

# A Closer Look at Drivetrains

The purpose of a vehicle's drivetrain is to draw energy from the vehicle's engine to provide the thrust needed to induce motion. Through changes in gear ratio, the drivetrain adapts available torque to tractive force. Drivetrain components commonly found in modern equipment include the following:

## Transmissions

Transmissions provide the ability to change gear ratios and available torque. Transmissions may be manual, giving shift command to the operator, or automatic, shifting according to a variety of variables, such as load and speed.

## Differentials

When a vehicle turns a corner, the outer wheels must travel a greater distance than the inner wheels. The vehicle's differential acts as a balance arm, allowing the outer wheels to rotate at a higher speed and establishing equilibrium of torques and forces between the outer and inner wheels.

## Transaxles

Commonly found on vehicles in which the power unit and drive wheels are on the same end of the vehicle, transaxles are compact transmission/differential combinations.

## Transfer Cases

Typically found on four-wheel drive vehicles, transfer cases distribute drive power between the front and rear axles.

## Power Converters

Power converters are used to transfer energy to a secondary item often having nothing to do with thrusting the vehicle.

Every drivetrain component has unique lubrication requirements, but drivetrain fluids in general must perform many of the same common duties: reduce friction and wear, dissipate heat and prevent rust and corrosion. In addition, they must dissipate shock loading, reduce gear noise and inhibit foaming.

## Gear Lubricants

Gear designs vary depending on the requirements for rotation speed, degree of gear reduction and torque loading. Transmissions commonly use spur gears, while hypoid gear designs are usually employed as the main gearing in differentials. Bevel gears are usually found in the planetary portion of differentials and in industrial equipment. Various other designs, such as worm gear, herringbone and helical, are used in heavy-duty and industrial applications.

When it comes to gear lubricants, performance and application criteria are set forth by the American

Petroleum Institute (API). The U.S. military and many equipment manufacturers have their own separate guidelines, as well.

API service classifications range from GL-1 through GL-5, with the number indicating level of service severity. GL-1 is the least severe, and its requirements are normally satisfied with motor oil. GL-2 requirements are met with rust and oxidation inhibited oils. GL-3 through GL-5 require the addition of extreme pressure (EP) additives, with higher GL numbers indicating a higher level of EP additive. The MT-1 classification requires good performance in high-temperature applications.

Gear lubricants containing extreme pressure additives are required in severe service applications subject to elevated component loading, high sliding pressures and shock loading. By either providing a sacrificial wear surface or changing surface metallurgy, extreme pressure additives provide extra wear protection when the oil film alone cannot prevent component contact and wear. Because lubricants with extreme pressure additives can actually increase friction and wear at lower loads, they should be used only in applications which require their presence.

Viscosity is the most important property of a gear lubricant. As with motor oil, the Society of Automotive Engineers (SAE) developed a viscosity grading system for gear lubricants. The SAE system lists requirements for both single and multi-grade lubricants, but does not differentiate between EP and non-EP fluids. Typical SAE gear lubricant grades include SAE 80, 90, 140, 75W, 80W, 75W-90 and 85W-140. Although the grade numbers are larger than those associated with motor oils, gear lubricants are not necessarily heavier. The two separate grading systems are used to minimize confusion between motor oil and gear lubes.

### API Service Classifications

<b>GL-1</b>	Truck manual transmissions (engine oil)
<b>GL-2</b>	Worm gear drive, industrial gear oils*
<b>GL-3</b>	Manual transmissions and spiral bevel final drives*
<b>GL-4</b>	Manual transmissions, spiral bevel and hypoid gears in moderate service. 50% additive treat level of GL-5
<b>GL-5</b>	Moderate and severe service in hypoid and other types of gears. May also be used in manual transmissions
<b>GL-6</b>	Meant for severe service involving high-offset hypoid gears*
<b>MT-1</b>	Nonsynchronized manual transmissions in heavy-duty service

\* *Obsolete*