

SLOVENSKI STANDARD
SIST EN ISO 10819:1998

01-april-1998

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Mechanical vibration and shock - Hand-arm vibration - Method for the measurement and evaluation of the vibration transmissibility of gloves at the palm of the hand (ISO 10819:1996)

Mechanische Schwingungen und Stöße Hand-Arm-Schwingungen - Verfahren für die Messung und Bewertung der Schwingungsübertragung von Handschuhen in der Handfläche (ISO 10819:1996) (standards.iteh.ai)

Vibrations et chocs mécaniques - Vibrations main-bras - Méthode pour mesurer et évaluer le facteur de transmission des vibrations par les gants a la paume de la main (ISO 10819:1996)

Ta slovenski standard je istoveten z: EN ISO 10819:1996

ICS:

13.160	Vpliv vibracij in udarcev na ljudi	Vibration and shock with respect to human beings
13.340.40	Varovanje dlani in rok	Hand and arm protection

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ICS 13.160; 13.340.00

Descriptors: See ISO document

English version

**Mechanical vibration and shock - Hand-arm
vibration - Method for the measurement and
evaluation of the vibration transmissibility of
gloves at the palm of the hand (ISO 10819:1996)**

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Mechanische Schwingungen und Stöße -
Hand-Arm-Schwingungen - Verfahren für die
Messung und Bewertung der
Schwingsübertragung von Handschuhen in der
Handfläche (ISO 10819:1996)

This European Standard was approved by CEN on 1996-03-19. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

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

Foreword

The text of EN ISO 10819:1996 has been prepared by Technical Committee CEN/TC 162 "Protective clothing including hand and arm protection and lifejackets", the secretariat of which is held by DIN, in collaboration with Technical Committees ISO/TC 108 "Mechanical vibration and shock" and CEN/TC 231 "Mechanical vibration and shock".

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 December 1996, and conflicting national standards shall be withdrawn at the latest by December 1996.

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).

There are five annexes to this standard whereof annex A is normative and annexes B, C, D and ZA are for information only.

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

This European Standard was developed in response to the growing demand to protect people from the risks of vibration damage caused by exposure to hand-transmitted vibration.

In the field of personal protective equipment (PPE), gloves are being marketed which are intended to reduce the magnitude of vibration exposure.

On present evidence, there have been no circumstances in which gloves have been shown to provide adequate attenuation of vibration to prevent vibration injuries.

Within the current state of knowledge, gloves do not provide significant attenuation in the frequency range below 150 Hz. Some gloves may provide amplification in this frequency range. Also, the use of gloves might alter the gripping force which would alter the transmission of vibration into the arms thus increasing the risk of damage. However, it must be emphasized that an important purpose of gloves is to keep the hands warm and dry, as this may help to limit some vibration-induced effects.

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This standard describes a method of measuring the vibration transmissibility of gloves in the laboratory, but as far as possible under conditions typical of use at actual working places. The measurement is performed at the palm of the hand and so does not give the transmission of vibration to the fingers. However, when evaluating the protective effects of a glove, it must be remembered that in many work situations vibration is transmitted not only to the palm but also to the fingers. A different measurement procedure will be required to establish the vibration transmissibility of gloves at the fingers.

This standard describes a method of measuring the vibration transmissibility of gloves worn by a test subject. For the measurement of the vibration transmissibility of resilient materials which are used to cover handles of tools or make gloves, EN ISO 13753 should be consulted.

1 Scope

This European Standard specifies a method for the laboratory measurement, the data analysis and reporting of the vibration transmissibility of gloves in terms of vibration transmission from a handle to the palm of the hand in the frequency range from 31,5 Hz to 1250 Hz.

The standard is intended to define a screening test for the vibration transmission through gloves. It is recognised that many factors influence the transmission of vibration through gloves. Therefore the transmissibility value according to this standard is not sufficient to assess the health risk due to vibration.

The transmissibility of vibration is measured and reported for two input spectra, which are representative of the vibration of some tools, and may be reported as a function of frequency.

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.

