INTERNATIONAL STANDARD

**ISO
8662-5**

Hand-held portable power tools — Measurement of vibrations at the handle —

Part 5:
Pavement breakers and hammers for construction work

Machines à moteur portatives — Mesurage des vibrations au niveau des poignées —

Partie 5: Brise-béton, marteaux de démolition et marteaux piqueurs

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.

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.

International Standard ISO 8662-5 was prepared by Technical Committee ISO/TC 118, *Compressors, pneumatic tools and pneumatic machines*, Sub-Committee SC 3, *Pneumatic tools and machines*.

ISO 8662 consists of the following parts, under the general title *Hand-held portable power tools — Measurement of vibrations at the handle*:

— *Part 1: General*

— *Part 2: Chipping hammers and riveting hammers*

— *Part 3: Rock drills and rotary hammers*

— *Part 4: Grinding machines*

— *Part 5: Pavement breakers and hammers for construction work*

— *Part 6: Impact drills*

— *Part 7: Impact wrenches*

— *Part 8: Orbital sanders*

Annex A forms an integral part of this part of ISO 8662. Annexes B and C are for information only.

Introduction

This part of ISO 8662 specifies how a type test for the measurement of vibrations at the handles of pavement breakers and hammers for construction work shall be performed. It supplements ISO 8662-1 which gives the general specifications for the measurement of vibrations at the handles of hand-held portable power tools. It specifies the operation of the tool under type test and other requirements for the performance of the type test.

The principle of the operation of these power tools is that a driving medium causes a piston to transmit energy periodically to a moil point or other type of tool. The piston also generates a reaction force on the housing of the power tool, which makes it necessary to apply a certain minimum static force on the tool to produce a stationary operating condition.

The reproducibility determined from a great number of tests in which these tools were operated in typical work situations (i.e. breaking concrete) was found to be poor and the possibility of improving it is small. It was therefore concluded that the type test must be carried out using a dummy load, so chosen that the values measured correspond to those found in typical work situations. The reproducibility of the proposed method has been found to be good.

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Hand-held portable power tools — Measurement of vibrations at the handle —

Part 5:
Pavement breakers and hammers for construction work

1 Scope

This part of ISO 8662 specifies a laboratory method for measuring the vibrations at the handles of hand-held power driven pavement breakers and hammers for construction work. It is a type test procedure for establishing the magnitude of vibration in the handle of a power tool operating under a specified load.

The power tools covered by this part of ISO 8662 may be electrically, pneumatically or hydraulically driven, or driven by means of an internal combustion engine.

It is intended that the results obtained can be used to compare different power tools or different models of the same power tool. Although the levels measured are obtained in a simulated work operation they give an estimation of the levels that would be found in a real work situation.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8662. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8662 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2787:1984, *Rotary and percussive pneumatic tools — Performance tests.*

ISO 8662-1:1988, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 1: General.*

3 Quantities to be measured

The quantities to be measured are as follows:

a) the root-mean-square (r.m.s.) acceleration in accordance with ISO 8662-1:1988, subclause 3.1, presented as a weighted acceleration in accordance with ISO 8662-1:1988, subclause 3.3, and as a frequency analysis in accordance with ISO 8662-1:1988, subclause 3.2;

NOTE 1   The frequency analysis may be omitted if the absence of d.c.-shift can be proved by other means.

b) the supply voltage, and the air or hydraulic pressure;

c) the blow frequency;

d) the feed force.

4 Instrumentation

4.1 General

The specifications for the instrumentation given in ISO 8662-1:1988, subclauses 4.1 to 4.6, apply.

4.2 Transducer

The specification for the transducer given in ISO 8662-1:1988, subclause 4.1, applies.

NOTE 2   For light handles, for example made of plastic, care must be taken not to load the handle with too large

a mass when mounting the transducer. If the handle acts as a mechanical filter, then a light transducer may be glued to the surface; in this case the mass of the transducer should be less than 5 g.

4.3 Fastening of the transducer

Fastening of the transducer and mechanical filter shall be in accordance with ISO 8662-1:1988, subclause 4.2 (see figure 1).

For plastic handles, a mechanical filter may not be necessary (see ISO 8662-1:1988, subclause 4.3).

