

Steering and Suspension


## Bearings, Tires and Wheels

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Steering and Suspension

## Bearing Loads

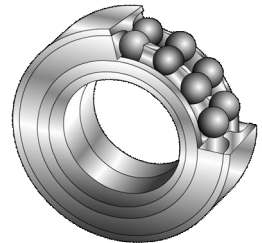
- Radial
  - Load is applied straight downward
- Thrust
  - Load is applied in a horizontal direction
  - A wheel bearing experiences thrust loading during turns
- Angular
  - Load is applied somewhere between horizontal and vertical



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## Types of Bearings

- Cylindrical ball bearings
  - Single and double row ball bearings available
  - Radial loads
- Tapered roller bearings
  - Coned shaped races
  - Radial, thrust and angular loads
- Needle roller bearings
  - Caged and un-caged
  - Radial loads



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## Grease Seals

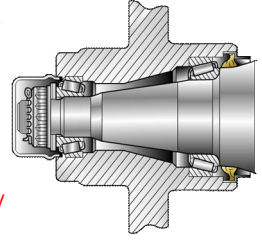
- Seals are designed to keep the lubricant in and contamination out
- Spring-less seals
- Spring loaded seals
  - When a lip seal is installed the garter spring should face toward the flow of lubricant
- Wheel bearing grease seals should not be reused



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## Wheel Bearing Components

- Spindle
- Inner bearing assembly
- Grease seal
- Hub cavity
- Nut lock
- Dust cap
- Cotter pin
- Outer bearing assembly
- Hub



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## Servicing Wheel Bearings


- Clean and carefully inspect the bearings, races and spindles for damage
- Always keep the bearings and with their mated races
- Lubricate the bearings with high temperature long fiber grease
- Carefully follow the manufacturer's procedure to properly adjust the wheel bearings
- [Watch video](#)

**Never spin the bearings with air during the cleaning procedure!**

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### Bearing Diagnosis

- Defective bearings may create a squeaking, grinding or whining noise
- Bearing noise is often more noticeable at low speeds
- Bearing noise increases with load

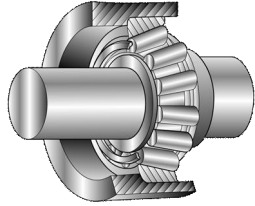


The car is turning right. Which wheel is carrying the greatest load?

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### Types of Bearing Failures

- Worn spot on roller
- Chipping
- Roller Pitting
- Bent cage
- Cracked cage
- Rust
- Race Pitting
- Visible wear patterns
- Heat discoloration



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### Replacing Wheel Bearings

- If a wheel bearing or race is damaged they must be replaced as a set
- Drive the race out carefully to avoid damaging the hub
- Carefully inspect the hub and spindle for damage
- Be certain to seat the new race fully with the proper tools



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### Tire Construction

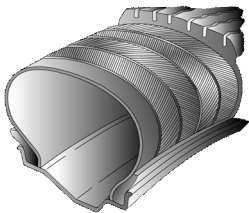
- Tread
  - wear bars are exposed at 1/16"
- Sidewall
- Bead
  - bias verses radial
- Belt
- Inner liner



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### Bias Ply Tires

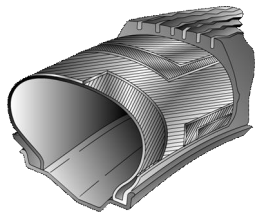
- Bias-ply tires have a body of fabric plies that run alternately at opposite angles to form a crisscross design
- The angle varies from 30 to 38 degrees with the centerline of the tire and has an effect on high-speed stability, ride harshness, and handling
- Commonly available in 2- or 4-ply



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### Bias Belted Tires

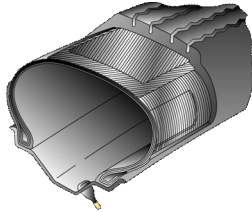
- Similar to bias-ply tires, except two or more belts run the circumference of the tire under the tread
- This construction adds strength to the sidewall and greater stability to the tread
- The belts reduce tread motion during contact with the road surface, thus improving tread life



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### Radial Ply Tires

- Body cords extend from bead to bead at an angle of about 90 degrees, radial to the tire circumference centerline
- Two or more layers of relatively inflexible belts are positioned under the tread
- The belts restrict tread motion while rolling improving tread life, traction and fuel economy



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### Tire Identification

- 205/75R15 92H
  - 205 - cross sectional width in mm
  - 75 - aspect ratio
  - R - radial construction
  - 15 - rim diameter in inches
  - 92 - load index
  - H - speed rating



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### Tire Speed Ratings



• F – 50 mph	• Q – 100 mph
• G – 56 mph	• R – 106 mph
• J – 62 mph	• S – 112 mph
• K – 68 mph	• T – 118 mph
• L – 75 mph	• U – 124 mph
• M – 81 mph	• H – 130 mph
• N – 87 mph	• V – 149 mph
• P – 93 mph	• Z – 149+ mph

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### Wheel Size

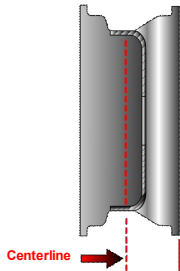
- A wheel's size is determined by the rim width and rim diameter
  - Rim diameter is measured across the bead seating areas from top to bottom
  - Rim width is the distance between the inner and outer wheel flange



