Figure 98-1 Rolling contact bearings include (left to right) ball, roller, needle, and tapered roller.

Figure 98-2 Ball bearing point contact.
Figure 98-3  Radial load is the vehicle weight pressing on the wheels. The thrust load occurs as the chassis components exert a side force during cornering.

Figure 98-4  Roller bearing line contact.

Figure 98-5  A tapered roller bearing will support a radial load and an axial load in only one direction.
Figure 98-6  Many tapered roller bearings use a plastic cage to retain the rollers.

Figure 98-7  Non-drive-wheel hub with inner and outer tapered roller bearings. By angling the inner and outer in opposite directions, axial (thrust) loads are supported in both directions.

Figure 98-8  Sealed bearing and hub assemblies are used on the front and rear wheels of many vehicles.
Sealed bearing and hub assemblies are serviced as a complete unit as shown. This assembly includes the wheel speed sensor.

**FREQUENTLY ASKED QUESTION: What Do Different Grease Colors Mean?**

**Nothing.** According to grease manufacturers, grease is colored for identification, marketing, and for consistency of color reasons.

- **Identification.** The color is often used to distinguish one type of grease from another within the same company. Blue grease from one company may be totally different from the blue grease produced or marketed by another company.
- **Marketing.** According to grease manufacturers, customers tend to be attracted to a particular color of grease and associate that color with quality.
- **Consistency of color.** All greases are produced in batches, and the color of the finished product often varies in color from one batch to another. By adding color to the grease, the color can be made consistent.

Always use the grease recommended for the service being performed.

**Typical lip seal with a garter spring.**
SAFETY TIP: Smoking Can Kill You

Some greases contain polymers such as Teflon® that turn to a deadly gas when burned. Always wash your hands thoroughly after handling grease that contains these ingredients before smoking. If some of the grease is on the cigarette paper and is burned, these polymers turn into nitrofluoric acid—a deadly toxin.

Figure 98-11  A garter spring helps hold the sharp lip edge of the seal tight against the shaft.

Figure 98-12  Removing the grease cap with grease cap pliers.
**TECH TIP: Easy Wheel Bearing Looseness Test**

Looseness in a front wheel bearing can allow the rotor to move whenever the front wheel hits a bump, forcing the caliper piston in, which causes the brake pedal to kick back and creates the feeling that the brakes are locking up. Loose wheel bearings are easily diagnosed by removing the cover of the master cylinder reservoir and watching the brake fluid as the front wheels are turned left and right with the steering wheel. If the brake fluid moves while the front wheels are being turned, caliper pistons are moving in and out, caused by loose wheel bearings. If nothing happens, the brake fluid should not move. Loose wheel bearings can also cause the brake pedal to sink due to movement of the rotor, causing the caliper piston to move. This sinking brake pedal is usually caused by a defective master cylinder. Before replacing a master cylinder, check the wheel bearings.

**Figure 98-13** Using a seal puller to remove the grease seal.

**Figure 98-14** Cleaning a wheel bearing with a parts brush and solvent.
CHART 98–1
Wheel bearing inspection chart. Replace the bearing if it has any of the faults shown.

Figure 98–15
A wheel bearing race puller.
Figure 98-16 Installing a bearing race with a driver.

Figure 98-17 Notice the new blue grease has been forced through the bearing.

Figure 98-18 A commonly used hand-operated bearing packer.
Figure 98-19 The wheel bearing is placed between two nylon cones and then a grease gun is used to inject grease into the center of the bearing.

Figure 98-20 The wheel bearing adjustment procedure as specified for rear-wheel-drive vehicles. Always check service information for the exact specified procedure for the vehicle being serviced.

Figure 98-21 A properly secured wheel bearing adjustment nut.
Figure 98-22 A rear wheel sealed bearing hub assembly.

Figure 98-23 Removing the drive axle shaft hub nut. This nut is usually very tight and the drift punch wedged into the cooling fins of the brake rotor keeps the hub from revolving when the nut is loosened. Never use an impact to remove or install a drive axle shaft hub nut because the hammering action will damage the bearing.

Figure 98-24 A special puller makes the job of removing the hub bearing from the knuckle easy without damaging any component.
Figure 98-25  A typical full-floating rear axle assembly.

Figure 98-26  A semi-floating rear axle housing is the most commonly used in light rear-wheel-drive vehicles.

Figure 98-27  A retainer plate-type rear axle bearing. Access to the fasteners is through a hole in the axle flange.
Figure 98-28 A slide hammer-type axle puller can also be used.

