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Building construction machinery and equipment — External vibrators for concrete

Machines et matériels pour la construction des bâtiments — Vibrateurs externes pour le béton

Reference number
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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.org
Web www.iso.org

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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 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 18652 was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*, Subcommittee SC 1, *Machinery and equipment for concrete work*.

This corrected version of ISO 18652:2005 incorporates the following corrections:

— a description of dimension W_3, shown in Figure A.7 but missing from the legend, has been added, the dimension itself has been changed on the drawing, and the description of d_1 in the legend corrected;

— in the legend to Figure A.9, the symbol for "width of base" has been corrected to L_2;

— in the legend to Figure A.11, "$L_1 \times W_1$" has been corrected to "$L_1 \times W_3$" and a description of dimension W_4, present in the figure but missing from the legend, has been added.

In addition, all the figures have been enlarged slightly.

Building construction machinery and equipment — External vibrators for concrete

1 Scope

This International Standard defines terms and specifies the classification, performance requirements, test methods, designation and commercial specifications of external vibrators for concrete (hereinafter referred to as “vibrators”). It is applicable only to those power-driven external vibrators used for compacting concrete mix by vibration from the outside.

NOTE The use of external vibrators consists in their attachment to forms, vibration stands, vibration tables, surface vibrators and vibrating beams in order to compact the concrete mix.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2398:1995, *Rubber hose, textile-reinforced, for compressed air — Specification*

ISO 4414:1998, *Pneumatic fluid power — General rules relating to systems*

ISO 6150:1988, *Pneumatic fluid power — Cylindrical quick-action couplings for maximum working pressures of 10 bar, 16 bar and 25 bar (1 MPa, 1,6 MPa, and 2,5 MPa) — Plug connecting dimensions, specifications, application guidelines and testing*

ISO 7241-1, *Hydraulic fluid power — Quick-action couplings — Part 1: Dimensions and requirements*

ISO 8041, *Human response to vibration — Measuring instrumentation*

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guide to selection, storage, use and maintenance*

ISO 11375:1998, *Building construction machinery and equipment — Terms and definitions*

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

IEC 60034-1:2004, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60034-5, *Rotating electrical machines — Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) — Classification*

IEC 60204-1:2000, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60745-1:2003, *Hand-held motor-operated electric tools — Safety — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11375 and the following apply.

3.1
electric external vibrator
vibrator in which the prime mover is an electric motor

NOTE The electric external vibrator is moved by a squirrel-cage, single- or three-phase induction motor on the shaft ends of which eccentric out-of-balance masses are fixed (for examples, see Figures A.1 and A.7).

3.2
pneumatic external vibrator
vibrator operating on the principle of bearingless turbine with pneumatic drive

NOTE 1 The pneumatic external vibrator has typically a rotary vibration generator in the form of a bushing or ball located in a housing, which rolls on a fixed axle. The vibrator set is composed of the vibrator itself, supply hose with on/off stopcock and various fixtures for use with metal and wooden-type shuttering. The on/off stopcock makes it possible to change the vibration parameters.

NOTE 2 For examples, see Figures A.2, A.3, A.8 and A.9.

3.3
hydraulic external vibrator
vibrator comprising a rotating eccentric mass directly coupled to a specially designed hydraulic motor

NOTE 1 The hydraulic external vibrator is supplied by a feeder containing hydraulic pump, pressure and flow controls, with the aim of the precise regulation of vibration frequency to suit requirements.

NOTE 2 For an example, see Figure A.4.

3.4
high-frequency external vibrator
HF external vibrator
vibrator operating at a frequency 70 Hz and above

NOTE High-frequency electric vibrators are typically squirrel-cage induction motors fed from convertors.

3.5
normal frequency external vibrator
NF external vibrator
vibrator operating at a frequency below 70 Hz

NOTE Normal frequency electric vibrators are typically squirrel-cage induction motors supplied with the current of a network frequency.

3.6
external vibrator of directed vibration
vibrator for generation of directed vibrations

NOTE For examples, see Figures A.10, A.11 and A.12.

3.7
single external vibrator of directed vibration
vibrator for generation of linear, vertical vibrations by special fixing on the hinge

NOTE For examples, see Figures A.10 b) and A.11.

