# Guidance – Grease Lubricated Gears

## Thermal Degradation/Aging

High operating temperatures caused by friction or heavy loads chemically break down a grease. This oxidizes the lubricant, turning it into a stiff, tar-like substance that accelerates wear and promotes failure.

Excessively high speeds or heavy loads generate intense frictional heat. Because a lubricant's degradation rate roughly doubles for every 10°C rise in temperature, increasing temperature cooks the grease more quickly, breaking down its thickeners and destroying its ability to protect.

Grease has a finite service life. As it degrades due to mechanical shearing and natural aging, the oil bleeds out from the thickener, leaving behind a hard residue that fails to coat or protect the metal surfaces.

## Gear Failure

Grease lubrication of gears fails primarily through **thermal degradation**, **base oil separation**, or **mechanical channelling**. When grease is subjected to continuous churning, high temperatures, or pressure, it can lose its ability to release its base oil, causing the lubricating film to break down and resulting in metal-to-metal contact.

In addition to thermal degradation, common ways grease lubrication fails include:

## Oil Separation (Bleeding)

Excessive heat or prolonged stress causes the thickener and base oil to separate. The base oil leaks away or evaporates, leaving behind a hardened, dry soap residue that cannot lubricate.

## Channelling

In high-speed gearboxes, the churning action of the gears pushes the grease aside, creating a groove (or channel). The gears then spin in a dry path because the grease is too stiff to slump back into the mesh point.

## Contamination

Unlike liquid oils, grease cannot easily carry contaminants away from the gear teeth. Dirt, moisture, or wear particles get trapped in the grease and form an abrasive paste, which accelerates pitting and scoring on the gear faces.

## Bearing Failure

In industrial gearboxes, bearings carry radial and axial loads, maintain shaft alignment, control gear mesh stability, and support continuous torque transmission. When the lubricant film breaks down, metal-to-metal contact, heat, vibration, contamination, and surface fatigue can escalate quickly.

Failure in gearbox bearings occurs when the grease can no longer create a protective film between rolling elements, races, cages, and adjacent gearbox components.

In addition to thermal degradation, the most common primary causes for grease-lubricated bearing failure include:

## Inadequate Maintenance

Both **under-greasing** (leaving the bearing starved of its protective film) and **over-greasing** cause premature failure. Too much grease causes churning, resulting in rapid temperature spikes, seal damage, and accelerated thermal degradation of the grease.

## Contamination

Airborne dust, dirt, or moisture can breach the bearing housing. When these particles mix with the grease, the compound turns into an abrasive paste that grinds down the rolling elements and raceways. Water or moisture can also wash away the grease and cause rust, leading to pitting and spalling.

## Incorrect Grease or Mixing

Using the wrong base oil, viscosity, or thickener type for your specific load, speed, and temperature can cause the grease to separate or fail to build an elastohydrodynamic (EHL) oil film. Mixing incompatible greases (e.g., lithium complex and polyurea) can cause the base oil to bleed out prematurely, hardening the grease.