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Mechanical vibration — Rotor balancing —

Part 23: Enclosures and other protective measures for the measuring station of balancing machines

Vibrations mécaniques — Équilibrage des rotors —

Partie 23: Enceintes et autres mesures de protection pour le poste de mesurage des machines à équilibrer

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 21940-23 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 2, *Measurement and evaluation of mechanical vibration and shock as applied to machines, vehicles and structures*.

This first edition cancels and replaces ISO 7475:2002, which has been technically revised. The main change is deletion of protection class 0.

ISO 21940 consists of the following parts, under the general title *Mechanical vibration — Rotor balancing*:

— *Part 1: Introduction*[1)]

— *Part 2: Vocabulary*[2)]

— *Part 11: Procedures and tolerances for rotors with rigid behaviour*[3)]

— *Part 12: Procedures and tolerances for rotors with flexible behaviour*[4)]

— *Part 13: Criteria and safeguards for the* in-situ *balancing of medium and large rotors*[5)]

— *Part 14: Procedures for assessing balance errors*[6)]

— *Part 21: Description and evaluation of balancing machines*[7)]

— *Part 23: Enclosures and other protective measures for the measuring station of balancing machines*[8)]

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1) Revision of ISO 19499:2007, *Mechanical vibration — Balancing — Guidance on the use and application of balancing standards*

2) Revision of ISO 1925:2001, *Mechanical vibration — Balancing — Vocabulary*

3) Revision of ISO 1940-1:2003 + Cor.1:2005, *Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances*

4) Revision of ISO 11342:1998 + Cor.1:2000, *Mechanical vibration — Methods and criteria for the mechanical balancing of flexible rotors*

5) Revision of ISO 20806:2009, *Mechanical vibration — Criteria and safeguards for the in-situ balancing of medium and large rotors*

6) Revision of ISO 1940-2:1997, *Mechanical vibration — Balance quality requirements of rigid rotors — Part 2: Balance errors*

7) Revision of ISO 2953:1999, *Mechanical vibration — Balancing machines — Description and evaluation*

8) Revision of ISO 7475:2002, *Mechanical vibration — Balancing machines — Enclosures and other protective measures for the measuring station*

— *Part 31: Susceptibility and sensitivity of machines to unbalance*[9)]

— *Part 32: Shaft and fitment key convention*[10)]

9) Revision of ISO 10814:1996, *Mechanical vibration — Susceptibility and sensitivity of machines to unbalance*

10) Revision of ISO 8821:1989, *Mechanical vibration — Balancing — Shaft and fitment key convention*

Introduction

In designing and operating balancing machines, efforts already are made to minimize hazards arising from the use of the machines themselves. Rising demand for still greater safety in the working environment, however, requires additional protective measures, especially with respect to the rotor to be balanced. Potential hazards to the balancing machine operator or the surrounding workshop area can exist, e.g. by personnel coming into contact with machine components or the rotor, by rotor components or unbalance correction masses detaching and flying off or by the rotor lifting from the supports or disintegrating.

Special-purpose balancing machines, e.g. those used in the mass production automotive industry, normally incorporate all necessary protective measures because the workpiece, as well as the operating conditions of the machine, are known and can be taken into account by the machine manufacturer. For multipurpose balancing machines, however, where the workpieces to be balanced are generally unknown to the machine manufacturer, and are thus beyond his control, basic protective measures are limited to obvious hazards, e.g. from end-drive or belt-drive systems. However, the balancing machine manufacturer has to provide sufficient information for the user to assess possible hazards originating from a rotor when in the balancing machine, and from the intended use of the balancing machine. Together with this information, the user of the balancing machine has to state the possible hazards originating in his rotors in order to allow the balancing machine manufacturer to supply equivalent protective measures or the user has to provide adequate protective measures on his own.

When the rotors are not known in advance, e.g. in service and repair, a good estimation is needed. Table A.2 states typical values for different balancing machine sizes. But for each individual type of rotor to be balanced, the user of the balancing machine needs to check if the protective measures cover all hazards.

Most local regulations require certain minimum protective measures to be taken. Observance of such requirements in conjunction with the recommendations contained in this part of ISO 21940 will generally provide an adequate measure of protection to the balancing machine operator and surrounding workshop personnel. There may be applications, however, in which the recommended enclosures or other protective measures are so costly, or their use so time-consuming, that other protective precautions have to be considered, such as vacating the surrounding area for a sufficient distance, remote control of the balancing machine or work outside normal hours.

The consideration of accident probability can be important if a rotor needs to be balanced or spin-tested at or above its service speed, where major rotor failure cannot be excluded with as much certainty as during low-speed balancing.

On the other hand, a rotor being balanced at low speed may consist of an assembly of several components, such as a bladed turbine wheel. It is then important to consider whether an enclosure for low-speed balancing should withstand penetration of a turbine blade or whether it is sufficient to protect against unbalance correction masses that might fly off during balancing. If the probability of blade separation is practically non-existent, a light enclosure, which just protects against correction masses, may be sufficient.

Since this part of ISO 21940 deals with balancing machines and protective measures in general, no details of the risk can be stated for specific rotor types and balancing machines. Individual investigations, based on actual rotor parameters, will probably be required in each specific case. In this connection, risk analysis of possible accidents should include the characteristics of the balancing machine itself. For the extent of the ensuing damages, it may be of decisive importance to know how much unbalance can be endured by its supports and bearings due to partial rotor failure, e.g. rotor components becoming detached.

The significant hazards covered by this part of ISO 21940 are listed in Clause 4. The safety requirements and protective measures to prevent or minimize those hazards are identified in Clause 5, and procedures for verification of these requirements and protective measures are found in Clause 6.