EN 420	General requirements for gloves
ENV 25349	Mechanical vibration – Guidelines for the measurement and the assessment of human exposure to hand-transmitted vibration (ISO 5349:1986)
ENV 28041	Human response to vibration – Measuring instrumentation (ISO 8041:1990)
EN 61260	Electroacoustics - Octave-band and fractional-octave-band filters (IEC 1260:1995)
ISO 2041	Vibration and shock – Vocabulary
ISO 5805	Mechanical vibration and shock affecting man – Vocabulary

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3 Definitions

The terminology used in this standard is in accordance with ISO 2041, ISO 5805 and ENV 25349. Additionally for the purposes of this standard, the following definition applies:

Transmissibility: the ratio of the accelerations measured at the surface of the hand and at the reference point. Transmissibility values greater than 1 indicate that the glove amplifies the vibration. Values lower than 1 indicate that the glove attenuates the vibration.

4 Symbols and abbreviations

The following symbols and abbreviations are used:

- a_w r.m.s. frequency-weighted acceleration, measured by means of a weighting filter or calculated from acceleration spectrum (see ENV 28041 and ENV 25349)
- a_{ws} r.m.s. frequency-weighted acceleration for vibration spectrum s ($s = M$ or H , see clause 6.2)
- R subscript used to denote measurements taken at the reference point, i. e. at the handle
- P subscript used to denote measurements taken at the palm of the hand
- b subscript used to denote measurements taken with "bare hand", i. e. without glove
- g subscript used to denote measurements taken with "gloved hand", i. e. between glove and hand.

Examples of combined subscripts:

- a_{wMPg} weighted acceleration for vibration spectrum M , measured at the palm of the hand with glove
- TR_{sb} transmissibility for vibration spectrum s measured with bare hand
($TR_{sb} = a_{wsPb} / a_{wsRb}$)
- TR_{sg} transmissibility for vibration spectrum s measured with gloved hand
($TR_{sg} = a_{wsPg} / a_{wsRg}$)
- TR_s corrected vibration transmissibility of glove for vibration spectrum s
($TR_s = TR_{sg} / TR_{sb}$)
- \overline{TR}_s mean corrected transmissibility of glove for vibration spectrum s (see clause 7.1).

5 Measuring principle and equipment

5.1 General principle and setup

The method uses a vibration excitation system ("shaker") equipped with a special handle (see annex B) to measure the gripping force and a device for measuring the feed force. The vibration in the direction of the excitation is measured at two points simultaneously: at the surface of the handle and – by means of an adaptor containing an accelerometer – between hand and glove, i. e. inside the glove. In order to compensate for the frequency response of the adaptor, the vibration transmissibility of the glove is calculated as the difference in vibration transmissibility from handle to hand with and without glove.

The measuring setup is shown in figure 1. The acceleration at the reference point (at the handle) and the vibration at the hand shall be measured simultaneously.

The values of the gripping force and the feed force have to be displayed continuously, to enable the operator to adjust them to the required values.

