# INTERNATIONAL STANDARD

# ISO 7475

Second edition
2002-03-01

# Mechanical vibration — Balancing machines — Enclosures and other protective measures for the measuring station

*Vibrations mécaniques — Machines à équilibrer — Enceintes et autres mesures de protection pour le poste de mesurage*

Reference number
ISO 7475:2002(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

 

# Contents

Page

# 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7475 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, Subcommittee SC 1, *Balancing, including balancing machines*.

This second edition cancels and replaces the first edition (ISO 7475:1984) and the technical corrigendum, of which it constitutes a technical revision.

Major chances to the previous edition are

— expanding the permissible particle velocity range,

— using the area-specific energy of a particle as criterion for the capability of the enclosure material to hold a particle which leaves the rotor,

— taking the absolute energy of a particle as criterion for the strength of the fastening of the whole enclosure or of its components,

— considering the impulse of a particle when it hits a free-standing enclosure, and

— adding other safety aspects that are intrinsic to balancing machines and are related to the integrity of the operator.

This International Standard follows the rules for drafting and presentation of a machinery-related safety standard as they are mandatory in European Standards, and gives verification procedures for the safety requirements.

Annex A constitutes a normative part of this International Standard. Annexes B and C are for information only.



 

# Introduction

In designing and using balancing machines, efforts 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 protection, especially with respect to the rotor to be balanced. Potential hazards to the balancing machine operator or the surrounding workshop area may exist, for example, 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. These potential hazards may theoretically increase with rotor size and balancing speed, but they are generally minimized by appropriate rotor design and balancing instructions.

Special-purpose balancing machines, for example 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, for example end-drive coupling and/or drive belt covers. Therefore 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 these 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 rotor to be balanced, the user should 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 International Standard will generally provide an adequate measure of protection to the balancing machine operator and surrounding workshop personnel. There may be applications, however, where the recommended enclosures or other protective measures are so costly, or their use so time-consuming, that other protective precautions, such as vacating the surrounding area for a sufficient distance, remote control of the balancing facility, or work outside normal hours, etc., have to be considered.

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. Maximum service and spin-test speeds are generally well below the speed where major rotor failure can be expected.

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 International Standard deals with balancing machines and protective measures in general, no details of the risk can be stated for specific rotor types and balancing facilities. 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, for example rotor components becoming detached.

The significant hazards covered by this International Standard are those listed in clause 4. The safety requirements and/or protective measures to prevent or minimize those hazards identified in Table 1 and procedures for verification of these requirements or protective measures are found in clause 5.

# Mechanical vibration — Balancing machines — Enclosures and other protective measures for the measuring station

## 1 Scope

This International Standard specifies requirements for enclosures and other protective measures used to minimize mechanical hazards produced by the rotor in the unbalance measuring station of centrifugal (rotational) balancing machines. The hazards are associated with the operation of balancing machines under a variety of rotor and balancing conditions. This International Standard defines different classes of protection that enclosures and other protective measures provide and describes the limits of applicability for each class of protection.

Devices for adjusting the mass distribution of a rotor and devices to transfer the rotor are not covered by this International Standard, even if they are combined with the measuring station.

Special enclosure features, such as noise reduction, windage reduction or vacuum (which may be required to spin bladed rotors at balancing speed), are not covered by this International Standard.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1925, *Mechanical vibration — Balancing — Vocabulary*

ISO 2041, *Vibration and shock — Vocabulary*

ISO 2806, *Industrial automation systems — Numerical control of machines — Vocabulary*

ISO 4849, *Personal eye-protectors — Specifications*

## 3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 1925 and ISO 2041 apply.

## 4 List of significant hazards

### 4.1 General

Significant hazards identified at measuring stations of centrifugal (rotational) balancing machines are listed in Table 1 together with examples of associated hazardous situations, activities and danger zones.

### 4.2 Risk assessment

The user of this International Standard (i.e. the user, designer, manufacturer or supplier) shall conduct a risk assessment. As part of the risk assessment, the user of this International Standard shall describe the intended use of the balancing machine including manual tool loading, workpiece set-up, maintenance, repair and cleaning, together with reasonably foreseeable misuse of the machine. As part of the risk assessment, the user of this