



Get ready for the future of wind turbine lubrication for extended lifetime

KLÜBER
LUBRICATION
your global specialist

Innovative solutions for main bearing lubrication

The wind energy industry has been evolving significantly in technology, size and capacity in recent years. All of these mean a demanding lubricant requirements including ability to work under harsh conditions, good lubricating properties at high loads, avoid damages like wear and micropitting – to name a few. Our main

bearing lubricants have excellent field record for over two decades. This article will briefly introduce available innovative Klüber greases, their key features and what's new in 2024 from Klüber Lubrication.

Klüber main bearing greases

Klüberplex BEM 41-141 and Klüberplex BEM 41-301

It has been conventionally believed that ensuring higher kappa (ratio of lubricant viscosity at operating temperature to the required viscosity at operating temperature for $k = 1$) is sufficient for a problem-free bearing operation. But there are cases in the field showing bearing failures even with higher kappa, tending to suggest that higher kappa or lubricant viscosity is not necessarily the sole requirement for a problem-free operation. Important is to ensure good lubricant film formation, good reflow properties and right additives that can form durable tribofilms to protect surfaces against damages. Klüber main bearing greases are designed with special additives and thickeners that offer the following superior properties.

- Excellent wear protection even at extremely high loads
- Excellent lubricating film formation & reflow behaviour
- Excellent micropitting resistance

Lubricant film thickness

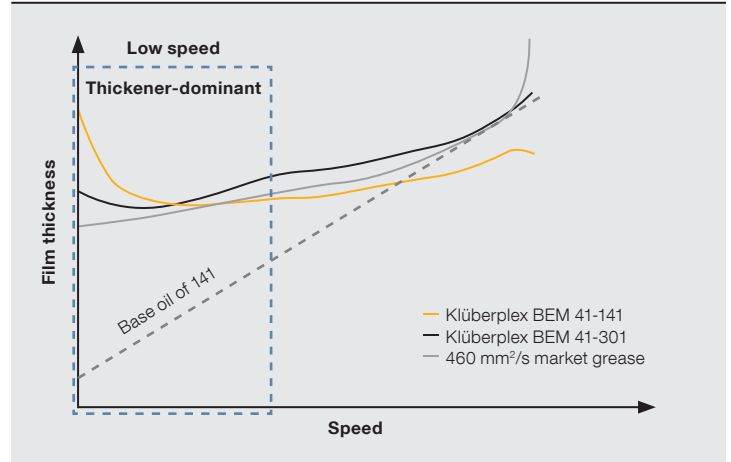


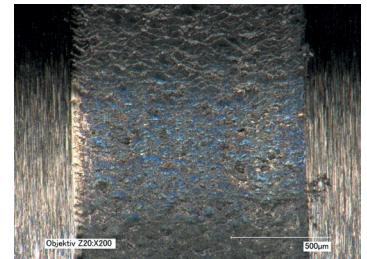
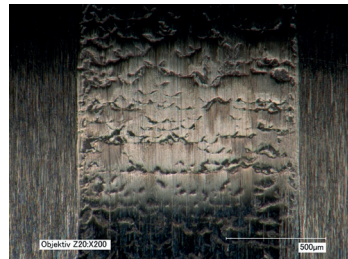
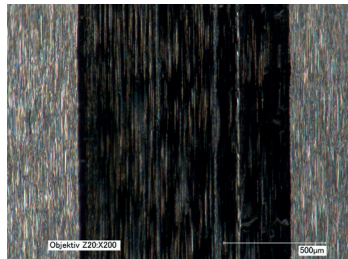
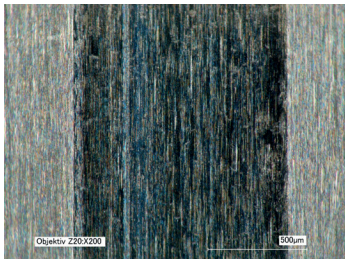
Fig. 1 Thicker lubricating film formation at low speeds by Klüber greases than the representative 460 mm²/s market grease

No micropitting

No micropitting

Significant micropitting

Micropitting escalated to macropitting



Klüberplex BEM 41-141 ✓

Klüberplex BEM 41-301 ✓

460 mm²/s market grease 1
(not Klüber)

460 mm²/s market grease 2
(not Klüber)

Fig. 2 Micropitting performance of Klüber greases and other greases available in the market. Klüber greases show no micropitting formation while the other market greases show significant micro/macropitting

New Rescue Grease in 2024 – a new and needed shift in paradigm

Klübersynth BEM 48-1501

- One-stop solution for wind turbines facing main bearing damages.
- Allows operators to run wind turbines without power production and financial losses.

This grease has been specially designed for use in damaged bearings, allowing enough time for operators to replace damaged bearings and extend life of damaged bearing until scheduled maintenance can be carried out. Field trials with operators and service companies show very positive results.

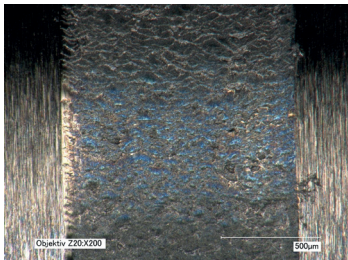


Fig. 4 Damage seen with a 460 mm²/s market grease after 4 million cycles. If corrective measures are not taken, damage would progress like shown in this figure and lead to catastrophic failure



Fig. 5 Early detected mild damage with a 460 mm²/s market grease after 2 million cycles

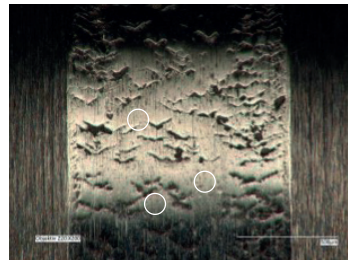


Fig. 6 460 mm²/s market grease replaced with 50% Klüber rescue grease, image taken at the same location of the component after 6 million cycles

Green circles in figs. 5 and 6 show areas where there were no cracks after 2 million cycles still show no crack formation even after 6 million cycles. Rescue grease arrests formation of new cracks

” One operator initially thought to run the damaged bearing with rescue grease for two months until scheduled maintenance for bearing replacement but has decided to run longer for about one year as the rescue grease performed excellently and arrested further damage progression. This allowed the operator to run turbine without financial loss.

Should you be interested in knowing more and willing to try our innovative lubricant solutions, please do not hesitate to contact us.

Daniel Narnhammer
Daniel.Narnhammer@klueber.com

Dr. Balasubramaniam Vengudusamy
Balasubramaniam.Vengudusamy@klueber.com

Edition 09.24

Publisher and copyright:
Klüber Lubrication München GmbH & Co. KG
Geisenhausenerstraße 7, 81379 München, Germany, HRA 46624
www.klueber.com