

Module 7: Drive Axles

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Terms and Definitions

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- The amboid gear is a gear that is similar in appearance to a spiral bevel gear, but the driving gear is located above the center of the driven gear.
- Backlash is the distance that one gear can be moved back and forth without moving the gear into which it is meshed.
- Differential is an arrangement of gears connecting two shafts or axles in the same line, dividing the driving force equally between them, and permitting one shaft to revolve faster than the other (also known as the third member).
- The differential pinion is small gears mounted on a shaft pinned to the differential case; they mesh with, and drive, the axle end gears.
- 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.
- Final drive is the last phase of the power train; it gives the final reduction in speed and increase in torque to the drive wheels.
- 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 bearing to "float."
 - Note:** This type of drive axle is designed for heavy duty applications.
- Gear tooth distance is the distance separating two gear teeth that are meshed together.
- The hypoid gear is a gear that is similar in appearance to the spiral bevel gear, but the driving gear is located below the center of the driven gear.
- Overload is in excess of designed load.
- The pinion is a small gear having the teeth formed in the hub; it drives a larger gear.
- The planetary gear set is a gearing unit consisting of a ring gear with internal teeth, a sun or central pinion gear with external teeth, and a series of planet gears that are meshed with both the ring and the sun gear.
- Preload is adjusting the antifriction bearing so that it is under mild pressure; this prevents bearing looseness under a driving stress.
- Ring gear is the name given to the bevel gear in a differential, and the gear that surrounds or rings the sun and planet gears in a planetary system.
- The steering axle is the axle that contains a steering knuckle, which allows the vehicle to be turned (steered).
 - Note:** This is typically the front axle.
- The tooth contact pattern test is a method of testing the wiping action between the ring gear and the pinion gear to determine if they are properly adjusted.
- The tooth profile is the area of contact of the pinion gear on the ring gear teeth, and the pinion gears position on the ring gear teeth.
- Traction control is a feature available on some antilock brake systems that applies braking force to a wheel that spins as a result of low traction.
- The vent is used to release pressure build-up inside of the differential case due to increased temperature.
- The wheel bearing is a bearing used to distribute the load of a vehicle on its axles.

Parts of a Differential Carrier Assembly

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- Differential housing assembly
 - Housing
 - Ring gear
 - Cross shaft
 - Side gears
 - Bearing cups
 - Bearing cones
 - Bearing adjusting rings
 - Bearing caps
 - Axle shafts
- Carrier housing assembly
 - Housing
 - Pinion gear
 - Pinion bearing cones
 - Pinion bearing cups
 - End yoke

Types of Differentials and Final Drives

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- The single reduction axle is a rear axle assembly with a single reduction through the ring gear and drive pinion.
- The double reduction axle is a rear axle assembly with two reductions: one through the ring and drive pinion and one through a set of helical gears.
- The two-speed axle is a rear axle assembly with two gear ratios for various road and load conditions.
- The tandem drive axle is a rear axle assembly incorporating two single axle units and a power divider interconnected by a drive shaft.
- The planetary double reduction axle is a rear axle assembly with two reductions: one through the ring gear and drive pinion and one through the planetary gearing.
- The planetary drive axle is a rear axle assembly that is more durable because torque loads are spread more evenly over several gears.

Parts of a Gear Tooth

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- Face
- Tooth
- Heel
- Top land
- Root
- Toe

Evaluating Gear Tooth Contact Patterns

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- In order to evaluate conventional gear tooth contact patterns or tooth profile, it is necessary to check tooth contact patterns on both sides of the tooth: the drive side and the coast side. The drive side should have concave teeth and the coast side should have convex teeth.
- The drive side of the tooth:
 - Should be centrally located between the top and bottom
- Tends to spread toward the heel of the tooth as the load increases
- Can be slightly closer to the toe end
- The coast side of the tooth:
 - May be a little longer and closer to the toe end
 - Should be centrally located between the top and bottom

Parts of a Planetary Gear Differential

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- Sun gear
- Planet gears
- Planet carrier
- Ring gear