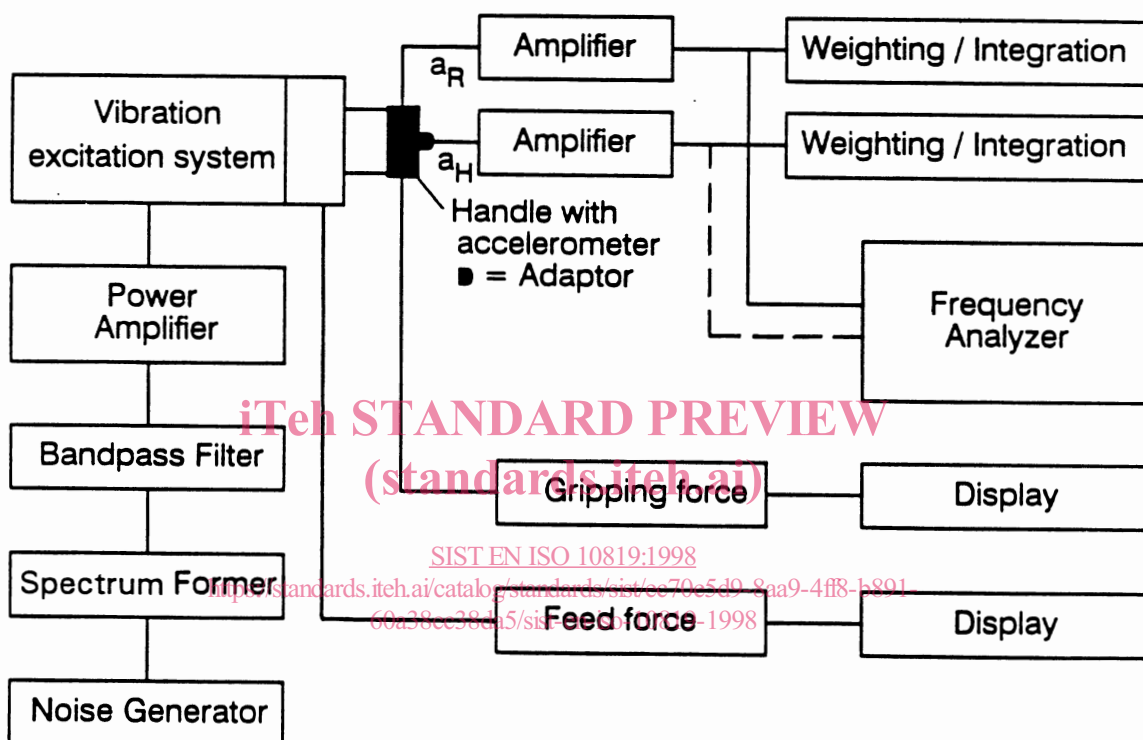


Figure 1: Schematic diagram for measurement of vibration transmissibility

5.2 Measuring equipment

5.2.1 General requirements

A frequency analyzer (narrow band or one-third octave band, preferably twin channel), two transducers and two channels of measuring equipment (including signal conditioning and weighting) are required.

The elements of the measuring chain shall fulfill the requirements for type 1 instrumentation according to ENV 28041.

An overload indication for the input signals shall be provided. The dynamic range shall be at least 60 dB.

5.2.2 Transducer mounting

5.2.2.1 Mounting at the reference point in the handle

The transducer shall be rigidly mounted into the handle, close and in parallel to the excitation axis. The exact location of the transducer shall be marked on the surface of the handle.

5.2.2.2 Mounting for measurement at the hand

The transducer shall be held in the palm of the hand. Therefore, an adaptor according to the drawing in figure 2 shall be used which contains the transducer. Its mass shall not exceed 15 g including transducer.

