Lubrication

Gear Lubrication

Function

Regimes

Systems

AGMA Thermal Ratings

Lubricant Selection

System Maintenance

Lubricant Function

Reduce Friction and Wear
Reduce Power Loss and Noise
Prevent Scoring and Welding
Dissipate Heat
Prevent Rust and Corrosion
Promote Release of Entrained Water and Air
Promote System Cleanliness

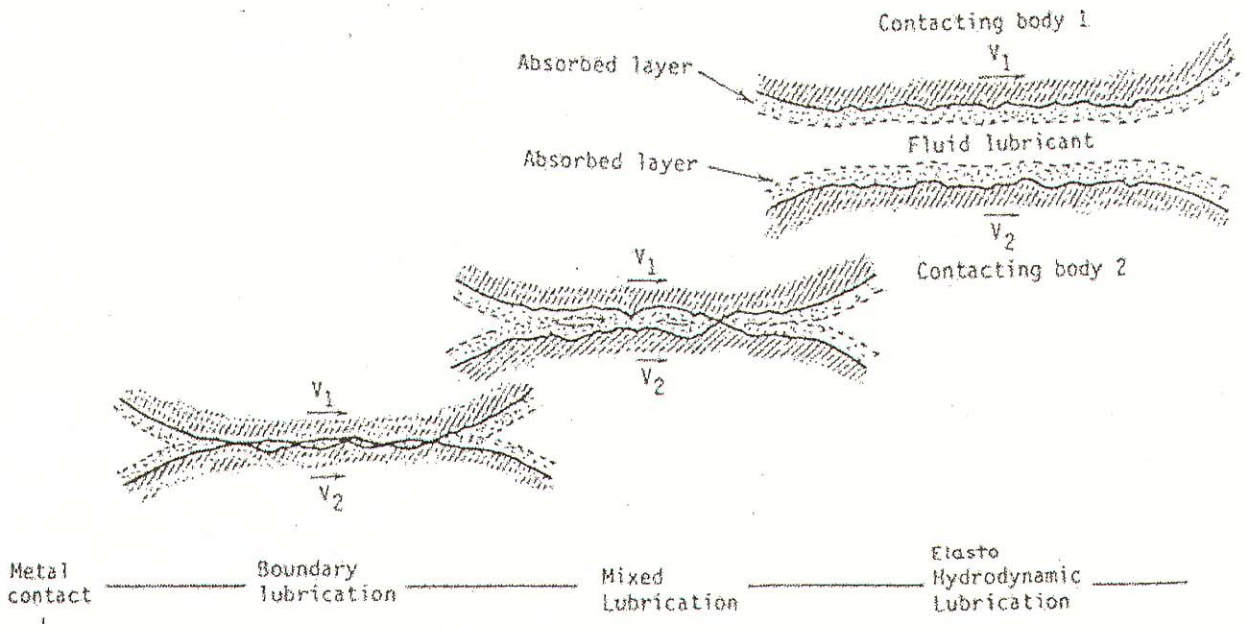
Lubricant Regimes

Full Elastohydrodynamic Lubrication

Mixed Film Lubrication

Boundrary Lubrication

Lubrication Regimes



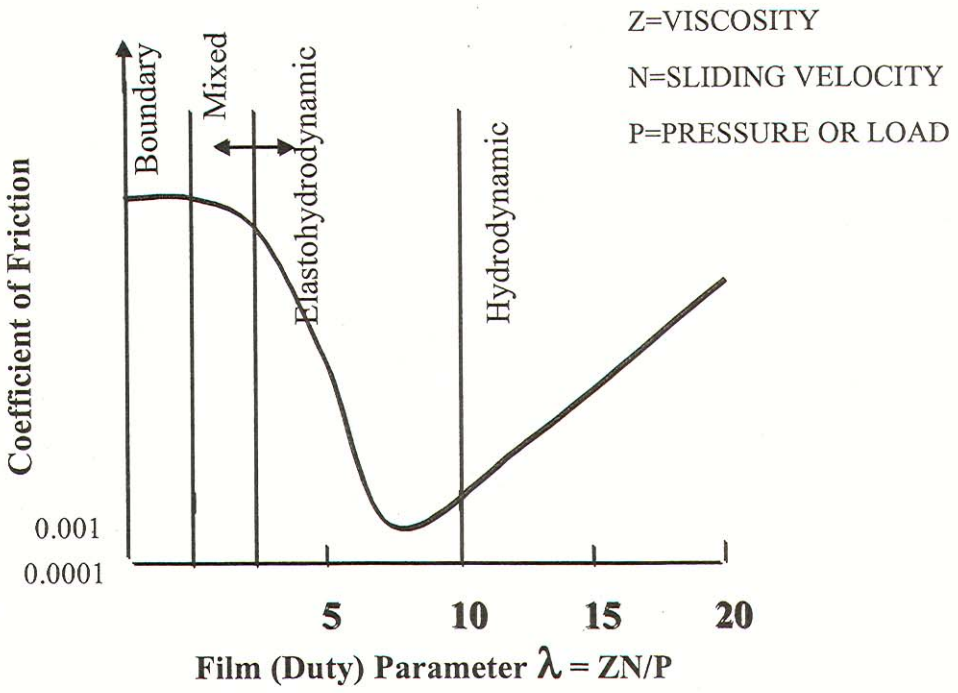
REGIME 1: Boundary lubrication exists where the gears are wetted with oil but the film thickness developed is small compared to the tooth surface associated with gears operating at low pitch line velocities and/or heavy loads.

