



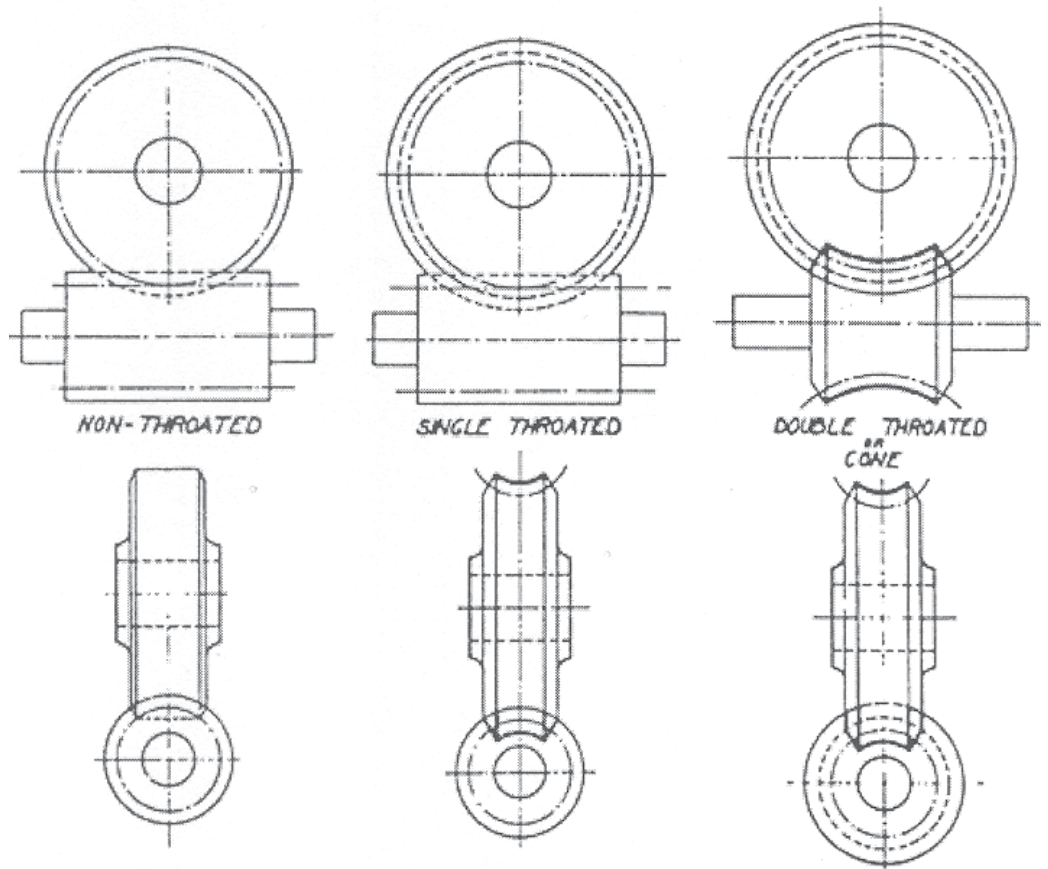
## Why the Need for Worm Gear Lubricants

Worm gearing is used to transmit motion and power between nonintersecting shafts (such as shafts at right angles to each other). This is often the case where space is very limited. High gear ratios can be obtained, often more than 300:1. However, at high ratios the efficiency can be as low as 40-50 percent. The worm drives by its threads sliding into contact with the teeth of the worm wheel (gear). This constant sliding action generates heat due to friction, and therefore adequate cooling and superior lubrication must be provided for gears working at high sliding velocity and load.

Worm gears have an interesting property that no other gear set has: the worm can easily turn the gear, but the gear cannot turn the worm. This is because the angle on the worm is so shallow that when the gear tries to spin it, the friction between the gear and the worm holds the worm in place. This feature is useful for machines such as conveyor systems, in which the locking feature can act as a brake for the conveyor when the motor is not turning. This static action can cause tremendous pressures on the film of oil, often rupturing the film and allowing metal-to-metal contact.

### Basic Types of Worm Gears

- 1 – Cylindrical (Non-Throated) Worm Gear
- 2 – Single Enveloping (Single-Throated) Worm Gear
- 3 – Double Enveloping (Double-Throated) Worm Gear

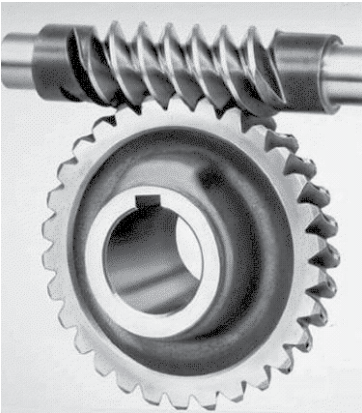


See more details about these three types on next page.



