REWITEC®

application catalog

Surface Damages of gears and bearings – Where REWITEC® technology can help solving wear problems

Technology for more performance

The requirements for plants, machines and transmissions inevitably increase in terms of performance, energy efficiency and longevity - at the same time maintenance and down-times are to be constantly minimized. Based on the specially developed and proven REWI-TEC® technology, REWITEC GmbH offers solutions for reducing friction and wear with its patented products.

Wind Energy
Manufacturers and operators of wind turbines depend on a smooth and continuous operation. REWITEC® offers optimized products for the wind industry in order to decisi-vely increase service life and operational safety.
MAIN GEARS | MAIN BEARINGS | GENERATOR BEARING | PITCH AND AZIMUT GEARS/BEARINGS

Industry
Long-term investment protection for engines, transmissions and bearings - with REWITEC® you get more security for your investments, reduce downtimes and contribute to sustainable and environmentally conscious action.
GEARBOXES | GENERATORS | COMPRESSORS | BEARINGS

Marine
Well-known shipping companies, owners and insurers already rely on REWI-TEC® technology and have already integrated the product solutions into their processes for operating main engines and auxiliary diesel engines.
MAIN ENGINES AND AUXILIARY DIESELS | WINCHES | SEPARATORS

Automotive
Fewer emissions and higher energy efficiency, as well as reduced vibrations, noises and more train for the vehicle - also in the automotive sector (vehicle fleet, transport, construction vehicles and leisure) the REWITEC® products have their outstanding effect.
ENGINES | GEARBOXES | BEARINGS | DIFFERENTIALS

Table of contents

All technical data is subject to change in line with ongoing technical development!

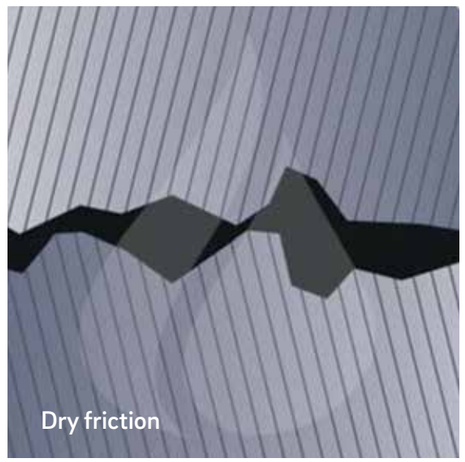
1. Introduction

Although tribological research has made significant progress in recent years, especially in the field of computer simulation, it is still difficult or impossible in many cases to record all the influence parameters on wear and tear.
This manual is mainly intended for the practical work of the service and the maintenance personnel. It is intended to provide concrete assistance in the analysis and assessment of wear problems by the treatment of numerous damage examples from the past years and to enable measures to optimize safety and reliability in the operation of plants and machines.

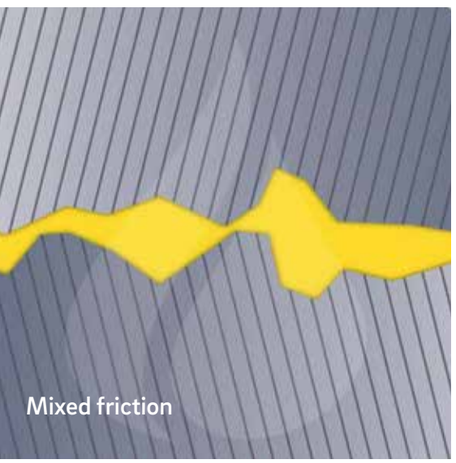
Kinds of friction

DRY FRICTION:

The metal surfaces rub directly against each other without a lubricating film. Friction resistance and wear and tear are both high. Very high local temperatures can build up, which can lead to the jamming and destruction of touching parts. This rubbing effect can occur in a lubricated gearbox only in extreme cases, for example in case of failure of the supply of lubricant to the location of friction.



Dry friction



Mixed friction

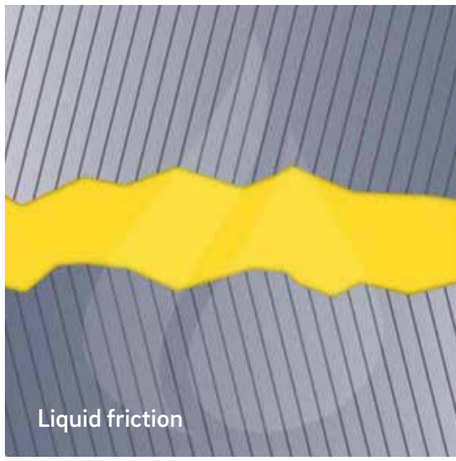
MIXED FRICTION:

There is no complete lubricating film between the metal surfaces, and different roughness peaks can touch each other. This condition always occurs in gearboxes and bearings at start-up and shut-down.

Continuous reduced mixed friction occurs in the upper and lower dead point area in all machines at the tooth flanks. The lubricants must therefore be capable of forming protective and reactive layers with the help of additives on the sliding surfaces and keep friction force, wear and tear as low as possible.

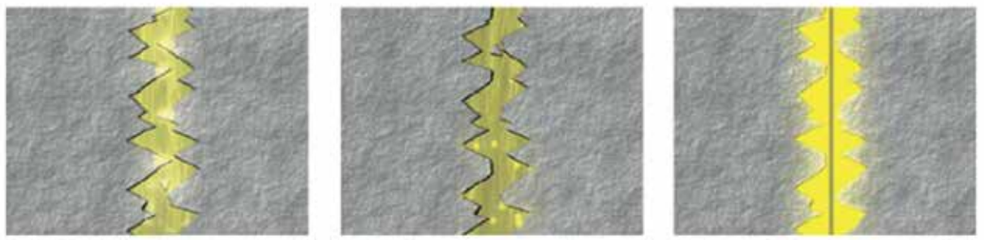
LIQUID FRICTION:

Both metal surfaces are separated completely by a lubricating film; friction (power loss) is low and wear and tear is equal to zero. This is the ideal condition. The following conditions must be met to make a complete load-carrying liquid film:



Liquid friction

HOW DURAGEAR® AND GR400 WORKS

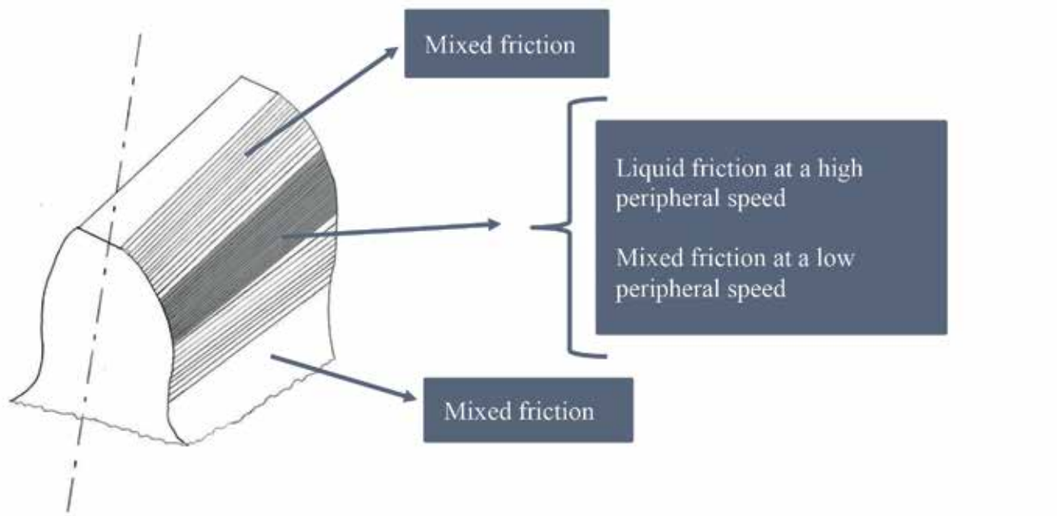


The REWITEC® silicon coating is conveyed via a lubricant into the gearbox, bearing or motor and gets in this way to the stressed metal surface.
As a result of the crystalline temperatures that arise in live operation, the product's coating particles react with the molecules of the metal surface and the chemical/physical process is set in motion. On the basis of this chemical bonding, the rubbing metal surfaces gain a ceramic quality, producing a new, corrosion-resistant metal/ceramic surface. In the process, the material properties in relation to friction and wear improve appreciably, whereas the lubricant properties remain unchanged.

A SKETCH FOR THE EXPLANATION OF FRICTION CONDITIONS ON A TOOTH FLANK

In the previous considerations of the tooth flank stress, the presence of the lubricant as a major structural element has often been disregarded. Depending on the changing load conditions in the area of engagement and the lubricant used, different lubrication conditions occur on the tooth flanks. Picture 4 schematically illustrates the desirable liquid friction and is generally achieved only at high circumferential speeds or low loads, so-called hydrodynamic lubrication.

Even a onetime application with REWITEC® can solve wear problems and prolong the life of tribo systems. Examples can be considered in Chapter 2 „Classification of the type of damage".



