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**Building construction machinery
and equipment—Internal vibrators
for concrete**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Construction Mechanization Association (JCMA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS A 8610 : 1993** is replaced with this Standard.

This revision has been made based on **ISO/CD 18651 : 2002** *Building construction machinery and equipment—Internal vibrators for concrete* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Building construction machinery and equipment—Internal vibrators for concrete

Introduction This Japanese Industrial Standard has been prepared based on **ISO/CD 18651 : 2002** *Building construction machinery and equipment—Internal vibrators for concrete* with some modifications of the technical contents.

Portions underlined with dots are the matters modified from the original International Standard. A list of modifications with the explanations is given in annex 1 (informative).

1 Scope This Standard specifies internal vibrators for concrete (hereafter referred to as “vibrators”) used for concrete mix compaction. It is applicable to only the power driven vibrators with head diameter of 180 mm or less.

NOTE : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21**.

ISO/CD 18651 : 2002 *Building construction machinery and equipment—Internal vibrators for concrete* (**MOD**)

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of coming into effect apply only to the most recent edition (including amendments).

JIS C 4034-1 *Rotating electrical machines Part 1 : Rating and performance*

NOTE : **IEC 60034-1 : 1996** *Rotating electrical machine—Part 1 : Rating and performance* is equivalent to the said standard.

JIS C 9745-1 *Safety of hand-held motor-operated electric tools—Part 1 : General requirements*

NOTE : **IEC 60745-1 : 1993** *Safety of hand-held motor-operated electric tools—Part 1 : General requirements* is equivalent to the said standard.

JIS C 9745-2-12 *Safety of hand-held motor-operated electric tools—Part 2-12 : Particular requirements for concrete vibrators (internal vibrators)*

NOTE : **IEC 60745-2-12 : 1993** *Safety of hand-held motor-operated electric tools—Part 2 : Particular requirements for concrete vibrators (internal vibrators)* is equivalent to the said standard.

ISO 8041 : 1990 *Human response to vibration—Measuring instrumentation*

ISO 5349-1 : 2001 *Mechanical vibration—Measurement and evaluation of human exposure to hand-transmitted vibration—Part 1 : General requirements*

ISO 5349-2 : 2001 *Mechanical vibration—Measurement and evaluation of human exposure to hand-transmitted vibration—Part 2 : Practical guidance for measurement at the workplace*

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

3 Terms and definitions For the purposes of this Standard, the following main terms and definitions apply.

3.1 internal vibrators vibrator (poker) designed for immersion in the concrete mix to effect its compaction (see ISO 11375 : 1998, 2.3.1.1)

3.2 eccentric-type immersion vibrator immersion vibrator using the eccentricity of a mass rotating inside its casing in bearings to produce harmonic vibration for compacting concrete mix [see ISO 11375 : 1998, 2.3.1.1.1 and annex A figure 2 a)]

NOTE : Vibrators may have various drives, for example, electric, internal-combustion engine, pneumatic or hydraulic drive. An immersion vibrator with an electric drive may have an electric motor enclosed in its body (poker) or a power unit composed of an electric motor and frequency converter.

3.3 pendulum-type (p-t) immersion vibrator vibrator with a pendulum mechanism generating vibrations by rotating an out-of-balance mass along a circular path. Most p-t vibrators are driven by electric motor or internal combustion engines [see ISO 11375 : 1998, 2.3.1.1.2 and annex A figure 2 b)]

3.4 flexible drive immersion vibrator vibrator with power transmission from prime mover to vibration head in form of a flexible shaft

3.5 electric immersion vibrator with flexible drive flexible drive immersion vibrator in which the prime mover is an electric motor (see annex A figure 9)

3.6 combustion engine immersion vibrator with flexible drive flexible drive immersion vibrator in which the prime mover is an internal combustion engine (see annex A figure 10)

3.7 built-in motor type electric immersion vibrator vibrator in which electric motor and vibration generator are built-in a vibration head (see annex A figures 3 to 5)

NOTE : A set of the motor built-in type electric immersion vibrator is typically composed of a frequency and voltage converter, handling hose power lead and control box with contactor.

3.8 pneumatic immersion vibrator vibrator supplied with compressed air and provided with vibration head comprising pneumatic motor (see annex A figure 6)

NOTE : The pneumatic vibrators are typically composed of handling hose and twist grip throttle control.

3.9 hydraulic immersion vibrator vibrator comprising a hydraulic motor and rotating eccentric mass directly coupled thereto, to produce and vibration (see annex A figure 7)

NOTES 1 The method of a control of the hydraulic vibrator typically enables precise regulation of frequency.

2 These units are usually designed for use in production of big-sized concrete elements with large aggregate.

3.10 normal frequency immersion vibrator vibrator of a vibration frequency equal to or less than 69 Hz

3.11 high frequency immersion vibrator vibrator of a vibration frequency equal to or more than 70 Hz

3.12 portable-type immersion vibrator vibrator whose all components are handled by an operator in operation

3.13 vibration head unit comprising a vibration generator immersed in concrete mix with the aim of its compaction (see annex A figure 2)

NOTE : The vibration head has got typically a cylindrical form and its end is adapted for coupling driving unit or power network.

3.14 vibration generator eccentric type mechanism generating harmonic vibration by the eccentricity of a mass rotating inside the casing in bearings [see ISO 11375 : 1998, 2.3.1.1.1 and annex A figure 2 a)]

3.15 vibration generator pendulum type mechanism generating vibration with a pendulum by rotating an out-of-balance mass along a circular path [see ISO 11375 : 1998, 2.3.1.1.2 and annex A figure 2 b)]

3.16 flexible shaft part used between a mover and vibration head for power transmission

Example 1 **Mechanical type** Composed of a reinforced outer casing (flexible hose) and a heavy duty flexible inner core which rotates. This includes portable type vibrators with handle.

