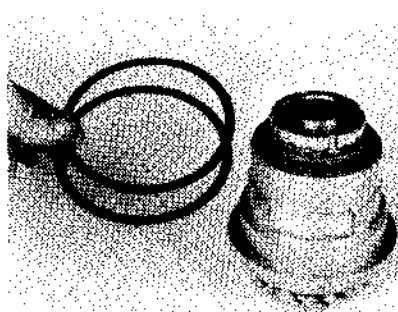
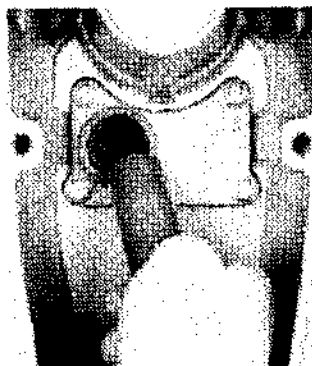




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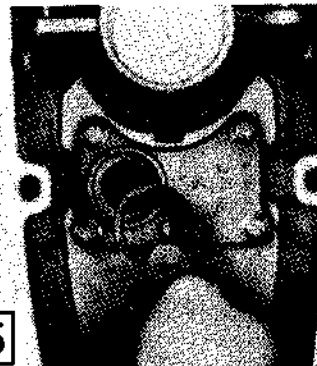
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- 13 4. Remove all shims from the lip of the carrier and inside the housing. They can be reused if undamaged.

Water Tube and Cover Removal

- 14 15 1. Pull out water tube by wiggling or twisting it. Pull seal out of water tube cover.

Note Do not remove water tube cover unless it's damaged.

- 16 2. To replace cover, unscrew the water tube cover screws. Place the blade of a large screwdriver between curved side of cover and rib of the housing. Twist the blade to free cover from its gasket.

3. Remove and discard the cover gasket.

Rear Bearing Cup Removal

- 17 1. Screw OMC Bearing Cup Remover P/N 912291 (B) onto OMC Drive Handle P/N 311880.

2. Lay a shop cloth on a workbench. Rest housing's forward face on the cloth and lower skirt over edge of bench so the housing sits level.

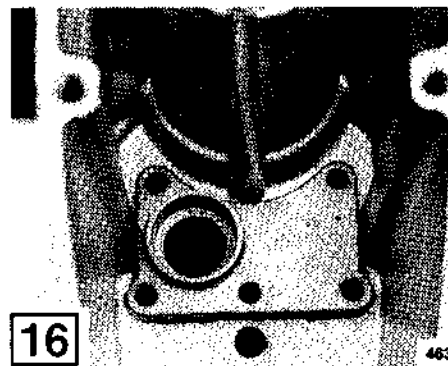
- 17 3. Rest the remover on the back of the cup and drive the cup and shims out with a mallet. Discard any damaged shims.

Shimming Thrust Plates

- 18 1. Check width across the thrust plates with a 6 in. caliper. This is a shimmed dimension that should not exceed 5.036 inches.

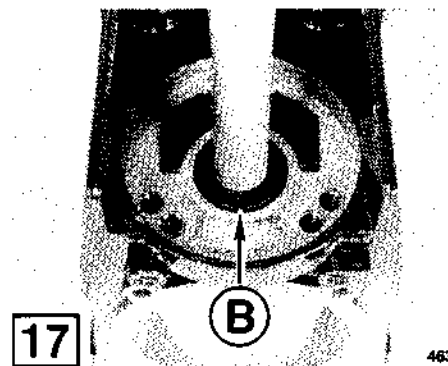
Note Do not remove thrust plates unless the dimension is incorrect. Make a note of the measurement if the width is wrong.

- 18A 2. To reset width, pry off four retaining rings and remove the thrust plates. The retaining rings can be reused unless they are broken. Notice that the concave side of each ring faces inside of housing.



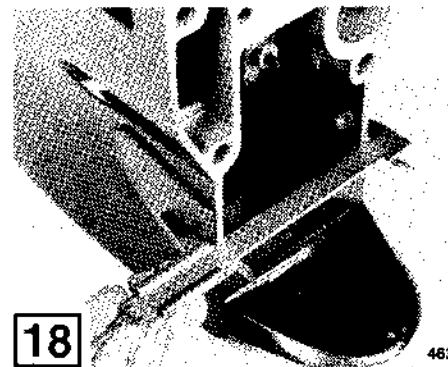
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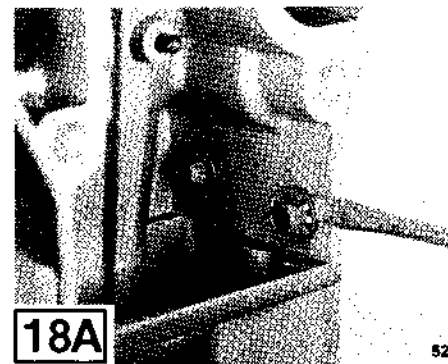
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19 3. Underneath each plate is one or more shims. Each shim is the same size, .015 inches. Shims must always be installed in pairs, one on each side of the housing. There must be a minimum of one shim per side, but no more than four per side. If more than four are needed, replace both thrust plates and check the dimension again.

4. To determine if shimming is necessary, compare your measurement with 5.036 inches.

Example: 5.036 in. required width
 5.012 in. measured width

 .024 in. difference

In this example, no shims are required. Since shims are added in pairs, the difference would have to exceed .030 in. (.015 in. x 2) before shims would be needed.

Note Do not exceed 5.036 in. when adding shims. Excessive width will cause interference between the upper gear housing and transom bracket.

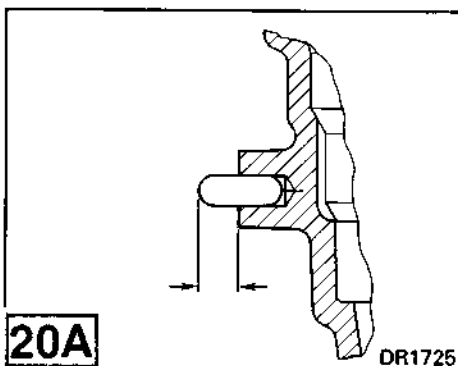
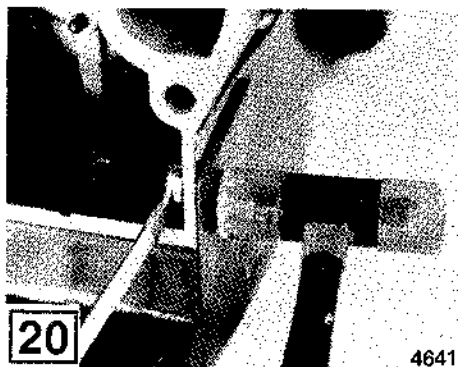
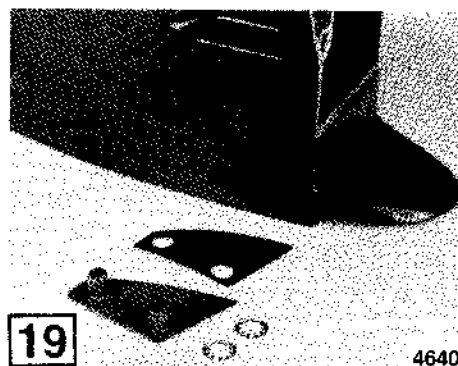
20 5. Place correct shims on the thrust plates and insert plates into housing. Face concave side of each ring toward inside of housing and push the rings onto the plate studs. Hold rings with a ½ in. box-end wrench and hit thrust plate with a soft hammer until rings seat against the housing.

Upper Gear Housing Cleaning and Inspection

Clean housing in solvent to remove sealer from all screw holes, gasket surfaces, and O-ring bores. Dry housing thoroughly.

Note All threaded holes in upper gear housing have *HeliCoil*®* inserts. **Do not use a thread tap to clean screw holes.** Tap will damage *HeliCoil* insert and make replacement necessary.

- **Rear Bearing Seat** - look for metal scoring or discoloration that would indicate a spinning cup. Remove gouges or scratches that would prevent cup seating and affect shimming.
- **Lock Ring Threads** - lock ring must turn freely for full depth.



**HeliCoil* is a registered trademark of *HeliCoil Division of Black & Decker Inc.*

- **Water Pump Cavity** - remove sharp edges that would prevent O-rings and gaskets from seating.
- **Cooling Passages** - check for corrosion build-up that would restrict circulation.
- **U-joint Carrier Bore** - remove all sharp edges that would cut O-ring.
- **Pinion Carrier Bore** - remove all sharp edges from inside diameter of lower end to prevent cutting lower gearcase driveshaft housing O-rings.
- **Model I.D. Plate** - transfer plate to new gear housing when replacing old one.

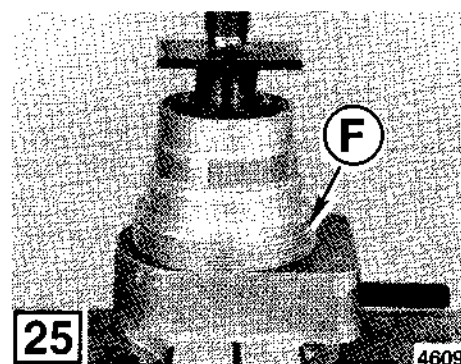
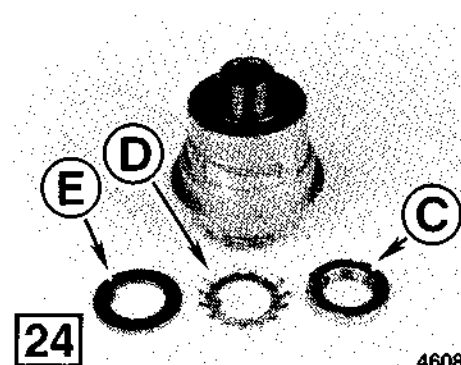
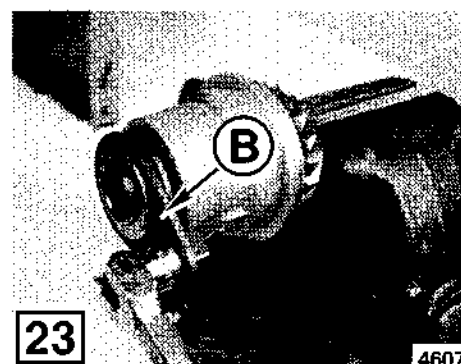
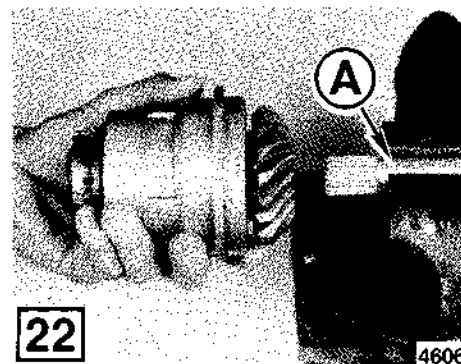
Shift Rod Guide Pin Replacement

- 20A** Remove only if worn or broken. Drill or pull out old pin. Press in new pin with large diameter end of OMC Driver P/N 912270. When properly installed, pin height is .340 in. (8.64 mm) from casting.