2. Classification of the type of damage

Damage on tooth flanks is classified by ISO standard 10825:1995 and DIN 50320.
Decision support for the application of REWITEC® products.

- Beginning damage with low severity, regression of the damage.
- Freezing the damage, extension of the life time.
- Advanced damage, application no longer recommended.

	Wear terminology according to ISO 10825	Wear resistance according to DIN 50320				REWITEC application		
		Adhesion	Abrasion	Surface breakdown	Tribochem. reaction	Recommended	Succesful application possible	Not recommended
1	Indications of surface disturbances							
1.1	Sliding wear							
1.1.1	Normal wear (running-in wear)							
1.1.1.1	Moderate wear							
1.1.1.2	Polishing							
1.1.2	Abrasive wear							
1.1.3	Excessive wear							
1.1.4	Moderate scratching (scoring)							
1.1.5	Severe scratching							
1.1.6	Interference wear							
1.2	Corrosion							
1.2.1	Chemical corrosion							
1.2.2	Fretting corrosion							
1.2.3	Scaling							
1.3	Overheating							
1.4	Erosion							
1.4.1	Cavitation erosion							
1.4.2	Hydraulic erosion							
1.5	Electric erosion							
2	Scuffing							
3	Permanent deformations							
3.1	Indentation							
3.2	Plastic deformation							
3.2.1	Plastic deformation by rolling							
3.2.2	Plastic deformation by tooth hammer							
3.3	Rippling							
3.4	Ridging							
3.5	Burrs							

	Wear terminology according to ISO 10825	Wear resistance according to DIN 50320				REWITEC application		
		Adhesion	Abrasion	Surface breakdown	Tribochem. reaction	Recommended	Succesful application possible	Not recommended
4	Surface fatigue phenomena							
4.1	Pitting							
4.1.1	Initial pitting							
4.1.2	progressive pitting							
4.1.3	Micropitting							
4.2	Flake pitting							
4.3	Spalling							
4.4	Case crushing							
5	Fissures and cracks							
5.1	Hardening cracks (quench cracks)							
5.2	Grinding cracks							
5.3	Fatigue cracks							
6	Tooth breakage							
6.1	Overload breakage							
6.1.1	Brittle fracture							
6.1.2	Ductile fracture							
6.1.3	Semi-brittle fracture							
6.2	Tooth shear							
6.3	Breakage after plastic deformation (smeared fracture)							
6.4	Fatigue breakage							
6.4.1	Bending fatigue							
6.4.2	Tooth end breakage							

Damage on bearings is classified by ISO standard 15243:2004. Decision support for the application of REWITEC® products for bearing applications

- Beginning damage with low severity, regression of the damage.
- Freezing the damage, extension of the life time.
- Advanced damage, application no longer recommended.

	Wear terminology according to ISO 15243:2004	Wear resistance according to DIN 50320				REWITEC application		
		Adhesion	Abrasion	Surface breakdown	Tribochem. reaction	Recommended	Succesful application possible	Not recommended
5.1	Rolling contact fatigue							
5.1.1	Subsurface initiated fatigue							
5.1.2	Surface initiated fatigue							
5.2	Wear							
5.2.1	Abrasive wear							
5.2.2	Adhesive wear							
5.3	Corrosion							
5.3.1	Moisture corrosion							
5.3.2	Frictional corrosion							
5.3.2.1	Fretting corrosion							
5.3.2.2	False brinelling							
5.4	Electrical erosion							
5.4.1	Excessive current erosion							
5.4.2	Current leakage erosion							
5.5	Plastic deformation							
5.5.1	Overload deformation							
5.5.2	Indentations from particles							
5.6	Cracking and fracture							
5.6.1	Forced fracture							
5.6.2	Fatigue fracture							
5.6.3	Thermal cracking							

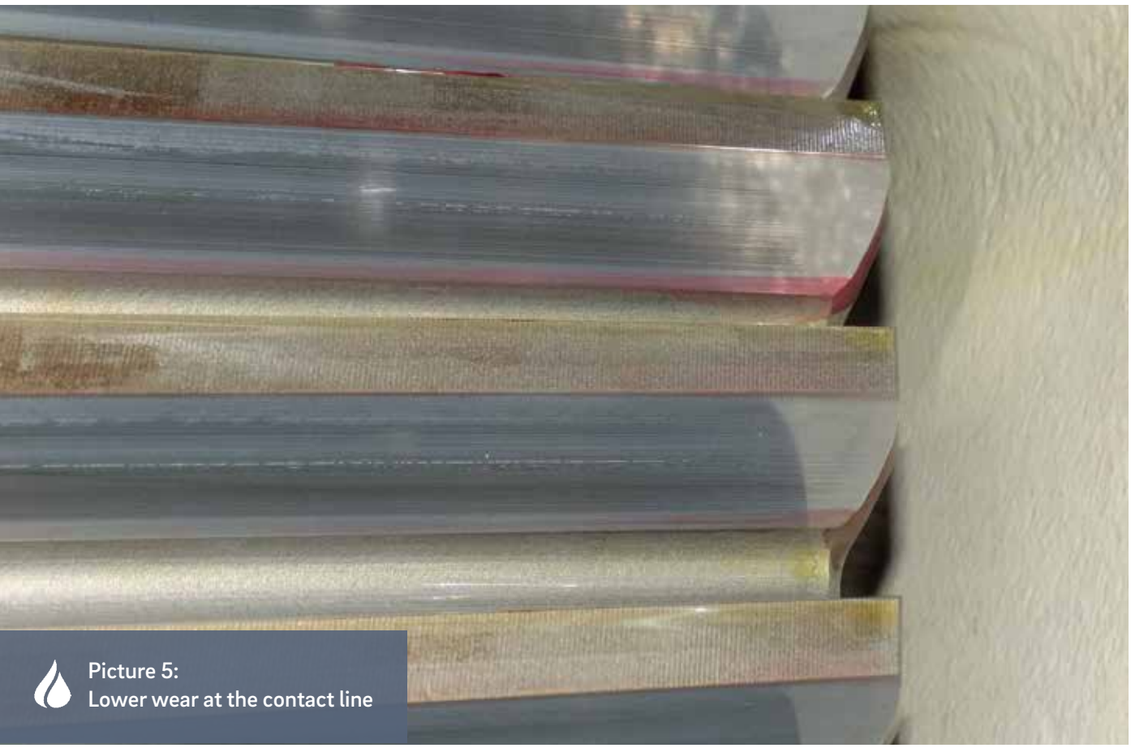
3. Pictures of classified damage types

The following pictures illustrate various types of damage to gear tooth flanks and bearings.
The pictures were taken at different wind power plants.

MODERATE WEAR

Definition according to ISO 10825:1995
Examination of the flanks reveals that metal has been removed from both the addendum and dedendum tooth surfaces.
The pitch surface begins to show as a line continuous like picture 5. [ISO 95]

- Moderate wear can be repaired, frozen or prevented by the use of REWITEC®-products (Picture 5).



Picture 5:
Lower wear at the contact line

Picture 6:
Overload breakage on a tooth flank

OVERLOAD BREAKAGE

Definition according to ISO 10825:1995
This type of breakage usually occurs as a result of single or very few, very high overload incidents. Sometimes a crack initiated by an overload will progress as a fatigue crack with slow propagation in which there is usually evidence of fretting corrosion in the region of the initial crack. Three types of overload fractures surfaces are to be found:

- brittle fracture
- ductile fracture
- semi-brittle fracture [ISO 95]

- Overload breakages can no longer be restored by the use of REWITEC®-products (Picture 6).

Picture 7: Run-through damage caused by abrasive particles

ABRASIVE WEAR

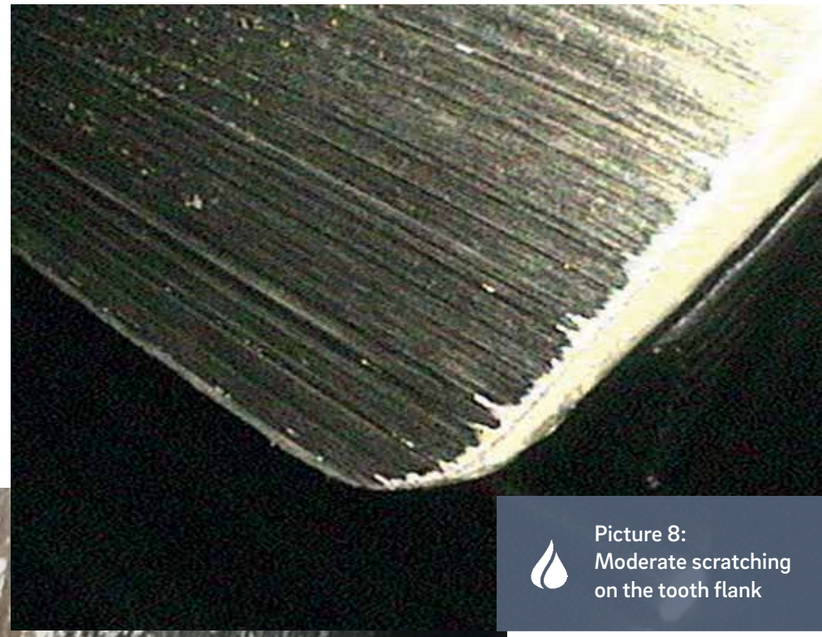
Definition according to ISO 10825:1995
Abrasion is the removal or displacement of material due to the presence of hard particles (e.g. metallic debris, scale, rust, sand, abrasive powder or the like) suspended in the lubricant or embedded in the flanks of mating teeth. Picture 7 illustrate a pinion with opposite tooth flanks worn by abrasion to such an extent that the tooth tips are reduced to sharp edges. Active surfaces of the flanks are smooth but radial scratches due to hard particles embedded in the flanks of the mating gear are also present. [ISO 95]

- Run-through damage can be reduced or repaired by the use of REWITEC® products (Picture 7).