4.4 Auxiliary equipment

The supply voltage of electrically powered tools shall be measured using instruments measuring r.m.s. values.

The air or hydraulic pressure shall be measured using a manometer of precision class.

The feed force can be measured using a scale (see 6.3).

4.5 Calibration

Calibration shall be carried out in accordance with ISO 8662-1:1988, subclause 4.8.

5 Measurement direction and measurement location

5.1 Measurement direction

Measurements shall be made in a direction parallel with the percussive direction, i.e. in the z-direction (see figure 1). The directions in a machine-related coordinate system are defined in annex A.

NOTE 3   For vibration exposure measurements in accordance with ISO 5349, it may be necessary to measure in all three directions defined in annex A.

5.2 Measurement location

Measurements shall be carried out on the main handle, where the operator normally holds the power tool and applies the feed force.

The normal position of the transducer shall be half-way along the length of the handle. On power tools with a closed or open bow grip or a pistol grip, the location of the trigger may make this impossible. In this case the transducer shall be placed as close as possible to the hand, between the thumb and the index finger (see figure 1).

For power tools having two handles, the transducer shall be mounted on the handle without a trigger.

6 Determination of working procedure

6.1 General

Measurements shall be carried out on a new, properly serviced and lubricated power tool.

For electric and hydraulic tools and for tools powered by an internal combustion engine, a warming up time of about 10 min should be allowed before starting the measurements. For pneumatic tools, no such warming up time is necessary.

During the test the tool shall operate at the rated power, i.e. the rated voltage or pressure, and shall be used in accordance with the manufacturer's specifications. The operation of the power tool shall be stable and smooth (see 6.3).

During the test the energy absorber shall be positioned so that the operator can have an upright posture and work the power tool vertically downwards while performing the test (see figures 2 and 3).

Pick hammer

Pavement breaker

Surface milled flat

Handle

Hose clip

Welded nut

Mechanical filter
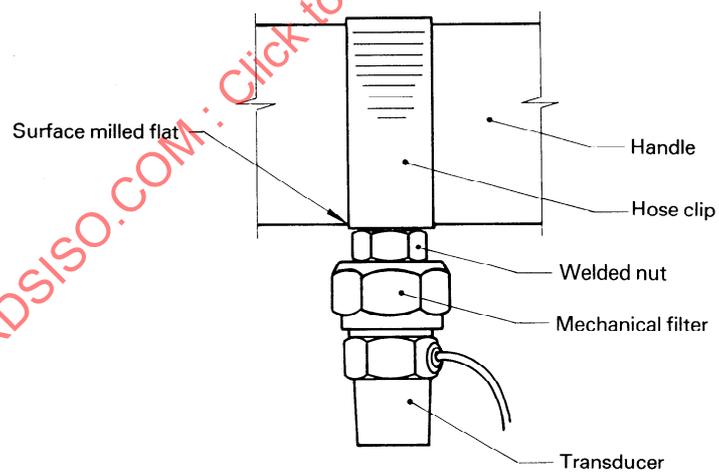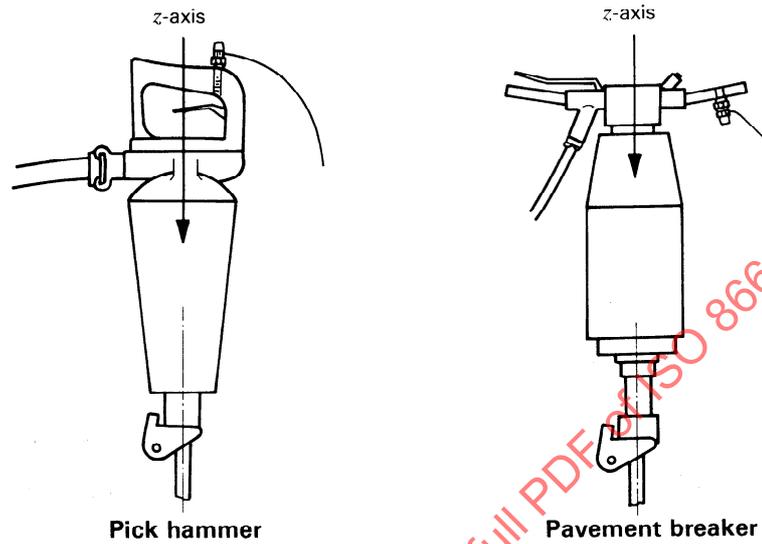
Transducer

