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(तीसरा पुनरीक्षण)

Indian Standard

CONCRETE VIBRATORS — IMMERSION TYPE — GENERAL REQUIREMENTS

(Third Revision)

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

The compaction of concrete by vibration has revolutionized the concept of concrete technology, making possible practical use of low slump, stiff mixes for production of high quality concrete with required degree of strength, density, durability and impermeability. Immersion vibrators are most commonly used for compaction of plain as well as reinforced concrete and are known for their efficacy and ease of operation even in thin and narrow sections, intricate forms, and sections with closely spaced reinforcement. This standard has been prepared with a view to providing guidance both in the manufacture and purchase of concrete vibrators of immersion type capable of giving satisfactory performance.

Pneumatic or electrically driven motor in head type immersion vibrators and flexible shaft driven immersion vibrators of size larger than 90 mm are not covered in the standard although some of the provisions may also apply to these types of vibrators.

The prime mover to be used with the vibrator shall be of sufficient power to ensure required performance. The prime mover may be with internal combustion engine or electric motor conforming to relevant Indian Standards. It may be mounted on a suitable base. A suitable device for starting or stopping the vibrator without disconnecting the flexible shaft from the prime mover may also be provided.

The moving parts of the vibrator shall be suitably encased and appropriate safeguards against accident be provided. Suitable earthing and other safety arrangements shall also be provided for the electrical motors and components in accordance with the provisions of relevent Indian Standards.

This standard was first published in 1963 and subsequently revised in 1968 and 1980. The present revision has been done with a view to incorporate modifications necessary as a result of experience gained with the use of this standard. In this revision, provisions relating to pendulum type of immersion vibrators have been added.

A mere measurement of amplitude and frequency may not always yield a firm basis for judging the efficiency of an immersion vibrator. On the other hand, a direct measurement of the degree and uniformity of compaction of concrete achieved with such a vibrator would give a more convincing and fairer appreciation of its performance. However, in view of large number of variables involved, it has not been found feasible as yet to prescribe in this standard a simple and practical method of test for direct measurement of compaction characteristics. Further the Sectional Committee has also appreciated that even the requirements in regard to amplitude and frequency may considerably vary from case to case and, therefore, the attempt in this standard has been made to lay down, only the limiting ranges to the operational and performance characteristics besides the physical dimensions of the vibrators, on the basis of available technical literature on the subject, experience and the current manufacturing practices in the country.

In the preparation of this standard, considerable assistance has been given by Central Building Research Institute, Roorkee.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CONCRETE VIBRATORS — IMMERSION TYPE — GENERAL REQUIREMENTS

(Third Revision)

1 SCOPE

1.1 This standard lays down the requirements for materials, sizes, construction and performance of concrete vibrators of immersion type, flexible shaft driven and up to 90 mm size.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard.

IS No.	*Title*
1030 : 1989	Carbon steel castings for general engineering purposes (*fourth revision*)
1161 : 1979	Steel tubes for structural purposes (*third revision*)
1239 (Part 1) : 1979	Mild steel tubes, tubulars and other wrought steel fittings: Part 1 Mild steel tubes (*fourth revision*)
1570 (Part 1) : 1978	Schedules for wrought steels: Part 1 Steels specified by tensile and/or yield properties (*first revision*)
6276 : 1971	Flexible shafts used in concrete vibratiors
11389 : 1985	Methods of test for performance of concrete vibrators; Immersion type.

3 TERMINOLOGY

3.1 Amplitude of Vibration

Maximum displacement from its mean position measured at the centre of the length of vibrating needle. It is usually expressed as half of its total displacement.

3.2 Bottom Cap

Cap fitted at the lower end of the vibrating needle casing (*see* Fig. 1A and 1B).

3.3 Eccentric Shaft

Rotating shaft with eccentrically placed mass designed to produce the required amplitude of vibration to the vibrating needle (*see* Fig. 1A).

3.3.1 *Rotor and Runner*

Rotating members in the pendulum type vibrators designed to produce the required amplitude of vibration in vibrating needle (*see* Fig. 1B).

3.4 Flexible Shaft

Shaft consisting of inner core and casing which transmits rotary motion from prime mover to eccentric shaft/rotor, runner and vibrating needle (*see* IS 6276 : 1971).