MODERATE SCRATCHING

Definition according to ISO 10825:1995
Fine grooves, running in the direction of sliding motion, irregularly spaced and of varying length, and often scattered over the tooth flank [ISO 95]

- Moderate and severe scratching can be reduced, repaired, frozen or prevented with the use of REWITEC® products (Picture 8 and 9).



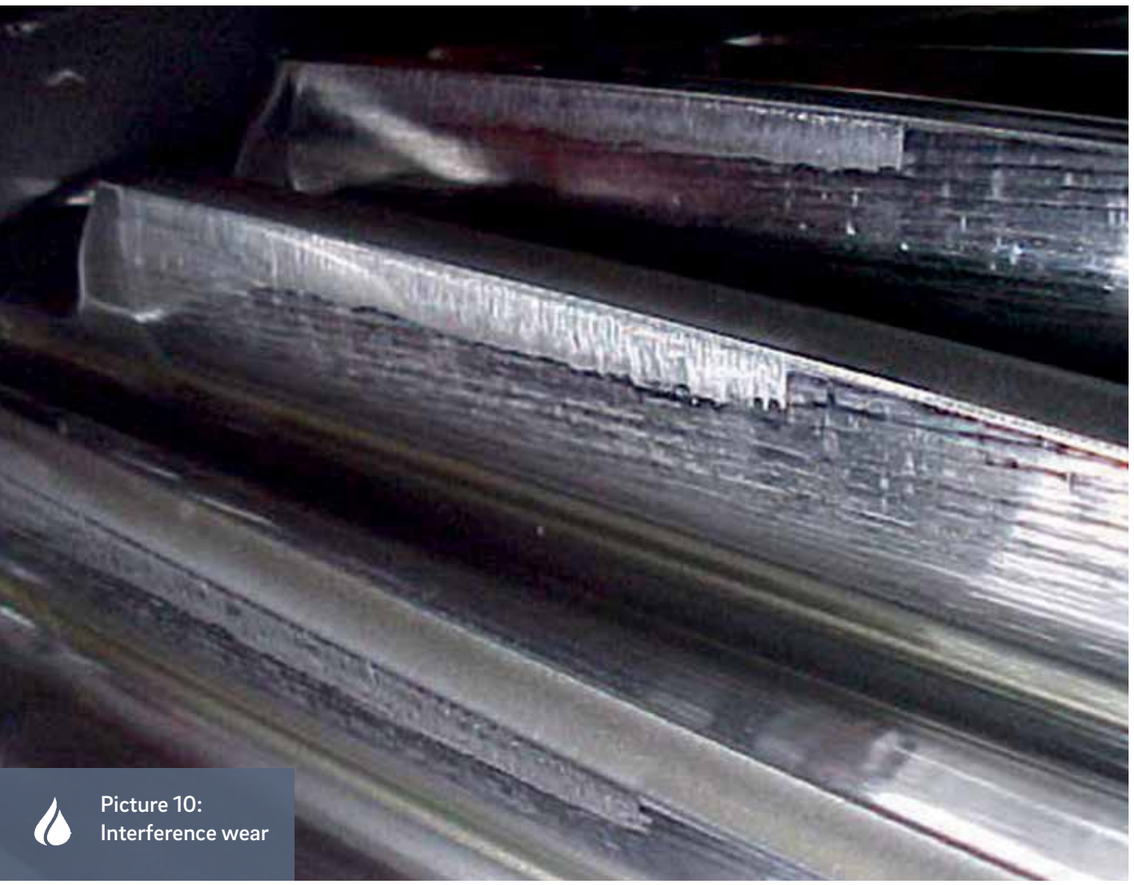
Picture 8: Moderate scratching on the tooth flank

Picture 9: Severe scratching on a cylinder roller bearing

INTERFERENCE WEAR

Definition according to ISO 10825:1995
Wear at the tip of one tooth and/or at the root of the mating tooth, caused by excess material at the tips of one or at the roots of the other. The result is scraping and wear of booth roots and tips of the teeth, hollowing the former and rounding the latter. [ISO 95]

- Constructive faults can no longer be remedied by the use of REWITEC® products. If necessary, bridging is possible until replacement of the gearbox. (Picture 10).



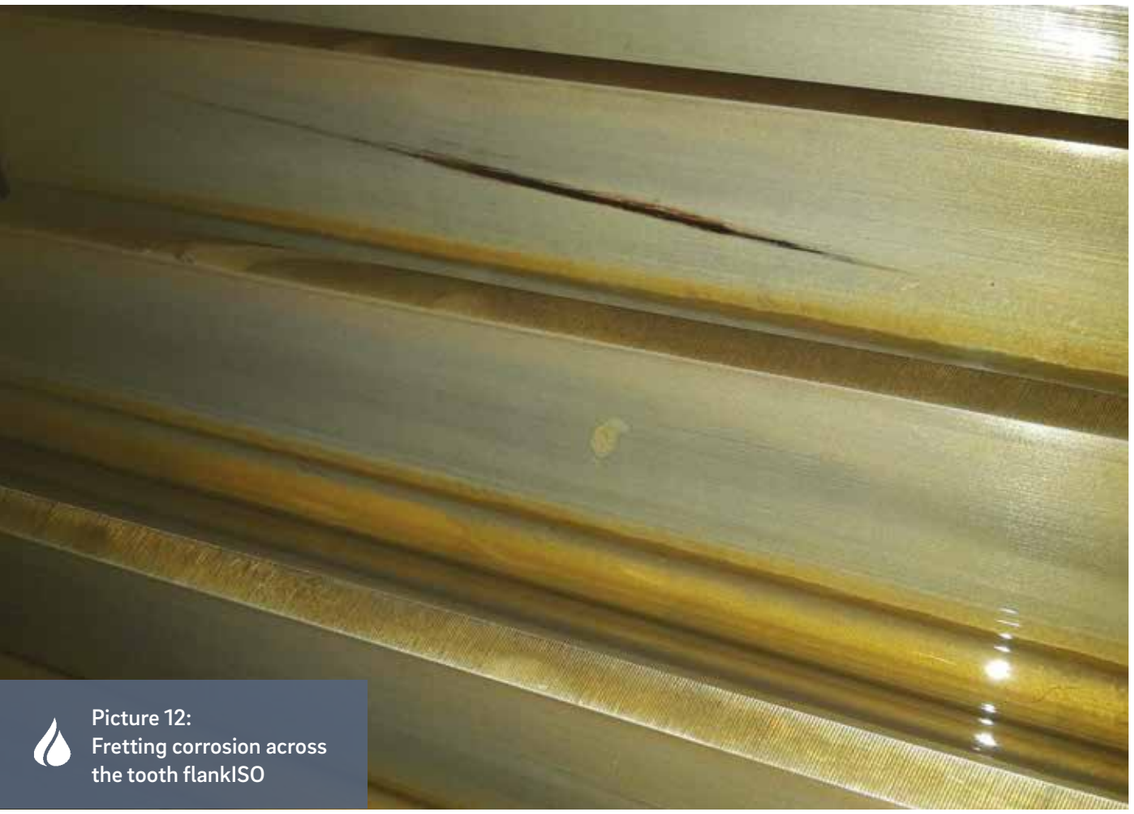
Picture 10:
Interference wear

Picture 11:
Corrosion at the tooth flank

CHEMICAL CORROSION

Definition according to ISO 10825:1995
Surface degradation caused by chemical attack. Common symptoms are fine pitting over the entire tooth surface and grain boundary oxidation. Sometimes, reddish brown rust traces are found, usually near active parts of the tooth flanks. Low corrosion on gear tooth surfaces as a result of chemical attack. [ISO 95]

- Chemical corrosion can be reduced, removed or prevented with the use of REWITEC® products. (Picture 11).