Pinion Bearing Carrier Disassembly

- 21** 1. The spanner nut at the base of the carrier is held by a retainer. Use a punch to disengage the tab locking the nut.
- 22** 2. Horizontally clamp OMC Driveshaft Spline Socket P/N 314438 **A** in a vise, then slide the bearing carrier onto it.
- 23** **24** 3. Attach a $\frac{1}{2} \times \frac{3}{4}$ in. adaptor to a $\frac{1}{2}$ in. breaker bar and use OMC Spanner Wrench P/N 912272 **B** to remove nut **C**, retainer **D** and washer **E**.
- 25** 4. The gear and shaft are a single piece and are pressed into the lower bearing. Face the recessed side of OMC Holding Block P/N 912278 up, and place the carrier lock ring **F** around the opening. Units with 21:21 gear ratios will require two lock rings. This will raise the carrier assembly away from the block, and allow sufficient room to press the shaft and gear out.

Note Do not drop the bearing when lifting the carrier out of the press.



26 5. Do not remove the pinion shaft bearing **A** or carrier cups **B** unless they need to be replaced. When replacing a bearing, always replace its respective cup.

27 To remove the pinion bearing, use a bearing separator. Place curved side of jaws under the bearing. Catch the pinion shaft when it falls free.

28 6. To remove the carrier bearing cups, you'll need the following OMC special tools:

- Bridge Base Plate
- Holding Block P/N 912278
- Bridge Assembly P/N 432127
- Puller Jaws P/N 432129
- and
- Bearing Carrier Lock Ring removed earlier

29 • **Removing large cup** - rest carrier on bench with large cup facing up. Position recessed side of holding block **C** down, and set on top of carrier **D**. Place base plate **E** on holding block. Lightly oil washer on top of bridge. Position bridge legs to span opening in base plate. Fully expand puller jaws behind cup and pull cup from carrier.

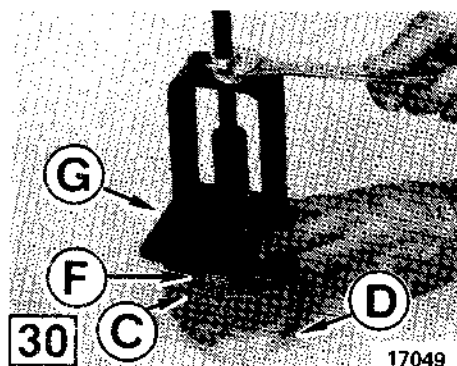
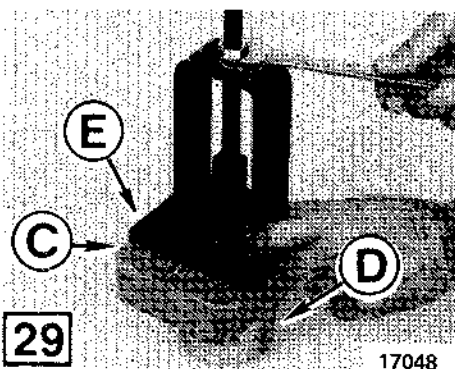
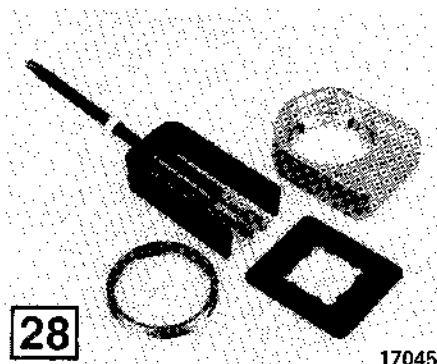
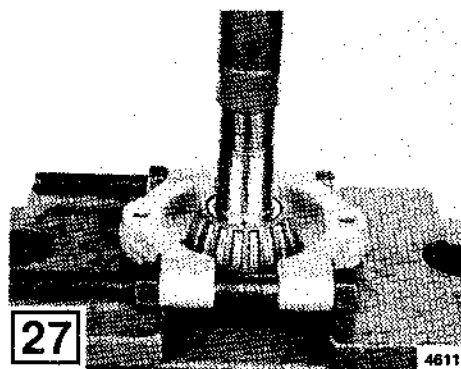
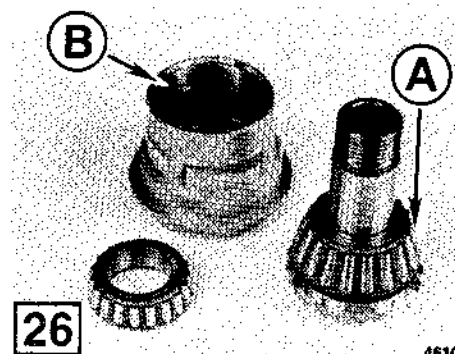
30 • **Removing small cup** - turn carrier upside down. Face recessed side of holding block **C** up and set on carrier **D**. Place bearing carrier lock ring **F** on the holding block, followed by puller base plate **G**. Lightly oil washer on top of bridge. Expand puller jaws behind cup and pull cup from carrier.

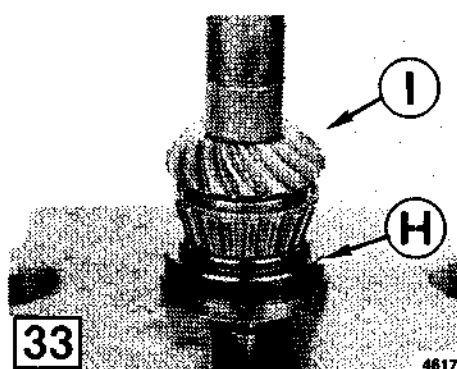
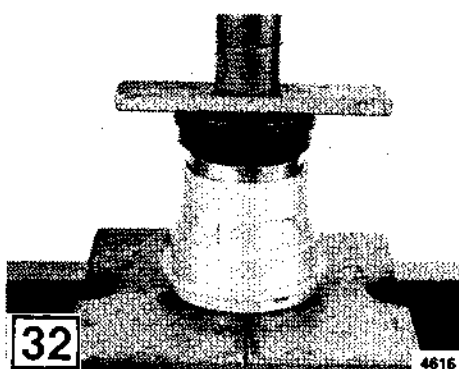
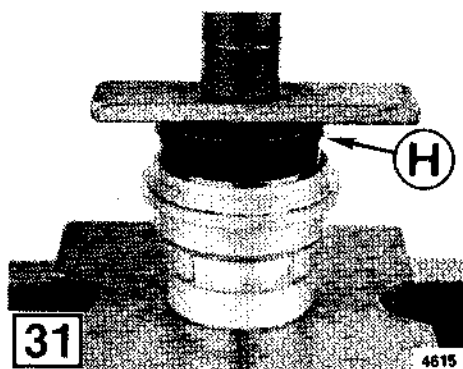
Pinion Bearing Carrier Cleaning and Inspection

Clean all parts in solvent and dry them thoroughly. Roller bearings should be washed in soapy water and dried after cleaning with solvents. This will prevent pitting and scoring after assembly.

- **Pinion and Shaft** - inspect gear teeth for cracks, chips or discoloration. Screw threads on end must be undamaged.
- **Carrier Housing** - check shim surface for nicks or burrs that would affect shim readings. If cups are removed, check seats for galling that would prevent cups reaching correct depth.
- **Bearings and Cups** - check for pitting, corrosion and discoloration.

Note Discoloration of a part usually indicates overheating damage due to lack of lubrication, or use of improper type of oil. Replace suspect components.





Pinion Bearing Carrier Assembly

31 1. Face carrier's large diameter end up, and set it in a press. Set the cup on the carrier. Face side "A" of OMC Combination Installer P/N 912276 (H), away from carrier, and set it on the cup. Press the cup in until it seats.

32 2. Turn the carrier over. Set remaining cup on carrier, use the same tool side, and press cup in until it seats.

33 3. If the large pinion bearing was removed, install a new one. Face side "A" of OMC Combination Installer P/N 912276 (H) down and set it in a press. Oil inside diameter of bearing, set it on installer, and insert the shaft (I). Press in shaft until gear seats on the bearing.

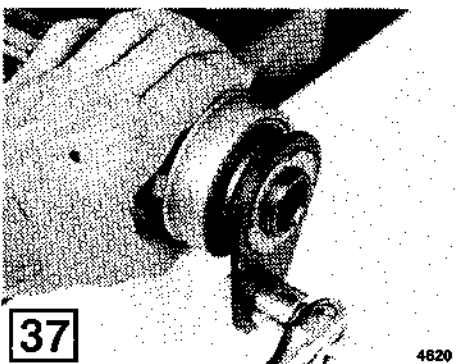
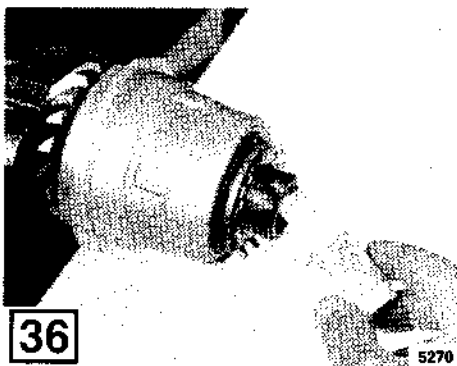
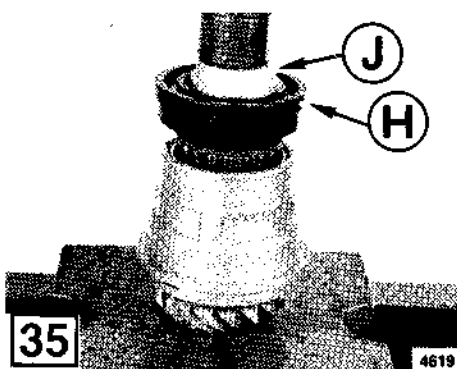
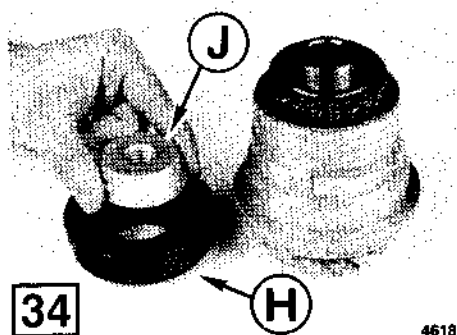
34 4. Set carrier on the pinion shaft. Lightly oil inside diameter of small bearing and set it on shaft. Position OMC Installer P/N 314429 (J), as shown and place it inside center of side "A" of OMC Combination Installer P/N 912276 (H).

