

Technical Presentations

Title of paper: The new "MoreQuiet" grease noise evaluation system: the best of two worlds
Author: Max Bichler, Christian Roth, SKF Quality Technology Centre, Steyr, Austria

Brief summary of topic:

The bearing industry is mainly using a system from FAG or/and SKF to evaluate the quality of the grease noise behaviour in bearing applications. With the new MoreQuiet electronics and software, which has been developed by SKF QTC recently, the evaluation according to both specifications can be done with one testing system. The SKF BeQuiet+ is calculating the highest peak value in a certain frequency range using the envelope techniques and The FAG MGE 11 system is evaluating the same sampled values in a different way. The result as well shows the damping factor, the grease start-up behaviour, and the average value in middle and high band. In this paper a comparison between these two test methods is drawn with the new MoreQuiet noise evaluation system by using different grease samples. It will also show the advantages of both methods the damping characteristic of the grease.



The new "MoreQuiet" grease noise evaluation system: the best of two worlds

Presented at the
12th Lubricating Grease Conference
NLGI INDIA CHAPTER
Goa, India

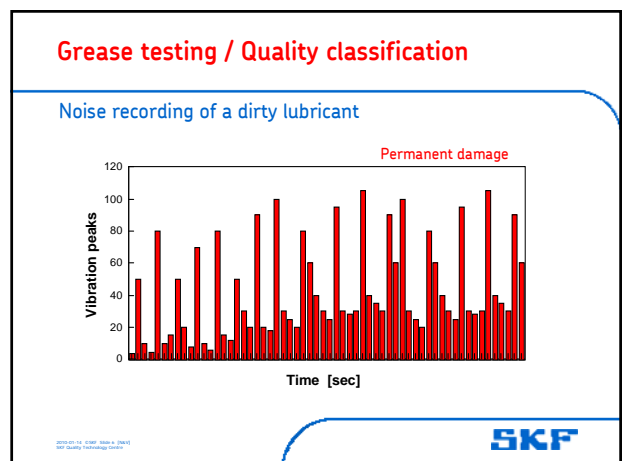
By Christian Roth / SKF-QTC
January 29, 2010

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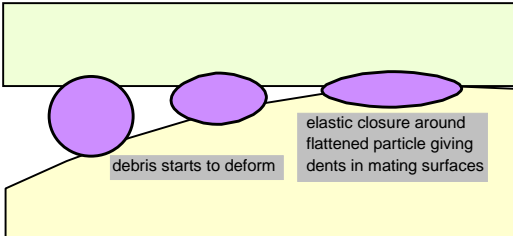
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Grease noise testing

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Grease testing / large particles

Creation of permanent dents

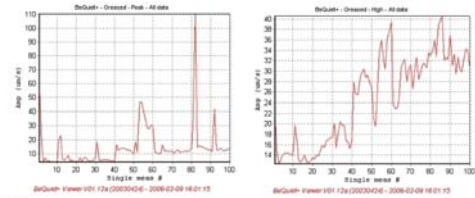


The overall vibration will increase in time, and the original high bearing quality is actually lost by the use of insufficient cleanliness.

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Grease testing / large particles



GNX

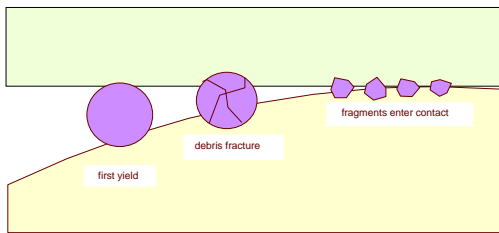
Example: Large particles in Lithium Calcium grease cause a signal increase over time both for the peak measurement and the High band, indicating damages in the bearing race way.

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Grease testing / brittle particles

Creation of small damages

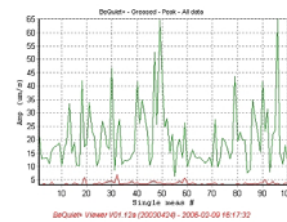


Example: Polyurea with agglomerates of the thickener. Produce large Peaks in the signal, but the low particle hardness will not give noticeable dents.

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Grease testing / brittle particles



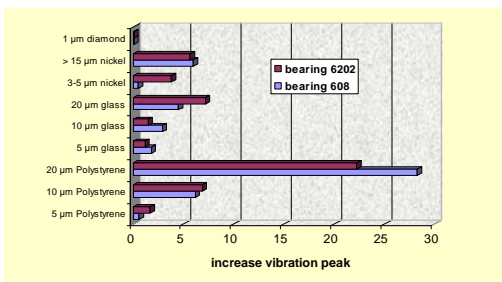
Example: Comparison of 2 Polyurea greases: the red curve shows a very low noise level, the green curve has very high individual peaks, but neither damages the bearing.