Picture 12:
Fretting corrosion across the tooth flankISO

FRETTING CORROSION

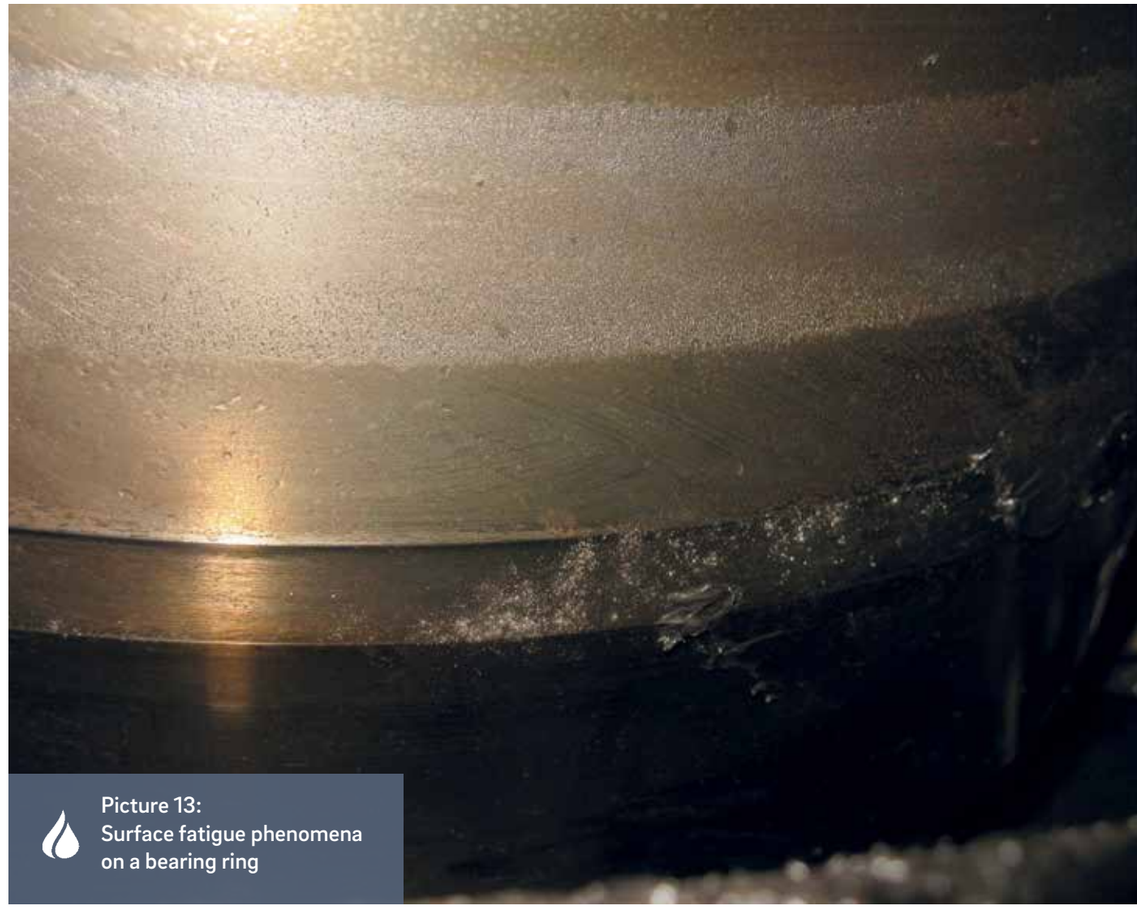
Definition according to ISO 10825:1995
Surface damage caused by repeated small movements of one contacting surface over another with the formation of fine reddish-brown oxide particles. These remain in the contact zone and their abrasive action adds to the rate of surface deterioration.
Stationary gears may be thus affected if they are subjected to structure-borne vibrations such as those encountered during transport. [ISO 95]

- Fretting corrosion can be reduced, removed or prevented with the use of REWITEC® products.

SURFACE FATIGUE PHENOMENA

Definition according to ISO 10825:1995
Material damage due to surface and subsurface stresses produced by the repeated application of forces. It is characterized by removal of metal and formation of cavities.
Damage of this type is classified as fatigue damage and not wear. [ISO 95]

- Seizures can be frozen or prevented by the use of REWITEC® products.

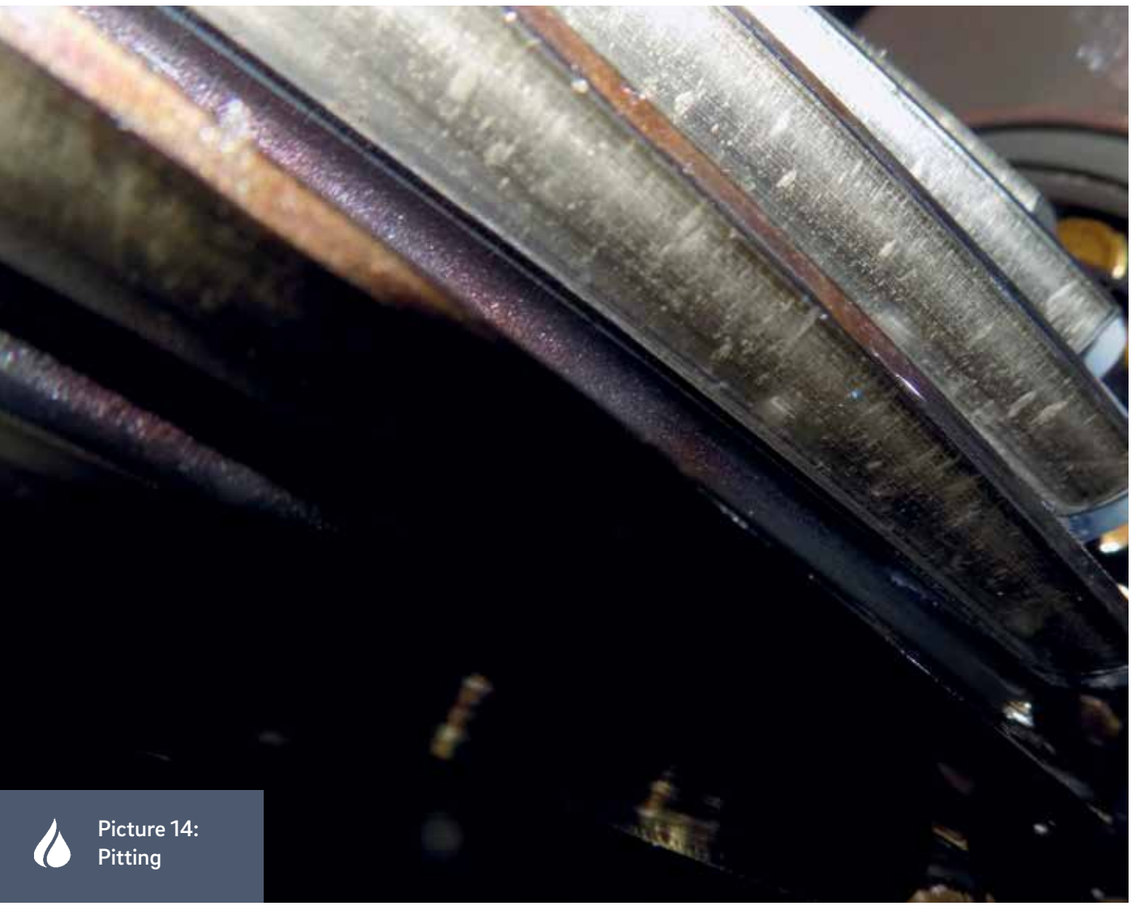


Picture 13:
Surface fatigue phenomena on a bearing ring

PITTING

Definition according to ISO 10825:1995
Surface fatigue phenomena occurring in the presence of rolling or mixed rolling and sliding contacts. Particles breaks out of affected areas leaving surfaces pock marked with scattered holes. [ISO 95]

Pitting can be repaired, frozen or prevented by the use of REWITEC® products.



Picture 14:
Pitting

Picture 15:
Tooth flank with micropitting and corrosion

MICROPITTING

Definition according to ISO 10825:1995
Degradation of gear tooth working surfaces under lubrication conditions where the film is too thin for the load. It appears under magnification as dense patches of micropits or microcracks. Picture 15 impressively shows micropitting damage.

Micropitting can be repaired, frozen or prevented by the use of REWITEC® products.

