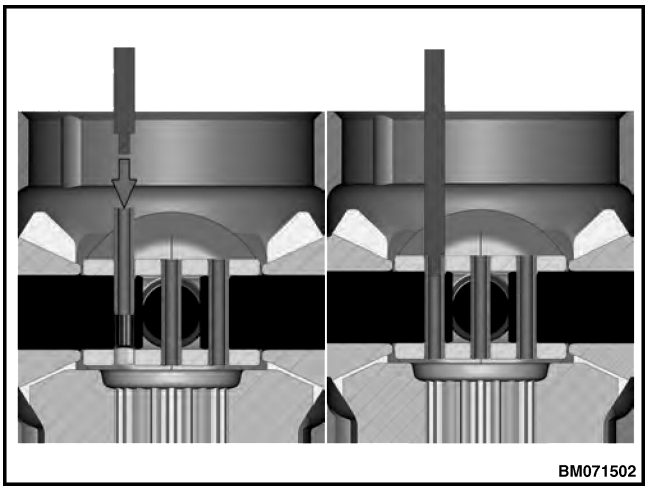
STEP 7.
Insert the differential spider sleeve into the correct position.



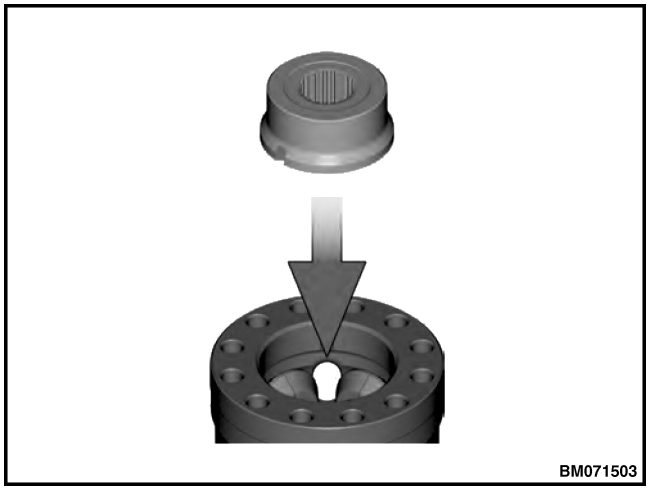
STEP 8.
Complete insertion of the differential spider and differential spider pins.



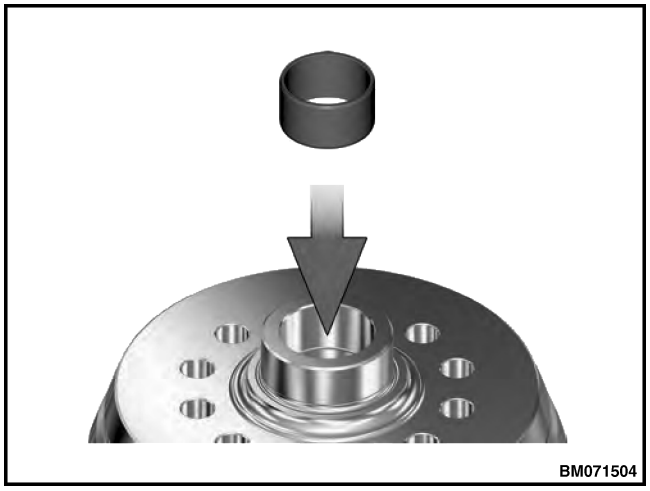
STEP 9.
Bring the pin holes in line with the help of a pin-driver. Insert spider roll pins into spider sleeve.



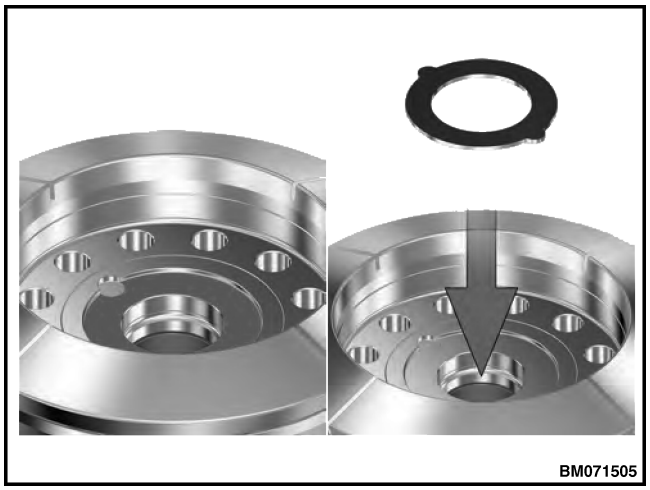
STEP 10.
Insert side gear into differential housing.



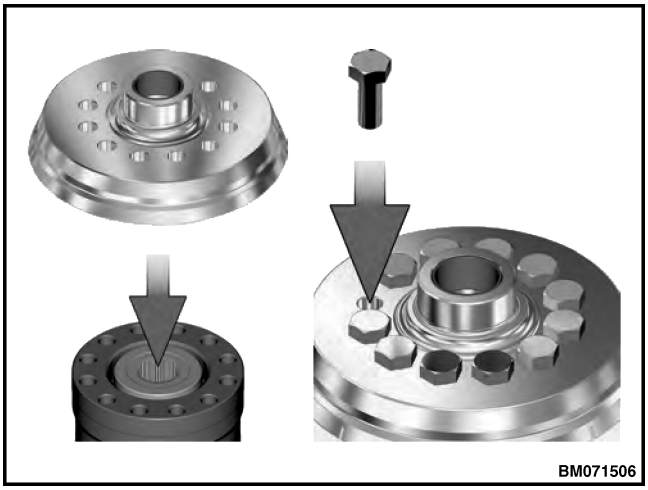
STEP 11.
Press the bushing into its seated position in the ring gear.



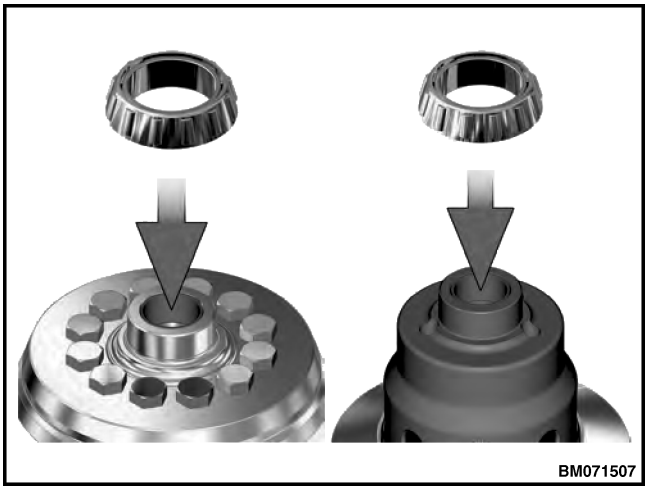
STEP 12.
Apply lithium-based grease to the ring gear surface on which the thrust washer will be installed to hold thrust washer in position for assembly. Insert the thrust washer into the ring gear.



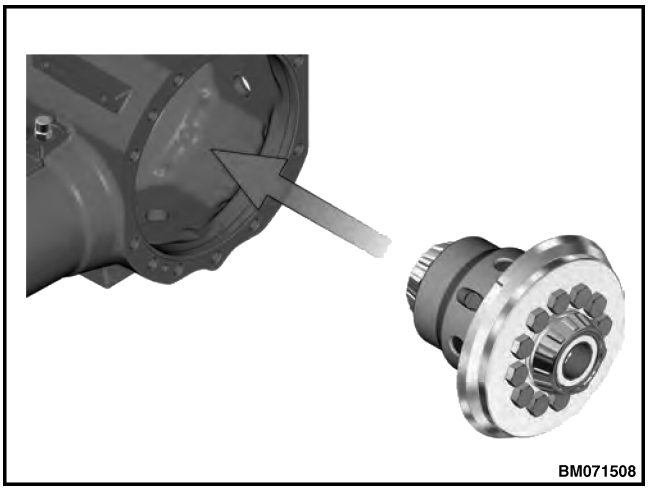
STEP 13.
Position the ring gear on the differential housing. Apply Loctite® 243 to threaded portion of capscrews and install into ring gear. Tighten capscrews, in an alternating cross pattern, to 115 to 142 N•m (84.8 to 104.7 lbf ft).


BM071506

STEP 14.
Heat the bearings to approximately 100°C (212°F) and fit to the ring gear and differential housing.


BM071507

STEP 15.
Install the complete differential assembly into center section housing.


BM071508

NOTE: Measure the backlash at a distance of 85 mm (3.35 in.) from the pinion axis.

STEP 16.
If the bevel set has been replaced, ring and pinion backlash must be checked to be within specification listed.

PARK BRAKE
202001-259

PARK BRAKE REPAIRS

Remove

To remove park brake lever, use the following procedure:

1. Block front and rear sides of wheels, to ensure lift truck cannot move. Release park brake lever.

2. Detach the wire harness connector from the park brake sensor. See Figure 171.

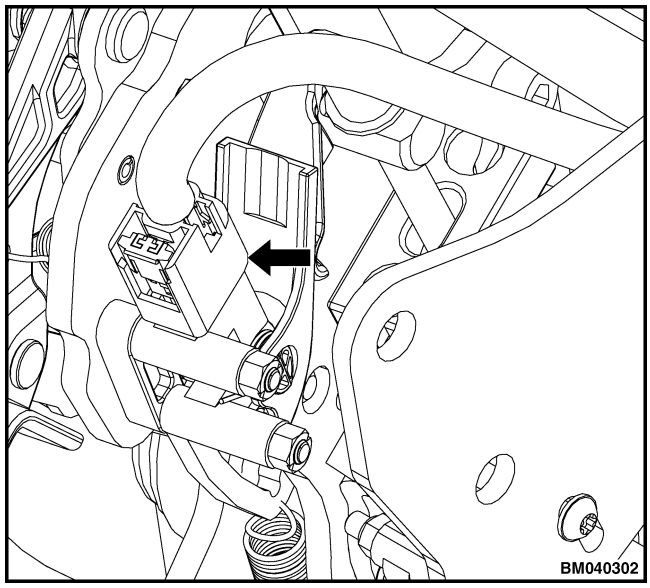
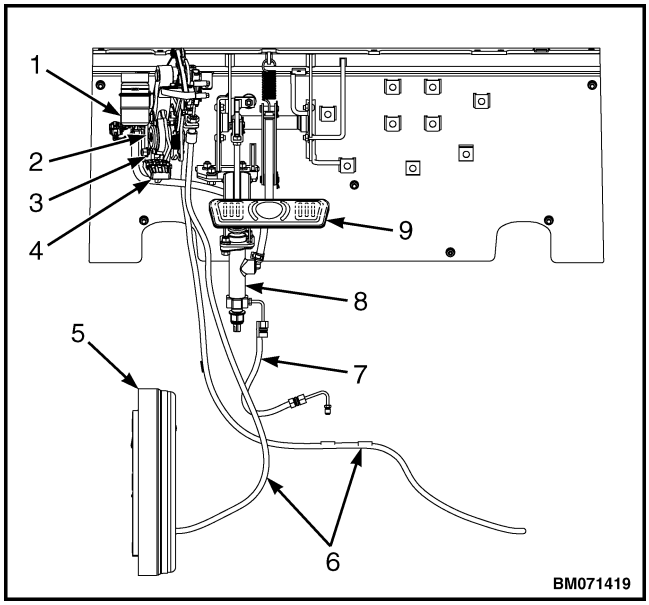


Figure 171. Park brake connector

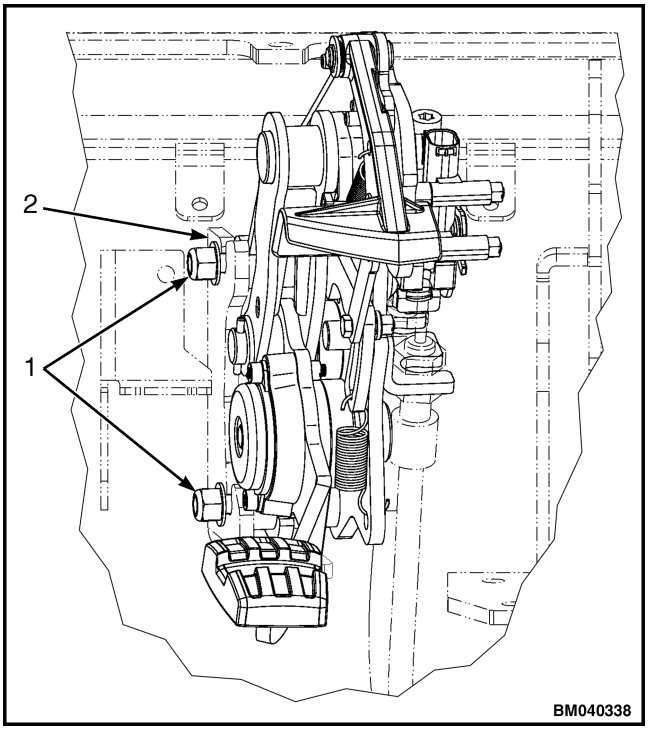
3. Remove the service brake reservoir. See Figure 172.



1. RESERVOIR
2. PARK BRAKE BRACKET
3. MOUNTING BOLT AND LOCK NUT
4. PARK BRAKE LEVER
5. BRAKE ASSEMBLY
6. PARK BRAKE CABLE
7. BRAKE HOSE ASSEMBLY
8. MASTER CYLINDER
9. INCHING/BRAKE PEDAL

Figure 172. Park Brake Assembly

4. Remove the park brake mounting bolts, lockwashers, and locknuts from mounting bracket and park brake assembly. See Figure 173.



1. MOUNTING BOLTS, LOCKWASHERS, AND LOCKNUTS
2. MOUNTING BRACKET

Figure 173. Park Brake Mounting

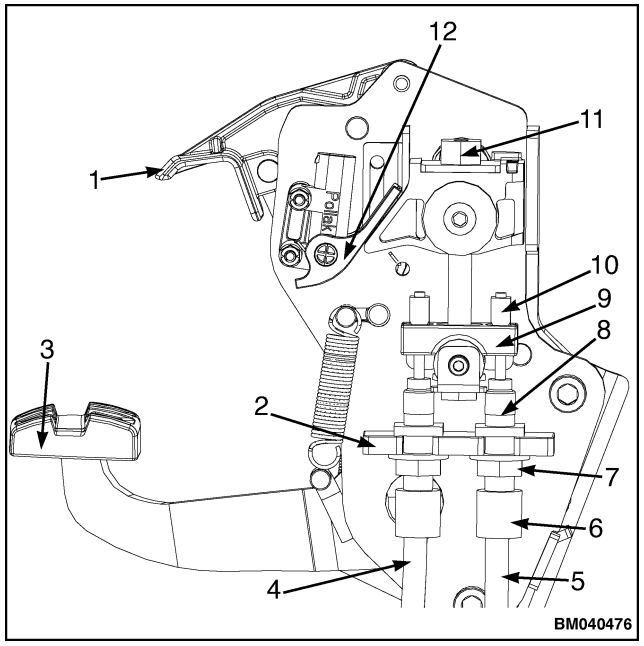
5. Remove the park brake from the cowl with the cables still attached.

6. Loosen jam nut on cable start of left-hand park brake cable and remove from cable mount. Repeat for right-hand park brake cable. See Figure 174.

Install

To install park brake lever assembly, use the following procedure:

1. Park brake cables must be installed in back plate before service brake is installed. A snap ring holds sheath of park brake cable in back plate of service brake. See Figure 172.



1. PARK BRAKE RELEASE HANDLE
2. CABLE MOUNT "C"
3. PARK BRAKE LEVER
4. PARK BRAKE CABLE, LEFT
5. PARK BRAKE CABLE, RIGHT
6. CABLE START
7. JAM NUTS
8. SQUARE NUTS
9. EQUALIZER BAR "D"
10. CABLE ENDS
11. CABLE TENSION ADJUSTER BOLT "E"
12. SENSOR ARM "G"

Figure 174. Park Brake

2. Attach cable assemblies to equalizer bar "D". See Figure 174.

3. Adjust jam nuts on cable to locate cable start as shown in Figure 174.

4. Hold final adjustment with square nut position and torque jam nut to 17 to 19 N•m (12.5 to 14 lbf ft).

5. When cable ends are properly adjusted, the cable ends will be even with each other and will not pull on the equalizer bar with park disengaged. See Figure 174.

6. Activate park brake several times and verify equalizer bar is still perpendicular to actuation path, and cable ends are even.

7. Install the park brake assembly onto park brake bracket. See Figure 172.

8. Install the mounting bolts, lockwashers, and nuts to park brake assembly and mounting bracket. See Figure 173. Torque to 78 to 84 N•m (57.5 to 62 lbf ft).

9. Install the reservoir. See Figure 172.

10. Install the park brake sensor connector. See Figure 171.

DRY BRAKE AXLE SPECIAL TOOLS 202001-260

TOOLS

End-Stop Plier Settings

Retaining Snap Ring for Bores

CAUTION

This procedure is aligned with DIN standard, specifically the prevailing DIN 472 regulation.

CAUTION

Snap ring replacement is required if they are removed without pre-set plier.

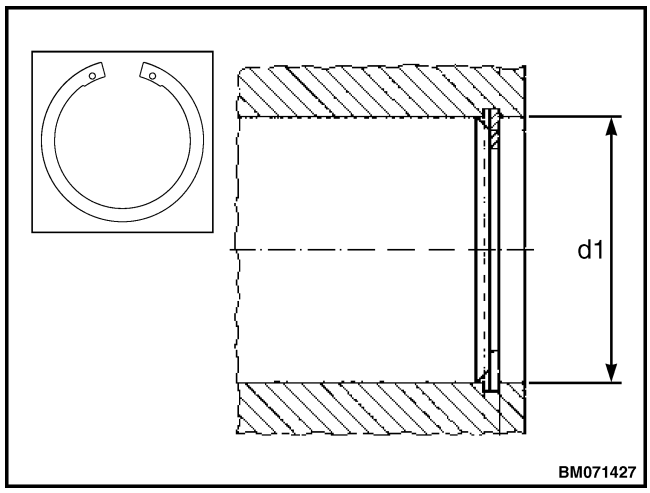


Figure 175. Bore Snap Ring

1. Measure the bore diameter of snap ring "d1"
2. Pre-set the caliper at value "Dmin" ("Dmin" = "d1" x 0.99)
3. Fix it with the screw on caliper (see - Point A)
4. Put the snap ring into the plier
5. Close snap ring as far as the end-stop bolt allows
6. Adjust the end-bolt in order to match the external diameter of the snap ring with "Dmin" value
7. Discard the snap ring used for the end-stop plier calibration

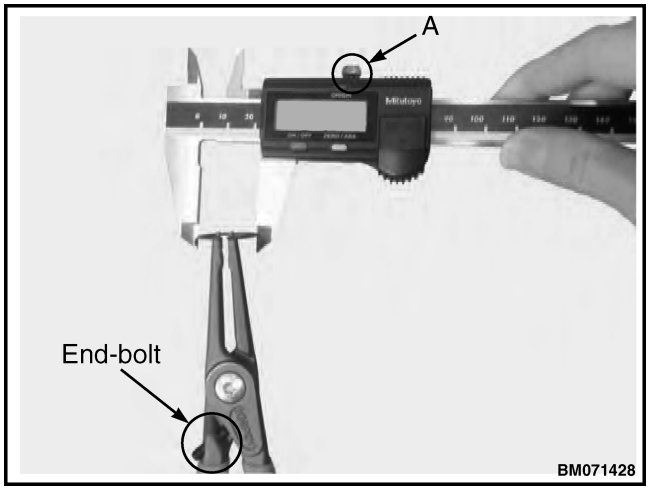


Figure 176. Pliers

Retaining Snap Ring for Shafts

CAUTION

This procedure is aligned with DIN standard, specifically the prevailing DIN 471 regulation.

CAUTION

Snap ring replacement is required if they are removed without pre-set plier.

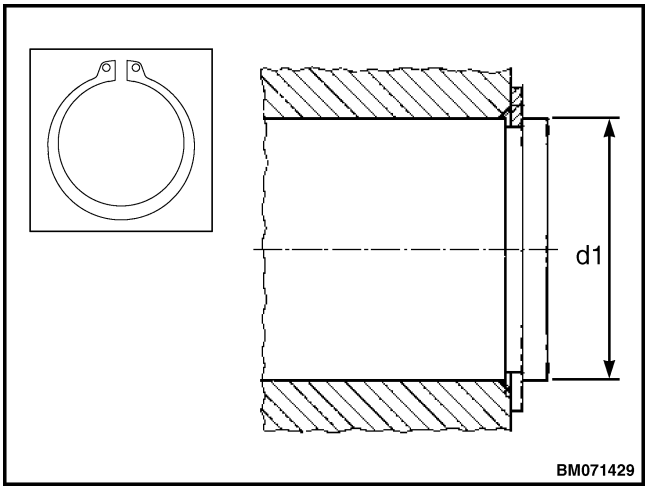
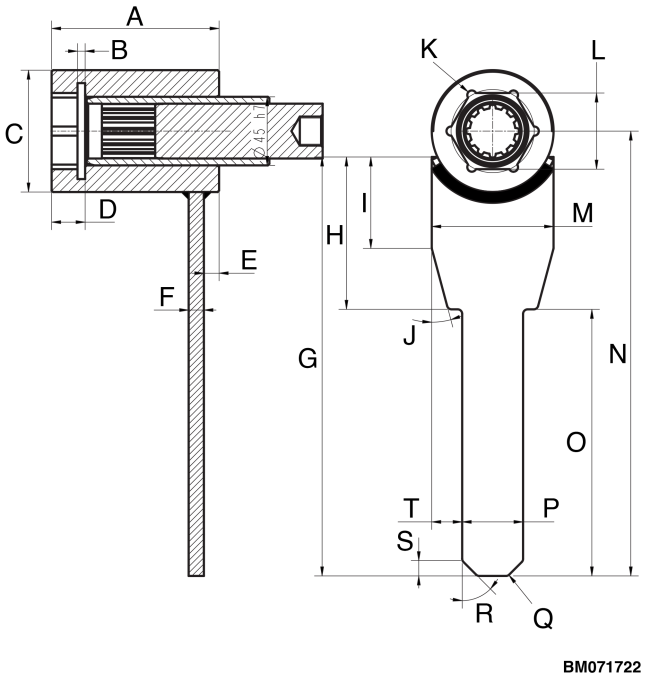


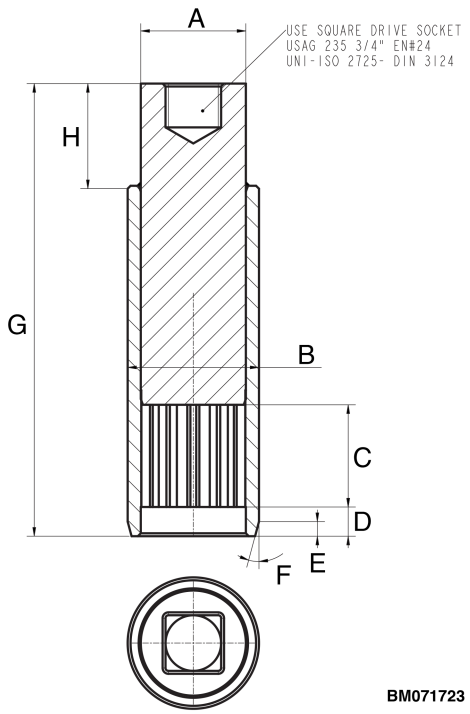
Figure 177. Shaft Snap Ring

1. Measure the shaft diameter of snap ring "d1"
2. Pre-set the caliper at value "Dmax" ("Dmax" = "d1" x 1.01)
3. Fix it with the screw on caliper (see - Point A)
4. Put the snap ring into the plier
5. Open snap ring as far as the end-stop bolt allows
6. Adjust the end-bolt in order to match the internal diameter of the snap ring with "Dmax" value
7. Discard the snap ring used for the end-stop plier calibration

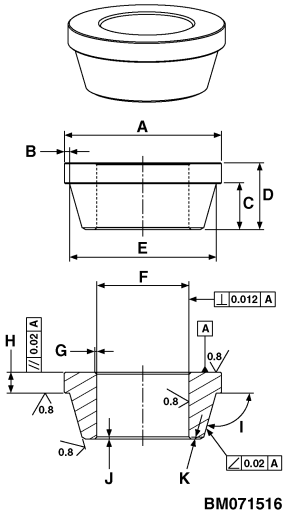
SPECIAL TOOLS

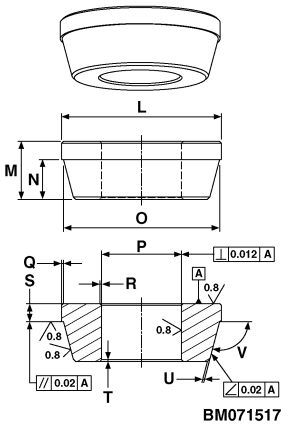
T1

Applicable Model and Tool Size	Illustration
A 110 mm (4.33 in.)	
B 5 mm (0.2 in.)	
C ø80	
D 22 mm (0.9 in.)	
E 10 mm (0.39 in.)	
F 10 mm (0.39 in.)	
G 275 mm (10.83 in.)	
H 100 mm (3.94 in.)	
I 60 mm (2.36 in.)	
J 15°	
K R3 Max /Int ø54.5	
L CH 50 +0.3/+0.2	
M 80 mm (3.15 in.)	
N 292 mm (11.5 in.)	
O 175 mm (6.89 in.)	
P 40 mm (1.57 in.)	
Q R3 TYP	
R 2 X 45°	
S 10 mm (0.39 in.)	
T 20 mm (0.79 in.)	

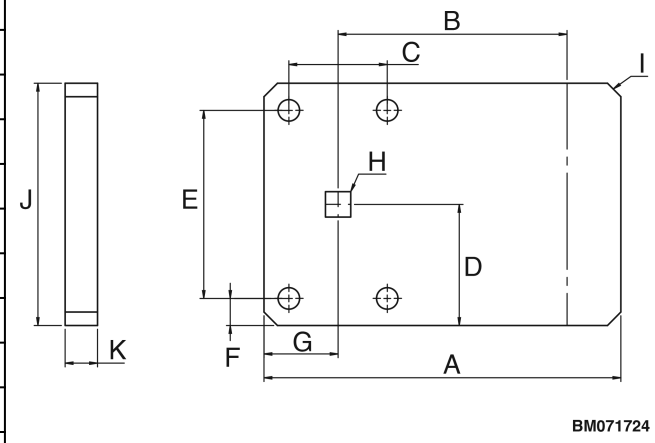
Applicable Model and Tool Size	Illustration
A ø36 H8	
B ø45 -0.08/-0.12	
C 35 mm (1.34 in.)	
D 10 mm (0.39 in.)	
E 5 mm (0.2 in.)	
F 15°	
G 155 mm (6.10 in.)	
H 36 mm (1.42 in.)	

T2

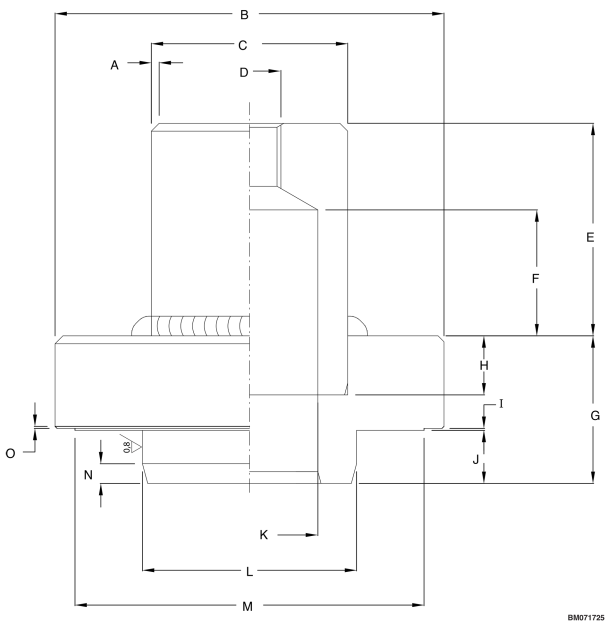
Applicable Model and Tool Size	Illustration
A ø 75 ±0.1	
B (2.5)	
C 22.5 ±0.05	
D 32	
E ø 70 -0.2/-0.05	
F ø 44 H7 (+0.025/0	
G 1 X 45°	
H10	
I 105.77°	
J 1 X 45°	
K 45° X 1	

Applicable Model and Tool Size	Illustration
L ø 88 ±0.1	
M 32	
N 22 ±0.5	
O ø 86 -0.2/-0.05	
P ø 44 H7 +0.025	
Q 45° X 1	
R 45° X 1	
S 10	
T 45° X 1	
U 45° X 1	
V 104.61°	

T3

Applicable Model and Tool Size	Illustration
A 132.50 mm (5.22 in.)	
B 85 mm (3.35 in.)	
C 36.53 mm (1.44 in.)	
D 45 mm (1.77 in.)	
E 69.85 mm (2.75 in.)	
F 10.08 mm (0.40 in.)	
G 27.50 mm (1.08 in.)	
H 9.5 mm (3/8 in.) Square	
I Chamfer 5 X 45° (TYP)	
J 90 mm (3.54 in.)	
K 12.00 ±0.1 mm (0.47 in.)	

T4

Applicable Model and Tool Size	Illustration
A 2 X 45°	
B ø 99	
C ø 50	
D M16	
E54 mm (2.13 in.)	
F32 mm (1.3 in.)	
G37.50 mm (1.48 in.)	
H15 mm (0.6 in.) Square	
I50 mm (2.0 in.)	
J13.50 mm (0.53 in.)	
K ø 34.80	
L ø 54.50	
M ø 88.85	
N 5 X 15°	
O 1 X 45°	

Drive axle repair (wet brakes)

WET BRAKE AXLE REMOVE AND INSTALL 202001-057

REMOVE

WARNING

When putting the lift truck on blocks, make sure the surface is solid, even, and level. Any blocks used to support the lift truck must be solid, one-piece units.

1. Put blocks on each side (front and back) of the steering tires to prevent movement of the lift truck.

2. Raise the lift truck and put blocks under the frame so that the drive wheels do not touch the floor. Put blocks under the counterweight for stability. See How to put a lift truck on blocks in **Periodic Maintenance** 8000SRM2305.

3. Remove the mast assembly as described in **Front End** 4000SRM2303.

WARNING

On lift trucks with pneumatic tires, completely remove air from tires before removing them from lift truck. Air pressure in tires can cause tire and rim parts to explode, which can cause serious injury or death. Never loosen nuts that hold together inner and outer wheel halves when there is air pressure in tire.

4. Remove the wheels.

5. See Wet brake hydraulics repair, with Powershift transmission in **Hydraulics** 1900SRM2302 and follow procedure to drain all fluids and disconnect all hydraulic lines from the drive axle. Follow procedure to disconnect the park brake cable.

6. Place blocks under the axle assembly. Attach a sling connected to a lifting device to the drive axle.

7. Support the transmission while removing the drive axle, by placing blocks or work stands beneath the transmission assembly at the surface where the two halves of the tranmission assembly meet. See Figure 178.

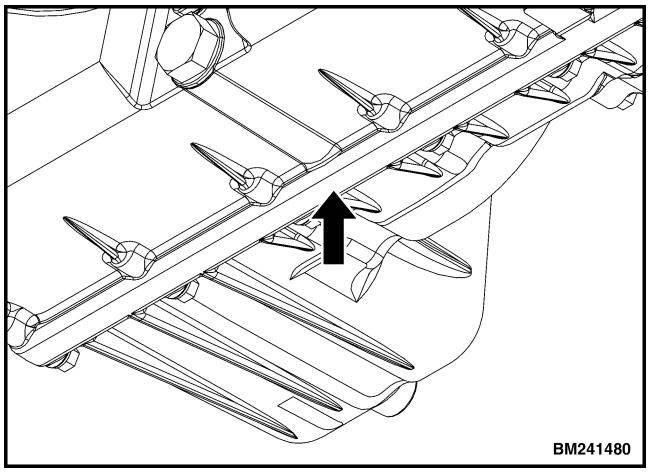
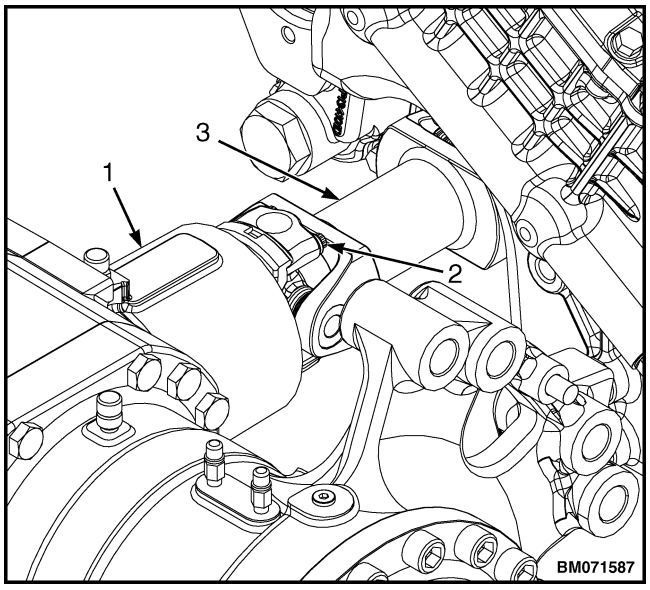


Figure 178. Blocking the transmission

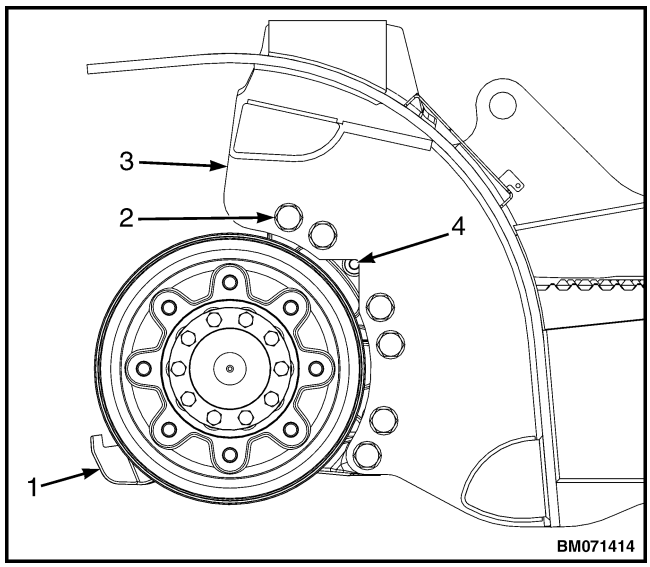
8. Remove the capscrews retaining the drive shaft to the drive axle and remove the drive shaft. See Figure 179.



1. DRIVE AXLE
2. CAPSCREW
3. DRIVE SHAFT

Figure 179. Drive axle and drive shaft

9. Remove the six mounting capscrews and washers retaining one side of the drive axle to the frame. See Figure 180. Repeat for the other side of the frame.



1. HANGER
2. CAPSCREW AND WASHER
3. FRAME
4. DOWELL

Figure 180. Drive axle mounting capscrews

10. Make sure slings and lifting devices are secure. Remove last mounting capscrew from frame and drive axle on each side.

11. Remove blocks and lower the drive axle assembly. Pull axle forward and away from frame.

12. Place blocks under the differential assembly.

INSTALL

1. Attach slings connected to a lifting device to the drive axle.

NOTE: When installing the drive axle, hold the upper surface of the drive axle against the frame. This will prevent any gap between the frame and the drive axle mount, and will ensure even weight distribution.

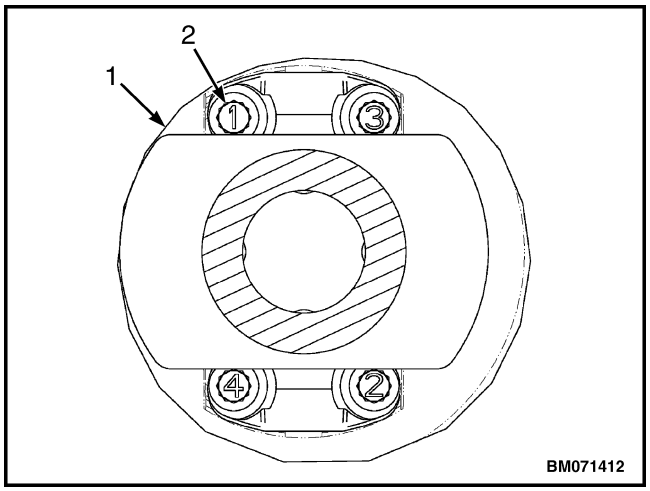
2. Position the drive axle in the lift truck.

NOTE: It is recommended to use a torque multiplier to achieve the torque specification.

3. Install the six mounting capscrews and washers on one side of the frame. Tighten the capscrews to
435 to 455 N•m (320.8 to 335.6 lbf ft). See Figure 180. Repeat for the other side of the frame.

4. Place the drive shaft in position and install the retaining capscrews. See Figure 179.

5. Tighten the drive shaft in the following sequence. See Figure 181. Torque capscrews to 32 to 36 N•m (23.6 to 26.6 lbf ft).



1. DRAFT SHAFT
2. CAPSCREW

Figure 181. Drive shaft torque sequence

6. Remove blocks from under the transmission.

7. See Wet brake hydraulics repair, with Powershift transmission in **Hydraulics** 1900SRM2302 and follow procedure to connect all hydraulic lines to the drive axle. Follow procedure to connect the park brake cable.

8. Fill the sections of the drive axle with the proper fluid. For correct fluid, quantity, and fill procedure for lift truck models, see **Periodic Maintenance** 8000SRM2305.

9. Remove the air from the brake system as described in Wet brake hydraulics repair in **Hydraulics** 1900SRM2302 for procedure.

WARNING

Add air to the tires only in a safety cage. Inspect safety cage for damage before use. When adding air, use a clip-on chuck with enough hose to let the operator stand clear of the cage.

10. If tires were deflated, inflate the tires now using a safety cage. Install the wheels and nuts. Tighten nuts to 450 to 500 N•m (332 to 369 lbf ft).

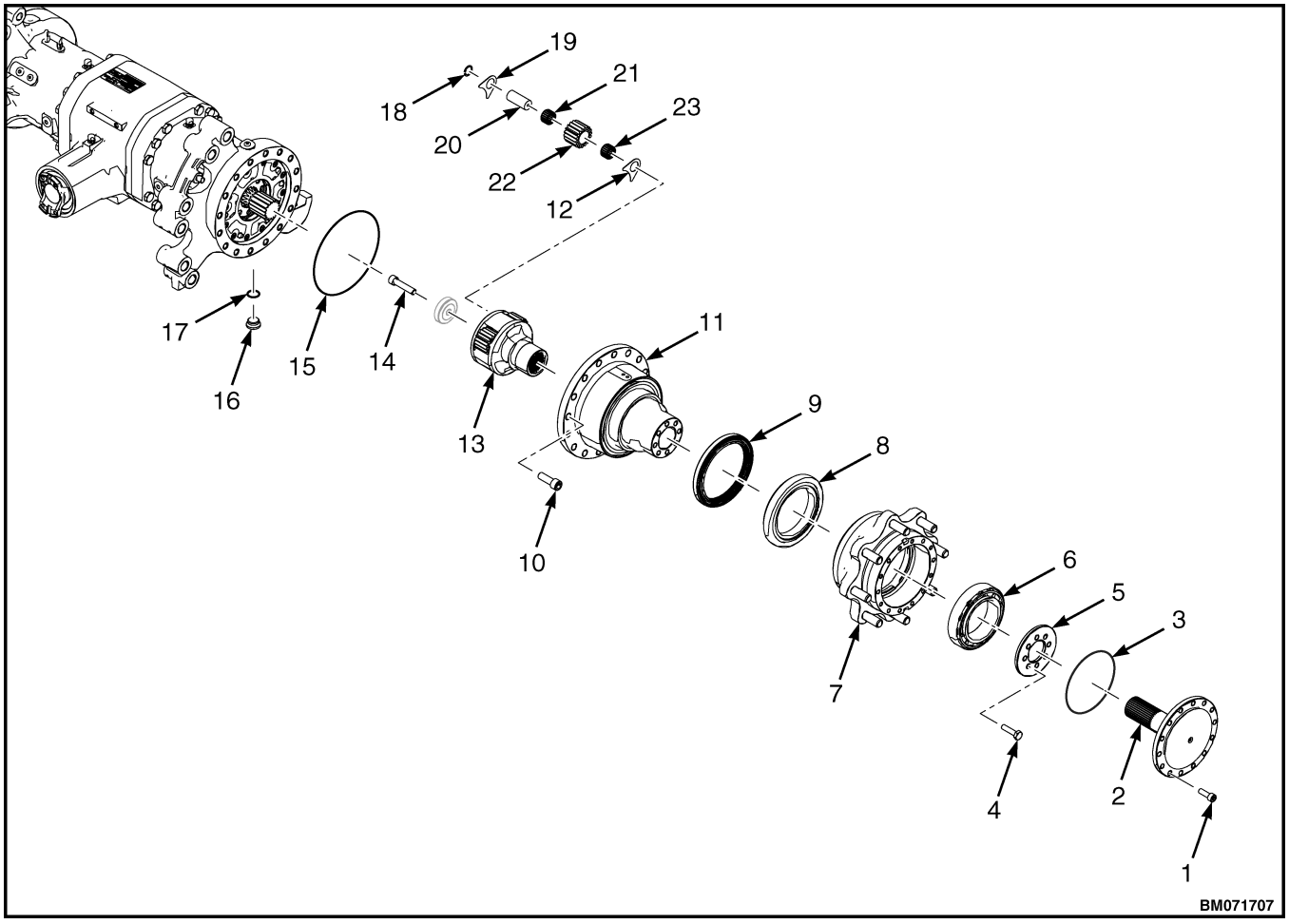
11. Install the mast assembly as described in **Front End** 4000SRM2303.

12. Raise the lift truck and remove blocks from under frame and from under the counterweight. Lower the lift truck.

13. Remove the blocks on each side (front and back) of the steering tires.

14. Operate the lift truck and check for proper operation and leaks.

WHEEL ENDS
202001-224



1. CAPSCREW
2. HUB AXLE SHAFT
3. O-RING
4. BOLT
5. SAFETY FLANGE
6. EXTERNAL BEARING CUP
7. HUB
8. INTERNAL BEARING CUP
9. HUB SEAL
10. CAPSCREW
11. SPINDLE
12. WASHER
13. PLANETARY CARRIER
14. CAPSCREW
15. O-RING
16. OIL DRAIN PLUG
17. O-RING
18. SNAP RING
19. WASHER
20. PIN
21. NEEDLE CAGE BEARINGS
22. GEAR
23. NEEDLE CAGE BEARINGS
24. WASHER

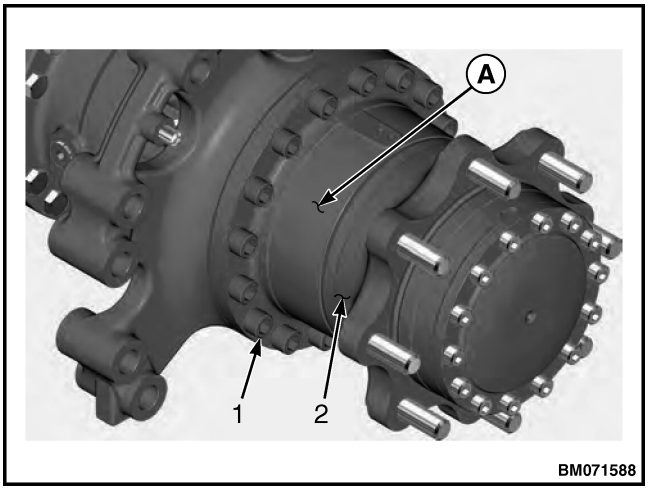
Figure 182. Planetary gear components

DISASSEMBLE WHEEL ENDS

STEP 1.
Confirm all oil was removed from the drive axle as stated in the previous section.

STEP 2.
Attach a sling connected to a lifting device around the center section of the planetary reduction gear (see item A in the next figure). Raise the lifting device until there is tension on the sling.

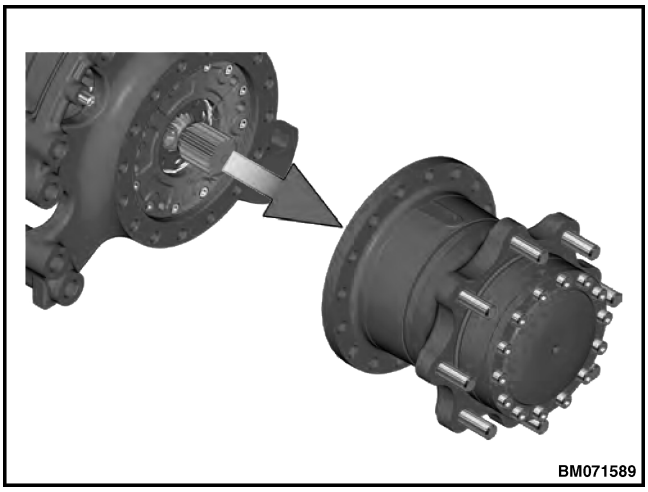
STEP 3.
Loosen and remove the capscrews attaching the planetary reduction gear.



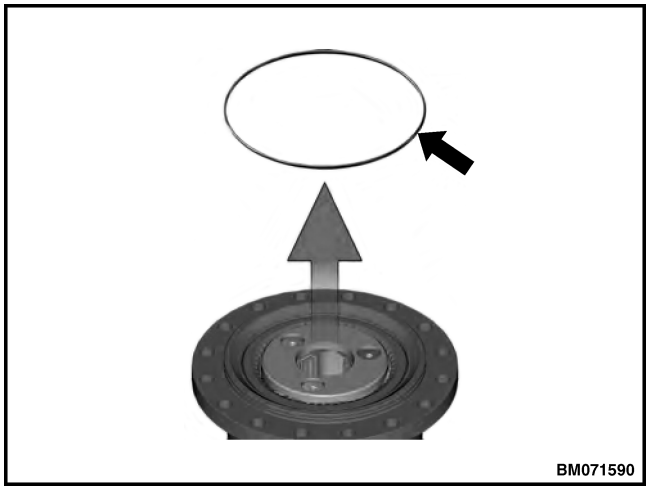
A. CENTER SECTION OF PLANETARY REDUCTION GEAR

1. CAPSCREW
2. PLANETARY REDUCTION GEAR

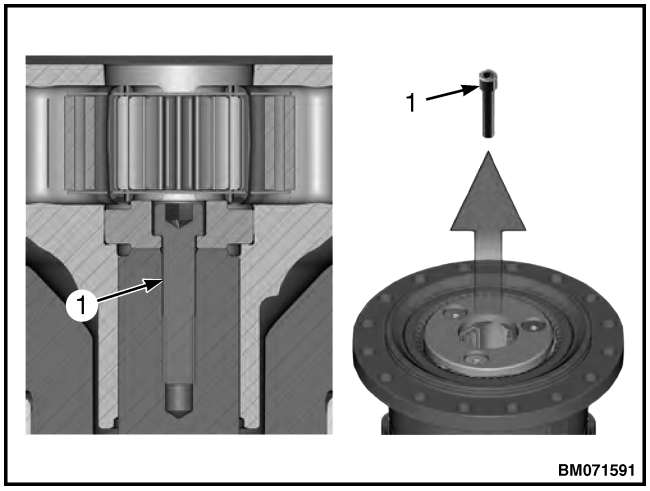
STEP 4.
Remove the planetary reduction gear section as a complete assembly.



STEP 5.
Use a flathead screwdriver to pry the O-ring loose from the planetary reduction gear and remove the O-ring.

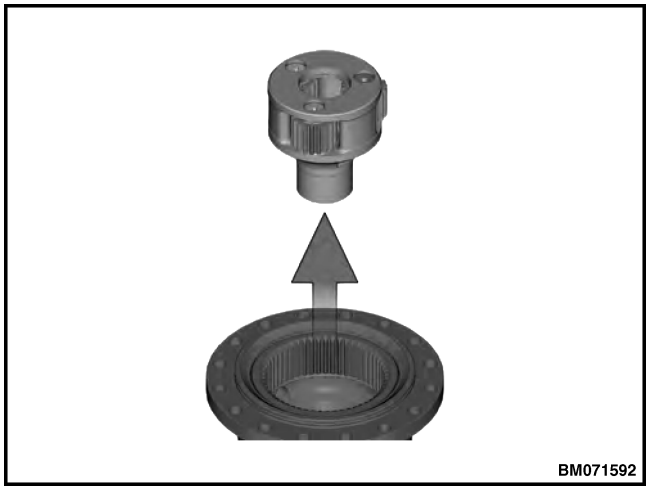


STEP 6.
Loosen and remove the capscrew from the center of the planetary carrier train.



1. CAPSCREW

STEP 7.
Remove the planetary carrier as a complete assembly.

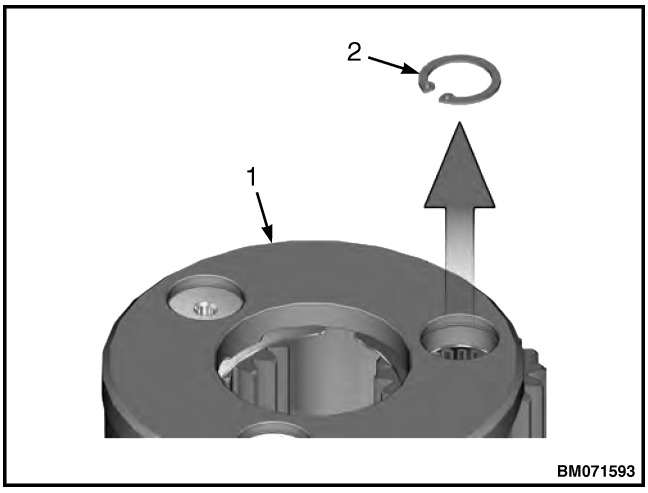


WARNING

Removing the snap rings can cause personal injury. Wear appropriate PPE and eye protection when removing the snap ring. Only use the appropriate tool (end-stop snap ring pliers) to remove the snap ring.

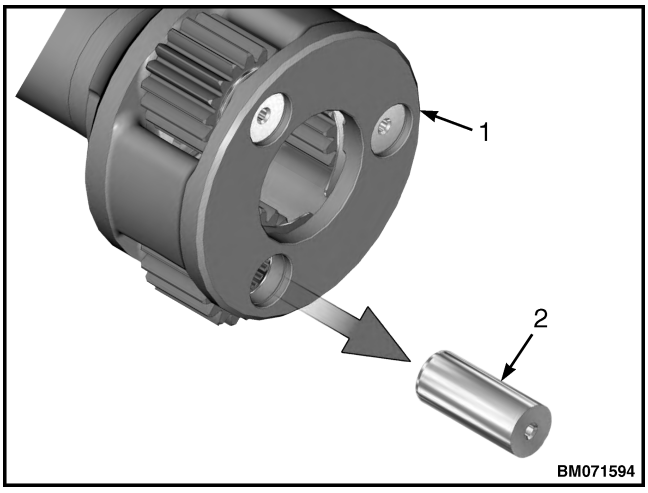
STEP 8.
Set the end-stop snap ring pliers. See End-Stop Plier Settings.

STEP 9.
Use the end-stop pliers to remove the three snap rings.



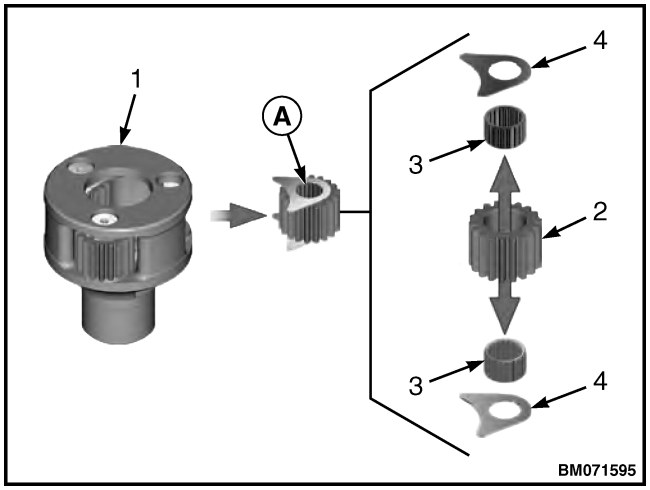
1. PLANETARY CARRIER TRAIN
2. SNAP RING

STEP 10.
Insert a screw (M6 x 1) of at least 20 mm length into the threaded hole in the center of each of the three pins and remove each pin. Leave the screw in the pin to aid in installation.



1. PLANETARY CARRIER
2. PIN

STEP 11.
Remove the gear assembly from the center of the planetary carrier train.