3.8
double external vibrator of directed vibration
vibrator for generation of the linear directed vibrations and composed of two external vibrators rotating in opposite directions and joined by a gear

NOTE 1 These vibrators may be driven by an external motor or consist of two induction motors geared together and enclosed in a common housing.

NOTE 2 For examples, see Figures A.10 a) and A.12.

3.9
fixed external vibrator
vibrator fixed to the vibrating object directly by mean of treads

NOTE For examples, see Figures A.1, A.2 and A.5.

3.10
removable external vibrator
vibrator fixed to the vibrating object indirectly by means of a quick-action clamping and releasing device

NOTE For examples, see Figures A.3, A.6 and A.9.

3.11
external vibrator with external motor
vibrator driven by external electric motor or internal combustion engine

3.12
frequency and voltage converter for external vibrator
unit used for electric supply of the external vibrator with frequency higher than in power network and safety voltage

3.13
high-and-normal frequency generating set
unit composed of internal combustion engine, electric generator and frequency converter

4 Classification

Vibrators shall be classified according to frequency, power source and structure in accordance with Table 1.

Table 1 — Classification of external vibrators

Class	Frequency	Power source	Structure	Power W
NF	Normal	Electric motor	Fixed type Removable type	25, 35, 50, 75, 100, 150, 200, 250, 400, 550, 750, 1 100, 1 500, 1 700, 2 200, 3 000 4 000
HF	High			30, 50, 100, 150, 200, 300, 400, 550, 750, 1 000, 1 500, 2 000, 2 500
P	—	Pneumatic	Fixed type Removable type	—
H	—	Hydraulic	Fixed type Removable type	—

5 Structure

A vibrator's structure depends on the type of drive (electric, pneumatic, hydraulic), parameters (frequency and centrifugal force) and the method of fixing to the vibrating object. Examples of different vibrator structures are shown in Annex A.

6 Performance requirements

6.1 Frequency

Vibrators shall be classified according to their frequency, in accordance with Table 2, when subjected to the load test according to 8.2. The vibrator's frequency shall comply with the data as declared by its manufacturer.

Table 2 — Frequency of external vibrators

Designation	Frequency
NF	Below 70 Hz
HF	70 Hz and above

6.2 Centrifugal force

A vibrator's prime mover shall be sufficient to drive the device, without losing speed, such that the declared centrifugal force is maintained continuously under the maximum load of intended use.

6.3 Rating time

The rating time of a vibrator shall be continuous. For electric external vibrators, an intermittent duty (rating class) specified according to IEC 60034-1:2004, 3.2 and 4.2, and agreed between the supplier and purchaser is permissible. The designation of these vibrators shall correspond to IEC 60745-1:2003, 7.2.

6.4 Current and power consumption

The current and power consumption of the electric vibrators, when subjected to a load according to 8.2, should comply with data declared by the manufacturer.

6.5 Safety requirements

6.5.1 General

External vibrators shall be designed and their components selected, applied, mounted and adjusted to provide safe operation. In the event of a failure, the safety of personnel shall be the prime consideration and damage to equipment and environment minimized. Possible modes of failure and intended operations and use shall be considered.

It is recommended that technical principles and specifications according to ISO 12100-2 for the design of vibrators in respect of their safety, be followed and used.

6.5.2 Electric external vibrators

6.5.2.1 General

These vibrators shall comply with the requirements of IEC 60204-1 and IEC 60034-1 unless otherwise specified in this International Standard and shall be constructed as far as possible in accordance with internationally accepted best design practice, as appropriate to the application.

6.5.2.2 Degree of protection

The vibrator cabling should be protected to at least IP 55 according to IEC 60034-5 due to exposure to water cleaning and fine dust.

6.5.2.3 Protection against overload

Overload protection of electric external vibrators shall be provided for each unit rated at more than 0,5 kW. For recommendations on overload protection, see IEC 60204-1:2000, 7.3.

6.5.2.4 Thermal performance

The temperature rise of properly mounted vibrators should remain within the limits of the insulation class according to IEC 60034-1:2004, section 7.

6.5.2.5 Earthing

The vibrators shall be provided with means for connecting a protective conductor or an earth conductor. A performance of these means shall comply with the requirements of IEC 60034-1:2004, 10.1.