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Grease testing / Quality classification

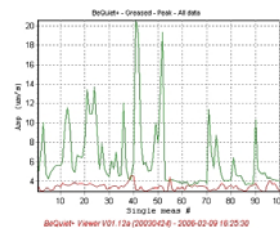
Effect of particle size (depend also on hardness)



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Grease testing / Quality classification



Lithium grease is used as low noise grease (red curve). The green curve shows the same thickener and has almost the same oil viscosity, but is much noisier due to the presence of "wool fat".

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Grease testing / Quality classification

➤ **dirty**
GN 1 / IV



Particles over-rolling leads to a permanent damage and reduced bearing fatigue life

➤ **noisy**
GN 2 / III



Particles may damage the bearing surface which gives an increase in overall bearing noise

➤ **clean**
GN 3 / II



Particles produce noticeable vibration peaks but there is no permanent damage of the bearing

➤ **quiet**
GN 4 / I



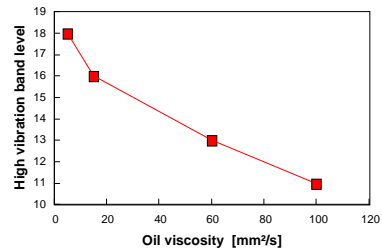
Highest degree of cleanliness due to a minimum of particles giving vibration peaks

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Grease testing / Quality classification

Damping characteristics



For oils the damping depends on viscosity, base oil type and additive types.

Besides for erratic greases the type and microstructure of thickener may play a role.

Moreover additives influencing wettability and surface attack can become dominant.

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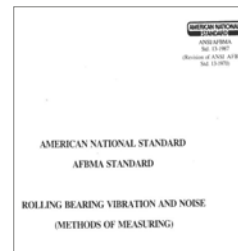
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Standards for rolling bearing noise

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AFBMA / ISO 15242



Anti Friction Bearing Manufacturers Association



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AFBMA – standard

- Initially installed by ANSI in 1969
- Defines the measurement set-up
 - Rigidly supported, rotating inner ring
 - Radial unconstrained, non-rotating outer ring
 - Axially loaded outer ring
 - Vibration measured radial at outer ring
 - Speed at 1800 rpm +/- 2%
- Defines the signal evaluation
 - L, M, H – band values
 - Filter specifications, ...

Anti-Friction Bearing Manufacturers Association, Inc
Velocity proportional signals have to be measured in three frequency bands at the assembled bearing. The bearing has to run at 1800 rpm

ANSI/AFBMA	Channel A	Channel B	Channel C
band width (Hz)	50 - 300	300 - 1800	1800 - 10000
rotational speed (rpm)	1800		

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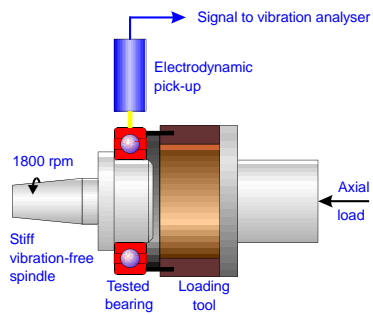
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Bearing noise testing

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Noise testing / Measurement principle



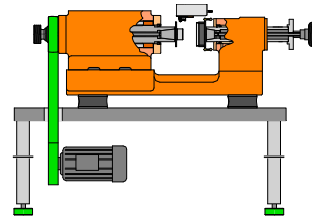
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Noise testing / Mechanics

Example: Bequiet+

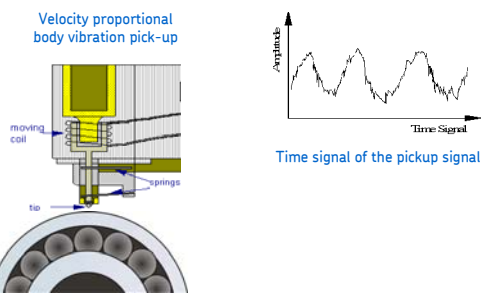


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Noise testing / Pickup principle

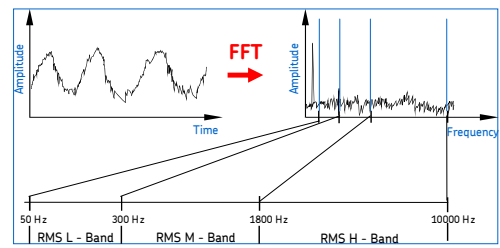


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Noise testing / Filter bands



