INTERNATIONAL STANDARD



Second edition 2017-08

Rolling bearings — Measuring methods for vibration —

Part 3:

Radial spherical and tapered roller bearings with cylindrical bore and outside surface iTeh STANDARD PREVIEW

Roulements — Méthodes de mesurage des vibrations —

Partie 3: Roulements à rotule sur rouleaux et à rouleaux coniques, à alésage et surface extérieure cylindriques

https://standards.iteh.ai/catalog/standards/sist/ea56fb82-a9c4-42b0-b9ccc5676f66ea7c/iso-15242-3-2017



Reference number ISO 15242-3:2017(E)

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<u>ISO 15242-3:2017</u> https://standards.iteh.ai/catalog/standards/sist/ea56fb82-a9c4-42b0-b9ccc5676f66ea7c/iso-15242-3-2017



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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 on 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 the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

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

This second edition cancels and replaces the first edition (ISO-15242-3:2006), which has been technical corrigendum ISO 15242-3:2006/Cor. 1:2010.

The main changes compared to the previous edition are as follows:

- editorial changes have been made for clarification and removal of inconsistencies;
- figure keys have been updated for clarification.

A list of all parts in the ISO 15242 series can be found on the ISO website.

Introduction

Vibration in rotating rolling bearings can be of importance as an operating characteristic of such bearings. The vibration can affect the performance of the mechanical system incorporating the bearing and can result in audible noise when the vibration is transmitted to the environment in which the mechanical system operates, can lead to damages, and can even create health problems.

Vibration of rotating rolling bearings is a complex physical phenomenon dependent on the conditions of operation. Measuring the vibration of an individual bearing under a certain set of conditions does not necessarily characterize the vibration under a different set of conditions or when the bearing becomes part of a larger assembly. Assessment of the audible sound generated by the mechanical system incorporating the bearing is further complicated by the influence of the interface conditions, the location and orientation of the sensing device, and the acoustical environment in which the system operates. Assessment of airborne noise that, for the purpose of ISO 15242 (all parts), can be defined as any disagreeable and undesired sound is further complicated by the subjective nature of the terms *disagreeable* and *undesired*. Structure-borne vibration can be considered the driving mechanism that ultimately results in the generation of airborne noise. Only selected methods for the measurement of the structure-borne vibration of rotating rolling bearings are addressed in the current edition of all parts of ISO 15242.

Vibration of rotating rolling bearings can be assessed by a number of means using various types of transducers and measurement conditions. No simple set of values characterizing the vibration of a bearing is adequate for the evaluation of the vibratory performance in all possible applications. Ultimately, a knowledge of the type of bearing, its application and the purpose of the vibration measurement (e.g. as a manufacturing process diagnostic or an assessment of the product quality) is required to select the most suitable method for measuring. The field of application for standards on bearing vibration is, therefore, not universal. However, certain methods have established a wide enough level of application to be considered as standard methods.

ISO 15242-3:2017

This document serves to define the detailed method for assessing vibration of radial spherical and tapered roller bearings with cylindrical bore and outside surface on a measuring device.

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Rolling bearings — Measuring methods for vibration —

Part 3: Radial spherical and tapered roller bearings with cylindrical bore and outside surface

1 Scope

This document specifies vibration measuring methods for double-row radial spherical roller bearings and single-row and double-row radial tapered roller bearings, with cylindrical bore and outside surface and a contact angle up to and including 45°, under established measuring conditions.

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 286-2, Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts

ISO 1132-1, Rolling bearings — Tolerances — Part 1: Terms and definitions ISO 2041, Mechanical vibration, shock and condition monitoring — Vocabulary ISO 5593, Rolling bearings — Vocabulary^{656666676/6666676/iso-15242-3-2017}

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1132-1, ISO 2041, ISO 5593 and ISO 15242-1 apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Measurement process

4.1 Rotational frequency

The default rotational frequency shall be 900 min⁻¹ (15 s⁻¹), with a tolerance of $^{+1}_{-2}$ %.

Other rotational frequencies and tolerances may be used by agreement between the manufacturer and the customer, e.g. it may be necessary to use a higher rotational frequency for bearings in the smaller size range in order to obtain an adequate vibration signal. Conversely, it may be necessary to use a lower rotational frequency for bearings in the larger size range to avoid possible roller, rib and raceway damage.

4.2 Bearing axial load

The bearing load shall be in the axial direction with default values as specified in <u>Table 1</u>.

