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SPECIFICATION FOR FORM VIBRATORS FOR CONCRETE

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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SPECIFICATION FOR FORM VIBRATORS FOR CONCRETE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 May 1968, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Form vibrators are generally used for compaction of concrete in precast concrete moulds, such as pipes, gullies and deep post-tensioned beams. They are also used for compaction of *in-situ* concrete in small and narrow sections or very heavily reinforced sections where immersion vibrators can not be used.

0.2.1 Form vibrators are generally powered by electric or air motor and are of two types, namely 'the fixed or clamp type' and 'the manual type'. The clamp type is mostly used although hand held type is also sometimes used in situations where there are no means of fittings the clamps or where continuous movement along the forms is desirable. The fixed type is always directly coupled with the prime mover unit whereas the manual type is either directly coupled to the prime mover or is connected to the primer mover through a flexible shaft drive. This standard covering electrically operated, fixed and manual type form vibrator has been prepared with a view to providing guidance to the manufacturers and users in obtaining form vibrators capable of giving satisfactory service.

0.3 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*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard lays down requirements for material, sizes, construction and performance of form vibrators for concrete.

1.2 The requirements of this specification apply mostly to electric motor driven form vibrators. Pneumatic powered form vibrators are not covered by this standard, although some of the provisions of this standard may also apply to these types of vibrators.

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Amplitude of Vibration — Maximum displacement of a vibrating body from its mean position during vibration. It is usually expressed as half of the total displacement.

2.2 Eccentric Shaft (Rotor) — The rotating shaft of the vibrating unit designed to produce the required frequency and amplitude of vibration.

2.3 Frequency of Vibration — Number of complete cycles of vibrations per minute.

2.4 Vibrating Unit — The complete assembly of casing, eccentric shaft, bearings, couplings, etc.

2.5 Vibration Acceleration — The maximum acceleration per cycle of vibration. It is usually expressed as a multiple of *g*, the acceleration due to gravity.

3. MATERIAL

3.1 Steel Sections, Bars and Plates — Steel sections, bars and plates shall conform to IS : 226-1962*.

3.2 Mild Steel Sheets — Mild steel sheets shall conform to IS : 1079-1963†.

3.3 Rivet Bars — Rivet bars shall conform to IS : 1148-1964‡.

3.4 Springs — Springs shall be manufactured from suitable grade of spring wire conforming to IS : 727-1964§.

3.5 Eccentric Shaft — The eccentric shaft shall be of suitable grade of carbon steel, such as C-35 of IS : 1570-1961¶ or equivalent to minimize wear.

3.6 All other materials to be used in the construction of the vibrator shall conform to the relevant Indian Standards.

4. TYPES

4.1 The form vibrator shall be of the types as given in **4.1.1** and **4.1.2**.

4.1.1 *Fixed or Clamp Type* — The vibrator provided with the clamping arrangement for fixing on the outside of form for concrete.

4.1.2 *Manual Type* — The vibrator provided with a handle to allow it to be held manually against the formwork for concrete.

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*Specification for structural steel (standard quality) (*third revision*)

†Specification for hot rolled carbon steel sheet and strip (*revised*).

‡Specification for rivet bars for structural purposes (*revised*).

§Specification for hard drawn carbon steel wire for springs for general engineering purposes (*revised*). (Since withdrawn).

¶Schedules for wrought steels for general engineering purposes.

5. SIZE DESIGNATION

5.1 The vibrators shall be designated according to the capacity of the primer mover (power unit) and the type of the vibrator.

Examples:

FDC-200 Fixed, directly coupled; capacity of the power unit 0·2 kW

MDC-200 Manual, directly coupled; capacity of the power unit 0·2 kW

MF-400 Manual, flexible shaft drive; capacity of the power unit 0·40 kW

5.2 The size designation of the vibrator and the weight of the vibrating body for vibrators of different sizes shall be as given in Table 1.

TABLE 1 DETAILS OF VIBRATORS

Designation	Type of Vibrator (*see* **4**)	Capacity of the Power Unit kW	Weight of the Vibrating Body, kg	Remarks
FDC-200	Fixed, directly coupled	0·2	10 - 25	The eccentric shaft shall be directly coupled to the power unit (electric motor) (*see* **6.2**).
FDC-400	—do—	0·4	25 - 40	
FDC-550	—do—	0·55	30 - 50	
FDC-750	—do—	0·75	60 - 80	
MDC-200	Manual, directly coupled	0·2	Less than 10	The eccentric shaft shall be directly coupled to the power unit (electric motor) (*see* **6.2**).
MDC-250	—do—	0·25	Less than 15	
MF-400	Manual, flexible	0·40	Less than 5	The eccentric shaft shall be coupled to the power unit through a flexible shaft drive (*see* **6.2**).
MF-550	—do—	0·55	Less than 6	

NOTE — The weight of the vibrating body includes the electric motor in the case of direct coupling type, but excludes the chuck of the flexible shaft guard ring in the case of flexible shaft driven type.