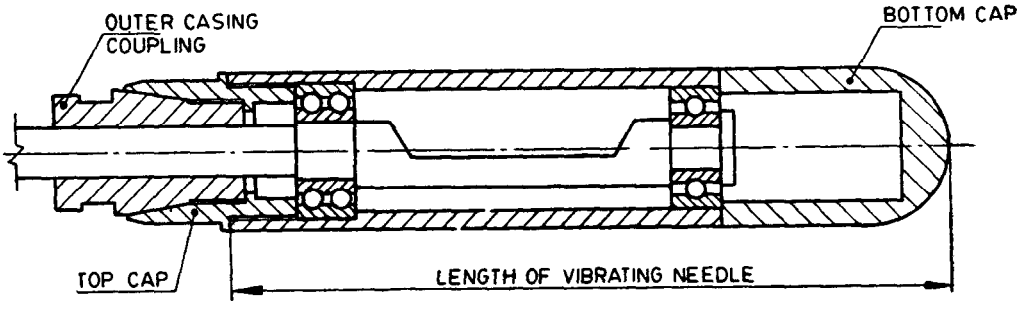

FIG. 1A TYPICAL VIBRATING NEEDLE WITH ECCENTRIC SHAFT

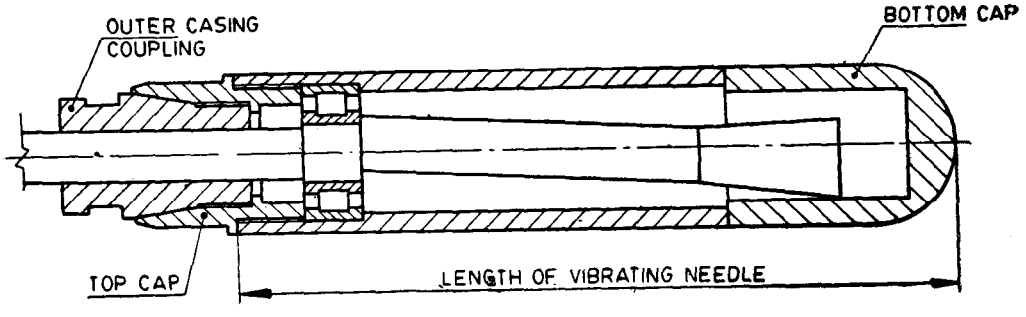

FIG. 1B TYPICAL VIBRATING NEEDLE WITH ROTOR AND RUNNER

3.5 Frequency

Number of complete cycles of vibration per second of the vibrating needle.

3.6 Inner Core

Core of the flexible shaft.

3.7 Inner Core Coupling

Connecting member at either end of the inner core with the eccentric shaft/rotor and runner of the prime mover.

3.8 Needle Coupling

Connecting member in the vibrating needle used for joining the eccentric shaft/rotor and runner to inner core coupling of the flexible shaft.

3.9 Outer Casing Coupling

Fitting at either end of the outer core of the flexible shaft to connect it to the prime mover or the top cap of the vibrating needle.

3.10 Top Cap

Cap which is on driving end/power end of vibrator connected by flexible shaft.

3.11 Tube

Outer casing of the vibrating needle.

3.12 Vibrating Needle

Complete assembly of tube, eccentric shaft/rotor and runner, bottom cap, needle coupling, top cap, etc.

4 MATERIALS

4.1 The tube of the vibrating needle shall be seamless steel tube or heavy class ERW tube conforming to IS 1161 : 1979 or IS 1239 (Part 1) : 1979.

4.2 The bottom cap shall be of carbon steel of Grade 35C8 of IS 1570 (Part 1) : 1978 or cast steel conforming to Grade I of IS 1030 : 1969 and shall be tempered and hardened to 40 to 50 HRC.

4.3 The eccentric shaft/rotor shall be made of carbon steel of Grade 35C8 of IS 1570 (Part 1) : 1978 and shall be tempered.

4.3.1 The runner shall be made of high carbon steel of Grade 45C8 of IS 1570 (Part 1) : 1978.

4.4 Bearings

The bearings shall be preferably double row ball bearing or cylindrical roller bearing, for eccentric shaft type vibrating needle and double row self-aligning bearing for pendulum type vibrating needle. The bearings shall conform to relevant Indian Standards.

4.4.1 *Seals*

The oil seal used in pendulum type vibrating needle shall be made of good quality rubber conforming to relevant Indian Standards.

4.5 The flexible shaft shall conform to IS 6276 : 1971.

5 SIZES

5.1 The size of the vibrator shall be denoted by the nominal outside diameter of the vibrating needle expressed in mm.

5.1.1 The actual outside diameter of the needle measure anywhere in its length excluding the bottom cap shall not differ from the nominal diameter by more than ± 2 mm.

5.1.2 The standard nominal outside diameter of the vibrating needle shall be as given below:

25, 35, 40, 50, 60, 75, and 90 mm.

5.1.3 *Length of the Vibrating Needle*

The length of the vibrating needle shall be measured from the outer end of the bottom cap to the joint between needle casing and upper eccentric housing. Tolerance on the length shall be ± 5 mm.

