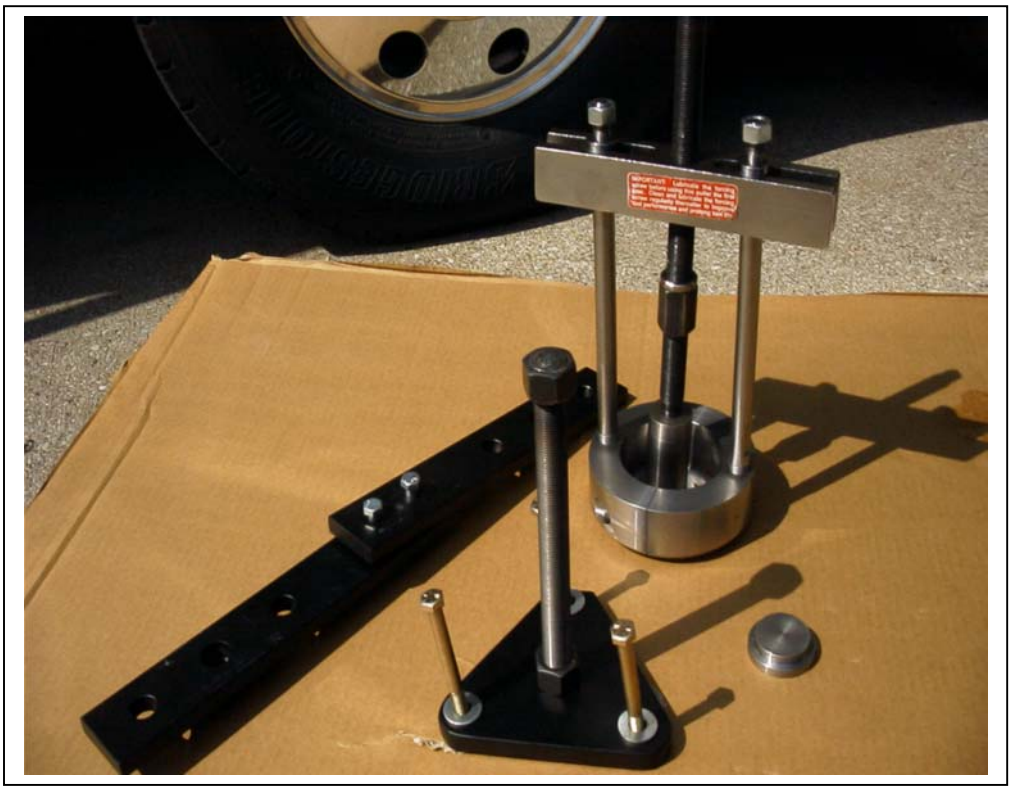
11/24/03

GMC Motorhome
Front Wheel Bearing Replacement

Utilizing Warner Puller Tools



Remember, cleanliness is next to Godliness, so if work on this project remains unfinished overnight, place a baggy over any greased parts or if at any time you are working under dusty conditions, cover all your parts under plastic sheeting.

(Dennis Simpson, Portage MI, May 2002)

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Parts

(for both front wheels)

2 ea bearing sets (e. g. Timken 23)
2 ea seals - inner (e. g. Chicago Rawhide 25515)
- outer (e. g. Chicago Rawhide 24888)
2 ea cotter keys - axle
- outer tie rod
- upper ball joint
- lower ball joint

Optional

(depending on condition found after disassembly)

6 ea 3/8", grade 5 bolts (for grease seal retainer plate)
6 ea small O-rings to fit over above bolts
2 ea grease boots - outer tie rod
- upper ball joint
- lower ball joint
2 ea brake calipers (choice of original or 80 mm size)
2 ea brake disc's
Right & left brake hoses (choice of original or 80 mm size)
4 ea caliper mounting bolts/pins
Brake pad set (e. g. Performance Friction 524)
4 ea banjo bolts (i. e. for 80 mm calipers)
Stabilizer bar end link hardware kit (e. g. graphite impregnated polyurethane bushings)
2 ea outer tie rod ends
2 ea upper ball joints
2 ea lower ball joints
2 ea outer CV joint boots and clamps
2 ea caliper O-ring kits