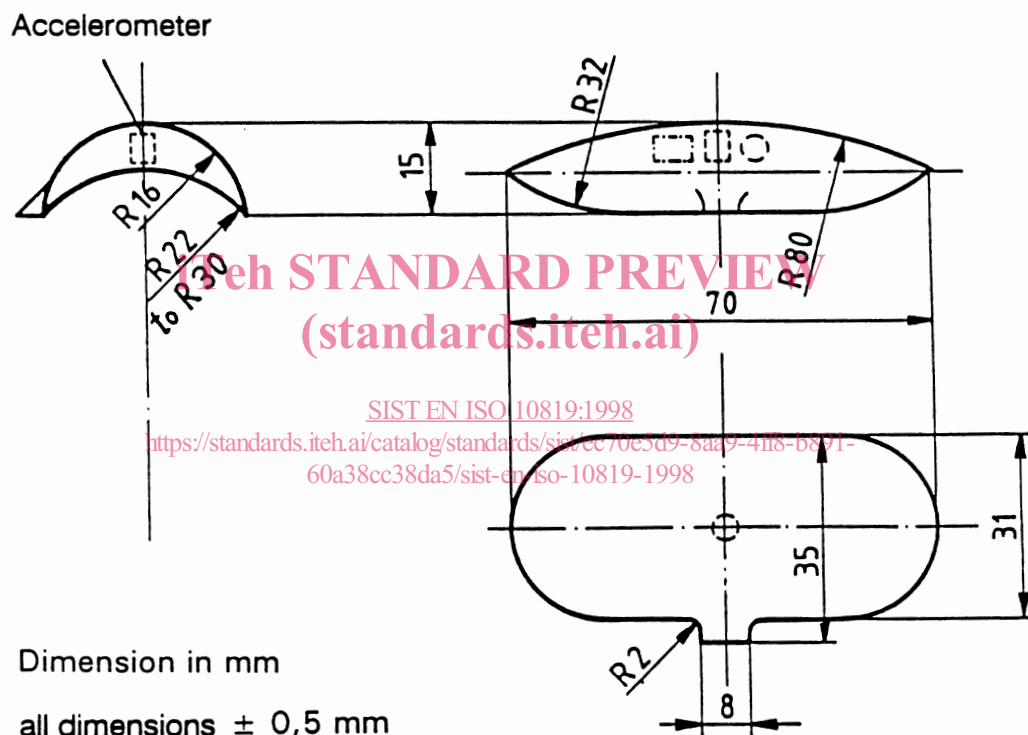


Figure 2: Adaptor for holding accelerometer in the palm of the hand

The exact value of R 22 to R 30 shall be chosen such as to apply a uniform pressure onto the glove material.

The frequency response is checked with the criterion indicated in clause 6.3.2.

5.2.3 Frequency analysis

If frequency analysis in third-octave bands is applied, the filters shall fulfill the requirements of EN 61260.

If constant bandwidth analysis is applied, the resolution for spectrum M shall be better than 1 Hz, for spectrum H better than 10 Hz.

5.2.4 Gripping force measuring system

In the context of this standard, gripping force means the force measured according to the principle shown in figure 3.

The gripping force measuring system shall fulfill the following requirements:

Dynamic range: 10 N to 50 N

Resolution: better than 2 N

Other measuring errors: less than 5 %

Integration time for display: 0,25 s

An example of a technical solution based on a strain gauge built into the handle is shown in annex B.



Figure 3: Definition of gripping force to be measured (top view)

5.2.5 Feed force measuring system

In the context of this standard, feed force means the horizontal force pushing towards the vibration excitation system.

The feed force measuring system shall fulfill the following requirements:

Dynamic range: 10 N to 80 N

Resolution: better than 2 N

Other measuring errors: less than 5 % of value

Integration time for display: 0,25 s

To measure the feed force, different technical solutions are possible:

- measuring the horizontal force applied to the platform by the operator (see figure 4);
- direct measurement of the feed force as a part of the vibration excitation system.

5.3 Vibration excitation system

5.3.1 Geometrical characteristics

5.3.1.1 Dimensions and direction of the handle

The handle shall have a circular section of 40 mm diameter and a length of 110 mm. The direction of the handle shall be vertical.

5.3.1.2 Position of the excitation system

The axis of vibration shall be horizontal and parallel to the forearm of the standing operator (see figure 4).

The excitation system or the platform the operator is standing on shall be adjusted so, that the requirements regarding the operator's posture as defined in clause 6.1.4 are fulfilled.

5.3.2 Performance

The excitation system shall be able to produce the vibration spectra specified in clause 6.2 when a feed force and a gripping force according to clause 6.1.3 are applied.

6 Measurement conditions and procedure

6.1 Measurement conditions

6.1.1 Test subjects

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Three adults with hand sizes from 7 to 9 according to EN 420 shall serve as test subjects.

6.1.2 Test gloves

Three gloves shall be tested (one for each test subject).

6.1.3 Further conditions

For the measurements, the conditions specified hereafter shall be observed.

6.1.3.1 Gripping force

The gripping force shall be displayed continuously. The operator shall maintain the gripping force at $30 \text{ N} \pm 5 \text{ N}$ throughout the test period.

6.1.3.2 Feed force

The feed force shall be displayed continuously. The operator shall maintain the feed force at $50 \text{ N} \pm 8 \text{ N}$ throughout the test period.

6.1.3.3 Room temperature

The measurements shall take place at a room temperature of $20 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$.

6.1.3.4 Humidity

The relative humidity shall be below 70 % and shall be reported.