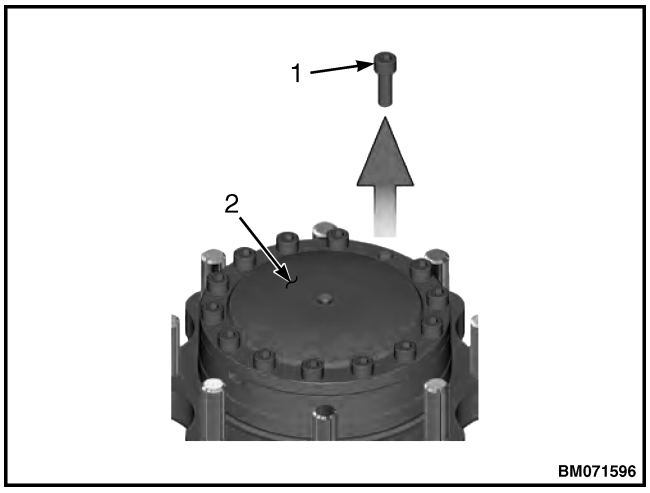


A. GEAR ASSEMBLY

1. PLANETARY CARRIER TRAIN
2. GEAR
3. NEEDLE CAGE BEARINGS
4. WASHERS

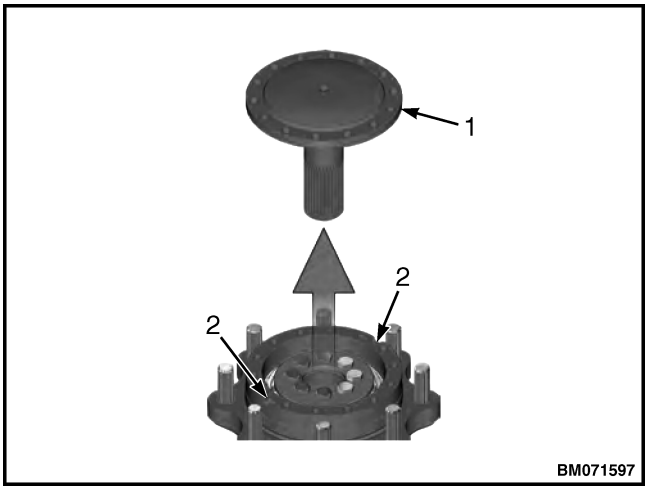
STEP 12.
Remove the washers and the needle cage bearings.

STEP 13.
Loosen and remove the fourteen capscrews retaining the hub axle shaft.



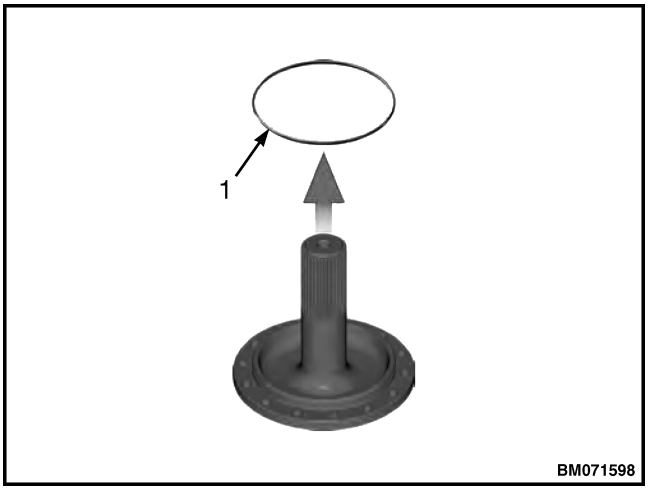
1. CAPSCREW
2. HUB AXLE SHAFT

STEP 14.
Remove the hub axle shaft.



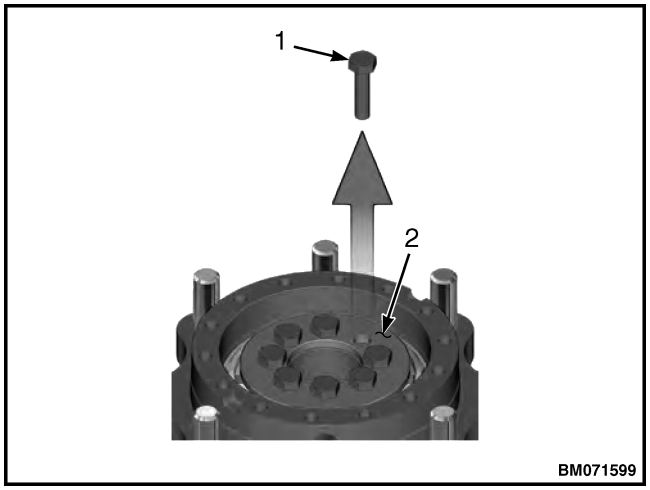
1. HUB AXLE SHAFT
2. PRY POINTS

STEP 15.
Use a flathead screwdriver to remove the O-ring.



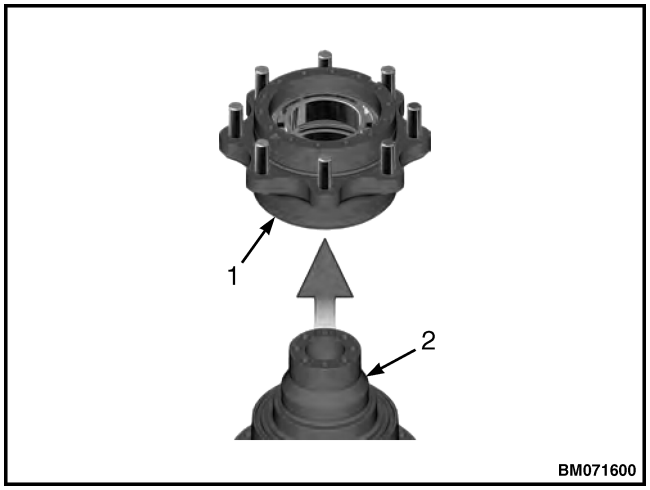
1. O-RING

STEP 16.
Loosen and remove the capscrews retaining the safety flange. Remove the safety flange.



1. CAPSCREW
2. SAFETY FLANGE

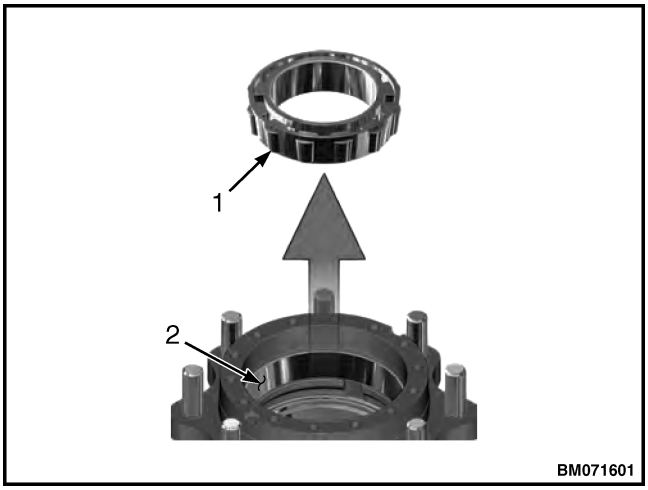
STEP 17.
Use an extractor to separate the hub from the spindle.



1. HUB
2. SPINDLE

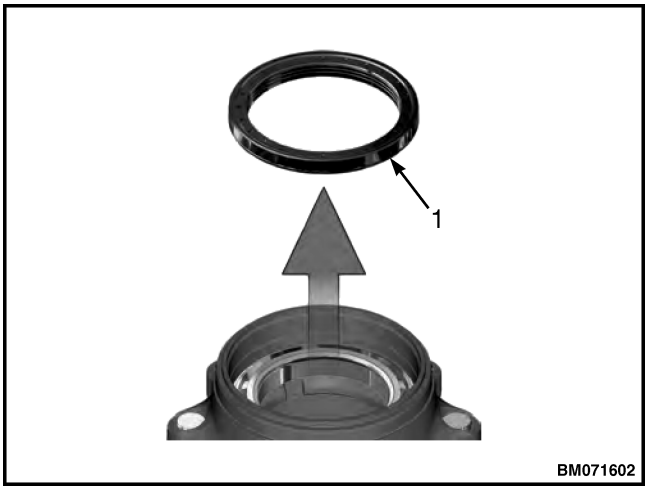
NOTE: Avoid damaging or deforming the bearing cups when removing.

STEP 18.
Remove the external bearing. Use an internal extractor to remove the bearing cup.



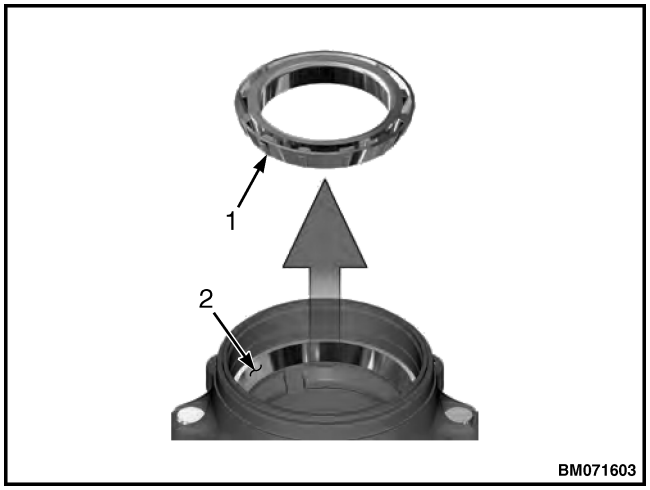
1. EXTERNAL BEARING
2. BEARING CUP

STEP 19.
Use the extractor to remove the hub seal, taking care to not damage the surface of the hub seal.



1. HUB SEAL

STEP 20.
Remove the inner bearing.

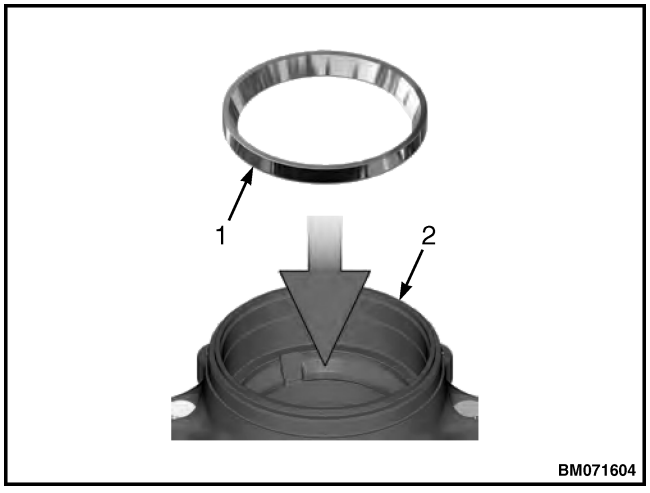


1. INNER BEARING
2. INNER BEARING CUP

STEP 21.
Use an internal extractor to remove the inner bearing cup, taking care to not damage the housing, inner bearing and bearing cup.

ASSEMBLE WHEEL ENDS

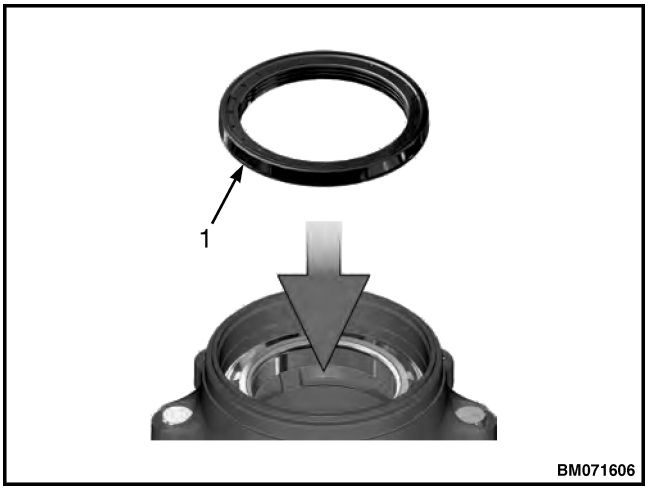
STEP 1.
Position the upper part of tool T1 and press the inner bearing cup into the hub all the way down.



1. INNER BEARING CUP
2. HUB

STEP 2.
Install the inner bearing.

STEP 3.
Place the hub seal in the special tool T2 (see T2, in Wet Brake Axle Special tools). Position tool T2 and press the hub seal into its seat.

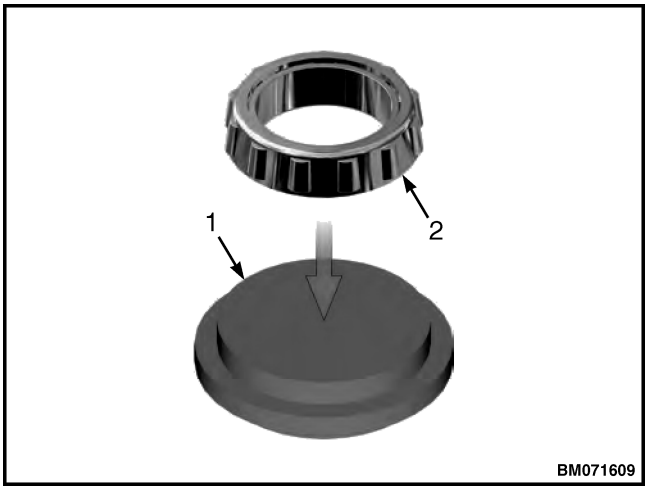


1. HUB SEAL

STEP 4.
Confirm the hub seal is correctly oriented (the flat surface should be visible after mounting).

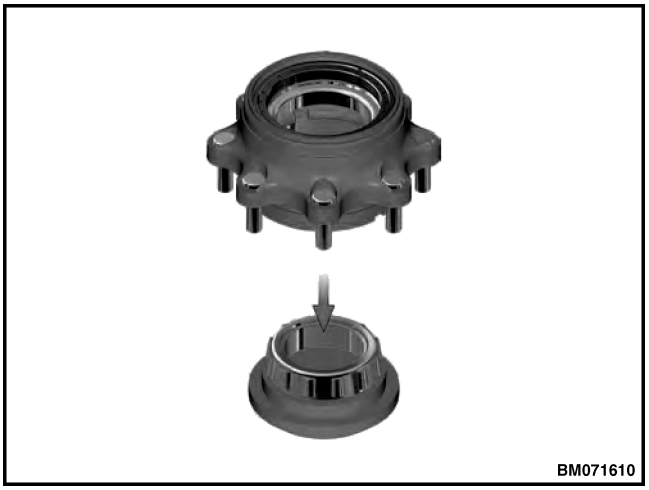
STEP 5.
Position the upper part of tool T3 (see T3, in Wet Brake Axle Special tools) and place the thrust blocks into the hub and press all the way down.

STEP 6.
Position the outer bearing on the special tool T4 (see T4, in Wet Brake Axle Special tools).

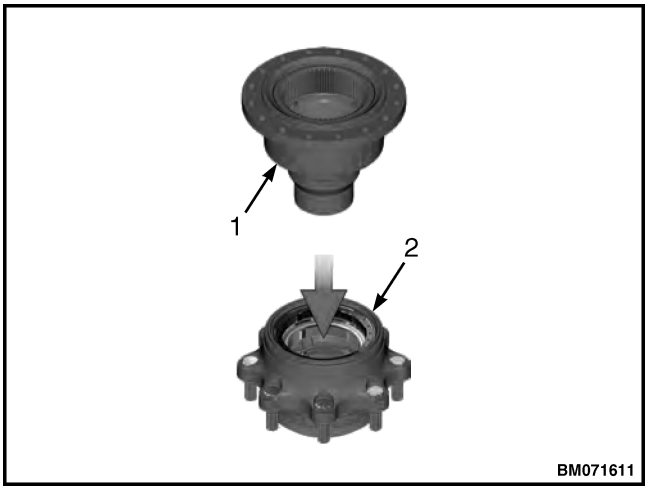


1. SPECIAL TOOL (T4)
2. OUTER BEARING

STEP 7.
Place the complete wheel hub on the bearing.



STEP 8.
Install the hub on spindle. Use a suitable press, assemble the components.

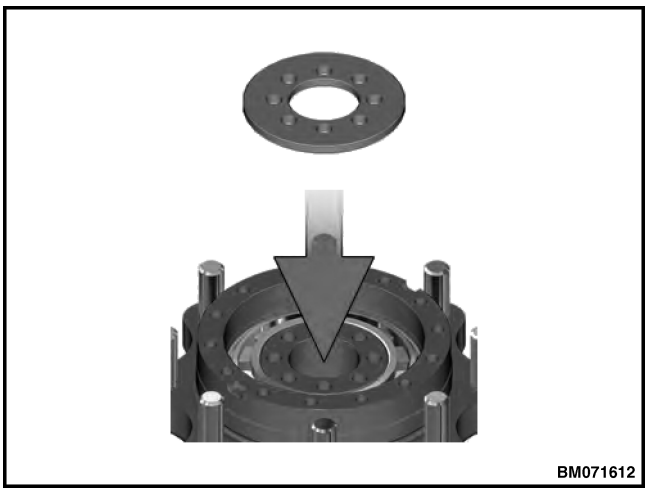


1. HUB
2. SPINDLE

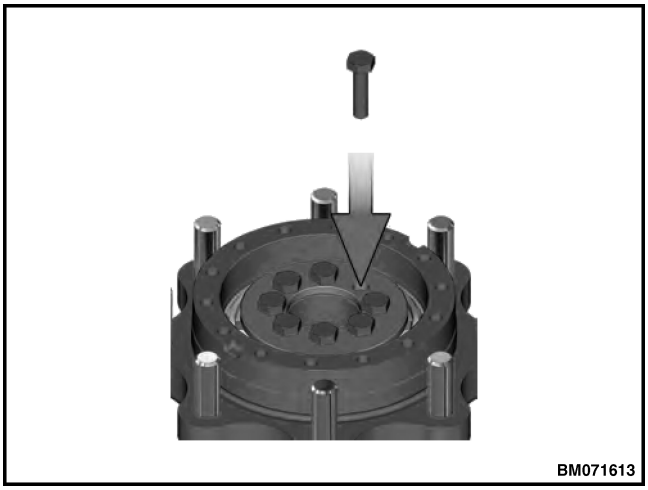
WARNING

Remove the T4 special tool before proceeding to the following steps. The T4 tool could fall and cause crushing injuries.

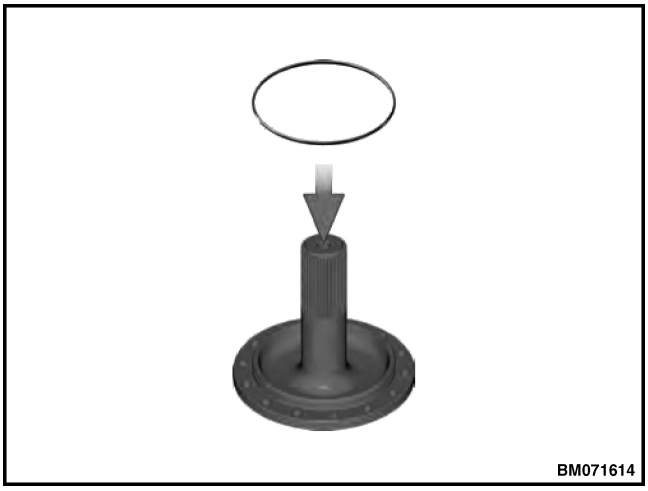
STEP 9.
Install the safety flange.



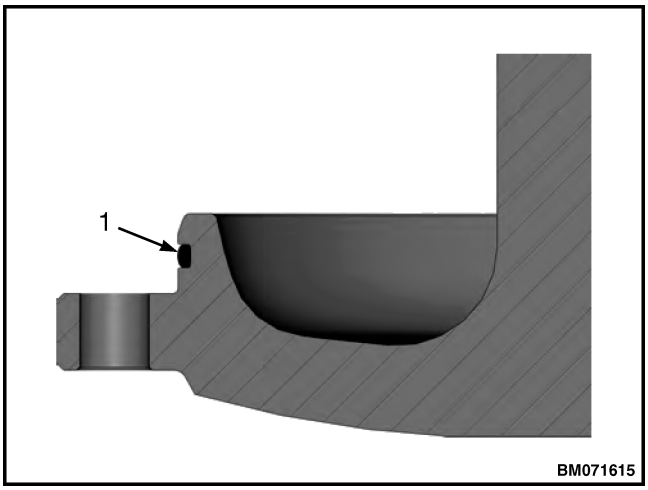
STEP 10.
Apply Loctite 243 to threaded portion of the capscrew. Install the capscrews and tighten in an alternating cross pattern. Torque to 72 to 78 N•m (53.1 to 57.5 lbf ft).



STEP 11.
Lubricate with lithium-based grease and install the outer O-ring.

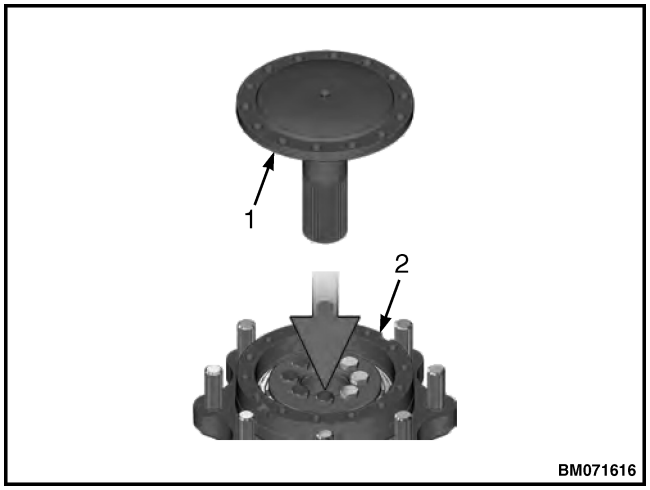


STEP 12.
Confirm the O-ring is fully seated.



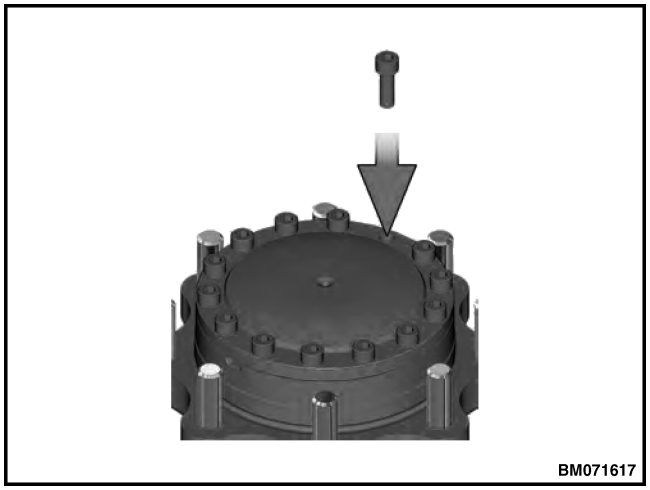
1. O-RING

STEP 13.
Install the hub axle shaft and engage it in the planetary carrier.

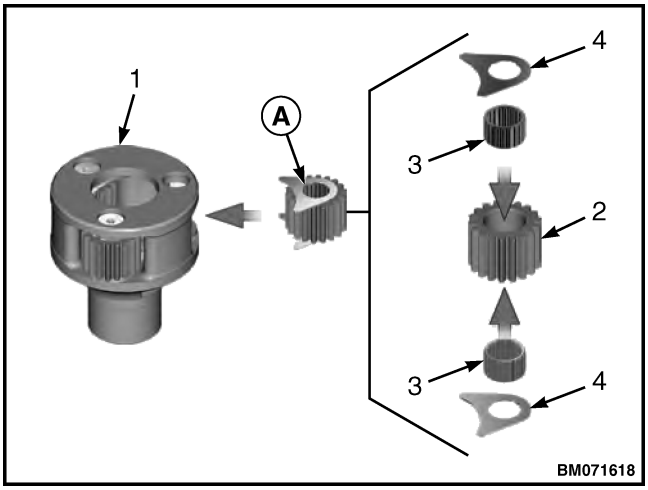


1. HUB AXLE SHAFT
2. PLANETARY CARRIER

STEP 14.
Apply Loctite 243 to the threaded portion of the capscrew. Install the capscrews and tighten in an alternating cross pattern. Torque to 50 to 59 N•m (36.9 to 43.5 lbf ft).



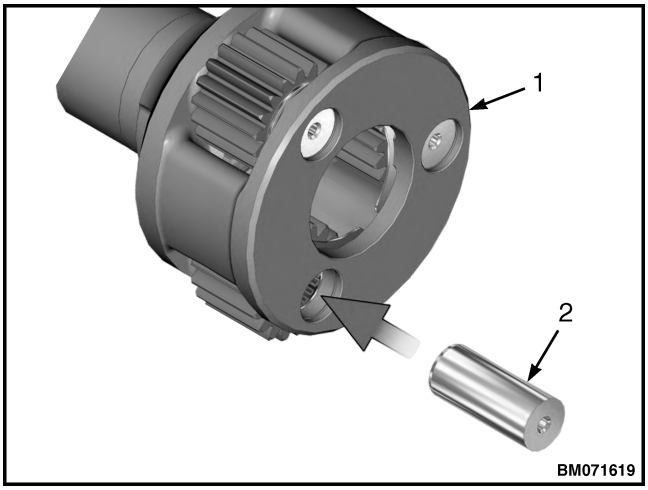
STEP 15.
Assemble the washers and the needle cage bearings. Install the gear and componenets as one assembly.



A. GEAR ASSEMBLY

1. PLANETARY CARRIER TRAIN
2. GEAR
3. NEEDLE CAGE BEARINGS
4. WASHERS

STEP 16.
Install the pin in the planetary carrier.



1. PLANETARY CARRIER
2. PIN

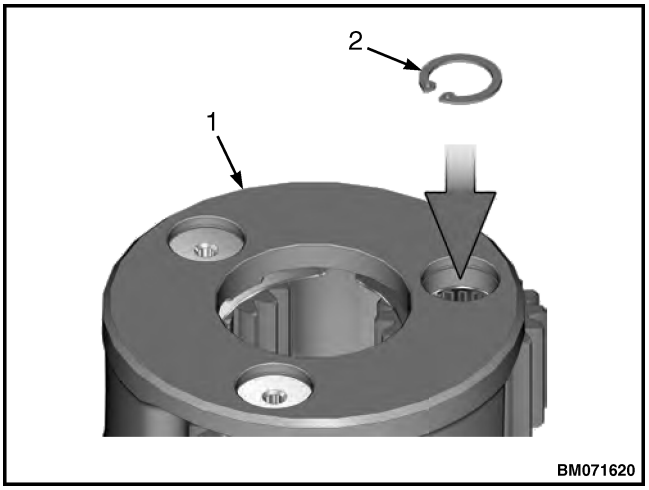
WARNING

Personal injury can result when installing then snap rings. The appropriate safety equipment must be worn. To avoid injury to your eyes, wear protective glasses during this procedure.

CAUTION

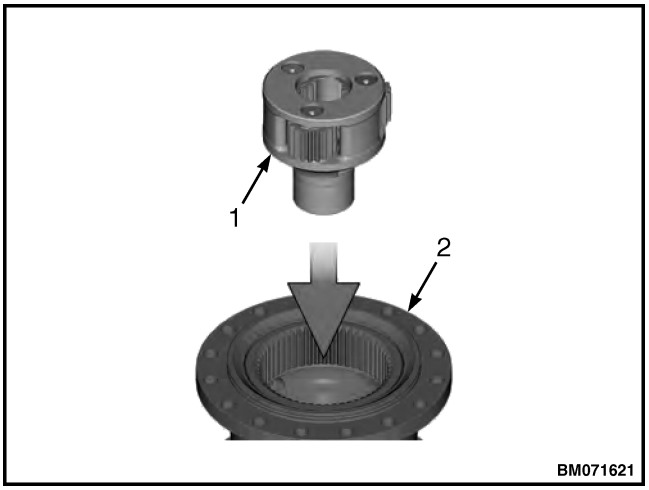
Set the pliers following the correct procedure. See End-Stop Plier Settings in the Wet Brake Axle Special tools section of this manual.

STEP 17.
Install the three snap rings.



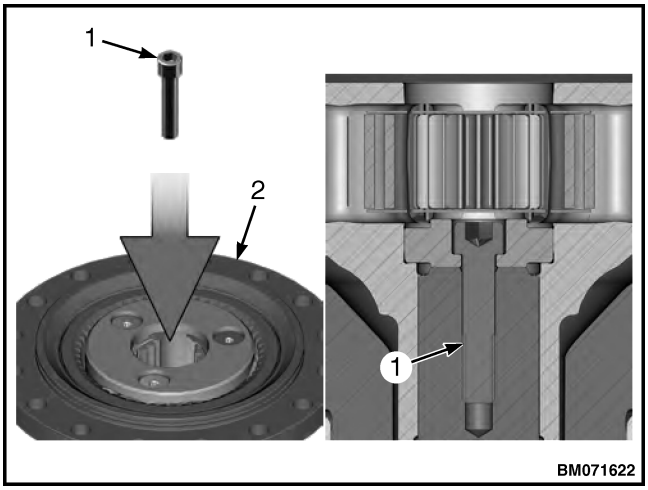
1. PLANETARY CARRIER
2. SNAP RING

STEP 18.
Install the assembled planetary carrier.



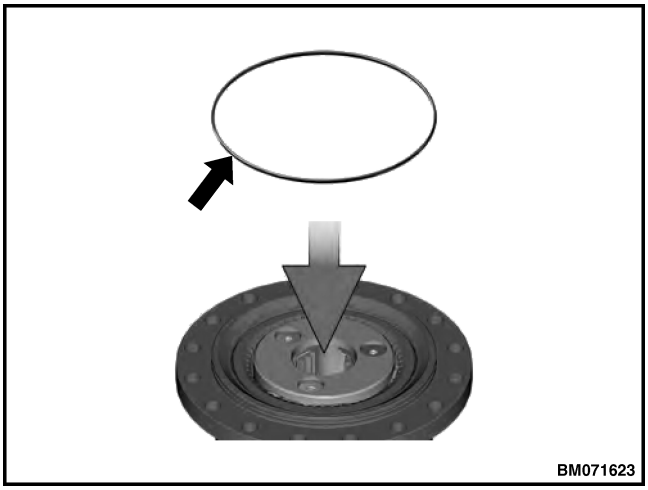
1. PLANETARY CARRIER
2. HOUSING

STEP 19.
Apply Loctite 243 to threaded portion of the capscrew. Install the capscrew and tighten. Torque to 116 to 128 N•m (85.6 to 94.4 lbf ft).

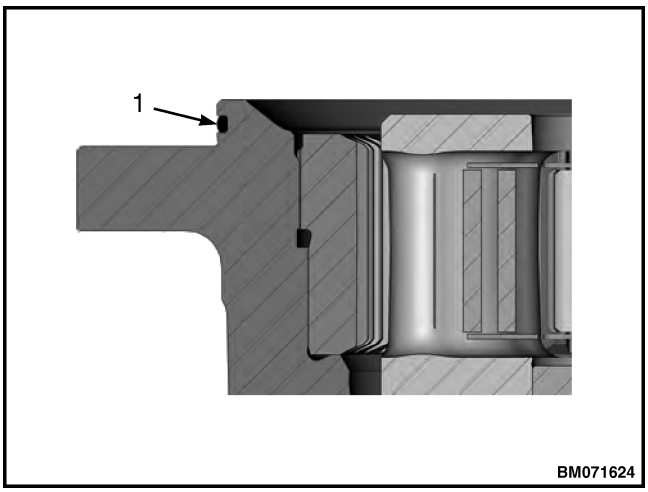


1. CAPSCREW
2. PLANETARY CARRIER

STEP 20.
Lubricate new O-ring with lithium-based grease and install the outer O-ring.



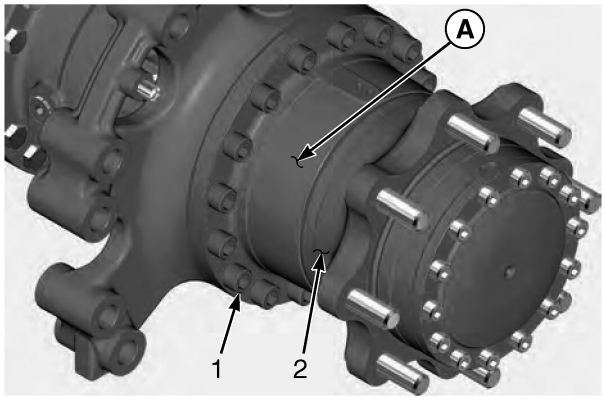
STEP 21.
Confirm the O-ring is fully seated.



STEP 22.
Attach a sling connected to a lifting device to planetary reductor. Raise the lifting device until there is tension on the sling.

STEP 23.
Install the assembled planetary reduction gear.

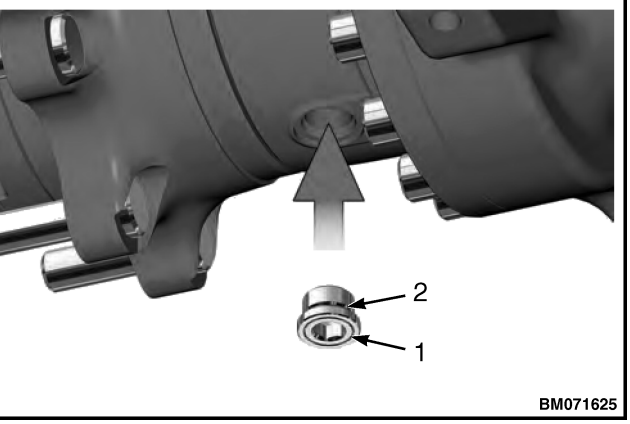
STEP 24.
Apply Loctite 243 to threaded portion of the capscrew. Install the capscrews and tighten in an alternating cross pattern. Torque to 116 to 128 N•m (85.6 to 94.4 lbf ft).



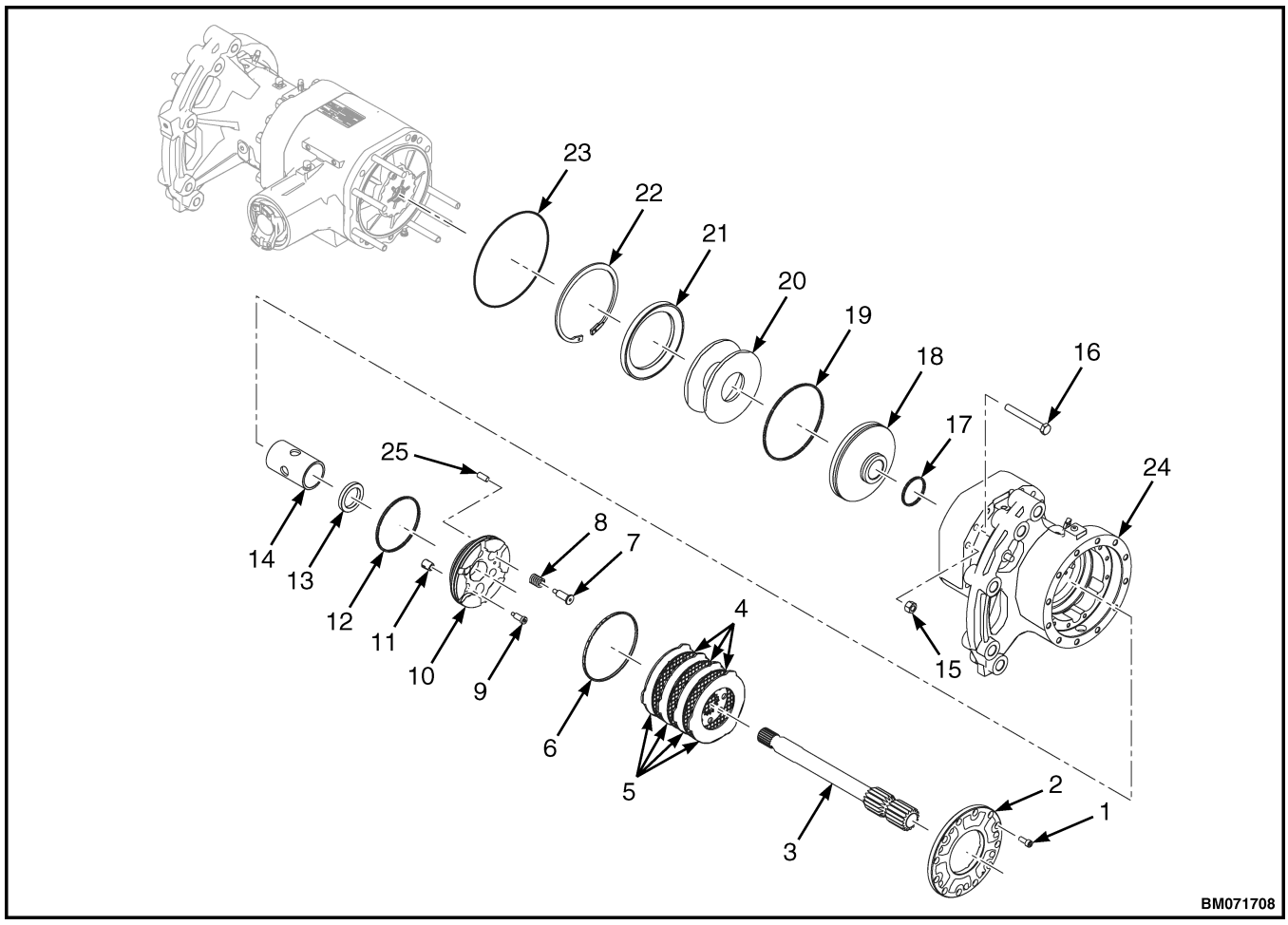
A. CENTER SECTION OF PLANETARY REDUCTION GEAR

1. CAPSCREW
2. PLANETARY REDUCTION GEAR

STEP 25.
Install the oil drain plug and O-ring. Torque to 35 to 50 N•m (25.8 to 36.9 lbf ft).



SERVICE BRAKE
202001-225



1. CAPSCREW
2. COUNTERDISC
3. AXLE SHAFT
4. BRAKING DISCS
5. BRAKING DISCS
6. O-RING
7. SCREW
8. RETURN SPRING
9. ADJUSTING SCREW
10. PISTON
11. SELF ADJUSTERS
12. O-RING
13. CALIBRATED SPACER
14. SPACER
15. NUTS
16. SCREWS
17. SEAL
18. PISTON ASSEMBLY
19. SEAL
20. BELLEVILLE WASHERS
21. SPACER
22. SNAP RING
23. O-RING
24. ARM
25. PIN

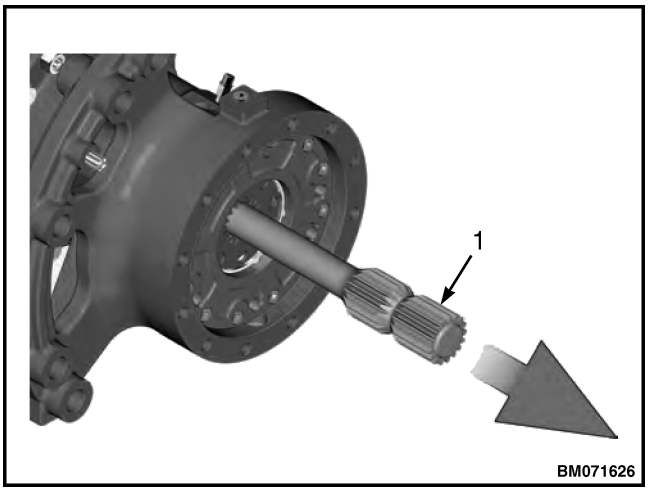
Figure 183. Service brake components

DISASSEMBLE SERVICE BRAKE

STEP 1.
Confirm all oil was removed from the drive axle.

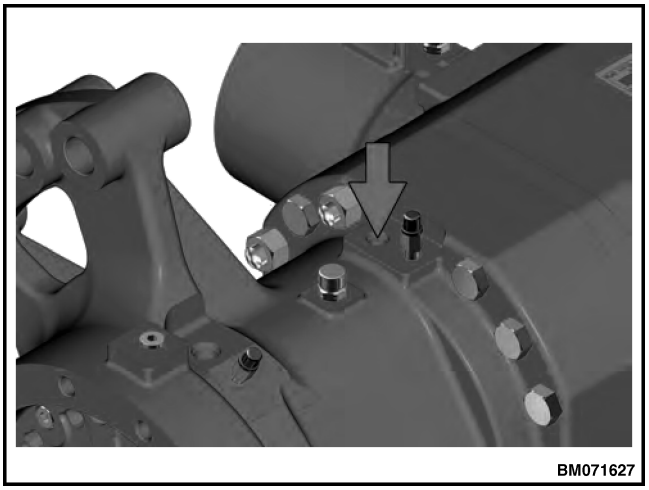
STEP 2.
Remove the wheel ends as described in Wheel ends.

STEP 3.
Remove the axle shaft.



1. AXLE SHAFT

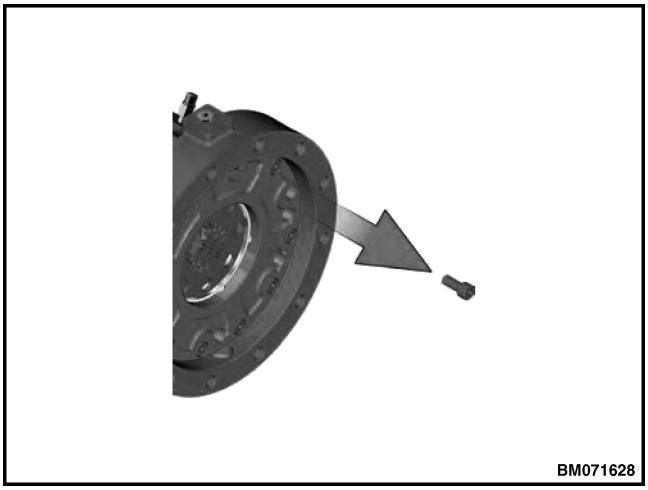
STEP 4.
Connect an external pump (such as a Porto-Power®) to the negative brake at the park brake release chamber. Apply pressure to 65 to 70 bar (943 to 1015 psi).



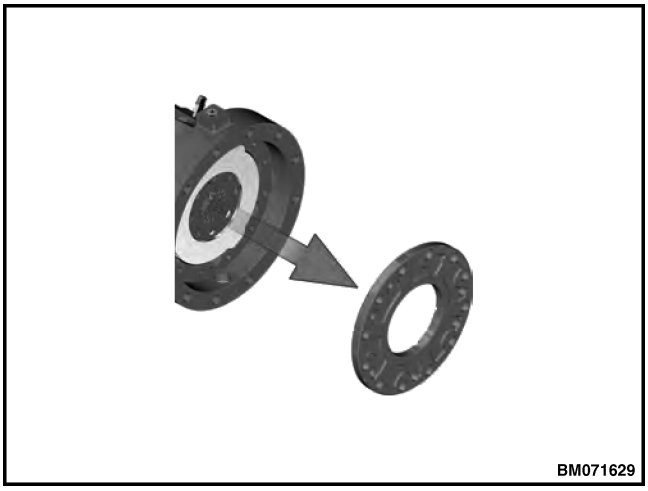
DANGER

Always check the hydraulic circuit for leaks under pressure. Always use a cardboard or a panel to control the loss. A leak from a hole of the size of a pin can cause serious injury. If fluid is injected into the skin it is necessary to seek immediate medical care.

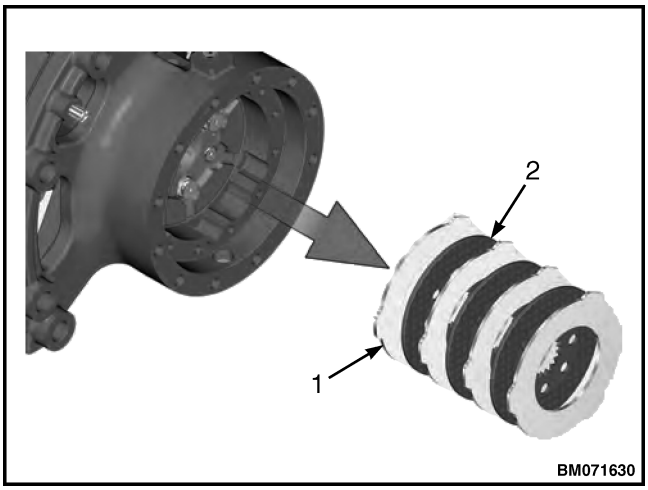
STEP 5.
Loosen and remove the capscrews from the counterdisc.



STEP 6.
Remove the counterdisc.



STEP 7.
Remove the braking discs, noting the position and direction of the assembly.



1. OUTER DISC
2. INNER DISC

DANGER

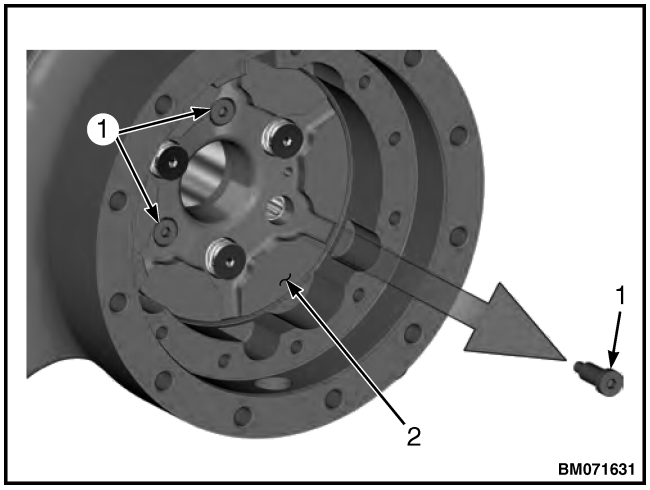
Failure to replace the brake discs can cause serious damage, injuries or death

CAUTION

Disc quantity changes according to the model. Detect and mark the quantities and position of discs for your axle. Avoid the exchange of positions

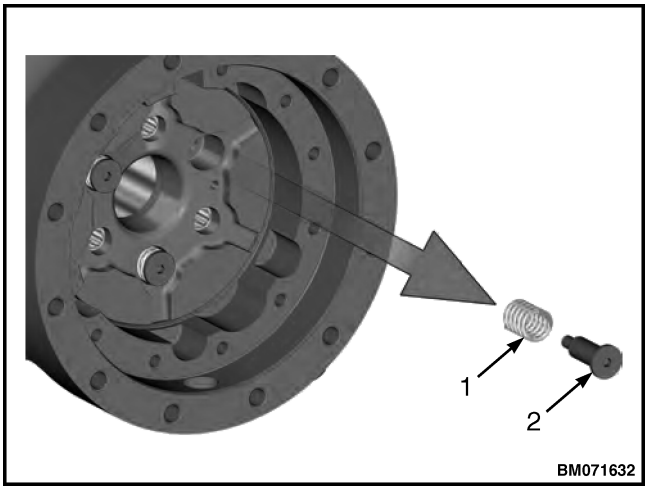
STEP 8.
Check the removed braking discs for wear. If thickness of friction material is less than 0.2 mm for each side, replace the complete disc pack.

STEP 9.
Remove the three adjusting screws from the piston.



1. ADJUSTING SCREWS
2. PISTON

STEP 10.
Remove the return springs and screws. Check springs for wear. If springs have been deformed by compression, replace the springs.



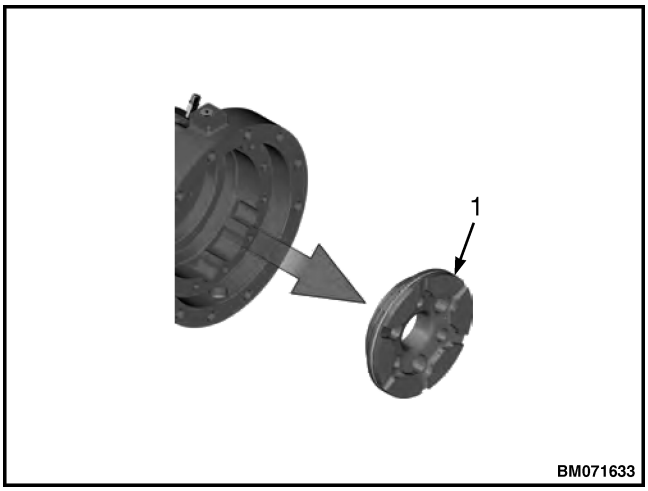
1. RETURN SPRING
2. SCREW

STEP 11.
Slowly apply compressed air via the service brake inlet to extract the piston assembly.

DANGER

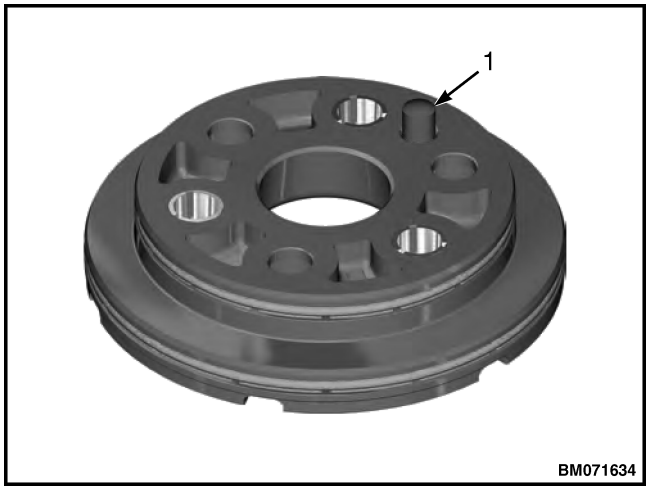
The following operation is potentially dangerous. Retain the piston as it may be expelled rapidly and damaged.

STEP 12.
Remove the piston assembly.



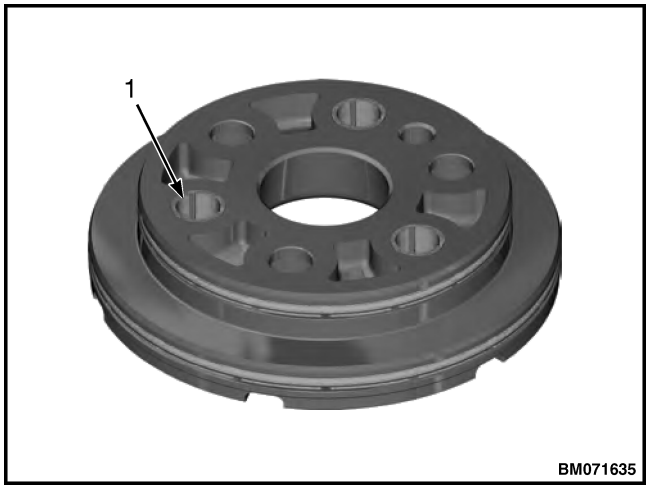
1. PISTON

STEP 13.
Use pliers to remove the cylindrical pin.



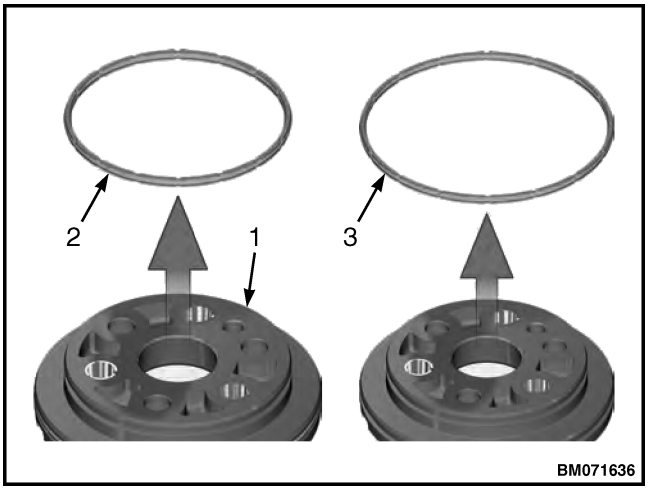
1. CYLINDRICAL PIN

STEP 14.
Use cylindrical punch to remove the service brake self adjusters.



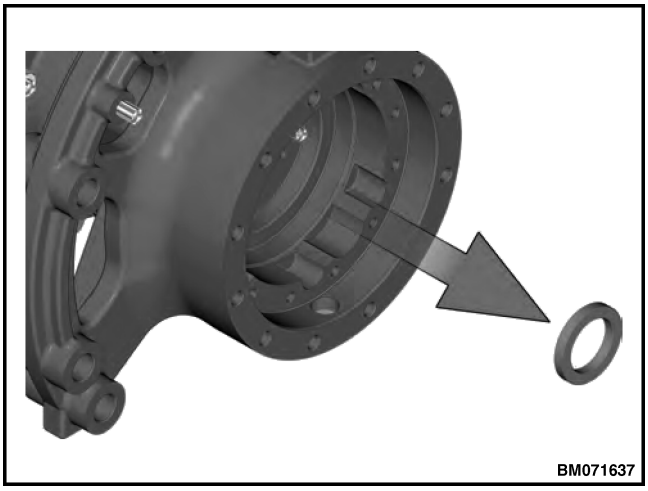
1. SELF ADJUSTER

STEP 15.
Remove the seals from the piston.

