IS : 5892 - 1970
(Reaffirmed 1996)

Indian Standard

(Reaffirmed 1996)

SPECIFICATION FOR CONCRETE TRANSIT MIXERS AND AGITATORS

(Third Reprint MARCH 1997)

UDC 666.97.031.3

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

Gr 3 *September* 1971

IS : 5892 - 1970
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Indian Standard

SPECIFICATION FOR CONCRETE TRANSIT MIXERS AND AGITATORS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 26 October 1970, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The transit mixer as the name implies, basically consists of a mixer mounted more commonly on a truck, but sometimes on other suitable mobile haulage unit, so that concrete is mixed or agitated during its transit. In view of the increasing use of transit mixers and agitators on heavy construction projects and also in view of the fact that the manufacture of transit mixers has already been started in the country by some of the manufacturers, it has been considered necessary to lay down standards for transit mixers and agitators. This Indian Standard, therefore, has been prepared with the following main objectives:

a) To guide the manufacturers and the purchasers by specifying working limits for the capacity, general construction and other features of the machine;

b) To assist in efficient production by standardization of the sizes; and

c) To guide the purchaser in acquiring machines which meet certain minimum performance requirements.

0.3 A transit mixer can perform three functions, that is, it can mix a batch of coarse and fine aggregates, cement and water into concrete while it is moving or stationary; it can also keep already mixed concrete from seggregation during transit by agitation as a result of slow revolution of the drum; it can also completely mix the 'shrink mixed' concrete (that is concrete partially mixed in the central plant) during transit.

0.3.1 On the other hand, the transit agitator alone is a comparatively simpler equipment which cannot work as a mixer; if loaded with concrete fully or partially mixed at a central plant, it can prevent seggregation of fully mixed concrete or fully mix the partially mixed concrete during transit by agitation as a result of slow rotation of the drum.

0.3.2 Whereas the requirements of the specification have been specifically laid for the transit mixer as described in **0.3**, they may also apply with suitable modifications, wherever necessary, to the transit agitator alone as described in **0.3.1**.

0.4 This standard contains clauses which call for agreement between the purchaser and the supplier and also clauses which permit the purchaser to use his option for selection to suit his requirements. The relevant clauses are **3.2.1**, **9.2** and **11.1**.

0.5 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 covers concrete transit mixers and agitators of the inclined axis rotary drum type, driven by power take off from the mobile vehicles, engine itself or through a separate engine for mixing and agitating concrete during transit.

1.2 The standard defines the various terms, designations and standard sizes of the mixers and specifies the requirements of construction, capacity, performance, accessories and other features of transit mixers and agitators.

2. TERMINOLOGY

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

2.1 Gross Drum Volume — This is the total interior volume of the revolving portion of the mixer drum.

2.2 Nominal Batch Capacity of Agitator — The volume in cubic metres of mixed concrete as in **3.2**, which may be held and agitated satisfactorily in one batch without spillage.

NOTE — The nominal capacity of a truck mixer when used as agitator as stated above may not be achieved with some types of mixes of higher slump without spillage. In such cases purchaser shall define the agitator capacity required indicating the concrete slump, maximum size of aggregate and the road gradient involved, with the discharge opening facing down hill.

2.3 Nominal Batch Capacity of Mixer — The volume in cubic metres of mixed concrete which may be held and mixed properly in one batch in the mixer when the mixer is operated in its normal mixing position with the concrete of 50 mm slump and aggregate of 80 mm maximum size.

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

2.4 Transit Agitator — A mobile equipment mounted on a truck or some other suitable mobile haulage unit, in which freshly mixed concrete may be agitated by rotating the drum continuously or intermittently during transit.

2.5 Transit Mixer — A mixer generally mounted on truck or similar other suitable mobile haulage unit, self-propelled capable of mixing ingredients of concrete and agitating the mixture during transit from a concrete batching plant to the point of placement of concrete.

3. DESIGNATION OF SIZES

3.1 The sizes of concrete transit mixers shall be designated by the number representing its nominal mixer batch capacity in cubic metres together with the letter TM to indicate the transit mixer.

3.2 The concrete transit mixers and agitators shall be of the sizes given in Table 1.

TABLE 1 SIZES OF TRANSIT MIXERS

Designation	Nominal Capacity	
	Mixer, *Min*	Agitators, *Min*
	m^3	m^3
3 TM	3	3·75
4 TM	4	5·00
5 TM	5	6·25
6 TM	6	7·5

3.2.1 Intermediate and other sizes shall not be considered as standard sizes although these may be supplied by mutual agreement between the purchaser and the supplier.