Picture 16:
Flake pitting on a tooth flank

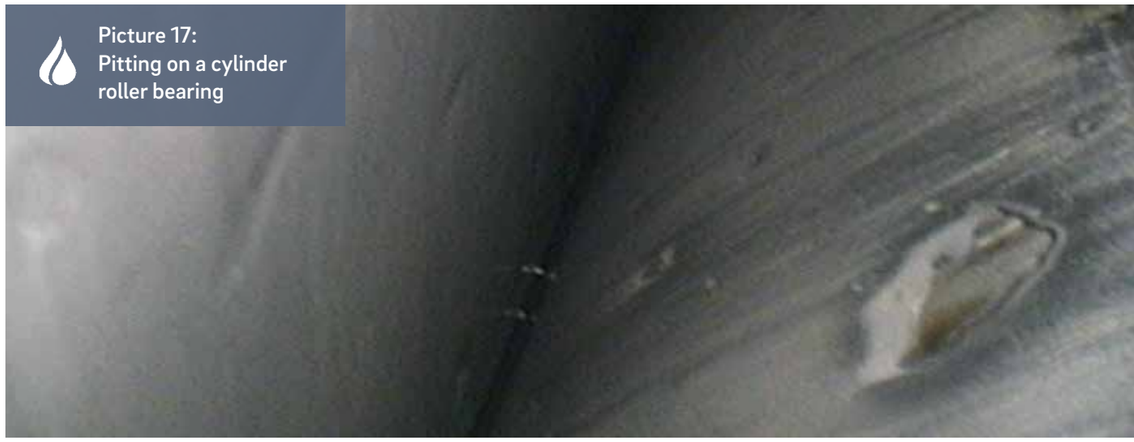
FLAKE PITTING

Definition according to ISO 10825:1995
A form of tooth-surface damage involving the breaking out of thin flakes of material of comparatively large area, leaving shallow cavities of roughly constant depth shaped like inverted triangles. Flake pitting present on the active flanks of heavily crowned spur gear. This through-hardened gear sustained a heavy overload which was the cause of the damage as you can see in Picture 16. [ISO 95]

Halting or reduction of further damage

The following damage to bearing elements cannot be repaired, it can only be frozen to wait for a replacement for a low wind period. Pitting on a bearing element (Picture 17)

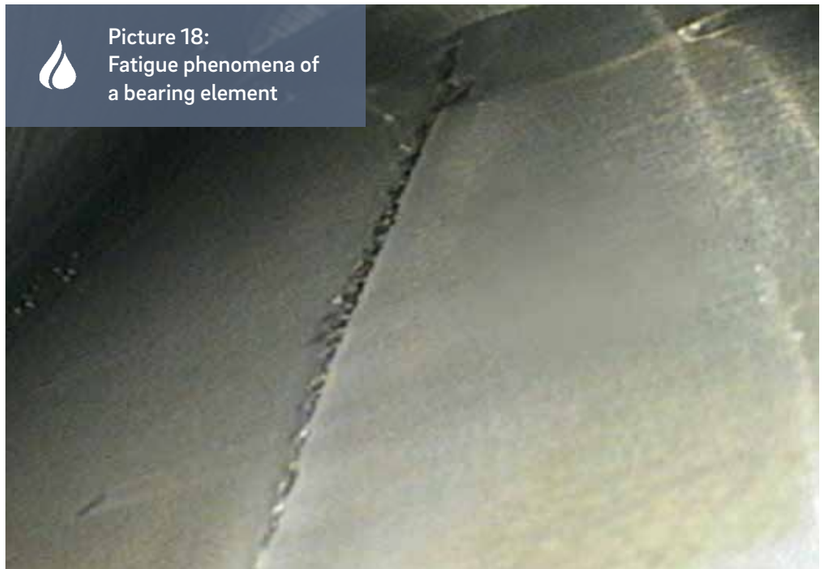
Halting or reduction of further damage



Picture 17:
Pitting on a cylinder roller bearing

A diagnostic by an endoscopy show a tear in a cylinder roller bearing. The following Picture 18 illustrates the significant effect of tribological and usage-related fatigue.

Halting or reduction of further damage.



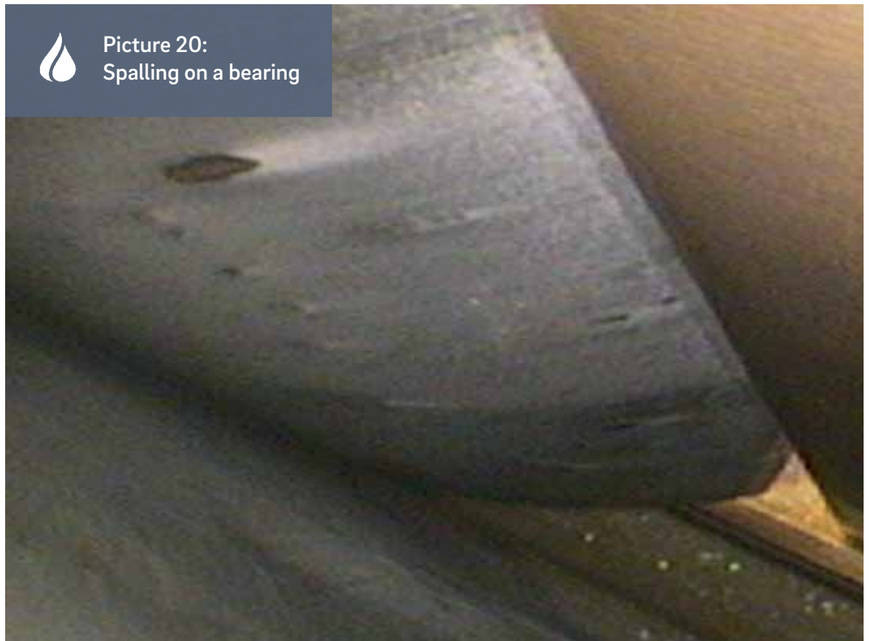
Picture 18:
Fatigue phenomena of a bearing element

Pictures 19 and 20 show spalling damage on a bearing.

Halting or reduction of further damage

Picture 19:
Spalling on a bearing

Halting or reduction of further damage



Picture 20:
Spalling on a bearing

Triple life expectancy.

The product REWITEC® DuraGear® W100 has clear, positive effects on the life cycle of wind turbines - this is confirmed by the latest figures.

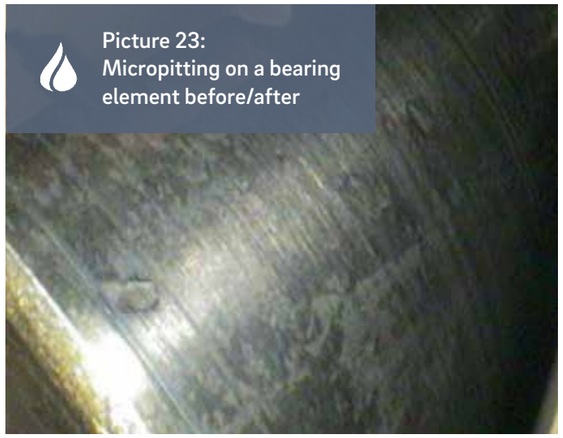
4. Before/after comparison

Picture 21 shows micropitting and corrosion before an application with the surface treatment additive REWITEC® DuraGear® W100:

Picture 21:
Micropitting and corrosion before the REWITEC® application

In Picture 22 you can see the same location after six months of operation.

Picture 22:
Micropitting after the REWITEC® application



Picture 23:
Micropitting on a bearing element before/after

In Picture 23 you can see micropitting on a cylinder roller bearing before/after REWITEC® application. The images were taken from an endoscopy report.

Picture 24 shows wear damage in the second stage of the sun pinion, in the after picture you can see a mat surface with diminished passages.

Picture 24:
Wear before/after in a sun pinion

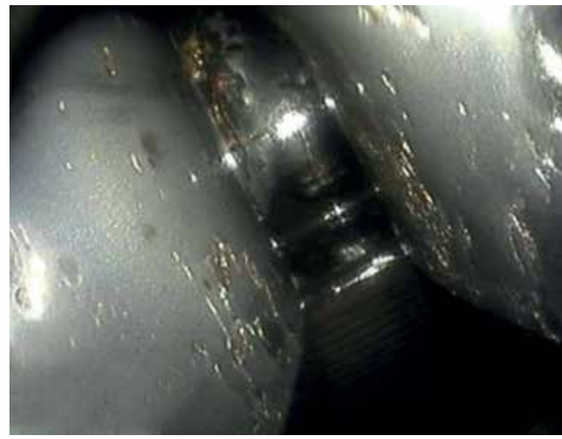
Picture 25:
Surface grooves at planetary bearing

The following grooves are at a rolling bearing element of a planetary bearing, in Picture 25 you can see the comparison before/after.

The grooves are at a rolling bearing element from a planetary bearing, in Picture 26 you can see the comparison before/after.

