# SLOVENSKI STANDARD
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**Mechanical vibration and shock - Vibration isolation of machines - Information for the application of source isolation**

Mechanical vibration and shock - Vibration isolation of machines - Information for the application of source isolation

Mechanische Schwingungen und Stöße - Schwingungsisolierung von Maschinen - Angaben für den Einsatz von Quellenisolierungen



Vibrations et chocs mécaniques - Isolation vibratoire des machines - Informations pour la mise en oeuvre de l'isolation des sources



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English version

# Mechanical vibration and shock - Vibration isolation of machines - Information for the application of source isolation

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Mechanische Schwingungen und Stöße - Schwingungsisolierung von Maschinen - Angaben für den Einsatz von Quellenisolierungen

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**CEN**

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

**Central Secretariat: rue de Stassart,36 B-1050 Brussels**

**Contents**

**Foreword**

This European Standard has been prepared by Technical Committee CEN/TC 231 "Mechanical vibration and shock", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

**Introduction**

Vibration isolation is a measure used to either reduce significantly any transmission of periodic, shock or random type forces from a machine into surrounding structures (source isolation, protection from emission) or to protect sensitive machines, instruments, buildings and people from vibration received from their surroundings (receiver isolation, protection from immission). In both cases, the use of vibration isolators creates a mass-spring system whose vibration response is critically influenced by the characteristics of the source of vibration, the dynamic characteristics of the machine, the structure to which the machine is mounted and the characteristics of the elastic and damping elements. Optimization of the system to satisfy protection criteria requires a full and detailed knowledge of all the factors which influence the design and effective application of vibration isolation to a particular machine or installation. The interchange of information between the machinery manufacturer, the isolation supplier and the user plays a key role in achieving this.

## 1 Scope

This European Standard gives guidelines to ensure that manufacturers of machines provide adequate information on application of vibration isolation to reduce the risks arising from vibration generated by their machines. Guidelines are also provided to ensure that users furnish sufficient information regarding their applications to suppliers of machines or, where applicable, to the supplier of the isolation system, to enable the optimum selection and design of vibration isolation.

This European Standard is restricted to source isolation.

Although this standard is primarely intended for the use of new machines, it may be applied to the installation of used machines, too.



This European Standard is addressed to manufacturers and installors of a machine, as a guide to define relevant parameters for the choice and installation of a vibration isolation system to be used with the machine.



NOTE : This European Standard may also be applied by users of machines already installed, who use or wish to use vibration isolation to solve a vibration problem caused by the machine.

This European Standard shall not be considered as a manual for the design or installation of an isolation system. Examples of elements of vibration isolation are shown in annex A only for information.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

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| ISO 2041:1990 | Vibration and shock – Vocabulary |
| ISO 7626-1:1986 | Vibration and shock – Experimental determination of mechanical mobility – Part 1: Basic definitions and transducers |

## 3 Definitions

For the general terms and their definitions used in this European Standard, see ISO 2041 and ISO 7626-1.

## 4 Purpose of source isolation

The purpose of source isolation is to protect the surrounding structure from vibration by taking action on the installation of the source itself.

A source isolation system may be necessary

a) for the safety of the operators of the vibrating machines;

b) for the safety of bystanders to vibrating machines;

c) for the safety of structures or buildings containing vibrating equipment;

d) for the safety of people in buildings that may be subjected to intense vibration excitation;

e) when there are limiting values for vibration in legislation which are exceeded.

## 5 Applicability of vibration isolation

A source isolation shall be used aditionally to design measures for reducing vibration; it shall not be a substitute to such measures. It can be applied

a) when vibrating machines are designed or installed;

b) when buildings containing vibrating machines are designed or modified.

Prior analysis of vibration phenomena and analysis of background vibration is necessary. Time history monitoring and frequency analysis for a sufficient period of time relative to the working cycle of the machine is important.

Analysis of frequency response functions for the structures that transmit and receive vibration will facilitate the "best matching" of the structures and avoid coincidence between dominant frequencies of the source and the natural frequencies of these structures.

A determination of the background vibration shall be carried out in order to know the inherent vibration level below which normally no isolation is necessary.

NOTE : In case of correction of an existing situation, the vibration (displacement, velocity or acceleration) should be measured simultaneously

- on and close to the mounting points of the machine,
- at operator's or bystander's position.

Measurements shall be made in the environmental conditions relevant for the location of the machine. The measurements and analysis shall help in providing an understanding of the origin of the problem and possibly give an indication of possible solutions. Measurements should be made in accordance with an appropriate standard, and the standard should be identified.

The mounting points of transducers and directions of measurement shall be reported.

In a complex situation where isolation systems are used expert advice should be sought. The situation is especially complex when the machine and/or the supporting structure has natural frequencies (vibrational modes) in the frequency range of interest.

## 6 Information for the choice of an isolation system for a machine

### 6.1 General

In order to select appropriate isolators and correctly install source isolation, an exchange of information is needed between the machine manufacturer, the supplier of the isolator and the machine user. The following paragraphs list the information required for an optimized machine isolation. If the machine manufacturer is also the supplier of the isolation system, some of the information in the following paragraphs may seem to be not relevant. Nevertheless, some of this information may be useful when replacement parts have to be provided and should be part of the instruction handbook.