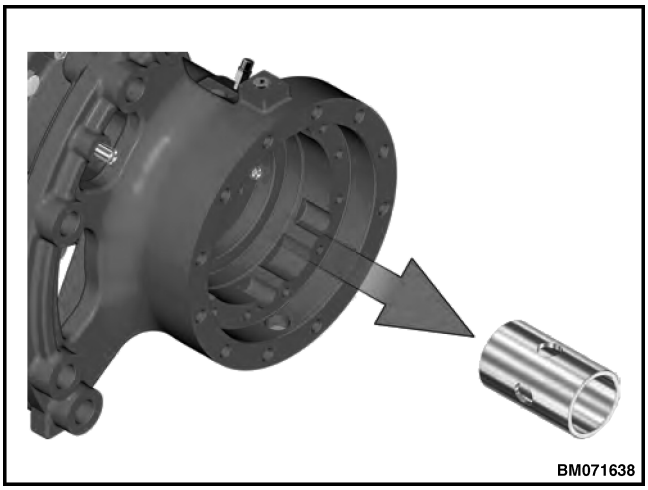


1. PISTON
2. OUTER SEAL
3. INNER SEAL

STEP 16.
Remove the calibrated spacer.

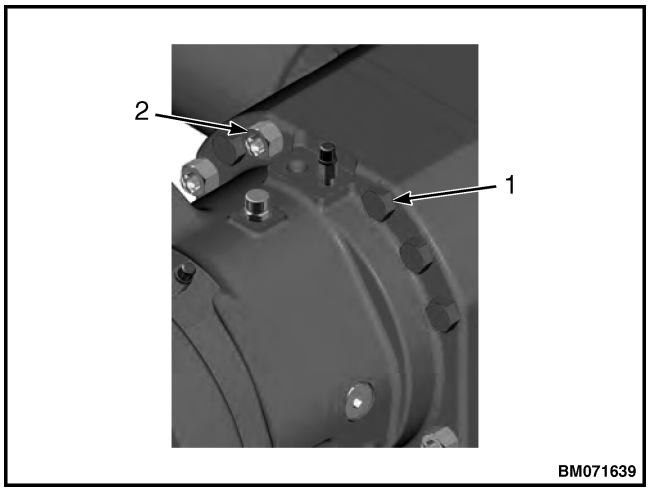


STEP 17.
If your drive axle model features an optional spacer, remove the spacer.



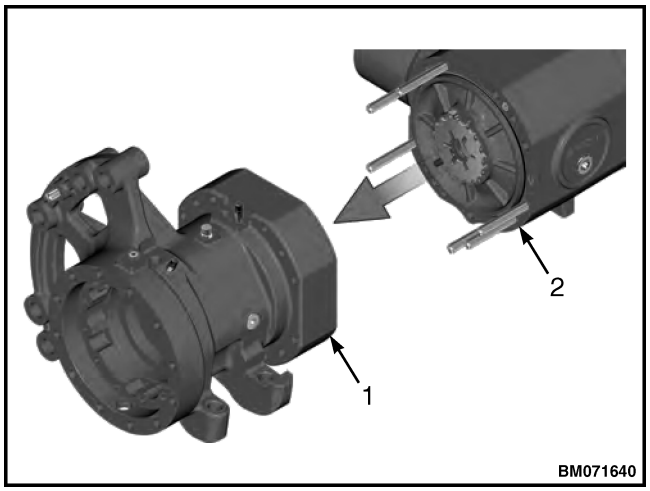
STEP 18.
Release the negative brake pressure. Connect a suitable lifting system.

STEP 19.
Loosen and remove the screws and nuts securing the arm to the central housing.



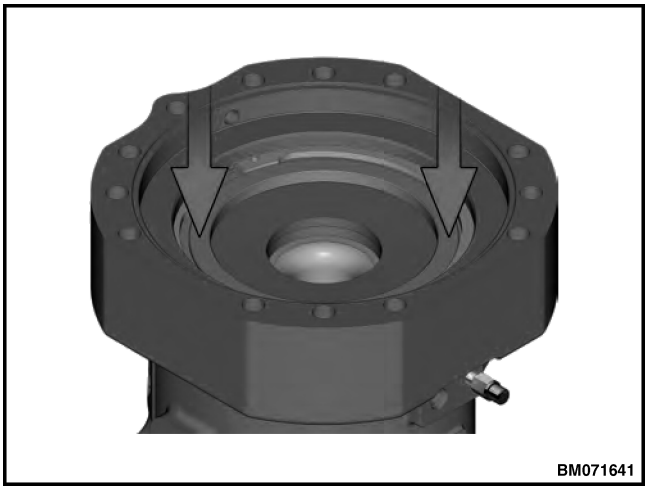
1. SCREW
2. NUT

STEP 20.
Remove the arm from the central housing.



1. ARM
2. CENTRAL HOUSING

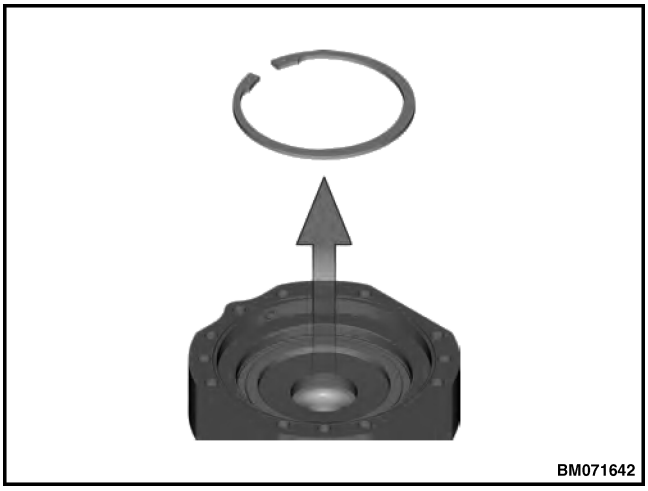
STEP 21.
Press the piston to move it away from the snap ring.



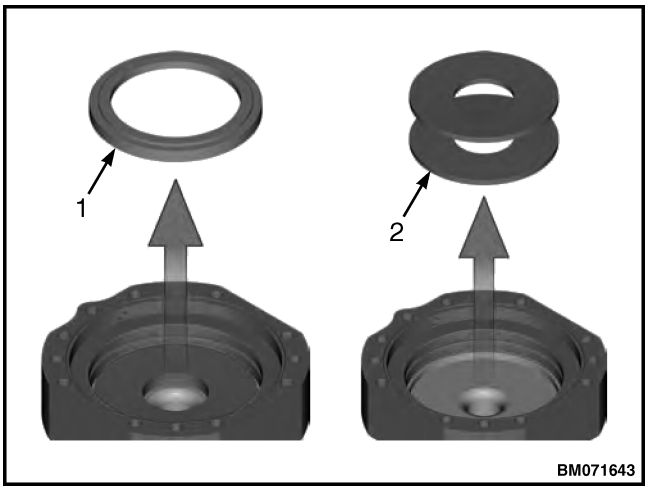
WARNING

Removal of the snap rings may cause personal injuries. You must wear appropriate safety equipment. To avoid injury to eyes, wear eye protection equipment.

STEP 22.
Use a suitable pliers to remove the snap ring. See End-Stop Plier Settings in the Wet Brake Axle Special tools section of this manual.

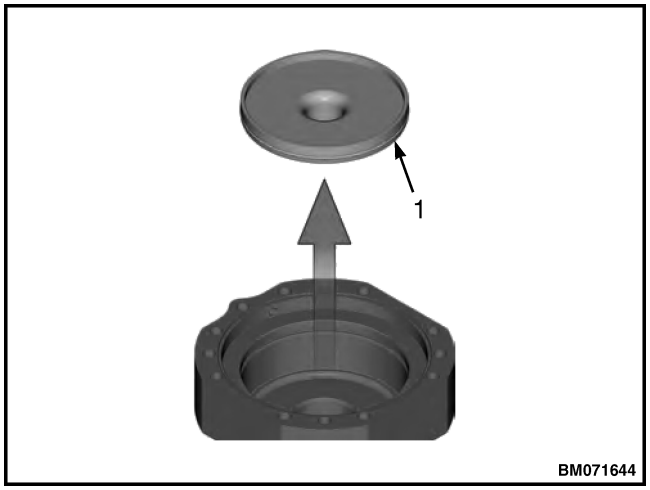


STEP 23.
Remove the spacer and washers.



1. SPACER
2. WASHERS

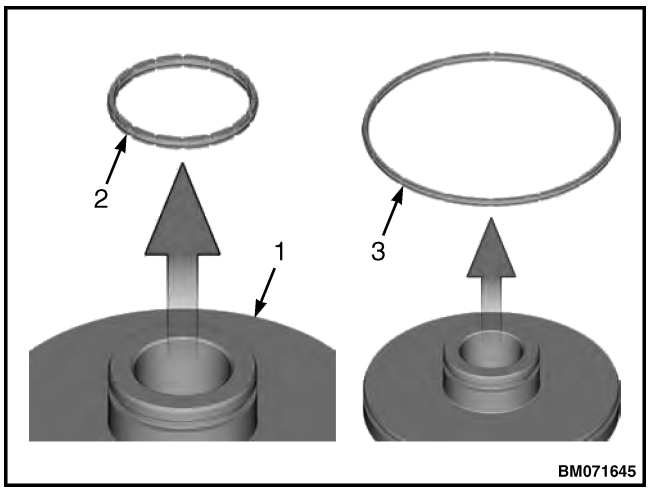
STEP 24.
Note the position of the assembly. Apply compressed air via the inlet to extract the piston assembly.



1. INNER PISTON

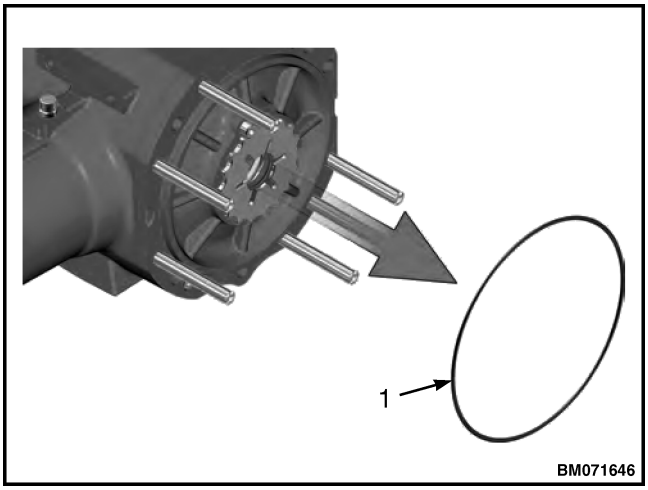
WARNING
The following operation is potentially dangerous. Retain the piston as it may be expelled rapidly and damaged.

STEP 25.
Remove the seals from the inner piston.



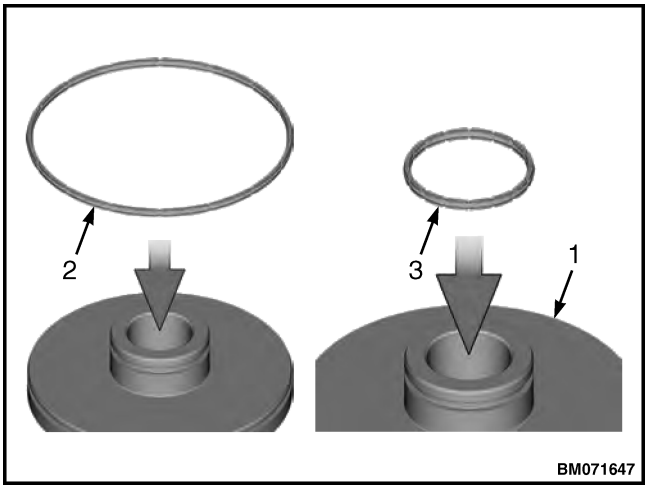
1. INNER PISTON
2. INNER SEAL
3. OUTER SEAL

STEP 26.
Use a flathead screwdriver to remove the O-ring.



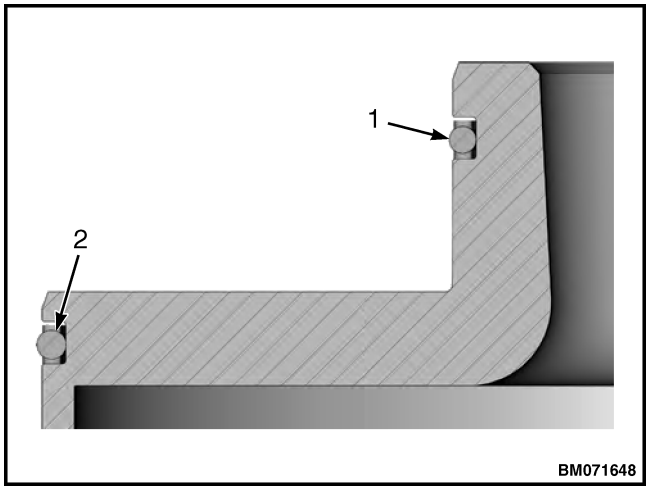
ASSEMBLE SERVICE BRAKE

STEP 1.
Install the seals onto the inner piston.



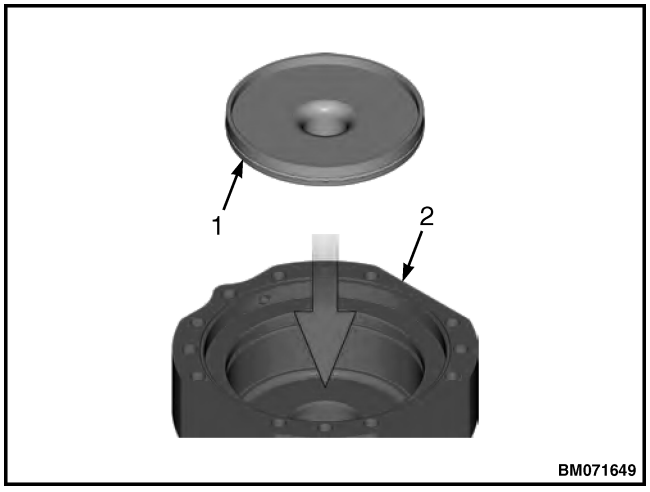
1. INNER PISTON
2. INNER SEAL
3. OUTER SEAL

STEP 2.
Fully seat the small and large O-rings into the grooves on the piston.



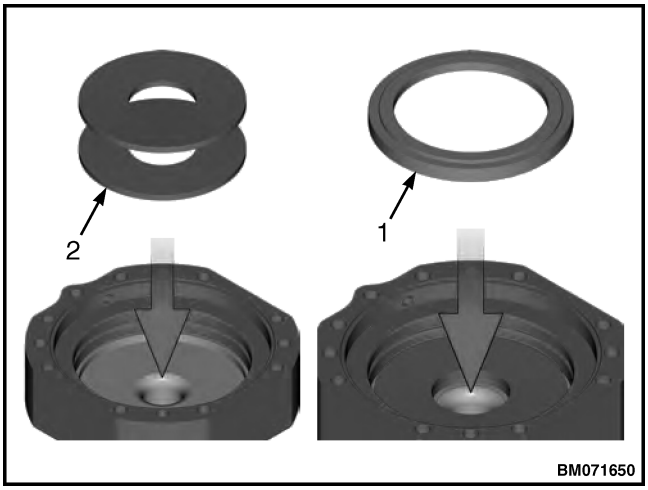
1. INNER SEAL
2. OUTER SEAL

STEP 3.
Lubricate the piston and the seals with hydraulic oil. Install the piston into the arm.



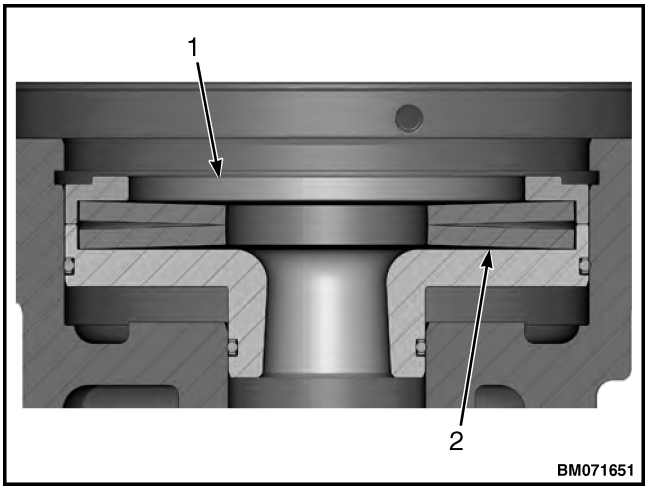
1. PISTON AND SEALS
2. ARM

STEP 4.
Install the washers and spacer.



1. SPACER
2. WASHERS

STEP 5.
Confirm the washers and spacers are fully seated.



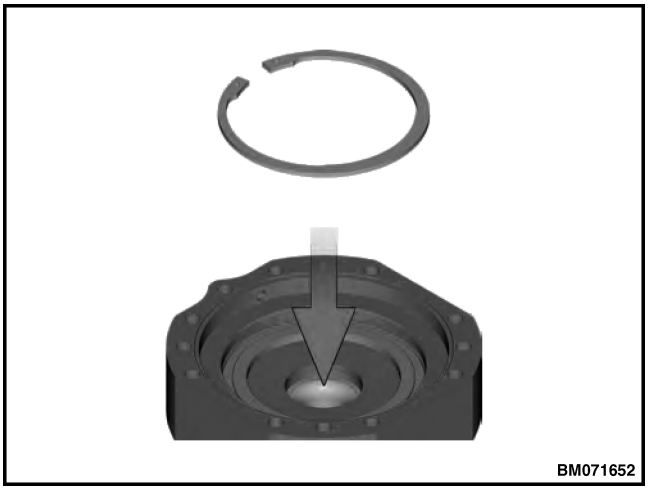
1. SPACER
2. WASHERS

WARNING

Personal injury can result when installing snap ring. Appropriate safety equipment must be worn. To avoid injury to your eyes, wear protective glasses during this procedure.

NOTE: Calibrate the end stop pliers before removing the snap ring. See End-Stop Plier Settings.

STEP 6.
Install the snap ring.

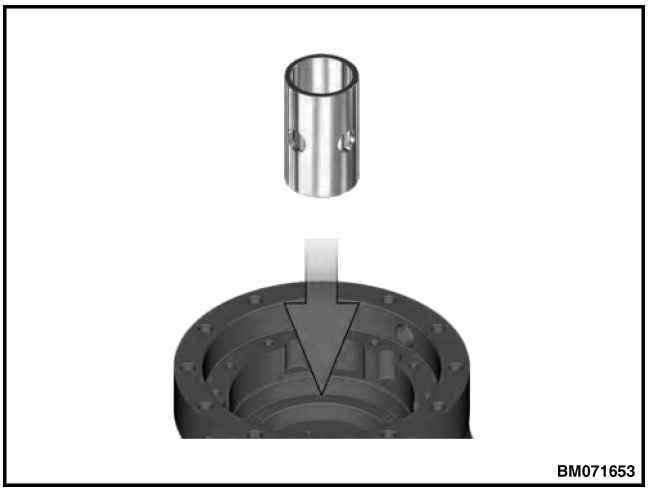


DANGER

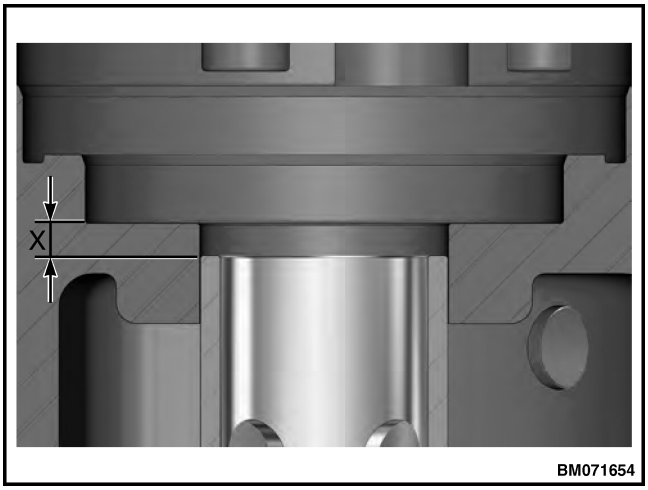
Always check the hydraulic circuit for leaks under pressure. Always use a cardboard or a panel to control the loss. A leak from a hole of the size of a pin can cause serious injury. If fluid is injected into the skin it is necessary to seek immediate medical care.

STEP 7.
Connect an external pump to the negative brake and apply air pressure to 65 to 70 bar (942.7 to 1015.3 psi).

STEP 8.
If a spacer was removed, install the spacer.



STEP 9.
Measure spacer at dimension "X" in the figure.



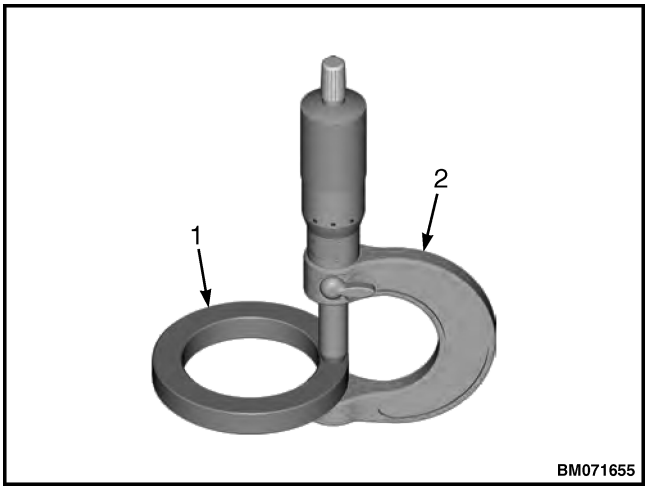
STEP 10.
Calculate the measure "S" of the calibrated spacer (13) to be installed.

S = X-Y

Y = prefined gap = 0-0.1 mm

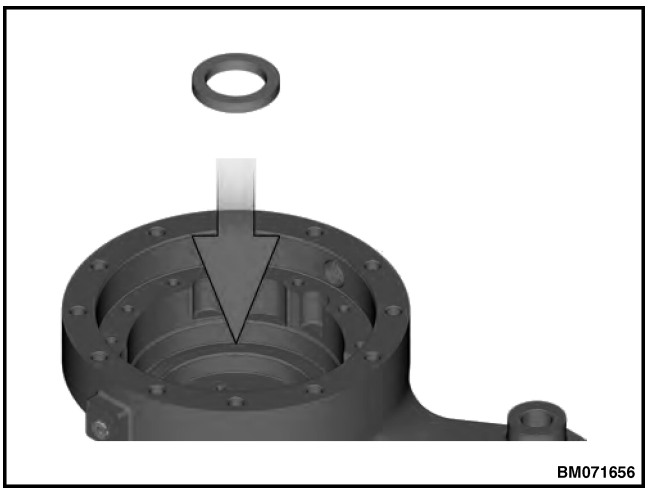
EXAMPLE: S = 8,1 - 1 = 8 mm

S = 8 mm

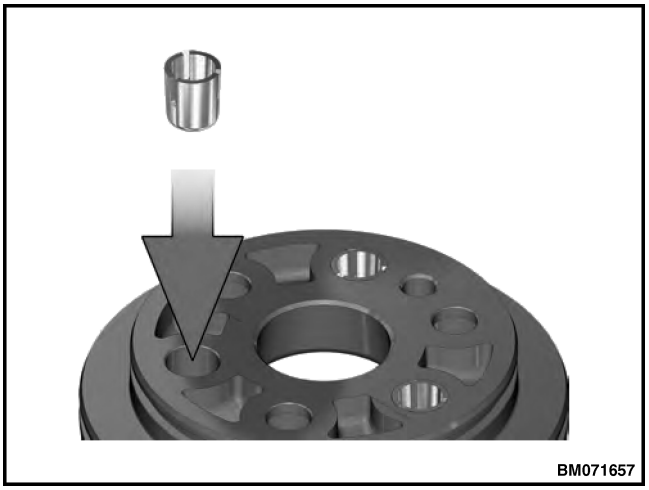


1. SPACER
2. CALIPERS

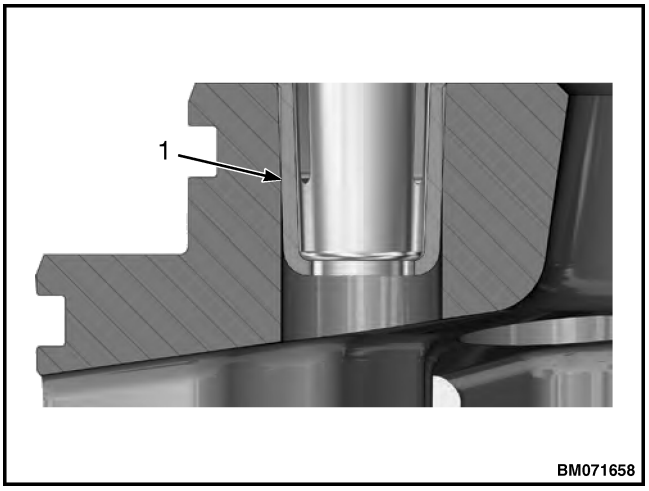
STEP 11.
Install the spacer.



STEP 12.
Insert the three service brake self adjusters.

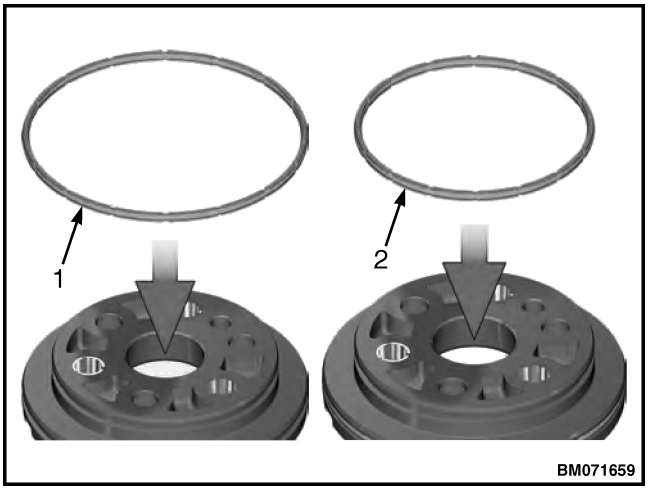


STEP 13.
Fully seat the service brake self adjusters until flush with the service brake.



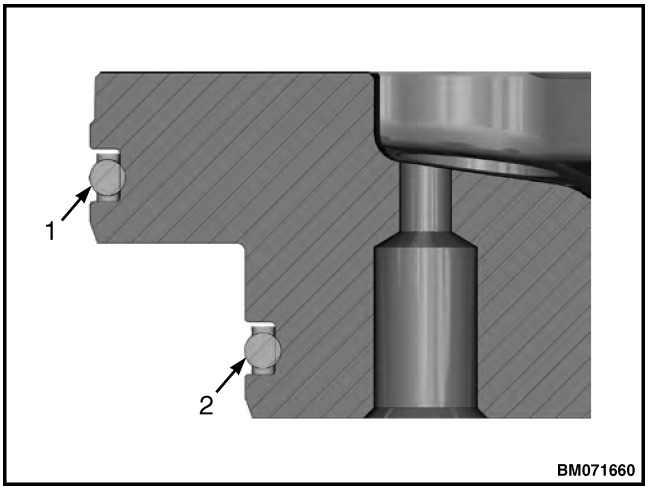
1. BRAKE SELF ADJUSTER

STEP 14.
Install the outer and inner seals onto the piston.



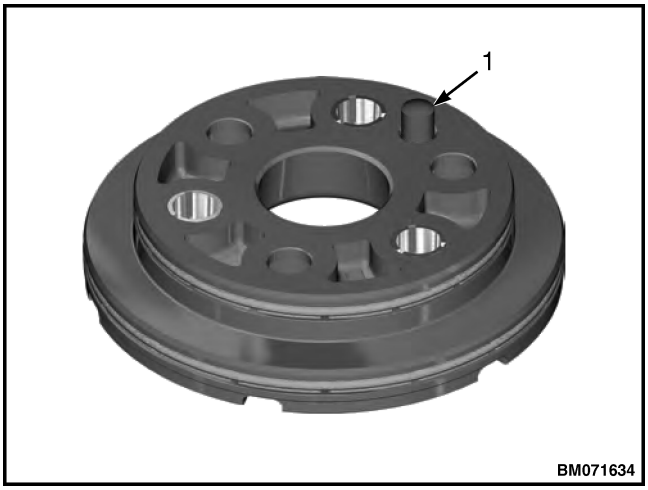
1. OUTER SEAL
2. INNER SEAL

STEP 15.
Fully seat the inner and outer seals.



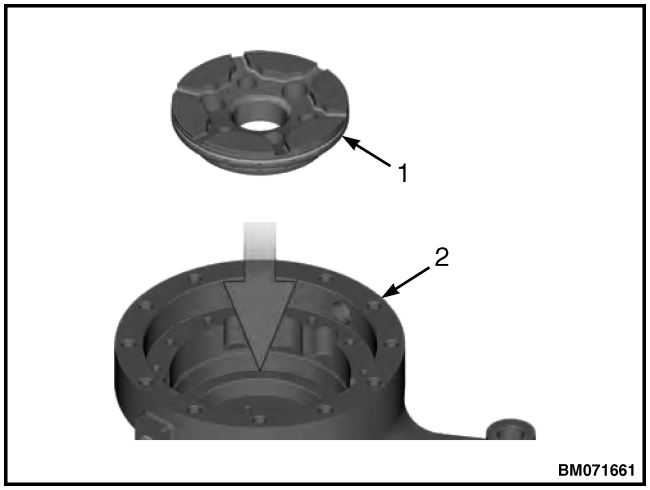
1. OUTER SEAL
2. INNER SEAL

STEP 16.
If the cylindrical pin was removed, use a plastic mallet to install the cylindrical pin.



1. CYLINDRICAL PIN

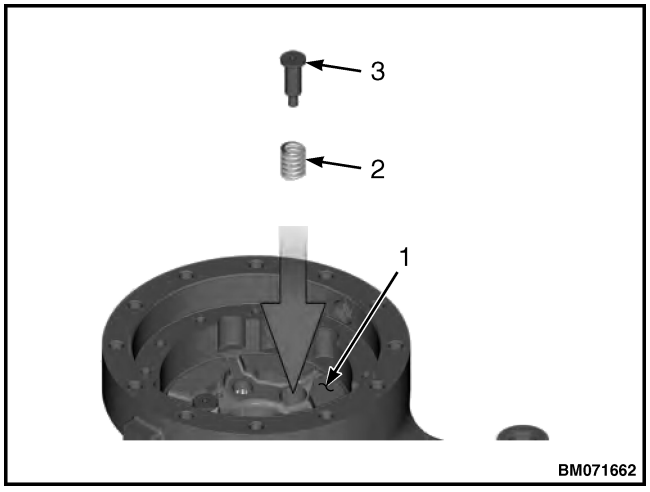
STEP 17.
Lubricate the piston and seals with hydraulic oil and install the piston into the arm.



1. PISTON
2. ARM

NOTE: Use only new screws pre-treated with Driloc® locking adhesive. Cleaned from oil from threads. Degrease only non pre-treated threads.

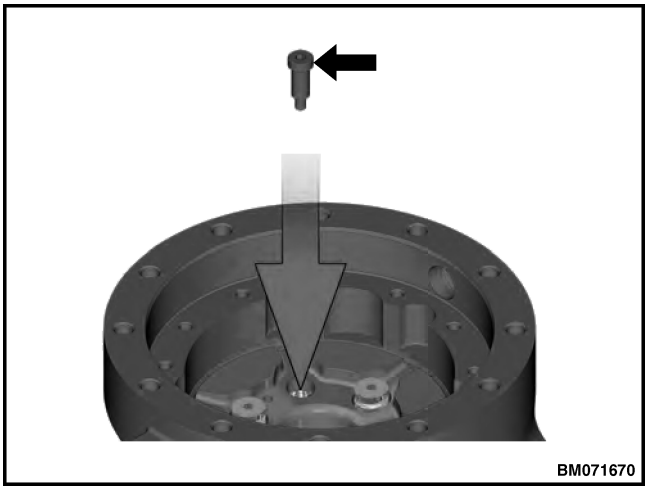
STEP 18.
Fit the return springs into the piston. Insert the screws and tighten. Torque to 8 to 10 N•m (5.9 to 7.4 lbf ft)



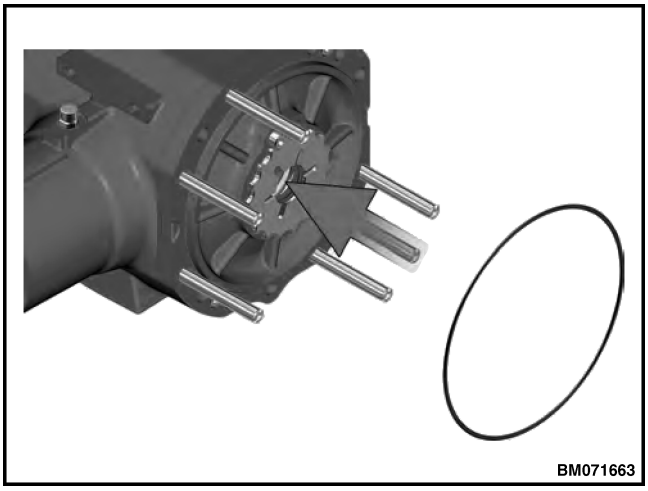
1. PISTON
2. RETURN SPRING
3. SCREW

NOTE: Use only new screws pre-treated with Driloc® locking adhesive. Cleaned from oil from threads. Degrease only non pre-treated threads.

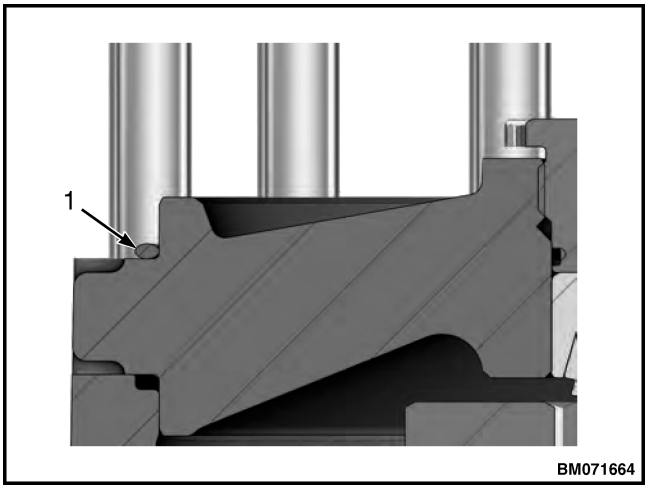
STEP 19.
Insert the adjusting screws and tighten. Torque to 12 to 15 N•m (8.6 to 11.1 lbf ft).



STEP 20.
Lubricate the O-ring with lithium-based grease and install the O-ring.

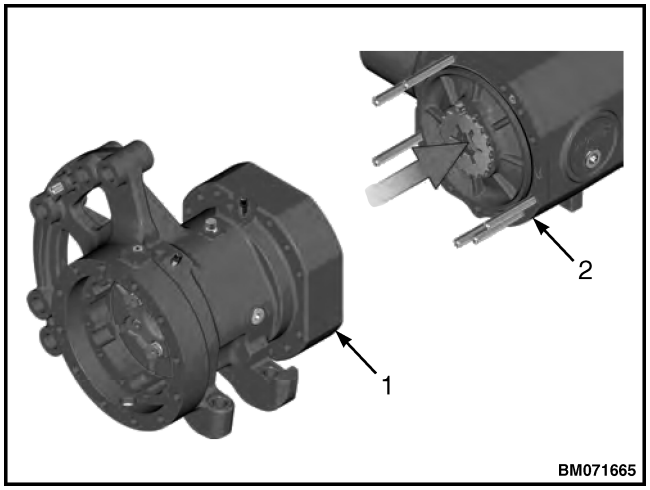


STEP 21.
Fully seat the O-ring.



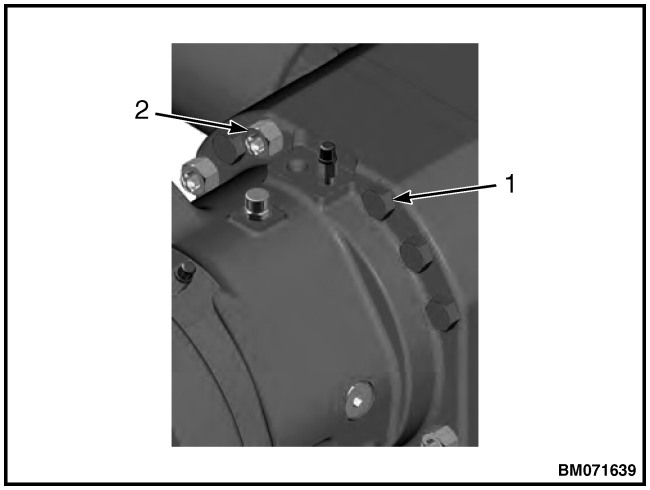
1. O-RING

STEP 22.
Attach the arm to the central housing.



1. ARM
2. CENTRAL HOUSING

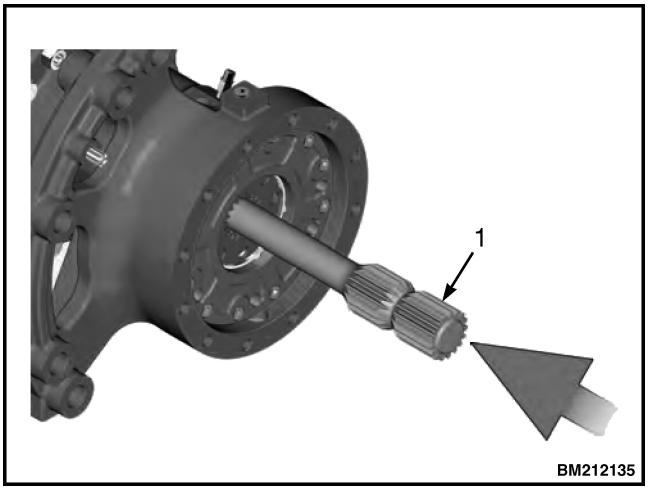
STEP 23.
Apply Loctite 243 to threaded portion of the capscrews that secure the arm to the central housing. Install the screws and tighten. Torque to 116 to 128 N•m (85.6 to 94.4 lbf ft).



1. CAPSCREW
2. NUT

STEP 24.
Apply Loctite 243 to threaded portion of the nuts. Install the nuts to secure the arm to the central housing. Torque to
82 to 91 N•m (60.5 to 67.1 lbf ft).

STEP 25.
Install the axle shaft.



1. AXLE SHAFT

DANGER

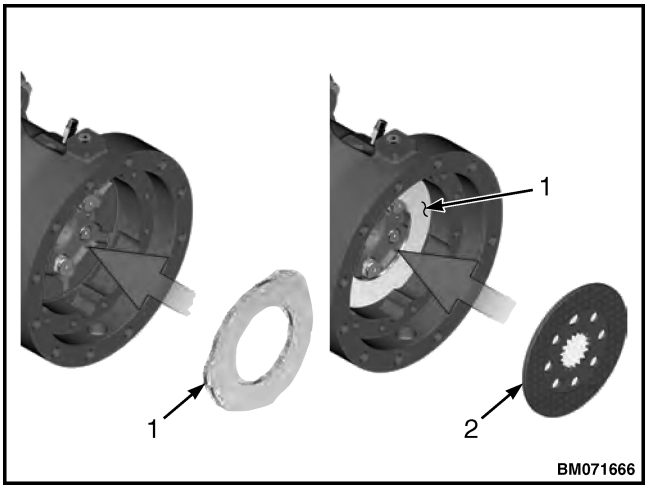
Check the discs for wear. Failure to replace the brake discs can cause serious damage, injuries or death.

WARNING

If thickness of friction material is less than 0.2 mm for each side, replace the complete disc pack.

CAUTION

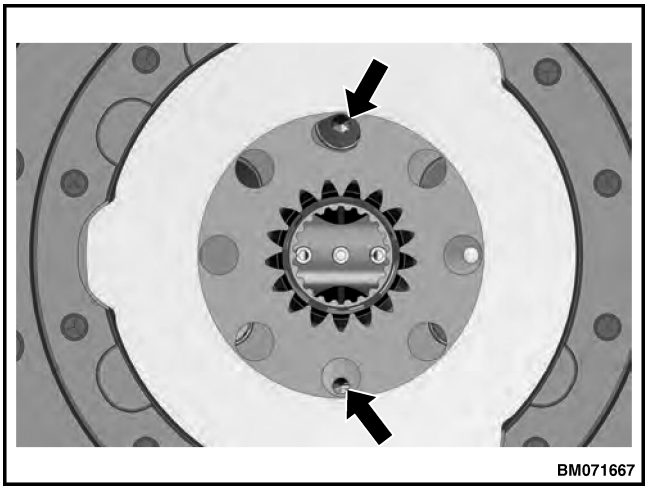
Disc quantity may change according to the your drive axle model. Detect and mark the quantities and position of discs. Avoid the exchange of positions.



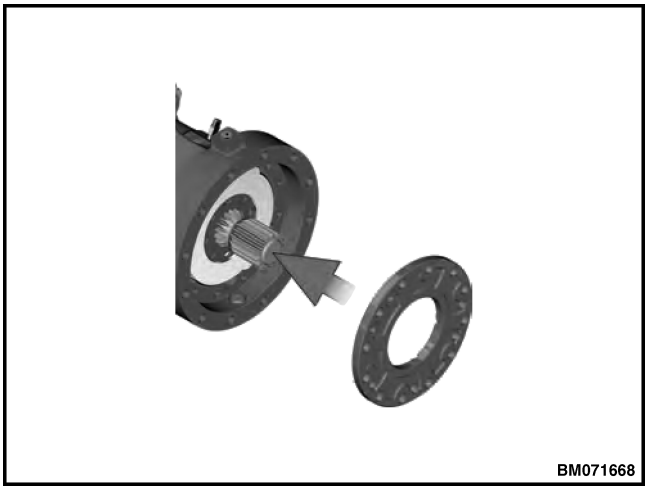
1. INNER BRAKE DISC
2. OUTER BRAKE DISC

STEP 26.
Insert the brake discs in the following sequence.

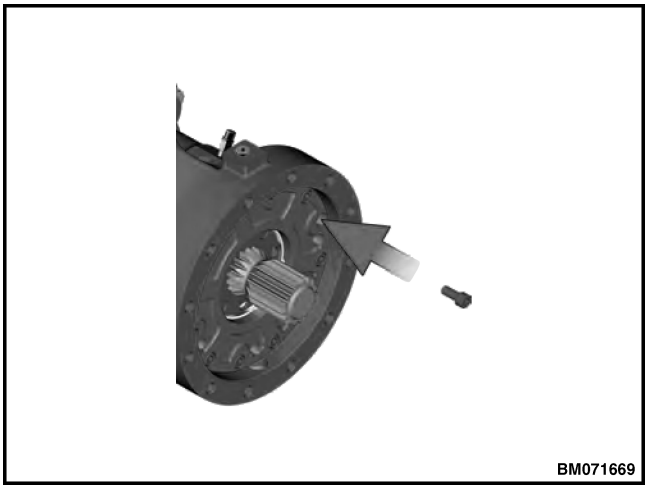
STEP 27.
Align the lubrication ports in the friction discs to ensure correct coolant flow.


BM071667

STEP 28.
Install the counterdisc.

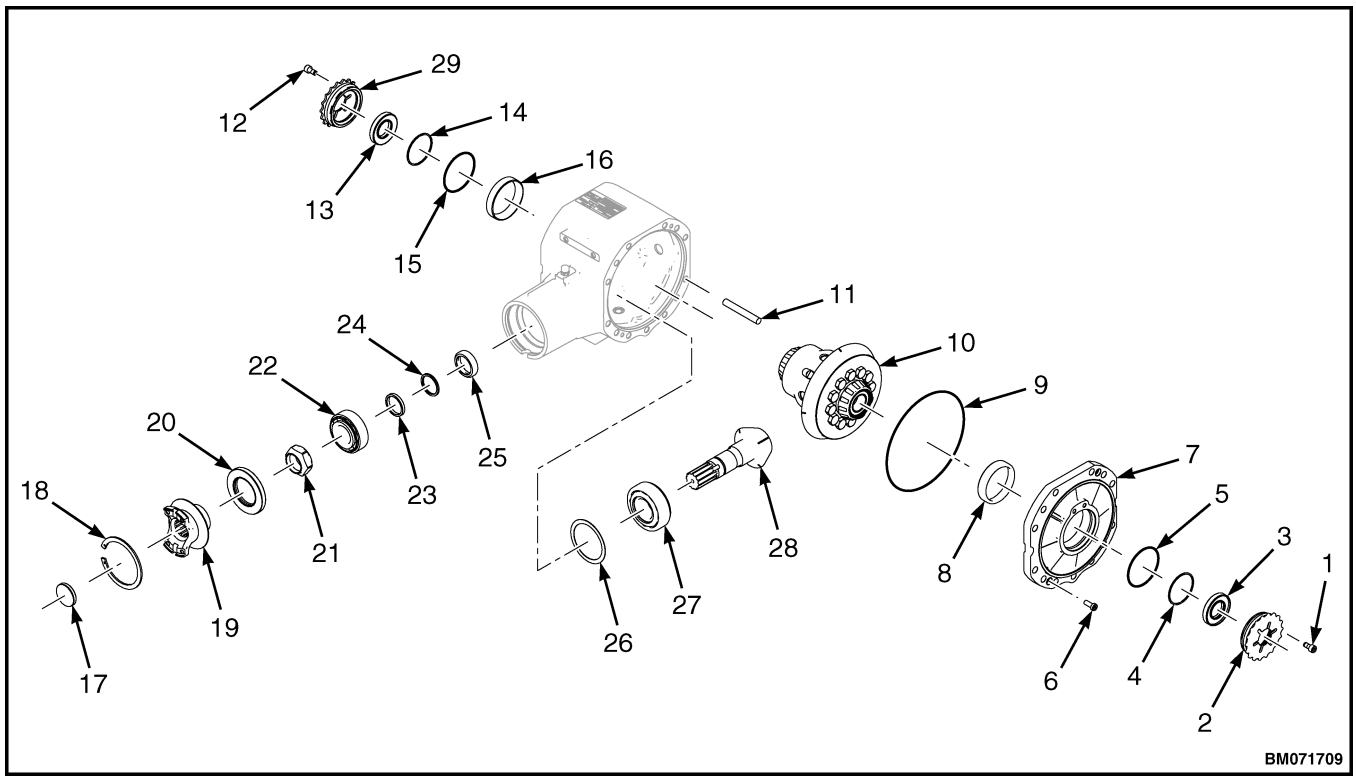

BM071668

STEP 29.
Apply Loctite 243 to threaded portion of the capscrew. Install the capscrews and tighten. Torque of 30 to 37 N•m (22.1 to 27.3 lbf ft).


BM071669

STEP 30.
Install the planetary reduction gear assembly as described in Wheel ends.

CENTER SECTION
202001-226



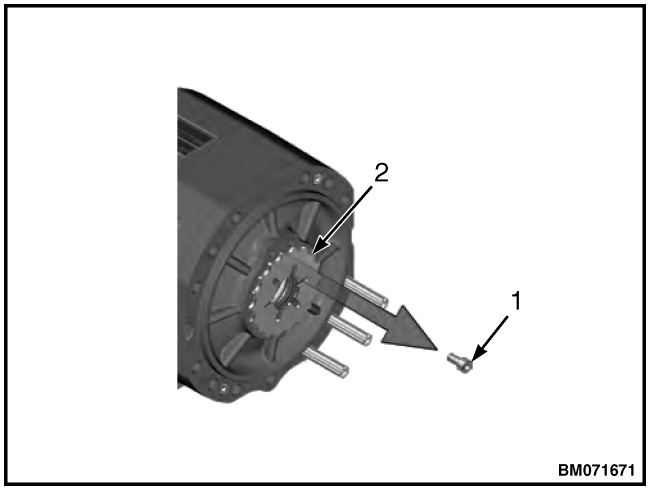
1. CAPSCREW
2. ADJUSTMENT NUT
3. SEAL
4. SNAP RING
5. O-RING
6. CAPSCREW
7. MIDDLE COVER
8. BEARING CUP
9. O-RING
10. DIFFERENTIAL
11. STUD
12. CAPSCREW
13. SEAL
14. SNAP RING
15. O-RING
16. BEARING CUP
17. CAP
18. SNAP RING
19. FLANGE
20. PINION SEAL
21. RING NUT
22. BEARING
23. CALIBRATED SPACER
24. CALIBRATED SPACER
25. SPACER
26. PINION SHIMS
27. BEARING CUP
28. PINION
29. ADJUSTMENT NUT

Figure 184. Center section components

DISASSEMBLE

STEP 1.
Remove the wheel hubs and service brakes from the drive axle assembly. See Wheel ends and Service brake.

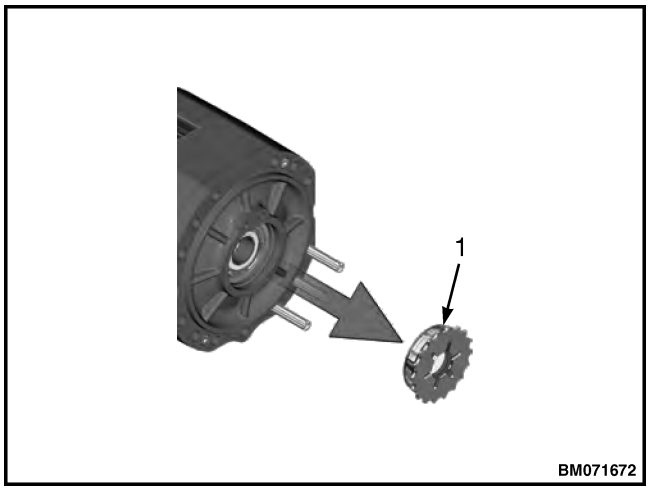
STEP 2.
Mark the position of the differential adjustment nut.



1. CAPSCREW
2. DIFFERENTIAL ADJUSTMENT NUT

STEP 3.
Remove the capscrew from the differential adjustment nut.

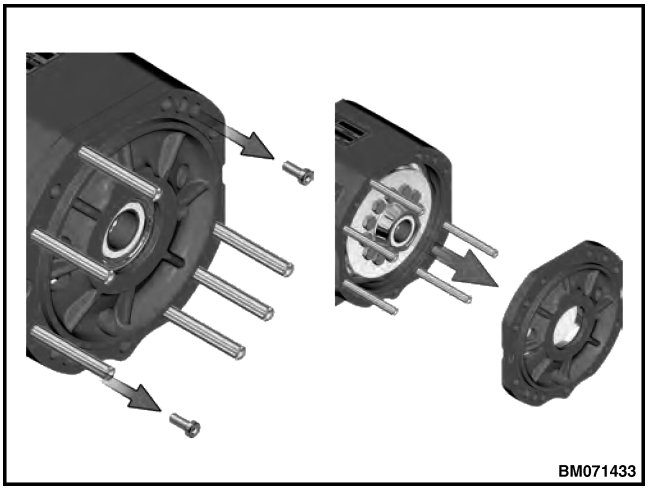
STEP 4.
Apply tool T9 (see, Wet Brake Axle Special tools) and remove the differential adjustment nut.



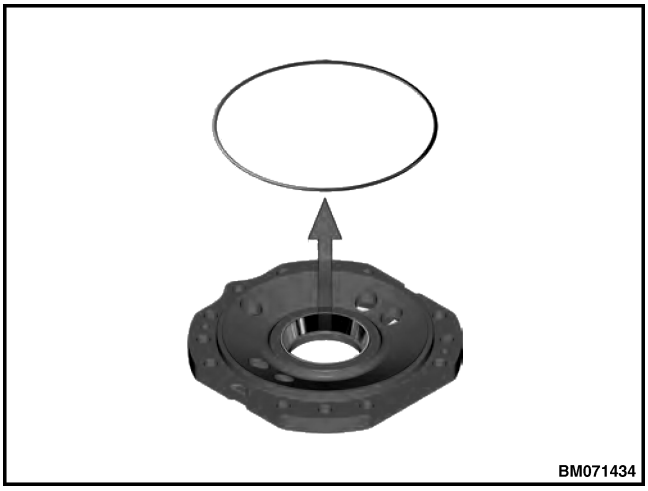
1. DIFFERENTIAL ADJUSTMENT NUT

STEP 5.
Clean the threaded portions of each differential adjustment nut.

STEP 6.
Remove the capscrews from the middle cover of the center section housing. Insert a screw driver in the opposing slots of the middle cover, then use force to remove the middle cover from the center section housing. Repeat for the middle cover on the other side of the center section housing.