Example 2 **Hydraulic type** Hose transmitting a hydraulic pressure to drive the vibration head.

Example 3 **Pneumatic type** Hose transmitting a pneumatic pressure to drive the vibration head.

Example 4 **Electric type** Enclosing electric power cable to drive the vibration head.

3.17 frequency and voltage converter of immersion vibrator power unit used for electric supply of a vibrator with frequency higher than supplied by power network and with safety voltage

3.18 high and normal frequency generating set electric power unit composed of internal combustion engine, and frequency converter

4 Classification The vibrators are classified under five categories according to motor installation type, power source and structure as shown in table 1.

Table 1 Classification of vibrators

Symbol ⁽¹⁾	Motor installation	Power source	Structure	Nominal diameter of vibration head mm ⁽²⁾
IE	Internal motor	Electric motor	– Flexible	18, 20, 25, 30, 35,
IH		Hydraulic motor	– Portable	38, 40, 45, 48, 50,
IP		Pneumatic motor	– Flexible and portable – Fixed to apparatus	57, 60, 65, 70, 80, 90, 100, 110, 130, 150, 180
EE	External prime mover	Electric motor	– Flexible	22, 23, 25, 27, 28,
EC		Combustion engine	– Portable – Flexible and portable	32, 38, 45, 60, 75

Notes (1) The first letter expresses the motor installation and, the next, the power source.

(2) The nominal vibration head diameters are recommended.

5 Structure, dimensions and rating time

5.1 Structure Vibrator structures depend on their type of vibration, type of drive, power source and way of hold in operation.

Typical examples of these structure are presented in annex A figures 2 to 10.

5.2 Dimensions The lengths of the flexible shaft or hose, given in table 2 are recommended.

Table 2 Length of flexible shaft or hose

Symbol of type	Length of flexible shaft or hose m
IE, IH, IP, EE, EC	1.5, 4, 5, 6, 8
EE, EC	0.4, 0.6, 0.7, 0.8, 1, 1.3, 1.5, 1.8, 2

5.3 Rating time Rating time of the power unit shall be continuous. For electric motors, a short time of 30 min or more may be rated (see JIS C 4034-1).

6 Performance requirements

6.1 Frequency The frequency of the vibrators is recommended as shown in table 3.

Table 3 Recommended frequencies

Nominal diameter of vibration head mm	Frequency Hz
Less than 90	130 or more
90 or more	90 or more

6.2 Double amplitude (full amplitude) The double amplitude of the vibrators should meet the value shown in table 4. In this case, double amplitude is defined as a distance “peak to peak” as illustrated in annex A figure 1.

Table 4 Double amplitude

Nominal diameter of vibration head mm	Double amplitude mm
18 to 32	0.6 and above
35 to 48	0.8 and above
50 to 70	1.0 and above
75 to 90	1.5 and above
100 or more	2.0 and above

6.3 Evaluation of centrifugal force The centrifugal force is calculated by the following formula:

$$F = m \times r \times \omega^2$$

where, F : centrifugal force
 m : unbalanced mass
 r : eccentric value
 ω : angular acceleration

6.3.1 Acceleration The acceleration shall be measured by a vibration meter (see **ISO 8041**) directly, or calculated from the measured values of the amplitude and frequency. The formula is as follows.

$$a_{\max} = (2 \times \pi^2 \times A \times n^2) / 1\,000$$

where, $a_{\max}$: maximum acceleration (m/s²)
 A : full amplitude (mm) $A = 2a$
 a : amplitude (mm)
 n : frequency (Hz)

6.3.2 Theoretical calculation value of centrifugal force The theoretical calculation value of centrifugal force is as follows.

$$F = (4 \times m \times r \times \pi^2 \times n^2) / 1\,000$$

where, F : centrifugal force (N)
 m : unbalanced mass (kg)
 r : eccentric value (mm)
 n : frequency (Hz)

Unbalanced mass is the mass only of the part being out of balance to the axis.

The unbalanced mass and eccentric value are presented by the vibrator manufacturer as requested.

6.4 No-load amplitude Amplitude of vibration shall be measured by no-load test.

6.5 Electric insulation The electric insulation of electric motor-driven vibrators should meet the requirements of **JIS C 9745-1** and **JIS C 9745-2-12**.

6.6 Daily vibration exposure The equivalent acceleration level (r.m.s. value) during continuous 8 h operation on the grip part (hose or handle) of the vibrator should be noted in the instruction manual (see **ISO 5349-1** and **ISO 5349-2**).

7 Performance testing

7.1 No load test The no load test shall be accomplished as follows:

7.1.1 The double amplitude and the frequency shall be measured while operating with no load.

7.1.2 For the operation, the vibrator head shall be suspended almost vertically in midair to be driven.

7.1.3 Vibration testers or stroboscopes shall be used for frequency data acquisition. For rotation rate measurement of prime mover or motor, a rotation tester can be supplementary used.

7.1.4 The amplitude meters shall be used for amplitude measurement as a rule (refer to **ISO 8041**).

NOTE : Double amplitude may be measured simply as that, sticking a triangular paper for vibration measurement on the head outer casing at a portion producing greatest amplitude so as to its centre line comes to be at right angles to the direction of vibration, observe the amplitude visually in the direction perpendicular the paper surface at the point of observation.

7.2 Load test under water Load test shall be accomplished as follows only in case requested.

7.2.1 Set a reservoir (made of concrete, steel or plastics) of which the volume is more than 0.4 m³.

7.2.2 Reservoir should be filled by water, put the internal vibrator and keep the tip end of it from the bottom of the reservoir with the distance more than 10 cm.