REGIME 2: Mixed film (combination of boundary and EHD) lubrication exists where the gears operate with partial metal-to-metal contact. Mixed film lubrication is the most prevallent form and is generally associated with gears operating at moderate pitch line velocities and relatively heavy loads.

REGIME3: Full elastohydrodynamic (EHD) lubrication exists where complete separation of the gear tooth surfaces is developed by the lubricant film. Full EHD film is formed generally under conditions of light loads with moderate pitch line velocities and low or high load intensities with higher pitch line velocities

Coefficient of Friction

Stribeck Curve



What is lack of lubrication?

It does not necessarily mean.....

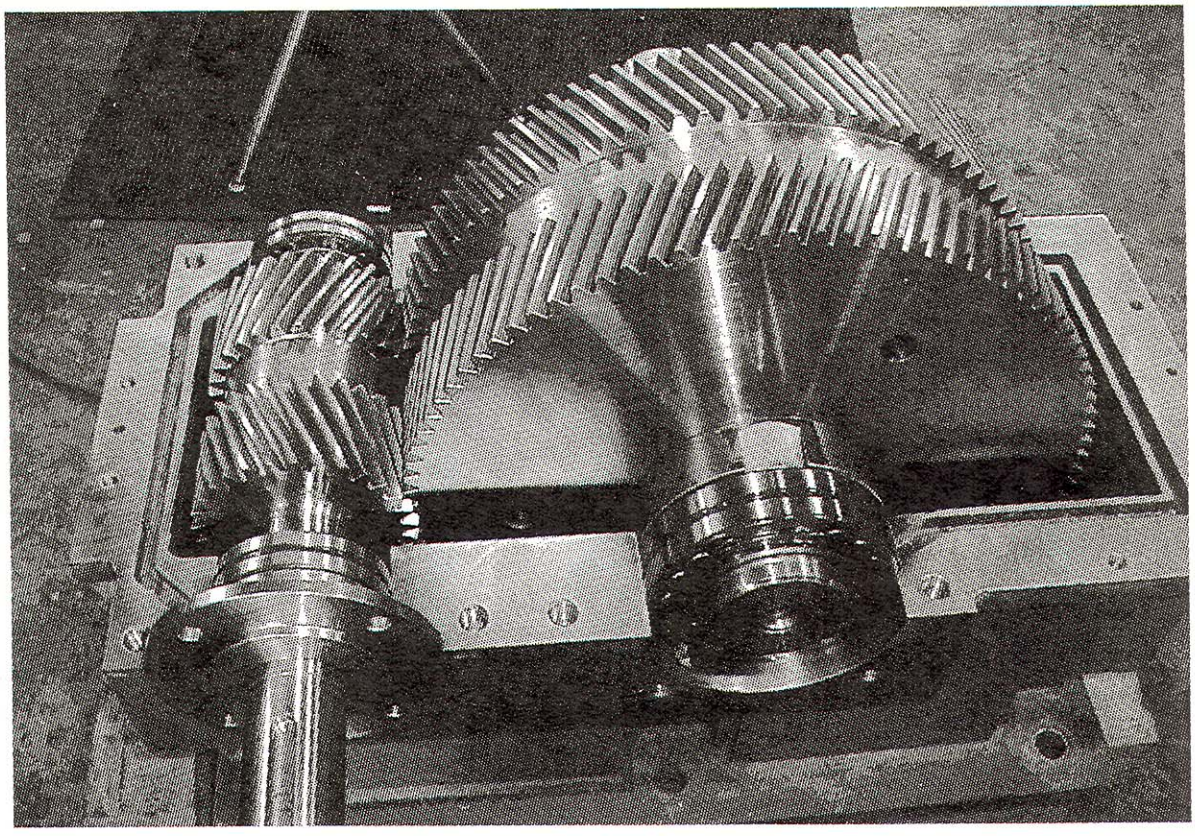
NO OIL!