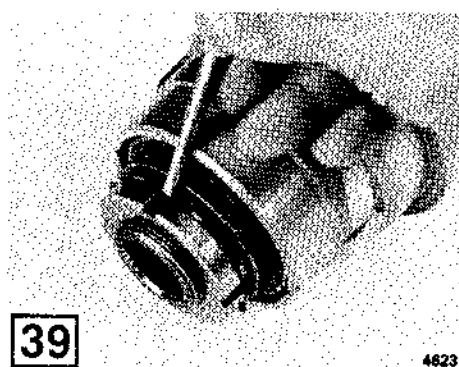
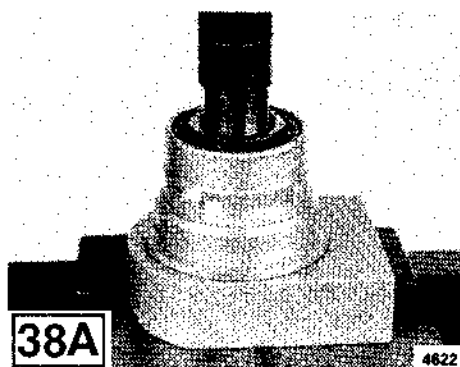
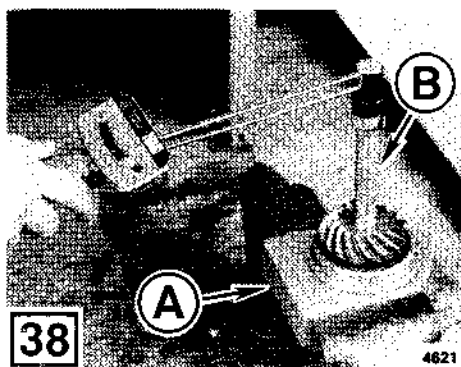
Note The OMC Installer P/N 314429 acts as a stop by seating against end of pinion shaft to limit bearing depth. Substitution of another tool that would allow improper depth will result in premature bearing failure.

35 5. Place pinion carrier assembly in a press. Rest installing tools (H) (J) on top of bearing and press bearing on until the tool seats.

6. Spray shaft and spanner nut threads with *OMC Locquic Primer* and allow to air dry.

36 7. Install washer and retainer on the shaft. Apply *OMC Ultra Lock* adhesive to the shaft threads. Face nut's beveled edge toward carrier, and screw nut on by hand as far as possible.





Pinion Bearing Carrier Rolling Torque Procedure

37 1. Clamp OMC Driveshaft Spline Socket P/N 314438 horizontally in a vise as shown. Slide pinion carrier onto socket, gear end first. Use a $\frac{1}{2}$ x $\frac{3}{4}$ in. adaptor to attach OMC Spanner Wrench P/N 912272 to a breaker bar. Oil bearings and rotate carrier while slowly tightening nut until all shaft end play is eliminated.

38 2. Clamp OMC Holding Block OMC P/N 912278 **A** in a vise and insert the carrier assembly. Use OMC Driveshaft Spline Socket, P/N 314438, **B** to check for a rolling torque of 3-9 in. lbs. (0,3-1,0 N·m). The optimum torque for maximum bearing life is 6 in. lbs. (0,7 N·m).

- If torque is too low - tighten nut to next locking tab recess, then recheck torque. Continue this sequence until torque is correct.

38A • If torque is too high - remove nut, retainer and washer. Rest carrier assembly in holding block and place in a press as shown. Apply just enough pressure to slightly move shaft, then stop. Repeat torque procedure starting with step 6 (page 7-9).

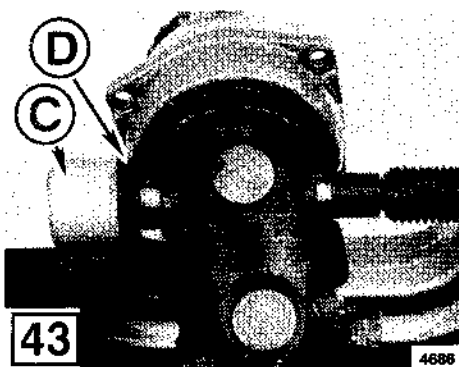
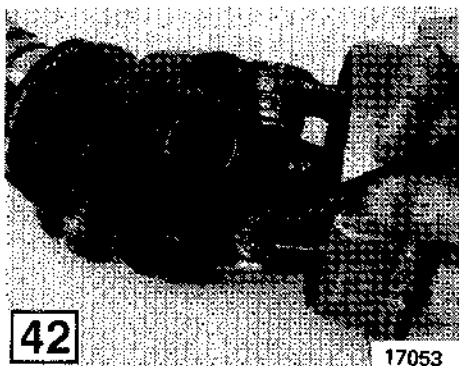
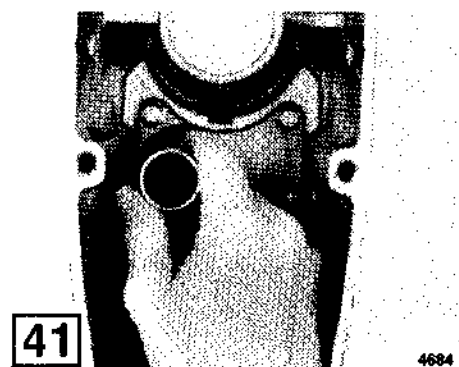
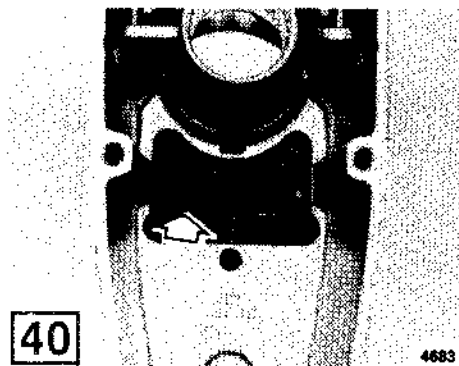
39 3. Finish pinion carrier assembly by bending one retainer tab into a locking recess of the nut.

Water Tube and Cover Installation

40 1. If the cover was replaced, coat both sides of a new gasket with *OMC Gasket Sealing Compound*. Position circular opening as shown and place gasket in housing.

2. Set cover in place. Apply *OMC Gasket Sealing Compound* to each screw, then install and torque them to 12-14 ft. lbs. (16-19 N·m).

41 3. Press seal into cover (no sealer is required). Twist water tube into seal until it seats.



U-joint Disassembly

The following procedure can be performed either with the U-joint shaft still assembled in the upper gear housing, or removed as shown.

42  1. **Wear eye protection.** On the inside of each U-joint arm is a retaining ring. Use a small drift and mallet to remove all eight.

43 2. To press out the U-joints, use Owatonna Tool P/N T74-4635-C © or equivalent, and use open adapter © from OMC U-joint Kit P/N 986265 to pilot bearing cup.

3. Remove the U-joint pair requiring replacement. Follow the instructions provided by the tool manufacturer.

44 **Note** Do not press any bearing cup completely through its yoke. When the pressure-side cap is almost through the yoke, remove U-joint shaft from tool and pull off exposed cap with pliers. Rotate U-joint 180° and press crossbar in opposite direction to remove remaining cap.

45 4. Press out the remaining bearings. Pay special attention to the position of the grease fittings in relation to the U-joint yokes.

U-joint Assembly

Note Remove all bearing caps from a new U-joint. Use grease fitting and lubricate U-joint with *OMC Marine Wheel Bearing Grease* until lube appears at end of all four lobes. This ensures each lobe will receive equal volumes of grease after assembly.

46 1. Place U-joint inside the center coupler or either of the driveshaft yokes. Grease fitting **E** must be toward its respective driveshaft yoke as shown (i.e. face away from center coupler).

Note If grease fitting incorrectly faces coupler, there will be no access for a grease gun to reach fitting after the U-joint shaft is assembled.

46 2. Insert both bearing caps into yoke. Position U-joint in tool and press one cap in until its retaining ring groove completely clears the yoke.

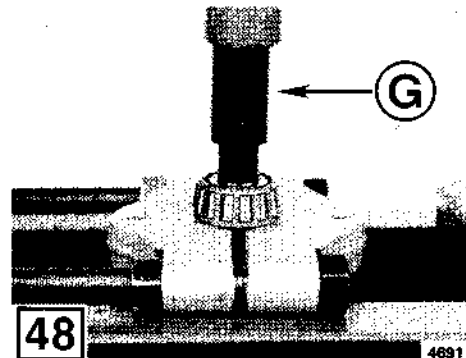
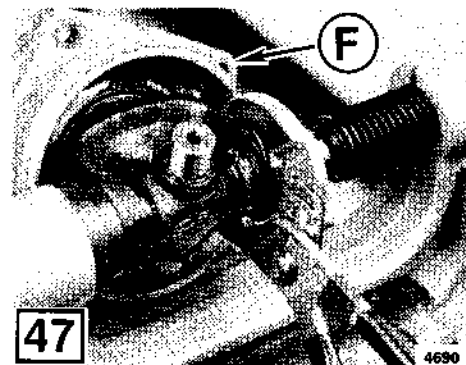
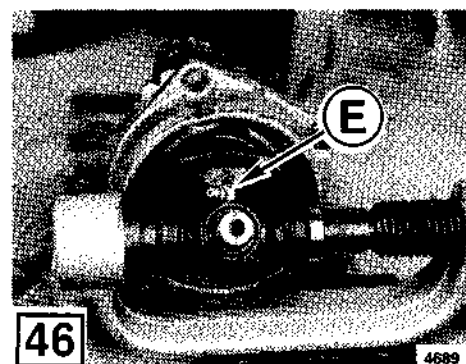
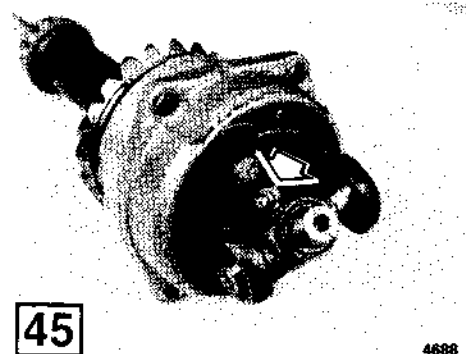
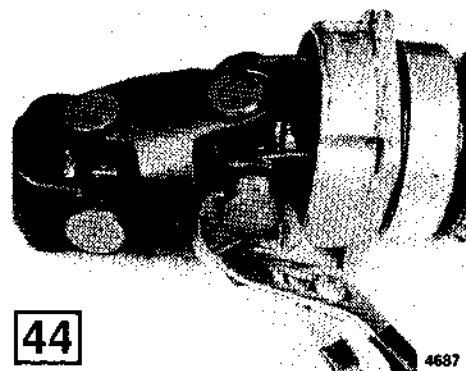
47  3. **Wear eye protection.** Face open end of ring directly toward the carrier **F**. Attach to cap with pliers or hammer.