6.1.3.5 Conditioning of gloves

The glove to be tested shall be stored at the specified temperature for at least 30 min and worn by a subject for at least 3 min before starting the test procedure.

6.1.3.6 Fitting of gloves

The size of the gloves shall be chosen according to EN 420.

6.1.3.7 Test period

Each test period to be evaluated shall be of at least 30 s duration for weighted measurements or third-octave band analysis, and shall allow averaging of at least 60 spectra if constant bandwidth analysis is applied.

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6.1.4 Operator's posture

The operator is standing upright on a horizontal surface (floor or platform, see figure 4). The forearm is directed in the axis of vibration. The elbow forms an angle of approximately $90^\circ \pm 10^\circ$. The elbow shall not touch the body during the measurements. The wrist shall be bent from 0° (neutral) to 40° (dorsal bending) maximum (see figure 5).

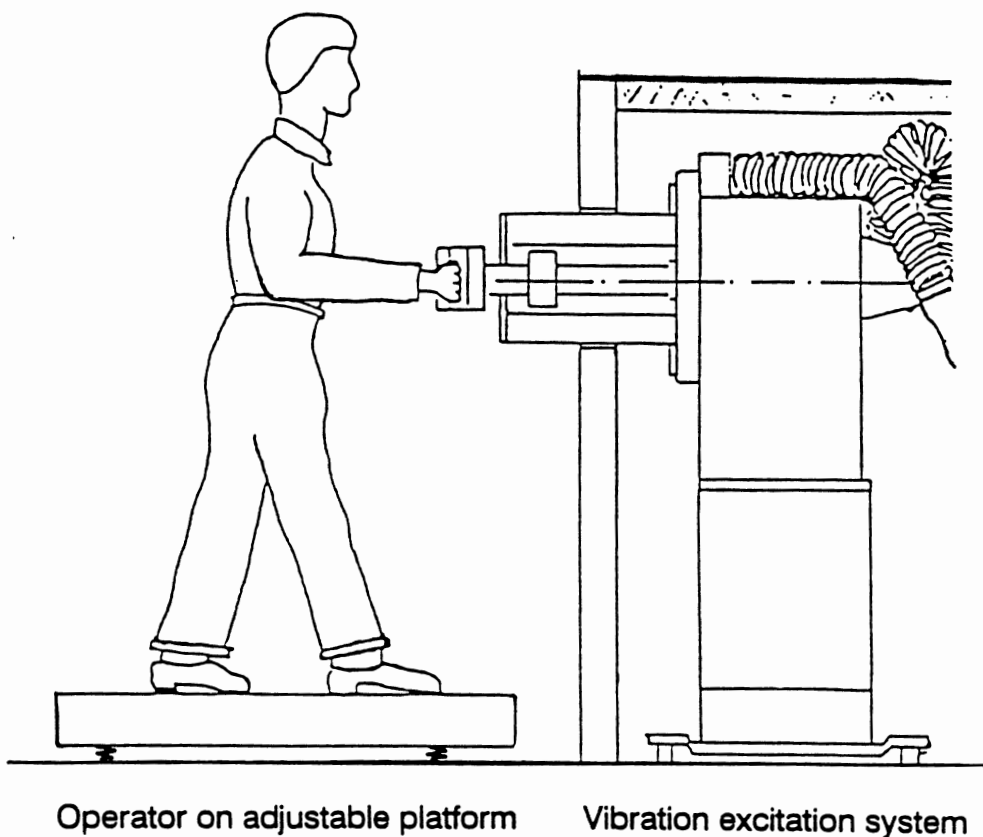


Figure 4: Posture of the operator during measurements



Figure 5: Position of hand with handle and adaptor (top view)

6.2 Vibration signal

The two vibration spectra (M and H) as measured at the handle consist of band-limited random noise and shall fulfill the requirements according to figure 6 and table 1. The power spectral density (PSD) is expressed as mean square acceleration per unit bandwidth in $(\text{m/s}^2)^2/\text{Hz}$. The mathematical definition of these signals is to be found in annex A.

The required PSD function can be generated for example by means of a white noise generator and a bandpass filter with slopes of 12 dB/octave. Depending on the excitation system, additional spectrum forming may be necessary.