But it does mean a lubrication

failure!

Gearbox Lubrication Systems

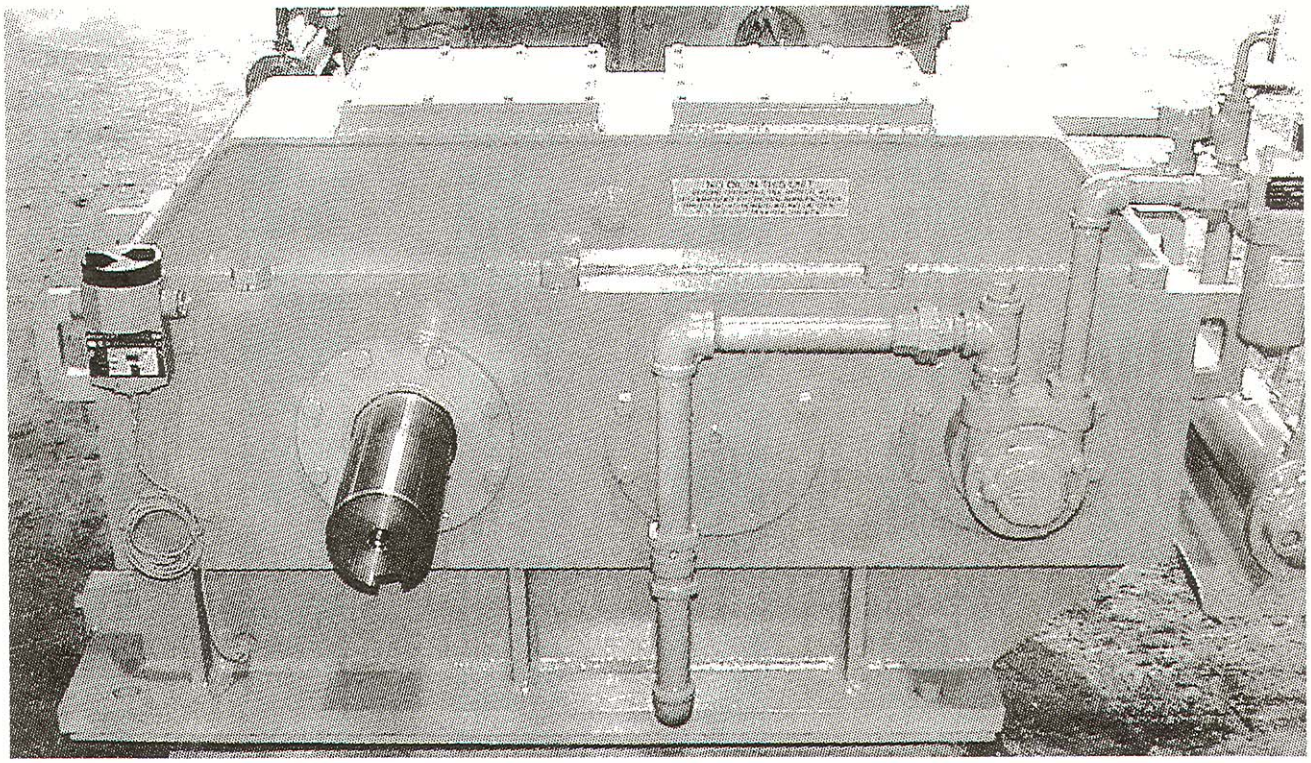
Splash



Splash relies on centrifugal force to sling oil inside housing.