Note If open end of first retaining ring does not face carrier, there may not be adequate clearance to install remaining ring on opposite end of crossbar.

4. Remove U-joint from tool and rotate it 180°. Press in opposite cap until snap ring of first cap seats against yoke. Face open end of ring toward driveshaft and attach it to cap. If necessary, use a punch and hammer to seat ring in groove.

5. Repeat steps 1 thru 4 above for all remaining bearing caps. Lubricate U-joint with *OMC Marine Wheel Bearing Grease*.

 **Safety Related**



U-joint Shaft Disassembly

1. Separate U-joint shaft from driveshaft at yoke closest to bearing carrier. Follow procedure under Disassembling U-joints.

48 2. Clamp the flat side of a bearing separator below the small bearing. Face small diameter of OMC Remover/Installer P/N 912269 **Ⓒ** toward the bearing, and slide it over the impeller shaft.

Note Do not press against impeller shaft. Shaft will change position and cause premature seal wear and inadequate engagement with impeller.

Press off the bearing. Be ready to catch shaft as bearing comes free.

49 3. Make a yoke support **Ⓐ** by cutting a 1 in. diameter pipe 2 $\frac{7}{8}$ in. long. Slide the support through both yokes.

50 4. Rest the bearing carrier on top of a vise and clamp the yoke securely.

! The spanner nut is held by **OMC Ultra Lock** and is torqued to 200 ft. lbs. Use caution when unscrewing spanner nut.

Attach a $\frac{3}{4}$ in. breaker bar to OMC Spanner Wrench P/N 912272 **Ⓑ**, and unscrew nut. If necessary, apply heat to loosen **Ultra Lock** adhesive.

51 5. Face small diameter end of OMC Remover P/N 912269 **Ⓒ** toward gear and slide it over impeller shaft. Support bearing carrier in a press and leave an opening wide enough for the shaft to press through. Catch the shaft when it comes free.

Note Do not remove the large bearing unless it or its cup needs to be replaced.

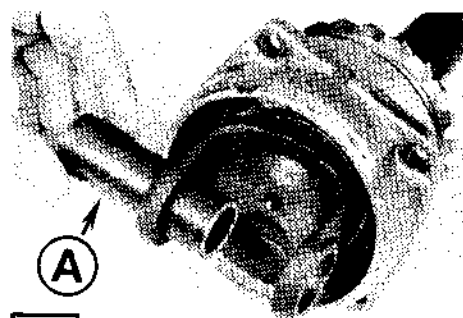
52 6. Clamp the gear and bearing in a bearing separator, placing the curved side of the jaws behind the bearing. Insert OMC Cup Remover P/N 912291 **Ⓓ** into the gear, and press it out of the bearing. Catch the gear when it comes free.

Impeller Shaft Replacement

Do not remove the impeller shaft unless it's damaged and needs to be replaced.

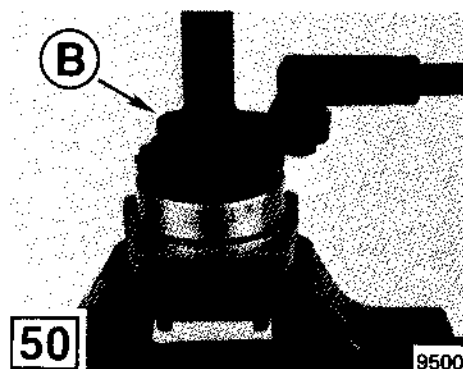
1. Remove the small rear bearing as described in steps 1 and 2 under U-joint Shaft Disassembly.

2. Impeller shaft is pressed in U-joint shaft and must be pulled out. Drill a hole through shaft or cut a thread on its outside surface, then attach a suitable puller.



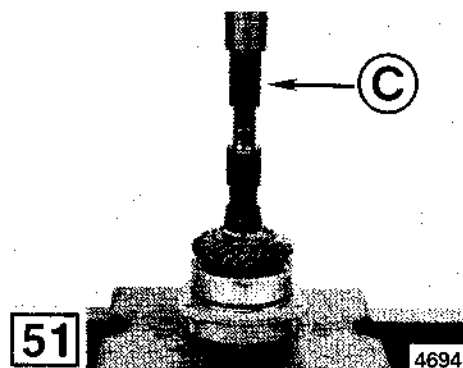
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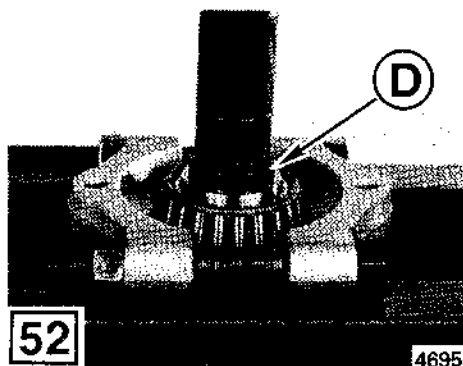
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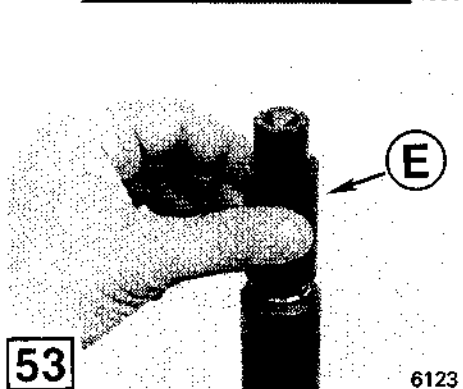
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53 3. Lightly oil a new impeller shaft. Face large opening of OMC Remover/Installer P/N 912269 **E** down, and rest on end of U-joint shaft. Insert impeller shaft into tool, and press in until shaft is flush with end of installer.

Note Shaft is pressed in to a specific depth; it will not bottom. If shaft is incorrectly positioned, seal life and impeller engagement will be adversely affected.

4. Reinstall small rear bearing as described in step 5 under U-joint Shaft Assembly.

U-joint Bearing Carrier Disassembly

54 1. Remove and discard the carrier O-ring.

55 **56** 2. Position forward face of bearing carrier down, and set it in a press. Push nose of OMC Installer P/N 912287 **F** through the seal, then press seal out of carrier.

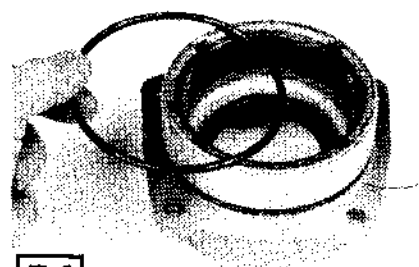
Note Do not try to press seal out with carrier facing upward. Carrier will be damaged and have to be replaced.

57 3. **Do not remove bearing cup unless it or its bearing needs to be replaced.** Face recessed side of holding block P/N 912278 **G** down, and set on top of bearing carrier. Rest base plate **H** on top of block. Position Bridge P/N 432127 and large Jaws P/N 432129 on base plate. Lightly oil washer on top of bridge, and pull out bearing cup. Keep jaws expanded snugly behind cup.

U-joint Bearing Carrier Cleaning and Inspection

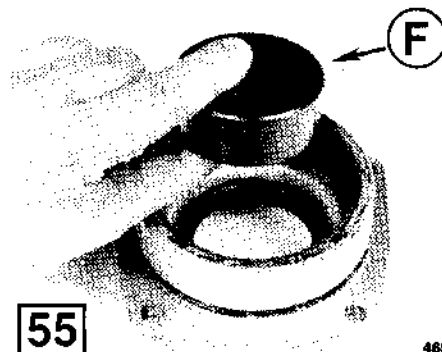
Clean all parts in solvent and dry them thoroughly.

- **Bearing Carrier** - remove sharp edges from O-ring groove that would cut O-ring and prevent sealing. If bearing cup was removed, inspect bore and remove nicks or gouges that would prevent cap sealing. Check seal bore for similar damage.
- **Drive Gear, Bearings and Cups** - check for corrosion, chips, cracks, metal transfer or discoloration. Bearings and cups must be replaced as pairs. If drive gear is damaged, also replace the pinion gear; they're available only in a matched set.
- **U-joint shaft, Centering Cone and Nut** - use a wire brush to clean Loctite from all surfaces. Inspect sealing surfaces on impeller shaft and yoke. Check splines for cracks and chips. Bearing surfaces must not be discolored, corroded, or show metal transfer.
- **Spanner Nut** - replace if colored lockpatch material has been removed from threads, or driving notches are damaged.