Recommended Tools

½" drive socket set
¾" drive socket set
Warner bearing puller/installer/knuckle puller set (includes either OTC 927 puller or Gil bar)
Hammers - soft faced (plastic headed) or rubber
- 3-4 lb (minimum) "engineer"
- medium sized ball peen
Floor or bottle jack
2 ea jack stands (i. e. prefer 3 ton if available)
¼ x 12" line up punch
Cotter key remover
Allen wrench's - 3/8" for caliper mounting bolt or 3/8" drive Allen head/hex bit socket (e. g. Sears 46665)
- 5/16" for bearing puller clamp
3/8-16 NC tap
7/16-20 NC tap
T-slider tap wrench
Drill motor
7/16" drill bit
Combination wrench's - ¾"
- 9/16" 12-pt (e. g. Sears 44696)
- 15/16"
- 1-1/8"
12" or larger adjustable (e. g. Crescent) wrench
Impact wrench and sockets
Small bottle jack or Porta-Power type unit
Center punch
Assorted sizes of common screwdrivers
Grease seal remover/puller
Caliper(s)
Three-point cylinder bore gauge or appropriate caliper
Steel block
File
Hack saw/band saw/Dremel tool
½" drive torque wrench
Parts cleaner

Other Supplies

4-5 cans of spray brake cleaner
Penetrant oil
Shop and paper towels
Hand wipes (Lava brand heavy duty hand cleaner towels recommended)
Tube of Mobil 1 or preferred brand of synthetic grease
Mechanics wire
Permatex brand EXTEND aerosol spray
Silicon brake grease
Anti seize compound
Sheet of 80 grit sandpaper

Note that throughout this document all parts, supplies, and tools are marked in bold and underlined as an aid in recognizing them.

Fig. 1. **Permatex Extend** aerosol spray can, shown on the left, used for corrosion control (it encapsulates any remaining rust and dries black in color) and **Mobil 1** tube of synthetic grease, shown on the right, used to pack bearings. Packed bearing set, shown in the center of the picture, is protected by a plastic "baggie".

DISCLAMER: These instructions are intended to be used as a way to facilitate communication on how to change your front wheel bearings and are not intended as absolute.

Just remember: "There is more than one way to skin a cat".

Removal and Teardown

If planning to look at/replace both front wheel bearing sets, it makes sense to perform some of the below listed steps simultaneously (e. g. loosing axle nuts prior to jacking up the coach) to both wheels.

Use your own best judgment in whatever works for you, as no attempt is made to call this out below as we proceed in the process.

1. Prior to jacking up the front end, remove hubcap (if original steel wheel is in use), hub dust cover, and with a **cotter key remover** the axle nut cotter key.

2. Loosen:

   a. Axle nut with **¾" drive socket set** or **impact wrench** using a **1-1/2" socket** Spray **penetrant oil** on axle threads exposed around castle nut. Attempt to back off nut. If unsuccessful, lightly hit castle nut between the notches with a **ball peen hammer** and **line-up punch** to break rust bond. In extreme cases may need as much as a 4' "cheater bar" to break the rust bond. Often times in this situation a heavy duty enough impact wrench is required.

   See photo 2 below.

Fig. 2. Note **¾" drive ratchet with extension** and **1-1/2"socket** over drive axle nut. Turn wrench in conventional counterclockwise direction to loosen nut, both driver and passenger sides.

   b. Wheel lug nuts.

3. Block rear wheels, jack up front end of coach from the center of, and let down on top of **jack stands** resting under front frame cross member.

4. Remove:

   a. Front wheel.

b. The two brake caliper mounting bolts/pins using **3/8" Allen wrench/hex bit socket** and caliper. Tie up caliper out of way to A frame with **mechanics wire** so it does not hang by flexible brake hose. Determine condition of the mounting bolts/pins. Often times they are corroded to the point where they no longer perform their intended function of allowing the caliper to readily move back in forth in response to use. If either the outboard or inboard brake pad is worn more than its mate, suspect the bolts/pins need replacement.

c. Axle nut and washer.