Gearbox Lubrication Systems

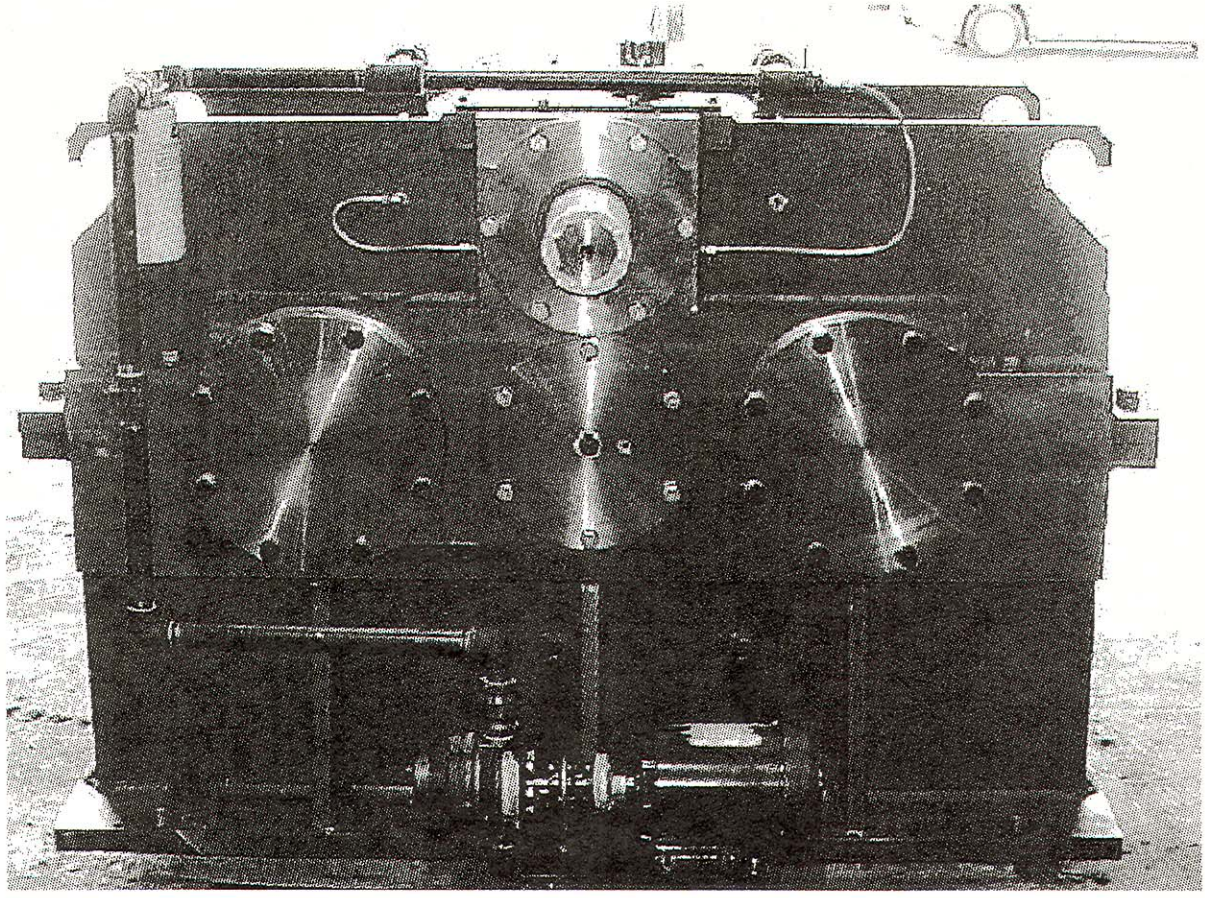
Shaft Driven Pump



Shaft Driven Pump uses rotating shaft end to drive mechanical pump. This allows for filtration and cooling.

