Servicing Wheel Bearings

Servicing wheel bearings is not technically difficult. However, a person needs to perform the process properly. The most demanding part of the process is setting the bearing clearance properly. This article will cover bearing service in general terms, and will focus on the proper adjustment of the bearings.

JIM SHEPHERD

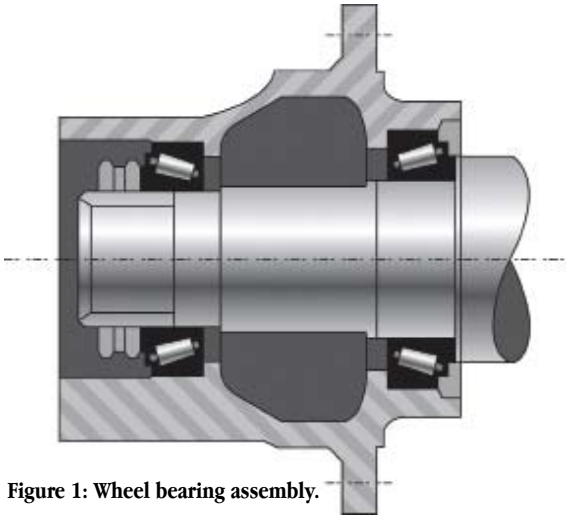

Figure 1: Wheel bearing assembly.

Background

Our buses all use tapered roller bearings (see Fig. 1). Let's take a look at tapered bearings and their application techniques. Henry Timken patented tapered roller bearings in 1898 for use with horse drawn carriages. You will often find the term "Timken bearings" used to describe tapered roller bearings. They are used extensively in automotive and industrial applications. Their main claim to fame is they have very good ratings for both axial and radial load. Axial loads are the side forces caused by turning a corner, while radial loads are the weight-bearing loads.

Tapered bearings are often used in gear applications since they can locate the gears very accurately and take the thrust load produced by some gears. In this application the bearings are installed with some "preload." In other words they are "squeezed" together so that the gear (or other equipment) is very accurately located. An example of this type of application is the pinion in a rear end. There, the preload is very carefully controlled via a shim pack. In some cases, the preload is controlled by a very close tolerance spacer between the bearings. Conversely, applications like wheel bearings are designed to run with clearance. Folks who work on differentials sometimes attempt to apply preload to wheel bearings and that can cause severe damage.

Fig. 2 shows the effect preload/clearance has on tapered roller bearing life. The curve clearly shows that excessive preload drastically reduces bearing life. That is why preload in gear applications is very carefully set and measured. Since the rolling surfaces are tapered, they can be compared to a wedge. A slight side force on a wedge can create huge forces in the opposing direction. The same is true with tapered bearings. A bearing whose preload is not set properly will exert huge axial loads on the bearing and quickly exceed the capacity of the bearing.

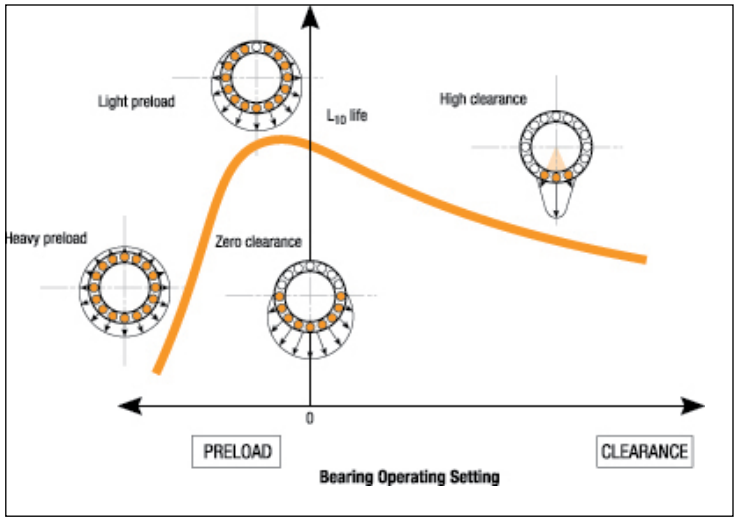

Figure 2: Wheel bearing pre-load effect on bearing life.

When should wheel bearings be serviced?

In general, the mileage we put on our buses will not demand frequent bearing service. This is especially true if your bus uses oil-type hubs. Hubs packed with grease will need periodic servicing (check your manual for recommended service interval). Obviously, wheel service will be dictated by leaking seals.

Figures 1 and 2 courtesy the Timken Company.

Not so obvious, would be the need to adjust bearing clearance if abnormal tire wear or steering stability is encountered. For these conditions, wheel bearing adjustment can be quickly checked by jacking up the wheel and rocking the top of the tire back and forth. There should be a slight movement, but anything over 1/8 inch movement would suggest re-setting the bearing clearance.

Wheel bearing adjustment specifications

So, with all that technical discussion out of the way, how should wheel bearings be adjusted? The obvious answer is to follow the procedure defined in your manual. However, almost every reference source has the same general procedure. Two good references are:

• Technology & Maintenance Council's (TMC) Recommended Practice 618 (see Fig. 3)

• Timken Tech Tips Vol. 2 Issue 1 (available at: http://www.timken.com/)

Both of these sources (as well as the manuals I have reviewed) recommend the same process which involves tightening the wheel bearing adjustment nut and then backing off the nut 60 to 90 degrees (no more than ¼ turn). This should give an end play of about 0.001 – 0.005 inches. The process is described in a bit more detail in the next section.