5. Using the **cotter key remover**, remove cotter key from both upper and lower ball joint and tie rod end studs.

6. Back off ball joint and tie rod stud castle nuts (use **3/4" combination wrench** on both top ball joint and tie rod nuts; **15/16" combination wrench** on bottom ball joint nut) such that top of nuts are flush with the end of the studs.

7. Hold a **steel block** against one side of the knuckle steering eye and with the other hand rap on eye with a **4# hammer** to make outer tie rod end stud pop out of place. Repeat for both upper and lower ball joint studs by rapping on each ball joint stud knuckle eyes.

   Commonly, a so-called "pickle fork" is used to remove the above. However, it tends to tear up the grease boots and distort the studs.

8. Remove both ball joint and tie rod stud nuts after studs have popped loose.

9. Lift:

   a. Outer tie rod end stud out of knuckle steering arm and place out of way.

   b. Knuckle and hub assembly out of ball joint stud eyes and slide off drive shaft. After removal, place assembly on the bench in preparation for disassembly.

See photo 3 below.

Fig 3. Knuckle and hub assembly on the bench.

10. Place a combination tire and wheel on top of work surface and set hub upside down on top of the wheel such that all wheel studs fit in bolt holes in the wheel. Secure hub to wheel with two lug nuts placed opposite each other and snugged tight by hand.

    See photo 4 below.

Fig. 4. Inverted hub inserted in the wheel bolt holes.

11. Using the box end portion of a **9/16" combination/box end wrench** (preferably make sure you use the type wrench having a slightly angled box-end head), back out the three bolts securing outer grease seal retainer plate in place.

See photo 5 below.

Fig. 5. Outer grease seal retainer bolts being loosened.

An opened end wrench is not recommended for this operation. It tends to slip off of and distort the bolt heads plus it does not have desirable head angle.

12. If disassembling both front wheels to replace the bearings, separately mark one hub and knuckle as a set so that they don't get interchanged as a set later. For example, use **center punch** to make marks on each piece somewhere.

13. Clean out/chase the threads on back side of the knuckle that hold the three bolts removed in step 10 above using a **3/8-16 NC tap** and **T-slider tap wrench** If tap will not engage in any of the holes, use **drill motor** and **7/16" drill bit** to enlarge hole opening to top depth of threads.

Note: Failure to do so will result in attempted newly cut threads not lining up with existing ones.

See photos 6 and 7 below.

Fig. 6 This photo illustrates drill enlargement on the back side of the knuckle of the outer grease seal retainer plate bolt holes when needed, prior to chasing/tapping.

Fig. 7. Chasing/tapping outer grease seal retainer plate bolt hole threads in the knuckle.

14. Using the **grease seal remover**, lift out and remove inner grease seal and discard.

See photo 8 below.

Fig. 8. Inner grease seal removal.

15. Place circular **Warner bearing puller tool** plate (i. e. so called "puck") in end of exposed hub shaft opening.

    See photo 9 below.

Fig. 9. Circular **Warner bearing puller tool** plate (i. e. aka "puck") placed over end of hub shaft. Puller screw point bears on this plate when pulling the knuckle off the hub.

    Install appropriate (i. e. there are two sizes in the set) puller screw through triangular shaped **Warner bearing puller tool** knuckle puller plate and bolt plate in place on back side of the knuckle with the three long bolts and washers.

See photo 10 below.

Fig. 10. **Warner bearing puller tool** knuckle puller plate bolted in place shown with puller screw in place.

    With **1-1/8" combination wrench**, turn the puller screw to separate knuckle from hub.

    After removal of the knuckle, disconnect puller pieces and set knuckle aside for the time being.