NOTE — The nominal capacities for agitators given in Table 1 will also apply, when the concrete is 'shrink mixed' that is partially mixed in a central plant to reduce its volume and the remaining mixing is done in transit by the transit mixer or the transit agitator.

4. OPERATION SPEEDS

4.1 Mixing Speed — The mixing speed shall be not less than 4 rev/min of the drum nor greater than a speed resulting in a peripheral velocity of the drum of 70 m/min at its largest diameter.

4.2 Agitating Speed — The agitating speed of the agitator shall be not less than 2 rev/min nor more than 6 rev/min of the drum.

4.3 The number of revolutions of the mixing drum or blades at mixing speed shall be between 70 to 100 revolutions for a uniform mix, after all ingredients have been charged into the drum. Unless tempering water is added, all rotation after 100 revolutions, shall be at agitating speed of 2 to 6 rev/min and the number of such rotations shall not exceed 250.

5. GENERAL CONSTRUCTION

5.1 Besides the vehicle chassis and mixer drive mechanism, other main components of transit mixer shall be, the frame structure for mounting the mixer assembly and accessories, charging hopper, discharge chute, water tank, water pump, water measuring devices, controls, etc. All transit mixers of the same size manufactured or supplied under a specific contract shall be physically and mechanically identical. The unit shall be designed on the basis of a single-man control for mixing, agitating and truck operation.

5.2 All parts and components of the mixer shall be cleaned, treated and painted in the best commercial practice.

6. MIXER UNIT

6.1 Various components of the mixer unit shall conform to the requirements as given in **6.2** to **6.4.**

6.2 Mixing Drum — The rotary mixing drum shall be made of high tensile strength high manganese steel or equally abrasion resistant steel not less than 5 mm thick; alternatively the drum shall be of equally abrasion resistant construction, such as mild steel drum covered with renewable cast iron linear plates or hard faced bead weld material, etc. Main mixing blades, other than the auxiliary blades inside the drum, shall normally be in the form of L-shaped continuous spirals of progressively increasing section extending along the full length inside the drum. These blades shall also be of high tensile strength high manganese steel or equally abrasion resistant steel not less than 3 mm thick. The mixing blades shall carry hard faced bead weld on leading edges for maximum life and ease of built up on wearing. The blade formation and size shall be such as to mix concrete to uniform consistency (*see* **17**) in the shortest time and enable quick discharge from the drum, when it is reversed.

6.2.1 *Minimum Drum Volume* — The gross drum volume shall not be less than 1·7 times nominal mixer capacity.

6.2.2 *Drum Opening* — The drum opening shall not be less than 900 mm diameter and shall be provided with drip ring to prevent grout running down the mixer drum.

6.2.3 *Drum Roller* — The drum rollers shall be made from cast iron or forged steel and shall be surface hardened, precision ground and fitted with antifriction bearings. The drum roller track shall be welded or shrunk to

the drum and shall be machined properly so as to ensure smooth and a true running of the drum. It shall be made as one piece from wear resistant high carbon or equivalent alloy steel. Drum brake shall be interlocked with the mixer drive clutch so that it automatically engages as the clutch is thrown out and disengages when the drum is started. In addition to the supporting rollers the drum mounting shall be on a pivot type support of sufficient strength at the centre of closed end, so that any drum movement or driving over uneven ground does not put undue stresses or jerks on the driving mechanism.

6.3 Mixer Drive

6.3.1 The transit mixer shall be of inclined axis rotating drum type mounted on truck chassis of adequate pay load. The drive to the mixer drum shall be either through power-take-off unit from the vehicle engine itself or through separate engine. In the case of power-take-off type units, the vehicle chassis shall be furnished with either front end or fly wheel power take off. Power shall be transmitted to the intake shaft of the drum through a clutch and transmission arrangement capable of delivering maximum torque required to operate the mixer under all operating conditions during transit as well as in stationary condition. The mixer drive mechanism shall be of design that has been tried satisfactorily in extensive transit mixer use. Transmission drive may be of V-belt or reduction gear or chain and sprocket type as applicable for the type of power take off furnished.