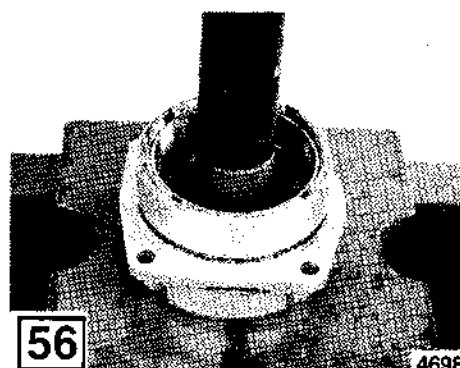
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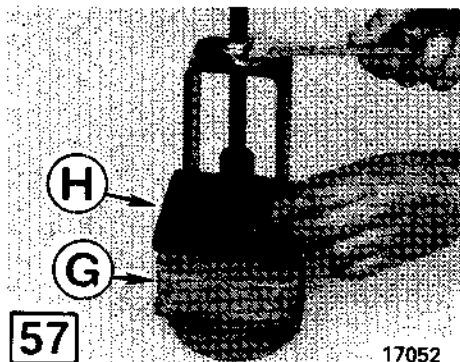
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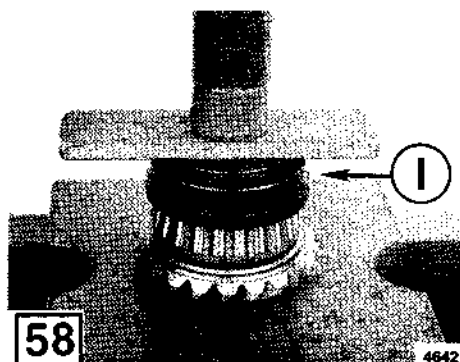
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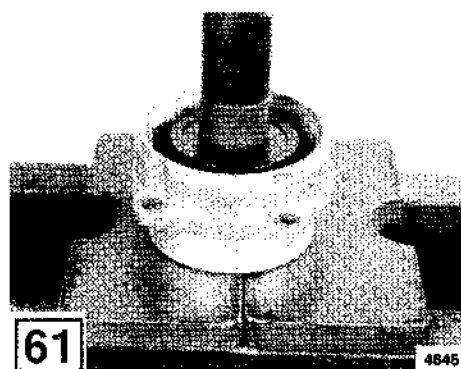
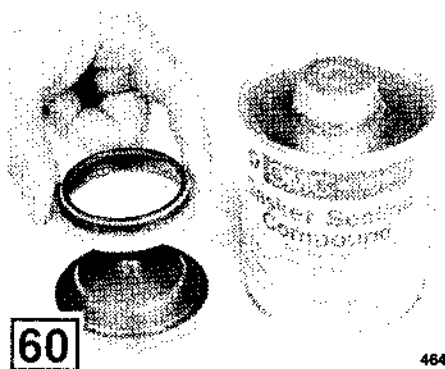
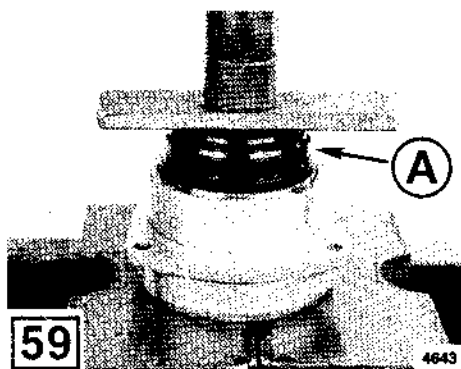
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U-joint Bearing Carrier Assembly

58 1. If drive gear bearing was removed, install a new one. Lightly oil inside of bearing. Set gear in a press and rest bearing on it. Place side "A" of OMC Combination Installer P/N 912276 **1** against bearing, and press it on until it seats.

59 2. If bearing cup was removed, place carrier in a press. Lightly oil outside of cup and set it on the carrier. Face side "A" of OMC Combination Installer P/N 912276 **A** toward the cup, and press it in until the cup seats.

60 3. Face the protruding lip of a new seal away from Installer, P/N 912286, and push it onto the stepped side of the tool. Apply *OMC Gasket Sealing Compound* to the seal's metal case.

61 **62** 4. Face carrier upward and set in a press. Push in the seal until it seats in the housing. Coat the seal lips with *OMC Triple-Guard* grease.

Note After the installation of the bearing cup and seal, it is a good practice to check the bearing carrier fit in the upper gear housing. The carrier should insert freely to ensure that carrier is not out-of-round. If carrier will not freely insert into housing, the carrier should be replaced.

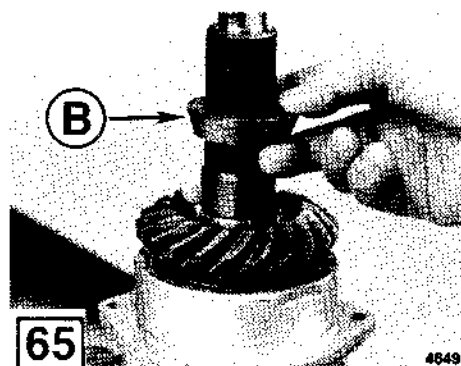
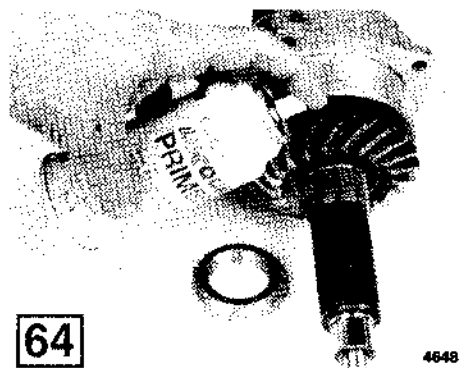
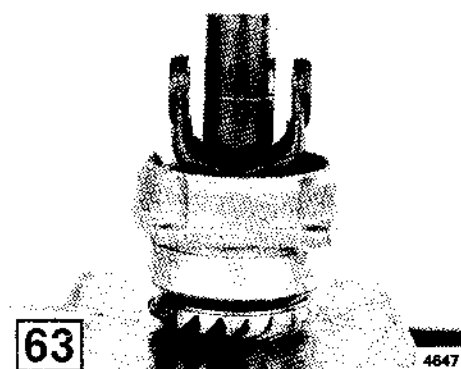
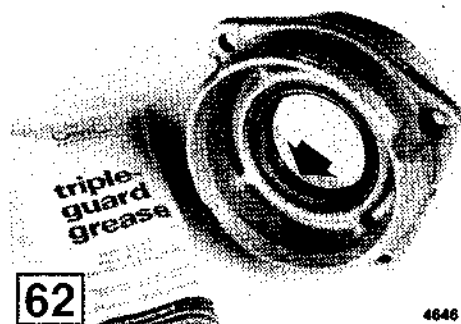
U-joint Shaft Assembly

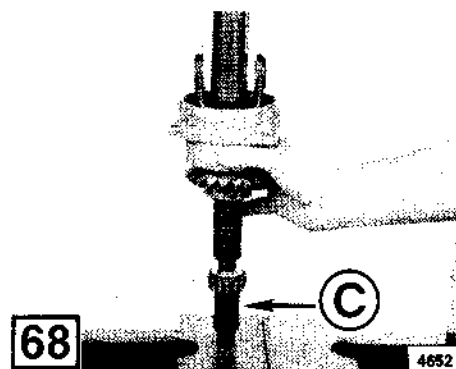
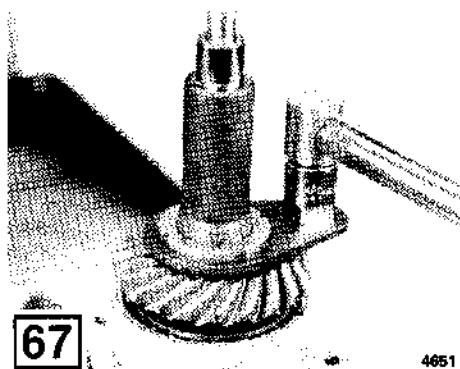
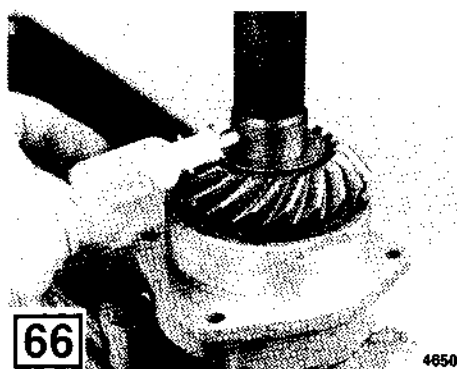
63 1. Place the carrier on the drive gear bearing. Lightly oil U-joint shaft splines and bearing rollers, then insert shaft into gear. Support gear and carrier in a press, then press shaft into gear until it seats.

Note When shaft seats in gear, bearing will not be tight in carrier. Carrier movement of $\frac{1}{8}$ in. is normal.

64 2. Spray shaft and nut threads with *OMC Locquic Primer* and allow to air dry.

65 3. Place support tube in yoke, and clamp U-joint assembly securely in vise. Slide centering cone **B** onto shaft and seat it tightly in the gear. Use a mallet and drift if necessary.





66 67 4. Evenly apply *OMC Ultra Lock* adhesive to the threads of the shaft. Face the beveled edge of the spanner nut toward the gear and screw it onto the shaft. Tighten the nut to a torque of 200 ft. lbs. (271 N·m) using OMC Spanner Wrench P/N 912272. Attach torque wrench to Spanner at a 90° angle to ensure an accurate reading.

68 5. Lightly oil inner diameter of small bearing. Position OMC Bearing Installer P/N 912269 **C** in a press, large end up. Set bearing on installer. Lightly lubricate water pump shaft with *OMC Extreme Pressure Grease*, then insert U-joint shaft assembly into bearing and tool. Press shaft into bearing until shaft seats.

Shimming U-joint Shaft

Use OMC Shim Gauge Kit P/N 984329 to shim the U-joint shaft assembly. It performs two functions:

- it determines the amount of shims required behind the small rear bearing cup to set the location of the drive gear
- it determines the amount of shims needed behind the bearing carrier to set the preload of the tapered roller bearings.

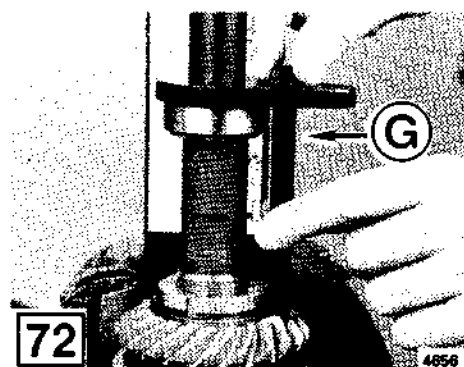
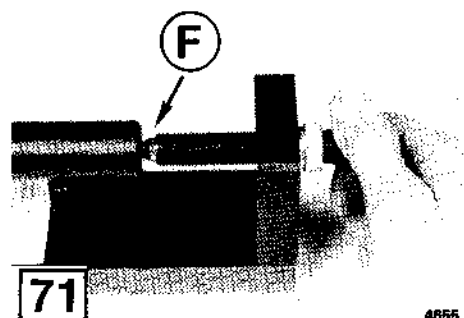
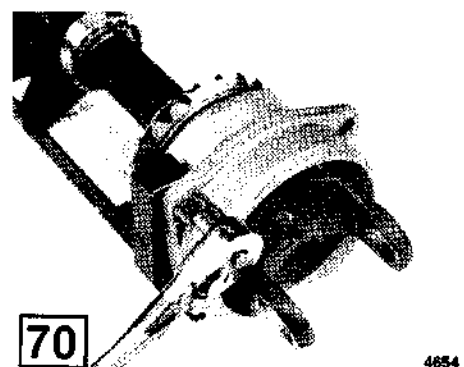
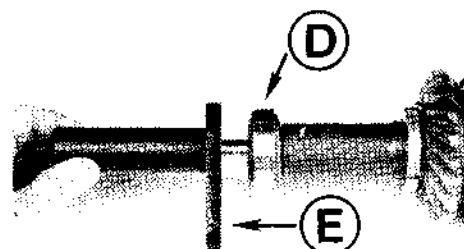
Remove the carrier's O-ring, and clean all pieces thoroughly before shimming.