Annex C gives third-octave band values of both spectra.

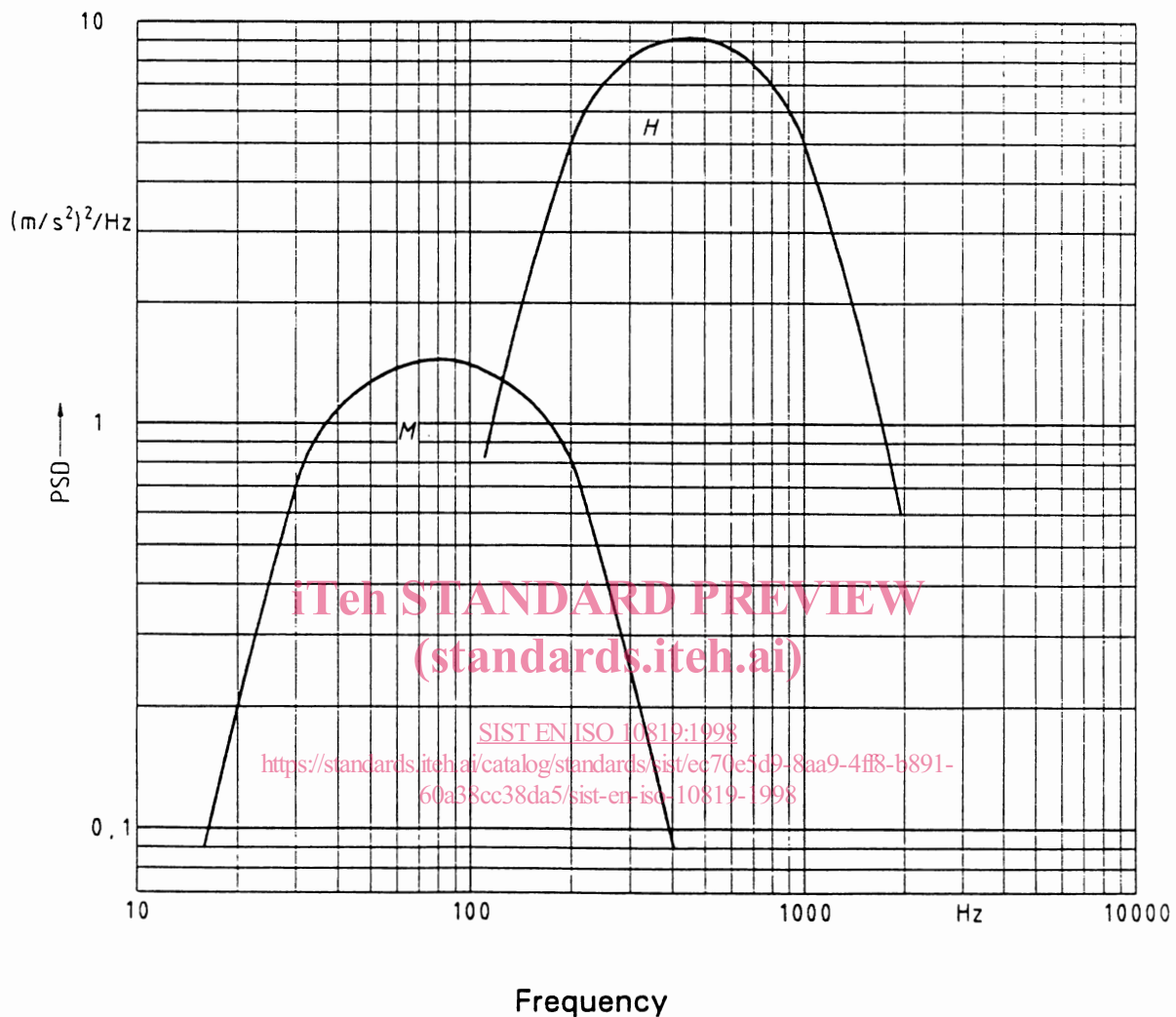


Figure 6: Spectra of the two vibration signals (M and H) measured on the handle