NOTE — The following standard lengths in mm are recommended for selection of suitable length, depending upon the nature of the job required. These sizes have been recommended arbitrarily, purely with a view to aiding rationalized production by limiting the number of sizes:

300, 325, 350, 375, 400, 425, 475, 500, 525, 550, 575, 600, 625, and 650.

5.1.4 *Mass*

The mass of the vibrating needle shall be expressed in kilograms and shall conform to the following minimum values for needles of different sizes:

Size of the Vibrator	*Mass*
mm	kg
25	1
35	2
40	2
50	3
60	4
75	5
90	6

NOTE — The mass of the vibrating needle excludes the chuck of the flexible shaft guard ring.

6 CONSTRUCTION

6.1 Vibrating Needle

6.1.1 *Tube*

The wall thickness of the tube at the threaded portion, measured from the root of the thread shall not be less than the following:

Size of the Vibrator mm	*Wall Thickness* mm
25	1·5
35	1·5
40	1·5
50	2·0
60	2·5
75	3·0
90	3·0

6.1.2 *Bearings*

These shall be of adequate size and suitably mounted, preferably press fitted on the shaft so as to take both radial and axial loads. The bearings and the eccentric shaft assembly shall be such as to enable the removal of the shaft for repairs and replacement.

6.1.3 *Concentricity*

The eccentric shaft or rotor upon assembly shall be such that all components are eccentric about their respective centre lines, where bearing journals and housing are concerned. This requirement may, however, be suitably modified for vibrating needles designed on the principle of the conical pendulum combined with that of epicyclic gears.

6.1.4 The vibrating needle shall be completely sealed against entrance of moisture or dust.

6.2 Flexible Shaft

6.2.1 The inner core shall be of adequate strength to transfer the power. The outer casing shall be capable of holding the needle securely without stretching under normal conditions of use in construction and without damage to the core. The outer casing shall be provided with adequate insulated covering.

6.2.2 Coupling or threading arrangement between the flexible shaft and the vibrating needle shall be designed to prevent disengagement of the needle from the shaft during its operation.

6.2.3 The length of the flexible shaft shall be expressed in metres and shall be either 4 or 6 m or as required and shall be measured from extreme end of both couplings.

7 PERFORMANCE REQUIREMENTS

7.1 Operational Characteristics

The vibrating needle shall be so designed that when tested for operational characteristics shall be in accordance with IS 11389 : 1985 and with the provision given in **7.1.1** and **7.1.2.** The requirements given in **7.1.1** and **7.1.2** shall be checked on selected samples on the basis of suitable sampling scheme.

7.1.1 *Frequency*

The operational frequency (*see* **3.5**) under no load state (operation in the air) shall be not less than 100 Hz and should preferably be higher. This is 100 Hz to 270 Hz related to the amplitude of vibration and the concrete mix proportions and workability.

7.1.2 The optimum amplitude (*see* **3.1**) under no load state (operation) measurement in the middle of the vibrating needle for different sizes of needle shall be as under:

Diameter of Vibrating Needle (mm)	*Frequency of Vibration* (Hz)	*Amplitude* (mm)	
		Eccentric Shaft Type Vibration	Pendulum Type Vibration
25-35	200-270	0·85-0·55	0·65-0·40
40-60	150-200	1·10-0·75	0·85-0·55
75-90	100-150	1·60-1·30	1·20-0·95

7.2 Range of Action

The area of the range of action of the vibrating needle measured in accordance with IS 11389 : 1985 in concrete with maximum nominal size of aggregate not more than 20 mm and of workability 0·74 to 0·82 compacting factor shall be not less than 100 times the cross sectional area of the needle.

7.3 Leakage Test

The vibrator shall be operated for one hour in 75 mm slump concrete to determine its ability to operate with the needle submerged and to determine if the needle is completely sealed against the entrance of concrete, mortar and/or water. After one hour of operation, the vibrator needle shall be disassembled and examined for presence of concrete, mortar and/or water inside the vibrator head. The presence of either concrete, mortar and/or water on the inside mechanism shall be the cause for rejection. It shall be a type test.

7.4 Endurance Test

The vibrator shall be operated continuously for 20 hours with not more than 2 stoppages of

15 minutes required for change of prime mover in a barrel of crushed stone aggregate, sand and water simulating a concrete mix. The minimum size of the barrel shall be such that the cross-sectional area is at least equal to the range of action; the depth being at least twice the length. The vibrator shall be able to complete this test without any break down. It shall be a type test.

8 INSTRUCTION SHEET

8.1 An instruction sheet containing instructions relating to installation, maintenance including safety requirements and lubrication of the vibrator and the prime mover shall be given.

9 MARKING

9.1 Each vibrator shall have firmly attached to it a mark plate bearing the following information:

a) Manufacturer's name or trade-mark,
b) Vibrator reference number,
c) Type and rating of the power unit,
d) Year of manufacture, and
e) Frequency and amplitude.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

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