### 1 – Cylindrical (Non-Throated) Worm Gear

Similar to a rack and pinion and has straight teeth, this type uses gear oils such as Duolec® Industrial Gear Oil (1600 or 1300 series).



### 2 – Single Enveloping (Single-Throated) Worm Gear

This type is helical cut and has a parallel-sided gear mating with a curved (concave) worm wheel. It is more forgiving for position and alignment to tolerance problems. These gears may be used with Almasol® Worm Gear Lubricant (460, 680), Duolec® Industrial Gear Oil (1600 or 1300 series) or Monolec® Syn Industrial Oil (9046-9460); consult OEM specifications.



### 3 – Double Enveloping (Double-Throated) Worm Gear

This type is helical cut and has a curvature of both gears that increases the surface of contact between the gears. This can be very useful for power applications but also generates the most heat from the sliding motion. Due to the extreme sliding motion, compounded lubricants, PAG-based lubricants, and PAO-based non-EP lubricants are generally preferred by most OEMs. LE recommendations include Almasol® Worm Gear Lubricant (460, 680), Monolec® Syn Industrial Oil (9046-9460), and Duolec® PAG Gear Lubricant (9705-9707); consult OEM specifications.

## Sulfur Problem

Many worm wheels (gears) are made of a soft “yellow” metal material, bronze, which is very sensitive to active sulfur. Most EP gear oils contain sulfur as part of the EP package, which when activated can etch the gears.

As a result of the operating conditions of worm gears, it is very important to use an oil that adheres to the metal surfaces (whether the worm is above or below the wheel), exhibits excellent film strength, and prevents asperities from welding to each other from the sliding action.

## LE Worm Gear Oils

- **Almasol® Worm Gear Lubricant (460, 680)** provides excellent adherence through compounding agents, which are blended into select mineral oils for excellent film strength. It is fortified with Almasol, LE’s proprietary wear-reducing additive, which is designed to adhere to all metal surfaces (worm and wheel). This allows much easier sliding action. Almasol provides protection in a wide temperature range and provides superior oxidation resistance in high-temperature applications where EP gear lubricants cannot be used. It reduces friction in high sliding worm gear applications and protects bronze bull gears from excessive wear in enclosed worm gearboxes.
- **Duolec® PAG Gear Lubricant (9705-9707)** is a PAG gear oil that has been specially formulated for the ultimate in corrosion resistance, wear protection and thermal stability. Polyalkylene glycol (PAG) lubricants are synthetic formulations known for their high viscosity index, EP properties, and ability to handle temperature extremes. In addition to the PAG base fluid, this formulation features Duolec, LE’s proprietary dual-acting additive that provides both wear-reducing and EP protection.
- **Duolec® Industrial Gear Oil (1601-1610, 1302, 1304)** is a high-performance industrial and automotive gear oil with ISO grades ranging from ISO VG 46 to 1500. Designed for use in any industrial gear or bearing application that requires a thermally stable EP lubricant, it maintains performance even after filtration. It contains Duolec, LE’s exclusive dual-acting additive, and is fortified with a shear stable tackifier to provide adhesion to metal during use.
- **H1 Quinplex® White Gear Lubricant (4090-4250)** is recommended for a variety of gearboxes and other critical applications in food and beverage manufacturing facilities. It is NSF H1 registered for incidental food contact and was formulated to withstand severe loading conditions and prevent rust and corrosion. It contains a carefully selected blend of pure mineral and synthetic base stocks to provide superior protection at a wide range of operating temperatures. It also offers anti-wear protection, differentiating it from many other white oils on the market. To ensure good metal adhesion, it contains a shear stable polymeric tackifier system including Quinplex, LE’s proprietary impact-resistant additive.



- **H1 Quinplex® Syn FG Gear Oil (4150-4460)** is recommended for a variety of gearboxes and other critical applications in food and beverage manufacturing facilities. It is NSF H1 registered for incidental food contact and was formulated to withstand severe loading conditions and prevent rust and corrosion. It contains 100 percent synthetic base oil to provide superior protection in extreme high and low temperatures. It also offers great seal compatibility and excellent nonfoaming qualities. Its anti-wear capability differentiates it from many other white oils on the market. To ensure good metal adhesion, it contains a shear stable polymeric tackifier system including Quinplex, LE's proprietary impact-resistant additive.
- **Monolec® Syn Industrial Oil (9046-9460)** is designed to prolong equipment life by combating the effects of high temperatures, contamination and loads that accelerate wear. It is a versatile lubricant formulated with high-viscosity 100 percent synthetic base oil and a specially developed additive package for applications running at extreme temperatures. The additive package provides outstanding thermal stability and rust and oxidation resistance as well as wear resistance as pressures and temperatures rise. A foam suppressant completes the package. The base oil and additive formulation works synergistically to reduce wear, extend oil drain intervals, reduce oil consumption, and practically eliminate deposits and sludge formation, all while providing excellent compatibility with seals.