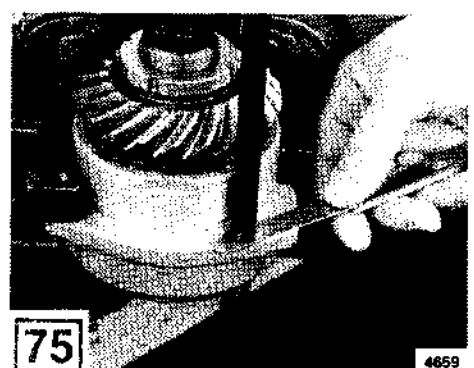
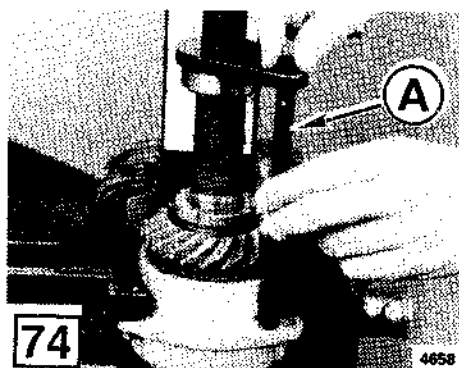
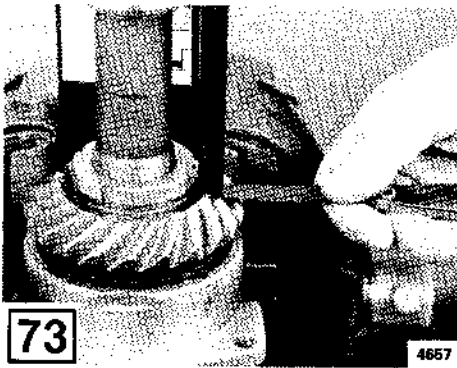
69 1. Set the bearing cup **D** on the rear bearing, then slide on the shim fixture's center adaptor **E**. Do not install any original shims.

70 2. Place the shaft and carrier assembly in the fixture frame. Rotate the carrier until three screw holes align. Secure carrier to the frame with three screws provided and tighten them securely.

71 3. Turn in preload screw until screw end reaches the reference groove **F**. This sets the proper bearing preload. Tighten locknut securely. Rotate shaft a minimum of four revolutions to seat bearing rollers and ensure accurate shim measurement.

72 4. Vertically clamp fixture frame in a vise. Read the gear ratio stamped on the bearing carrier and select the appropriate gauge rod **G** for shimming the rear bearing cup.





5. **Setting drive gear location** - is done by determining the amount of shims needed behind the rear bearing cup.

Note Perform this shimming operation first. Shims for bearing preload cannot be determined without first knowing the amount of shims required for drive gear location.

73 6. Attach the proper gauge rod to the inner hole of the center adaptor. Tighten the screw securely.

73 7. Measure the clearance between the rod and a flat on top of one of the gear teeth. Subtract this figure from .020 in. to determine the amount of shims required behind the small bearing cup.

• Example:

.020 in.
-.008 in. feeler gauge measurement

.012 in. shims required for positioning gear

74 8. **Setting bearing preload.** Remove the gear position gauge rod. Attach the long gauge rod A to the outer adaptor hole.

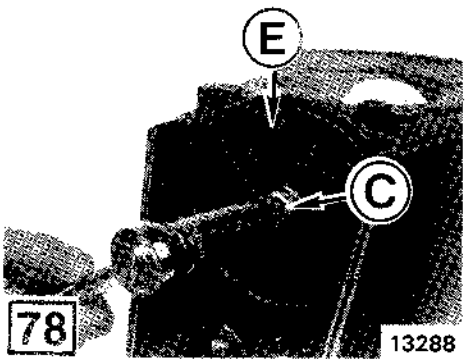
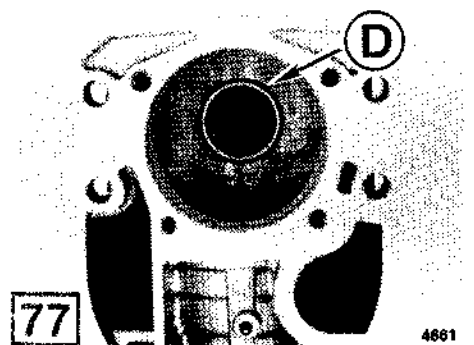
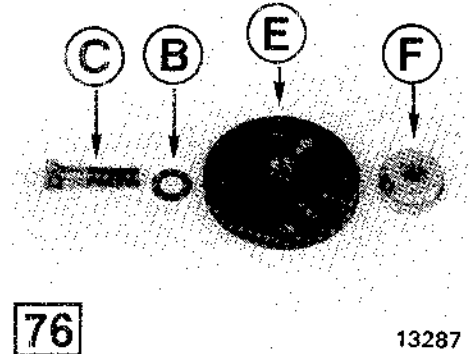
75 9. Measure the clearance between the rod end and the carrier flange. Add this measurement to the amount of shims needed behind the small cup, then subtract .020 in. from that sum. The result is the correct amount of shims needed for bearing preload.

• Example:

.022 in. feeler gauge measurement
+.012 in. shims needed behind small cup

.034 in. subtotal
-.020 in.

.014 in. shims required for bearing preload

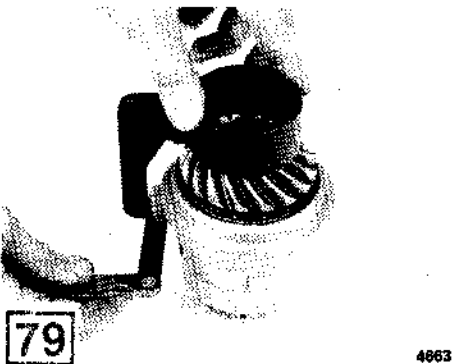


Upper Gear Housing Assembly

Rear Bearing Cup Installation

76 1. Place a 5/8 in. I.D. flat washer B on a 5/8 in. x 3 in. bolt C.

77 2. Place the proper amount of shims in the cup seat. Oil the outside of the cup D and set it in its seat.



- 76** **78** 3. Position Puller Head P/N 307636 [Ⓔ] (from OMC Universal Puller P/N 378103) inside adaptor housing recess with flat side of puller against casting. Set Bearing Cup Installer P/N 314429 [Ⓔ] in cup, then insert bolt [Ⓒ] through puller head and screw into installer. Tighten bolt until bearing cup seats.

Shimming Pinion Bearing Carrier

Shimming the pinion carrier assembly will set the vertical position of the pinion gear in relation to the horizontal drive gear. This will ensure the proper tooth contact pattern for long gear life.

- 79** 1. Rest OMC Shim Gauge P/N 912290 on the flats on top of the gear teeth. Use a feeler gauge to measure the clearance between the tool arm and the underside of the carrier rim.

2. Subtract .020 in. from your measurement. The result will be the amount of shims necessary to properly position the carrier assembly.

Example: .032 in. feeler gauge measurement
 -.020 in.

 .012 in. shims required

Pinion Bearing Carrier Installation

- 80** 1. Place the correct amount of shims [Ⓔ] on the carrier seat inside the housing.

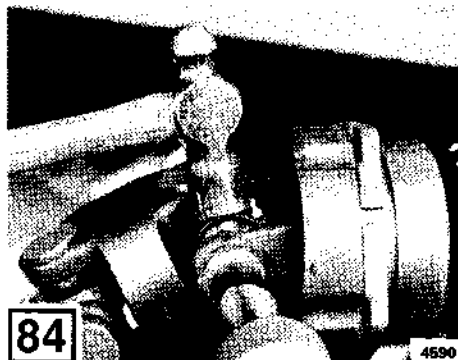
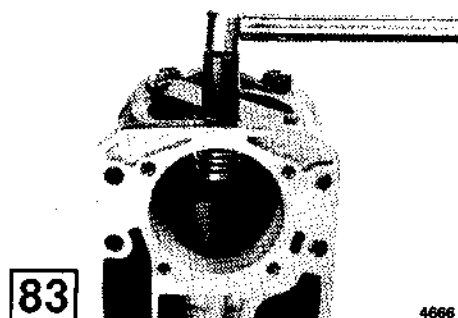
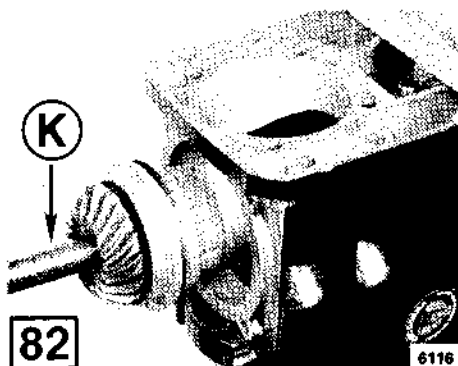
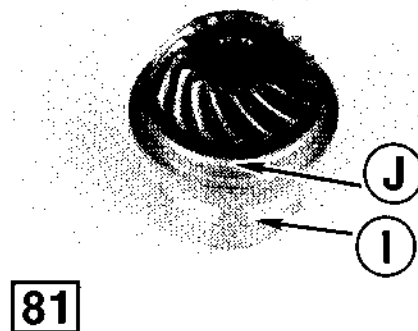
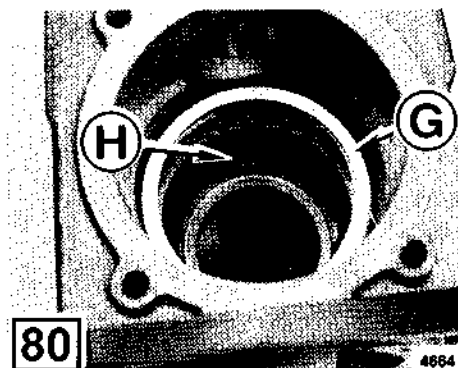
- 80** **81** 2. When installing the carrier assembly, the upper gear housing's locating slots [Ⓕ] must engage the lugs [Ⓘ] on the side of the carrier housing. To help you position the carrier while installing it, notice that the oil circulation slot [Ⓙ] inside the top of the carrier housing is in line with a carrier lug. Use this for reference when inserting the carrier assembly.