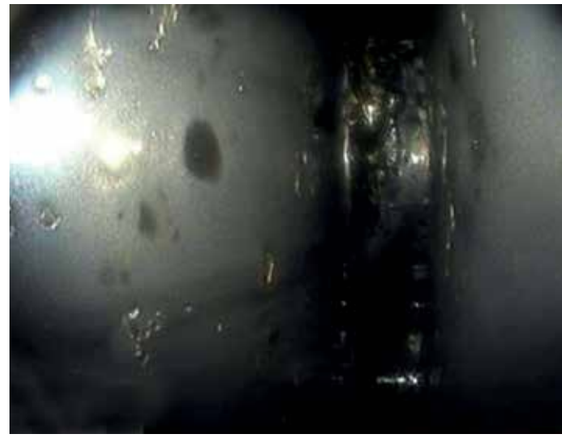
Picture 26:
Planetary bearing element with grooves

Picture 27:
Rolling element in a planetary bearing, before/after

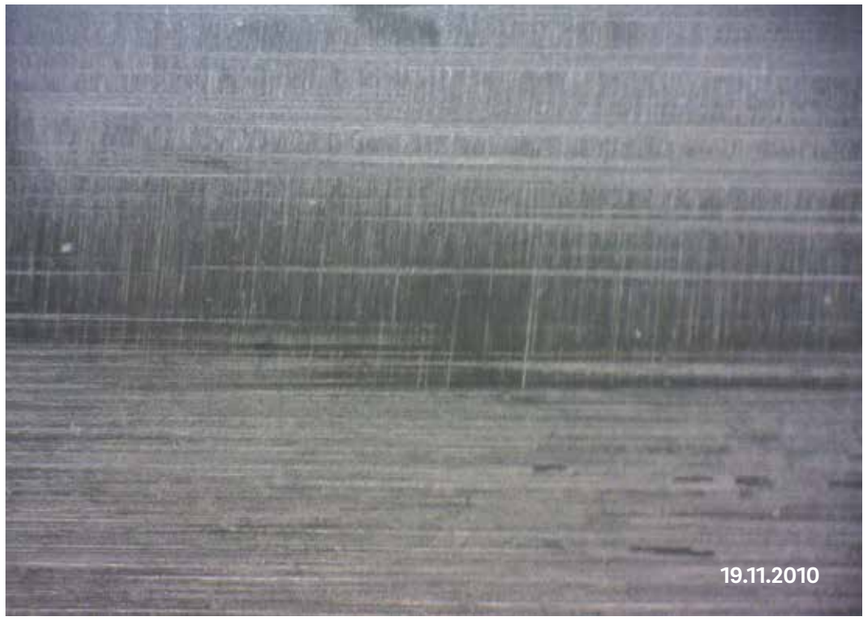


The following two pictures show a rolling element in a planetary bearing of a GE 1.6sl wind turbine. The rolling element had considerable surface damage. Therefore the operator just searched for a temporary solution before exchanging the whole gear and decided to use REWITEC's® DuraGear® W100. To date, the gearbox has not been replaced and continues to function with REWITEC®.

Picture 28:
Rolling element in a planetary bearing before/after



Picture 29:
Before/after comparison of micropitting damage. Analyzed via REWITEC® Replica Set imprints and light microscope.



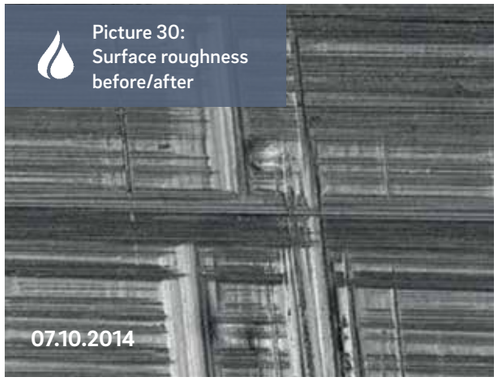
5. Surface analysis

The following impressions were evaluated under a laser confocal microscope with a 20-fold magnification at the same point of the tooth.

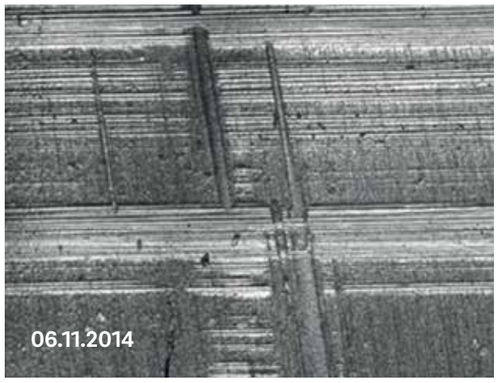
EXAMPLES OF APPLICATION: GE 1.5 SL

Wear development on a Bosch Rexroth gear tooth (GE 1.5 SL) over a period of two years.

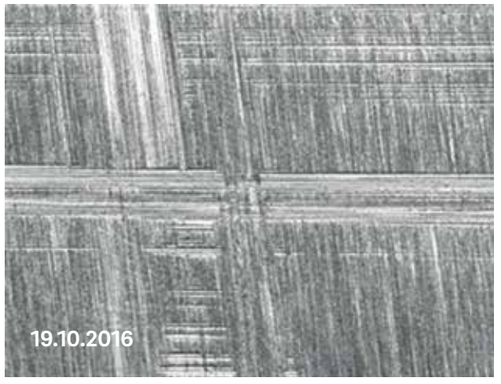
Picture 30:
Surface roughness before/after



Surface roughness
- R_a = 7,606 µm
- R_Z = 238,547 µm



Surface roughness
- R_a = 3,464 µm
- R_Z = 133.443 µm

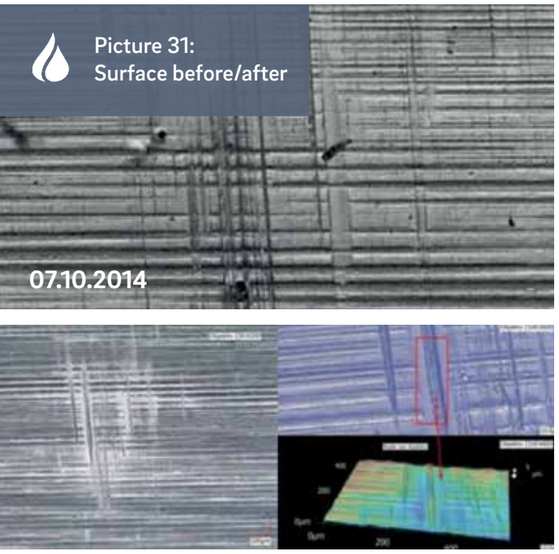


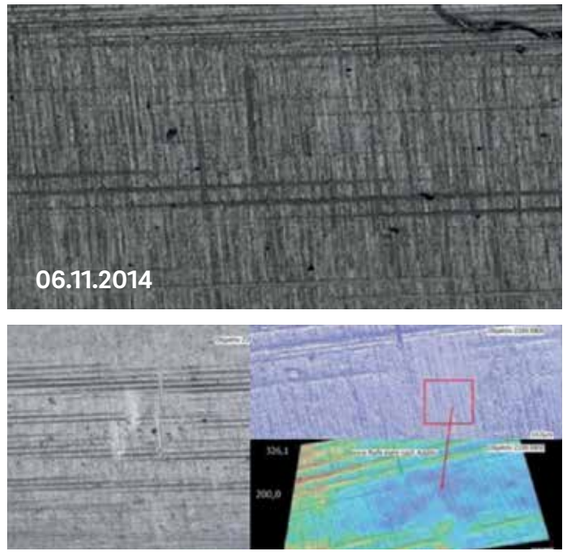
Reduction of the surface roughness (R_a) up to 54 %.

WEAR DEVELOPMENT ON A BOSCH-REXROTH GEAR TOOTH OVER A PERIOD OF TWO YEARS.

The following impressions were evaluated under a laser confocal microscope with a 10-fold magnification at the same point of the tooth.

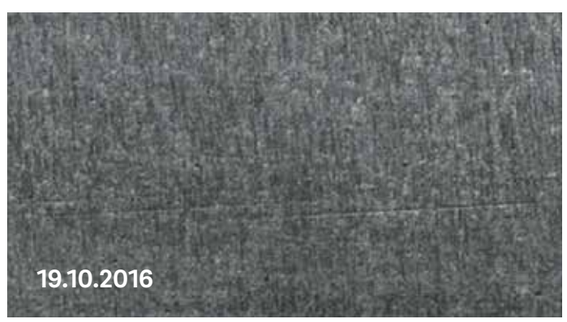
Picture 31:
Surface before/after





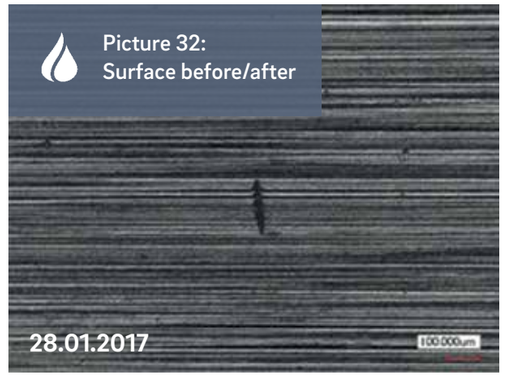
Run trough marks on the tooth flank after 6 weeks and 2 years:

- Reduction of the surface roughness and friction force
- Improved load contact pattern
- Less stress for the tooth flank



WEAR DEVELOPMENT ON A BOSCH-REXROTH GEAR TOOTH

Picture 32:
Surface before/after



Surface roughness before:

- R_a = 9,287 µm
- R_Z = 286,979 µm
- R_q = 13,739 µm

Surface roughness after:

- R_a = 6,840 µm (Reduction up to 26 %)
- R_Z = 239,675 µm (Reduction up to 16 %)
- R_q = 10,702 µm (Reduction up to 22 %)

6. Summary

Scientifically proven, practically tested. The future for gears & bearings.