Figure 1 — Position and fastening of transducer and measurement direction

The operator is
standing on a scale

Energy absorber
(see figures 4 and 5)
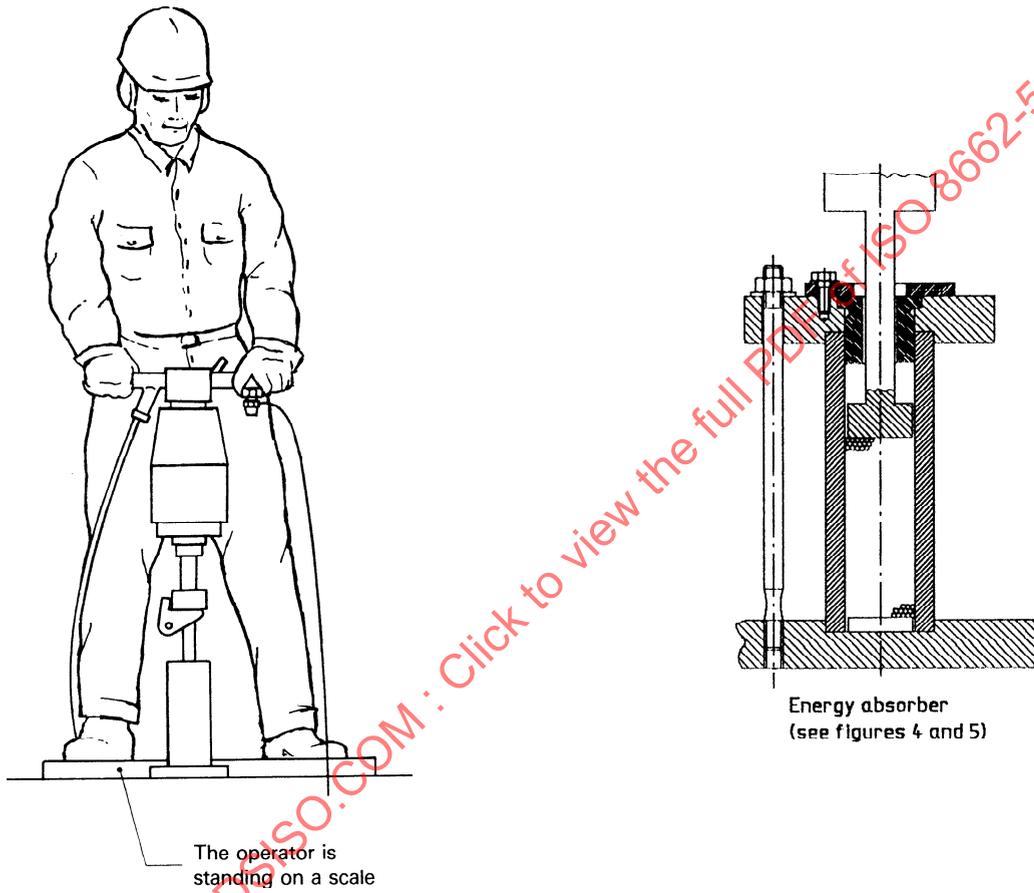
Figure 2 — Working position of operator — Pavement breaker
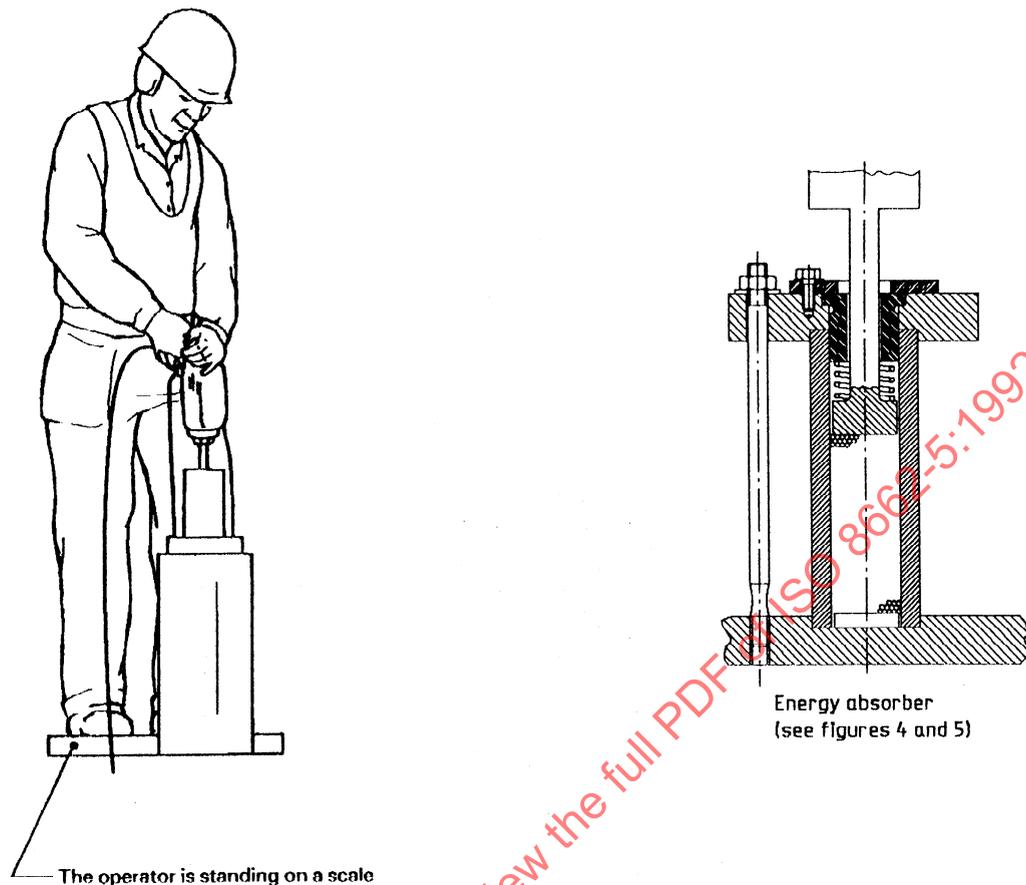
— The operator is standing on a scale