- 82** 3. Lightly oil the carrier's locating lugs and the surface between them. Rotate the housing until the forward opening faces up as shown. Stick the intermediate driveshaft [Ⓚ] into the gear, then insert the carrier assembly into the housing. Align the locating lugs and slots, then push on the driveshaft to seat the carrier. When properly seated, all of the lock ring threads will be visible and the top of the gear teeth will be 3.10 inches (78.7 mm) below the gear housing cover surface.

- 83** 4. Lightly oil the threads of the lock ring and position it in the housing. Place OMC Spanner Tool P/N 984330 on the lock ring and turn it in by hand as far as possible. Bolt the tension arm to the top of the gear housing, and tighten the lock ring to a torque of 145-165 ft. lbs. (197-224 N·m).

U-joint Shaft Installation

- 84** 1. Reassemble the U-joints. Follow the procedure under the section titled U-joint Assembly (page 7-11).



85 2. Place the correct amount of preload shims on the bearing carrier flange, and align the notches on the shims and carrier. Coat a new O-ring with *OMC Gasket Sealing Compound* and slide it onto the carrier.

86 3. Install the U-joint shaft assembly. Seat the carrier O-ring, then coat the threads of the mounting screws with *OMC-Gasket Sealing Compound* and install them. Tighten the screws to a torque of 12-14 ft. lbs. (16-19 N-m). Rotate shaft four full turns to seat bearings and allow accurate end play and backlash checks.

Note After installation, the U-joint shaft must have zero end play. Recheck shimming if end play is not zero.

Checking Gear Backlash

87 1. Attach a dial indicator to the top of the gear housing. Place the indicator pin against center of a gear tooth at a radius of 1.580 in. from the centerline of the U-joint shaft. Zero the indicator following the manufacturers instructions.

2. Slowly rotate the shaft back and forth so that the gear teeth make contact first in one direction and then the other. Correct backlash is .009 in. to .015 in (0,23 to 0,38 mm).

3. To correct gear backlash, change equal amounts of shims at the rear bearing cup, the U-joint bearing carrier, and the pinion bearing carrier. The amount of shims added/subtracted at each location should equal one-half of the total change required.

Example:

.020 in. measured backlash
-.012 in. desired backlash (midpoint of range)

.008 in. amount of change necessary

To decrease backlash to midpoint of range:

- Subtract .004 in. shims from behind rear bearing cup
- Subtract .004 in. shims from behind U-joint bearing carrier
- Add .004 in. shims under pinion bearing carrier

Steps "a" and "b" move the drive gear rearward, and step "c" moves the pinion upward. Backlash will be decreased:

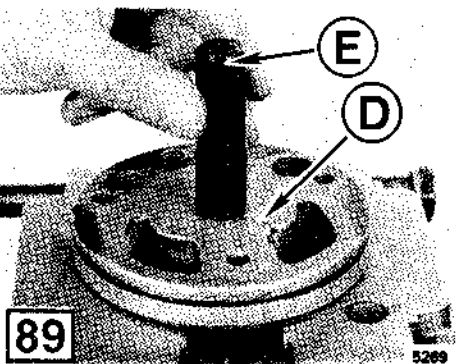
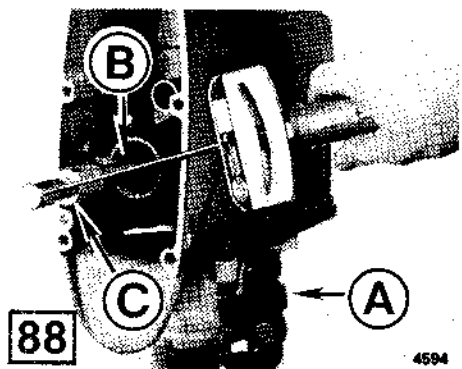
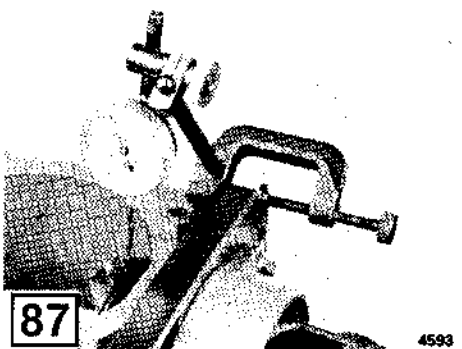
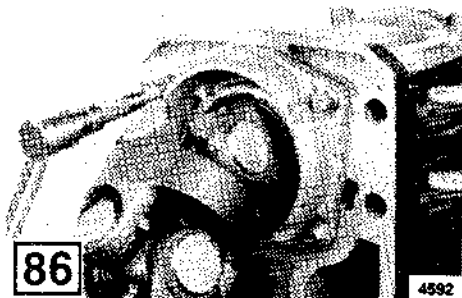
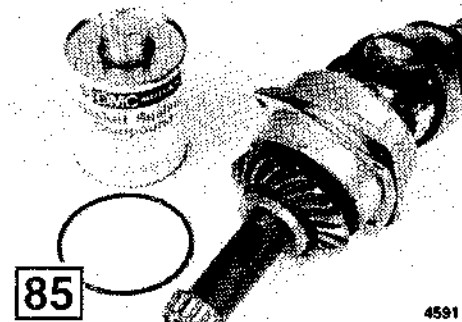
To increase backlash, add shims in step "a" and "b", and subtract shims in step "c".

Note When changing backlash, remember that steps "a" and "b" must both do the same thing, i.e. both subtract shims or both add.

Upper Gear Housing Rolling Torque Procedure

88 1. Turn the gear housing in its mounting fixture so that the U-joint shaft hangs vertically **A**. Insert the intermediate driveshaft **B** into the pinion carrier.

Note If the U-joint shaft is attached when checking rolling torque, it must hang vertically to ensure an accurate torque reading.



88 2. Attach a 0-50 in. lb. torque wrench to OMC Spline Socket P/N 311875 **C**. Rotate the driveshaft rapidly enough to get a steady needle reading and check for 4-20 in. lbs. (0,5-2,3 N-m) of rolling torque.

3. If rolling torque is incorrect, check gear backlash and change it if necessary. If gear lash is within specifications, change the plastic shims under the U-joint carrier flange. Adding shims will decrease rolling torque; subtracting shims will increase it.

Water Pump Disassembly

89 1. Position the adaptor with the relief slot **D** up, and place it in a press. Use OMC Driver, P/N 912270 **E**, to press out the center seal. Catch the tool and seal when they come free. Discard the seal.

90 2. Remove and discard the impeller housing O-ring seal.

91 3. If the impeller is still inside the housing, pull it out with pliers.

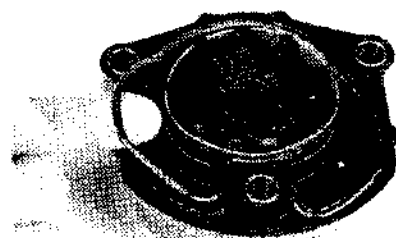
92 4. **Do not remove the liner unless it's scored or worn.** Pull it out with pliers if it needs to be replaced.

Water Pump Cleaning and Inspection

Clean all parts in solvent and dry them thoroughly.

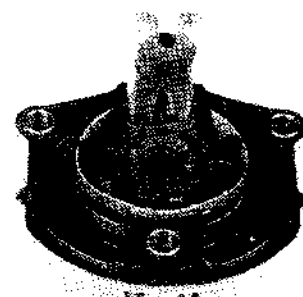
- **Adaptor** - clean sealer from all surfaces. Inspect O-ring grooves and gasket surfaces. Remove sharp edges that would prevent sealing.
- **Water Pump Housing** - clean sealer from seal groove and liner cavity. Make sure vent passage is clear. It ensures quick pump priming by preventing air pockets from forming. Check housing for cracks and replace if necessary.
- **Impeller Plate** - check impeller contact surface for wear, scoring or distortion caused by freezing. If only worn, do not throw plate away. Turn plate over and use other side when reassembling pump.
- **Impeller** - if blades are set in a bent position, or show flat instead of rounded edges on the liner contact surfaces, replace the impeller.

93 **Note** 2.3 and 3.0 Litre engines have special water pump impellers and liners. See the correct parts book for part numbers when ordering replacement parts for your engine.



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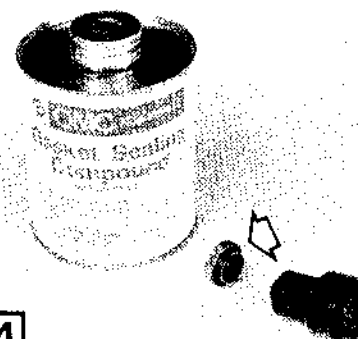
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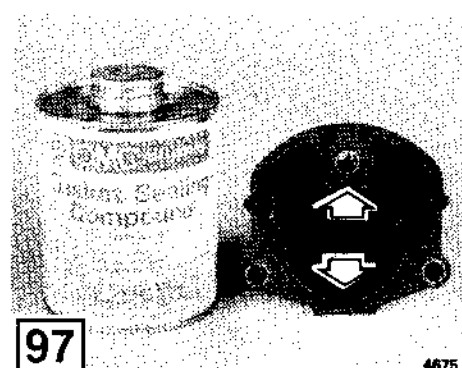
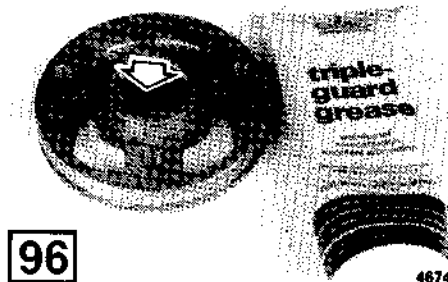
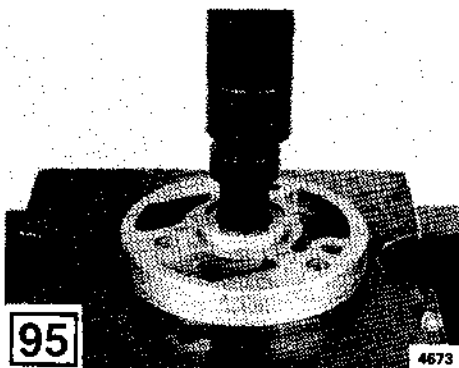
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Water Pump Assembly

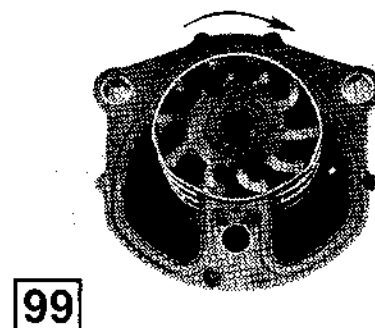
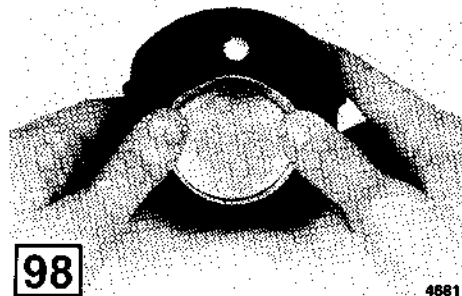
94 1. Install a new adaptor housing seal. Face the protruding lip toward OMC Installer P/N 912281, and slide it onto the tool. Lightly coat the seal's metal case with *OMC Gasket Sealing Compound*.