16. Separate **Warner bearing puller tool** round bearing puller clamp halves by using a **5/16" Allen wrench** to remove the cap screws. Push outer seal down sufficiently and in turn, install first one of the bearing puller clamp halves and then the second one around base of bearing set. Use a **soft face/rubber hammer** as an aid in seating halves around the bearings. Bolt bearing puller tightly in place using Allen head screws and **Allen wrench**.

    Install two long OTC puller legs in place on puller bearing clamp and place the OTC 927 puller cross block with pulling screw in place, forcing nut and washer ***under*** bar, over top of the legs. Secure legs to bar with sliding plates, washers, and nuts.

    With **1-1/8" open-end wrench** holding puller nut, use **12" adjustable wrench** to turn pulling screw to pull bearing set off hub shaft.

The Warner bearing puller tool set came with a bearing clamp shown below in two different diameters.

The clamp shown on the right in photo 11 below is the larger of the two, which spaces the holes for the OTC 927 puller legs slightly further apart. This allows use of the two-piece Gil bar, shown on the left side on the cover of this document, as well as being able to substitute a small hydraulic bottle jack for the pulling screw, if desired. It was distributed with the latter batch of sets.

Fig. 11. This view shows the two different diametered Warner bearing puller tool bearing clamps.

See photo 12 below.

Fig. 12. **Warner bearing puller tool** clamp halves assembled around the bearing pack. Also shown are the OTC puller tool legs threaded into the bearing puller clamp and the puller screw resting on the "puck". Note in this view that the bearing has been pulled off the hub shaft

17. Unbolt OTC puller tool pieces from bearing puller halves. Unbolt bearing puller halves from bearing set.

    Unless bearing set is to be reused, discard, however it is suggested that you save spacer as a spare for possible future use.

    If set is to be reused, set aside to be cleaned and inspected.

18. Remove outer:

    a. Outer seal from hub shaft and discard.

    b. Grease seal retainer plate from hub shaft and set aside.

19. Remove and inspect the three grease seal retainer plate bolts for reuse. Consider replacing with new **grade 5 bolts**.

20. Thoroughly de-grease any residue by spraying the following with **spray brake cleaner** and wiping clean using **shop/paper towels**:

    a. Axle nut and washer.

    b. Inside of front wheel surface. This is done in order to determine if grease is leaking from bearings upon use after re-assembly.

    c. Upper and lower A-arms.

    d. Axle and CV joint boot.

    e. Tie rod end including nut.

    f. Upper and lower ball joints including nuts.

    g. Bearing set if being reused.

See photo 13 below.

Fig. 13. This picture illustrates both the upper and lower control arms as well as the drive shaft with outer CV joint. Hub and knuckle are removed in this view. Note castle nut in place on the axle shaft.

h. Hub.

When dry, if necessary wire brush rust away and corrosion control by spraying **EXTEND** on all surfaces and set aside to dry. Protect machined surfaces from spray.

See photo 14 below.

Fig**. 14**. Cleaning hub shaft.

When dry, if necessary, corrosion control by spraying **EXTEND** on all surfaces of the plate and set aside to dry.

i. Knuckle.

When dry, if necessary wire brush rust away and corrosion control by spraying **EXTEND** where needed on all surfaces and set aside to dry. Protect machined surfaces from spray.

j. Outer grease seal retainer plate.

When dry, if necessary wire brush away rust and corrosion control by spraying **EXTEND** on all surfaces of the plate and set aside to dry.

21. Using appropriate **caliper** and ideally a **three point cylinder bore gauge**, measure for tolerances as follows:

a. Hub shaft, which must not be tapered or have a step on it. It is a ground dimension and should have a uniform measure from a minimum of 2.0015 to a maximum of 2.0020 inches. Anything less and the hub should be replaced or shaft reconditioned/rebuilt (e. g. metalized and ground).

See photo 15 below.

Fig. 15. Caliper being used to measure hub shaft dimension.

b. Knuckle bore, which should uniformly measure 3.2510 to 3.2525 inches. Bore can be 0.0015 inches out of round if the average diameter is within tolerance. However, the minimum diameter must not be less than 3.2510 inches. Knuckle

measurements are best made with a **three-point cylinder bore gauge**.