Gearbox Lubrication Systems

Motorized Pump



Motorized Pump uses electric motor driven pump to supply oil to strategic points.

AGMA Thermal Ratings

100 Degree F Maximum sump temperature rise

200 Degree F Maximum operating sump temperature

Published thermal ratings are determined by
Testing
Calculation - Heat Balance Equation

Sump Operating Temperature

200 Degree F Maximum - Synthetic preferred

180 Degree F Maximum perferred for Mineral Oil

180 Degree F Maximum for sleeve bearing temperature in load zone

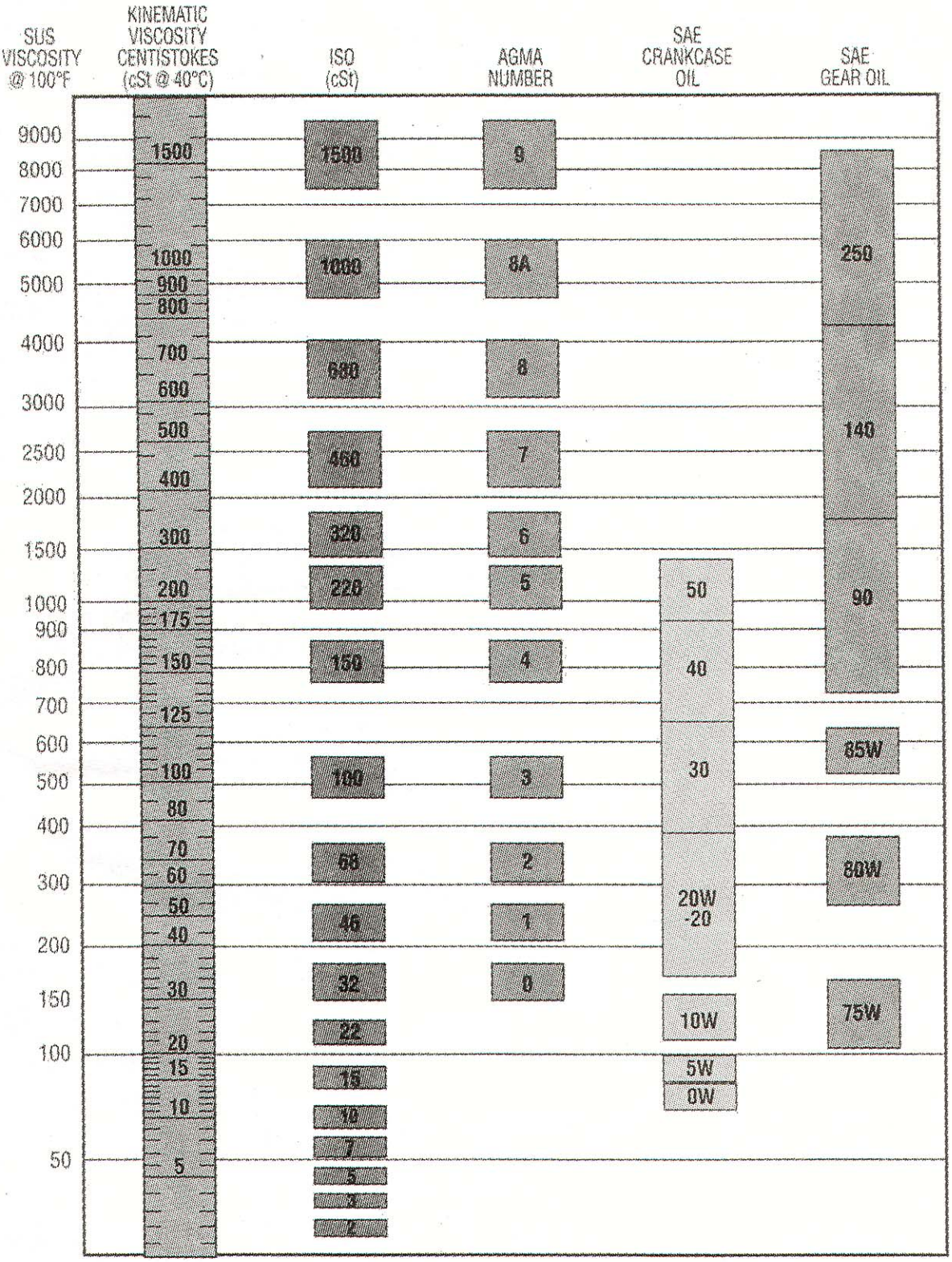
150 - 160 Degree F Desirable Operating Range