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### Wheel Terminology

- Centerline is the point located at the center of the wheel flanges
- Offset is the distance of the hub mounting surface from the centerline of the wheel
  - Positive - The hub mounting surface is outboard of the wheel's centerline
  - Negative - The hub mounting surface is inboard of the wheel's centerline



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### Tire Inspection


- Check for the tire and wheel for damage
- Check the tire pressure
- Check for excessive or abnormal tread wear
- Determine the cause of any abnormal tire wear
- [Watch video](#)

Tires should be replaced when the tread wear indicator bars are flush with the tread - 1/16"

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### Tire Wear Patterns

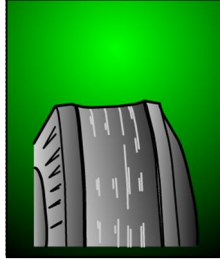
- Under inflation



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### Tire Wear Patterns

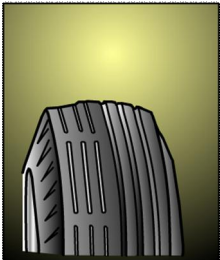
- Under inflation
- Over inflation



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### Tire Wear Patterns

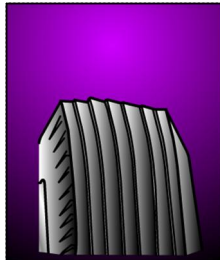
- Under inflation
- Over inflation
- Camber wear



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### Tire Wear Patterns

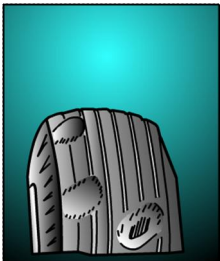
- Under inflation
- Over inflation
- Camber wear
- Toe wear



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### Tire Wear Patterns


- Under inflation
- Over inflation
- Camber wear
- Toe wear
- Cupping



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### Tire Wear Patterns

- Under inflation
- Over inflation
- Camber wear
- Toe wear
- Cupping
- Scalloping



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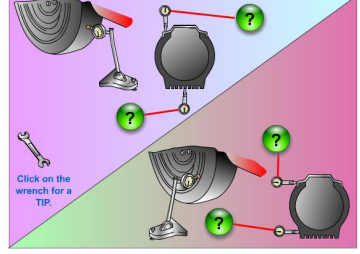
### Tire Pressure

- Use the vehicle's tire placard not the maximum pressure listed on the tire's sidewall
- Vehicles may have different front and rear tire pressure specifications
- Improper pressure can cause pull, noise, premature tire wear and affect vehicle handling



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### Tire and Wheel Runout



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### Tire Mounting and Dismounting

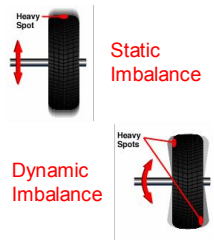
- Center post tire changer
- Rim clamp tire changer
- Follow the equipment manufacturer's operating instructions carefully
- Remember to be certain the tire and wheel are in good condition and a match
- Never stand over the tire or exceed 40 PSI while seating the bead



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### Types of Imbalance

- Static imbalance occurs when there is a heavy or light spot in the tire so that the tire won't roll evenly and the tire and wheel undergoes an up-and-down motion
- Dynamic imbalance occurs when there is unequal weight on one or both sides of the tire/wheel assembly's lateral centerline, thus creating a side-to-side wobble or wheel shimmy



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### Tire and Wheel Vibration

- Static imbalance causes an up and down wheel vibration referred to as tramp
- Dynamic imbalance causes a side to side vibration referred to as shimmy



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### Tire and Wheel Balancing

- Static balancing
- On-car balancing
- Computer balancing
- Road force computer balancing
- Tire and wheel run-out
- Tire and wheel indexing



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### Wheel Weights

- Use the proper style wheel weight and tools to minimize marring the wheel
  - Steel wheel weights
  - Aluminum wheel weights
  - Adhesive backed wheel weights



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### Computer Balancing a Tire

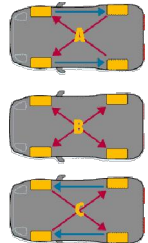
- Check the condition of the tire and wheel
- Check the tire's air pressure
- Carefully follow the equipment manufacturer's operating instructions
- Watch video

*Improper use of the equipment may damage the wheel or cause personal injury*

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### Common Rotation Patterns

- Modified X for front wheel drive
- Alternate X for front, rear or all wheel drive
- Modified X for rear or four wheel drive

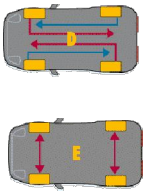


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### Special Rotation Patterns

- Directional tires that are the same size front and rear
- Non-directional tires that are a different size from front to rear

- What must be done to properly rotate the tires on vehicle E if it is equipped with directional tires?



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### Lug Nut Torque

- Lug nuts should be tightened to manufacturer specifications
- Over or under tightening can lead to vehicle damage and/or personal injury
- Use a torque wrench or torque sticks