See photo 16 below.

Fig. 16. Measuring bore of knuckle with caliper.

Note: bearing race OD measures 3.250 inches, so fit in knuckle is not interference.

If necessary, recondition/rebuild knuckle as follows (e. g. alternatives are):

- Metalize and machine.
- Machine for oversize race, or

- Sleeve with high strength tubing

If it **is** within tolerance and will be reused chase the two caliper mounting bolt/pin hole threads with **7/16-20 NC tap** and **T-slider tap wrench**.

See photo 17 below.

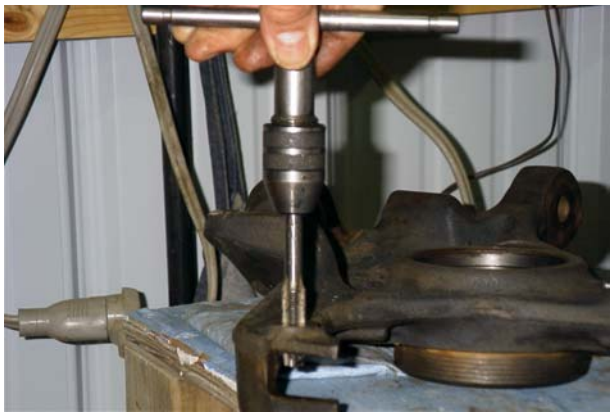

Fig. 17 Caliper mounting bolt/pin hole threads in knuckle being chased/cleaned.

c. Brake disc, which is to measure between 2.000 to 2.130 inches. Discard and replace if below minimum.

If within tolerance, sand disc on both front and back surfaces with **80 grit sandpaper** wrapped around a small block of wood, etc., to deglaze.

At this point, also consider need to turn disc, particularly if brakes pulsate (indicates warped disc) under braking use.

22. Inspect condition of:

a. **Outer tie rod/grease boot** and both **upper** and **lower ball joint grease boots**. Replace if damaged or torn.

b. **CV joint boot** for tears and **clamp** condition. Replace as necessary.

c. Outer tie rod and both ball joint stud looseness. Replace as necessary.

d.

23. This completes the process for one wheel. Now repeat for the opposite side, if necessary.

Reassembly

1. Place combination tire and wheel on top of work surface and set hub upside down on top of the wheel such that all wheel studs fit in bolt holes in the wheel as shown in Figure 4 on page .

2. Cut slots across threaded end of retainer plate bolts using either **hack saw**, **band saw**, **Dremel tool** with fiber disc attachment, etc., to facilitate use of **screwdriver** in threading bolts back in place.

   See photo 18 below.

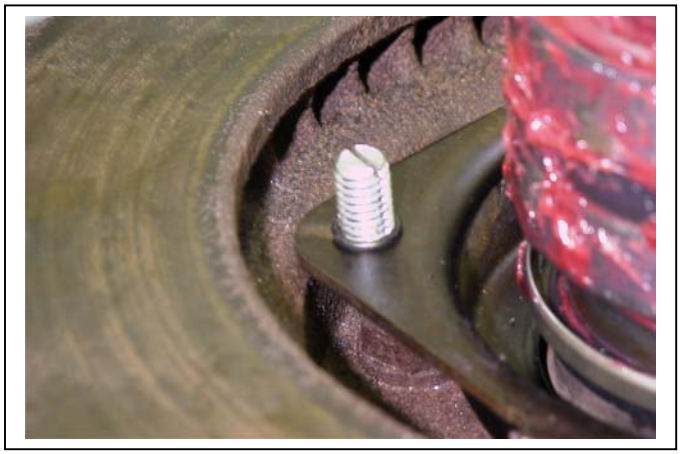

Fig. 18 This view illustrates slot for screwdriver cut across end of outer seal retainer plate bolts. Note "O" ring retaining bolt in seal retainer plate.

3. Place outer seal retainer plate:

   a. **Bolts** with lock washers upward through holes in the plate and secure from top side with **O-rings**, in three places. Coat threads with **anti seize compound** or a light coating of bearing grease at a minimum.

   b. In place over hub shaft.