The choice of the isolation system shall take into consideration not only the static characteristics of the machine, but also its dynamic characteristics (mobility) and the dynamic characteristics of its surrounding structure (and further sources).

It will often be necessary for the supplier of a vibration isolation system to ask for more detailed information from the user in order to provide the best possible solution.

### 6.2 Information to be supplied by the machine manufacturer

The manufacturer shall supply to the user of the machine as much of the following information as is needed to ensure proper installation of the machine. If necessary, he should use the support of the supplier of the vibration isolation system.

#### 6.2.1 Physical data of the machine

##### 6.2.1.1 Machine drawing

A drawing shall be furnished giving

a) the outline and installation of the machine, if appropriate, including an intermediate foundation prescribed by the machine manufacturer;

b) the overall dimensions;

c) the total weight and the location of the centre of gravity. Rotational inertia shall also be included.

d) specifications of bolt sizes and special connectors for securing the machine. Locations of attachments, tapped holes, tolerances and any special material considerations shall be indicated on the drawing.

e) identification and direction of the three mutually perpendicular axes with origin in the centre of gravity of the unit to be isolated under conditions of preferred orientation;

f) the normal machine orientation with respect to the vertical. The direction of major shock or vibration shall be indicated. Feasible structural attachment points shall be given. These points frequently determine the isolation system in relation to orientation, centre of gravity, etc.

##### 6.2.1.2 Vibration excitation

The vibration excitation by a machine as characterized by its exciting forces and couples as a function of frequency or in form of time history shall be described in the detail necessary to ensure the safe installation and use of machinery.

Examples are
- inherent rotational frequency forces and couples;
- residual rotational frequency forces and couples after balancing;
- forces and couples caused by reciprocating masses;
- torque reaction couples;
- amplitudes and/or frequencies of gas pulsation phenomena;
- frequencies of aerodynamic phenomena (e. g. for fans);
- electromagnetic forces and frequencies associated with electrical rotating machines or transformers.

#### 6.2.1.3 Special requirements

Special features peculiar to the equipment shall be covered in the machine description and by drawings. Among such special features are

a) electrical connectors, tubing, ducting or piping which might modify the mechanical response of the mounting system (type, size, stiffness, etc.);

b) externally applied forces and moments;

c) required access areas;

d) minimum clearance required for cooling air flow. Any temperature gradients which might adversely affect isolator operation shall be shown on the drawing and the expected temperature range shall be given.

e) maximum clearance between equipment and foundation, where applicable.

#### 6.2.1.4 Electrical features

Provisions for grounding and applicable specifications shall be indicated on the drawing, by an attached note.

#### 6.2.1.5 Special requirements for mechanical stability

Special requirements for mechanical stability shall be given. For example, special care is needed where equipment with a high or variable centre of gravity is supported by isolators located below the centre of gravity, or where uncompensated side thrusts exist.

### 6.2.2 Physical data of the isolation system

#### 6.2.2.1 General data

The supplier of the isolation system shall supply detailed information on characteristics of the isolation system:

a) type of isolation system;

b) materials of the isolation system;

c) weight of the isolation system;

d) levelling features;

e) static stiffness of isolators;

f) the maximum and minimum weight forces (expressed in Newtons) under operating conditions of the machine;

g) dimensions and location of the isolation (e. g. drawing);

h) creep of isolators relative to load and time.

#### 6.2.2.2 Dynamic behaviour

The supplier shall describe the translational and rotational dynamic behaviour of the isolation system in terms of dynamic stiffness. The environmental conditions and the rate of loading under which the load-deflection data were obtained shall be described and tolerances shall be given. However, where necessary, as an alternative, the supplier can describe dynamic behaviour by transmissibility characteristics measured in a testing setup which is fully described. Dynamic behaviour may be related to variations in the following input parameters:

a) resonance frequency as a function of load;

b) amplitude;

c) temperature;

d) damping.

The supplier shall describe the efficiency of isolation in the three principal directions, indicating applicable frequencies.

#### 6.2.2.3 Durability

The supplier shall present such information on durability or rather on the change of the physical characteristics as:

a) endurance limit associated with repeated deflections and shocks;

b) creep (permanent deformation) data, where applicable, and how the data have been obtained;

c) ageing effects due to storage in specified environments including maximum and minimum temperatures.

#### 6.2.2.4 Environmental data

The supplier shall supply the following information on the isolators as necessary to ensure proper use:

a) the upper and lower temperature limits beyond or below which the isolator under rated loads will not properly perform its function or will undergo permanent changes in characteristics;



b) the ability of the isolator to withstand corrosion or deterioration caused by such factors as humidity, water, salt spray, fungus, ozone, oils and fuels, corrosive vapours, sunshine, etc.;



c) the ability to perform under adverse conditions, for example, in an atmosphere loaded with sand or dust;

d) permissible storage environment.