Module 12: Wheel Bearings and Seals

Terms and Definitions

- The **axle** (straight axle) is a structural member attached to the suspension, which connects the wheels and allows them to turn through a series of bearings.
- The **bearing** is a part that helps spread the forces of a load to reduce the friction and wear of a moving part.
- The **drive axle** is an axle whose shaft is splined to the differential drive gears, which then rotates the wheel, hub, and tire assembly.
- **End play** is the amount of lateral movement of the hub along the spindle due to clearance in the bearings.
- The **full-floating drive axle** is a type of drive axle in which the axle housing carries the load of the vehicle, thereby allowing the bearings to “float.”
  - **Note:** This type of drive axle is designed for heavy duty applications.
- The **journal** is the part of a shaft, axle, or spindle that turns in a bearing.
- **Overload** means in excess of the designed load.
- **Packing** is the act of forcing grease into wheel bearings.

Preload is the adjustment of bearings so that there is a slight load on them to ensure proper internal alignment and limiting of end play.

- **Press fit** is a tight fit between mating parts that must be “pressed” into place.
- **Races** are tracks or channels in which something rolls or slides.
- **Seal** is the material used to form a leakproof connection between moving or fixed parts.
- The **spindle** is the small shaft or axle on which a wheel turns; it is also called the steering knuckle.
- The **steering axle** is the axle that contains a steering knuckle and allows the vehicle to be turned (steered).
  - **Note:** This is typically the front axle.
- The **wheel and hub assembly** is an assembly mounted on an axle in such a way that it rotates to allow movement of a vehicle.
- The **wheel bearing** is the bearing used to distribute the load of a vehicle on its axles.

Purposes of Wheel Bearings

- There are four purposes of wheel bearings:
  1. To spread the weight of the vehicle and its load over a greater surface
  2. To reduce the friction of wheel rotation
  3. To reduce wear to parts
  4. To provide a replaceable wear surface (wear ring)

Parts of the Wheel Bearing (Tapered Roller Shown)

- Outer race (cup)
- Cone assembly
- Bore
- Inner race
- Roller
Parts of Wheel and Hub Assemblies

- Inner wheel bearing
- Oil seal
- Axle spindle
- Hub cap
- Hub cap gasket
- Wheel bearing adjusting nut
- Outer wheel bearing
- Outer wheel bearing cup
- Brake drum

Common Wheel Bearings Defects

- Mechanical damage is the deforming or breaking of the bearing assembly, which is caused by mechanical stress and can be fixed by replacing the bearing.
- Abrasive wear is the wear on the rollers or races, which is caused by fine particles in the lubricant and can be fixed by replacing if the wear is excessive, or simply cleaning and repacking if the wear is minor.
- Pitting is surface indentations on the races or rollers, which is caused by contamination with large particles and can be fixed by cleaning and repacking, or replacing if the bearings are rough and noisy.
- Brinelling is surface indentations in the raceway that parallel the rollers, which is caused by excessive loading or vibration while the bearing is not rotating, or improper installation, and can be fixed by replacing the bearing.
- Spalling is flaking of the surface metal, which is caused by metal fatigue or poor quality bearings, and can be fixed by replacing the bearings.
- Discoloration ranges from faint yellow to dark blue; is caused by either inadequate lubrication, overloading, or another source of excessive heat; and can be fixed by replacing the bearings.

Reasons for Bearing Failures

- Dirt
- Improper assembly
- Misalignment
- Insufficient, improper type, or inferior lubricants
- Overloading
- Corrosion
- Inferior material
- Incorrect grooving
- Incorrect clearance

Wheel Bearing Problems and Their Results

- Loose or worn wheel bearings can cause:
  - Noise
  - The vehicle to pull to one side
  - Chatter
  - Uneven braking
  - Shimmy
  - Too much play in the steering system
  - Shortened bearing and seal lives
  - Misalignment of antilock brake wheel sensors
- Overtightened wheel bearings can cause:
  - Noise
  - Uneven braking
  - Overheating of the wheel and bearing
  - The vehicle to pull to one side
- Damaged wheel bearings can cause:
  - Noise
  - Shimmy in the affected wheel
  - The vehicle to pull to one side

Types of Wheel Bearing Lubricants

- Petroleum-based lubricants such as grease and oil
- Synthetic lubricants

Note: Use only the manufacturer’s recommended lubricant, and check to make sure it is compatible with the seals being used.
Guidelines for Servicing Wheel Bearings