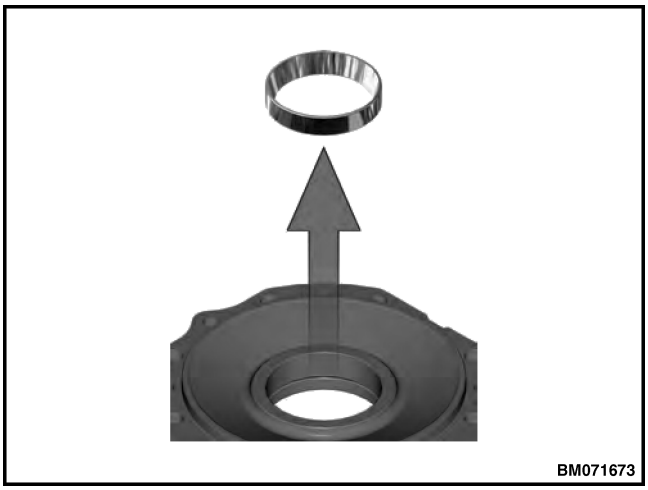

BM071433

STEP 7.
Use a screwdriver to remove the O-ring from middle cover.


BM071434

CAUTION
Be careful not to damage the bearing surfaces.

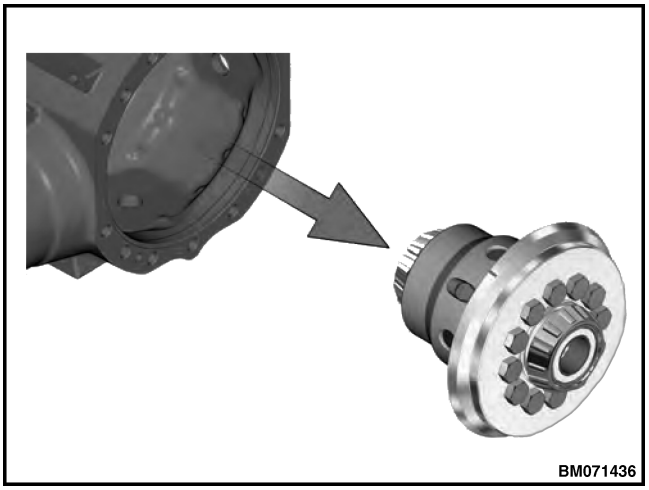
STEP 8.
If replacing bearings, extract the bearing cup from the middle cover.


BM071673

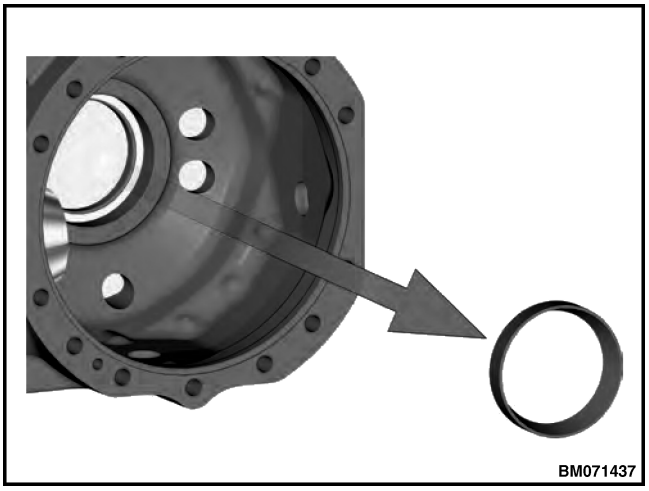
CAUTION

Take care to not damage the surfaces when removing the center section housing.

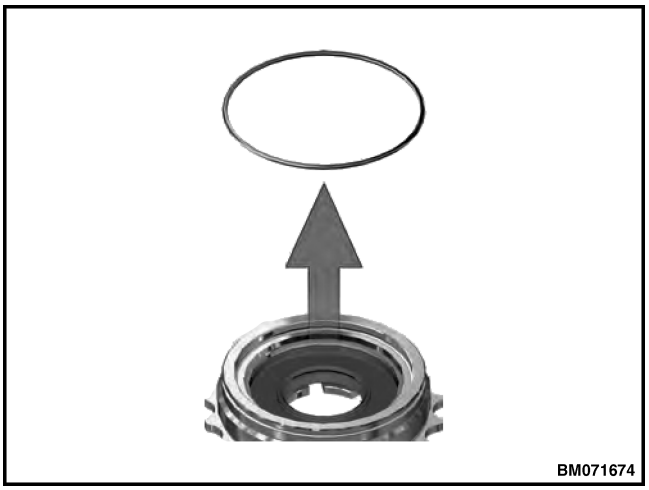
STEP 9.
Extract the differentials from the either side of the center section housing.


BM071436

STEP 10.
If replacing bearings, extract the bearing cups from the center section housing.


BM071437

STEP 11.
Use a screwdriver to remove the o-ring.


BM071674

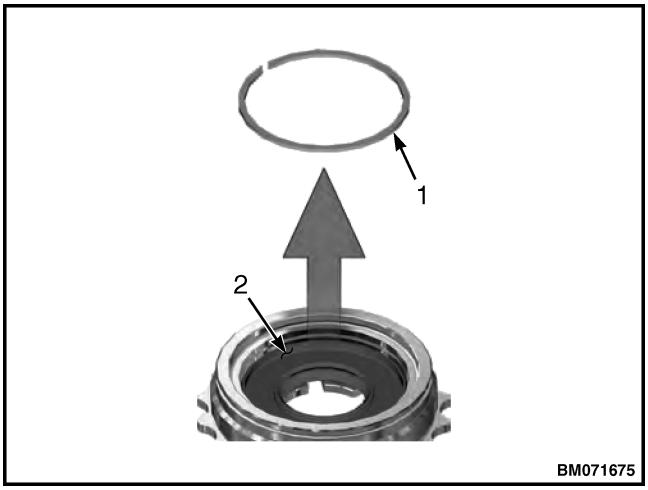
WARNING

Removal of the snap rings can cause personal injuries. Wear appropriate safety equipment. To avoid injury to eyes, wear eye protection equipment.

CAUTION

Be careful not to damage the bearing surfaces.

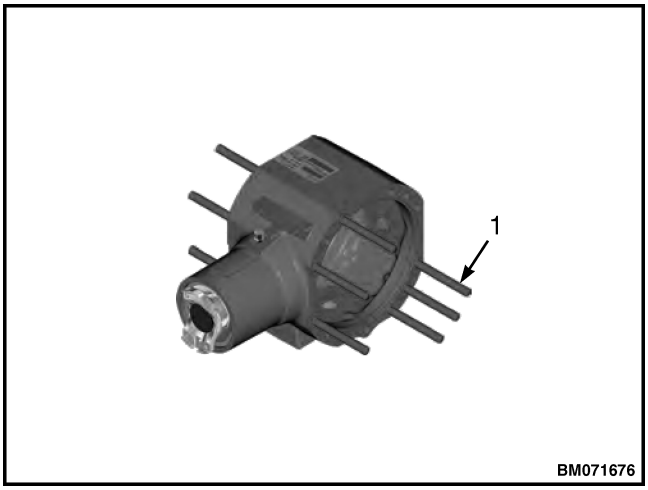
STEP 12.
Using suitable pliers, remove the snap ring.



1. SNAP RING
2. DIFFERENTIAL SEAL

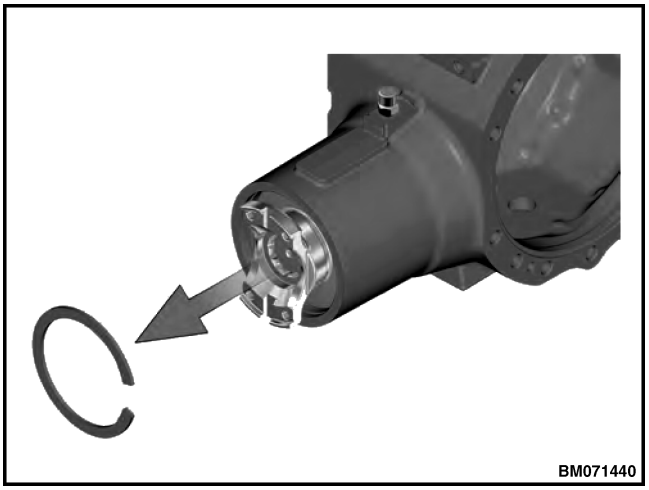
STEP 13.
Use an extractor to remove the differential seal.

STEP 14.
If necessary, remove the studs.



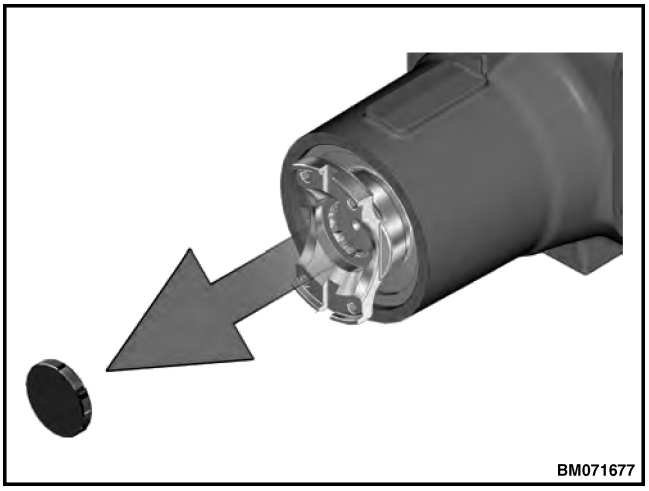
1. STUD

STEP 15.
Use suitable pliers to remove the snap ring.

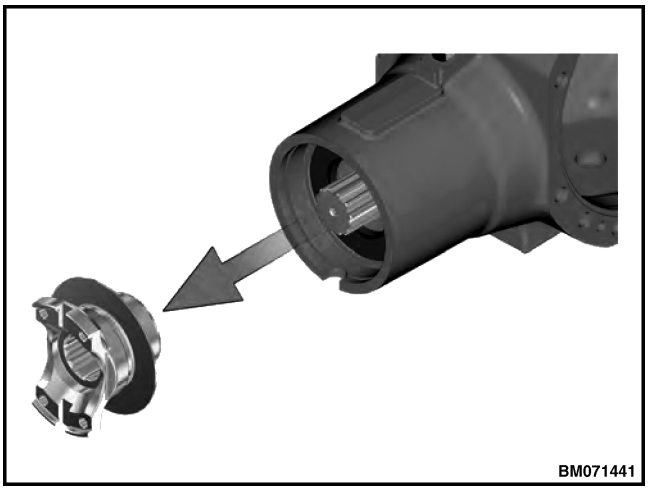


NOTE: The cap can not be reused. If removing the cap, replace with new. See Parts Manual for correct part information.

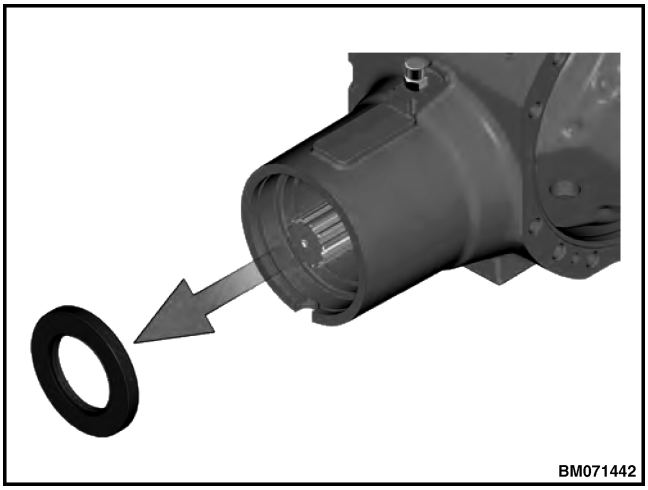
STEP 16.
If necessary, remove the cap.



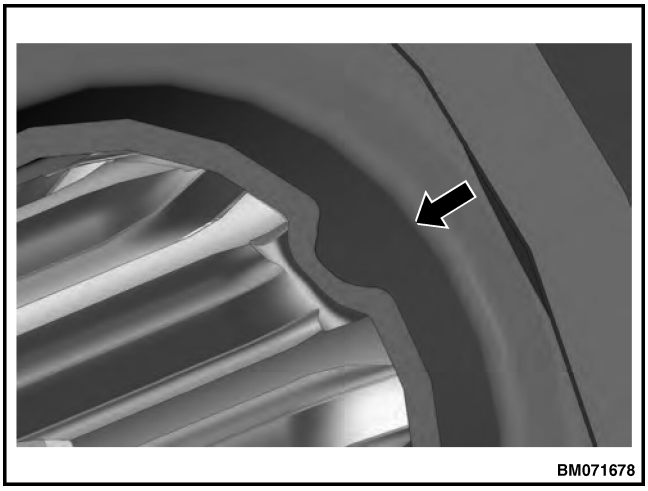
STEP 17.
Remove the axle input yoke and flange.



STEP 18.
Use an extractor to remove the seal ring from the pinion.

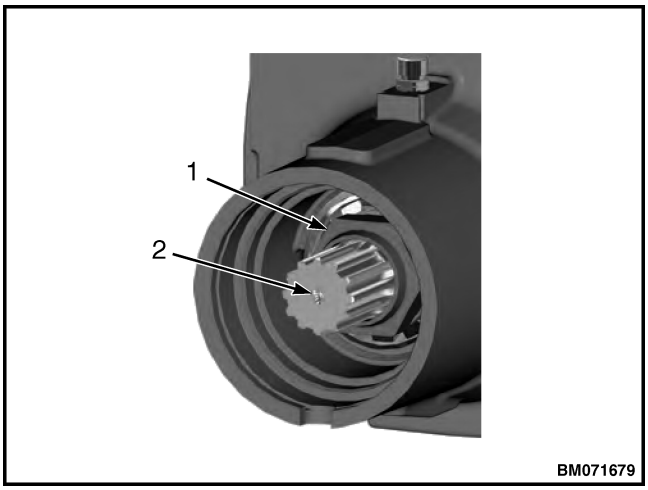


STEP 19.
Remove the staking in order to avoid the screw cutting the pinion during the ring nut removal.



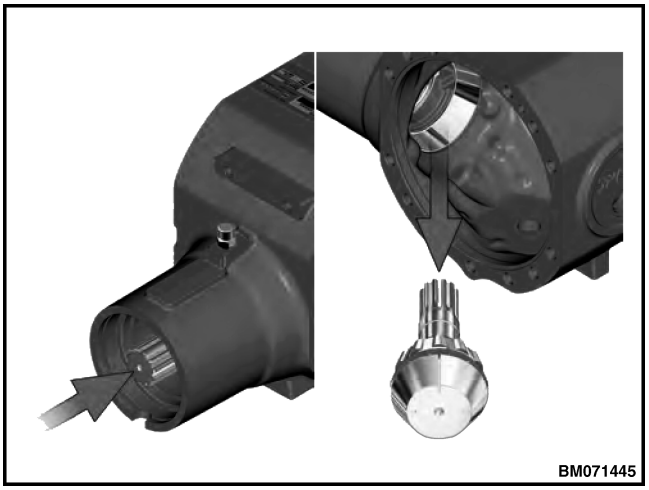
NOTE: If disassembly is difficult, heat the ring nut to approximately 80°C (176°F).

STEP 20.
Apply special tool T10 to the pinion and ring nut. Rotate the ring nut to release it from the pinion.



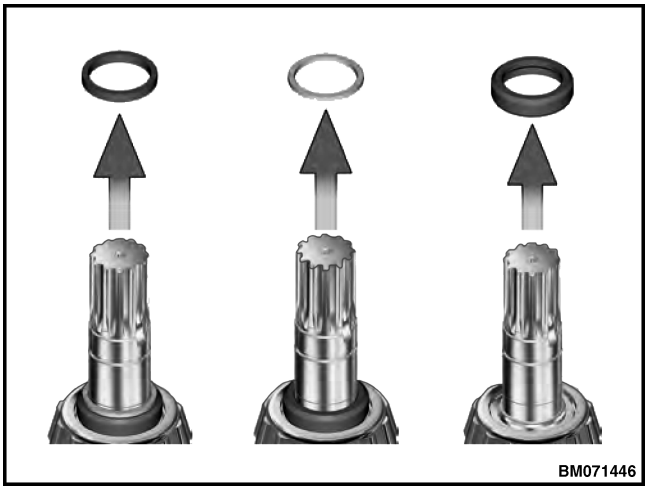
1. NUT
2. PINON

STEP 21.
Use a plastic hammer to remove the pinion from the center section housing.

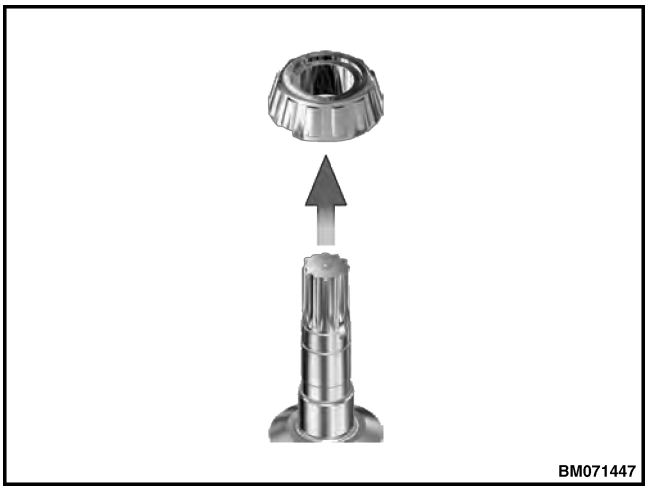


NOTE: Check the thickness of the shims. Example: = 3 + 5.8 = 8.8 mm (0.12 + 0.23 = 0.35 in.).

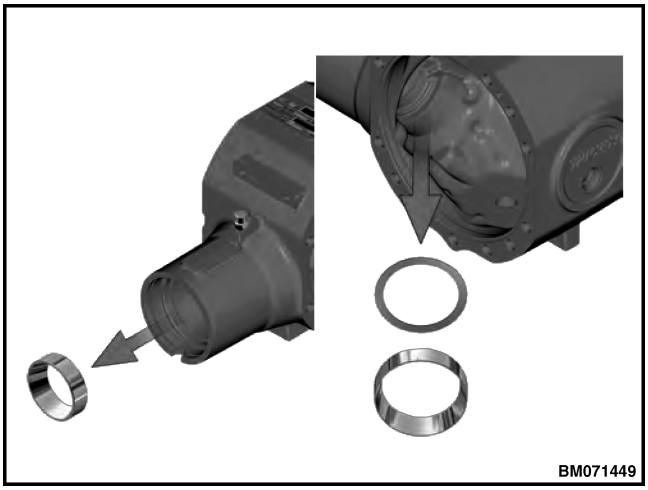
STEP 22.
Remove shims and spacer from the pinion.



STEP 23.
Use a puller and a press to remove the inner bearing from the pinion from center section housing.



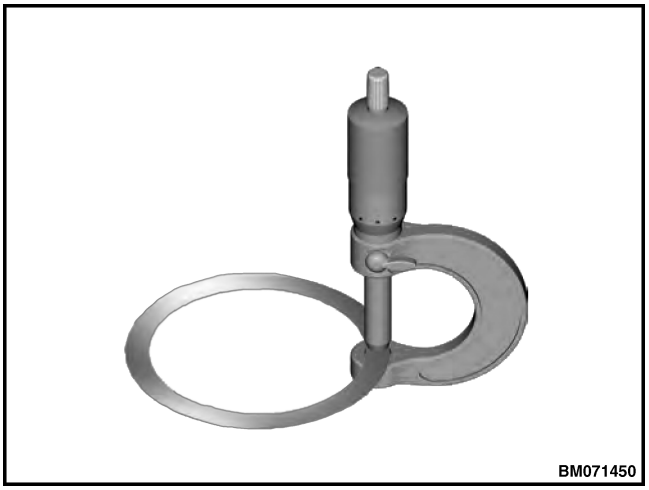
STEP 24.
Use an internal extractor to remove shim washers and bearing cup from the center section housing.



ASSEMBLE

STEP 1.
Check the thickness of the shims. Example: = 1.1 mm (0.043 in.).

STEP 1.
Use calipers to measure the thickness of the shims that were removed with the pinion. This will become dimension "A".


BM071450

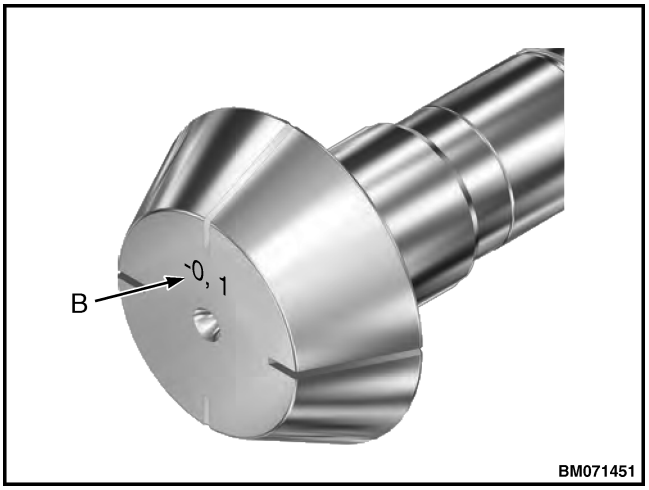
STEP 2.
Check deviation dimension "B" as marked on the old pinion. See item "B" below.

Subtract B from A to find nominal shim stack (dimension C), if zero pinion deviation. Execute the calculation following the indicated formula to obtain the necessary value to the successive calculation.

C = A - B

EXAMPLE: C = 1.1 - 0.1 = 1 mm (0.04 in.)

C =1 mm (0.04 in.)



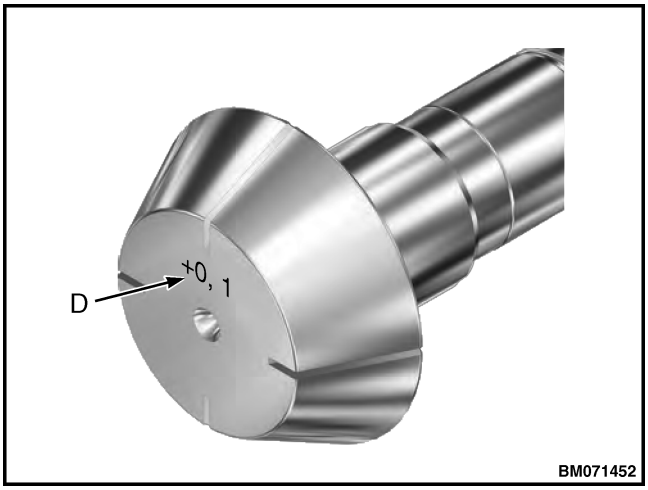
BM071451

STEP 3.
Adjust new shim stack to correspond with new pinion. Check nominal dimension "D" as marked on the new pinion. See item "D" below.

New shim stack = C - (D)

EXAMPLE: S = 1 (+0,1) = 0.9 mm (0.04 in.)

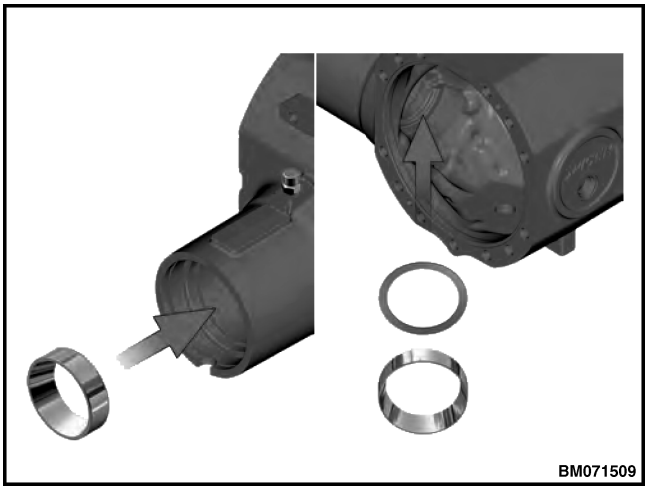
S =0.9 mm (0.04 in.)



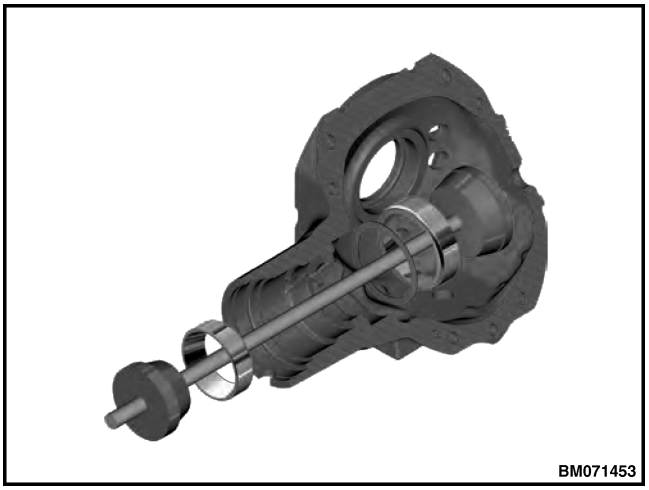
NOTE: Careful attention MUST be paid to the signs of deviation on the pinions, and signs in the equations. As shown, old pinion is -0.1, and new is +0.1. As such, shim stack changes 0.2 mm. If somebody just sees 0.1 for both and so uses the same shim stack, the new pinion will have 0.2 mm too much shim stack and so over-engage the new pinion, which will accelerate gear wear and could lead to premature gear tooth flank failure.

NOTE: The thinner shims must be placed in between the thicker ones.

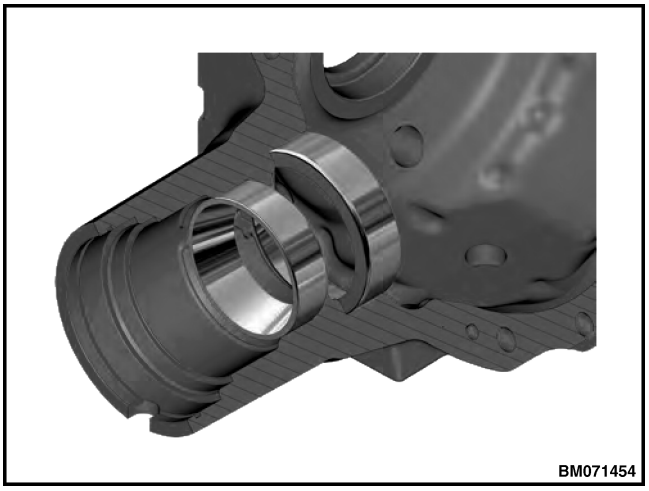
STEP 2.
Partially insert the thrust bearing cups with the shims into the center section housing.



STEP 3.
Install tension rod and guide tool, Special Tool T2 (see, Wet Brake Axle Special tools), on the external thrust block bearing and inner thrust block bearing.


BM071453

STEP 4.
Connect the tension rod to the press and move the bearing cups into their seat. Disconnect the press and remove the tension rod.


BM071454

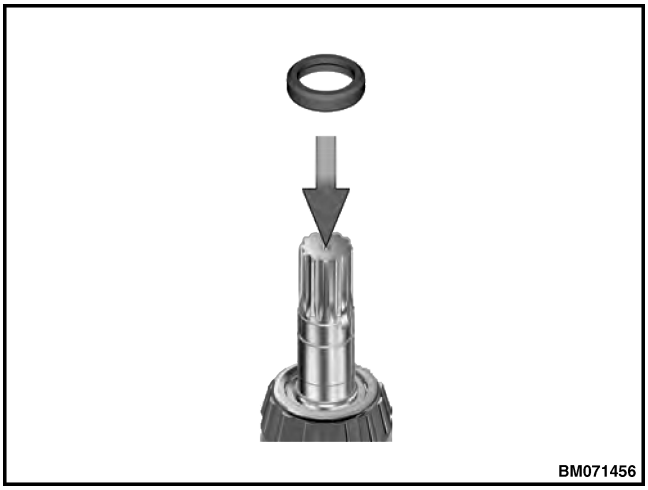
WARNING

Be careful when handling heated parts. Always wear the proper protective clothing, gloved, and eye protection.

STEP 5.
Heat the inner bearing to approximately 100°C (212°F) and fit it on the pinion.

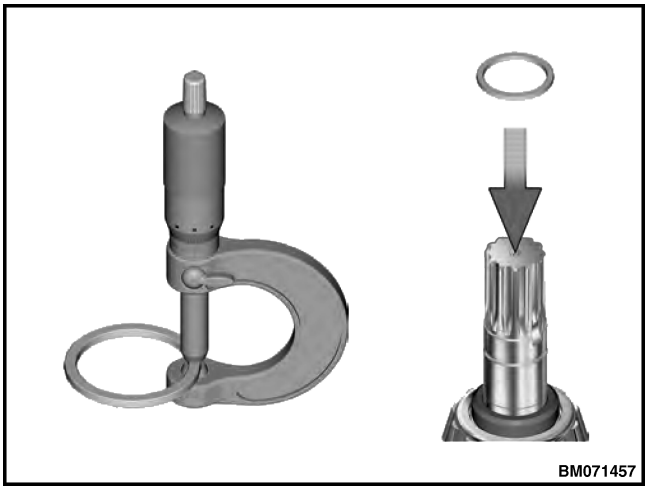

BM071455

STEP 6.
Install the spacer onto the pinion.



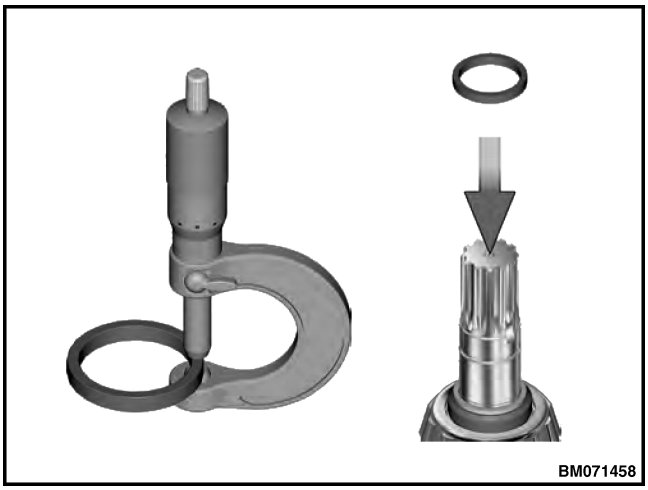
NOTE: Calibrated shim thickness. Example: 3 mm (0.12 in.).

STEP 7.
Install calibrated shim on pinion.

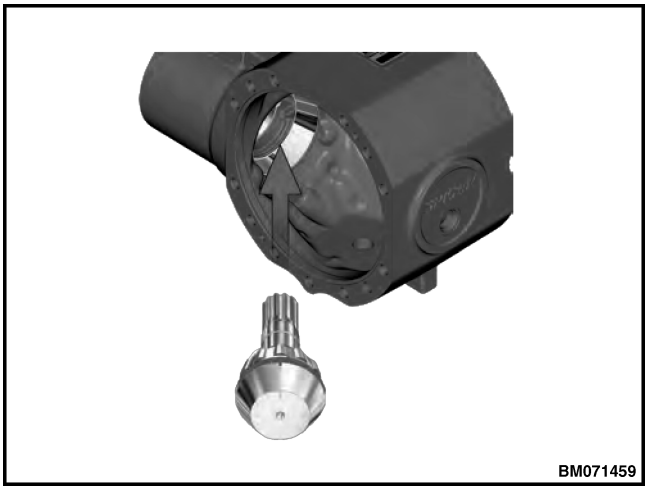


NOTE: Calibrated shim thickness. Example: 5.8 mm (0.23 in.).

STEP 8.
Install calibrated shim on pinion.

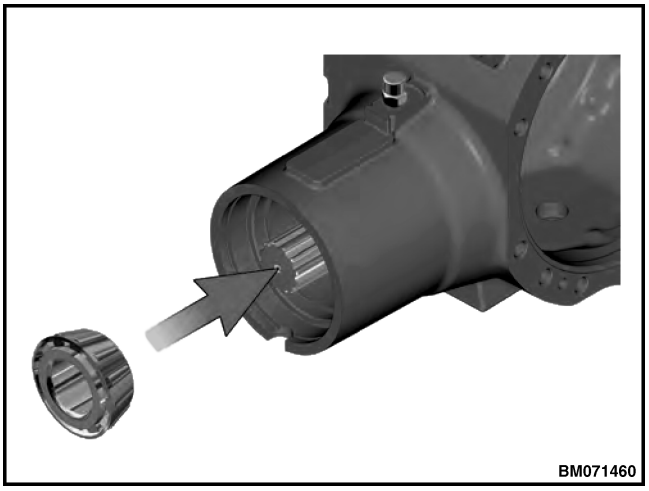


STEP 9.
Fit the pinion into the center housing.

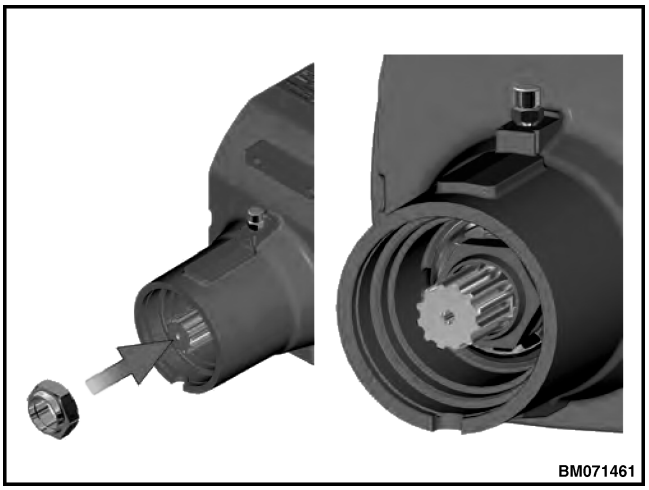

BM071459

WARNING
Be careful when handling heated parts. Always wear the proper protective clothing, gloved, and eye protection.

STEP 10.
Heat the outer bearing to approximately 100°C (212°F) and fit it on the pinion.

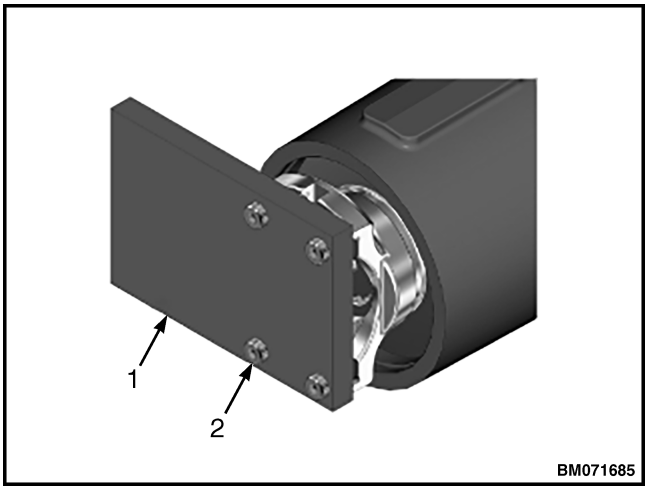

BM071460

STEP 11.
Coat the pinion nut with Loctite® 270. Use special tool T10 (see Wet Brake Axle Special tools) to hold the pinion nut in place then rotate the pinion relative to the nut to ensure the bearings are in motion during tightening. Tighten the nut using a torque wrench to 400 to 500 N•m (295 to 369 lbf ft).


BM071461

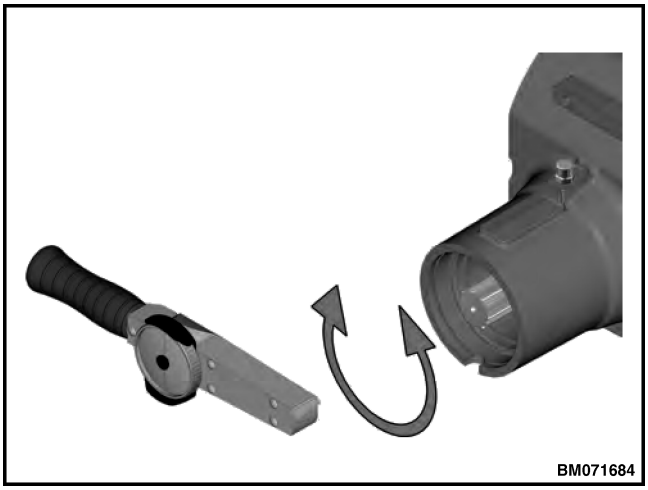
STEP 12.
Install the flange onto the pinion.

STEP 13.
Install special tool T12 (see Wet Brake Axle Special tools) on the flange. Secure the special tool with four screws.



1. T12
2. SCREW

STEP 14.
Use a torque meter to check the torque of the pinion.



CAUTION

If torque exceed the maximum value, the size of calibrated shim needs to be increased.

If torque does not reach the minimum value, the size of calibrated shim needs to be decreased.

CAUTION

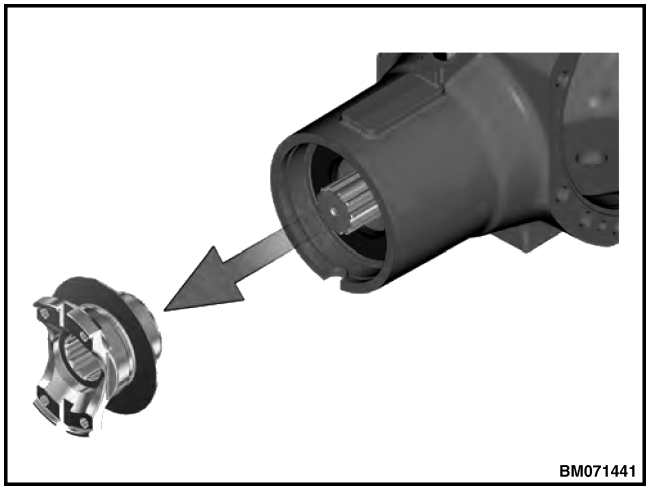
If bearings are not new, check static torque; if bearings are new, check continuous torque.

STEP 15.
Using a torque meter, check the torque of the pinion. See Table 7.

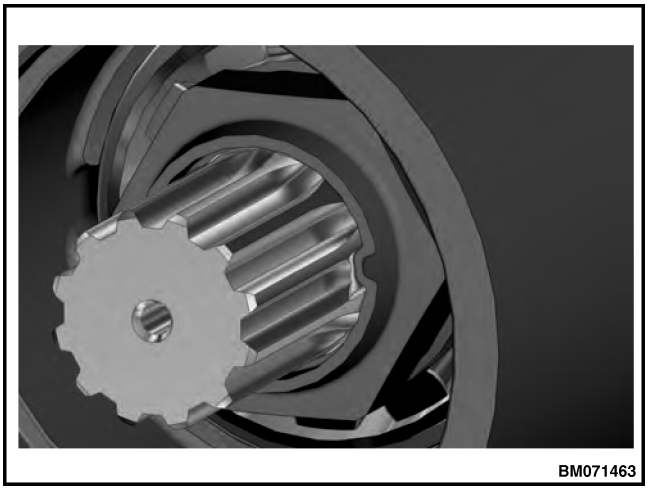
Table 7. Rolling Torques

Model	Rolling Torque
141/10139958 or 141/10142016	1.4 to 3.0 N•m (1.03 to 2.21 lbf ft)

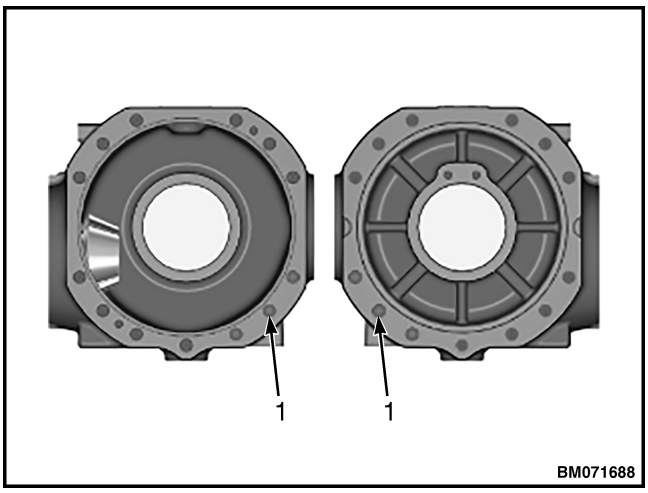
STEP 16.
Remove the axle input yoke and flange.



STEP 17.
Stake the nut in both provided positions set at 180° to each other.



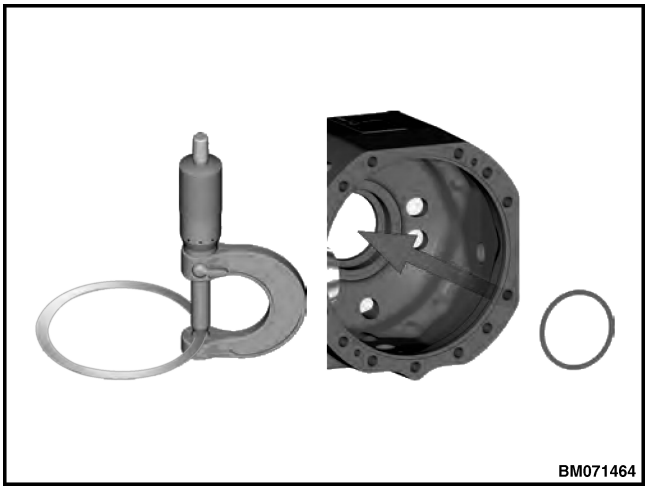
STEP 18.
If the studs were removed or got loose during the removal of the nut, replace the studs. Clean the threads of the studs and apply Loctite 272 to threaded portion of the studs. Install the studs and tighten. Torque to 82 to 91 N•m (60.5 to 67.1 lbf ft).



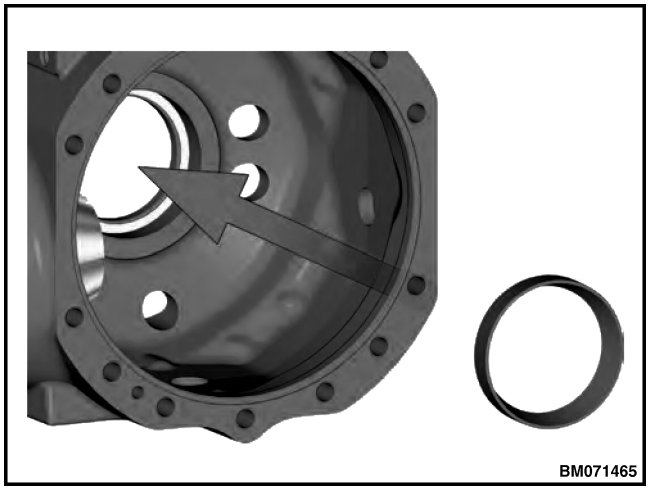
1. STUD

NOTE: Shim thickness. Example: 1.2 mm (0.05 in.).

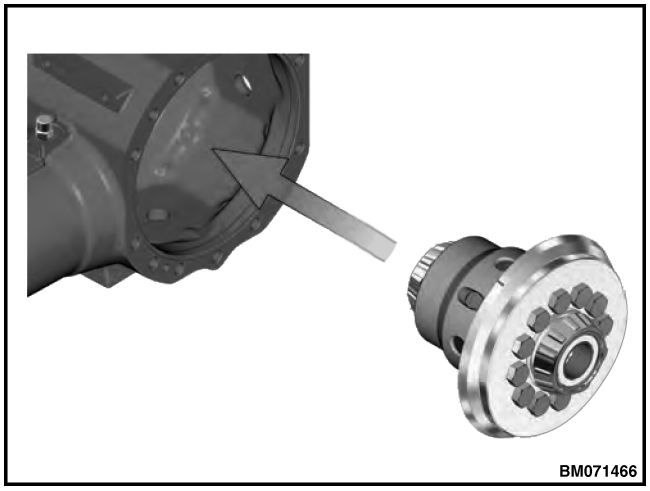
STEP 19.
Install the shims into the central housing body.



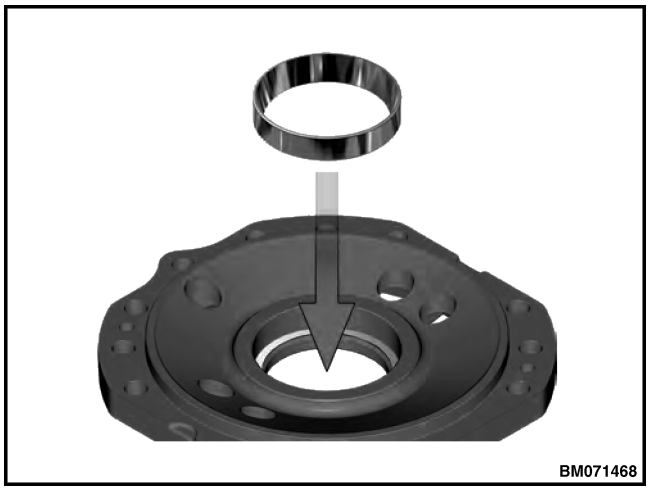
STEP 20.
If the bearings were replaced, insert the external thrust block bearing in the central section housing.


BM071465

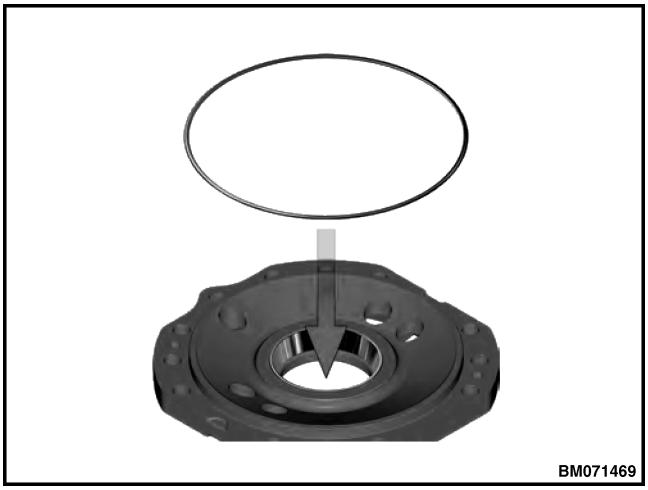
STEP 21.
Install the complete differential into the center section housing.

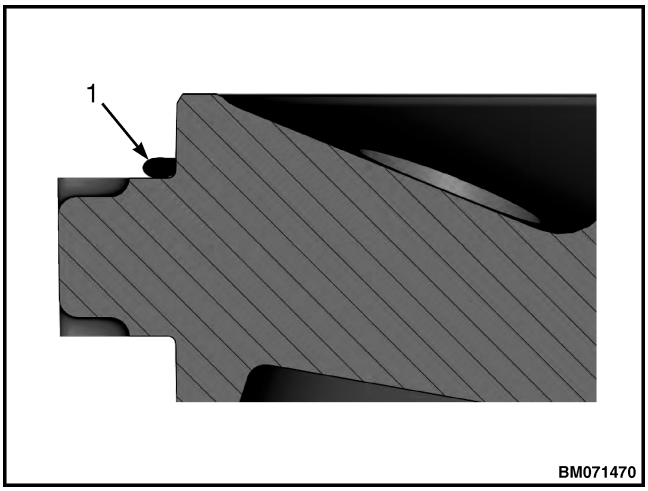

BM071466

STEP 22.
If the bearings were replaced, insert the outer thrust block bearing cup into the middle cover.


BM071468

STEP 23.
Lubricate with grease and replace the outer O-ring onto the middle cover.

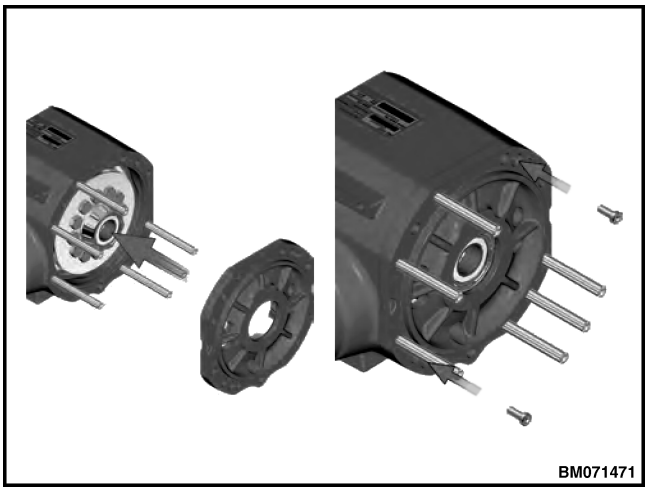




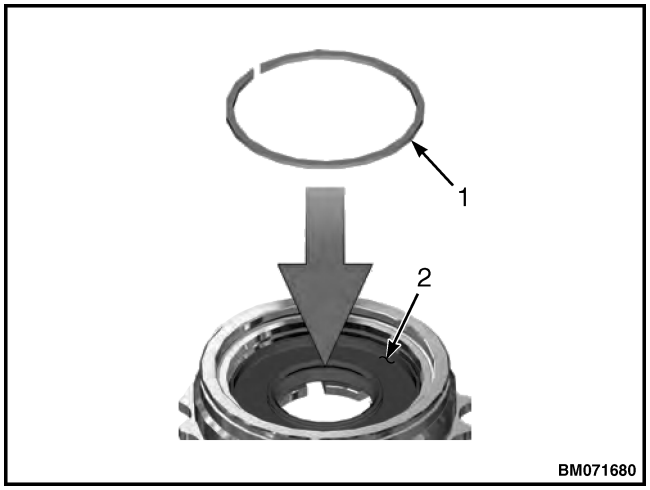
1. O-RING

NOTE: Use only new screws pre-treated with Driloc® locking adhesive. Threads must be clean from oil. Degrease only non pre-treated threads.

STEP 24.
Install the middle cover onto the center section housing. Install the capscrews on middle cover and center section housing. Tighten capscrews to 16.3 to 26.2 N•m (144.3 to 231.9 lbf in).



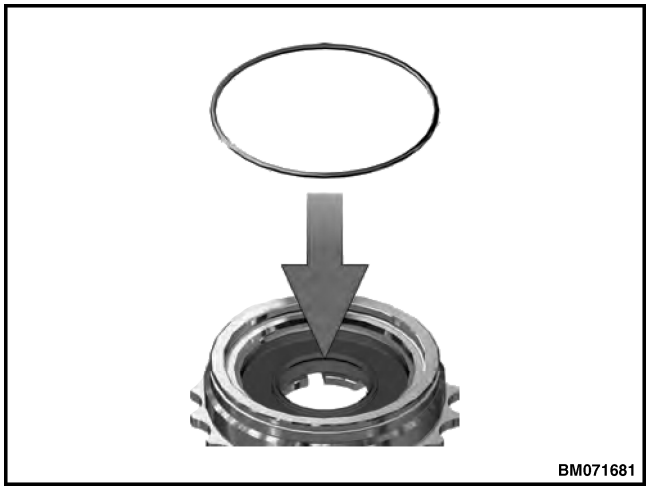
STEP 25.
Press the differential seal into its seat.



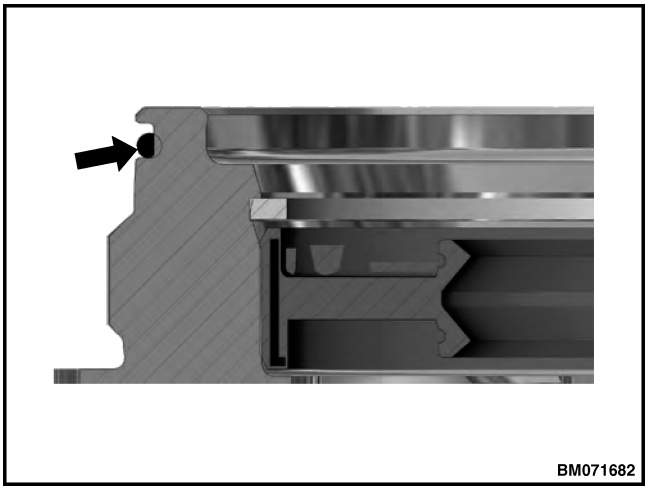
1. SNAP RING
2. DIFFERENTIAL SEAL

STEP 26.
Install the snap ring.

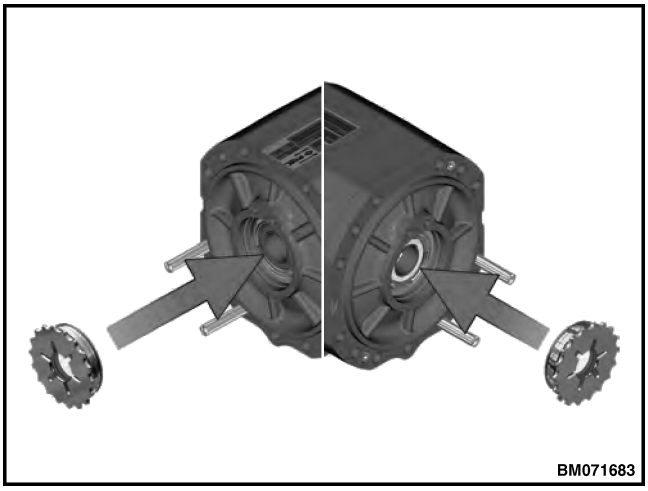
STEP 27.
Lubricate new O-ring and with lithium-based grease and install the O-ring.