Lubricant Selection

ANSI/AGMA 9005-D94, *Industrial gear Lubrication*
Manufacturers Nameplate or Manual

VISCOSITY GRADE COMPARISONS

FOR GENERAL GUIDE ONLY. VISCOSITIES ARE BASED ON A 95 VI OIL.



TEXACO
Lubricants Company
North America

Z-144 (1-98)

Lubricant Selection

Mineral Oils

Petroleum based fluids produced through the refining of crude oil

Advantage - lower cost than synthetics

Disadvantage - viscosity index lower than synthetics

Synthetic Oils

Manufactured chemically

Advantages-

Stable at high temperature

High viscosity indices

Lower pour points

Disadvantages-

Possible incompatibility

Higher cost that mineral oils

Lubricant Selection

What is Synthetic Basestock?
Chemical compounds manufactured by chemical reaction to predetermined specifications.

Tailored molecular structure is planned and controlled

Chemically react low molecular weight materials into higher molecular weigth component

Predictable properties

Synthetic Fluid Definitions

Class - Chemical Compound

Synthesized Hydrocarbons
Includes polyalphaolefins, Alkylated Aromatics, Polybutens

Esters
Includes Diesters, Polyol Esters

Polyglycol Ethers
Polyalkylene Glycols

Additives

Rust inhibitors
Oxidation inhibitors
Defoamants
Antiwear additives
Antiscuff additives (EP)

Lubrication System Maintenance

On-Site Analysis

Appearance test
Odor test
Sedimentation test
Crackle test

Laboratory Analysis

Viscosity
Total Acid Number (TAN)
Water Content

Effects of Water Contamination

Degrades lubricant
Degrades nonmetallic components
Causes corrosion
Promotes metal fatigue

Laboratory Analysis

Spectrochemical Analysis
Automatic Particle Counting
Ferrographic Analysis
Wear Particle Analysis

Analysis Limits for Gear Oils

Analysis Parameter	Borderline Value	Unsatisfactory Value
Water	0.05% (500ppm)	0.10% (1000ppm)
TAN increase	40%	>75%
Viscosity change in ISO limits	10%	>20%
Iron	75-100ppm	>100ppm
Copper	50-75ppm	>75ppm
Silicon	15-20ppm	>20ppm

Lubrication System Maintenance

Oil Change Intervals

Initial Oil Change - 500 hours or 4 weeks

Subsequent Oil Changes - 2500 hours or 6 months

Lubrication Myths

#1 Oil is Oil

Using the wrong oil is a common cause of gear failure. Specific lubricants are required for specific gear applications.

#2 Oil Never Wares Out

Over time, lubricants can succumb to water contamination, partical contamination and oxidation.

#3 Gears Do No Required Fine Filtration

Because of the thin film of oil separating the teeth, particles as small as 10 micron can cause abrasive wear.

#4 Oils are Interchangeable

Different oil companies may use different additivies in the same viscosity oil. Synthetics may react to mineral oils or different base synthetics.

#5 If a Little Oil is Good, A lot of Oil is Better

Each Gearbox has an optimum oil level. Too much oil can make the unit foam, overheat and leak.