Figure 3 — Working position of operator — Pick hammer

6.2 Energy absorber

The load used is a steel ball energy absorbing device which gives an appropriate absorption of the shock wave and sends consistent reflections, of the order of 15 % to 20 % (as is normal in a working situation), back to the tool.

The energy absorber consists of a steel tube which is firmly mounted on a rigid base plate having a minimum mass of 300 kg to prevent the tool from jumping, and filled with balls of hardened steel. At the top of the steel tube, resting on the balls, is inserted a test tool on which the power tool works. The steel tube shall have a hardness of 62 HRC ± 2 HRC or 750 HV 10, the anvil and test tool shall have a hardness of 55 HRC ± 2 HRC and the steel balls shall have a hardness greater than 63 HRC.

NOTE 4   For tests of long duration, cooling may be necessary.

Figures 4 and 5 illustrate an energy absorber (loading device) and a test tool. Their dimensions should be chosen from table 1.

Table 1 — Design criteria for the energy absorber

Dimensions in millimetres

Shank diameter, d	Steel tube diameter, D	Steel ball diameter	Ball column height, H
$13 \leqslant d < 23$	40	4	100
$d \geqslant 23$	60	4	150

For certain types of percussive power tool, to obtain representative test results, it is necessary that the inserted tool does not recoil freely. This requirement is also valid for practical working conditions. In such a case, the design of the energy absorber shall be modified (see figure 5).

The length of the test tool should be chosen to correspond to the shortest tool supplied.