The innovative technology is ideally suited to the needs of the wind industry and protects drives effectively against wear and tear. Well-known manufacturers, owners and insurers are already cooperating with us and use our products. The unique nanoparticle-based surface treatment additives show their convincing effect in all types of gearboxes and bearings. The refining process is already initiated by the first use. Thus, vibrations of the gearbox and bearings are significantly reduced. This function and mode of action has already been confirmed by some independent expert opinions.

REWITEC® is based on proven experience from various application areas of wind companies. Based on this, we have developed REWITEC® specifically to meet the needs of wind turbine users.

As a result, you can bring your gears and bearings fairly close to a new condition. Less friction means less wear, longer life and less down time.

7. Glossary

ABRASIVE WEAR
Gradual removal of material from one or more surfaces caused by abrasion.

FAILURE
Fault or damage, which prevents a transmission or bearing from fulfilling its actual purpose.

FRACTURE
Spread of a crack up to a complete separation.

FATIGUE
Damage (structural changes) of the material caused by damage accumulation in the steel metallurgy or a material defect causes the material to be in contact with the contact surfaces.

MOISTURE CORROSION
Chemical reaction occurs when water / moisture or another chemical substance evaporates on a metal surface and can thereby oxidize with oxygen.

MICROPITTING
Micropitting is a wear phenomenon in areas of highly stressed metallic components. It happens predominantly on gears and bearings. Micropitting occurs when high sliding speeds as well as low lubricant film thicknesses are present in the highly stressed contact between two components.

PITTING
A general term for a kind of local damage occurring in the form of small holes, craters or cavities. The causes of pitting include surface fatigue, corrosion and indentations by impurities.

CORROSION
An oxide layer is a chemical reaction with a metal surface.

FRICTION
The resistance force which acts when two objects move relative to each other under load.

DLE MARKS
Continuous ripples in the distance between the roller bodies on the running tracks or the tooth flank. They are caused by vibration-induced micro-motions of the rolling element / tooth flank at the static bearing.

WEAR
The gradual removal of material from a surface.

IMPURITIES
Solids particles or liquids which penetrate the system and impair its function.

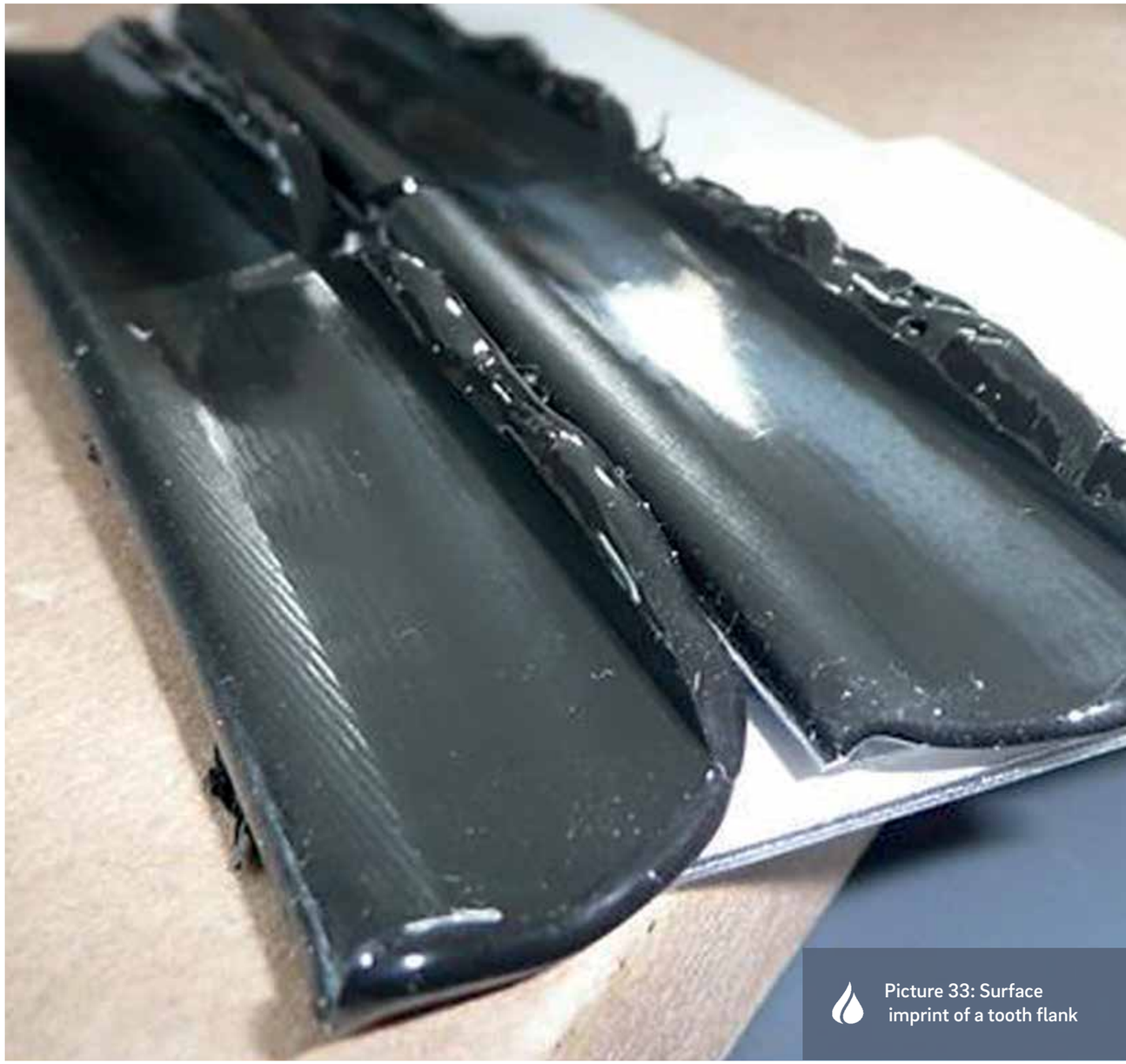
8. Anhang

SURFACE ANALYSIS WITH THE HELP OF IMPRINTS

In order to evaluate the surface of gears and bearings, we use various measurement methods and analyzes to provide constant proof of the added value and benefits of our products. To support our customers, we are able to carry out a part of these measurements directly at the plants and without long downtimes.
Substantial information about the quality of the application is provided by our surface analyzes. In this case, a negative impression of the tooth flank or bearing surface will be taken and evaluated with the REWITEC® Replica Set.

To create a tooth flank impression, a visual inspection of the surfaces is carried out first by one of our qualified service technician. Cleaned and marked with oil-resistant paint, the surface impressions of the tooth flanks or bearing surfaces are taken in order to evaluate them microscopically later. The corresponding REWITEC® product is added or applied and after approx. 500 operating hours, the entire process for the subsequent before/after-comparison is repeated.

The resulting surface imprints are analyzed and evaluated by a light microscope, laser microscope or confocal microscope. Thanks to the REWITEC® Replica Set, roughness depths with a resolution of up to 0.1 µm can be analyzed. In addition to the surface analysis, depending on the application, vibration-, temperature analyzes or comparative compression measurements on internal combustion engines can be carried out with similarly informative results. These are documented and finally compiled in an application report and made available to the customer.

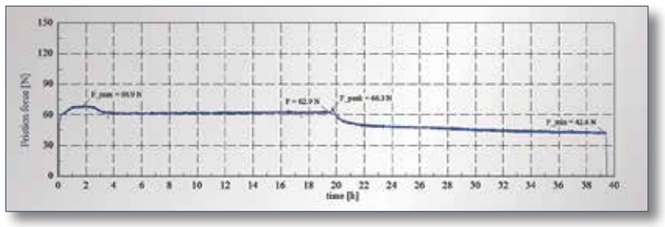


Picture 33: Surface imprint of a tooth flank

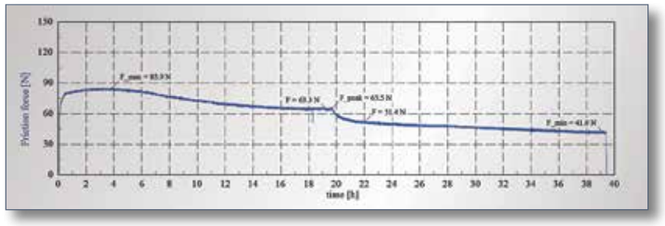
SCIENTIFIC TEST

The Competence Centre of Tribology at the University of Mannheim used the 2-disc test facility to examine the friction and wear behaviour of materials and coatings, and the lubricant properties in loads by rolling.

