Drive Axles and Differentials

FIGURE 66.1 The drive axle assembly changes the direction of engine torque and increases the torque to the drive wheels.

FIGURE 66.2 The difference between the travel distance of the drive wheels is controlled by the differential.
When the vehicle turns a corner, the inner wheel slows and the outer wheel increases in speed to compensate. This difference in rotational speed causes the pinion gears to "walk" around the slower side gear.

A hypoid gear set uses a drive pinion that meshes with the ring gear below the center line of the ring gear.

The differential case provides the support for the ring gear, side bearings, and side gears.
FIGURE 66.6 The relationship among the ring gear, drive pinion, as well as the side and spider gears.

FIGURE 66.7 The drive side is the convex side of the ring gear except for some front-wheel-drive front-wheel vehicles, and they often use the concave side on the drive side.

FIGURE 66.8 A close-up view of the side gears and spider (pinion) gear. Note the ridges on the gear teeth. These ridges are manufactured into the gear teeth to help retain lubricant so that no metal-to-metal contact occurs.
FIGURE 66.9 Two-wheel-drive vehicle equipped with an open differential. (b) Four-wheel-drive vehicle equipped with a limited-slip differential.

FIGURE 66.10 Trac-loc limited-slip differential. This type of limited-slip differential uses the preload force from the spring to generate the torque required by the side gear to split the torque as the difference between the speeds of the two axles.

FIGURE 66.11 An Eaton locker differential.
FIGURE 66.12 The Eaton design differential uses a torque-limiting disc to prevent the possibility of breaking an axle in the event of a high-torque demand. When the disc tangs shear, the differential will continue to function but as an open rather than as a limited-slip differential.

FIGURE 66.13 A Torsen differential. This type of differential provides torque to both drive wheels even if one tire slides. The complex system of gears allows the smooth transfer of torque without the use of clutches.

FIGURE 66.14 This pinion flange is equipped with a damper weight to help dampen driveline vibrations.
FIGURE 66.15 A collapsible spacer type drive pinion shaft.

FIGURE 66.16 Side bearings are press fit in the differential case.

FIGURE 66.17 Some side bearings use threaded adjusters to adjust preload.
FIGURE 66.18 (a) The axle shaft itself is the inner race if a straight roller bearing is used. So those straight roller bearings are lubricated by the rear axle fluid, and a leak at the rear axle seal can cause the fluid to get onto brake components.

FIGURE 66.19 The pinion gear thrust washers can be destroyed by spinning one wheel for an extended period of time.

FIGURE 66.20 This differential has obviously been leaking. If the differential lubricant is low, wear may have occurred that would require further inspection.
FIGURE 66.21 Backlash is determined by mounting a dial indicator to the differential housing, placing the button of the gauge against a tooth of the ring gear. Moving the ring gear back and forth will indicate on the dial indicator the amount of backlash. Backlash is the clearance between the drive pinion and the ring gear teeth.

FIGURE 66.22 Ring gear runout should be less than 0.002 inch (0.05 mm) as measured by a dial indicator.

FIGURE 66.23 A container of GL-5 SAE 80W-90 gear lubricant.
The beginning automotive student did not realize that the axle housing cover could fit the wrong way. The only problem was that the ring gear scraped against the cone.