See photo 19 below.

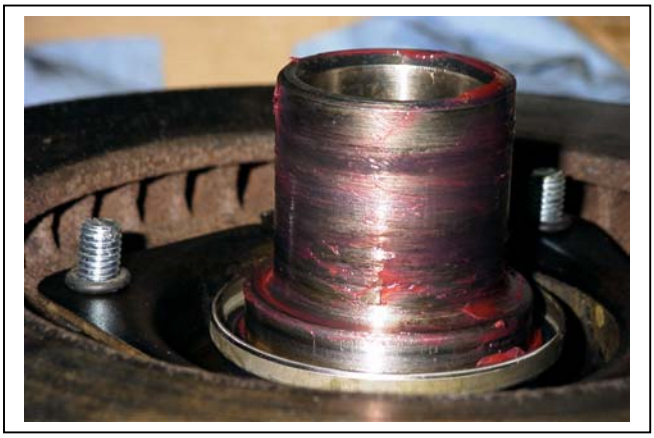

Fig. 19 Outer seal retainer plate, with bolts secured by **O-rings** in place, plus outer seal both in place over hub shaft. Note hub shaft bearing stop shoulder configuration just above seal as well as light coating of grease on hub shaft.

4. At this point, some individuals recommend checking the clearance (i. e. between each side of the spacer and bearing races when they are lightly clamped in a vise) of the bearing set. To do so requires two sets of feeler gauges positioned 180° apart.

   Others feel that the above method is meaningless since the bearing will be minutely distorted once it is pressed on the hub shaft, resulting in slightly different, usually tighter clearances while under stress.

   The Timken #23 bearing sets come with a spacer having a stock clearance of 0.0095". The spacer is ground to give this dimension. Various individuals assemble the bearing set ranging from 0.005" (requires careful grinding of the spacer edges) to the stock dimension. Be careful though. Bearing set sandwiched too close together results in heat buildup and premature failure.

5. Grease:

   a. Hub shaft lightly as shown in Fig. 19 above.

b. **Outer seal** rubber lips lightly and set in place over and *properly oriented* on hub shaft.

6. Pack either original, if reusing, or new **bearing set** with synthetic type grease (e. g. **Mobil 1**), stack in place and set aside on top of workbench.

   See photos 20 and 21 below.

Fig. 20. **Bearing** being packed with grease.

Some individuals prefer to skip this step in favor of installing the bearing set dry and subsequently lubricating once hub and knuckle are reinstalled and mounted back between the A-arms and the axle is tightened in place. In this case, lubrication is done using a zerk fitting that has been strategically installed in the knuckle.

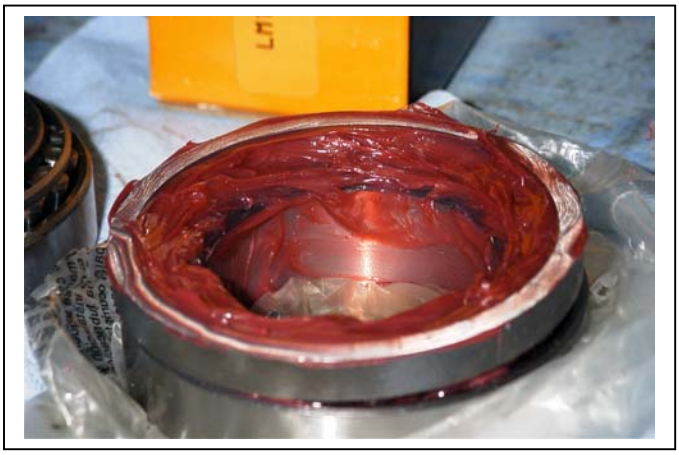

Fig 21. Note spacer ring, the middle piece of the bearing set, greased and in place on top of lower bearing.

