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Rolling bearings — Noise testing of rolling bearing greases —

Part 4: Test and evaluation method NQ

Roulements — Essais de bruit de graisse pour roulement —

Partie 4: Méthode d'essai et interpretation NQ

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 4, *Rolling bearings*.

A list of all parts in the ISO 21250 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The rolling bearing life theory emphasizes the use of pure and homogeneous lubricants as essential for a long bearing service life. The lubrication of rolling bearings is described in several national standards. The GfT worksheet 3[4] contains theoretical and practical knowledge of rolling bearing lubrication.

Grease lubrication is the most common type of rolling bearing lubrication. The purity grade of rolling bearing grease is influenced by thickeners, base oils, additives and solid lubricant additives as well as the manufacturing process and is reflected in the running noise. Therefore, noise testing of rolling bearing greases is recommended.

In addition, grease noise testing in accordance with this document allows the grease manufacturers to develop low-noise lubricants with better damping properties. This document can also support the rolling bearing manufacturers and end-users in the selection of low-noise grease with better damping properties.

This document covers requirements for the testing assembly and the test machine of method NQ to determine and assess the noise characteristics of rolling bearing grease jointly with ISO 21250-1, ISO 21250-2 and ISO 21250-3.

Rolling bearings — Noise testing of rolling bearing greases —

Part 4:
Test and evaluation method NQ

1 Scope

This document specifies the testing and evaluation method of rolling bearing grease noise in accordance with the method NQ.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5593, *Rolling bearings — Vocabulary*

ISO 15242-1:2015, *Rolling bearings — Measuring methods for vibration — Part 1: Fundamentals*

ISO 15242-2:2015, *Rolling bearings — Measuring methods for vibration — Part 2: Radial ball bearings with cylindrical bore and outside surface*

ISO 21250-1:—, *Rolling bearings — Noise testing of rolling bearing greases — Part 1: Basic principles, testing assembly, test machine*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5593, ISO 15242-1, ISO 21250-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
air bearing spindle
spindle supported by high accuracy air bearings

3.2
pre-loader
device for loading the test bearing

3.3
Anderon
unit that expresses the quantity of vibration (1 Anderon = 7,698 $\mu m \cdot s^{-1}$)

4 Symbols, abbreviated terms and subscripts

For the application of this document, the symbols, abbreviated terms and subscripts according to ISO 21250-1:—, Table 1 and Table 2, the symbols and abbreviated terms contained in Table 1 and the subscripts contained in Table 2 apply.

Table 1 — Symbols and abbreviated terms

Symbol	Unit	Description
L[a]	—	Low band (50 Hz to 300 Hz)
M[a]	—	Medium band (300 Hz to 1 800 Hz)
H[a]	—	High band (1 800 Hz to 10 000 Hz)
M&H[b]	—	Medium band and high band (300 Hz to 10 000 Hz)
v	$\mu m \cdot s^{-1}$	Vibration velocity
n	—	Number of noise count

[a] These bands are used in vibration analysis in ISO 15242 series. However, this document does not consider these frequency ranges for grease noise testing and its analysis.

[b] It can be also used as subscript to indicate the related band.

Table 2 — Subscripts

Subscript-symbol	Description
normal	normal value (of vibration velocity), greased bearing
pk	peak value
rms	root mean square

5 Calculation method

5.1 Signal processing

The signal detected by the transducer is amplified through a transformer. The amplified signal is subjected to an analysis of the M&H band, as shown in Figure 1.

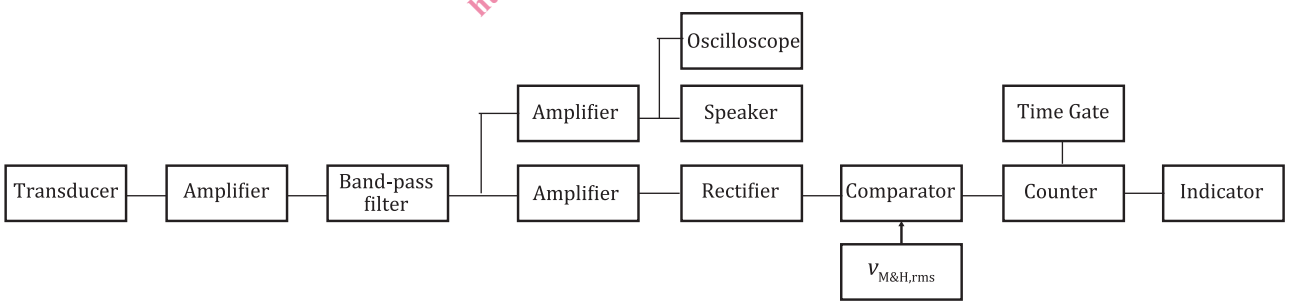

Figure 1 — Example of block diagram

5.2 Peak detection

The band-pass filtered signal is subjected to a rectifying process. To evaluate the performance of grease noise, the numbers of pulses shall be counted in four time intervals (3 s, 10 s, 30 s and 120 s) which exceed the threshold, as shown in Figure 2.