6.3.1.1 Alternative to the mechanical power take off described in **6.3.1**, hydraulic power take off may also be used provided it is of proven and accepted performance in transit mixer operation. In the case of hydraulic transmission, initial power for the hydraulic system comes from the vehicle engine and the final drive to the drum is provided by a low speed high torque reversible hydraulic motor.

In either case, where the drive to the mixer is from vehicle engine power take off, the vehicle shall be of adequate horsepower rating as to be able to supply required power for the mixer drive without affecting its own normal performance as a truck.

6.3.2 Whenever required, drive to the mixer may be provided through a separate engine mounted suitably on the vehicle chassis between the driver cab and the mixer drum. In the case of mixer driven with separate engine, the engine shall form an integral power unit of the assembly and shall be either a diesel engine or gasoline engine conforming to the relevant Indian Standards.

6.4 Revolution and Speed Recording — For proper indication of revolutions and speed of the mixing drum the mixer shall be provided with revolution counter and drum speed indicator as given in **6.4.1** and **6.4.2**.

6.4.1 *Revolution Counter* — For recording total drum revolutions during mixing of any particular batch, electrically operated, limit switch type, or an acceptable mechanical type drum revolution counter, shall be provided which shall be capable of being reset for each batch.

6.4.2 *Drum Speed Indicator* — Readings of both revolution counter as well as the speed indicator shall be recorded on the haulage vehicle dash board and shall be so positioned as to be visible to the operator and shall be within his reach for re-setting.

7. FRAME AND MOUNTING FOR MIXER AND AGITATOR

7.1 The supporting frame for the mixer and agitator and its components shall be designed for proper mounting and load distribution on the haulage vehicle chassis and shall be of sturdy construction. In the case of front end power take-off, suitable protection shall be provided to the drive mechanism and in the case of truck mixer the front bumper of the truck shall be reinforced accordingly.

8. WATER TANKS AND WATER SYSTEM

8.1 Unless otherwise specified, the transit mixer and agitator shall be furnished with one of the types of water tank described in **8.1.1** to **8.1.3**. Water tanks shall be of corrosion and rust proof construction.

8.1.1 *Flush Water Tank* — Where a flush water tank only is furnished, the total capacity of the tank shall not exceed 115 l/m^3 of the mixer capacity subject to a minimum of 200 litres. The tank shall be equipped with gauge glass on which the marking shall be visible for the entire range.

8.1.2 *Mix and Flush Water Tank* — This shall be a single compartment or a two compartment tank for mix and flush water. The total capacity of the tank may not be more than 250 l/m^3 of mixer capacity. The capacity of mix water compartment shall not be less than 150 l/m^3 of the mixer capacity. The tank shall be equipped with a sight gauge on both the compartments on which the gauge markings shall be visible through the entire range. The mix water compartment shall be equipped with an automatic water measuring device as described in **8.2**. The gauges used in either case shall be of sturdy construction and shall be protected against damage. The system shall be equipped with necessary plumbing to provide for checking of the calibrations.

8.1.3 A water pump or pressurised tank system using air pressure or any other suitable method for delivering water may be furnished which shall be capable of delivering not less than 160 litres of water per minute into the drum. Water for the entire batch when taken only from the truck mixer water system shall be introduced into the batch at the head section of the drum or by dual injection into the head and discharge section of

the drum to ensure rapid and complete dispersal of water throughout the entire batch. A properly supported wash hose with a hand valve operated from ground level, shall be included in the system.

8.2 Water Measurement Devices — In the case of mix water supply system accurate means shall be provided for measuring the amount of water added to the drum. The water measuring devices may be one of the following types:

a) Automatic cut-off syphon type,

b) Water meter of the automatic shut off type, and

c) Sight gauge.

8.2.1 The quantity of water delivered shall not vary from the predetermined quantity by more than ±3 percent of the indicated quantity.

9. CHARGING HOPPER

9.1 The charging hopper of open-end mixer and agitator shall be stationary or swing out type, properly supported in a concentric position with the drum opening. The hopper dimensions shall be adequate so as to pass down all the materials into the drum without spillage under normal working conditions at a minimum rate of at least 4·5 m^3/min.

9.2 Where a purchaser so desires, a drum closure plate arrangement shall be provided to prevent spillage as encountered on a hilly terrain, especially in the case of concrete of higher slump.

