

Gear Wear & Lubrication

Wear

Another factor to consider in the successful design of a gear train is tooth surface wear. It can take on many forms but always leads to reduced accuracy and loss of smooth operation. Wear can eventually cause enough deterioration to introduce dynamic forces that are strong enough to break or bend gear teeth.

The most common types of wear are Pitting, Scuffing and Scoring:

Pitting is caused by localized metal fatigue on the surface of the gear. Microscopic cracks are forced to propagate which causes small metal chunks to break off. The best ways to avoid this are:

- reduce contact stress
- use hardened gears
- use proper lubrication

Scuffing is caused by small surface irregularities that can rub each other as gear teeth come into and out of mesh. It is caused by the plastic deformation of microscopic surface protrusion. The best ways to avoid scuffing are:

- use gears that are cut to a high quality surface finish
- "run in" with 1/2 load for the first 10 hours
- use proper lubrication at all times

Scoring is caused by small particles in the lubrication that get caught in the meshing teeth. This causes scratches that can extend from the root to the tip. These can be quite deep. The best ways to avoid scoring are:

- proper high quality lubrication
- change the lubrication after the "run in" period
- change or filter the lubrication as needed

Lubrication

Using the proper lubrication can extend the life of your gear train by a factor of 4 or more. The lubrication will form a thin layer between the teeth in contact. This will reduce all types of tooth wear which will keep your gear running smoothly. This is especially important with Worm Gear Sets and Helical Gear Sets as these types of gears operate with more of a sliding motion than a rolling motion (as in spur gears).

There are many lubrications that work extremely well with gear sets. The one you choose depends on your application.

For lightly loaded, low speed systems, a light coating of grease can be brushed on during assembly. The grease will not fly off or overheat, and should be replaced regularly to ensure optimal life.

For higher speed systems, an oil bath is recommended. Oil is more effective than other lubrications at dissipating heat. The gears will always be in contact with the oil, so flying off is not a problem. The oil should be replaced after the "run in" period and regularly thereafter.

Many other lubricants exist for applications in which oil and greases could present a problem. They vary greatly in price, durability, thickness consistency and lubricity. For low torque and low speed systems where dry running is essential, you might make use of plastic gears against a metal pinion. Generally, this offers a low enough coefficient of friction to ensure long life.