5

Dimensions in millimetres
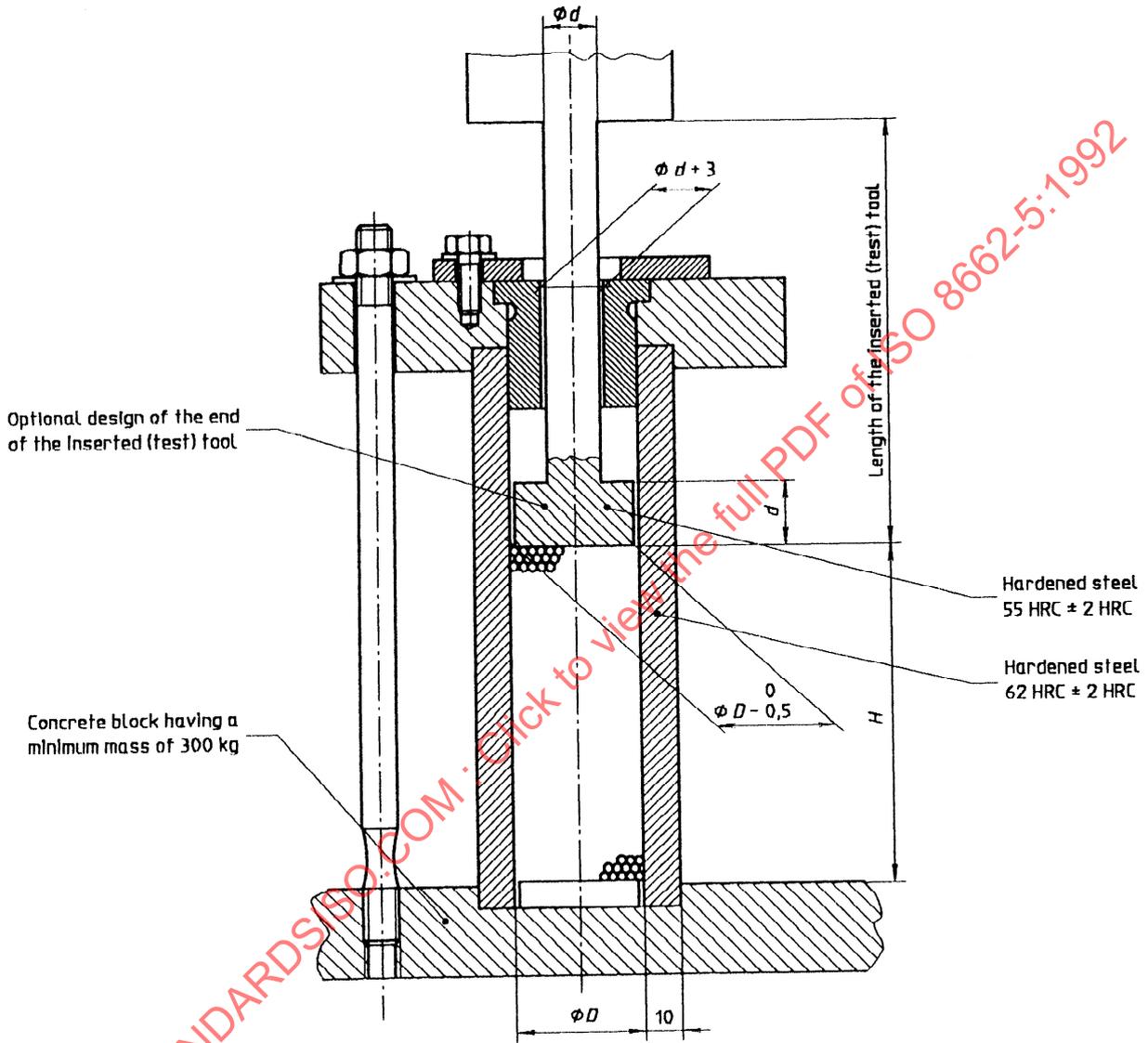
Figure 4 — Steel ball energy absorber