STEP 28.
Fully seat the O-ring.

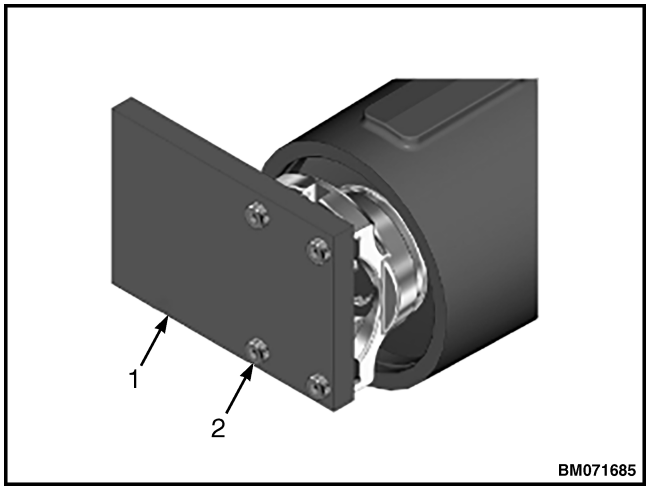


STEP 29.
Install the differentail adjustment nut on either side of the housing. Use special tool T9 to tighten differential adjustment nuts on the crown side until clearance between pinion and crown is zero, then lock the crown and go back 1/4 - 1/2 turn.



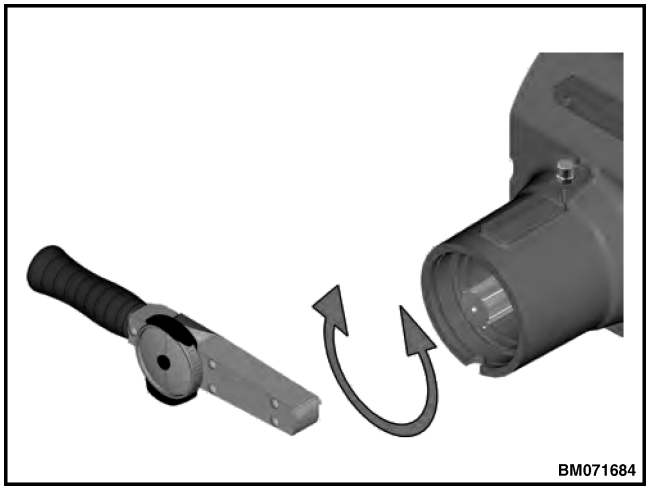
STEP 30.
Install the flange onto the pinion.

STEP 31.
Install special tool T12 (see Wet Brake Axle Special tools) on the flange. Secure the special tool with four screws.



1. T12
2. SCREW

STEP 32.
Use a torque meter to check the torque of the pinion.



CAUTION

If bearings are not new, check static torque; if bearings are new, check continuous torque.

STEP 33.
Attach a torque meter to check the rolling torque increases by
0.46 to 0.71 N•m (4.07 to 6.28 lbf in) relative to the rolling torque for pinion bearings measured previously, as a result of the preload of the differential bearings.

Example:

Pinion torque: 1.8 N•m (15.9 lbf in)

Pinion + differential torque: 2.26 to 2.51 N•m (20.0 to 22.2 lbf in).

CAUTION

In order to increase the gap while keeping the load on the bearing unchanged, remove shims from the crown wheel side and insert them on the opposite side. In order to decrease the gap, move them the other way round.

NOTE: Measure the backlash at a distance of 85 mm (3.35 in.) from the pinion axis.

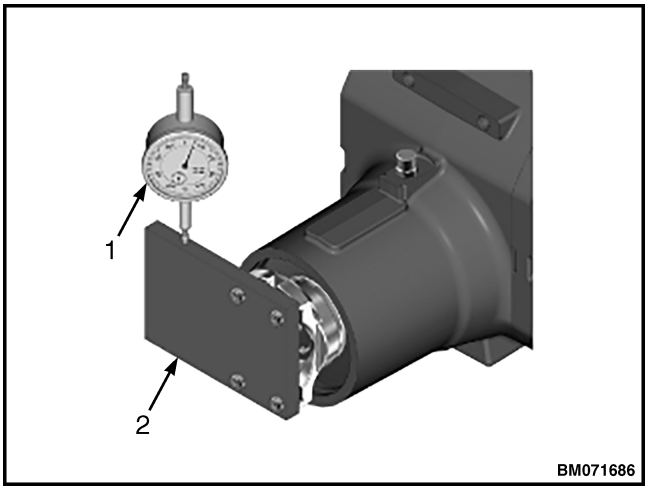
STEP 34.

Install a dial gauge and check the tolerance between the bevel gear teeth.

Backlash: See Table 8.

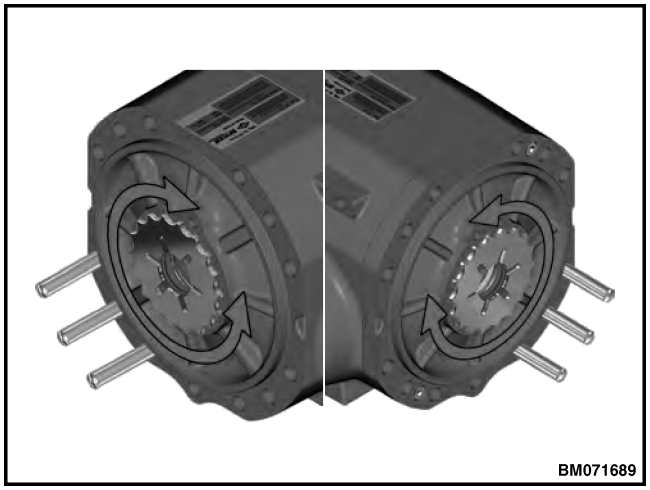
Table 8. Backlash

Model	Ratio	Backlash
141/10144741	10.42:1	0.57 to 0.75 mm (0.022 to 0.03 in.)
141/10144750	12.05:1	0.56 to 0.77 mm (0.022 to 0.03 in.)
141/10139958	14.82:1	0.55 to 0.77 mm (0.022 to 0.03 in.)
141/10142016	13.68:1	0.51 to 0.71 mm (0.02 to 0.03 in.)

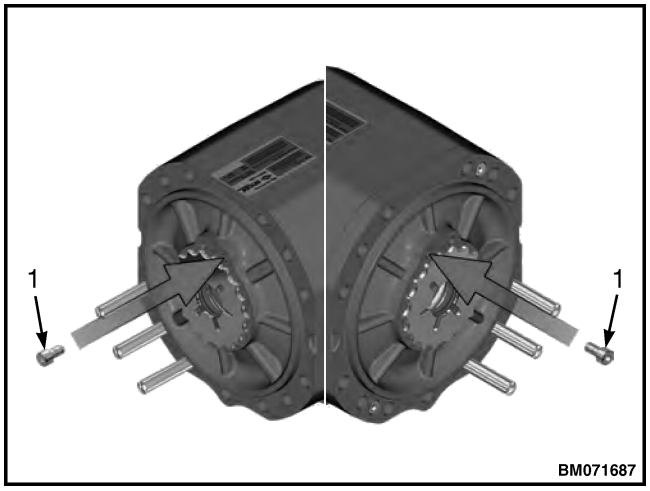


1. DIAL GAUGE
2. T12

STEP 35.
Using special tool T9 adjust the backlash between the pinion and the crown by loosening one of the differential adjustment nuts and tightening the opposite to compensate.

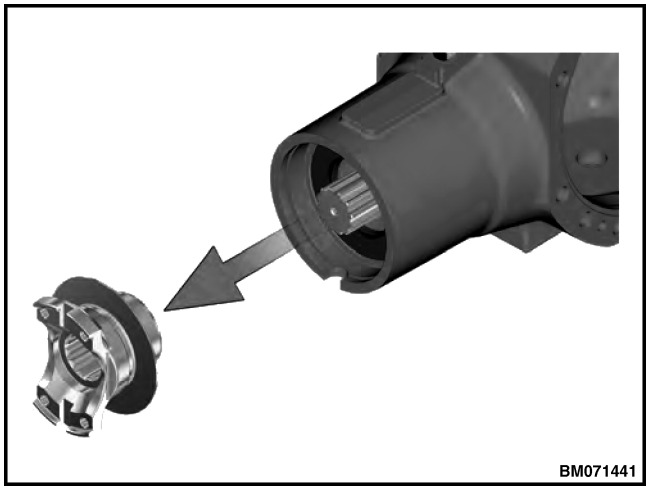


STEP 36.
Install the capscrews and tighten. Torque to 16.3 to 26.2 N • m (12 to 19.3 lbf ft)

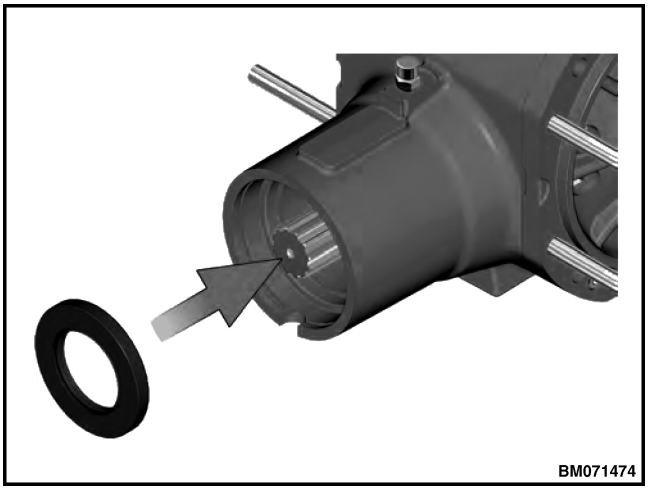


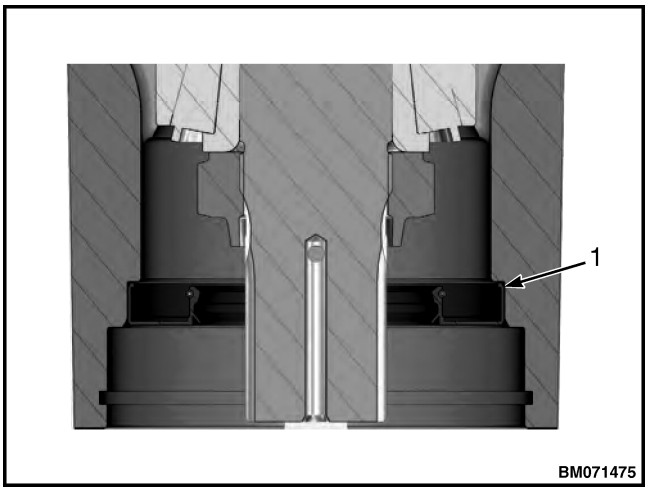
1. CAPSCREW

STEP 37.
Remove the axle input yoke and flange.



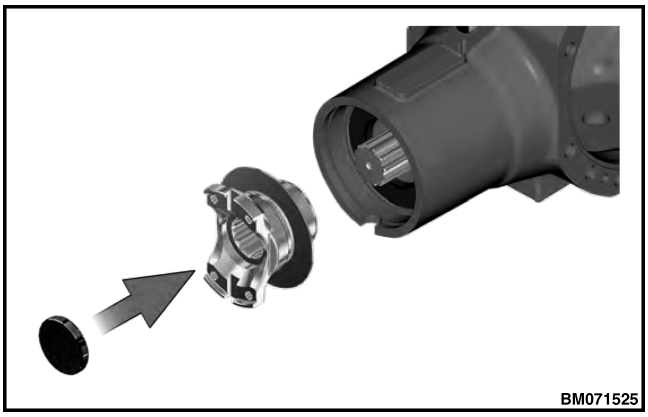
STEP 38.
Press the pinion seal into its seat.





1. PINION SEAL

STEP 39.
Install the flange and yoke onto the pinion.

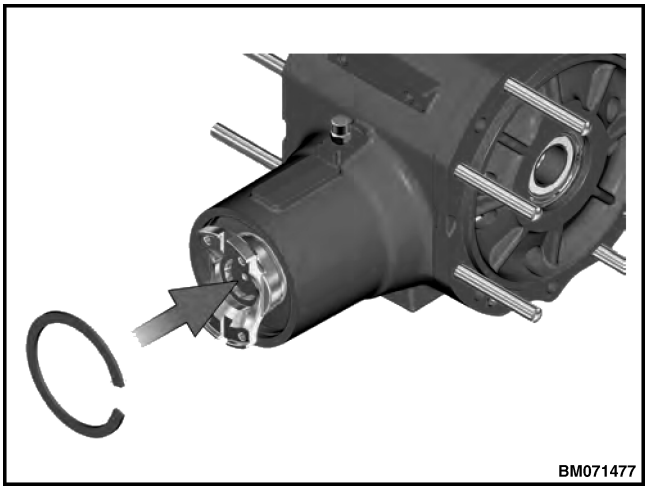


WARNING

Be careful when removing or installing snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

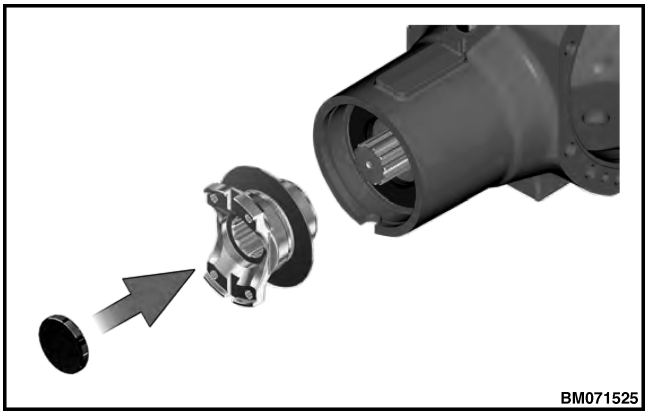
NOTE: See Tools section for procedures to set up suitable pliers.

STEP 40.
Install the snap ring.



NOTE: The cap must be replaced if removed.

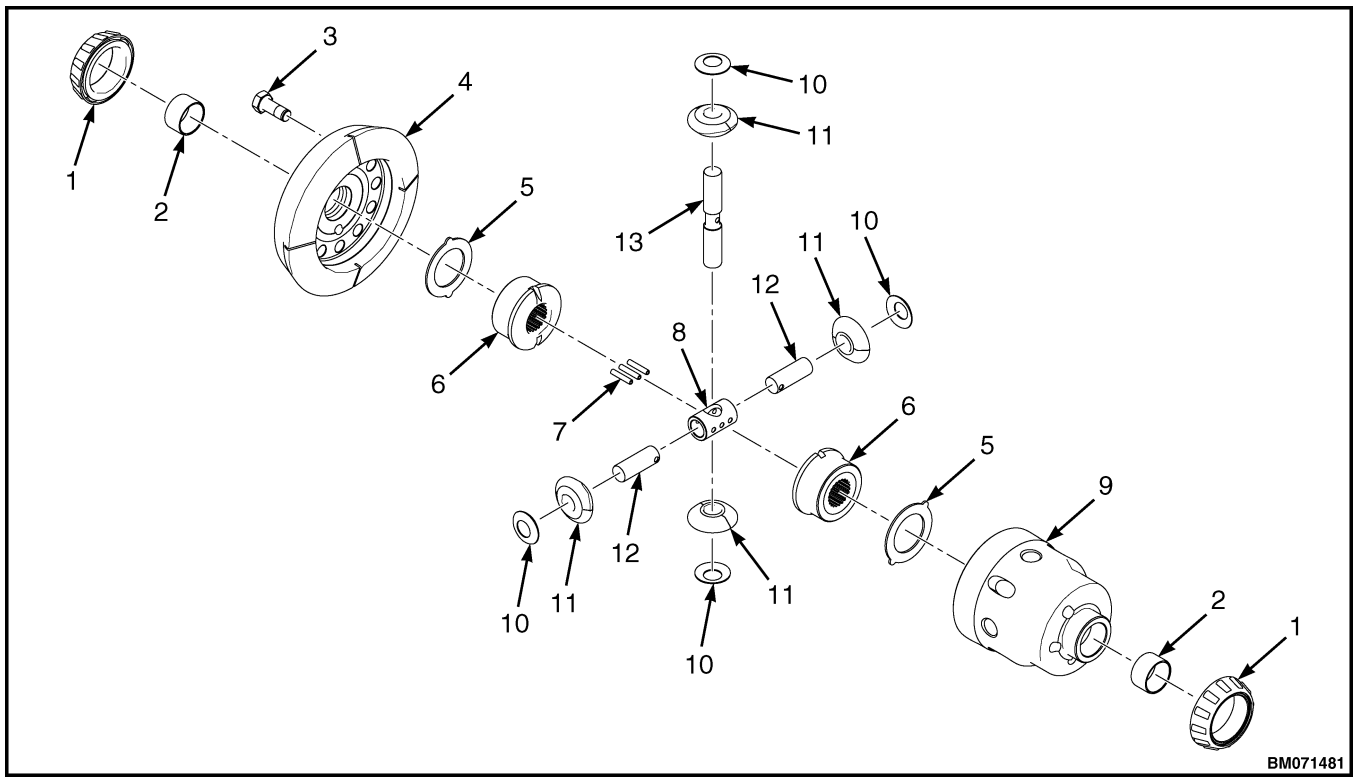
STEP 41.
If removed, coat cap with Loctite® 510 and install the cap.



STEP 42.
Install the wheel hubs and service brakes to the drive axle assembly. See Wheel ends and Service brake.

DIFFERENTIAL
202001-227

DIFFERENTIAL REPAIR

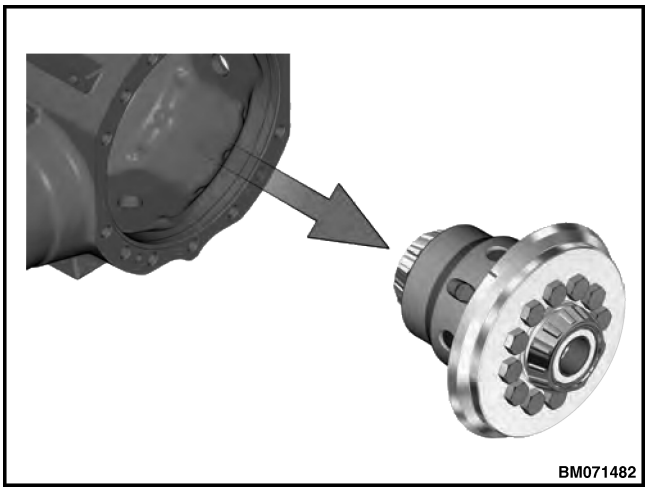


1. BEARING
2. BUSHING
3. CAPSCREW
4. RING GEAR
5. THRUST WASHER
6. SIDE GEAR
7. SPIDER ROLL PINS
8. SPIDER SLEEVE
9. DIFFERENTIAL HOUSING
10. SPHERICAL WASHERS
11. SATELLITE GEARS
12. DIFFERENTIAL SPIDER PINS
13. DIFFERENTIAL SPIDER

Figure 185. Differential Exploded View

Disassemble differential

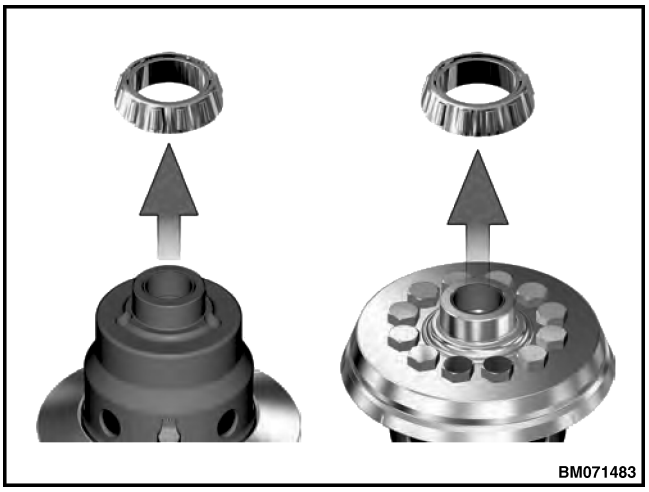
STEP 1.
Remove the differential as a complete assembly. See Center section for procedure.


BM071482

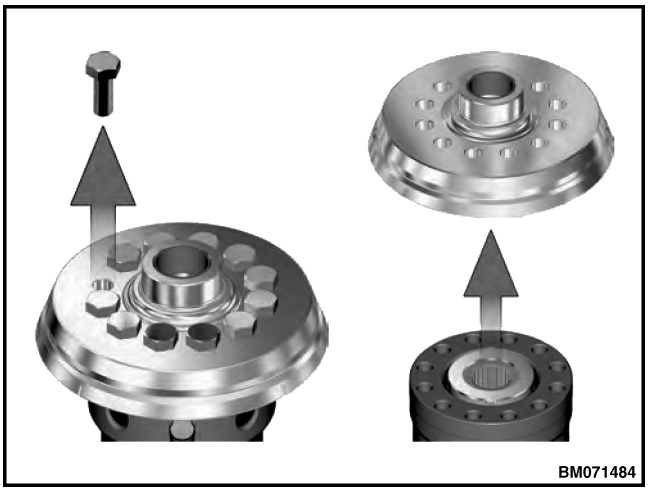
CAUTION

If disassembly is carried out in order to replace ring gear and pinion, bearings, or side gear, break up distance washers and calculate clearances as indicated in the sections regarding removal, disassembly, assembly, and installation of differential until and bevel pinion.

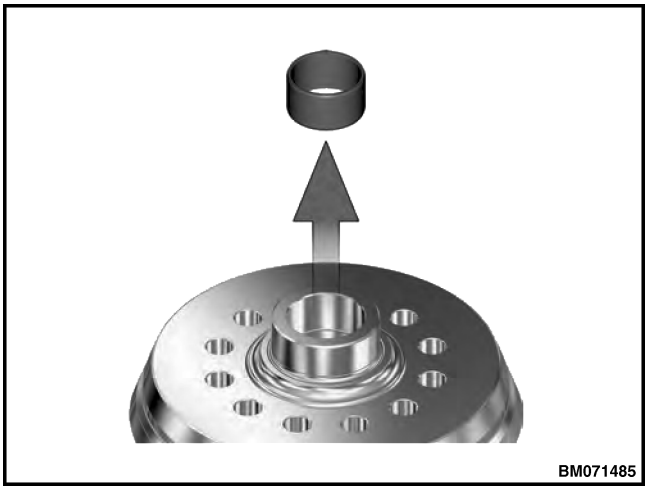
STEP 2.
If bearing replacement is required, extract the bearing from the differential housing and the ring gear.


BM071483

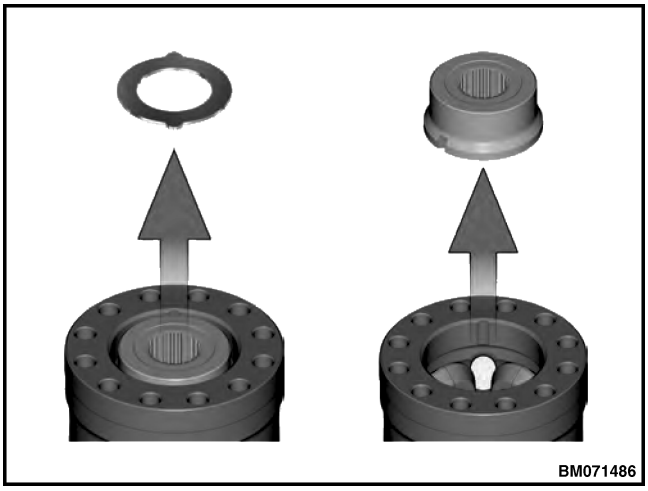
STEP 3.
Remove the capscrews in the ring gear. With the help of a plastic or rubber hammer or brass punch, remove the ring gear.


BM071484

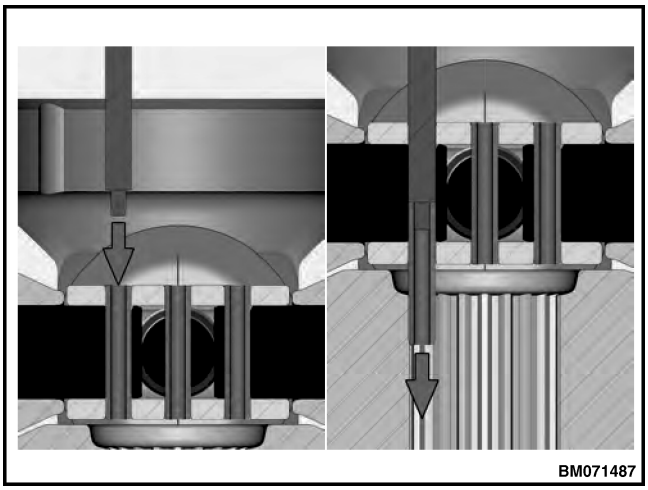
STEP 4.
Using an extractor remove the bushings from ring gear.


BM071485

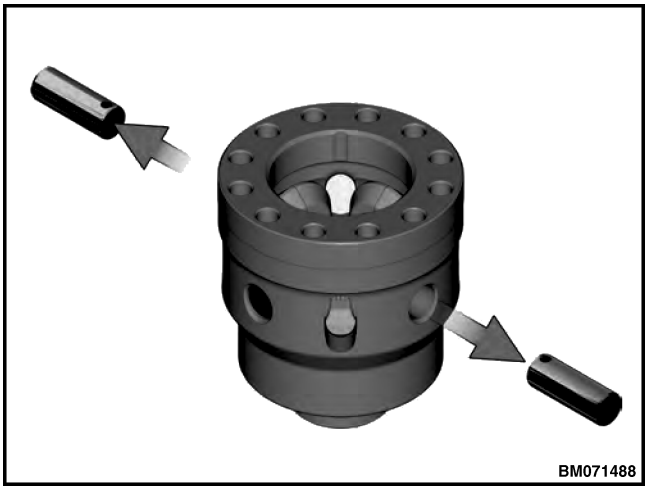
STEP 5.
Remove the thrust washer and the side gear from differential housing.


BM071486

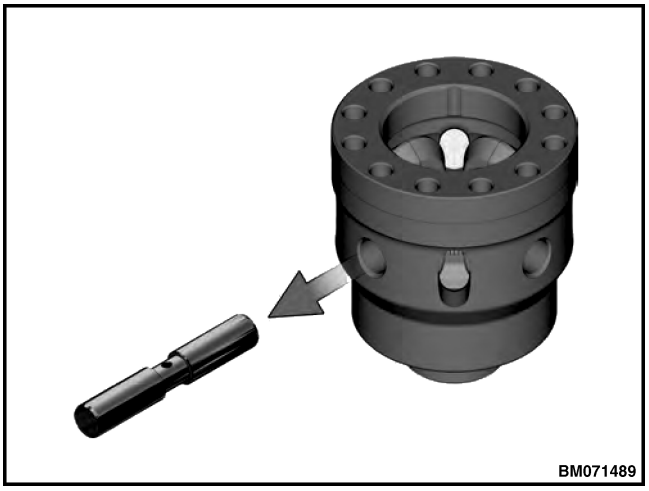
STEP 6.
Remove the three spider roll pins from differential housing using a pin driver.


BM071487

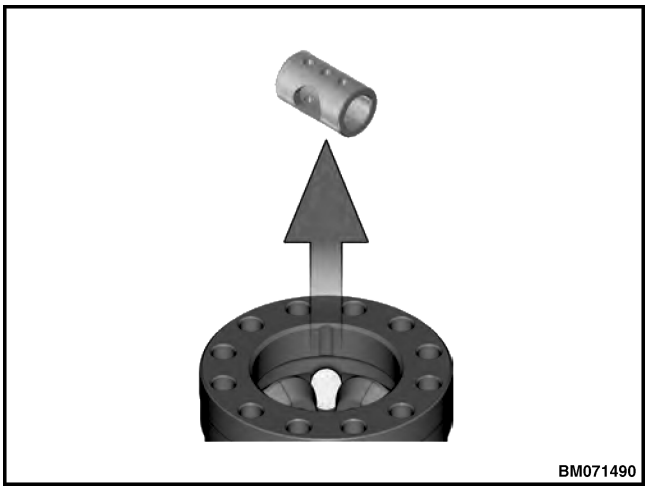
STEP 7.
Remove two differential spider pins from differential housing.



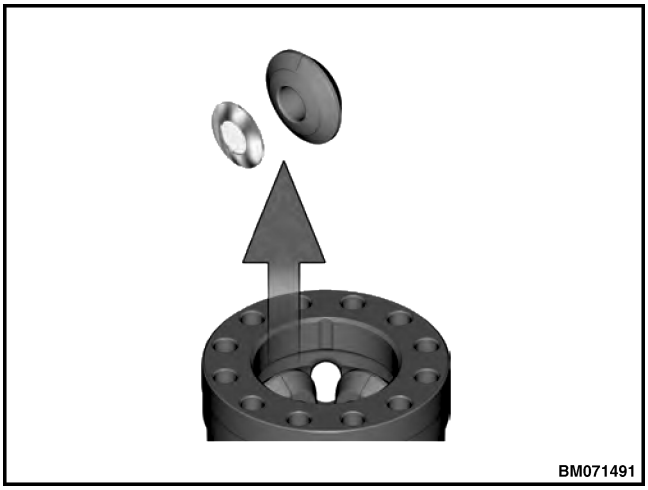
STEP 8.
Remove the differential spider from differential housing with the help of a drift.



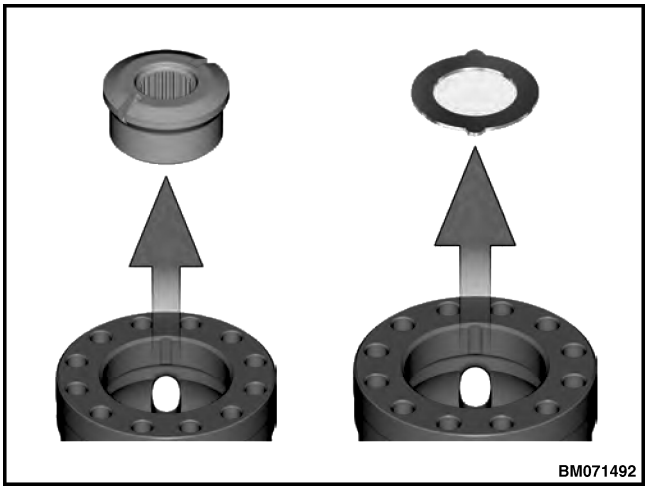
STEP 9.
Remove the spider sleeve from differential housing.



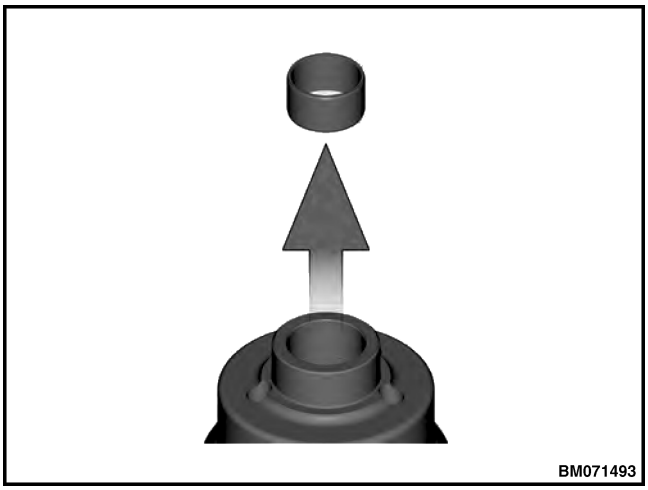
STEP 10.
Remove four spherical washers and four satellite gears from differential housing. Use paint pins to mark the outside of the differential housing to the ends of the pins (that the differential gears run on) with a different color for each pin, to aid in installation. Mark the gears and washers with the same paint color as their corresponding pin.


BM071491

STEP 11.
Remove the side gear and thrust washer from differential housing.

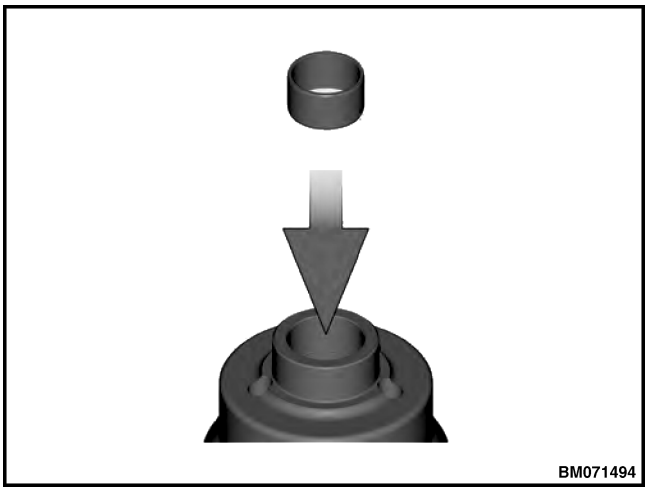

BM071492

STEP 12.
Use an inside diameter bearing/bushing puller to remove the bushing from differential housing.

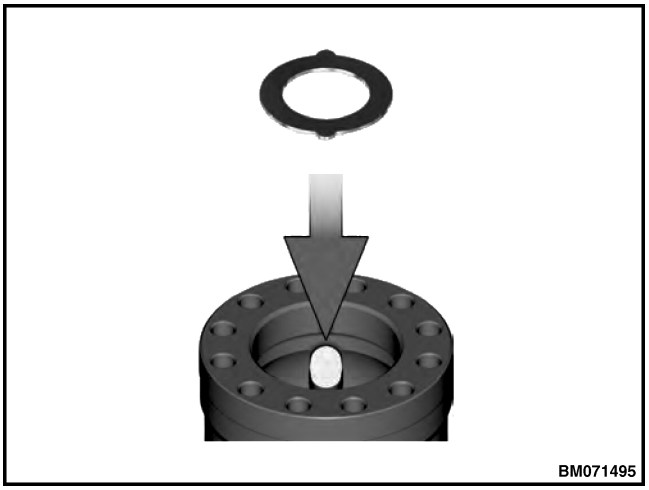

BM071493

Assemble Differential

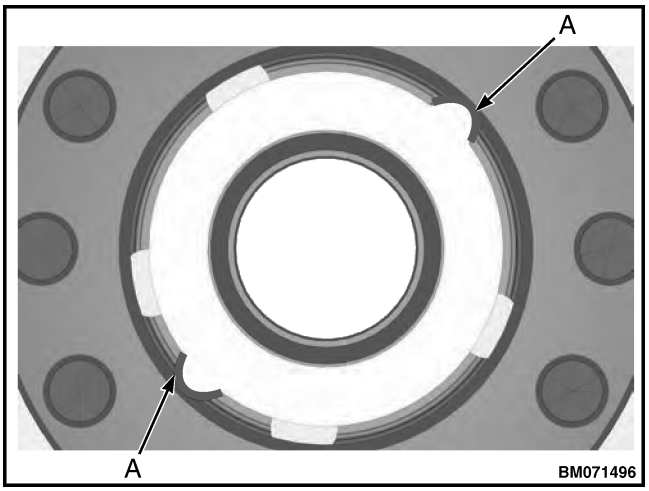
STEP 1.
Press the bushing into its seated position in the differential housing.



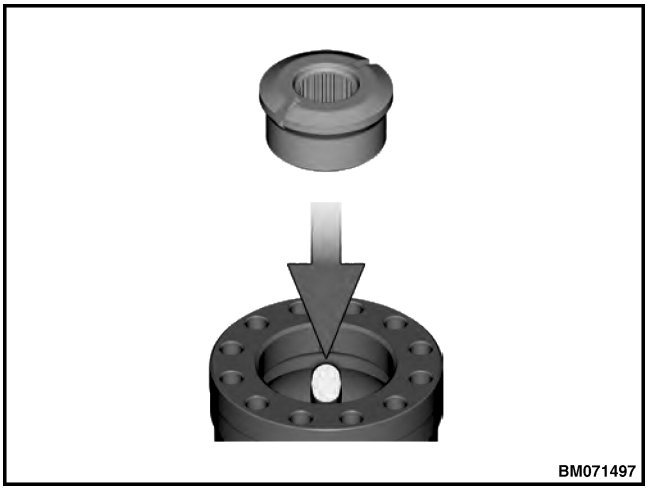
STEP 2.
Insert the thrust washer into position into the differential housing.



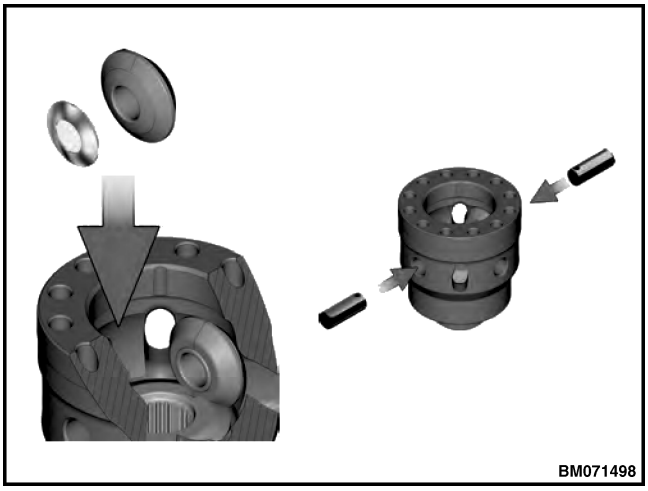
STEP 3.
Install the thrust washer engaging the anti-rotation keys "A" in their seats in the differential housing.



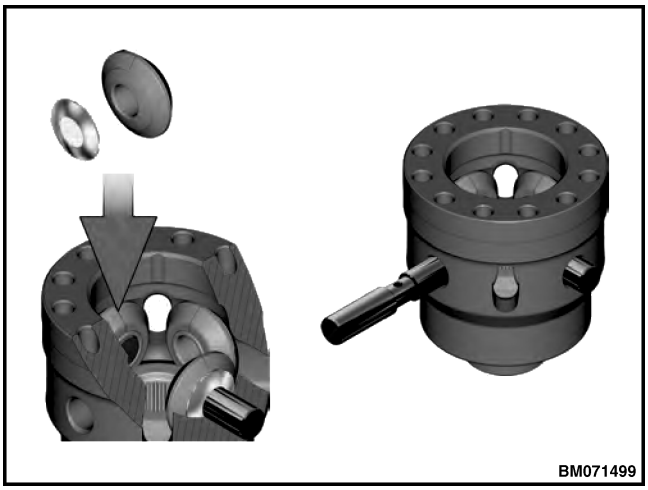
STEP 4.
Insert side gear into differential housing.



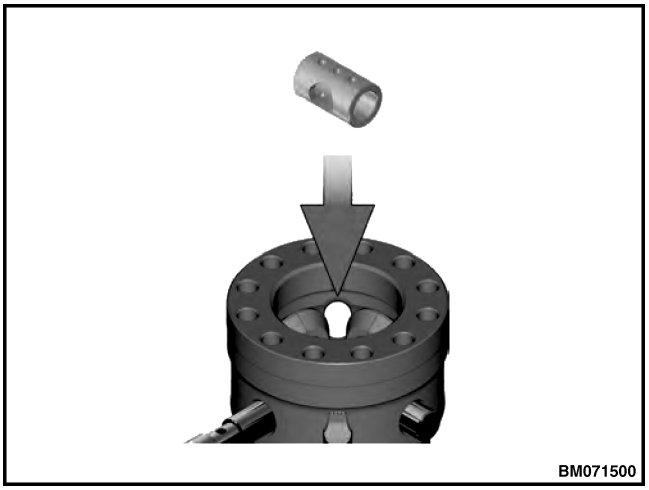
STEP 5.
Insert the two differential spider pins, two satellite gears, and two spherical washers into differential housing.



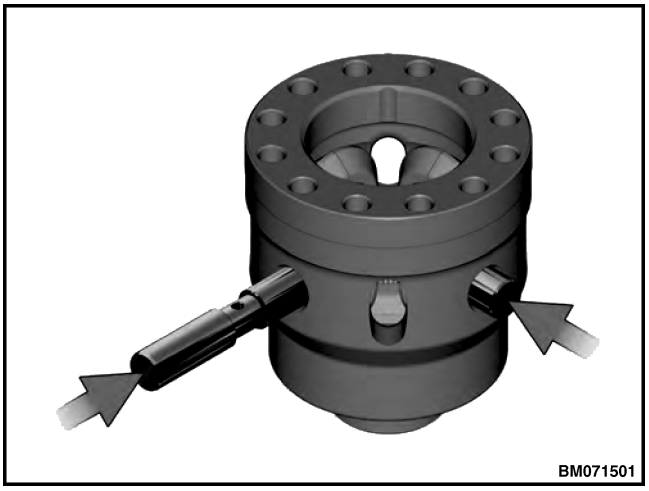
STEP 6.
Partially insert differential spider, two satellite gears, and two spherical washers.



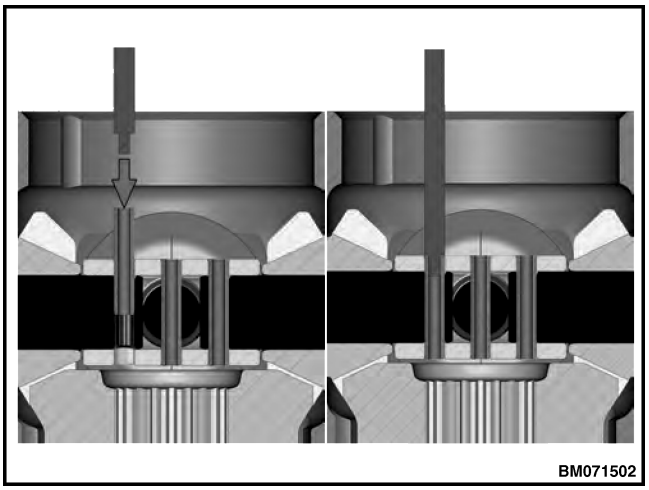
STEP 7.
Insert the differential spider sleeve into the correct position.



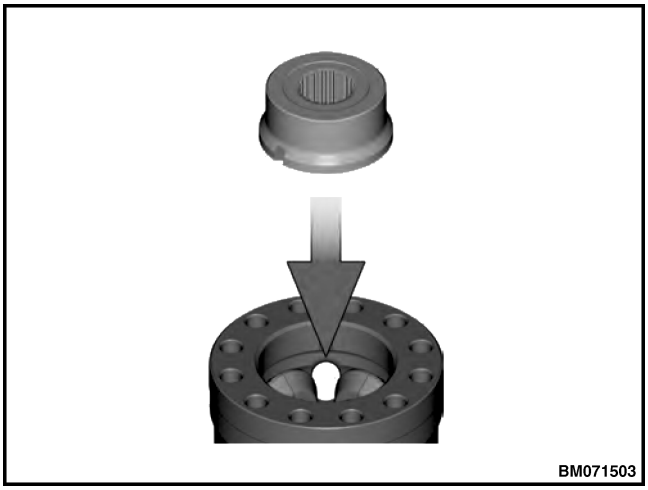
STEP 8.
Complete insertion of the differential spider and differential spider pins.



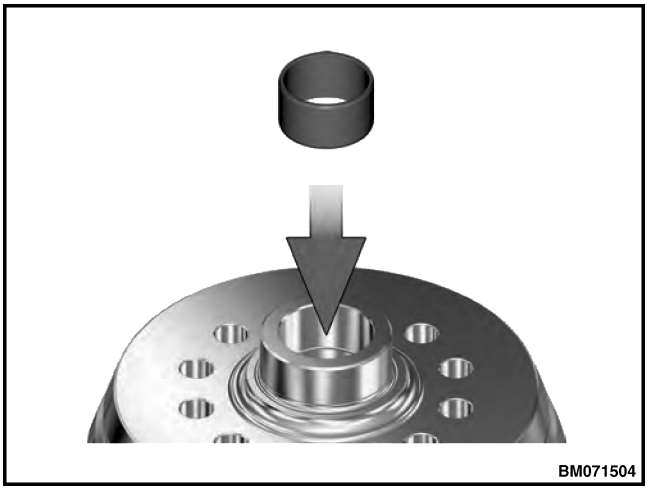
STEP 9.
Bring the pin holes in line with the help of a pin-driver. Insert spider roll pins into spider sleeve.



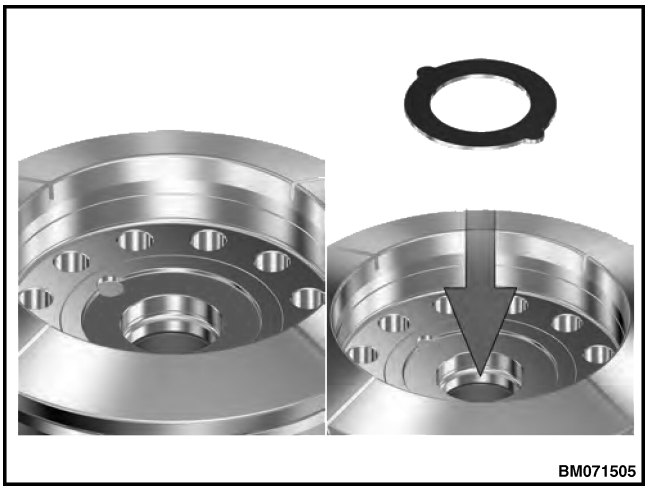
STEP 10.
Insert side gear into differential housing.


BM071503

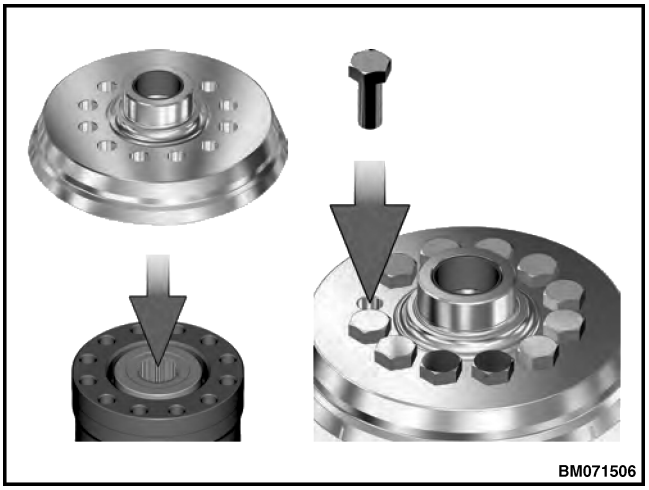
STEP 11.
Press the bushing into its seated position in the ring gear.


BM071504

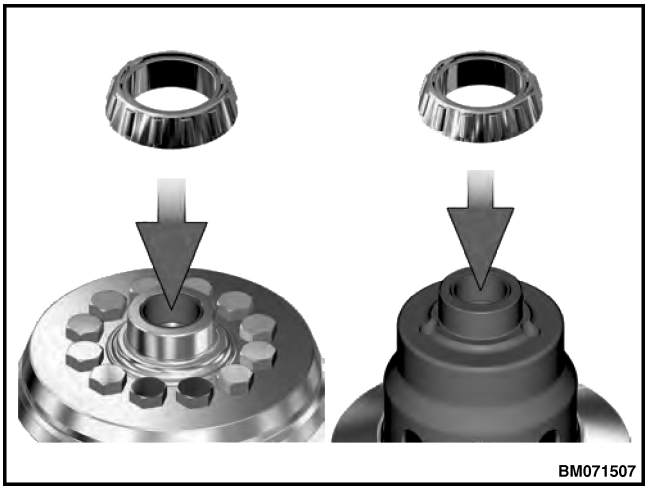
STEP 12.
Apply lithium-based grease to the ring gear surface on which the thrust washer will be installed to hold thrust washer in position for assembly. Insert the thrust washer into the ring gear.


BM071505

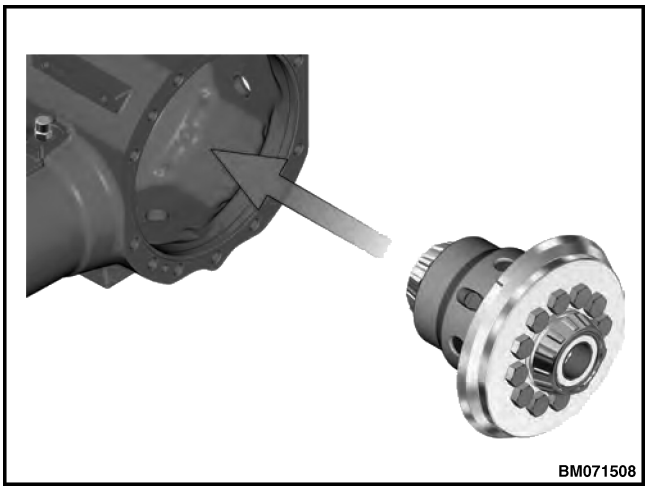
STEP 13.
Position the ring gear on the differential housing. Apply Loctite® 243 to threaded portion of capscrews and install into ring gear. Tighten capscrews, in an alternating cross pattern, to 115 to 142 N • m (84.8 to 104.7 lbf ft).


BM071506

STEP 14.
Heat the bearings to approximately 100°C (212°F) and fit to the ring gear and differential housing.


BM071507

STEP 15.
Install the complete differential assembly into center section housing.


BM071508

NOTE: Measure the backlash at a distance of 85 mm (3.35 in.) from the pinion axis.

STEP 16.
If the bevel set has been replaced, ring and pinion backlash must be checked to be within specification listed. See Center section for procedure.

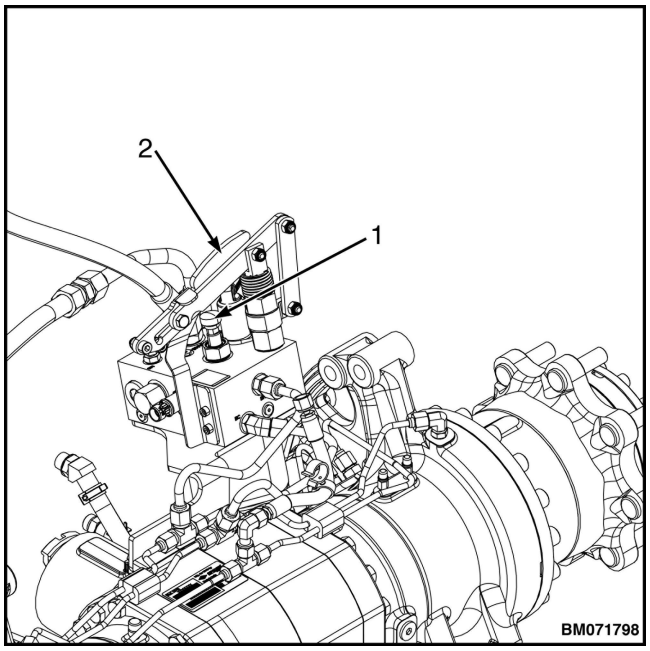
MANUAL OVERRIDE FLUSH PROCEDURE

PREPARE

1. Place the lift truck on blocks. See How to put a lift truck on blocks in **Periodic Maintenance** manual.
2. Remove the floormat and floorplate. See Covers repair in **Frame and Main Components** 8000SRM2306 manual.

PROCEDURE

1. Locate the manual override valve (item 1, Figure 186).
2. Press down on the top of the manual override valve to close. See Figure 186.
3. Locate the handle of the hand pump (item 2, Figure 186) and unfold the handle.
4. Use the handle to pump the hand pump until firm.
5. Pull up on the top of the manual override valve to open and release pressure.
6. Repeat Step 2 through Step 5 multiple times.
7. Start the truck and verify time between charge cycle (or make sure the DTC code has cleared and does not trigger again).
8. Verify with warm to hot oil.



1. MANUAL OVERRIDE VALVE
2. PUMP HANDLE

Figure 186. Manual override valve

WET BRAKE AXLE SPECIAL TOOLS 202001-228

TOOLS

End-Stop Plier Settings

Retaining Snap Ring for Bores

CAUTION

This procedure is aligned with DIN standard, specifically the prevailing DIN 472 regulation.

CAUTION

Snap ring replacement is required if they are removed without pre-set plier.