7. For the next series of steps, it is advisable to have a helper present.

   a. As it may be, either dry or packed with grease, place **bearing set** stack in place on end of hub shaft and thread the **Warner bearing tool** OTC 927 pressing screw and cross block through the center of the bearings. Make sure forcing screw nut rests on top of the bar.

      See photo 22 below.

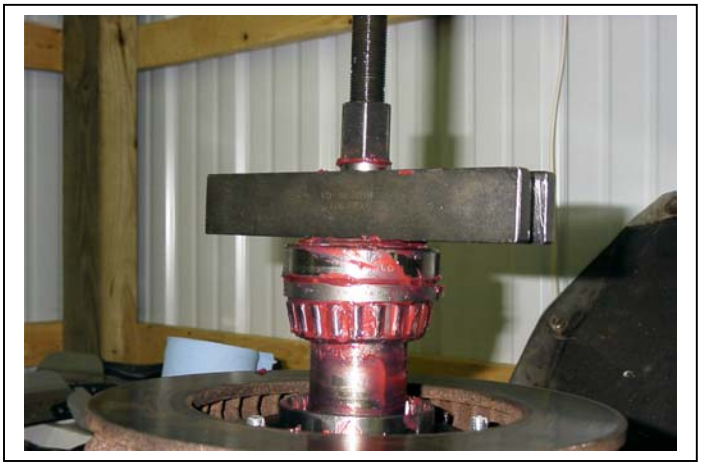

Fig. 22. Bearings stacked on top of hub shaft. Note OTC cross block bar and pressing/forcing screw in place on the shaft. HOWEVER, THE ABOVE PICTURE ILLUSTRATES THE WRONG SEQUENCE OF BEARING .ASSEMBLY.

Anytime the bearing race drops down, as shown above, THAT IS INCORRECT assembly. Reassemble in the proper sequence.

b. Lift hub up out of the wheel on one side high enough to place the **Warner bearing tool** axle cavity pressing screw retainer in center of hub axle bore. Be careful so that bearing set does not fall off the hub shaft.

See photo 23 below.

Fig. 23. Axle cavity pressing screw retainer.

c. While holding retainer in place, thread pressing screw into **Warner bearing tool** axle cavity retainer in center of the hub and then back it off a quarter turn so that it is easier to subsequently disassemble. This facilitates removal of the screw without need for a tool to hold the retainer while backing it out.

d. Secure hub to wheel with two lug nuts placed opposite each other and snugged tight by hand. See Fig. 4 above on page 4.

e. With **1-1/8" combination wrench**, turn pressing screw to press bearing set in place until it bottoms on the hub stop. The stop is visible in Figure 18 above on page 10.

See photo 24 below.

Fig. 24. Press bearings onto hub shaft by turning nut on the pressing screw with a wrench. HOWEVER, ONCE AGAIN THE ABOVE PICTURE ILLUSTRATES THE WRONG SEQUENCE OF BEARING .ASSEMBLY. Anytime the bearing race drops down, as shown above, THAT IS INCORRECT assembly. In this example, reverse lower bearing and reassemble stack in the proper sequence.

8. After bearing set is pressed in place, disassemble and remove bearing press hardware.

9. Pull up outer seal retainer plate, thread three bolts in place using a small **common screwdriver**, and tighten using **9/16" combination wrench**.

See photos 25 and 26 below.

Fig. 25. Threading inner grease seal retainer plate bolt in place.

Fig. 26. Outer grease seal retainer bolt being tightened.

10. Pack remainder of inner grease seal retainer plate bolt hole openings with grease for corrosion protection.

    See photo 27 below.

Fig. 27. Packing bolt holes with grease.

11. Lightly chamfer metal edge of **inner seal** with a **file**. Doing so facilitates seating the seal in the bore of the knuckle.

See photo 28 below.

Fig. 28. Using a **file** to chamfer metal edge of **inner seal**.

12. Set **inner seal** in place on knuckle by lightly tapping on it judiciously with a **soft-faced hammer** and **line-up punch**. Leave metal part of the seal stick up ~ 1/8" above face of knuckle bore. This allows the grease seal to be tightly seated (see Fig 29 below) against the outer CV joint so no water or debris can get into the bearings, after tightening the axle nut.