6. CONSTRUCTION

6.1 Fixed or Clamp Type Vibrator — The fixed or clamp type vibrator shall be made up of prime mover, vibrating unit and the clamping arrangements for attaching the vibrator to the concrete formwork. The shaft of the vibrating unit shall be directly coupled to the prime mover so that the prime mover and the vibrating unit are contained in a single body (*see* Fig. 1).

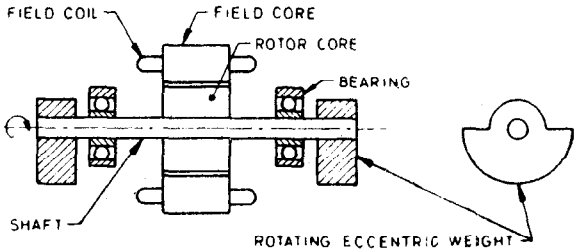


FIG. 1 TYPICAL DIAGRAMMATIC ARRANGEMENT OF FIXED OR CLAMP TYPE FORM VIBRATOR

6.1.1 The vibrator shall be capable of being firmly attached to the concrete forms, so that there is no relative movement between the vibrator and the forms. Suitable arrangements shall be provided to allow for attachment and removal of the vibrator from the formwork without any undue effort or loss of time.

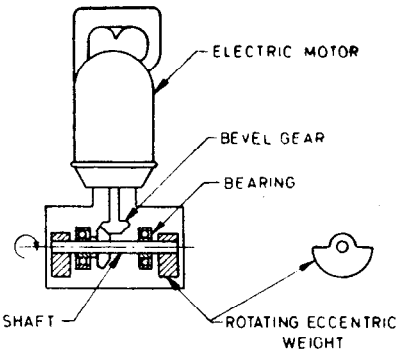
6.2 Manual Type Vibrator — The manual type vibrator shall be made up of power unit, vibrating unit and the flexible shaft. The shaft of the vibrating unit shall be either directly coupled to the power unit so that the power unit and the vibrating unit are contained in a single body [*see* Fig. 2 (A)] or connected to the power unit through a flexible shaft drive [*see* Fig. 2 (B)].

6.3 The coupling arrangement between the vibrating unit and the power unit, both in case of fixed as well as manual type, shall be designed to prevent disengagement of the eccentric shaft during operation.

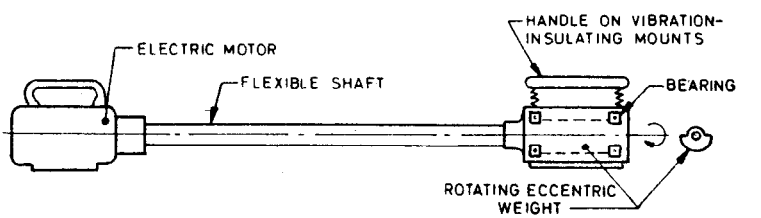
6.4 Vibrating Unit — The vibrating unit shall be of totally enclosed construction and shall be filled with correct amount of lubricant and properly sealed to protect against the entry of dust and moisture.

6.4.1 *Eccentric Shaft* — Eccentric shaft shall preferably be of suitable grade of carbon steel, such as C-35 of IS : 1570-1961* and shall be tempered and polished.

*Schedules for wrought steels for general engineering purposes.



2A DIRECTLY COUPLED TO ELECTRIC MOTOR



2B CONNECTED TO ELECTRIC MOTOR THROUGH A FLEXIBLE SHAFT

FIG. 2 TYPICAL DIAGRAMMATIC ARRANGEMENT OF MANUAL TYPE FORM VIBRATOR

6.4.2 *Bearings* — The bearings shall conform to relevant Indian Standards. They shall be of adequate size and suitably mounted, preferably press fitted on the shaft so as to take both radial and axial loads.

6.4.2.1 The bearings and the eccentric shaft assembly shall be such as to enable the removal of the shaft for repairs and replacements. Suitable arrangements shall be provided for adequate lubrication of bearings.

7. POWER UNIT

7.1 The vibrator shall be capable of being driven by an electric motor of continuous rating and of capacity indicated in **5.1** to ensure the required performance. The rating of the power unit in terms of kilowatts shall be suitably displayed on it.