Other axial loads and tolerances may be used by agreement between the manufacturer and the customer, e.g. depending on bearing design, rotational frequency and lubricant used, it may be necessary to use a higher load to prevent roller/raceway slip, or a lower load to avoid possible roller, rib and raceway damage.

Bearing	g outside meter	Double-r spheric	ow radial al roller	Single-row and double-row radial tapered roller bearings							
	D	bear	rings	Contact a	ngle ≤ 23°	23° < Contact angle ≤ 45°					
		Default values for bearing axial load									
>	≤	min.	max.	min.	max.	min.	max.				
n	nm	1	Ν	1	Ν	N					
30	50	45	55	90	110	180	220				
50	70	90	110	180	220	360	440				
70	100	180	220	360	440	720	880				
100	140	360	440	720	880	1 080	1 320				
140	170	540	660	1 080	1 320	1 4 4 0	1 760				
170 200		720	880	1 4 4 0	1 760	1 800	2 200				

Table 1 — Default values for bearing axial load

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5 Measurement and evaluation methods rds.iteh.ai)

5.1 Physical quantity measured ISO 15242-3:2017

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The default physical quantity to be measured is root mean square vibration velocity, v_{rms} (μ m/s), in the radial direction.

5.2 Frequency domain

The vibration velocity shall be analysed in one or more bands with default frequency ranges as specified in <u>Table 2</u>.

Other frequency ranges may be considered by agreement between the manufacturer and the customer in those instances where specific ranges have greater importance to successful operation of the bearing. Commonly used examples are listed in <u>Table 3</u>.

Changing the frequency of rotation should always come along with a proportional change of the filter frequencies and acceptance limits and minimum measuring time. Examples are given in <u>Table 3</u>.

Narrow band spectral analysis of the vibration signal may be considered as a supplementary option.

Table 2 — Default frequency ranges for default rotational frequency of 900 min⁻¹

Rota	tional frequ	ency	Low ba	and (L)	Medium	band (M)	High band (H)					
			Nominal band pass frequencies									
nominal	min. max.		flow fupp		$f_{\rm low}$	fupp	$f_{\rm low}$	$f_{ m upp}$				
	min ⁻¹		H	[z	Н	[z	Hz					
900	882 909		25 150		150	900	900	5 000				

Rota	tional frequ	ency	Low ba	and (L)	Medium	band (M)	High band (H)					
			Nominal band pass frequencies									
nominal	min.	max.	f_{low}	fupp	f_{low}	fupp	f_{low}	$f_{ m upp}$				
	min ⁻¹		H	Iz	H	Iz	Hz					
1 800	1 764	1 818	50	300	300	1 800	1 800	10 000				
700a	686	707	20	120	120	700	700	4 000				
a In case of	In case of 700 min ⁻¹ , cut-off frequencies are rounded (not according to exact relation of the rotational frequency).											

Table 3 — Examples of frequency ranges for non-default rotational frequencies

5.3 Measurement of pulses and spikes

Detection of pulses or spikes in the time domain velocity signal, usually due to surface defects and/or contamination in the measured bearing, may be considered as a supplementary option. Various evaluation methods exist.

5.4 Measurement

Double-row radial spherical and double-row tapered roller bearings shall be measured with the axial load applied from one side of the stationary ring and the measurement repeated with the axial load on the other side of the stationary ring. Single-row radial tapered roller bearings shall be measured in their axial load acceptance direction only.

In case of two inner or outer rings, they need to be clamped together to ensure repeatability.

For diagnostic purposes, performing multiple measurements with the stationary ring in different angular positions relative to the transducer is appropriate.

For acceptance of the bearing, the highest vibration reading for the appropriate frequency band shall be within the limits mutually agreed between the manufacturer and the customer.

Measurement duration shall be in accordance with ISO 15242-1:2015, 6.5.

For the default rotational frequency of the spindle of 900 min⁻¹ the measuring time shall not be less than 1 s.

6 Conditions for measurement

6.1 Bearing conditions for measurement

6.1.1 Prelubricated bearings

Prelubricated (greased, oiled or solid lubricated) bearings, including sealed and shielded types, shall be measured in the as-delivered condition.

6.1.2 Non-prelubricated bearings

Since contamination affects vibration, the bearings shall be effectively cleaned, taking care not to introduce contamination or other sources of vibration.

NOTE Some preservatives meet the lubrication requirements for vibration measuring. In this case, it is not necessary to remove the preservative.

Non-prelubricated bearings shall be adequately lubricated with fine filtered oil, typically having a kinematic viscosity in the range of 10 mm²/s to 100 mm²/s, appropriate to bearing type and size.