Planetary Gear Set Components

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- The sun gear is the center gear in mesh with the planet gears.
Note: The sun gear can be used as a drive gear (as in a final drive) or as a driven gear (as in a planetary differential).
- Planet gears are those gears in a planetary gear set that are a mesh with both the ring and sun gear.
Note: They are referred to as planet gears because they orbit or move around the central or sun gear.
- The planet carrier is that part of a planetary gear set upon which the planet gears are affixed.
- The ring gear is the large gear with internal teeth in mesh with the teeth of the planet pinions at all times.
Note: The ring gear may be attached to the inside of a differential carrier.

Types of Differential Locks

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- Driver controlled engagement is controlled by a cab-mounted air valve.
- The hydraulic lock uses oil pressure to lock out the differential; when the pedal is depressed, the valve allows pressure oil to flow to the differential. However, the hydraulic lock is used only on older vehicles.
- Seasonal engagement requires manual adjustment in a shop to engage the differential lock and is used only on older vehicles.
- Permanent engagement is normally engaged at all times, but still allows for relative motion between the wheels when cornering. When engaged, it prevents one wheel from spinning when it loses traction, thereby depriving the other wheel of full driving power.

Purposes of a Power Divider

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- Equally distributes power from the vehicle transmission to both the forward and rear axles
- On a tandem drive axle, when the power divider is disengaged, the two axles act as two individual axles; when the power divider is engaged, the two axles act as one.
- Provides maximum traction when road conditions are unfavorable (traction control)
- When the power divider is disengaged, it prevents axle fight and permits freer rolling.
Note: On a tandem drive axle, be sure that both axle ratios are the same.
- Allows for easier steering and better road ability
- Extends tire life
- May incorporate a gear drop or reduction on some trucks required to transport heavy loads
- Examples are dump, refuse, and oil field trucks; cement mixers; and other heavy haul vehicles.

Parts of a Power Divider

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- Output yoke
- Output shaft
- Bearing cups
- Bearing cones
- Output side gear
- Inter-axle differential
- Helical side gear
- Lockout sliding clutch
- Input yoke
- Cover
- Shift fork assembly
- Input yoke

Wheel and Hub Assemblies

READY FOR REVIEW

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

Purposes of Wheel Bearings

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- To spread the weight of the vehicle and its load over a greater surface
- To reduce the friction of wheel rotation
- To reduce wear to parts
- To provide a replaceable wear surface (wear ring)

Parts of a Wheel Bearing

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- Outer race (cup)
- Cage
- Bore
- Cone assembly
- Inner race
- Roller

Purposes of Wheel Seals

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- To retain lubricants or liquids
- To exclude dirt, water, and other contaminants
- To separate dissimilar fluids (such as lubricating oil and water)
- To confine pressure

Types of Wheel Seals

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- One-piece
 - Unitized, requires a special driver
 - Barrier, installed with bare hands
- Multipiece
 - Lip seal, may have a single or double lip
 - Wear rings, may have a flat ring or grit guard

Types of Shifting Mechanisms

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- **Electric shift**
 - Consists of a manually-operated control switch and an electric shift unit
 - Connected by electrical cables and normally protected by a circuit breaker
 - The shift unit includes a reversible electric motor, automatic switch, drive screw, and torsion spring drive.
- **Air-operated shift**
 - Consists of a manually-operated air shifter valve, a quick release valve, and an axle shift unit
 - The air shifter supplies air through the quick release valve to the axle shift unit.
 - Air pressure in the shift unit shifts the axle to high range.
 - To shift the axle to low range, air pressure is exhausted at the shifter valve, which exhausts air pressure at the quick release valve.

Types of Air Line Fittings

READY FOR REVIEW

- The flared fitting has the end of the tubing spread (flared) outward at an angle.
- The compression fitting (sleeve) is either a separate unit or designed as part of the nut, and when drawn together, the sleeve is compressed against the tubing, fitting, and nut.
- Quick connect/disconnect allows you to quickly connect or disconnect air lines without the use of tools.