Figure 3: Technology and Maintenance Council's Recommended Practice 618.

TAPERED ROLLER BEARING ADJUSTMENT PROCEDURE
RP-618

Step 1: Lubricate the tapered roller bearing with clean axle lubricant of the same type used in the axle sump or hub assembly.

NOTE: Never use an impact wrench when tightening or loosening lug nuts or bolts during the procedure.

Initial Adjusting Nut Torque	Initial Back Off	Final Adjusting Nut Torque	Back Off		Final Back Off	Jam Nut Torque		Acceptable End Play
			Axle Type	Threads Per Inch		Nut Size	Torque Specifications	
Step 2	Step 3	Step 4	Step 5		Step 6	Step 7		Step 8
200 lbf•ft (271N•m) While Rotating Wheel	One Full Turn	50 lbf•ft (68 N•m) While Rotating Wheels	Steer (Front) Non-Drive	12	1/6 Turn *	Install Cotter Pin to Lock Axle Nut in Position		0.001" - 0.005" (.025 - .127 mm) As Measured Per Procedure With Dial Indicator
				18	1/4 Turn *			
				14	1/2 Turn *	Less Than 2 5/8 (66.7 mm)	200-300 lbf•ft (271-407N•m)	
				18				
			Drive	12	1/4 Turn *	Dowel Type Washer	300-400 lbf•ft (407-542 N•m)	
				16		Tang Type Washer **	200-275 lbf•ft (271-373 N•m)	
			Trailer	12	1/4 Turn *	Less Than 2 5/8 (66.7mm)	300-400 lbf•ft (407-542 N•m)	
				16				

* If dowel pin and washer (or washer tang and nut flat) are not aligned, remove the washer, turn it over and reinstall. If required, loosen the inner (adjusting) nut just enough for alignment.

** Bendable type washer lock only: Secure nuts by bending one wheel nut washer tang over the inner and outer nut. Bend the tangs over the closest flat perpendicular to the tang.

Developed by the Technology & Maintenance Council

The Servicing Process

As mentioned above, the process is not technically difficult, but does involve heavy components and must be done in a careful manner.

The tools required include:

- Jack and heavy blocks
- Locknut socket. This is a thin-wall socket available at NAPA or online (one source: http://www.toolfetch.com/axle-nut-sockets.shtml)
- Heavy rubber hammer for installing seal
- Tool to drive out old seal (can use socket extension)
- Typical ratchet/sockets
- Torque wrench

The process of adjusting the bearing is straightforward:

1) Jack up the axle for the wheel to be serviced. Be sure to block the bus properly.

2) It is not necessary to remove the wheel if the only service is adjustment. If the hub is to be fully serviced, the wheel and brake drum should be removed (these are very heavy components and should be handled carefully).

3) Remove hub cover or axle for the drive axle.

4) Remove the locking nut with the locknut socket.

5) At this point, it is strongly suggested that, at the minimum, the adjusting nut be removed and the outer bearing removed for a thorough inspection. The best option is to remove the hub and perform a full service including replacement of the seal. Bearings and races should be carefully inspected for any signs of abnormal wear. Fig. 4 shows a race with a smooth uniform surface. If only the outer bearing is inspected, it should be understood that the inner

Continued Pg.20


Figure 4: Bearing race in excellent condition.

bearing condition is not necessarily indicated by the condition of the inner bearing. If either the race or the bearing show abnormal conditions, replace all bearings and races for that wheel.

6) Once the hub has been serviced and/or the bearings are inspected/replaced, the bearing adjustment will be as follows:

- Tighten adjusting nut to 100 ft-lb and rotate wheel/hub both ways (sets the races).
- Back off nut completely and re-tighten to 50 ft-lb and rotate wheel/hub.
- Back off nut 60 to 90 degrees.
- Tighten jam nut to specification (generally at least 200 ft-lbs).
- Check for end play "must be in the range of 0.001 to 0.005 inches".

7) Repack the wheels if grease is used.

8) Replace wheel/axle/cover and replenish the hub or differential fluid.

General Comments

In the old days, we used to use a chisel to get the adjusting and locking nuts off our cars. Do not try to do that with the hubs on your bus. You must use the locknut socket. They are generally less than $30. There are several sizes and you may have to measure yours before you buy the socket.

While it is quite a bit of extra work to do a full service job, replacing the seals is a strongly recommended process. There are special seal installation tools, but many folks simply use a good rubber hammer and carefully drive the seal in. Doing a full-service job allows both bearings (and races) to be properly inspected.

While every specification will recommend checking the end play, in practice it is seldom done. If you are careful in adjusting the nut, you will have the correct adjustment.

If a bearing inspection suggests replacement, be sure to replace the races as well. While it is possible to replace the races yourself, I would recommend having a shop press the races out (not an easy job) and then press the new races in. This will insure full seating of the races.

When adjusting the bearings, be very careful not to exceed the 90 degree recommendation when backing off the adjusting nut. This will make the bearings too loose. While that will not damage the bearing, the looseness affects steering adjustments and can cause significant, abnormal tire wear.