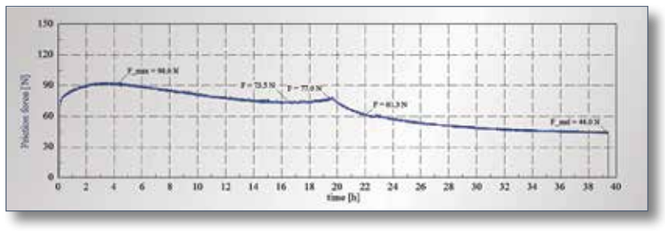
Castrol Optigear Synthetic X320



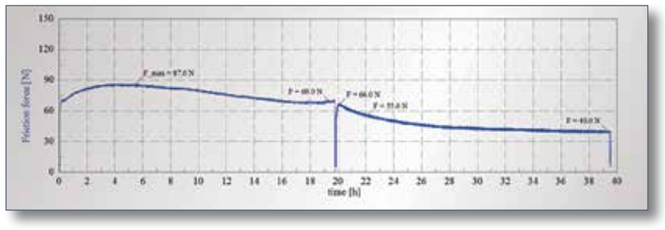
Mobilgear SHC XMP 320



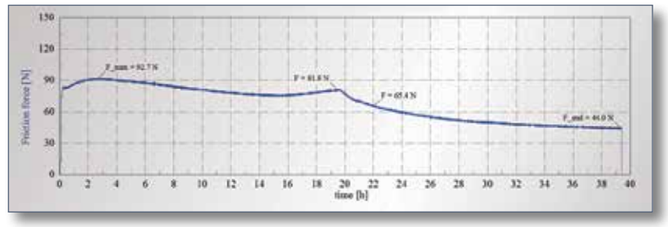
Klübersynth GEM



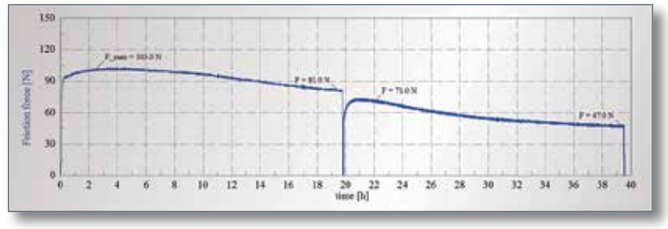
Fuchs Unisyn CLP 320



Amsoil PTN 320



Shell Omala S4 GX 320



Overview reduction of the surface roughness wind turbine oils

	Oil grade	Castrol Optigear Synthetic X320	Mobilgear SHC XMP 320	Klübersynth GEM 4-320N	Klüberbio EG 2-150	Fuchs Unisyn CLP 320	Amsoil PTN 320	Shell Omala S4 GX 320
Measured data	R_a before [µm]	0,22 µm	0,22 µm	0,22 µm	0,22 µm	0,22 µm	0,22 µm	0,22 µm
	R_a after [µm]	0,129 µm	0,123 µm	0,100 µm	0,133 µm	0,109 µm	0,180 µm	0,165 µm
	R_a Reduction [%]	**41 %**	**44 %**	**54 %**	**40 %**	**50 %**	**18 %**	**25 %**
	R_q before [µm]	2,00 µm	2,00 µm	2,00 µm	2,00 µm	2,00 µm	2,00 µm	2,00 µm
	R_q after [µm]	1,52 µm	1,18 µm	0,91 µm	1,04 µm	1,02 µm	1,51 µm	1,42 µm
	R_q Reduction [%]	**24 %**	**41 %**	**55 %**	**48 %**	**49 %**	**25 %**	**29 %**
	Friction Force, before	62,9 N	63,3 N	73,5 N	120,0 N	69 N	81,8 N	81 N
	Friction Force, after	42,6 N	41,0 N	44,0 N	54,0 N	44,0 N	44,0 N	47,0 N
	Reduction Friction Force	**33 %**	**35 %**	**40 %**	**55 %**	**36 %**	**46 %**	**42 %**

Instruction Manual
REWITEC® DuraGear® W100

Treatment of Gear Units and Bearings of Wind Turbines

- The REWITEC® technology helps to restore worn metal surfaces, provided these have been subjected to normal wear and have not been destroyed by mechanical influences.
- If oil filters with a mesh size of <30 µm be built in, these will have to be switched off, be bridged or replaced by a filter with a mesh width ≥30 µm during the time of treatment. Be sure to observe the advice given further downbelow on filters!
- The dosage of the product is 1 ltr. DuraGear® W100 per 100 ltr. gear oil volume (1:100).
- Following the treatment, an oil change could be carried out the earliest after 500 operating hours.
- In case of any questions or suggestions, please contact us under **support@rewitec.com** or by telephone **+49 6441 44 59 90**.

Application

1. The gear unit should have reached operating temperature. The REWITEC® DuraGear® W100 should have room temperature.
2. While the treatment takes place, the oil filters must be switched off, be bridged or removed temporarily:
   - Replace or remove filter ≥30 µm with a new or supplied filter *)
   - If necessary switch off existing fine filter ≤30µm for the duration of 500 operating hours
3. Shake the bootle(s) well for about 1 minute.
4. Pour the whole contents of the bottle(s) into the gear unit. After application the gear box should continue operating.
5. The coating process will be finished after approx. 500 operating hours. During this time the oil should not be changed. If necessary, the existing fine filter can be activated.

Safety Advice:

Must not be handled by children. Do not drink the liquid. Avoid skin contact. May be slightly irritating to the eyes. Rinse thoroughly with water and consult a doctor in case the irritation does not disappear. Do not pour into or place next to open flame.

Storage Advice:

Products must always be stored upright! Please, store at room temperature.

The REWITEC® application can temporarily result in an increased silicon (Si) amount of approx. 150 ppm in the oil analysis, which is technically safe.

*) Filter notice: The used filter material (40µm mesh) must be made of wire mesh (DIN) or paper (MC, Filterability testings by WAHLE from 2014-02-10) • Subject to technical alterations and typographical errors. • GR 11/01

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www.rewitec.com

Product Datasheet
REWITEC® DuraGear® W100

Product: REWITEC® DuraGear® W100
Description: Coating concentrate for wind turbine gears
Sales Unit: Bottle (1,000 ml)

Technical Data:

Name:	REWITEC®-Coating Concentrate
Colour:	Anthracite
Pourpoint:	-21°C
Flashpoint:	285°C
Density at 20°C:	892 kg/m³
Solubility in water:	no
Basic viscosity at 40°C:	223 mm²/s
Dosage:	1 bottle DuraGear® W100 per 100 ltr. oil volume (1:100)

Product Characteristics

- Reduction of friction in bearings and gears up to 33%*
- Decrease of temperature in bearings and gears up to 20%*
- Reduction of roughness on metal surfaces up to 50%*
- Reduction of wear and abrasion, as well as reconditioning of frictional metal surfaces
- Prevention of micropitting
- Lowering of vibrations and noise
- Durable wear protection
- Improvement of scuffing load capacity
- Significant optimisation of primary material properties
- Optimisation of lubrication film and emergency running properties in case of oil loss
- Surface finishing during operating (without downtime)
- Therefore reduction/prevention of costs of idleness
- Reduction of spare parts demand
- Life extension of treated gears

* Tests on a 2-Disc-Test-Bench at the Competence Center Tribology at the University of Mannheim (Germany) 09/2012.

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REWITEC®

Product Datasheet
REWITEC® GR 400

Product:	REWITEC® GR400
Description:	High-temperature coating grease for bearings
Sales Unit:	Cartridge (400 g)

Technical Data:

Description:	Synthetic hight-temperature coating grease for all kind of bearings
Colour:	grey
Consistency grade (NLGI):	2
Base oil:	PAO with anorganic thickener
Density at 20 °C:	880 kg/m³
Viscosity base fluid at 40 °C:	460 mm²/s
Temperature range:	-50 bis +200 °C
Temperature range (short term):	till +220 °C
Oxidation resistance (100 h 99 kPa):	<35 kPa
Dripping point:	>250 °C

Product Characteristics

- Reduction of friction
- Decrease of temperature
- Reduction of roughness on metal surfaces
- Reduction of wear and abrasion, as well as reconditioning of frictional metal surfaces
- Good corrosion prevention and durable wear protection
- Very good adhesion and water resistance
- Excellent load-carrying capacity
- Prevention of pitting and grey staining
- Lowering of vibrations and noise
- Improvement of scuffing load capacity
- Significant optimisation of primary material properties
- Optimisation of lubrication film and emergency running properties in case of oil loss
- Therefore reduction/prevention of costs of downtime
- Reduction of spare parts demand
- Life extension of treated gears
- With all greases mixable, except for greases with bentonite thickener

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Literature index

ANSI/AGMA 1010-F14 Appearance of Gear Teeth - Terminology of Wear and Failure

DIN 50320:1979-12 (Note: This draft has been withdrawn) Wear; Terms, Systematic Analysis of Wear Processes, Classification of Wear Phenomena

Figures no. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 17 kindly provided by Deutsche Windtechnik Service GmbH & Co. KG; Pictures Title/Back, P.23: Shutterstock

ISO 10825:1995 Gears - Wear and damage to gear teeth - Terminology

ISO 15243:2004 Rolling bearings - Damage and failures - Terms, characteristics and causes

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The fields of application and impact of our products convinces our customers

Dipl.-Ing. Stefan Bill, CEO REWITEC GmbH

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