**Guidelines for Adjusting Wheel Bearings**

| Follow the vehicle manufacturer’s recommendations for the selection and installation of wheel bearings. | If compressed air is used to clean the bearings, use only low pressure and never enough pressure to turn the rollers. |
| Follow the bearing manufacturer’s instructions for the selection and installation of lubricant. | Caution: A bearing may fly apart if high pressure compressed air is used. |
| Follow the vehicle manufacturer’s recommendations for wheel bearing service intervals. | Handle the bearings with care to prevent damage. |
| Compare the identification numbers of the old bearings and the replacement bearings, and do not destroy the old bearings until you record the identification numbers. | Observe asbestos exposure precautions because the removal and installation of wheel bearings may involve handling brake linings containing asbestos and other components contaminated with brake lining dust. |
| Every wheel has two sets of bearings—an inner bearing assembly and an outer bearing assembly—so be sure not to install these backwards. | Do not reuse cotter pins removed from the spindle, and always install a new cotter pin. |
| Keep the bearing assemblies together as a set and do not exchange parts between different assemblies. | |
| Use only an approved solvent to clean the bearings. | |

**Guidelines for Adjusting Wheel Bearings**

| Always follow the vehicle service manual procedure to adjust bearings. | Always rotate the wheel in both directions while tightening the adjusting nut. |
| Depending on the manufacturer, slight preload or limited end play may be recommended. | While adjusting the bearings, make sure the brakes do not drag on the drum or rotor to produce a false adjustment. |
| Adjustment of the wheel bearing will involve the use of either a torque wrench to apply preload or a dial indicator to adjust end play. | Do not reuse locking devices (cotter pins, washers with tangs, etc.) that are deformed. |
| The numerous spindle-nut systems and hubs make it difficult to give general rules of thumb concerning appropriate preloading or end play amounts. | Adjust the brakes after adjusting the wheel bearings. |

**Purposes of Wheel Seals**

| Wheel seals have four purposes: | 3. To separate dissimilar fluids (such as lubricating oil and water) |
| 1. To retain lubricants or liquids | 4. To confine pressure |
| 2. To exclude dirt, water, and other contaminants | |

**Types of Wheel Seals**

| One-piece: | Multipiece: |
| Unitized—needs a special driver | Lip seal—may have a single or a double lip |
| Barrier—installed with a bare hand | Wear rings—may have a flat ring or a grit guard |
Causes of Sealing Failures

All seals will eventually fail and begin to leak with normal use. However, seals that fail prematurely are usually caused by one of the following four situations.

1. Improper installation techniques or careless handling, which could result in nicked or cut sealing surfaces, a scratched shaft, a distorted or cocked seal, or a damaged garter spring.
2. Incorrect seals used for application, which includes seals that are the wrong size; that are used in systems with excessive speeds, temperatures, or pressures; or that use fluids incompatible with the sealing material. These could result in seals that are brittle, cracked, hardened, excessively worn, spongy, or blown out.
3. Misalignment of the shaft to the bore commonly results in excessive wear on one side of the seal.
4. Shaft or bore excessive roughness, scratches, burrs, or dirt can result in excessive wear to the shaft, bore, and/or seal.

Guidelines for Installing Wheel Seals

- Remove the old seal carefully, and take care when prying out the old seal not to scratch the housing. Sometimes a special puller will be needed.
- Inspect the bore and shaft for nicks and burrs, and file off any burrs that could cut the new seal.
- Check shaft and bore dimensions to make sure they match the seal specifications.
- Excessively worn or grooved shafts may be fitted with wear (repair) sleeves to create a new seal running surface, and these require a special installation tool.
- Never reuse old or damaged seals.
- Make sure the new seal faces in the correct direction, as usually the lip faces the lubricant or fluid to be retained.
- Prelubricate the sealing element with the same lubricant being retained prior to installation.
- Use the correct tool to install the seal—such as an arbor press, soft-face hammer, specially-made seal installer, or old bearing cup—and apply force evenly around the outer edge to avoid cocking the seal.
- Check to see that the seal is fully seated and aligned in its bore. The manufacturer may specify how deep the seal must be installed.
- Check and adjust the fluid level after installing a seal, and check for leaks.