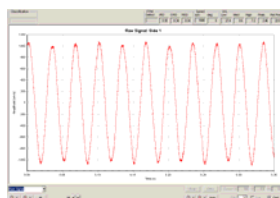
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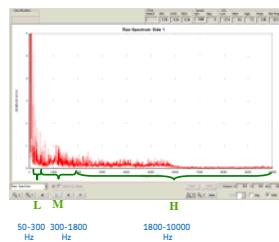
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Noise testing / Filter bands

Time signal of a low-noise 608 bearing without grease



Frequency spectrum of a low-noise 608 bearing without grease



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Grease noise tester

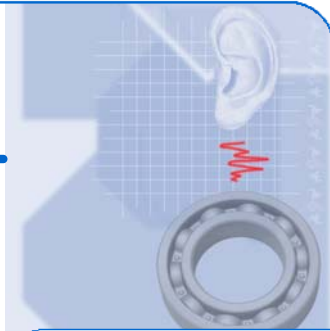
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SKF Semi-automatic grease noise tester

BeQuiet+



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Grease Testing / BeQuiet+ equipment

Semi-automatic grease noise tester

- DGBB 608
- ISO / AFBMA standard
- 1800 rpm
- L, M, H - band, Peak
- 15 - 50 N axial load
- Results displayed um/s and Anderon
- Reference run with selected bearings
- Automatic grease dosing / measuring / cleaning cycle
- MEB 95 - digital measuring electronics
- Windows 2000/XP



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Grease testing / Tooling

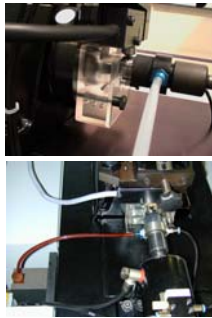


Syringe

The dosing unit presses the grease from the syringe into the bearing.

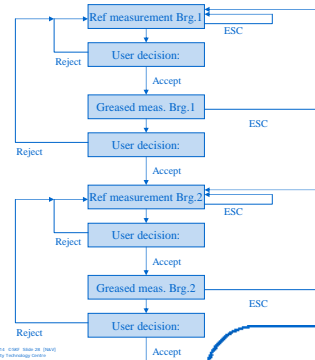
The syringe is best filled through suction (manual filling leads to air bubbles)

Tooling



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Grease Testing / Bequiet+ procedure



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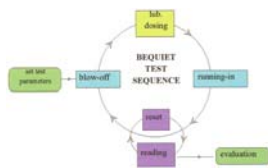
Grease Testing / Bequiet+ procedure

Procedure repeats 10 times

- Dosing of 150 mg grease into bearing
- 10 sec running in before measurement to distribute the grease in the bearing
- Peak reset
- Recording highest Peak value during 10 measurement (1 measurement = 3.2 sec)
- Blow off grease to clear bearing for next grease dose
- Second dosing ...
-

Measurement Results

- Start-up noise (Peak)
- Damping factors in M- and H-band
- Peak value, BQx, GNx classification



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Grease testing / Measurement parameters

L- , M - and H - band
(according AFBMA)

- L-band is not used (not relevant)
- M & H-band is used for damping characteristic

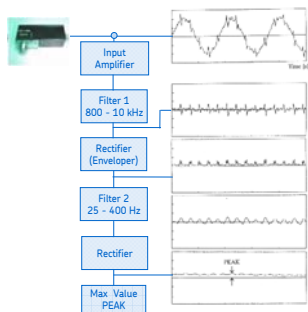
PEAK
(SKF Method)

- To identify:
- Dirt
 - (local surface defects of the test bearing)

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Grease testing / Peak enveloping method

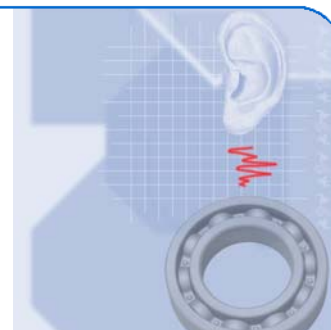


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FAG - Grease noise tester

MGG 11



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Grease testing / MGG 11 equipment

Manual grease noise tester

- DGBB 608
- AFMBA Standard
- 1800 rpm
- M, H- band
- 20 N axial load
- Results displayed in % and Anderson
- Reference run with selected bearings
- Manual filling of bearings with grease
- PC for evaluation



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Grease testing / MGG 11 tooling



Grease gun (high pressure)



filling with spatula



Manual greasing of the bearing

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Grease testing / MGG 11 procedure

Procedure done with 5 bearings

- Measurement of selected reference bearing with well known vibration levels
- Filling 330 mg grease into bearing
- Spindle motor start at the same time as the measurement
- Measurement of the M- and H-band for 64 sec
- Same sequence with second bearing ...
- ...