Dimensions in millimetres
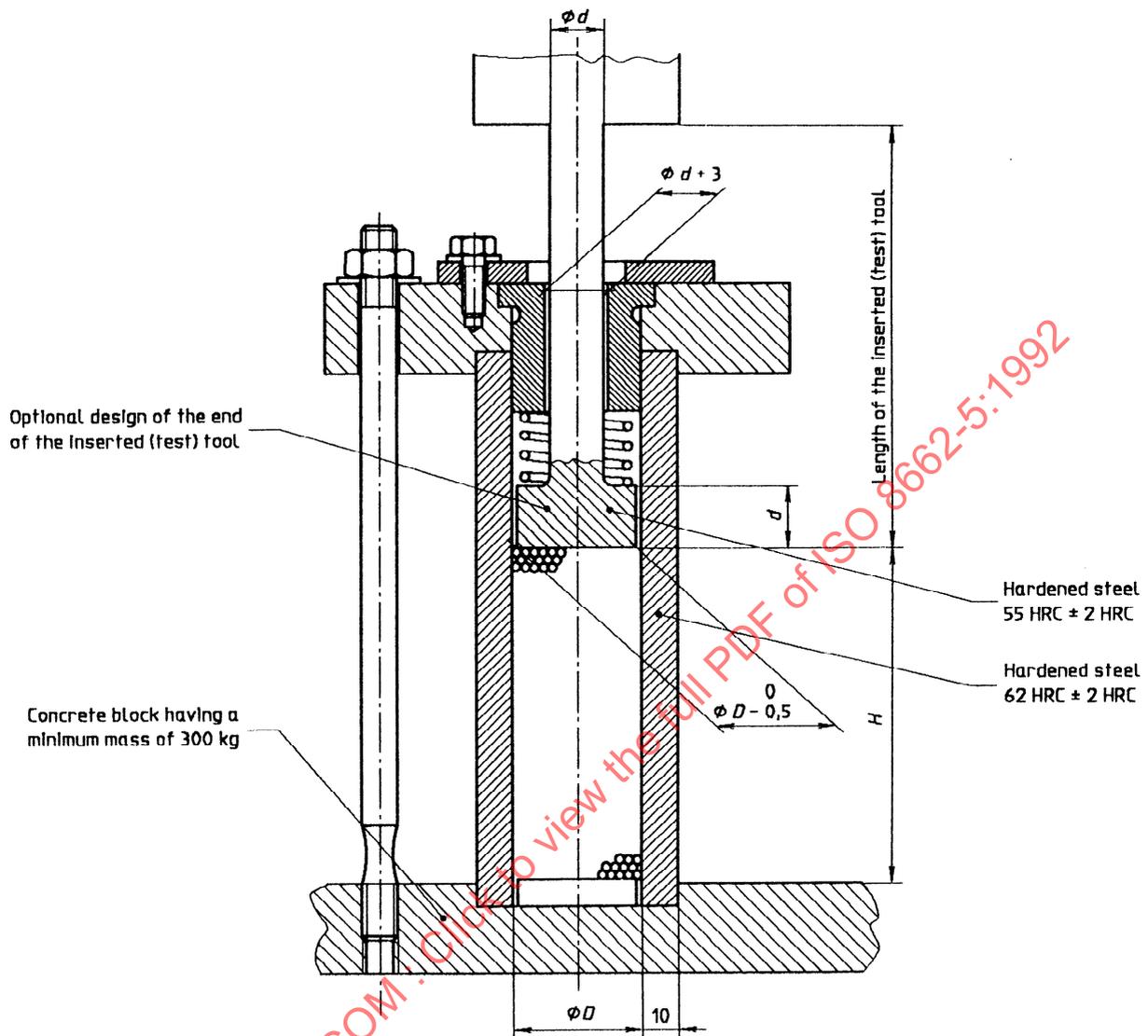
Figure 5 — Steel ball energy absorber with a spring

6.3 Feed force

The feed force to be applied to the tool, which is in addition to the weight of the power tool, shall ensure that it operates at its normal level of performance, i.e. there is stable operation and no contact is established with the collar of the inserted tool.

This is generally achieved by using a feed force, F_A, expressed in newtons, approximately 15 times the value of the mass, in kilograms, of the power tool. The feed force shall not be greater than 200 N.

NOTE 5   As an example, if the power tool has a mass of 12 kg, then the feed force should be approximately 180 N.

The feed force, F_A, can be controlled during the test by making the operator stand on a scale. The feed force is then the operator's weight minus the reading on the scale.

7 Measurement procedure and validity of measurements

7.1 Power supply

The supply voltage of electrically powered tools shall be measured using instruments measuring r.m.s. values.

The air pressure of pneumatically powered tools shall be measured in accordance with ISO 2787 and maintained at the value specified by the manufacturer.

Hydraulic pressure shall be measured and maintained as specified by the manufacturer.

7

Requirements equivalent to the above should be met for tools powered by other means, e.g. tools driven by internal combustion engines.

The blow frequency of the tool during the test can be determined by an electronic filter or other suitable means using the signal from the vibration transducer.