6.5.2.6 Insulation resistance

The insulation resistance measured at 500 V d.c. between the power circuit conductors and the protective bonding circuit shall not be less that 1 MΩ, in accordance with IEC 60204-1:2000, 19.3.

6.5.2.7 Withstand voltage test

The electric external vibrator shall withstand a test voltage applied for a period of at least 1 s between the conductors of all circuits and the protective bonding circuit. The test voltage shall

— have a value of twice the rated supply voltage of the vibrator or 1 000 V, whichever is the greater,

— be at a frequency of 50 Hz, and

— be supplied from a transformer with a minimum rating of 500 VA.

See IEC 60034-1:2004, 8.1 or IEC 60204-1:2000, 19.4.

6.5.3 Pneumatic and hydraulic external vibrators

Pneumatic and hydraulic vibrators shall

— demonstrate correct operation in the operational test, and

— pass the pressure test at the maximum working pressure under all conditions of intended use.

Leakage and damage of a vibrator component should not cause a fluid ejection hazard.

The design of the vibrator systems shall be in accordance with ISO 4414.

Special attention should be given to any flexible hoses and quick-action couplings with which vibrators can be equipped. The hoses should comply with ISO 2398 and ISO 8331 and the couplings with ISO 6150 and ISO 7241-1.

6.5.4 Requirement for no-load test

During 2 min work the vibrator shall demonstrate correct operation. See 8.1 and Annex B.

6.5.5 Requirement for load test

During 30 min running the vibrator shall demonstrate correct operation. See 8.2 and Annex B.

7 Instruction handbook

The instruction handbook shall contain the information necessary for installation, operation and maintenance of the vibrator.

The following should be presented:

a) description;

b) technical characteristics;

c) diagram;

d) documents attesting that the vibrator complies with mandatory requirements;

e) information related to

- use,
- maintenance,
- transport, handling and storage,
- commissioning,
- hazards and measures related to safety, with special attention given to the need for periodical checking of the efficiency of electrical shock protection and prevention against hoses bursting (if any), and the determination of service life of hoses, and
- spare parts.

8 Test methods

8.1 No-load test

Place the vibrator horizontally on a vibration insulator, selected in accordance with the vibrator's mass (see B.1).

All parts should be securely held in their positions and prevented from loosening. Set the hoses to straight position.

Run the vibrator for 2 min.

The vibrator shall comply with the requirement of 6.5.4.

8.2 Load test

Select a cubic mass, made of steel or cast iron, according to Table 3 and use this as a payload to fix the vibrator during the test. For pneumatic and hydraulic drive vibrators, the payload mass selected should be based on the calculated power consumption.

Firmly connect the vibrator to the payload.

Place the vibrator with its payload horizontally on a vibration-insulation base (see Annex B) and activate the vibrator.

Run the vibrator for 30 min.

The vibrator shall comply with the requirement of 6.5.5.

Table 3 — Mass of payload for vibrator fixing during payload test

Class and motor output W	Mass [a] kg	Class and motor output W	Mass [a] kg
NF 25	5	NF 3 000	700
NF 35	5	NF 4 000	950
NF 50	10	HF 30	10
NF 75	15	HF 50	15
NF 100	20	HF 100	25
NF 150	30	HF 150	40
NF 200	50	HF 200	50
NF 250	60	HF 300	80
NF 400	100	HF 400	100
NF 550	120	HF 550	150
NF 750	200	HF 750	200
NF 1 100	250	HF 1 000	280
NF 1 500	350	HF 1 500	420
NF 1 700	400	HF 2 000	560
NF 2 200	500	HF 2 500	700

[a] Mass tolerance: 2,5 %.

8.3 Frequency and acceleration measurements

Fix the vibrator to the payload under the same conditions as for the load test (see 8.2 and Annex B). For electric vibrators, the supply voltage value shall correspond to data specified by manufacturer. For pneumatic and hydraulic vibrators, air and oil pressures shall be at their nominal values.

Measure the frequency using either a vibration meter or stroboscope. In addition, a tachometer may be used for measurement of the motor speed. If a vibration meter is used, it shall be a single-axis accelerometer