    Assembly is now ready to mount back in place on the coach. However, now is the time to determine if **ball joints**, **grease seals**, **front stabilizer bad end link hardware/bushings**, or **tie rod** needs to be replaced. If so complete these tasks now.

13. To mount assembly on the coach, lift and maneuver it so that end of axle shaft is threaded through the center opening of the hub from the back side of knuckle and then lift it onto stud of lower ball joint. Hold the assembly in place while threading nut onto ball joint stud finger tight.

14. Push down on upper A-arm with one hand and guide upper ball joint stud into upper ball joint eye of knuckle. You may find it helpful to slightly **jack** up lower A-arm to facilitate connecting.

15. Place tie rod end stud in knuckle steering eye and thread nut finger tight on it to secure it in place.

16. Torque both **upper and lower ball joints** and tie rod studs nuts to 35 lbs-ft. Secure nuts with new **cotter key** in hole in the end of each stud.

    See photo 29 below.

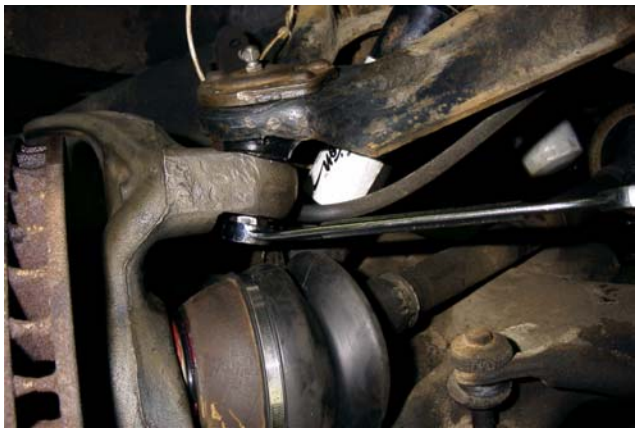

Fig. 28. Upper ball joint nut being tightened in place.

17. Thread axle nut on axle shaft and with torque wrench and 1-1/2" socket tighten to 120 lbs-ft if able to do so before axle spins. Otherwise, wait until wheel is reinstalled in step #22 below to finish torquing.

    See photos 30 and 31 below.

Fig. 30. Axle nut being tightened (turn in clockwise direction for both sides).

Fig. 31. Tightening axle nut draws the outer CV joint, seen on the right side above, in close proximity to back side of the knuckle, on the left side, and in the process seats (remember in step 12 above the grease seal was set ~ 1/8th inch above the knuckle) the inner grease seal lips.

18. Replace choice of **caliper**, **brake pads**, and **brake hose**.

    When replacing caliper, make sure to use sufficient **silicon brake grease** to lubricate caliper ear O-rings and **mounting bolts/pins** so that caliper is able to "float" back and forth in use.

19. Replace front wheel and with torque wrench tighten lug nuts to appropriate torque value.

20. Repeat process on other wheel if applicable.

21. Remove **jack stands** and lower **jack**.

22. Once coach is lowered, using a **torque wrench**, tighten axle nuts to 120 lbs-ft and install new **cotter key** in axle. If need be, torque nut until it lines up with hole in axle, not to exceed 280 lbs-ft.

23. Replace hub dust cap and hubcap (if original steel wheel is in use), using either **soft faced or rubber hammer** to position/secure in place.

24. Test drive.

25. Immediately after test drive:

    a. Note temperature of hub (i. e. feel exposed exterior surface of outer dust cap) after stopping. If it is very warm, this indicates an assembly problem and possibly requires disassembly again to find the problem. Hopefully that will not be the case.

    b. Note backside/inside of wheel to see if grease is leaking past seal. If grease is slung around the wheel, you have a leaking seal and the axle nut must be removed again so that the hub and knuckle can be removed to look at the seal.

26. Make any necessary corrections.

27. This completes the process for one wheel. Now repeat for the opposite side, if necessary.

----------(end)----------

NOTES SECTION