**TECH TIP: The Brake Drum Slide Hammer Trick**

To remove the axle from a vehicle equipped with a retainer plate-type rear axle, simply use the brake drum as a slide hammer to remove the axle from the axle housing. **SEE FIGURE 98-29.** If the brake drum does not provide enough force, a slide hammer can also be used to remove the axle shaft.

Figure 98-29 To remove the axle from this vehicle equipped with a retainer plate rear axle, the brake drum was placed back onto the axle studs backward so that the drum itself can be used as a slide hammer to pull the axle out of the axle housing. A couple of pulls and the rear axle is pulled out of the axle housing.
To remove the C-lock (clip), the lock bolt has to be moved before the pinion shaft.

The axle must be pushed inward slightly to allow the C-lock to be removed. After the C-lock has been removed, the axle can be easily pulled out of the axle housing.

Using a hydraulic press to press an axle bearing from the axle. When pressing a new bearing onto the axle, pressure should only be on the inner bearing race to prevent damaging the bearing.
Removing an axle seal using the axle shaft as the tool.

This is a normally worn bearing. If it does not have too much play, it can be reused. (Courtesy SKF USA Inc.)

When corrosion etches into the surface of a roller or race, the bearing should be discarded.
Figure 98-35 (b) If light corrosion stains can be removed with an oil-soaked cloth, the bearing can be reused. (Courtesy SKF USA Inc.)

Figure 98-36 (a) When just the end of a roller is scored, it is because of excessive preload. Discard the bearing.

Figure 98-36 (b) This is a more advanced case of pitting. Under load, it will rapidly lead to spalling. (Courtesy SKF USA Inc.)
Always check for faint grooves in the race. This bearing should not be reused.

Grooves like this are often matched by grooves in the race (above). Discard the bearing. (Courtesy SKF USA Inc.)

Regular patterns of etching in the race are from corrosion. This bearing should be replaced.
Figure 98-38 (b) Light pitting comes from contaminants being pressed into the race. Discard the bearing. (Courtesy SKF USA Inc.)

Figure 98-39 (a) This bearing is worn unevenly. Notice the stripes. It should not be reused.

Figure 98-39 (b) Any damage that causes low spots in the metal renders the bearing useless. (Courtesy SKF USA Inc.)
In this more advanced case of pitting, you can see how the race has been damaged.

Discoloration is a result of overheating. Even a lightly burned bearing should be replaced.

Pitting eventually leads to spalling, a condition where the metal falls away in large chunks.
Figure 98-41 (b)  In this spalled roller, the metal has actually begun to flake away from the surface. (Courtesy SKF USA Inc.)

Figure 98-42  These dents resulted from the rollers "hammering" against the race, a condition called brinelling. (Courtesy SKF USA Inc.)

TECH TIP: *Bearing Overload*

It is not uncommon for vehicles to be overloaded. This is particularly common with pickup trucks and vans. Wherever there is a heavy load, the axle bearings must support the entire weight of the vehicle, including its cargo. If a heavy load is hit while driving, the balls of a ball bearing or rollers of a roller bearing can make an indent in the race of the bearing. This dent or imprint is called brinelling, named after Johann A. Brinell, a Swedish engineer who developed a process of testing for surface hardness by pressing a hard ball with a standard force into a sample material to be tested. Since the indenter is made, the bearing will make noise when the roller or ball enters over the indent. Continued use causes wear to occur on all of the balls or rollers and eventual failure. While this may take months to fail, the cause of the bearing failure is often overloading of the vehicle. Avoid steep loads and overloading for safety and for longer vehicle life.
REAR AXLE BEARING 1
After safely hoisting the vehicle, remove the rear wheels and brake drums.

REAR AXLE BEARING 2
Remove the rear differential cover and inspect the magnet for metal particles that would indicate serious wear or damage.

REAR AXLE BEARING 3
Remove the retaining bolt and allow the pinion shaft to be removed.
Push the axle inward toward the center of the vehicle to free the axle clip.

After removing the clip, the axle can then be removed. Note that the backing plate is wet, indicating that the axle seal has been leaking.

A seal removal tool being used to remove the axle seal.
If a retainer-type axle is being serviced, the bearing and seal need to be pressed off of the axle.

After installing a new bearing and seal, insert the axle and install the clip, then the pinion shaft.

Clean the differential housing before installing the cover gasket and cover. Refill the differential with the specified fluid.