7.2 Test procedure

Three skilled operators shall each carry out one test series with the power tool to be tested. A test series shall consist of five test runs on the energy absorber.

The time for each test run on the energy absorber shall be such that when stable operation has been established, the reading shall be carried out for not less than 8 s.

7.3 Validity of test

Measurements shall be continued by each operator until a valid test series has been obtained, i.e. when the coefficient of variation (see 7.4) of five consecutive weighted values is less than 0,15.

7.4 Coefficient of variation

The coefficient of variation, C_v, of a test series is defined as the ratio of the standard deviation of a series of measurement values and the mean value of the series:

$$C_v = \frac{s_{n-1}}{\overline{X}}$$

where the standard deviation is

$$s_{n-1} = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (X_i - \overline{X})^2}$$

and the mean value of the series is

$$\overline{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

where

X_i is the ith value measured, in metres per second squared;

n is the number of measurement values.

8 Test report

In addition to the specifications given in ISO 8662-1:1988, clause 7, the following information shall be given in the test report:

a) the dimensions of the test tool;

b) the dimensions of the energy absorber;

c) the voltage, operating pressure, or other data related to the power supply;

d) the blow frequency;

e) the feed force.

A model test report is given in annex B.

Annex A

(normative)

Definition of the basicentric coordinate system

A.1 z-**direction:** Direction parallel to the percussive direction.

A.2 y-**direction:** Direction in the plane of the grip (or handle) axis and the z-axis, at right angles to the z-axis.

A.3 x-**direction:** Direction perpendicular to the y- and z-directions.

NOTE 6   Precautions should be taken when carrying out measurements with a mechanical filter in the tangential plane. It is necessary to ensure that the transfer function is unity up to 1 250 Hz.

Annex B

(informative)

Model test report for pavement breakers and hammers for construction work

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The test shall be carried out in accordance with ISO 8662-1:1988, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 1: General,* and ISO 8662-5:1992, *Hand-held portable power tools — Measurement of vibrations at the handle — Part 5: Pavement breakers and hammers for construction work.*

General

Tested by: ....

Date: ....

Reported by: ....

Power tool tested

Tool type: ....

Model No.: ....

Mass, kg: ....

Manufacturer: ....

Serial No.: ....

Inserted tool

Shank diameter, mm: ....

Mass, kg: ....

Energy absorber

Steel tube diameter, mm: ....

Steel ball column height, mm: ....

Steel ball diameter, mm: ....

Operating conditions

Blow frequency, Hz: ....

Hydraulic flow rate, l/s: ....

Feed force, N: ....

Pressure, bar, or voltage, V: ....

Duration of each test run, s: ....

Measuring equipment

Accelerometer — manufacturer, type: ....

Accelerometer — mass in g: ....

Mechanical filter — manufacturer, type: ....

Mechanical filter — mass in g: ....

Measuring equipment *(continued)*

Amplifier — manufacturer, type: ....

Analyser — manufacturer, type: ....

Tape recorder — manufacturer, type: ....

Fastening of transducer and mechanical filter

Description of method for fastening of transducer and mechanical filter, if any.

State the measurement direction.

Signal processing

State the type of signal integration in the spectral analyser and the method of determining the weighted acceleration.

Additional specifications

Report for the tape recorder, if used, the correction factors per octave band or third octave band centre frequencies.

Report any other details, if applicable, concerning the measurement.

Results

The results shall be expressed as octave band values and as weighted values in the following tables.

Individual r.m.s. values — Operator A

Values in metres per second squared

Octave band centre fre-quency Hz	Test run					Arithmetic mean of the r.m.s. values
	1	2	3	4	5	
8						
16						
31,5						
63						
125						
250						
500						
1 000						
Weighted value:						

Individual r.m.s. values — Operator B

Values in metres per second squared

Octave band centre frequency Hz	Test run					Arithmetic mean of the r.m.s. values
	1	2	3	4	5	
8						
16						
31,5						
63						
125						
250						
500						
1 000						
Weighted value:						

Individual r.m.s. values — Operator C

Values in metres per second squared

Octave band centre frequency Hz	Test run					Arithmetic mean of the r.m.s. values
	1	2	3	4	5	
8						
16						
31,5						
63						
125						
250						
500						
1 000						
Weighted value:						

Mean weighted value: ....