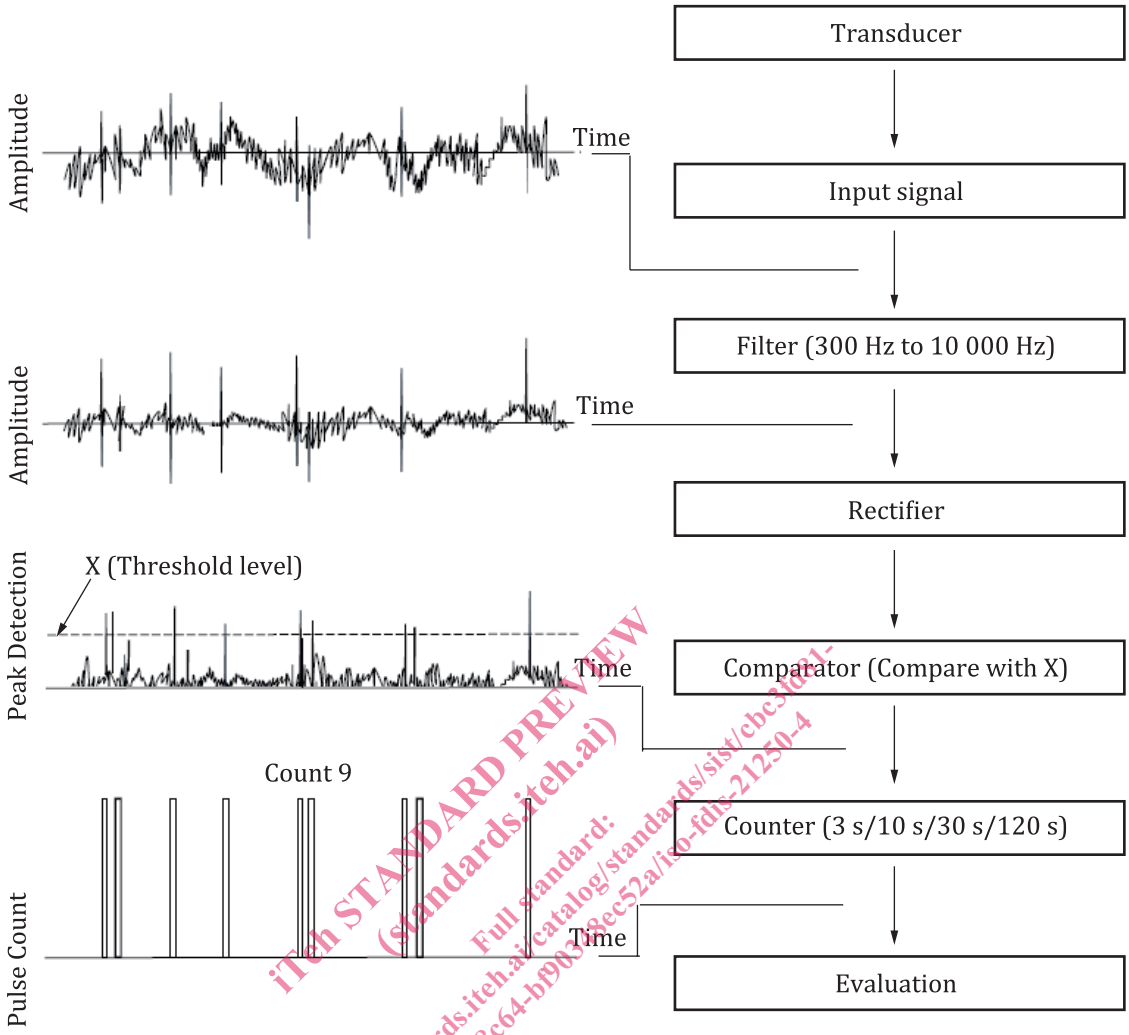

Figure 2 — Example of the peak detection algorithm

Figure 3 shows an example of the bearing noise wave in a time domain.

When in operation, vibration (i.e. noise) is generated. The level of the vibration, made by low-noise bearing [increased dimensionally and running accuracy; preferably tolerance class P4 (in accordance with ISO 492)] is small enough and its level is shown as $v_{M\&H,normal}$. If there are solid substances inside of the grease in the bearing, abnormal shock vibration (noise peak) occurs during operation. This peak value ($v_{M\&H,pk}$) is experimentally four times of the $v_{M\&H,normal}$ value, as shown in Formula (1).

$$v_{M\&H,pk} = 4 \times v_{M\&H,normal} \tag{1}$$

Defining the peak value ($v_{M\&H,pk}$) as the amplitude of the sinusoidal wave, the effective value ($v_{M\&H,rms}$) and peak value ($v_{M\&H,pk}$) of this wave can be calculated according to Formula (2):

$$v_{M\&H,rms} = \left(\frac{1}{\sqrt{2}}\right) \times v_{M\&H,pk} \tag{2}$$

The effective value ($v_{M\&H,rms}$) is applied as the threshold to count these shock vibrations made by solid substances inside the grease.