Modern Automotive Technology
Chapter 61
Differential and Rear Drive Axle Fundamentals
Learning Objectives

- Identify the major parts of a rear drive axle assembly.
- List the functions of a rear axle assembly.
- Describe the operation of a differential.
- Explain differential design variations.
- Compare different types of axles.
- Describe the principles of a limited-slip differential.
- Relate rear axle ratios to vehicle performance.
Chapter 61

1. The AXLE HOUSING is the metal body housing that encloses and supports parts of rear axle housing

2. REAR AXLE BEARINGS are either ball or roller type bearings that fit between axles and inside of axle housing
Basic Rear Drive Axle Assembly

- Tire
- Drive shaft
- Ring gear
- Pinion drive gear
- Rear axle bearing
- Drive axle
- Differential case assembly
- Axle housing
3. The **REAR DRIVE AXLES** connect the differential side gears to the drive wheels and normally support the weight of the vehicle.

4. The **DIFFERENTIAL CASE ASSEMBLY** holds the ring gear and other components that drive the rear axles.
Driving Straight Ahead

Equal traction in straight ahead driving

Balanced forces make differential seem locked

Pinion shaft
Turning Corners

- Outer wheel: 110% case speed
- Axle centerline: 100% differential case speed
- Inner wheel: 90% case speed
- Pinion gears rotate on shaft
- Axle gears turn at different speeds
5. The RING GEAR transfers the turning power of pinion drive gear to the differential case assembly

6. The PINION DRIVE GEAR transfers power from drive shaft to ring gear
Differential Assembly

- Case bearing
- Axle or side gear
- Pinion (spider) gears
- Axle (spider) side gear
- Gasket
- Carrier
- Adjusting nut
- Lock pin
- Washer
- Pinion shaft
- Pinion gear
- Pinion bearing
- Spacer
- Shim
- Ring gear
- Shim
- Differential case
- Case bearing
- Adjusting nut
- Flange
- Oil seal
- Pinion bearing
- Lock tabs
7. A LIMITED SLIP DIFFERENTIAL provides driving force to both rear wheels at all times.

8. The REAR AXLE RATIO is determined by comparing the number of teeth on the pinion drive gear and on the ring gear.
Limited Slip Differentials

- When one wheel of a conventional rear axle assembly lacks traction, the other wheel will not propel the vehicle.
- Torque will flow to the axle that turns easiest.
- Limited-slip differentials provide driving force to both rear wheels at all times.
Clutch Pack Differential

Multiple disc clutch set
Preload spring
Differential side gear
Differential case
Differential pinion gears
Tabs lock steel discs to case
Differential side gear splined to friction discs
Diaphragm spring preloads the clutch discs
9. The driving pinion centerline of a HYPOID GEAR SET is offset — or lowered — from the centerline of the ring gear.

10. SWING AXLES are used when the differential is mounted solidly on the car's frame.
Hypoid and Spiral Bevel Gears

Hypoid gears

- Pinion centerline lower in ring gear
- Pinion gear centerline

Spiral bevel gears

- Center of ring gear
- Pinion gear centerline
Learning Objectives

- Troubleshoot common drive shaft problems.
- Check universal joint wear.
- Measure drive shaft runout.
- Remove and replace a drive shaft assembly.
- Replace universal joints.
- Perform basic service operations on a transfer case.
- Cite and practice good safety procedures.