7.2 The electrical motor and other electrical equipment shall conform to relevant Indian Standards.

7.3 Suitable arrangement shall be provided for adjusting the vibration characteristics of the vibrating unit, and the efficiency of the device pro-

vided for this purpose shall be such that the performance of the vibrator is constant under any operating condition. In the case of flexible shaft driven vibrators, suitable arrangement shall be provided for starting or stopping the vibrating unit without its actual disconnection from the power unit.

8. SAFETY REQUIREMENTS

8.1 The moving parts shall be suitably enclosed to guard against accidents.

8.2 Suitable earthing and safety arrangements shall be provided for electric motors and components conforming to requirements of relevant Indian Standards and safety regulations.

9. VIBRATION CHARACTERISTICS

9.1 The vibrator shall be designed to have operational characteristics specified in **9.1.1** to **9.1.3.**

9.1.1 *Frequency* — Frequency of vibration under no-load (operation in air) state, measured in accordance with **9.2.1** and **9.2.2** shall not be less than 2 800 vibrations per minute.

9.1.2 The amplitude under no-load state (operation in air) measured in accordance with **9.2.1** and **9.2.3** shall not be less than the values specified below:

Designation (*see* **5**)	Amplitude mm
FDC-200	1
FDC-400	1·5
FDC-550	1·5
FDC-750	1·5
MDC-200	0·25
MDC-250	0·4
MF-400	0·25
MF-550	0·4

9.1.3 The acceleration of vibration under loaded state shall be not less than 3 *g* when tested according to **9.2.4.**

9.2 Measurement of Operational Characteristics

9.2.1 *Measurement of Frequency and Amplitude of Vibration* — The frequency and amplitude of vibration of the vibrating unit shall be determined in no-load state (operation in air) by operating the vibrating unit, so kept on a

piece of sponage rubber or a substance of similar softness more than 25 mm thick, that the eccentric shaft remains horizontal. In the case of flexible type, it should be operated with the flexible shaft in horizontal position.

9.2.2 The measurement of frequency shall be carried out with the help of an electromagnetic vibration pick up or reed vibrator or stroboscope or tachometer, or any other equally suitable instrument. However, the tachometer shall not be used with vibrator whose rate of rotation per minute and frequency are not the same.

9.2.3 The amplitude shall be measured by combined set of osciloscope, amplitude measuring apparatus and electromagnetic pick up or any other equally suitable instrument.

9.2.4 *Measurement of Vibration Acceleration in Loaded State* — The vibration acceleration in loaded state shall be measured by attaching to the vibrator, a rectangular parallelepiped plumb bob of cast iron or steel and of weight specified in Table 2 and operating the vibrator as stated in **9.2.1**. The load shall be fixed with the help of bolts to the part of the vibrator that comes in contact with the concrete form.

TABLE 2 WEIGHTS OF PLUMB BOBS

Designation	Weight of Plumb Bob kg
FDC-200	50
FDC-400	100
FDC-550	150
FDC-750	250
MDC-200	30
MDC-250	50
MF-400	30
MF-550	50

Note — The length and width of the plumb bob should preferably be equal to the part that comes in contact with the mould.

9.2.4.1 The vibration acceleration shall be either measured with the help of piezoelectric accelerometer, or by combined set of osciloscope, amplitude measuring apparatus and electromagnetic pick up, or any other equally suitable apparatus, calculated by using the following equation:

$$A = (11{\cdot}18\ a\ n^2\ 10^{-7})g$$

where

A = vibration acceleration,
a = amplitude of vibration in millimetres under loaded state as defined in **2.1**,
n = measured frequency of vibration under loaded state in cycles per minute, and
g = acceleration due to gravity, expressed in mm/s/s.

10. MECHANICAL EFFICIENCY

10.1 The vibrator, when operated continuously for one hour for compaction of concrete shall not show any over heating of the motor, the vibrating unit or its bearings; normally a temperature rise beyond 40°C above the ambient temperature shall not be allowed. There shall also be no notable variation in the frequency and amplitude of vibration. No undesirable play shall develop in the eccentric shaft and the means of attachment of vibrating unit to the power unit and the concrete form.

11. INSTRUCTION SHEET

11.1 The manufacturer or supplier shall supply to the purchaser instruction sheet containing instructions regarding installation, operation, maintenance and lubrication of the machine.

12. MARKING

12.1 The following information shall be permanently and conspicuously marked on the vibrator:

a) Manufacturer's name or trade-mark and serial number of the machine,

b) Vibrator designation (*see* **5**),

c) Vibration characteristics,

d) Type and rating of the power unit to be used, and

e) Year of manufacture.

12.1.1 The vibrator may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI 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 ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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