95 **96** 2. Position the adaptor with the seal cavity facing up and set in a press. Insert the seal and installer, and press in the seal until it seats. Apply *OMC Triple-Guard®* grease to both lips of the seal.

97 3. Sparingly apply *OMC Gasket Sealing Compound* to the interior walls of the impeller housing where the liner makes contact.

98 4. Push the liner into the housing until it seats. Wipe out any sealer that may squeeze into the liner through the water slots.

99 5. Lubricate the impeller with *OMC Hi-Vis®* gearcase lubricant. Face the drive pocket toward you, then twist the impeller into the liner with a clockwise motion.



Water Pump Installation

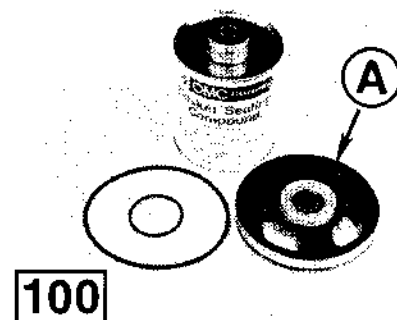
100 1. Coat both sides of a new adaptor housing gasket **A** with *OMC Gasket Sealing Compound* and install it on the back of the adaptor. Apply *OMC Gasket Sealing Compound* to two new O-rings and install them.

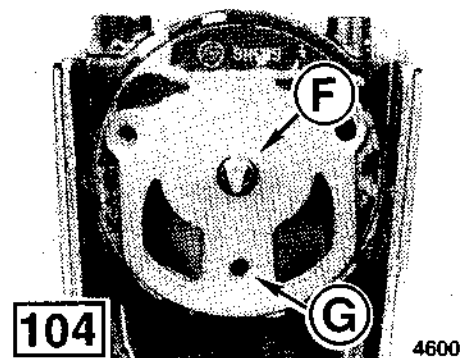
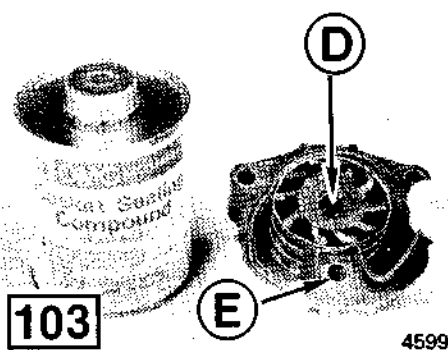
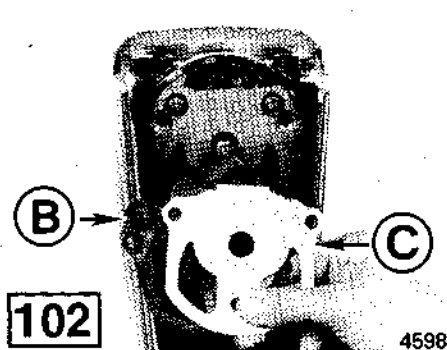
101 2. Slide OMC Seal Protector P/N 913501 onto end of water pump shaft. Install the adaptor housing. If necessary, use a soft hammer to seat it. Coat the threads of the two mounting screws with *OMC Gasket Sealing Compound* and tighten them to a torque of 12-14 ft. lbs. (16-19 N-m). Remove seal protector.

102 3. Apply a light coat of *OMC Gasket Sealing Compound* to both sides of a new impeller plate gasket **B**, then install it.

Note Do not apply sealer to the adaptor plate surface. The plate relief slot must remain open to prevent pressurizing seal around shaft.

102 4. Install the impeller plate **C**. If one side is worn, face that side toward the gasket. The plate does not have to be replaced unless it's distorted or damaged on both sides.





103 5. Coat a new seal ring with *OMC Gasket Sealing Compound* and place it in the groove on the water pump cover. Use a screwdriver to rotate the impeller clockwise until the narrow end of the impeller drive pocket **D** points directly at the cover's lower screw hole **E**.

104 6. Turn the U-joint shaft until the narrow end of the impeller drive wedge **F** is pointing directly at the lower mounting hole **G**.

Note Aligning the impeller and shaft will allow installation of the water pump cover without disturbing the cover seal. Engine overheating can occur if the pump cover is not properly sealed.

105 7. Push the water pump cover assembly onto the shaft and seat it against the plate. Coat the mounting screws with *OMC Gasket Sealing Compound* and tighten them to a torque of 108-132 in. lbs. (12-15 N-m).

105 8. Attach vent hose to water pump cover. Lubricate end of hose **H** and seat in housing.

106 9. Coat a new O-ring with *OMC Gasket Sealing Compound* and place it on the upper gear housing cover.

107 10. Install the upper cover. Coat the mounting screws with *OMC Gasket Sealing Compound*.

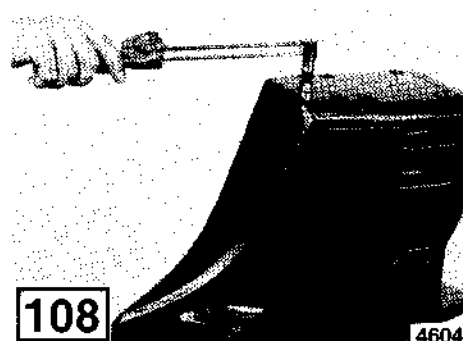
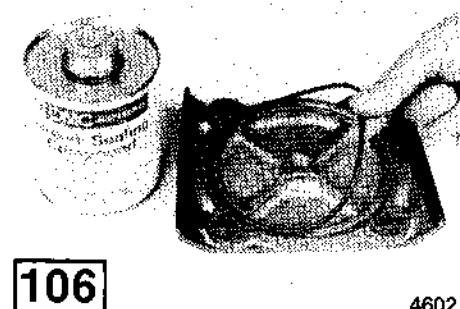
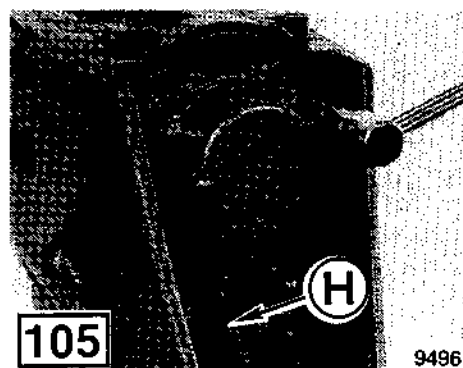
⚠ Note The upper gear housing cover screws are the four longest screws ($\frac{5}{16}$ -18 x 1 $\frac{1}{8}$ in.) used in the upper gear housing. Do not substitute any of the eleven shorter screws that are similar in appearance. The upper cover is the lifting point for the vertical drive, and maximum thread engagement is necessary to ensure cover attachment. Tighten the screws to a torque of 12-14 ft. lbs. (16-19 N-m).

108 11. Install the rear gear housing cover. Apply *OMC Gasket Sealing Compound* to the screws and tighten them to a torque of 108-132 in. lbs. (12-15 N-m).

Upper Gear Housing Installation

Refer to **Section 8** for the installation procedure for the upper gear housing. Perform the pressure and vacuum tests and fill the drive with *OMC Hi-Vis* gearcase lubricant as directed. To mount the vertical drive on the transom bracket, see **Section 17**.

⚠ Safety Related



Upper Gear Housing Specifications

Torques

Part	U.S.	Metric
Lock ring, pinion carrier	145-165 ft. lbs.	197-224 N·m
Nut, U-joint shaft	200 ft. lbs.	271 N·m
Screws		
Adaptor, water pump	12-14 ft. lbs.	16-19 N·m
Cover, rear gear housing	108-132 in. lbs.	12-15 N·m
Cover, upper gear housing	12-14 ft. lbs.	16-19 N·m
Cover, water tube	12-14 ft. lbs.	16-19 N·m
Impeller housing	108-132 in. lbs.	12-15 N·m
U-joint bearing carrier	12-14 ft. lbs.	16-19 N·m
Rolling torque		
Pinion bearing carrier	3-9 in. lbs.	0,3-1,0 N·m
Upper gear housing	4-20 in. lbs.	0,5-2,3 N·m
Gear backlash	0.009-0.015 in.	0,23-0,38 mm
End play, U-joint shaft	Zero	Zero

Adhesives, Lubricants, Sealants

Adhesives

Nut, pinion shaft Nut, U-joint shaft	<i>OMC Ultra Lock</i>
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Lubricants

Bearing cups (exterior) Impeller blades	<i>OMC Hi-Vis</i>
Seal lips (all)	<i>OMC Triple-Guard Grease</i>
U-joints	<i>OMC Marine Wheel Bearing Grease</i>

Sealants

Gasket, impeller plate Gasket, water pump adaptor Gasket, water tube cover Impeller liner Metal case seals (all) O-ring, U-joint bearing carrier O-ring, upper gear housing cover O-ring, water pump adaptor Seal ring, impeller housing Screw threads (all)	<i>OMC Gasket Sealing Compound</i>
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Safety Warning

Before working on any part of the lower gearcase, read the section called Safety at the beginning of this manual.

OMC Special Tools

P/N	Description
311875	Spline Socket
314438	Driveshaft Socket
316982	Puller Bolts (2)
321517	Bearing Installer
326551	Seal Installer
326562	Bearing and Seal Installer
326690	Seal Installer
328366	Gauge Bar
328367	Gauge Bar
328828	Installer
330224	Gauge Bar
330278	Puller Legs (2)
331045	Retaining Ring Pliers
334455	Pinion Nut Holder
378103	Universal Puller
383175	Guide Pin Set (2)
391010	Two-Jaw Puller
391012	Two-Jaw Puller
391257	Bearing Installer/Remover
391259	Bearing and Seal Remover
912031	Wrench
912277	Height Gauge
912280	Alignment Plate
984329	Shim Gauge Kit

Sealants, Lubricants and Adhesives

OMC Gasket Sealing Compound
OMC Triple-Guard® Grease
OMC Needle Bearing Assembly Grease
OMC Hi-Vis® Gearcase Lubricant
OMC Locquic Primer
OMC Screw Lock
OMC Ultra Lock
OMC Nut Lock