Measurement Results

- Start-up noise in M- and H-band
- Damping factors in M- and H-band
- Noise peaks from 0 – 32 sec
- Noise peaks from 32 – 64 sec
- Noise level from 32 – 64 sec

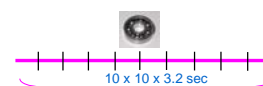
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Differences Bequiet+ and MGG 11

Measurement time

- Bequiet: meas time
10 x 10 x 3.2 sec = 320 sec (no start-up)
- Meas. "frame"
8192 samples @ 25.600 kHz = 0.32 s ->
100 MP/dose; 1000 MP
- MGE 11 5 x 64 sec = 320 sec
(with start-up)
- Meas. "frame"
4096 samples @ 32,768 kHz = 0.125 s ->
512 MP/dose 2560 MP



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MoreQuiet evaluation system



MoreQuiet / Electronics

Industrial PC

- Pentium CPU (DVD drive, USB, Ethernet)
- Windows 2000/XP based platform
- Data acquisition board: 20 bit AD-converter, signal processor, Anti-aliasing filter,
- Up to 56.2 kHz sample rate
- 2 pickup connections
- Loudspeaker connector
- PLC In- & Outputs
- CE certified



MoreQuiet / Hardware

Bequiet+ analyses



MGG 11 analyses



MoreQuiet / Upgrading of existing Bequiet+



existing Bequiet+



MoreQuiet / Upgrading of existing MGG 11



existing MGG 11

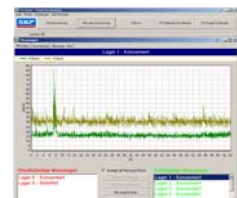


MoreQuiet / Measurement software

Bequiet+ mode

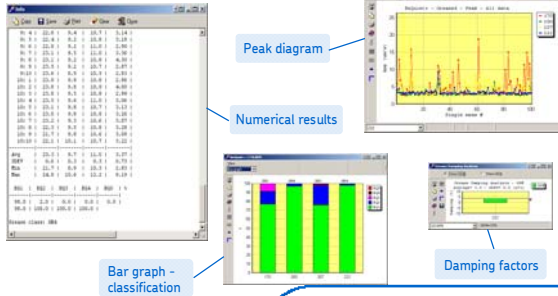


MGG 11 mode



MoreQuiet / Analyses & results

Bequiet+ mode

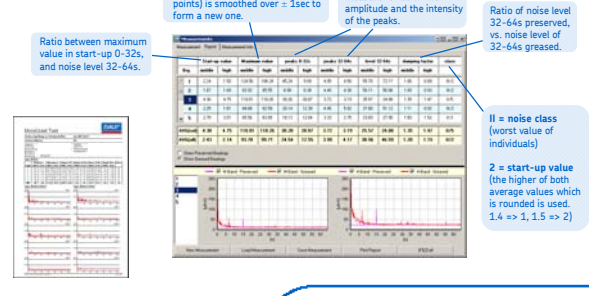


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MoreQuiet / Analyses & results

MGG 11 mode



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Results MoreQuiet

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MoreQuiet / Grease measurements

MGG 11 mode - Lithium grease

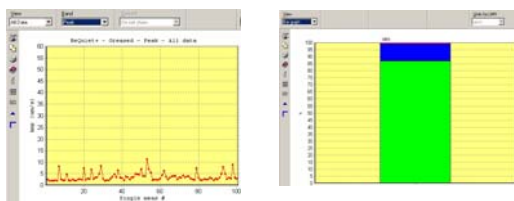


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MoreQuiet / Grease measurements

Bequiet+ mode - Lithium grease

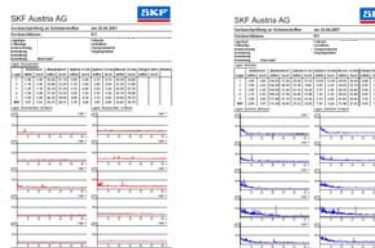


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MoreQuiet / Grease measurements

MGG 11 mode - Lithium grease

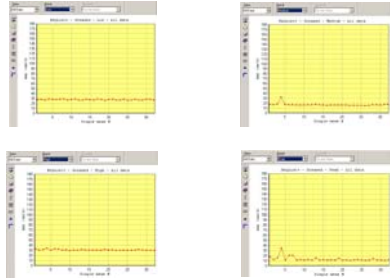


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MoreQuiet / Grease measurements