10. DISCHARGE CHUTE

10.1 The discharge chute or distributing chute shall be made of abrasion resistant steel and shall be of swing away type with fold-over extensions. The swing out fixture shall prevent the need to remove or replace the chute for direct discharge into high forms, hoppers or buckets. The chute alignment shall be such that the centre-line of the chute plate is at an angle of not less than 40° to the horizontal when in discharge position. Means shall be provided for locking the chute components in position when the mixer is in transit. All attachments shall be on the outside of the chute to ensure smooth flow of concrete.

Optional provision for the distributing chute shall consist of ratchet type or hydraulic chute lift for quicker positioning of the chute.

11. CONTROLS

11.1 The controls for the drum speed in either direction of rotation for its charging and discharging shall be fitted at the front of the mixer unit within the reach of the vehicle operator (*see* Note). All controls shall be

properly labelled indicating the function of each control and the manner in which it is to be operated and shall be of sturdy design and easy to operate.

NOTE — When so required by the purchaser, the control for the drum speed in either direction of rotation for its charging and discharging may be fitted in duplicate, that is, at the rear and the front of the mixer unit, the later being within the reach of the vehicle operator.

12. OTHER ACCESSORIES

12.1 Inspection Hatch — The mixer shall be provided with a hatch not less than 500 cm in diameter in the periphery of the drum and shall be of such design as to permit easy access to the inside of the drum for inspection, cleaning, repair, welding and built up of worn out spots of the drum and the blades. Hatch cover shall be of the quick detachable type and shall have sealing arrangements to prevent leakage. The position of batch shall be such so as to serve an emergency discharge opening to prevent the concrete from setting inside the mixer in the case of engine failure.

12.2 Lifting Attachments — The mixer shall be provided with shackles, eye-hooks or other suitable means to enable its being lifted in its normal position for assembly or dismantling. The attachments shall be so located that when hoisted, adequate clearance exists between lifting slings and all exterior parts of the equipment.

12.3 Safety Guards — Safety guards shall be provided for all hazardous moving parts. Non-skid platforms, steps and railings shall be provided wherever necessary in accordance with relevant safety regulation.

13. LUBRICATION

13.1 Lubrication fittings shall be provided for all moving parts requiring lubrication. Such fittings shall conform to relevant Indian Standards.

14. TOOLS AND OPERATING INSTRUCTIONS

14.1 A strong tool box with lock and key containing the necessary tools for normal running, adjustments and lubrication together with an inventory of the tool shall be provided with each machine. Operation and maintenance instructions and a spare parts list shall also be provided.

15. COMPLIANCE WITH ROAD TRAFFIC ACTS

15.1 The truck type transit mixer and agitator shall comply with relevant provisions of Road Traffic Act and Motor Vehicle Act.

16. MARKING

16.1 Instruction Plates — The mixer and agitator shall be fitted with suitably located instruction plates including warnings and cautions describing any special or important procedures to be followed in operating or servicing the mixer.

16.2 Rating Plate — Each transit mixer or agitator shall have a rating plate attached to a conspicuous part not easily removable. The rating plate shall have clearly marked on it the following information:

a) Manufacturer's name,
b) Machine reference No.,
c) Nominal capacity as a mixer in cubic metres,
d) Nominal capacity as a agitator in cubic metres,
e) Year of manufacture,
f) Total weight of mixer unit;
g) Range of drum rev/min for mixing, and
h) Range of drum rev/min for agitating.

16.3 The transit mixers or agitators 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. Presence of this 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 during production. This system, which is devised and supervised by ISI and operated by the producer, has the further safeguard that the products as actually marketed are continuously checked by ISI for conformity to the standard. 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.

17. MIXING EFFICIENCY

17.1 The mixer shall be tested under normal working conditions in accordance with the method specified in IS:4634-1968* with a view to checking its ability to mix the ingredients to obtain a concrete having uniformity within the prescribed limits. The uniformity of mixed concrete shall be evaluated by finding the percentage variation in quantity (weight in water) of cement, fine aggregate and coarse aggregate in a freshly mixed batch of concrete.

17.1.1 The percentage variation between the quantities of cement, fine aggregates and coarse aggregates (as found by weighing in water) in the two halves of a batch and the average of the two halves of the batch shall not be more than the following limits:

Cement	8 percent
Fine aggregates	6 ,,
Coarse aggregates	5 ,,

*Method for testing performance of batch type concrete mixers.

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Printed at Printograph, New Delhi (INDIA).