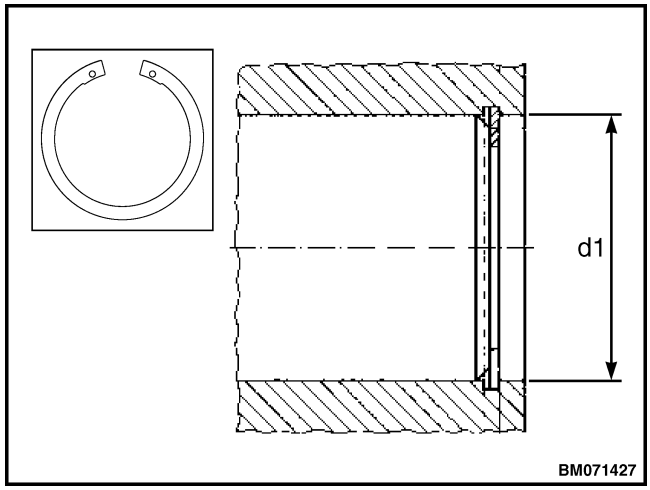


Figure 187. Bore Snap Ring

1. Measure the bore diameter of snap ring "d1"
2. Pre-set the caliper at value "Dmin" ("Dmin" = "d1" x 0.99)
3. Fix it with the screw on caliper (see - Point A)
4. Put the snap ring into the plier
5. Close snap ring as far as the end-stop bolt allows
6. Adjust the end-bolt in order to match the external diameter of the snap ring with "Dmin" value
7. Discard the snap ring used for the end-stop plier calibration

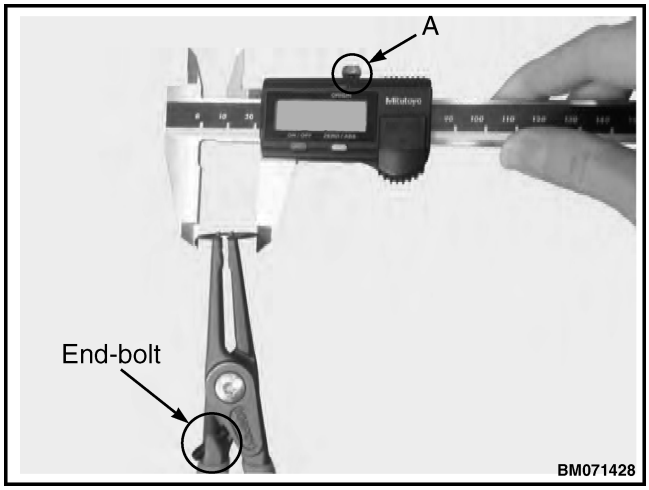


Figure 188. Pliers

Retaining Snap Ring for Shafts

CAUTION

This procedure is aligned with DIN standard, specifically the prevailing DIN 471 regulation.

CAUTION

Snap ring replacement is required if they are removed without pre-set plier.

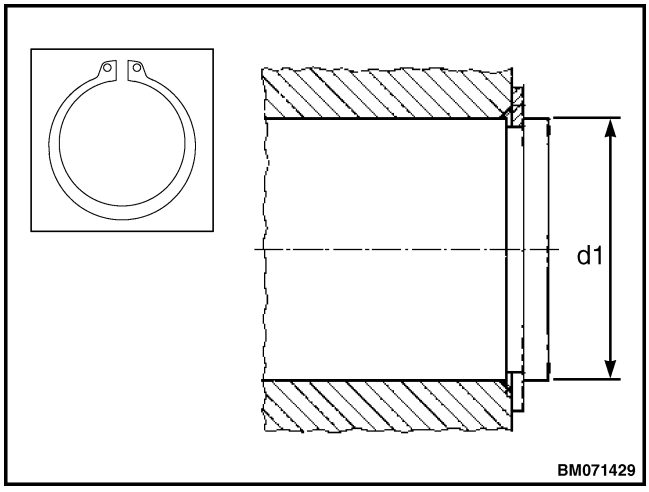


Figure 189. Shaft Snap Ring

1. Measure the shaft diameter of snap ring "d1"
2. Pre-set the caliper at value "Dmax" ("Dmax" = "d1" x 1.01)
3. Fix it with the screw on caliper (see - Point A)

4. Put the snap ring into the plier
5. Open snap ring as far as the end-stop bolt allows
6. Adjust the end-bolt in order to match the internal diameter of the snap ring with "Dmax" value
7. Discard the snap ring used for the end-stop plier calibration

SPECIAL TOOLS

T1

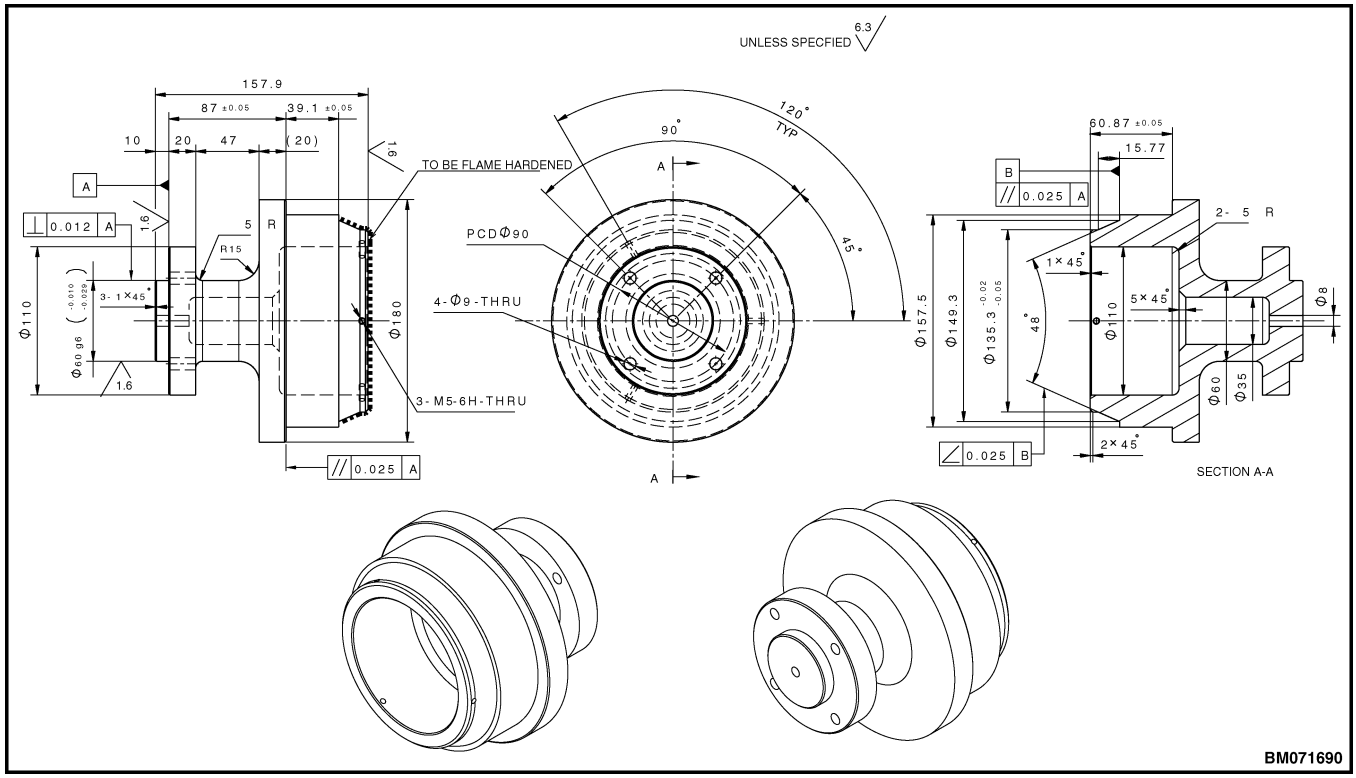


Figure 190. T1

T2

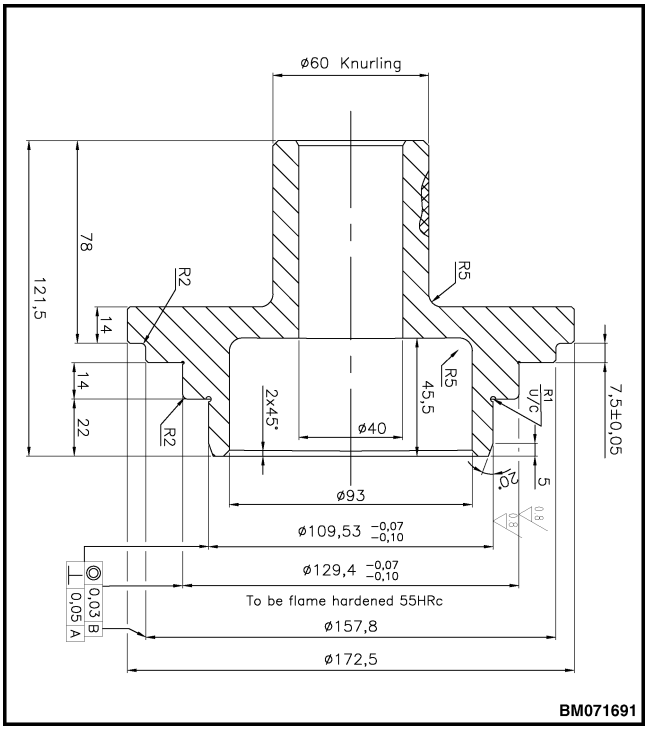


Figure 191. T2

T3

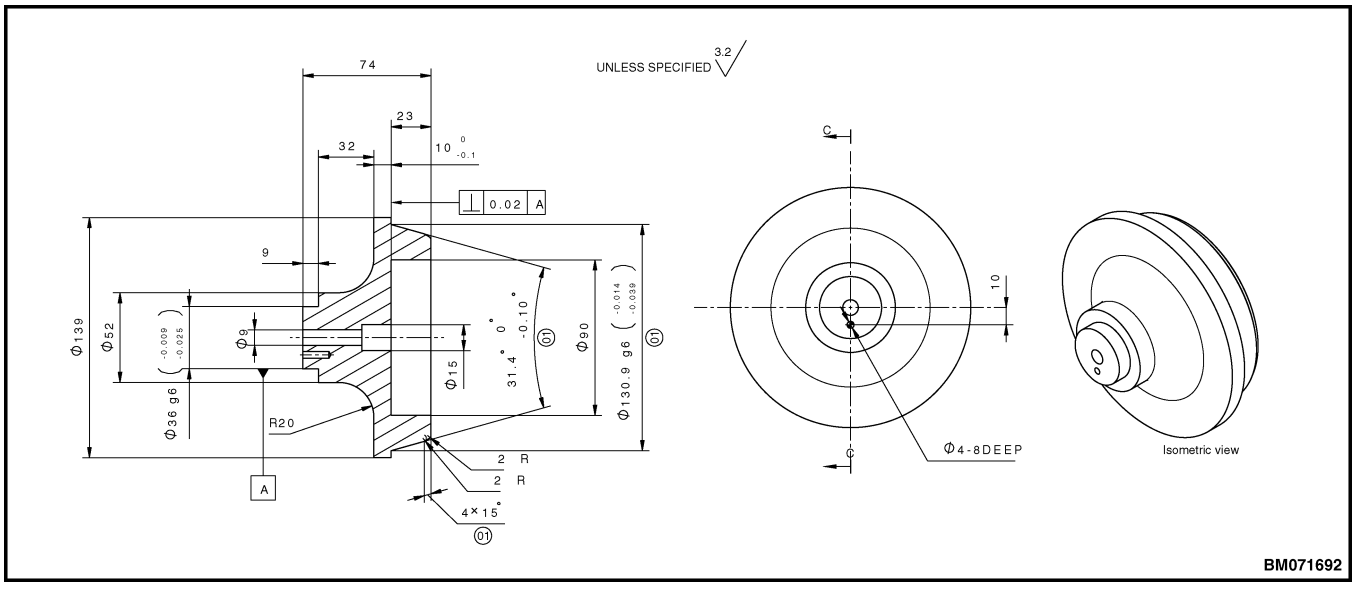


Figure 192. T3

T4

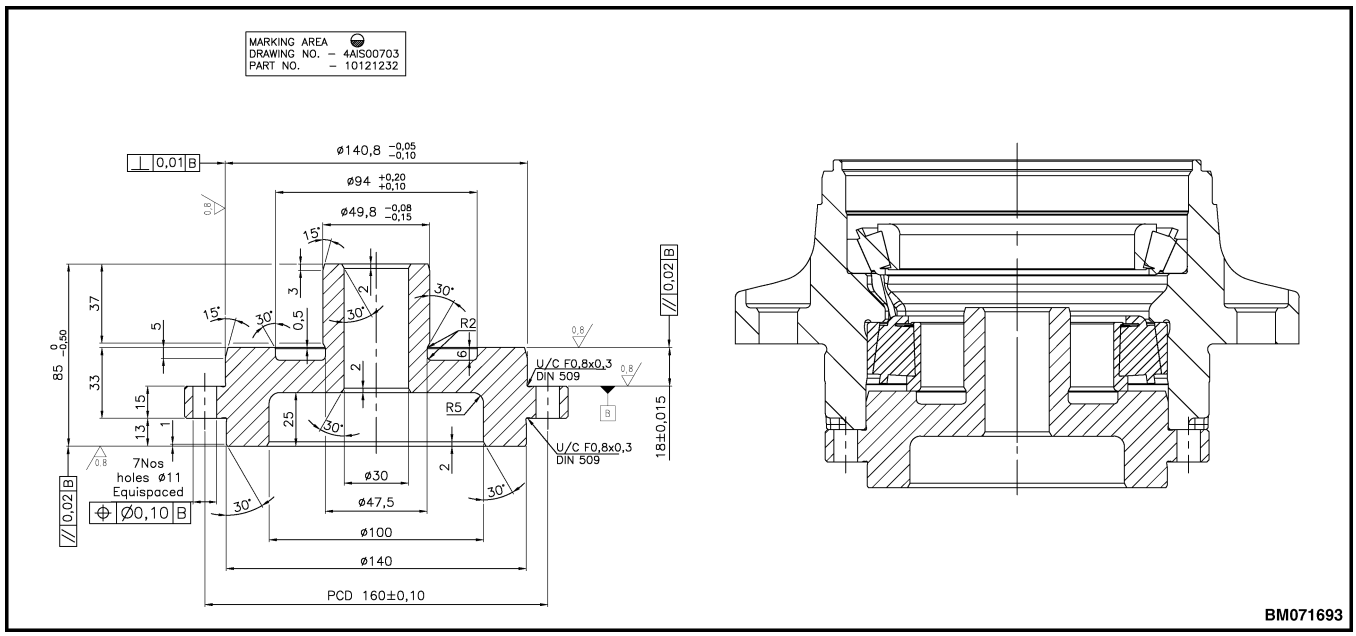


Figure 193. T4

T5

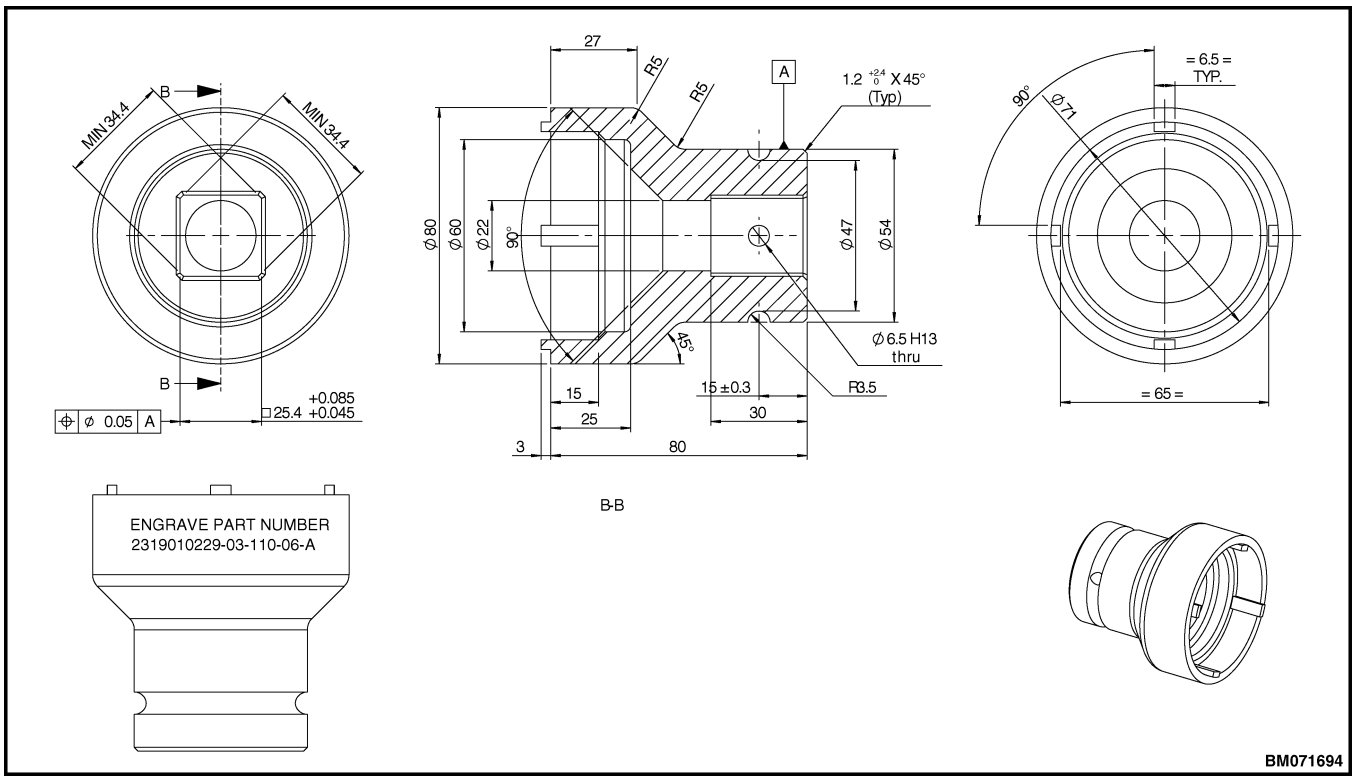


Figure 194. T5

T6

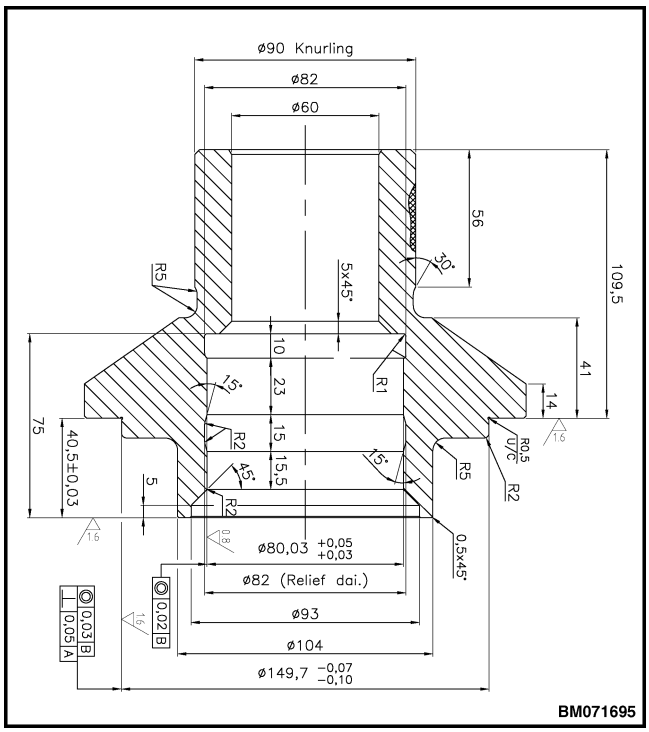


Figure 195. T6

T7

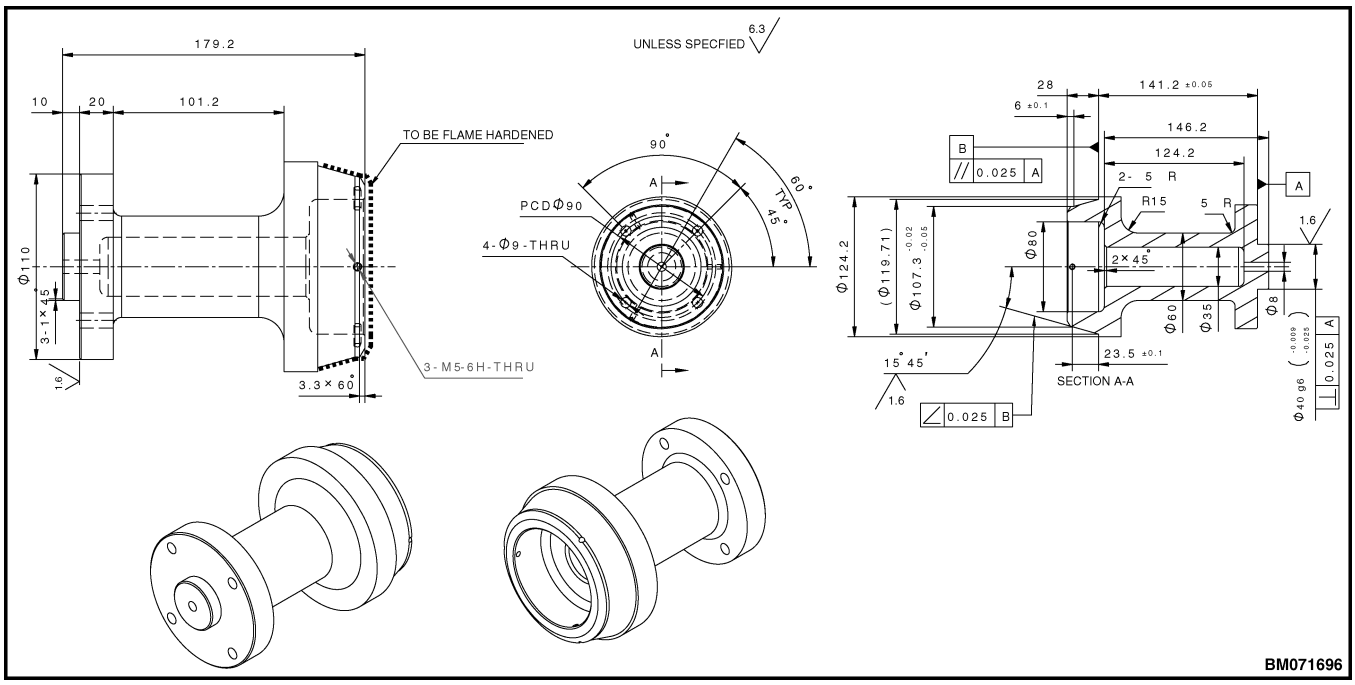


Figure 196. T7

T8

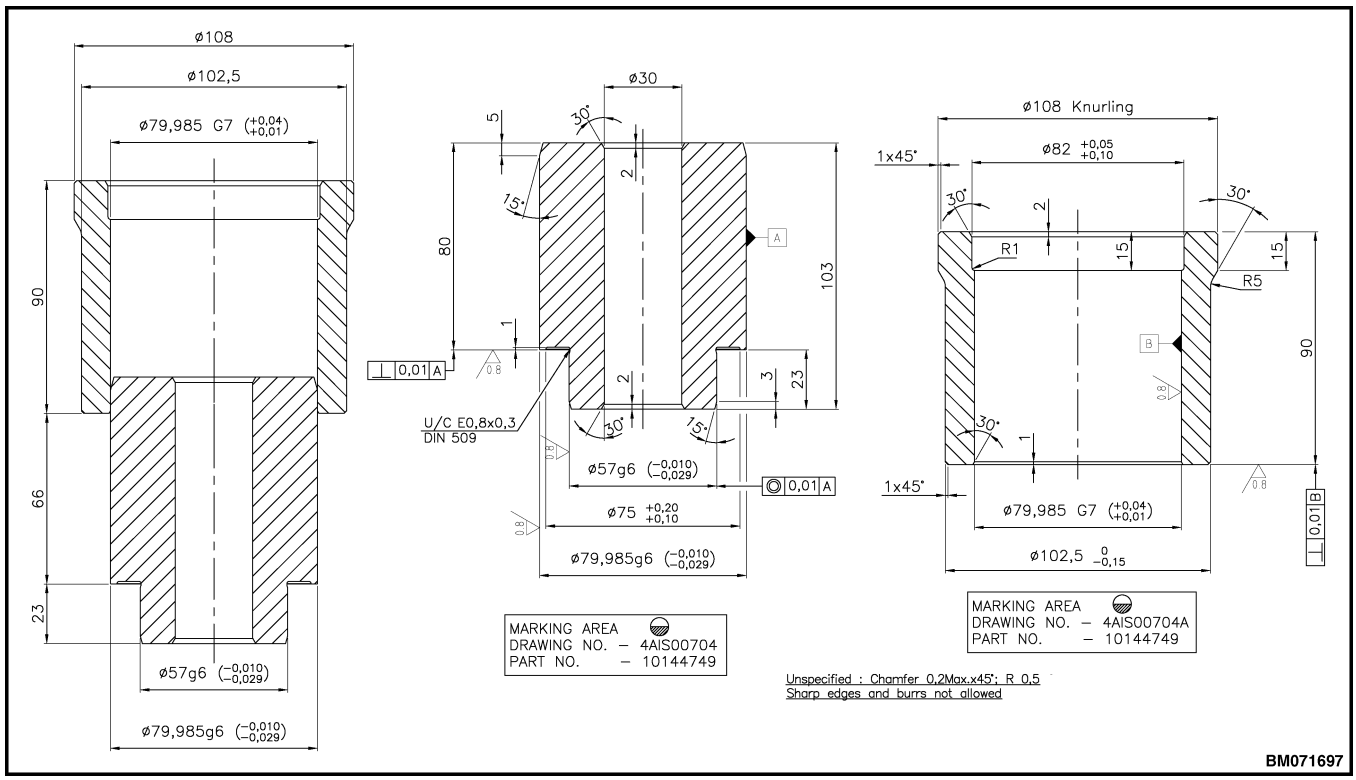
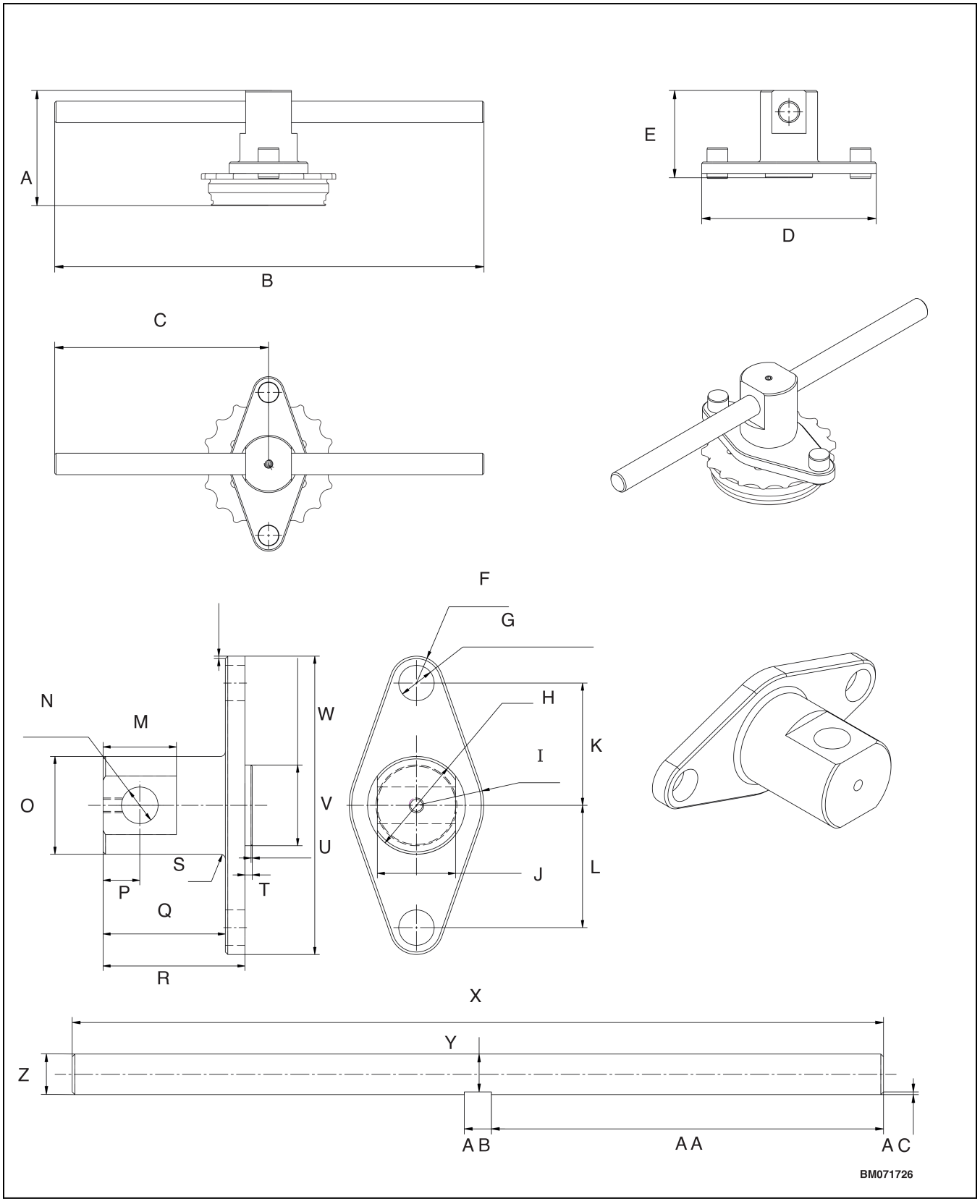
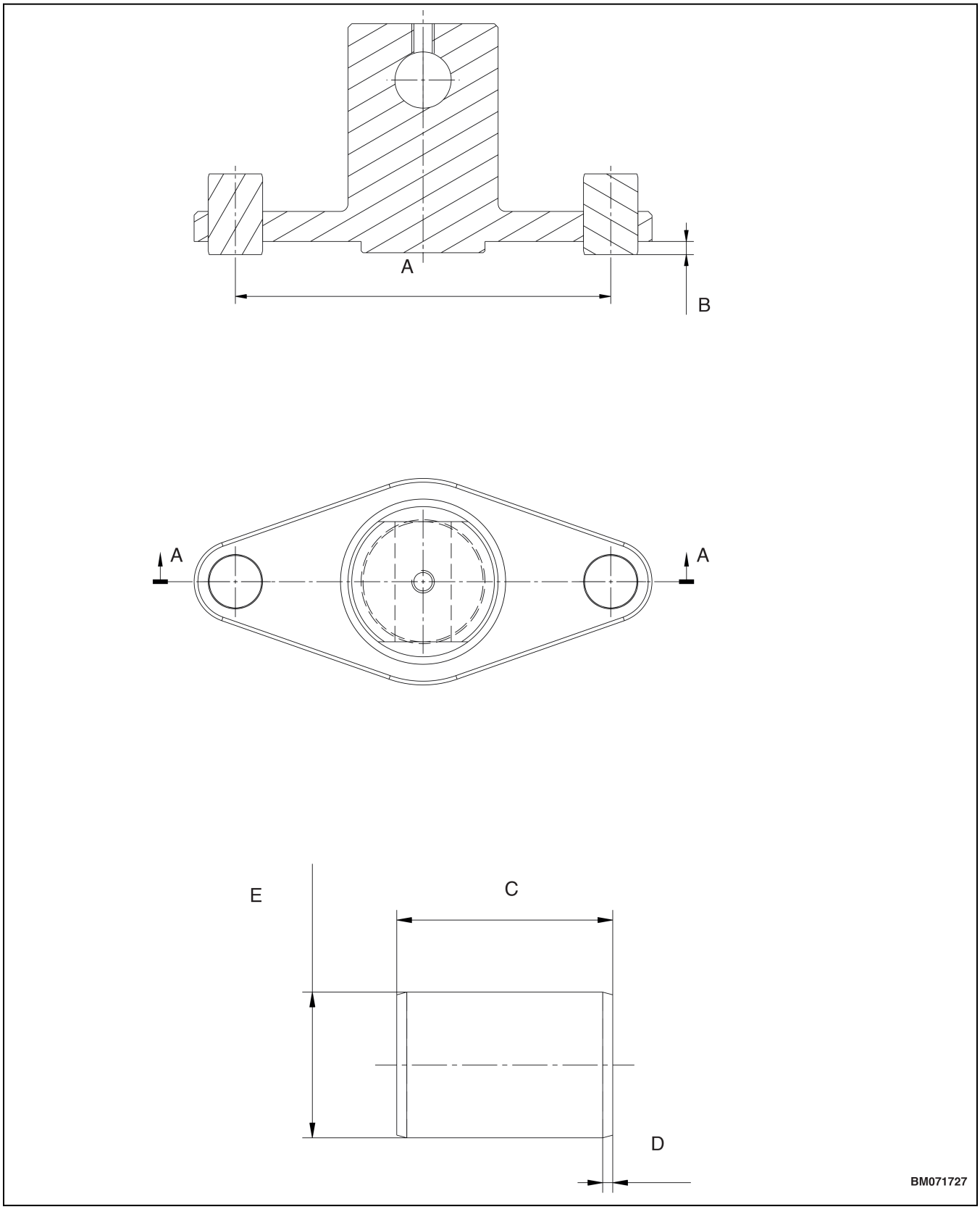


Figure 197. T8

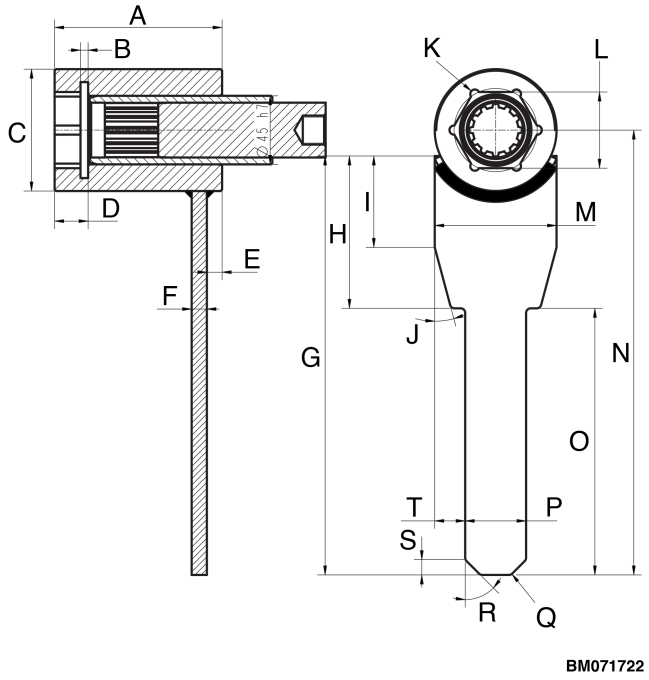
T9

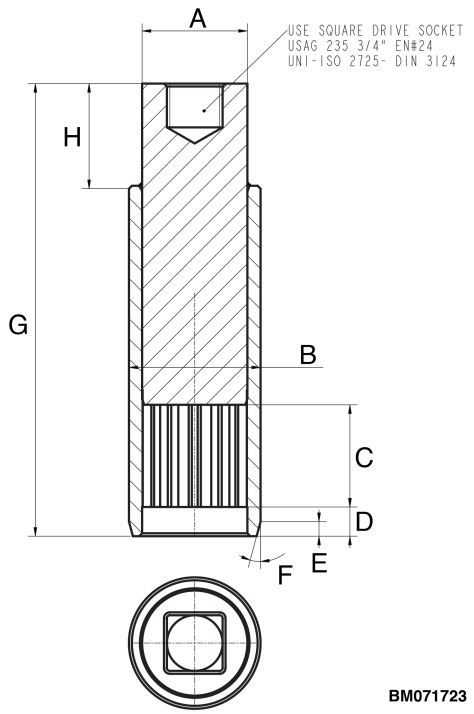



A
B
A
A
E
C
D
BM071727

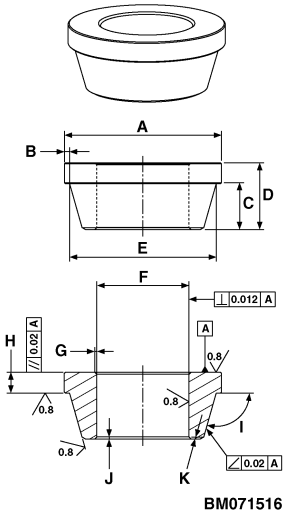
Illustrations
Applicable Model and Tool Size
A 80.5 mm (3.17 in.)
B 300 mm (11.81 in.)
C 149.5 mm (5.89 in.)
D 122 mm (4.8 in.)
E 61 mm (2.4 in.)
F 2-R11 - Thru
G ø14.5 H7 (+0.018)
H ø40
I 2-R27.5
J 32 A/F
K 50 mm (1.97 in.)
L 50 mm (1.97 in.)
M 30 mm (1.18 in.)
N ø15 (+0.1) - Thru
O ø40
P 15 mm (1.57 in.)
Q 50 mm (1.97 in.)
R 58 mm (2.28 in.)
S R2
T 3 mm (0.12 in.)
U 0.5 X 45
V 122 mm (4.8 in.)
W 33 g6
X 300 mm (11.81 in.)
Y 14 mm (0.55 in.)
Z ø15
AA 145 mm (5.71 in.)
AB 10 mm (.39 in.)
AC 1 X 45°
A 100 mm (3.94 in.)
B 3.5 ± 0.1 mm (0.14 in.)
C 21.5 mm (0.85 in.)
D 2- 1 X 15°
E ø14.5 n6 (+0.023/+0.012)

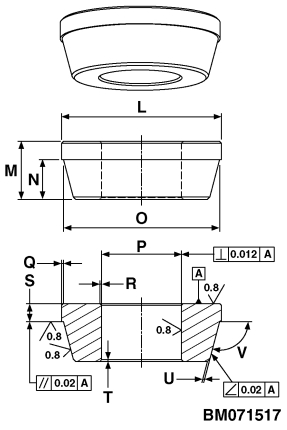
T10

Applicable Model and Tool Size	Illustration
A 110 mm (4.33 in.)	
B 5 mm (0.2 in.)	
C ø80	
D 22 mm (0.9 in.)	
E 10 mm (0.39 in.)	
F 10 mm (0.39 in.)	
G 275 mm (10.83 in.)	
H 100 mm (3.94 in.)	
I 60 mm (2.36 in.)	
J 15°	
K R3 Max /Int ø54.5	
L CH 50 +0.3/+0.2	
M 80 mm (3.15 in.)	
N 292 mm (11.5 in.)	
O 175 mm (6.89 in.)	
P 40 mm (1.57 in.)	
Q R3 TYP	
R 2 X 45°	
S 10 mm (0.39 in.)	
T 20 mm (0.79 in.)	

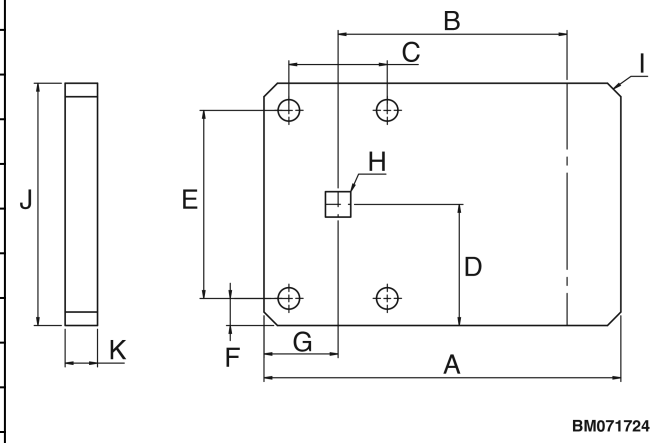
Applicable Model and Tool Size	Illustration
A ø36 H8	
B ø45 -0.08/-0.12	
C 35 mm (1.34 in.)	
D 10 mm (0.39 in.)	
E 5 mm (0.2 in.)	
F 15°	
G 155 mm (6.10 in.)	
H 36 mm (1.42 in.)	

T11

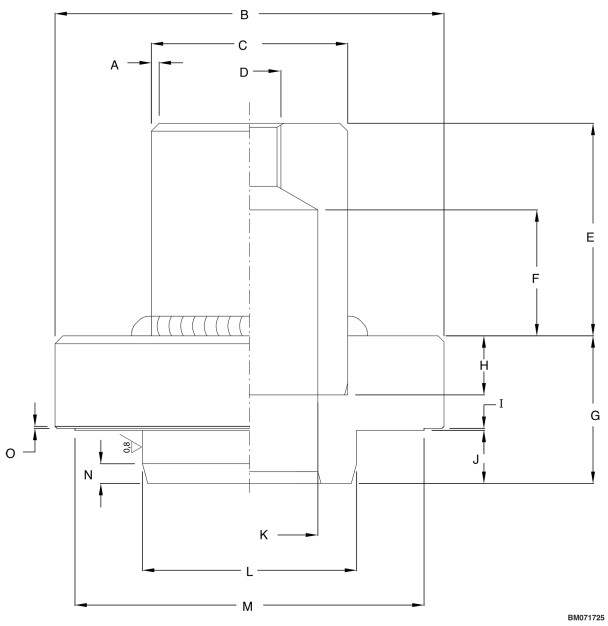
Applicable Model and Tool Size	Illustration
A ø 75 ±0.1	
B (2.5)	
C 22.5 ±0.05	
D 32	
E ø 70 -0.2/-0.05	
F ø 44 H7 (+0.025/0	
G 1 X 45°	
H 10	
I 105.77°	
J 1 X 45°	
K 45° X 1	

Applicable Model and Tool Size	Illustration
L ø 88 ±0.1	
M 32	
N 22 ±0.5	
O ø 86 -0.2/-0.05	
P ø 44 H7 +0.025	
Q 45° X 1	
R 45° X 1	
S 10	
T 45° X 1	
U 45° X 1	
V 104.61°	

T12

Applicable Model and Tool Size	Illustration
A 132.50 mm (5.22 in.)	
B 85 mm (3.35 in.)	
C 36.53 mm (1.44 in.)	
D 45 mm (1.77 in.)	
E 69.85 mm (2.75 in.)	
F 10.08 mm (0.40 in.)	
G 27.50 mm (1.08 in.)	
H 9.5 mm (3/8 in.) Square	
I Chamfer 5 X 45° (TYP)	
J 90 mm (3.54 in.)	
K 12.00 ±0.1 mm (0.47 in.)	

T13

Applicable Model and Tool Size	Illustration
A 2 X 45°	
B ø 99	
C ø 50	
D M16	
E 54 mm (2.13 in.)	
F 32 mm (1.3 in.)	
G 37.50 mm (1.48 in.)	
H 15 mm (0.6 in.) Square	
I 50 mm (2.0 in.)	
J 13.50 mm (0.53 in.)	
K ø 34.80	
L ø 54.50	
M ø 88.85	
N 5 X 15°	
O 1 X 45°	

Brake service and adjustments

BRAKE PEDAL ADJUSTMENT 202001-264

BRAKE PEDAL IDENTIFICATION

To ensure proper service, it is necessary to identifty the correct brake system. For Dry Brake Assemblies (DBA) (item 1 and 2), the brake pedal input crank (item A and B, Figure 198) has one notch. For Wet Brake Assemblies (WBA) (item 3 and 4), the brake pedal input crank has two notches.

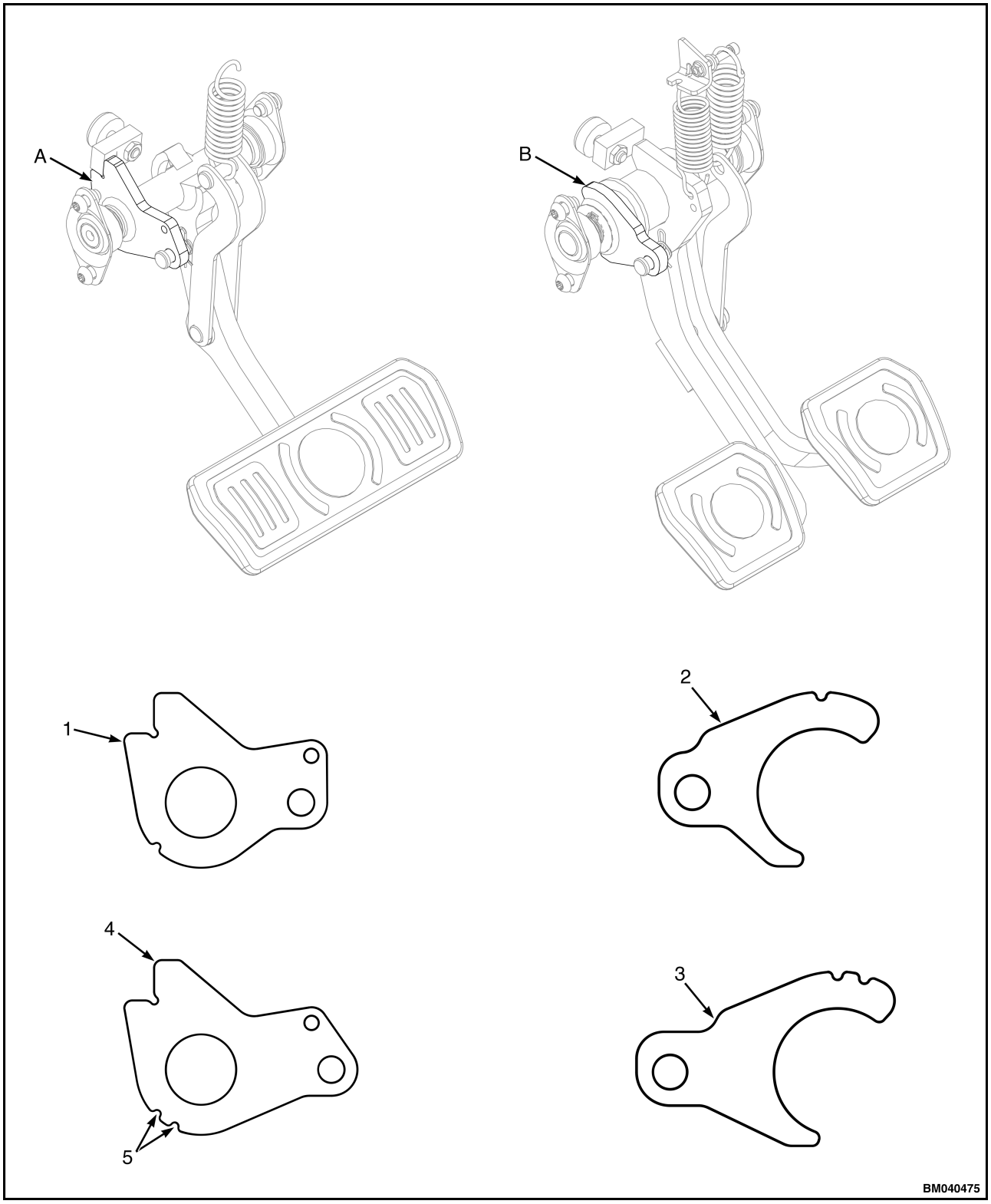


Figure 198. Brake Pedal Input Crank Identification

Legend for Figure 198.

A. SINGLE PEDAL

B. DUAL PEDAL

1. SINGLE PEDAL BRAKE INPUT CRANK - DBA
2. DUAL PEDAL BRAKE INPUT CRANK - DBA
3. DUAL PEDAL BRAKE INPUT CRANK - WBA
4. SINGLE PEDAL BRAKE INPUT CRANK - WBA
5. BRAKE INPUT CRANK IDENTIFICATION NOTCH

BRAKE PEDAL ADJUSTMENT WITH SINGLE PEDAL OPTION

Pedal Adjustment

1. Install stop screw through hole in brake pedal. See Figure 199.

2. Apply layer of multi-purpose grease to rod end pin and with twisting motion, insert through clevis of master cylinder and pedal. Install cotter pin through rod end pin. See Figure 199.

3. Install pedal:

a. For padded pedal, apply layer of multi-purpose grease to rod end pin and with twisting motion, insert through links, washers, and pedal. Install cotter pin through rod end pin. See Figure 199.

b. For diamond plate pedal, apply layer of multi-purpose grease to rod end pin and with twisting motion, insert through links and pedal. Install cotter pin through rod end pin. See Figure 199.

4. Adjust stop screw (item 1, Figure 199) until a measurement (Dim C) of 90 mm (3.54 in.) from top surface of floorplate to upper rear edge of brake pedal has been achieved.

5. Torque nut (item 2, Figure 199) to 8.5 to 9.5 N•m (6.3 to 7 lbf ft) while keeping stop screw fixed.

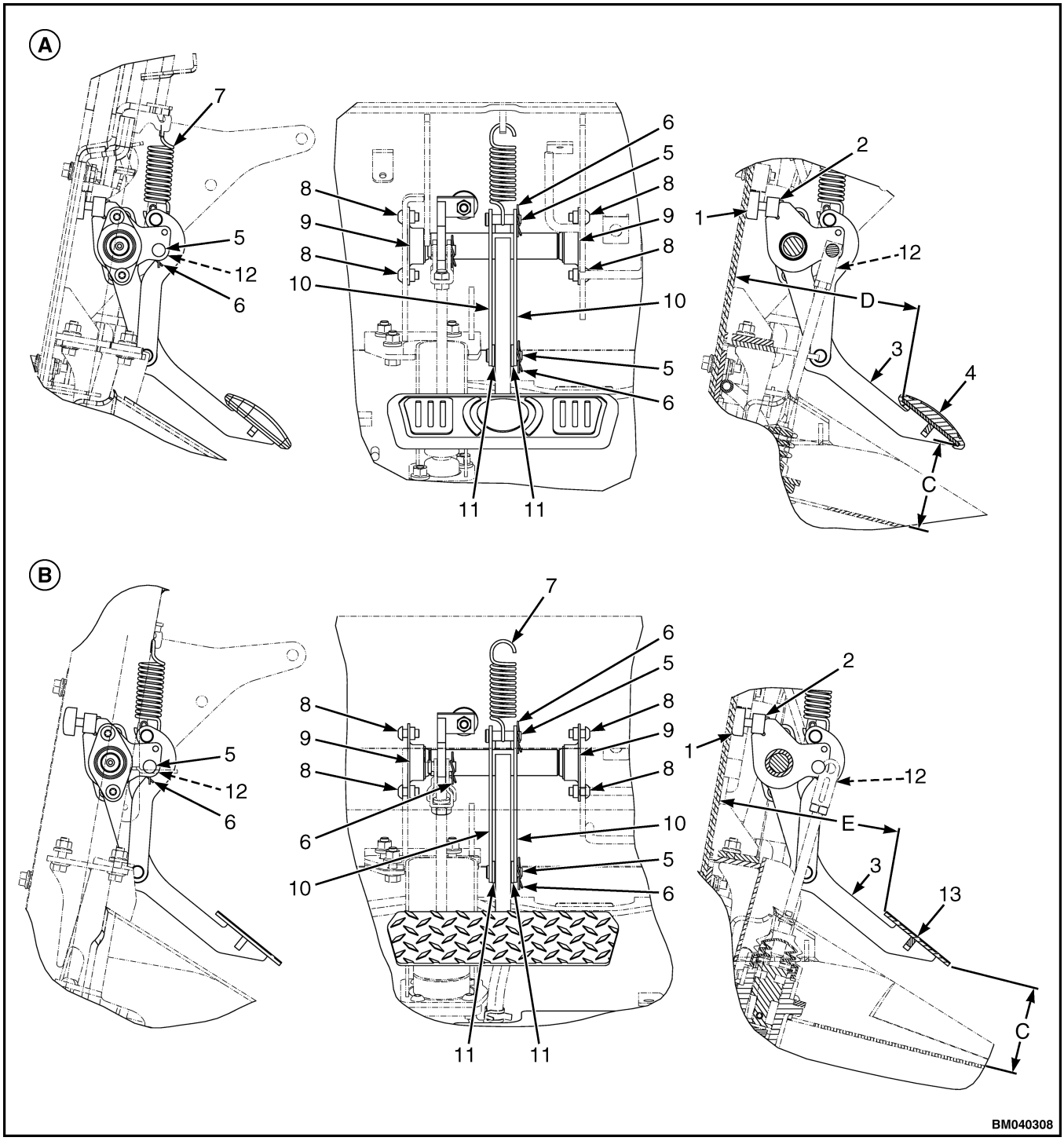


Figure 199. Brake Pedal Adjustment, Single Pedal

Legend for Figure 199.

A. INCH/BRAKE PEDAL WITH PAD
B. INCH/BRAKE PEDAL WITH DIAMOND PLATE
C. REFERENCE MEASUREMENT, FLOOR PLATE TO PEDAL EDGE -90 mm (-3.54 in.)
D. REFERENCE MEASUREMENT, COWL TO PEDAL EDGE -182 mm (-7.2 in.)
E. REFERENCE MEASUREMENT, COWL TO PEDAL EDGE -177 mm (-7.0 in.)

1. STOP SCREW
2. NUT
3. INCH/BRAKE PEDAL
4. STOP PEDAL PAD
5. ROD END PIN
6. COTTER PIN
7. SPRING
8. BUTTON-HEAD SCREW
9. FLANGE BUSHING
10. RETURN SPRING LINK
11. WASHER
12. CLEVIS
13. STOP PEDAL DIAMOND PLATE

BRAKE PEDAL ADJUSTMENT WITH DUAL PEDAL OPTION

Pedal Adjustment

1. Install stop screw through hole in brake pedal. See Figure 200.
2. Apply layer of multi-purpose grease to rod end pin and with twisting motion, insert through clevis of master cylinder and pedal. Install cotter pin through rod end pin. See Figure 200.
3. Apply layer of multi-purpose grease to socket screw, and with twisting motion, insert through return spring link and washers, then thread into pedal arm. See Figure 200.
4. Adjust stop screw (item 1, Figure 200) until a measurement (Dim C) of 90 mm (3.54 in.) from top surface of floorplate to upper rear edge of brake pedal has been achieved.
5. Torque nut (item 3, Figure 200) to 8.5 to 9.5 N•m (6.3 to 7 lbf ft) while keeping stop screw fixed.