Bequiet+ mode - Lithium grease



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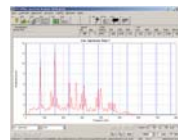
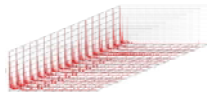
Further developments

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Further developments

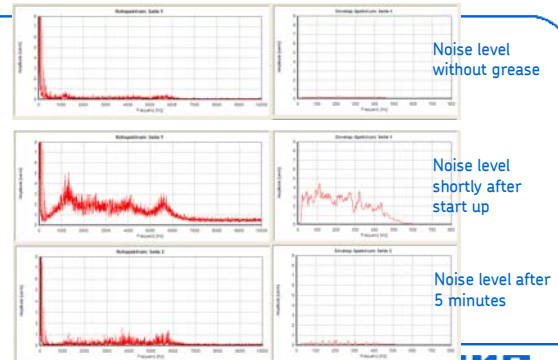
- Three-dimensional representation of the frequency spectrum
- Integration of envelop spectrum to be able to offer also the finger print method as for bearing noise testing



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608 Bearing with/without Retinax Grease

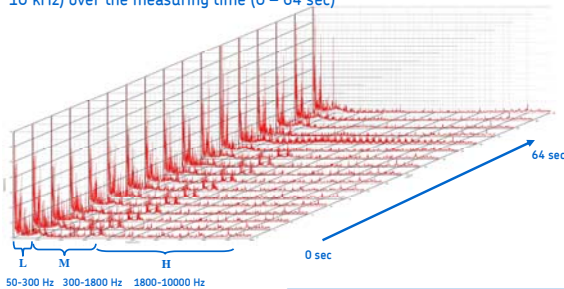


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Spectrumanalyse over the complete measuring time

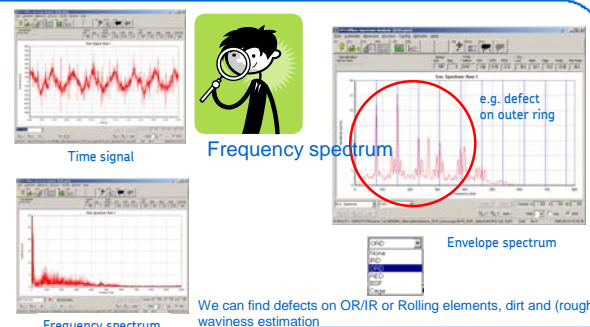
Three-dimensional representation of the frequency spectrum (0 - 10 kHz) over the measuring time (0 - 64 sec)



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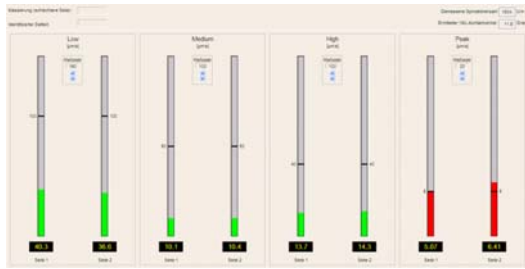
Finger print method



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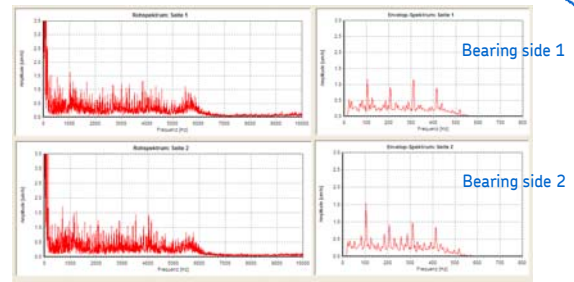
Grease XYZ – peak slightly above the limit => GN3 quality level



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Defects on the balls



Why ? dirt through inefficient cleaning process or additives

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Summary MoreQuiet

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MoreQuiet / Conclusions

The bearing industry is mainly using a system from FAG or/and SKF to evaluate the quality of the grease noise behavior in bearing applications.

With the new MoreQuiet, which has been developed by SKF QTC recently, the evaluation according to both specifications can be done on a single system.

It combines the advantages of the two systems. The system measures parameters essential for a bearing application:

- Start-up noise
- Damping factor
- Noise level development over time. This gives a good indication if the (peak) noise is originated from particles in the grease or from the bearing itself.

The Bequiet test procedure is (semi-)automatic which means reduction of operating cost reduced to a minimum, both in terms of bearing consumption as well as operator time.

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... Thanks for the attention ...