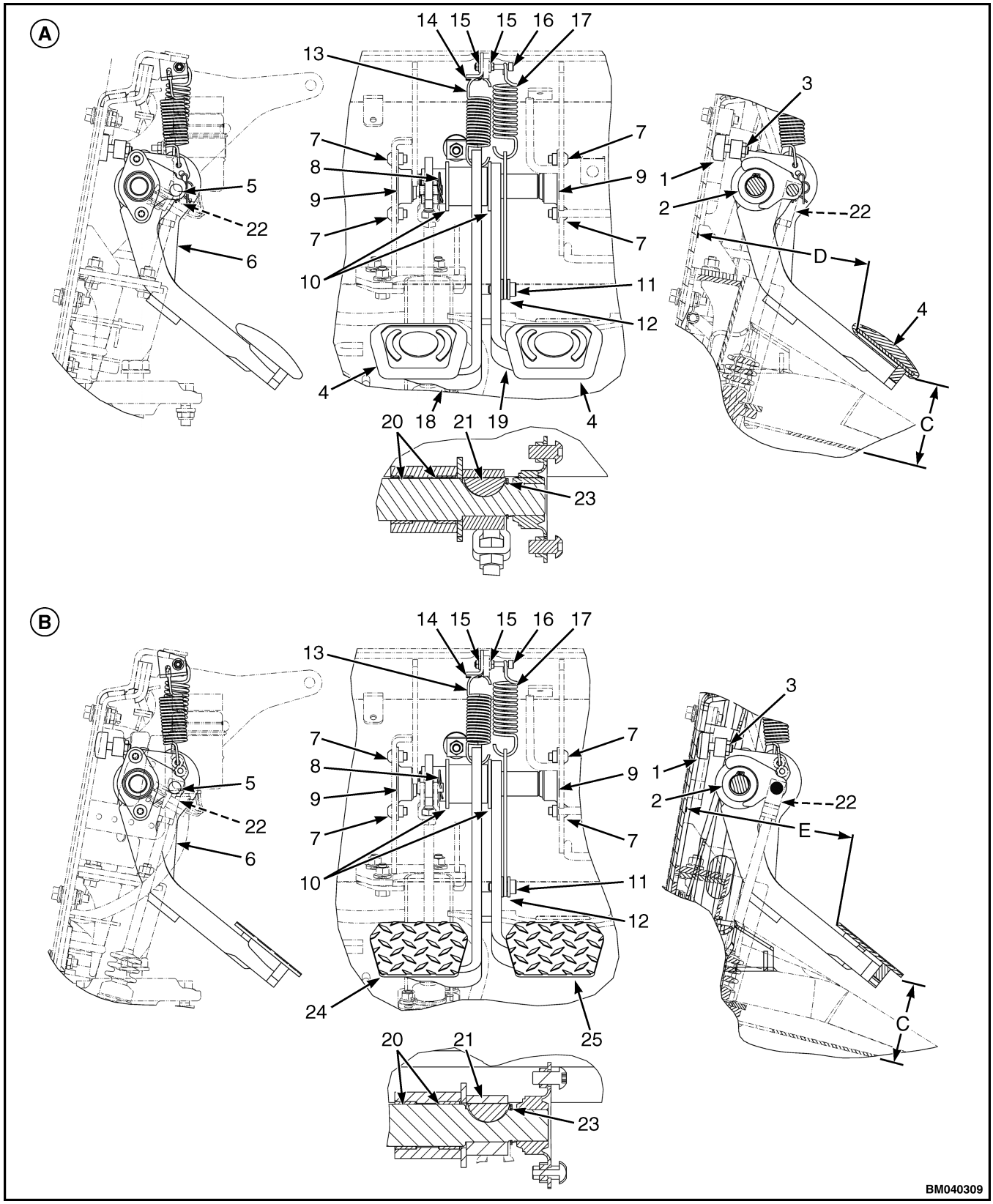


Figure 200. Brake Pedal Adjustment, Dual Pedal

Legend for Figure 200.

NOTE: SOME PARTS ARE REMOVED FOR CLARITY.

A. INCHING AND BRAKE PEDALS WITH PAD
B. INCHING AND BRAKE PEDALS WITH DIAMOND PLATE
C. REFERENCE MEASUREMENT, FLOOR PLATE TO PEDAL EDGE -90 mm (-3.54 in.)
D. REFERENCE MEASUREMENT, COWL TO PEDAL EDGE -179.5 mm (-7.10 in.)
E. REFERENCE MEASUREMENT, COWL TO PEDAL EDGE -174.9 mm (-6.89 in.)

1. STOP SCREW
2. INPUT CRANK
3. NUT
4. STOP PEDAL PAD
5. ROD END PIN
6. RETURN SPRING LINK
7. BUTTON-HEAD SCREW
8. COTTER PIN
9. BUSHING
10. WASHER
11. SOCKET SCREW
12. WASHER
13. OUTER SPRING
14. SPRING MOUNT BRACKET
15. NUT
16. CAPSCREW
17. SPRING
18. INCHING PEDAL
19. BRAKE PEDAL
20. BUSHING
21. KEY
22. CLEVIS
23. SNAP RING
24. INCHING PEDAL
25. BRAKE PEDAL

SERVICE BRAKES ADJUSTMENT 202001-265

The following procedure is for newly-installed brake shoes. If truck has been operated for more than 25 hours and pedal height is correct, the brakes normally will not need adjustment.

1. See the procedure **How to Put Lift Truck on Blocks** in **Operating Manual** or **Periodic Maintenance** manual for your truck. Put truck on blocks so drive wheels can be removed.
2. Remove rubber plug from lower inboard surface of each brake backing plate to gain access to the brake adjuster. Use an adjuster tool to rotate adjuster wheel so that the teeth of the wheel move downward. This adjustment expands brake shoes. Adjust brake shoes so that brake drum will not rotate.

NOTE: If the brake shoes are not replaced, loosen adjuster wheel approximately 10 teeth.

3. Push automatic adjuster lever away from adjuster wheel with a small screwdriver. Simultaneously, use adjuster tool to loosen adjuster wheel approximately 10 teeth.
4. Install drive wheels. See Tires and Wheels section in **Frame and Main Components** 8000SRM2306.
5. Remove truck from blocks. Operate truck in **FORWARD** and **REVERSE** directions. Stop truck 10 times in each direction. This procedure causes brake shoes to wear a small amount and fit brake drum better.

BRAKE SYSTEM 202001-266

BRAKE SYSTEM AIR REMOVAL

There are two commonly used methods to remove air from brake systems. The preferred method is using a pressure bleed system. The other method is by applying pressure using the brake pedal.

NOTE: Two people are required for the two procedures below to properly bleed brake system.

Using Pressure Bleed System

NOTE: Adjust service brakes before air is removed from brake system.

1. Fill brake fluid reservoir with brake fluid.
2. Place one end of a rubber hose on bleeder screw of each wheel cylinder. Place the other end of each hose into a container.
3. Connect a pressure bleeder to brake fluid reservoir.
4. Loosen bleeder screw at wheel cylinders one turn.

NOTE: While applying air pressure to pressure bleeder, check level of the brake fluid in reservoir for master cylinder. Make sure to maintain brake fluid at correct level to avoid forcing more air into brake system.

5. Apply 34.5 kPa (5 psi) of air pressure to pressure bleeder, forcing fluid through the lines until all air is removed from system. Close bleeder screws.
6. Check level of brake fluid in reservoir for master cylinder. Fill brake fluid reservoir to correct level.

Using Brake Pedal Pressure

NOTE: Adjust service brakes before the air is removed from brake system.

1. Fill brake fluid reservoir with brake fluid.
2. Place one end of a rubber hose on bleeder screw of each wheel cylinder. Place the other end of each hose into a clear container of brake fluid.

NOTE: Check level of brake fluid in reservoir for master cylinder during procedures. Make sure to maintain brake fluid at the correct level.

a. Push brake pedal and hold.
b. Slightly open bleed screw to vent fluid.
c. Near end of pedal stroke, close bleed screw.
d. If needed, fill reservoir again before repeating Step a through Step c.

3. Repeat procedures in Step 1 through Step d until there are no air bubbles in the brake lines.

4. Repeat procedures for remaining wheel cylinder.

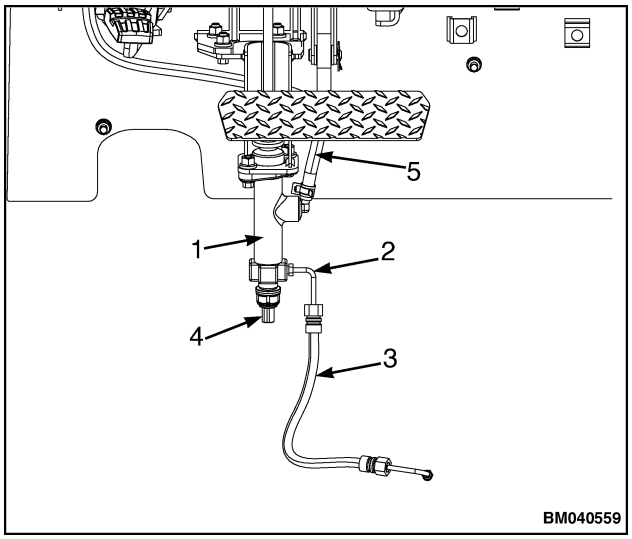
5. Check level of brake fluid in reservoir for master cylinder. Fill brake fluid reservoir to correct level.

MASTER CYLINDER REPAIR 202001-542

REMOVE (DRY BRAKE)

1. Remove floor plate, kick plate, and seal plate from the lift truck for access to the master cylinder. See **Covers repair** in **Frame and Main Components** 8000SRM2306.

2. Remove the brake hydraulic hose (item 3, Figure 201) and tube (item 2) from the master cylinder. Disconnect wire at brake pressure transducer, connected to the bottom of master cylinder and remove pressure transducer.



1. MASTER CYLINDER
2. HYDRAULIC TUBE
3. HYDRAULIC HOSE
4. PRESSURE TRANSDUCER
5. BRAKE SUPPLY HOSE

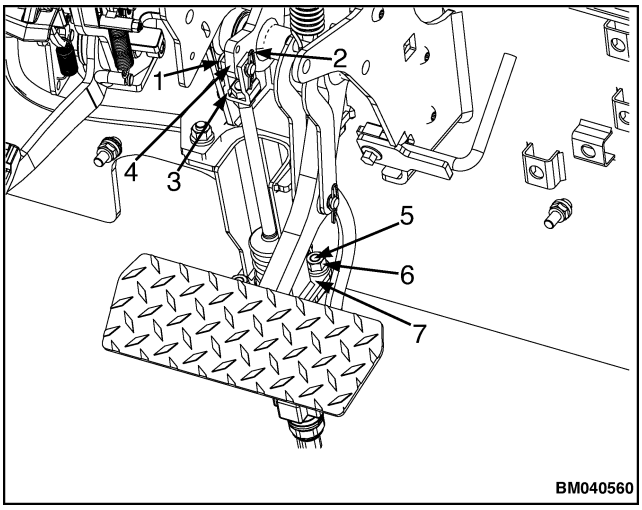
Figure 201. Master cylinder connections (dry brake)

3. Disconnect the wire connector at the brake pressure transducer (item 4, Figure 201) connected to the bottom of master cylinder (item 1) and remove the pressure transducer.

4. Disconnect the brake supply hose (item 5, Figure 201) from the master cylinder. Plug the hose to prevent the reservoir from draining.

5. Remove cotter pin (item 2, Figure 202) and clevis pin (item 1) that attaches the master cylinder to the brake pedal linkage (item 4).

6. Remove capscrews (item 5, Figure 202) and nuts (item 6) that hold the master cylinder to the bracket assembly (item 7).



1. CLEVIS PIN
2. COTTER PIN
3. MASTER CYLINDER
4. BRAKE PEDAL LINKAGE
5. CAPSCREW
6. NUT
7. BRACKET

Figure 202. Master cylinder (dry brake)

DISASSEMBLE (DRY BRAKE)

CAUTION

When the piston is removed or installed, make sure the cylinder bore and piston are not scratched or damaged.

1. Remove the clevis, push rod, nut, boot, fitting, and seal. See Figure 203.

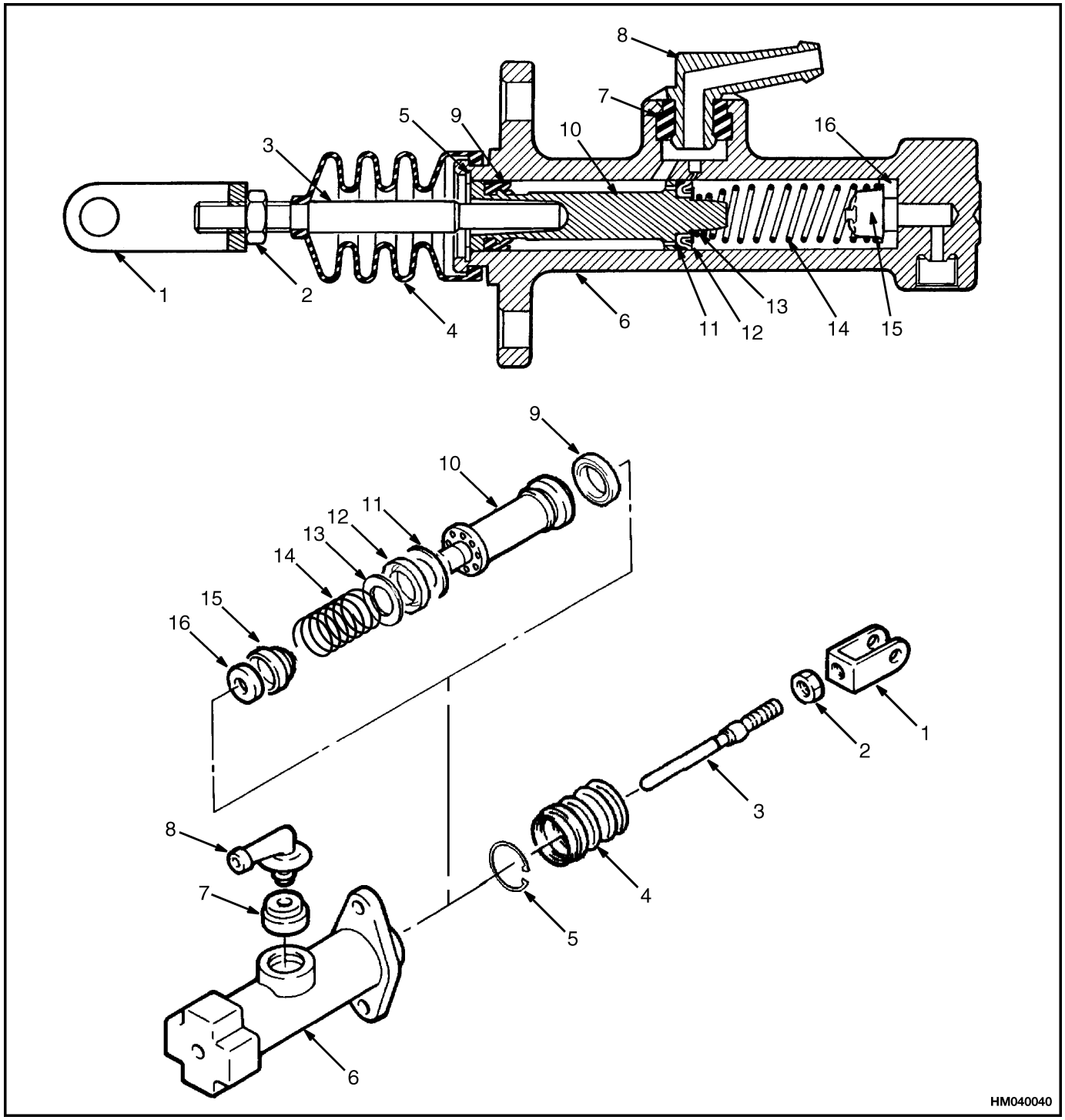


Figure 203. Master Cylinder (Dry Brake)

Legend for Figure 203.

1. CLEVIS
2. NUT
3. PUSH ROD
4. BOOT
5. SNAP RING
6. CYLINDER HOUSING
7. SEAL
8. FITTING
9. PISTON SEAL
10. PISTON
11. SPACER
12. PISTON CUP
13. RETAINER
14. SPRING
15. CHECK VALVE
16. VALVE SEAT

2. Remove snap ring, piston seal, and piston.

3. Remove spacer, piston cup, retainer, spring, check valve, and valve seat.

NOTE: Install new seals when the master cylinder is disassembled for repair.

CLEAN AND INSPECT (DRY BRAKE)

CAUTION

DO NOT use an oil solvent to clean the master cylinder, wheel cylinder, or brake linings. Use a solvent approved for cleaning of brake parts. Do not permit oil or grease in the brake fluid or on the linings.

Inspect the bore of the master cylinder for holes or scratches. Replace the master cylinder assembly, if there is damage.

ASSEMBLE (DRY BRAKE)

1. Install valve seat, check valve, spring, retainer, piston cup, and spacer.

2. Install the piston, piston seal, and snap ring.

3. Install seal, fitting, boot, nut, push rod, and clevis.

BENCH BLEED MASTER CYLINDER (DRY BRAKE)

NOTE: Master cylinder must be bench bled before installing it on the lift truck.

1. Place the master cylinder horizontally in a soft-jawed vise.

2. Connect the brake fluid reservoir supply hose to the master cylinder.

3. Connect hoses to the pressure ports of the master cylinder. Place other end of hoses in a clear container of brake fluid.

4. Fill the reservoir with brake SAE J-1703 (DOT 3) or SAE J-1704 (DOT 4) brake fluid.

5. Stroke the master cylinder until all air is purged from the master cylinder.

INSTALL AND ADJUST (DRY BRAKE)

1. Install brake fluid reservoir, supply hose, and master cylinder on lift truck as an assembly. Install capscrews and nuts that hold master cylinder to bracket assembly. See Figure 202.

2. Install brake hydraulic line on master cylinder.

3. Screw assembly of brake pressure transducer into master cylinder and tighten to standard torque.

4. Orient master cylinder side of brake hose assembly parallel with brake pressure transducer.

5. Tighten fitting nuts at each end of brake hose assembly to standard torque.

6. Apply a layer of multipurpose grease to the clevis pin and, with twisting motion, insert through clevis and the inching/brake pedal. Install cotter pin into the clevis pin.

7. Adjust free pedal per the following procedure:

a. Loosen the nut 1/4 turn clockwise and hold both lower and upper nut from rotation with respect to clevis (pinch both with clevis between the thumb and fingers).

b. Turn the push rod counterclockwise, as viewed from top, until push rod can be moved from side to side.

c. Turn push rod clockwise until it can no longer be moved from side to side.

d. Turn push rod counterclockwise 1.0 to 1.5 turns.

e. Tighten nut to 17 to 23 N•m (13 to 17 lbf ft).

f. Verify free pedal is 7 to 11 mm (0.39 to 0.47 in.). See Brake pedal adjustment.

8. Flush with brake fluid and air bleed the brake system. See Brake System Air Removal in Brake system.

9. Adjust fluid level until level is within 2.5 mm (0.098 in.) of MAX line or 5 to 7.5 mm (0.19 to 0.29 in.) above large rib on reservoir if MAX line is not present.

10. Verify all connections are leak-free.

11. Install floor plate, kick plate, and seal plate on lift truck. See **Covers repair** in **Frame and Main Components** 8000SRM2306.

12. Check adjustment of brake pedal as described in Brake pedal adjustment.

REMOVE (WET BRAKE)

1. Remove rubber floor mat, rear floor plate, forward floor plate (fastened into the truck), and lower dash panel from truck for access to master cylinder. If necessary, remove seal/trim panel to improve access to master cylinder hardware. See **Covers repair** in **Frame and Main Components** 8000SRM2306.

2. Disconnect electrical connector from pressure transducer. See Figure 204.

3. Disconnect brake fluid supply hose from master cylinder. Plug brake fluid supply hose to prevent reservoir from draining.

4. Remove brake fluid reservoir and brake fluid supply hose from lift truck.

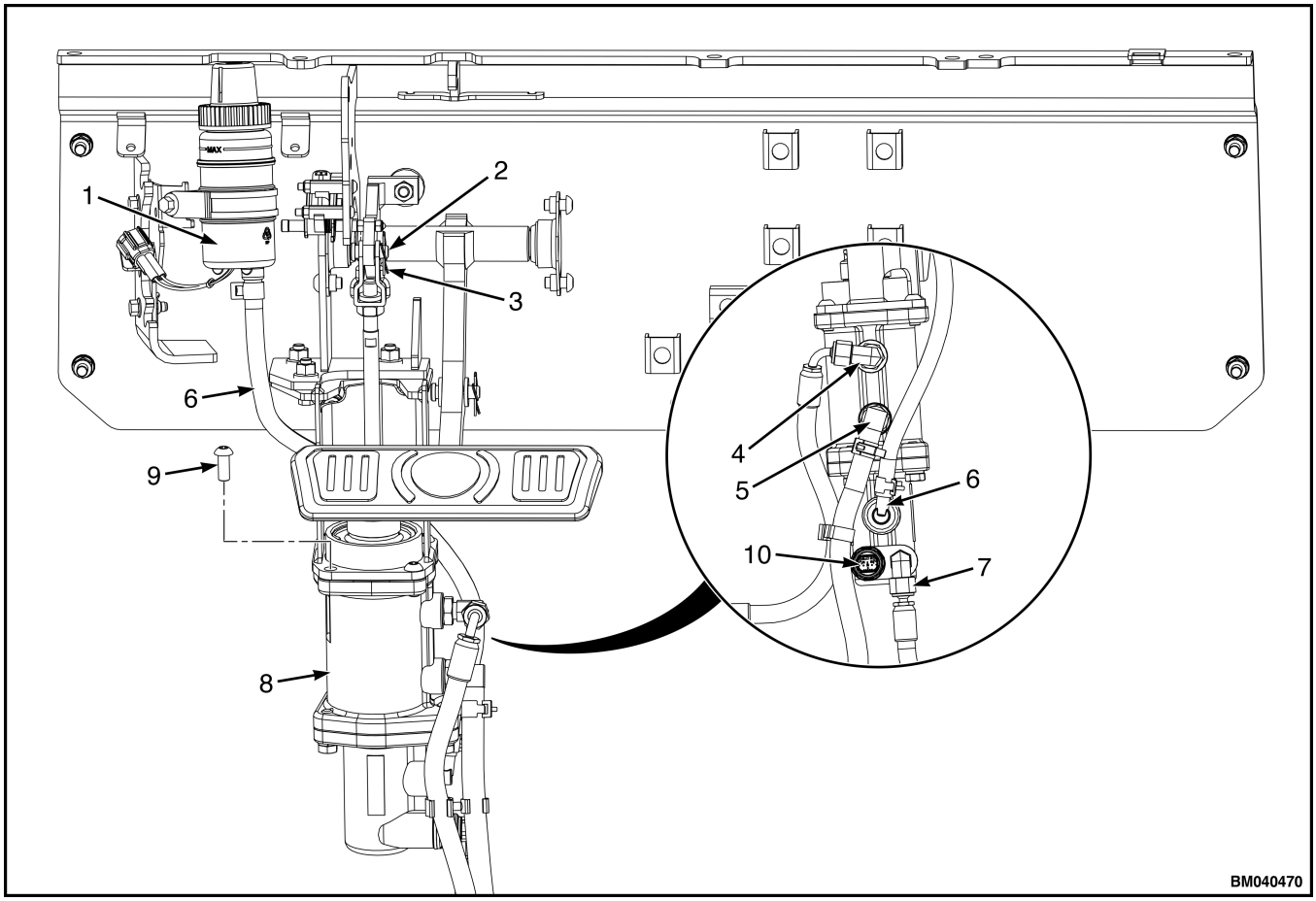
5. Disconnect brake hose assembly from bottom of master cylinder. Plug master cylinder and brake hose to prevent loss of fluid.

6. Disconnect brake boost supply hose from master cylinder. Plug master cylinder and brake boost supply hose to prevent loss of fluid.

7. Disconnect brake boost return hose from master cylinder. Plug master cylinder and brake boost return hose to prevent loss of fluid.

8. Remove cotter pin and rod end pin that attach master cylinder to brake input crank.

9. Remove four cap screws that hold master cylinder to bracket assembly. Remove master cylinder.



1. BRAKE FLUID RESERVOIR
2. ROD END PIN
3. COTTER PIN
4. BRAKE BOOST SUPPLY HOSE
5. BRAKE BOOST RETURN HOSE
6. BRAKE FLUID SUPPLY HOSE
7. BRAKE HOSE ASSEMBLY
8. MASTER CYLINDER
9. CAP SCREW
10. PRESSURE TRANSDUCER

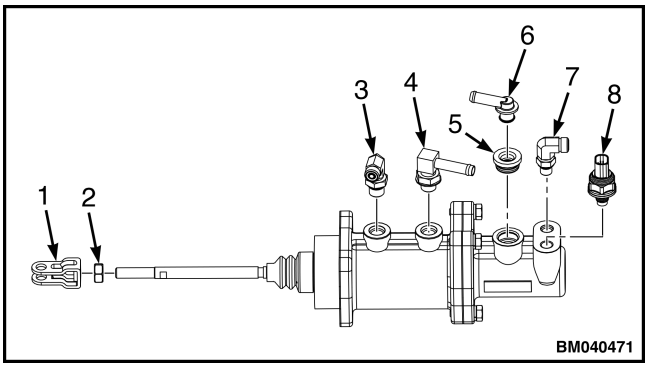
Figure 204. Master Cylinder and Reservoir Assembly

DISASSEMBLE (WET BRAKE)

CAUTION

When the piston is removed or installed, make sure the cylinder bore and piston are not scratched or damaged.

1. Place master cylinder and booster into a soft jawed vise.
2. Remove nut and clevis from push rod. See Figure 205.
3. Tag and remove four fittings and one gasket from master cylinder.
4. Remove pressure transducer.



1. CLEVIS
2. NUT
3. FITTING
4. FITTING
5. GASKET
6. FITTING
7. FITTING
8. PRESSURE TRANSDUCER

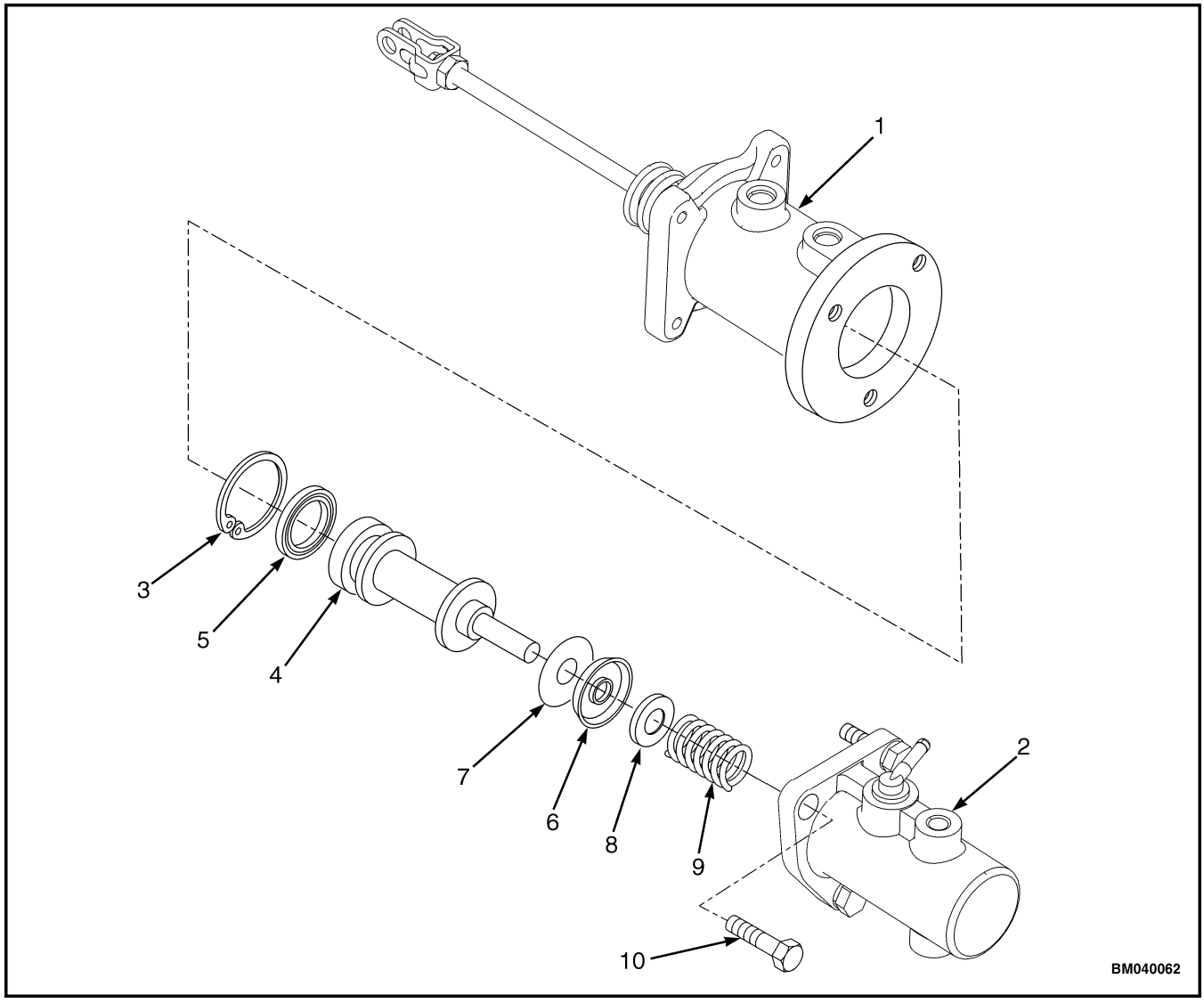
Figure 205. Master Cylinder

5. Remove three mounting bolts and the master cylinder from booster. See Figure 206.

WARNING

Piston is under extreme pressure. Use care when removing snap ring to avoid possible injury.

6. Remove the internal snap ring holding the piston.
7. Remove the piston.
8. Remove the spring and retainer from the bore.
9. Remove and discard the pressure seal from the spring end of the piston.
10. Remove the washer between the pressure seal and the piston.
11. Remove and discard the retaining seal from the piston. Note the position of the seal.



1. BOOSTER ASSEMBLY
2. HOUSING (MASTER CYLINDER)
3. SNAP RING
4. PISTON
5. RETAINING SEAL
6. PRESSURE SEAL
7. WASHER
8. RETAINER
9. SPRING
10. CAPSCREW

Figure 206. Master cylinder and booster (wet brake)

CLEAN AND INSPECT (WET BRAKE)

WARNING

Small amounts of water in the brake system can cause reduced braking performance if the water reaches the wheel cylinders and is subject to high temperatures. DO NOT allow water entry into the brake system. If water is present, remove all water and refill the system with Dexron III from a sealed container. Unfiltered shop air can contain substantial amounts of water, therefore, DO NOT use unfiltered shop air to blow out components.

CAUTION

DO NOT permit brake cleaning fluid to contact master cylinder or wheel cylinders. Brake cleaning fluid will cause damage and leaks in seals of the brake system.

Inspect the bore of the master cylinder and the bore of the Booster Assembly for holes and scratches. Replace the master cylinder and booster assembly if there is damage. See Figure 206.

Inspect wheel and master cylinder parts for dirt or water. Clean any dirt or water present in wheel and master cylinder parts using a clean lint free cloth.

ASSEMBLE (WET BRAKE)

NOTE: Install new seals when the master cylinder is being assembled.

1. Install the new retaining seal on the piston, as noted during removal.
2. Install the washer between the pressure seal and the piston.
3. Install the new pressure seal and retainer over the spring end of the plunger.
4. Install the retainer spring and piston into the bore of the master cylinder.
5. Install the internal snap ring holding the piston.
6. Install the master cylinder on the booster assembly with three bolts and tighten to 49 to 59 N•m (36 to 43 lbf ft).
7. Install pressure transducer onto master cylinder. Tighten to 23 to 28 N•m (17 to 20 lbf ft). See Figure 205.
8. Install four fittings and one gasket onto master cylinder.
9. Install nut and clevis on push rod.

BENCH BLEED MASTER CYLINDER (WET BRAKE)

NOTE: Master cylinder must be bench bled before installing it on the truck.

1. Place the master cylinder horizontally in a softjawed vice.
2. Connect the brake fluid supply hose to the master cylinder.
3. Connect hoses to the pressure ports of the master cylinder. Place other end of hoses in a clear container of brake fluid.
4. Fill the reservoir with brake fluid, SAE J-1703 (DOT 3).
5. Stroke the master cylinder until all air is purged from the master cylinder.

INSTALL AND ADJUST (WET BRAKE)

WARNING

Small amounts of water in the brake system can cause reduced braking performance if the water reaches the wheel cylinders and is subject to high temperatures. DO NOT allow water entry into the brake system. If water is present, remove all water and refill the system with Dexron III from a sealed container. Unfiltered shop air can contain substantial amounts of water, therefore, DO NOT use unfiltered shop air to blow out components.

NOTE: The master cylinder uses Dexron III oil. For the correct amount of oil used see the Maintenance Schedule.

1. Install master cylinder and four capscrews onto bracket assembly.

2. Apply a layer of multipurpose grease to rod end pin and, with twisting motion, insert rod end pin through clevis and brake input bracket. Install cotter pin into rod end pin.

3. Remove plugs and connect brake hose assembly to bottom of master cylinder.

4. Install brake fluid reservoir and brake fluid supply hose on lift truck.

5. Remove plugs and connect brake fluid supply hose to master cylinder.

6. Remove plugs and connect brake boost supply hose to master cylinder.

7. Remove plugs and connect brake boost return hose to master cylinder.

8. Orient master cylinder side of brake supply and return lines parallel with brake pressure transducer.

9. Tighten fitting nuts at each end of brake hose assembly to 13 to 17 N•m (115 to 150 lbf in).

10. Adjust pedal using following procedure:

    a. Loosen nut (A, Figure 207) and screw it away from clevis (B, Figure 207).

    b. Turn push rod (C, Figure 207) counter-clockwise, as viewed from top, until push rod can be moved from side to side along pin (E, Figure 207).

    c. Turn push rod (C, Figure 207) clockwise, as viewed from top, until it can no longer be moved from side to side.

    d. Turn push rod (C, Figure 207) counter-clockwise 0.5 to 1.0 turns.

    e. Tighten nut (A, Figure 207) against clevis (B, Figure 207) to 20 ±3 N•m (177 ±26.5 lbf in).

    f. Verify pedal free play (D, Figure 207) is 3 to 7 mm (0.12 to 0.28 in.) from crown of pedal. Free play is pedal travel from pedal-up position to initial contact with clevis, pin,pedal crank, and the push rod touches master cylinder input plunger.

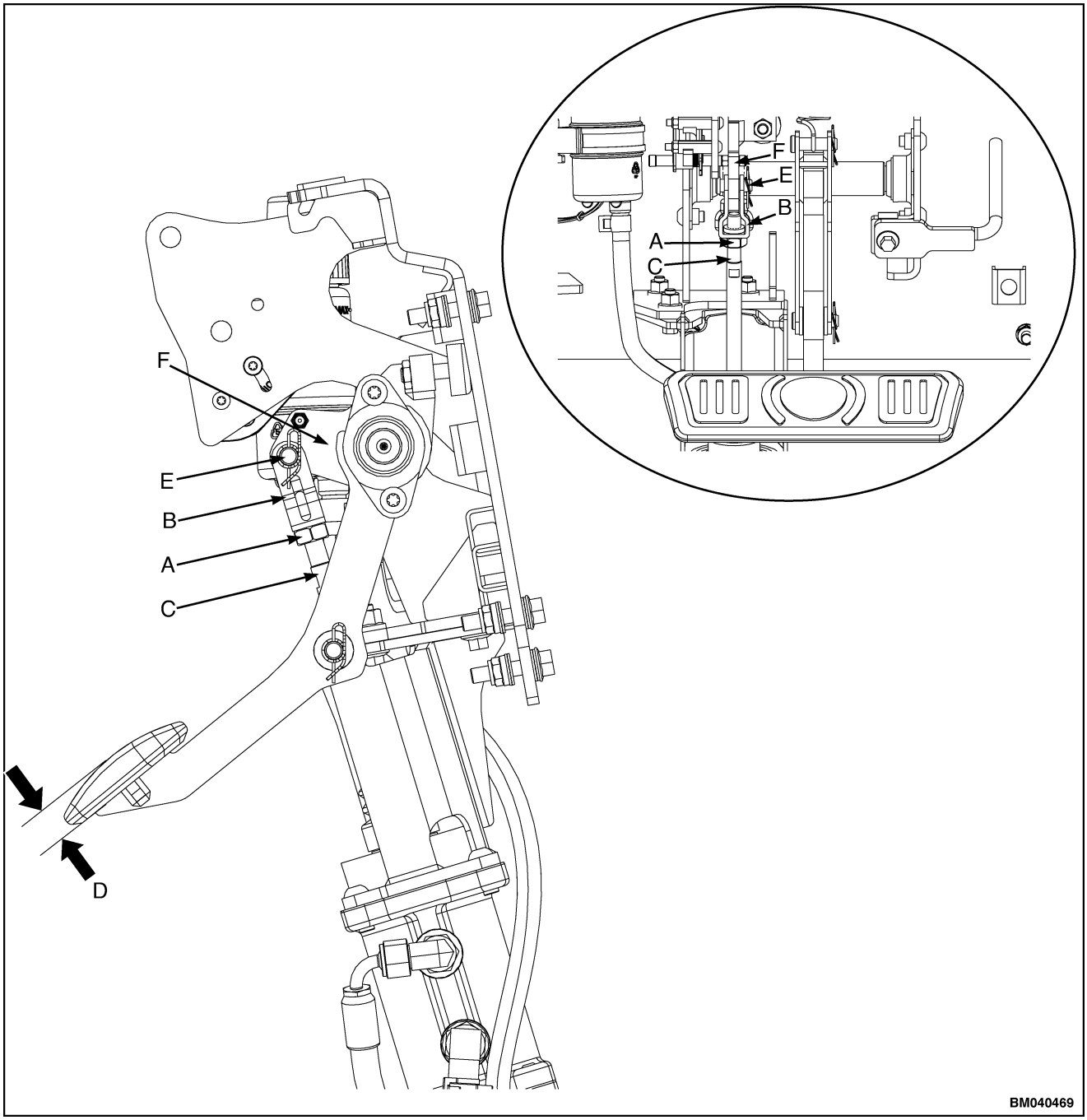
11. Flush with brake fluid and air bleed system.

12. Adjust fluid level until level is within 2.5 mm (0.12 to 0.098 in.) of MAX line.

13. Verify all connections are leak-free.

14. Install floor plate, kick plate, and seal plate on truck. See **Covers repair** in **Frame and Main Components** 8000SRM2306.

15. Check adjustment of brake pedal as described in Brake pedal adjustment with single pedal option or Brake pedal adjustment with dual pedal option.



A. NUT
B. CLEVIS
C. PUSH ROD
D. PEDAL FREE PLAY
E. PIN
F. CRANK

Figure 207. Pedal Free-Play Adjustment

Steer axle repair

SYNCHRONOUS STEER AXLE REPAIR 202001-059

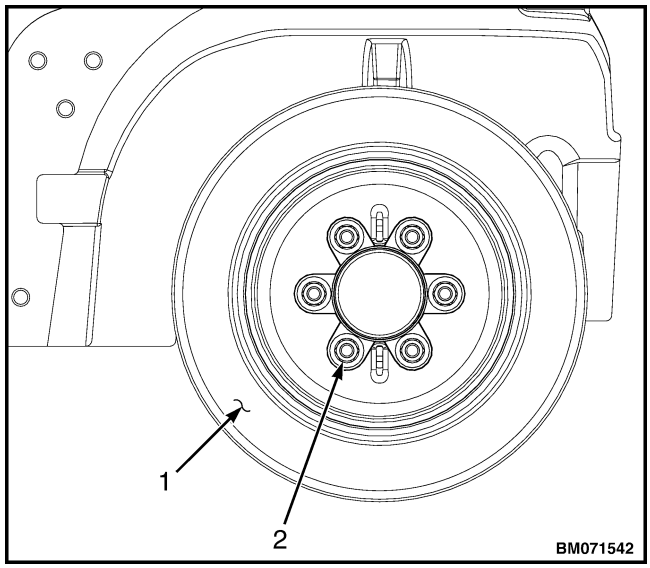
STEER AXLE ASSEMBLY

Remove

1. Lift truck must be on blocks so the steering axle will have enough clearance to be removed. The top of the axle frame must have clearance under the bottom of the frame at the rear of the lift truck. See section **How to Put a Lift Truck on Blocks** in **Operating Manual** or **Periodic Maintenance** 8000SRM2305.

2. Verify the wheels are set for straight travel.

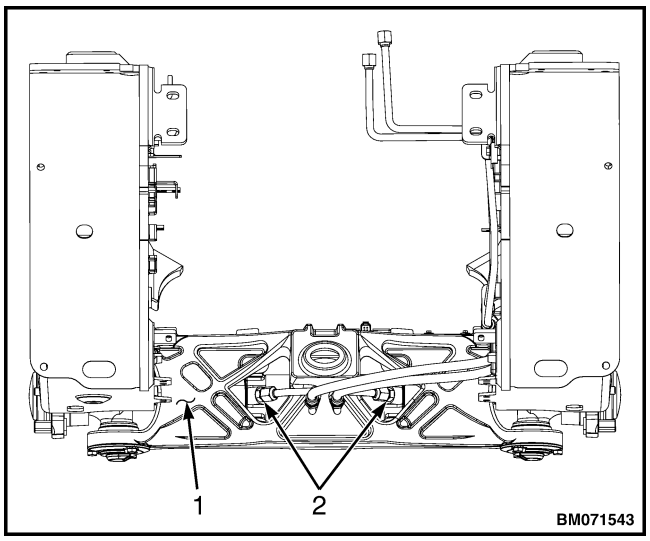
3. Loosen the lug nuts and remove the two steer tires and wheels. See Figure 208.



1. STEER TIRE AND WHEEL ASSEMBLY
2. LUG NUT

Figure 208. Steer Tire and Wheel

4. Disconnect the hydraulic lines at the steering cylinder and cap lines. See Figure 209.



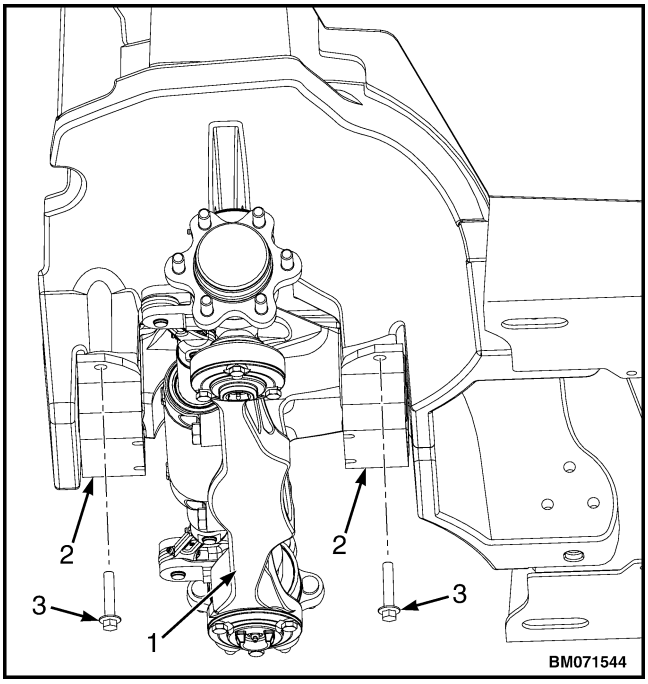
1. STEER AXLE
2. STEER HOSES

Figure 209. Steer Hoses

5. Install plug fittings in cylinder. Plug fittings will prevent spindles from turning as axle is removed from under the lift truck.

6. Slide a floor jack or the forks of another lift truck under steering axle, and raise until the weight of the axle assembly is supported.

7. Remove the four capscrews that fasten the two mounting brackets under the rubber mounts to the frame. See Figure 210.



1. STEER AXLE
2. MOUNTING BRACKET
3. CAPSCREW

Figure 210. Steer Axle Mounting

8. Remove the steer axle from the frame.

Disassemble

1. Disconnect steering sensor wire harness from steering axle jumper wire harness, connected to chassis harness.

2. Remove capscrews, insulated clamps, and washers from steer axle and wire harness. See Figure 211.

3. Remove two capscrews, steering sensor wire harness, and cap from left-hand side of steer axle. See Figure 211.

4. Remove screws securing magnet to top of left-hand spindle. Remove plug from top of right-hand spindle. See Figure 211.

5. Place steer axle on blocks so wheels just touch the floor.

6. Remove hub cap. See Figure 211.

7. Remove and discard cotter pin, nut-spindle and washer from hub. See Figure 211.

NOTE: Identify and tag the outer and inner bearing cones so they can be reassembled in their original locations.

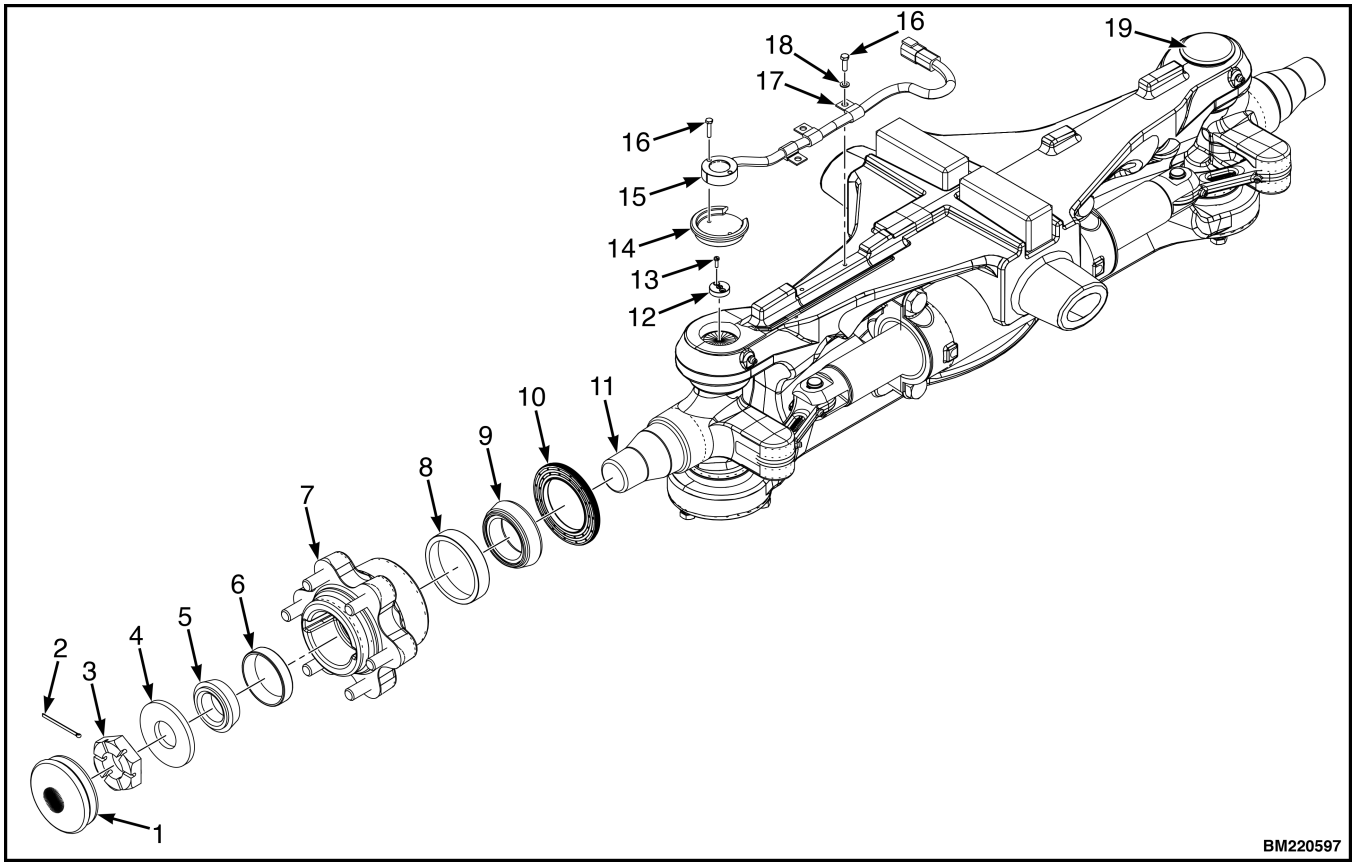
8. Remove outer bearing cone and outer bearing cup from spindle. See Figure 211.

9. Slide hub from spindle. See Figure 211.

NOTE: If bearings are to be replaced, bearing cup and cone must be replaced as an assembly. Use a brass drift pin to remove bearing assembly.

10. Remove inner bearing cup, inner bearing cone, and oil seal from spindle. See Figure 211.

11. Repeat Step 6 through Step 10 for the other wheel.



1. HUB CAP
2. COTTER PIN
3. NUT-SPINDLE
4. WASHER
5. OUTER BEARING CONE
6. OUTER BEARING CUP
7. HUB
8. INNER BEARING CUP
9. INNER BEARING CONE
10. OIL SEAL
11. SPINDLE
12. MAGNET
13. SCREW
14. CAP
15. STEERING SENSOR WIRE HARNESS
16. CAPSCREW
17. INSULATED CLAMP
18. WASHER
19. PLUG

Figure 211. Hub

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

WARNING

Compressed air is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

1. Clean bearings by placing them in a wire basket and immersing in a container of fress solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.

2. After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.

3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.

Inspect

1. Inspect for loose, burned, missing, cracked or damaged hardware.

2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion, or marred finish.

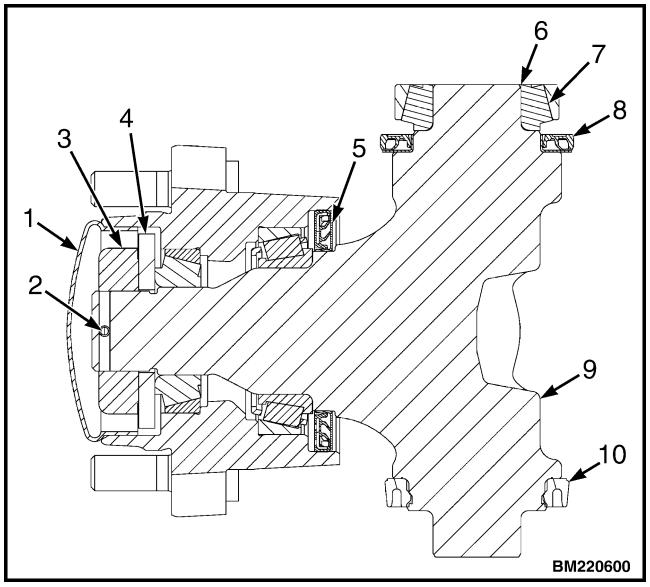
NOTE: If the spindle, bearings or tie rods need to be repaired, see Spindles, Bearings, and Tie Rods.

Assemble

NOTE: For specified lubricant to use, refer to **Periodic Maintenance** 8000SRM2305.

1. If necessary, use a press to install new bearing cups in hub, with markings facing outside. See Figure 212.

2. Lubricate bearing cones with multipurpose grease. Verify bearings are filled with grease. Install oil seal, inner bearing cup and inner bearing cone on the spindle. See Figure 212.



1. HUB CAP
2. PIN
3. NUT-SPINDLE
4. WASHER
5. SEAL
6. ROLLER BEARING CONE
7. ROLLER BEARING CUP
8. SEAL
9. SPINDLE
10. SEAL

Figure 212. Bearing Arrangement

CAUTION

DO NOT damage the seals during installation.

3. Carefully slide the hub onto the spindle. See Figure 212.

4. Install outer bearing cup and outer bearing cone. Install washer. See Figure 212.

NOTE: Ensure that the washer is seated properly against the bearing cone and not against the shaft shoulder before tightening the nut-spindle.

5. Install nut-spindle and tighten as follows:

   a. Tighten nut-spindle to 200 N•m (147.5 lbf ft) while rotating the wheel.

   b. Loosen nut-spindle until wheel turns freely with no end play.

c. Tighten nut-spindle to 12 to 15 N•m (8.9 to 11.1 lbf ft), then lock in place at nearest alignment position.

6. Install new cotter pin in nut-spindle. If the cotter pin cannot be installed, tighten the nut-spindle to the first alignment position where the cotter pion can be installed. See Figure 212.

7. Make sure the mating surfaces of the hub and cap are clean and install the hub cap. See Figure 212.

8. Repeat Step 1 through Step 7 for the other wheel.

NOTE: Air gap between magnet and sensor must not exceed 8 mm (0.31 in.).

9. Install screws and magnet on top of left-hand spindle. Install plug on top of right-hand spindle. See Figure 211.

NOTE: Chamfer of cap and steer axle must contact each other. Cap must be aligned with machining of steer axle. Sensor must be installed with resin side upward.

10. Apply pipe thread sealant and install steering sensor wire harness, cap, and two capscrews on left-hand side of steer axle. Tighten capscrews to 3.5 to 4.0 N•m (31.0 to 35.4 lbf in). See Figure 211.

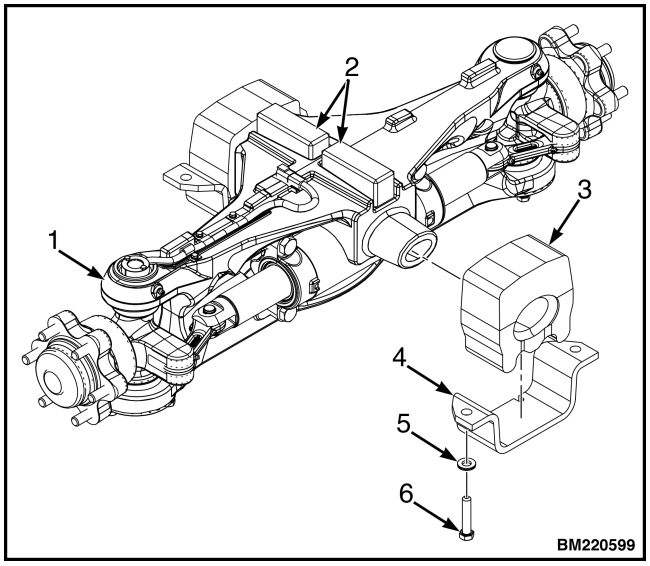
NOTE: Move any steering sensor wire harness slack towards center of axle to avoid the harness being pinched at pivot point.

11. Install capscrews, insulated clamps, and washers on wire harness and steer axle. See Figure 211.

12. Connect steering sensor wire harness to steering axle jumper wire harness, connected to chassis harness.

Install

1. Install rubber mounting and top mounts on the new axle with the part number away from the axle. Part number must be right side up after axle assembly is installed. See Figure 210.



1. STEER AXLE ASSEMBLY
2. TOP MOUNTS
3. RUBBER MOUNTS
4. MOUNTING BRACKET
5. WASHER
6. CAPSCREW

Figure 213. Rubber Mounts

2. Apply lubricant that is approved for use with rubber to the rubber mount, to ease assembly of the mount into frame and brackets.

3. Use a floor jack or another lift truck to lift the steering axle into position in the frame. Verify the rubber mounts fit securely inside the grooves on the frame. See Figure 210.

4. Install the mounting brackets and insert the capscrews and washers to attach the mounting brackets to the frame. See Figure 210.

5. Tighten the capscrews to 90 N•m (66.4 lbf ft). See Figure 210.

6. Remove plugs and caps and connect the hydraulic lines to the steering cylinder. See Figure 209.

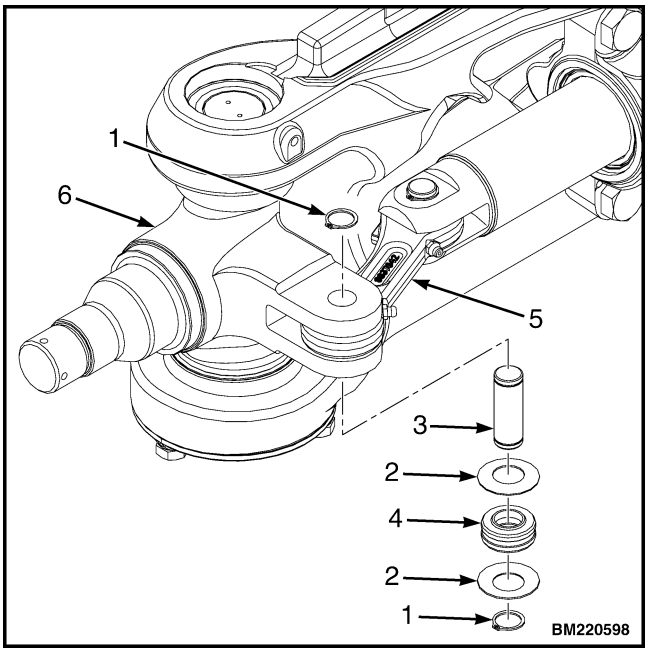
7. Operate steer system to remove air from system. Turn steering wheel several times from one stop to the other. Check for hydraulic leaks.

SPINDLES, BEARINGS, AND TIE RODS

Remove

1. Remove hub and bearings. See section Steer Axle Assembly.

2. Remove snap rings from pin holding tie rod to spindle assembly, then remove pin. If necessary, use a hammer and brass drift to remove pin. See Figure 214.



1. SNAP RING
2. WASHER
3. PIN
4. BUSHING
5. TIE ROD
6. SPINDLE

Figure 214. Tie Rod Components

3. Remove snap rings from pin holding tie rod to steering cylinder, then remove pin. If necessary, use a hammer and brass drift to remove pin. See Figure 214.

4. Remove tie rod from steering cylinder rod.

5. If necessary, repeat the procedure for the other spindle and tie rod.

Disassemble

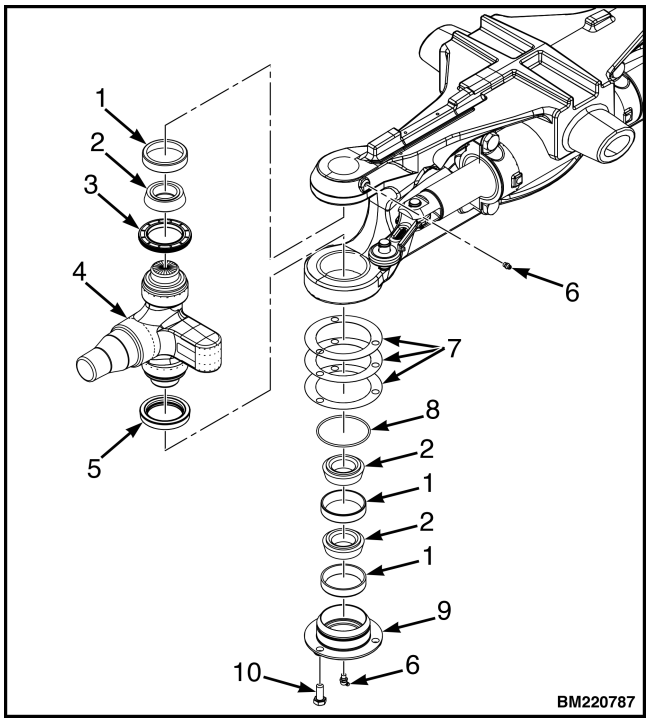
1. For right-hand side of steer axle, remove cap from spindle.

   For left-hand side of steer axle, cap and magnet were removed in Steer Axle Assembly, Disassemble procedures.

2. Remove capscrews from bearing cap. See Figure 215.

3. Remove bearing cap and shims. If necessary, remove bearing cups and bearing cones from bearing cap as shown in Figure 215.

4. Tilt spindle and lift from steer axle. If necessary, remove bearing cup, bearing cone, and seals from spindle. See Figure 215.



1. BEARING CUP
2. BEARING CONE
3. SEAL
4. SPINDLE LH
5. SEAL
6. GREASE FITTING
7. SHIMS
8. O-RING
9. BEARING CAP
10. CAPSCREW

Figure 215. Spindle Assembly

5. In necessary, repeat Step 2 through Step 4 for the other spindle and tie rod.

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

WARNING

Compressed air is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

1. Clean bearings by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearings in solvent to remove all traces of old lubricant.

2. After cleaning bearing, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.

3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.

Inspect

1. Inspect for loose, missing, cracked, burned, or damaged hardware.

2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion, or marred finish.

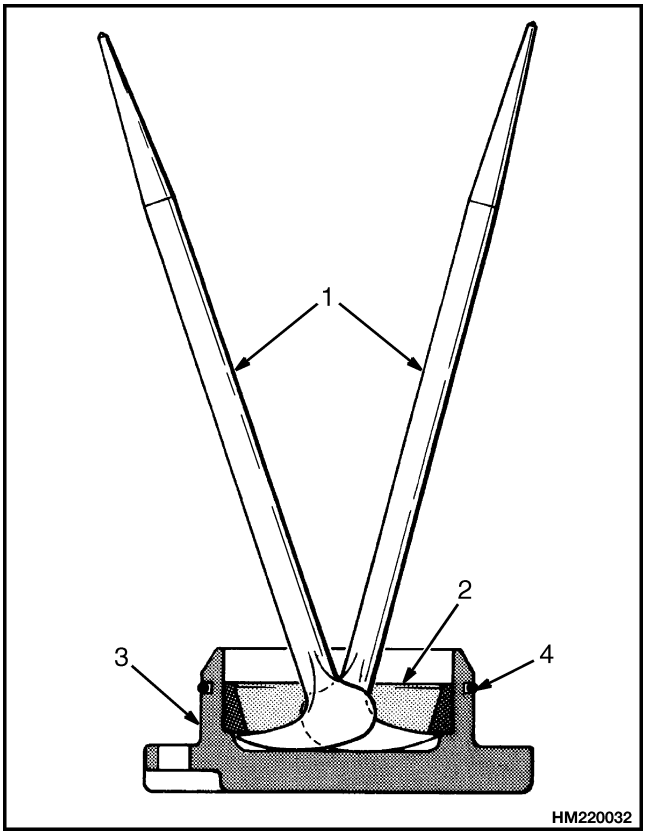
Assemble

1. Install new seals on spindle. Lubricate seals with grease. If necessary, press new bearing cones on spindle. See Figure 215.

2. Lubricate bearing cups and bearing cones with wheel bearing grease. If necessary, press new bearing cups into steering axle frame and bearing cap. See Figure 215.

3. Install spindle into steer axle. See Figure 215.

4. Install bearing cup into steer axle without shims. See Figure 216.



1. PRY BAR
2. BEARING CUP
3. BEARING CAP
4. O-RING

Figure 216. Bearing Cup Installation

5. Strike the cap (item 9, Figure 215) with a rubber mallet to ensure bearings are seated.

6. Re-tighten the three capscrews (item 10, Figure 215). Torque to 5 to 8 N•m (3.7 to 5.9 lbf ft).

7. Move spindle through the full range of motion three times.

8. Measure clearance between bearing cap and axle at three locations around the cap perimeter. See Figure 217.

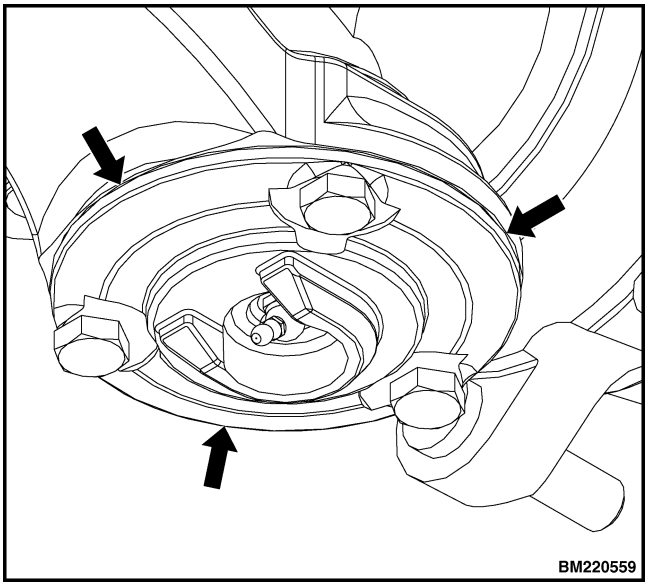


Figure 217. Measure Gap

9. Remove the three capscrews (item 10, Figure 215) and cap and install shims.

NOTE: The spindle bearings must have no clearance. Install shims as required until the gap of 0.00 to 0.13 mm (0.000 to 0.005 in.) is reached.

10. Install shims 0.00 to 0.13 mm (0.000 to 0.005 in.) less than the measured gap. See Figure 215 for shim placement.

11. Install O-ring on bearing cap. Apply Loctite® 242 to threads of capscrews. Install bearing cap and capscrews. Tighten capscrews to 44 to 55 N•m (32.5 to 40.6 lbf ft).

12. Use the grease fittings (item 6, Figure 215) on the upper and lower bearings and fill with grease.

13. If necessary, repeat Step 1 through Step 11 for the other spindle and tie rod.

Install

1. Install tie rod to spindle arm and steering cylinder.

2. Insert pin to retain tie rod to spindle arm. Secure pin with snap rings on top and bottom.

3. Repeat Step 2 for other end of tie rod, to secure tie rod to cylinder rod.

4. For left-hand side of steer axle, install magnet, cap and capscrews on spindle using procedure is described in Steer Axle Assembly, Assemble.

   For right-hand side of steer axle, install plug on spindle.

5. Install hub and bearings. See Steer Axle Assembly for procedures.

6. If necessary, repeat Step 1 through Step 5 for other spindle and tie rod.

STEERING CYLINDER

Remove and Disassemble

CAUTION

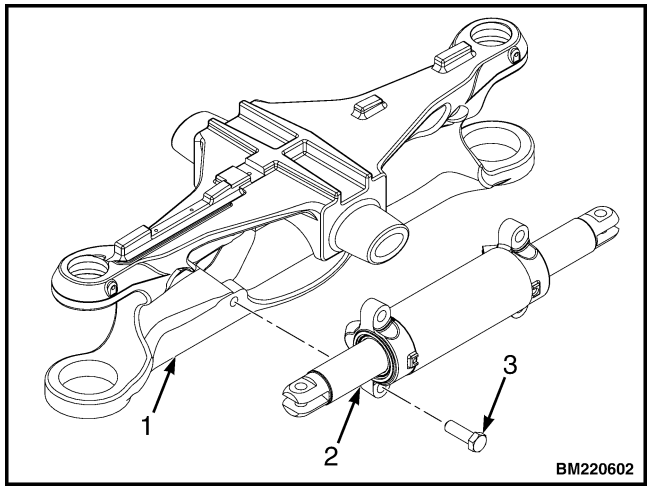
Disposal of lubricants and fluids must meet local environmental regulations.

NOTE: The end caps of steering cylinders are held in the shell by the installation of cylinder mount capscrews into axle frame. To prevent oil leaks at caps, hold caps on shell during removal.

1. Disconnect and tag hydraulic lines at steering cylinder. See Figure 209. Cap lines and fittings on cylinder.

2. Remove tie rods. See Spindles, Bearings, and Tie Rods section for procedures.

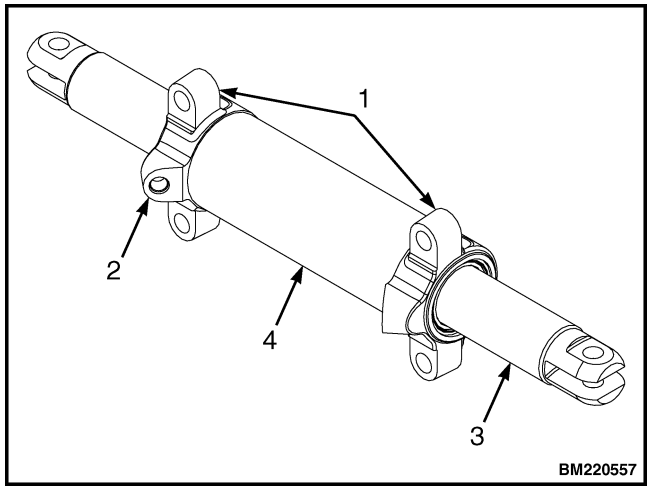
3. Remove capscrews that fasten steering cylinder to steer axle. See Figure 218.



1. STEER AXLE
2. STEERING CYLINDER
3. CAPSCREW

Figure 218. Steering Cylinder Mounting

4. Hold steering cylinder by end caps and remove from steer axle. See Figure 219.



1. END CAP
2. FITTING PORT
3. ROD
4. CYLINDER TUBE

Figure 219. Steering Cylinder End Caps

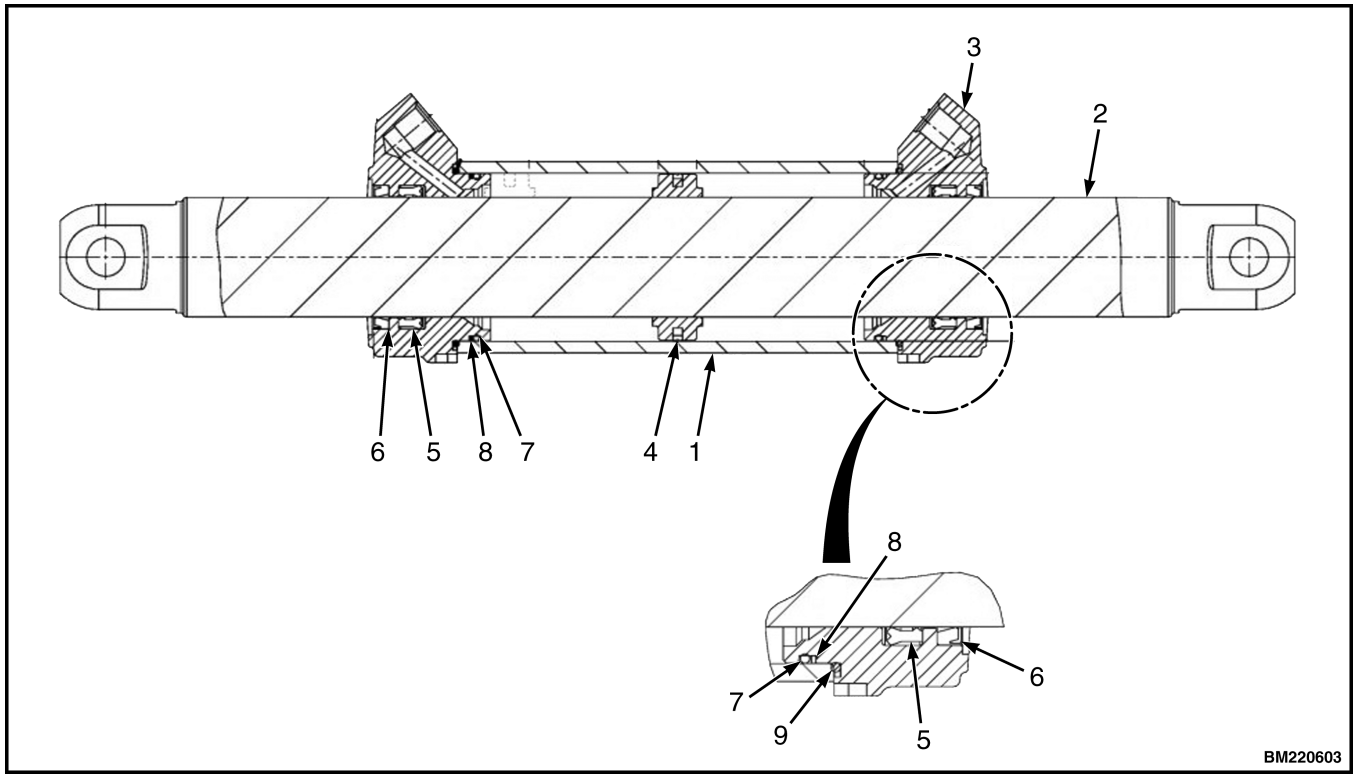
5. Hold one end of steering cylinder over a container to catch escaping hydraulic oil. Remove plug from fitting port on each end cap. Push rod toward the end of the cylinder tube that is over the container. Hydraulic oil will drain from cylinder. Repeat procedure for opposite end of cylinder.

6. Carefully remove one end cap from cylinder tube and slide it off the rod. Carefully pull rod out of cylinder tube, keeping rod centered in cylinder tube during removal.

7. Carefully remove other end cap from cylinder tube.

8. Remove all seals, wipers, and O-rings from cylinder rod. See Figure 220.

9. Remove piston seal from cylinder rod. See Figure 220.



1. CYLINDER TUBE
2. ROD
3. END CAP
4. PISTON SEAL
5. ROD SEAL
6. ROD WIPER
7. O-RING
8. BACKUP RING
9. O-RING

Figure 220. Steering Cylinder Components

Clean and Inspect

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

1. Clean all metal parts in solvent.
2. Inspect piston rod for grooves or damage. Remove small scratches with fine emery cloth.
3. Inspect cylinder bore for damage.
4. Inspect mounts for cracks.

Assemble and Install

1. Put O-rings, seals, and wipers in warm hydraulic oil.
2. Install O-rings, seals, and wipers as shown in Figure 220.
3. Lubricate O-rings, seals, and wipers with O-ring lubricant and carefully install one end cap on cylinder rod. See Figure 220.
4. Carefully slide cylinder rod into cylinder tube and end cap. Keep cylinder rod aligned in center of tube during installation so the parts are not damaged. Install the other end cap into the shell. Plug fitting ports of end caps.
5. Hold cylinder by end caps. Insert capscrews to install steering cylinder on steer axle frame. Tighten capscrews to 225 to 280 N•m (166 to 206.5 lbf ft).
6. Install tie rods. See Spindles, Bearings, and Tie Rods for procedures.

7. Remove plugs and caps then connect hydraulic lines, as tagged during removal, to steering cylinder. See Figure 209.

8. Operate steering system to remove air from cylinders and system. Run steering wheel several times from one stop to the other. Check that the steer cylinder operates lock to lock.

9. Install the two steer wheels. See Figure 208.

10. Install lug nuts to secure the wheels. Torque to 155-175 N•m (114-129 lbf ft).

NON-SYNCHRONOUS STEER AXLE REPAIR 202001-060

STEER AXLE ASSEMBLY

Remove

WARNING

PUTTING THE LIFT TRUCK ON BLOCKS

The lift truck must be put on blocks for some types of maintenance and repair. The removal of the mast, drive axle, battery, or counterweight assemblies will cause large changes in the center of gravity. When the lift truck is put on blocks, put additional blocks in the following positions:

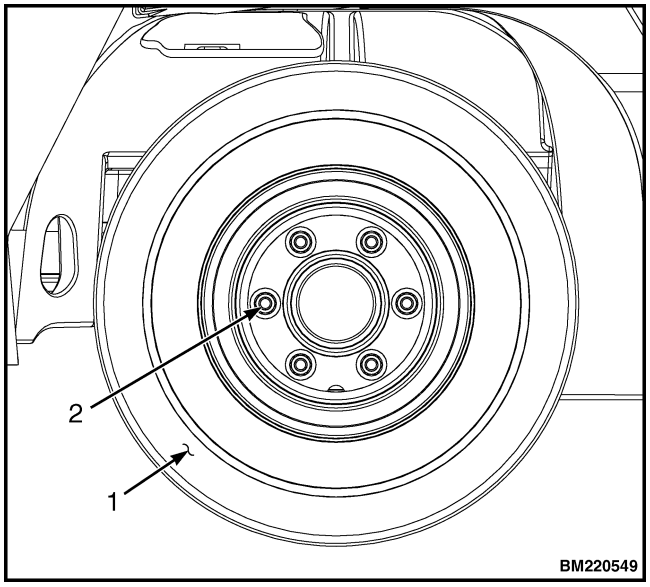
- **If the mast and drive axle are removed, put blocks under the counterweight so the lift truck cannot fall backward.**
- **If the counterweight is removed, put blocks under the mast so that the lift truck cannot fall forward.**

The steering axle can be removed without removing the counterweight.

1. The lift truck must be on blocks so the steering axle will have enough clearance to be removed. The top of the axle frame must have clearance under the bottom of the frame at the rear of the lift truck. See the Operating Manual or How to put a lift truck on blocks in **Periodic Maintenance** 8000SRM2305.

2. Verify the wheels are set for straight travel.

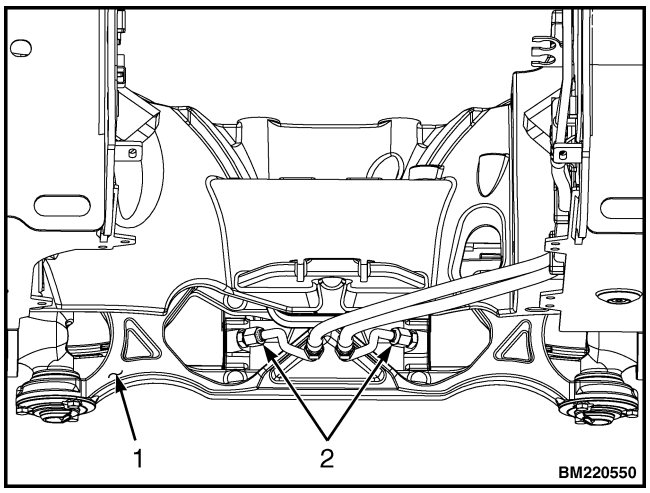
3. Loosen the lug nuts and remove the two steer tires and wheels. See Figure 221.



1. STEER TIRE AND WHEEL ASSEMBLY
2. LUG NUT

Figure 221. Steer tire and wheel

4. Disconnect the hydraulic lines at the steering cylinder and cap lines. See Figure 222.



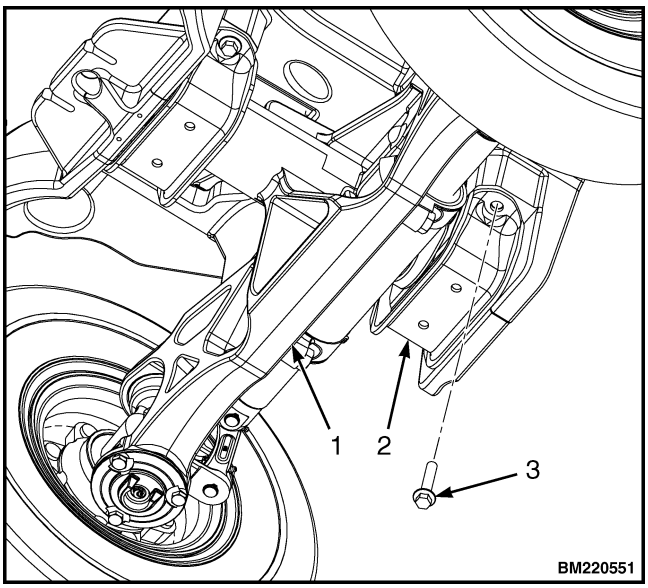
1. STEER AXLE
2. STEER HOSES

Figure 222. Steer hoses

5. Install plug fittings in cylinder. Plug fittings will prevent spindles from turning as axle is removed from under the lift truck.

6. Slide a floor jack or the forks of another lift truck under steering axle, and raise until the weight of the axle assembly is supported.

7. Remove the four capscrews that fasten the two mounting brackets under the rubber mounts to the frame. See Figure 223.



1. STEER AXLE
2. MOUNTING BRACKET
3. CAPSCREW

Figure 223. Steer axle mounting

8. Remove the steer axle from the frame.

Disassemble

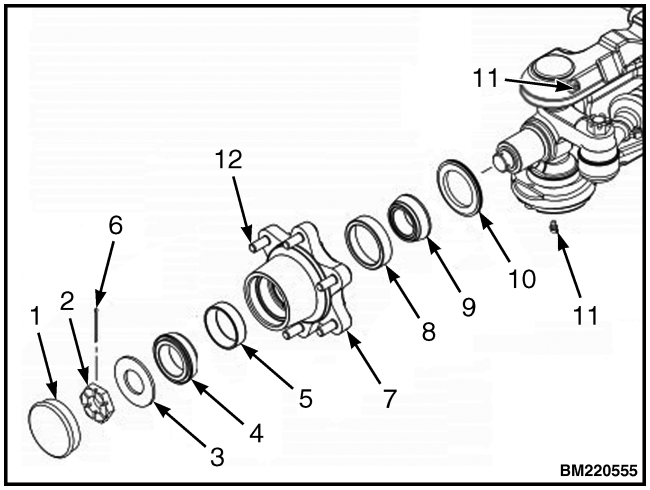
1. Place the steer axle on the blocks so the wheels just touch the floor.

2. Remove the hub cap (1, Figure 224).

3. Remove and discard cotter pin, washer, and spindle nut. See Figure 224.

NOTE: Identify and tag the outer and inner bearing cones so they can be reassembled in their original locations.

4. Remove outer bearing cone and outer bearing cup. See Figure 224.



1. HUB CAP
2. SPINDLE NUT
3. WASHER
4. OUTER BEARING CONE
5. OUTER BEARING CUP
6. COTTER PIN
7. HUB
8. INNER BEARING CUP
9. INNER BEARING CONE
10. OIL SEAL
11. LUBE FITTING

Figure 224. Hub

NOTE: If the bearings are to be replaced, the bearing cup and cone must be replaced as an assembly. Use a brass drift pin to remove the bearing assembly.

5. Slide the hub from the spindle. Remove the inner bearing cup, inner bearing cone and oil seal from the spindle. See Figure 224.

6. Repeat Step 2 through Step 5 for the other wheel.

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

WARNING

Compressed air is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

1. Clean bearings by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.

2. After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.

3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.

Inspect

1. Inspect for loose, burned, missing, cracked or damaged hardware.

2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion or marred finish.

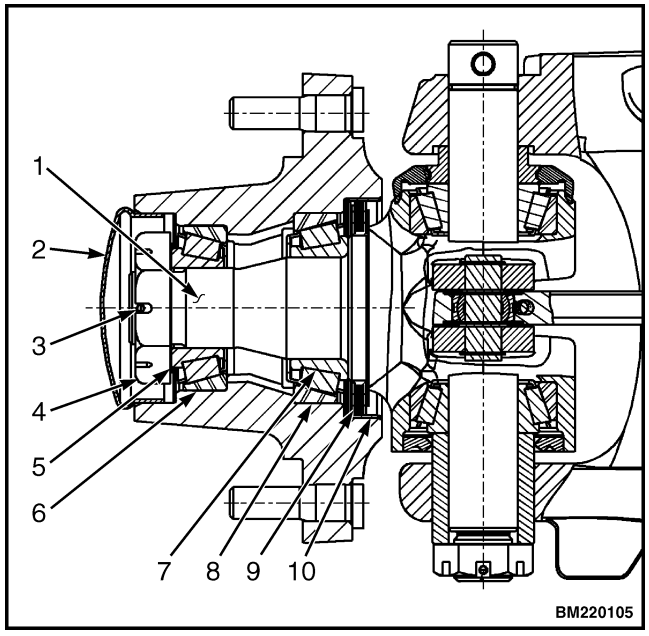
NOTE: If the spindle, bearings or tie rods need to be repaired, see Spindles, bearings and tie rods.

Assemble

NOTE: For specified lubricant to use, refer to **Periodic Maintenance** 8000SRM2305.

1. If necessary, use a press to install new bearing cups in wheel or hub, with the markings facing the outside. See Figure 224.

2. Lubricate bearing cones with multipurpose grease. Verify bearings are filled with grease. Install oil seal, inner bearing cup and innner bearing cone on the spindle. See Figure 225.



1. SPINDLE
2. HUB CAP
3. COTTER PIN
4. CASTLE NUT
5. OUTER BEARING CONE
6. OUTER BEARING CUP
7. INNER BEARING CONE
8. INNER BEARING CUP
9. OIL SEAL
10. WEAR RING (OPTIONAL)

Figure 225. Bearing arrangement

CAUTION

DO NOT damage the seals during installation.

3. Carefully slide the hub onto the spindle. See Figure 224.

4. Install the outer bearing cup and outer bearing cone. Install the washer. See Figure 224.

NOTE: Ensure that the washer is seated properly against the bearing cone and not against the shaft shoulder before tightening the spindle nut.

5. Install the spindle nut and tighten as follows for your lift truck:

   a. Tighten the spindle nut to 200 N•m (147.5 lbf ft) while rotating the wheel in both directions to properly seat the bearings.

b. Loosen the spindle nut until wheel turns freely with no end play.

c. Tighten the spindle nut to 12-15 N•m (8.9-11.1 lbf ft).

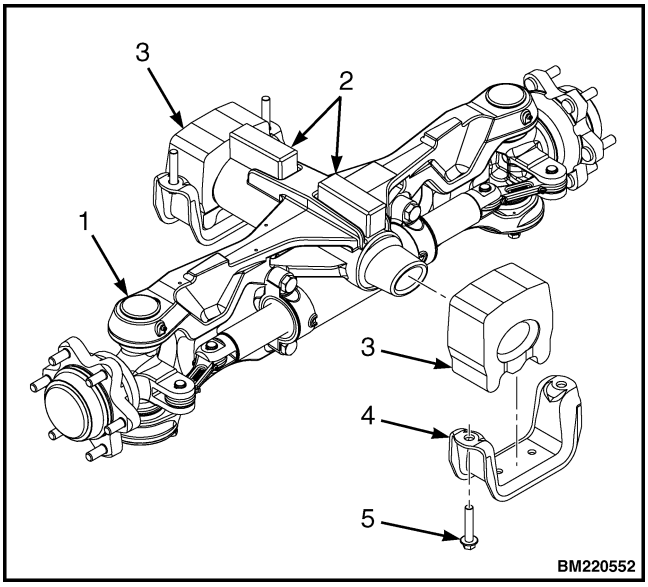
6. Install new cotter pin in spindle nut. If the cotter pin cannot be installed, tighten the spindle nut to the first alignment position where the cotter pin can be installed.

7. Install the hub cap. See Figure 224.

8. Repeat Step 1 through Step 7 for the other wheel.

Install

1. Install rubber mounts and top mounts on the new axle with the part number away from the axle. Part number must be right side up after axle assembly is installed. See Figure 226.



1. STEER AXLE ASSEMBLY
2. TOP MOUNTS
3. RUBBER MOUNTS
4. MOUNTING BRACKET
5. CAPSCREW

Figure 226. Rubber mounts

2. Apply lubricant that is approved for use with rubber to the rubber mount, to ease assembly of the mount into frame and brackets.

3. Use a floor jack or another lift truck to lift the steering axle into position in the frame. Verify the rubber mounts fit securely inside the grooves on the frame. See Figure 223.

4. Install the bottom brackets and insert the capscrew to attach the bracket to the frame. See Figure 223.

5. Tighten the capscrew to 90 N•m (66.4 lbf ft).

6. Remove plugs and caps and connect the hydraulic lines to the steering cylinder. See Figure 222.

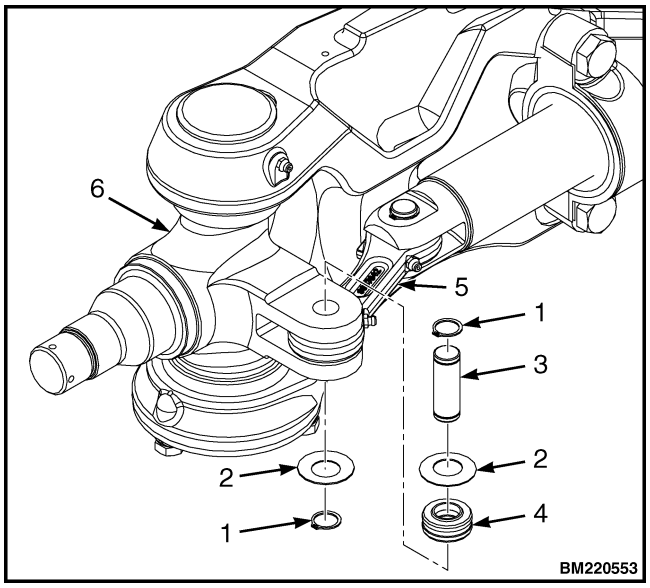
7. Operate the steering system to remove air from system. Turn steering wheel several times from one stop to the other. Check for hydraulic leaks.

SPINDLES, BEARINGS AND TIE RODS

Remove

1. Remove the hub and bearings. See Steer axle assembly section.

2. Remove the snap rings from the pin holding the tie rod to the spindle assembly, then remove the pin. If necessary, use a hammer and brass drift to remove pin. See Figure 227.



1. SNAP RING
2. WASHER
3. PIN
4. BUSHING
5. TIE ROD
6. SPINDLE

Figure 227. Tie rod components

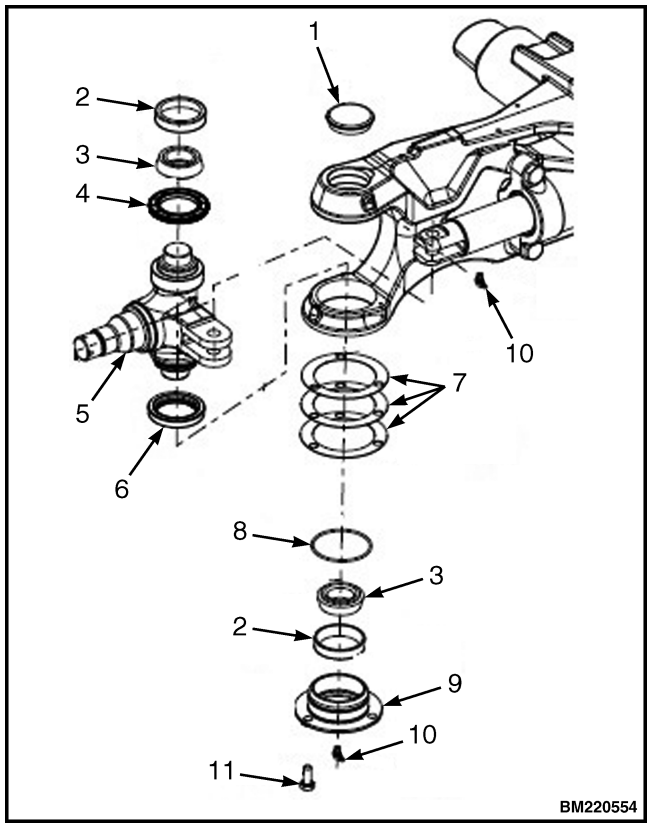
3. Apply the same procedure in the previous step to the other side of the tie rod where it connects to the steering cylinder rod. See Figure 227.

4. Remove the tie rod from the steering cylinder rod.

5. If necessary, repeat the procedure for the other spindle and tie rod.

Disassemble

1. Remove the cap from the spindle. See Figure 228.



1. CAP
2. BEARING CUP
3. BEARING CONE
4. OIL SEAL
5. SPINDLE
6. SEAL
7. SHIMS
8. O-RING
9. BEARING CAP
10. GREASE FITTING
11. CAPSCREW

Figure 228. Spindle assembly

2. Remove the capscrews from the bearing cap. See Figure 228.

3. Remove the bearing cap and shims. If necessary, remove the bearing cup and bearing cone from the bearing cap as shown in Figure 228.

4. Tilt the spindle and lift the spindle from the axle. If necessary, remove the bearing cup, bearing cone and seals from the spindle. See Figure 228.

5. If necessary, repeat the procedure for the other spindle and tie rod.

Clean

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

WARNING

Compressed air is used for cleaning or drying purposes, or for clearing restrictions. Wear protective clothing (goggles/shield, gloves, etc.) to avoid injury to personnel.

1. Clean bearings by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearings in the solvent to remove all traces of old lubricant.

2. After cleaning the bearings, dry them with clean compressed air. Take care to prevent spinning the bearings when using a compressed air jet.

3. Immediately wrap bearings in a lint-free cloth to protect them from dust and other foreign matter.

Inspect

1. Inspect for loose, missing, cracked, burned or damaged hardware.

2. Inspect all parts for dents, holes, bends, burrs, rust, corrosion, or marred finish.

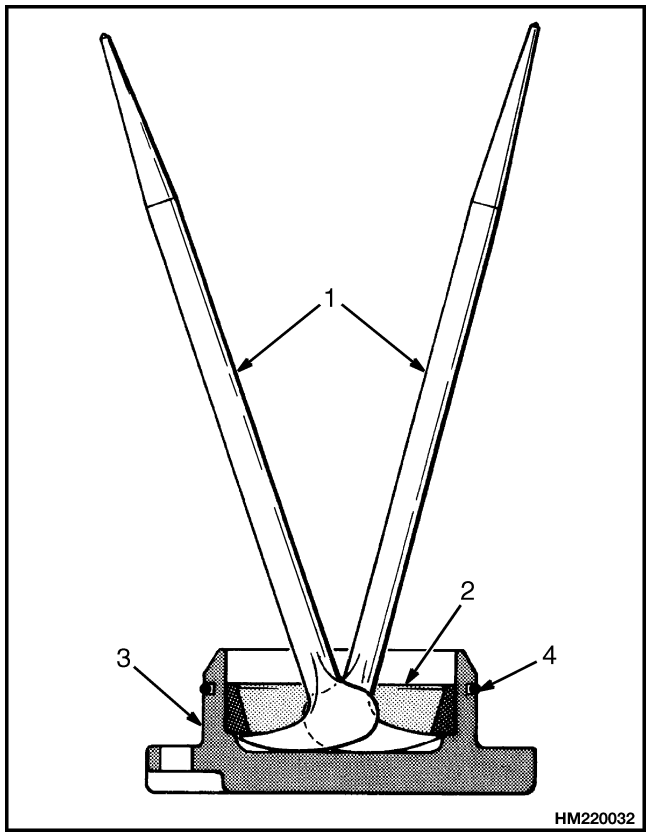
Assemble

1. Install new seals on the spindle. Lubricate the seals with grease. If necessary, press new bearing cones on the spindle. See Figure 228.

2. Lubricate the bearing cups and bearing cones with wheel bearing grease. If necessary, press the new bearing cups into the steering axle frame and bearing cap. See Figure 228.

3. Install the spindle into the steering axle. See Figure 228.

4. Install the bearing cup into the steer axle without the shims. See Figure 229.



1. PRY BAR
2. BEARING CUP
3. BEARING CAP
4. O-RING

Figure 229. Bearing cup installation

Measure the clearance between the bearing cap and the axle at three locations around the cap perimeter. See Figure 230.

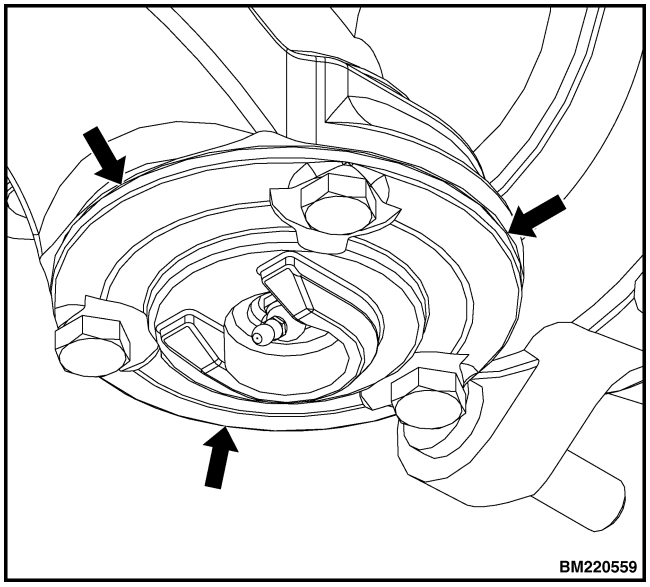


Figure 230. Measure gap

5. Install shims
0.00 to 0.13 mm (0.000 to 0.005 in.) less than the measured gap. See Figure 228, for shim placement.

NOTE: The spindle bearings must have no clearance. Install shims as required until the gap of 0.00 to 0.13 mm (0.000 to 0.005 in.) is reached.

6. Install the O-ring on the bearing cap. Apply Loctite® 242 to threads of capscrews. Install the bearing cap and capscrews. Tighten capscrews to 44-55 N•m (32.5-40.6 lbf ft).

7. If necessary, repeat the procedure for the other spindle and tie rod.

Install

1. Install the tie rod to the spindle arm and steering cylinder.

2. Insert the pin to retain the tie rod to the spindle arm. Secure the pin with the snap rings on the top and bottom.

3. Repeat the process in the previous step for the other end of the tie rod, to secure the tie rod to the cylinder rod.

4. Install the cap on the top of the spindle. See Figure 228.

5. Install the hub and bearings. See Steer axle assembly section.

6. If necessary, repeat the procedure for the other spindle and tie rod.

STEERING CYLINDER

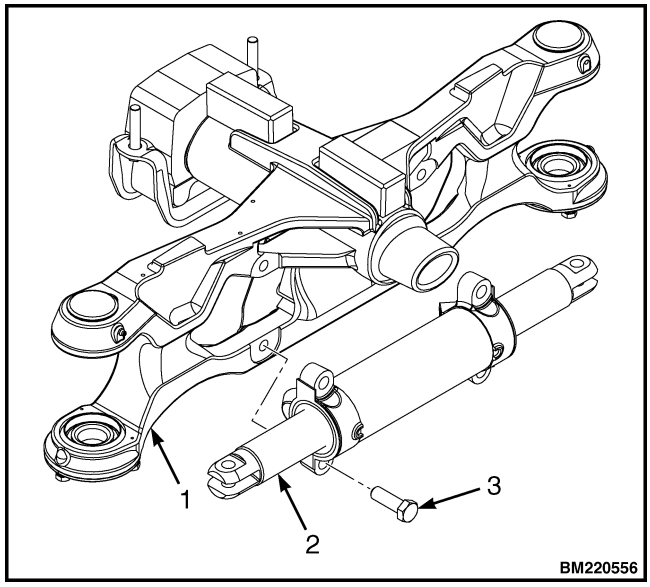
NOTE: The end caps of the steering cylinder are held in the shell by the installation of cylinder mount capscrews into the axle frame. To prevent oil leaks at the caps, hold the caps on the shell during removal.

NOTE: Hydraulic oil is to be disposed of in accordance with local directives.

1. Disconnect and tag hydraulic lines at steering cylinder. See Figure 222. Cap lines and fittings on the cylinder.

2. Remove the tie rods. See Spindles, bearings and tie rods section.

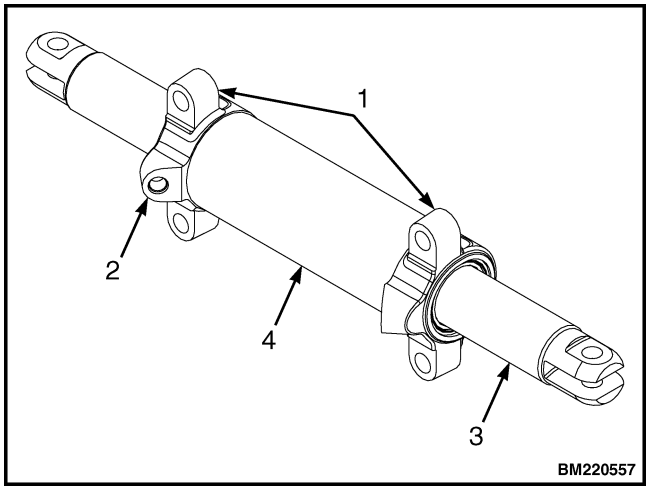
3. Remove the capscrews that fasten the cylinder to the steer axle. See Figure 231.



1. STEER AXLE
2. STEER CYLINDER
3. CAPSCREW

Figure 231. Steer cylinder mounting

4. Hold the cylinder by the end caps and remove the steering cylinder. See Figure 232.



1. END CAP
2. FITTING PORT
3. ROD
4. CYLINDER TUBE

Figure 232. End caps

5. Hold one end of the steering cylinder over a container, to catch escaping hydraulic oil. Remove the plug from the fitting port on each end cap. Push the rod toward the end of the shell that is over the container. Hydraulic oil will drain from the cylinder. Repeat the procedure for the other end of the cylinder.

6. Carefully remove one end cap from the shell and slide it off the rod. Carefully pull the rod out of the shell, keeping the rod centered in the cylinder tube during removal. Remove the other end cap from the shell. Remove all seals, wipers, and O-rings. See Figure 233.

7. Remove piston seal. If present, remove two guide rings.

CLEAN AND INSPECT

WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety procedures.

1. Clean all metal parts in solvent.

2. Inspect piston rod for grooves or damage. Remove small scratches with fine emery cloth.

3. Inspect cylinder bore for damage

4. Inspect mounts for cracks.

ASSEMBLE AND INSTALL

CAUTION

Do not damage the O-rings, seals, or wipers during installation.

1. Put O-rings, seals, guide rings, and wipers in warm hydraulic oil.

2. Install O-rings, seals, guide rings, and wipers as shown in Figure 233.

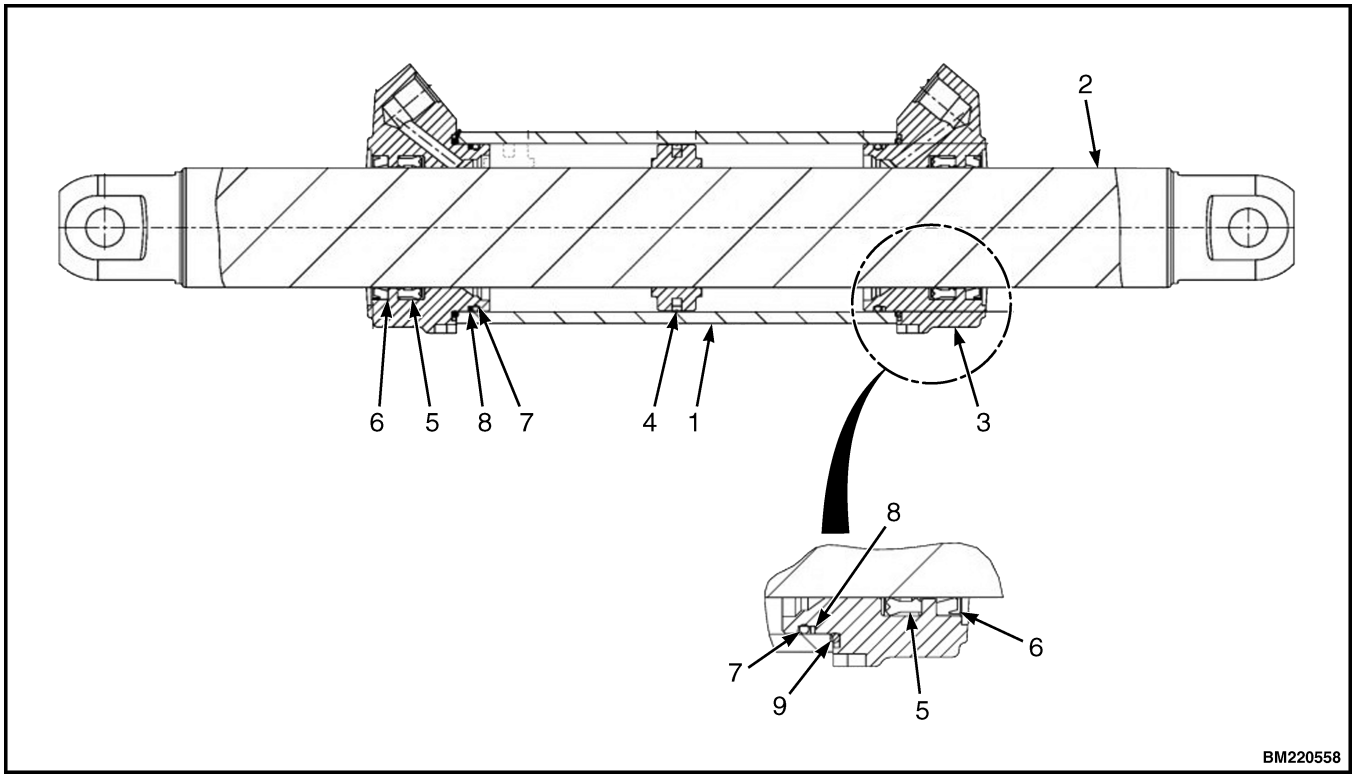
3. Lubricate O-rings, seals, and wipers with O-ring lubricant and carefully install one end cap on cylinder rod. See Figure 233.

4. Carefully slide cylinder rod into the cylinder tube and end cap. Keep cylinder rod aligned in center of shell during installation so the parts are not damaged. Install the other end cap into the shell. Plug the fitting ports of the end caps.

5. Hold the cylinder by the end caps. Insert the capscrews to install the cylinder on to the steer axle frame. Tighten capscrews to 225-280 N•m (166-206.5 lbf ft).

6. Install tie rods. See Spindles, bearings and tie rods.

7. Remove plugs and caps and connect hydraulic lines as tagged during removal, to steering cylinder. See Figure 222. Operate the steering system to remove air from cylinders and system. Turn the steering wheel several times from one stop to the other. Check that the steer cylinder operates lock to lock.



1. CYLINDER TUBE
2. ROD
3. END CAP
4. PISTON SEAL
5. ROD SEAL
6. ROD WIPER
7. O-RING
8. BACKUP RING
9. O-RING

Figure 233. Steering Cylinder

8. Install the two steer wheels. See Figure 221.

9. Install lug nuts to secure the wheels. Torque to 155-175 N • m (114-129 lbf ft).