भारतीय मानक

Indian Standard

IS 18627 : 2024

टिपिंग बकेट रेन गेज — विशिष्टि

Tipping Bucket Rain Gauges — Specification

ICS 07.060

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Meteorological Instruments Sectional Committee, PGD 21

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Meteorological Instruments Sectional Committee had been approved by the Production and General Engineering Division Council.

A tipping bucket rain gauge uses a tipping balance with two buckets as the measuring element. The balance tips whenever a fixed mass of water (for example, corresponding to 0.2 mm of rain) has been filled into one of the buckets. A tip of the balance removes the filled bucket from the filling nozzle and it is emptied while the second, empty bucket is moved underneath the filling nozzle.

Each tip produces an electrical impulse as signal output and is recorded by the data acquisition system. This mechanism provides a continuous measurement without manual interaction. Rain-fall intensity (RI) can be calculated at best over the period between 2 tips. In other words, for low intensities, the temporal resolution depends on the size of the bucket and the RI. A tip resolution equivalent to 0.2 mm leads to a RI resolution of 12 mm/h over a period of 1 min.

Tipping bucket gauges generally suffer from systematic non-linear and significant measuring errors, strongly dependent on rain-fall rate. Especially with higher intensities, these errors can amount to 20 percent for some tipping bucket gauges.

The composition of the Committee, responsible for the formulation of this standard is given at Annex B.

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 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in the standard.

Indian Standard

TIPPING BUCKET RAIN GAUGES — SPECIFICATION

1 SCOPE

This standard specifies the requirements for tipping bucket rain gauges, herein-after referred to as the 'rain gauges' which generate a pulse signal for every amount of rain-fall of 0.5 mm by using a water receiver for rain-fall of 200 mm in diameter.

2 NOMENCLATURE

Name of the main parts of a rain gauge shall be in accordance with Fig. 1.

3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply:

3.1 Water Receiver — The water receiver consists of mouth piece, shell, filter net (large), funnel, filter net (small), and vent hole. It is the component responsible for receiving rain-water as well as protecting the measuring part.

3.2 Measuring Part — The measuring part consists of a water filter, tipping bucket base plate, bearing, balance weight, tipping stopper pad stone, screw for tipping bucket stopper, drain cylinders, mosquito nets, level vial, basic stand, vent hole, fixing legs, etc, and is the part to measure the amount of rain-water dropped from the water receiver.

4 MATERIALS

The material of each part of the rain gauge shall be as given in Table 1 or that equivalent thereto in quality.

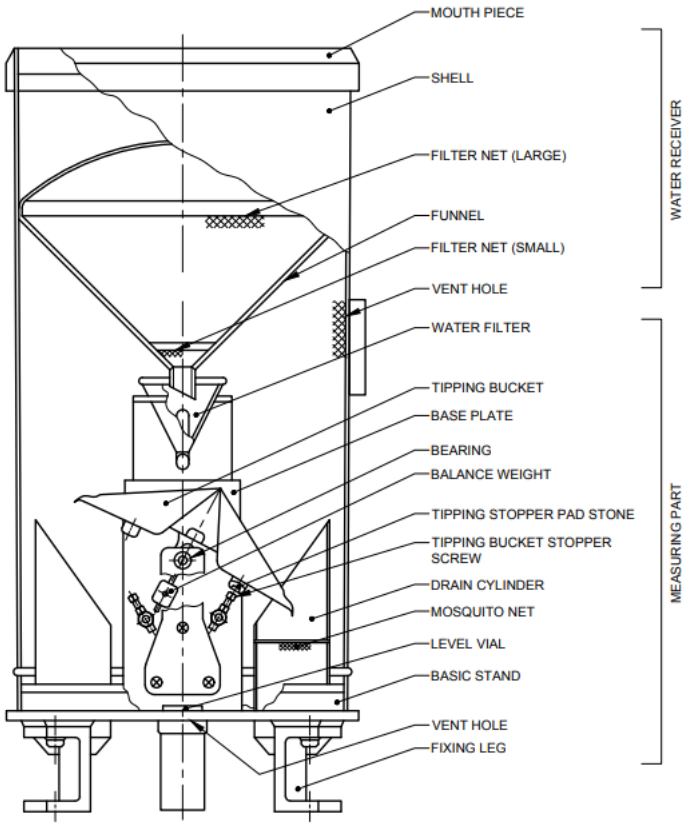


FIG. 1 TYPICAL TIPPING BUCKET RAIN GAUGE

NOTE — This figure only shows name of the parts and does not show the design details.

Table 1 Name of the Parts and the Material to be Used for their Preparation

(*Clause* 4)

Sl No.	Name of Parts	Material
(1)	(2)	(3)
i)	Mouth piece	Brass castings
ii)	Shell	Copper or copper alloy/galvanized steel sheets
iii)	Filter net (large and small)	Copper or copper alloy — sheets, plats, strip and coiled sheets or wires
iv)	Funnel	Copper or copper alloy/galvanized steel sheets
v)	Water filter	Copper and copper alloy — sheets, plates, strip, coiled sheets, seamless pipes and tubes
vi)	Tripping bucket	Copper and copper alloy — sheets, plates, strip and coiled sheets
vii)	Base plate	Copper and copper alloy — sheets, plates, strip and coiled sheets, brass castings, aluminum alloy castings or aluminum alloy die castings
viii)	Balance weight	Copper and copper alloy — rods and bars
ix)	Bearing, tipping stopper pad stone	Agate, sapphire
x)	Corresponding part to pad stone of tipping bucket stopper screw	Stainless steel
xi)	Drain cylinder	Copper and copper alloy — sheets, plates, strip, coiled sheets, seamless pipes and tubes
xii)	Mosquito net	Copper and copper alloy — sheets, plates, strip, coiled sheets and wires
xiii)	Basic stand	Brass castings, aluminum alloy castings or aluminum alloy die castings
xiv)	Fixing leg	Aluminum alloy die castings or aluminum alloy castings, hot rolled mild steel plates, sheets and strip, cold rolled carbon steel sheets and strip

5 CONSTRUCTION AND WORKMANSHIP

5.1 Each part of the water receiver and measuring part shall be rigid and treated with sufficient rust prevention to be endurable to outdoor use for a long period.

5.2 The mouth piece of the water receiver shall be such that when the lower end of the shell is fixed on the basic stand, the upper face of the mouth piece is horizontal.

5.3 The water filter shall be constructed such that the filter receives securely, the rain-water from the funnel attached to the shell. It shall effectively precipitate the fine dust contained in the rain-water for removal and be able to drain the rain-water into the tipping bucket. It shall maintain the water level within the filter at the minimum limit and be detached easily.

5.4 The tipping buckets shall be provided with two buckets (one on the right and the other on the left) and a rotary shaft at the middle lower portion. It shall have a mechanism to actuate the switch of the electrical circuit to count the tipping numbers of the tipping water receiver, ensuring no residual rain-water remains.

5.5 The construction shall be such that the balance of receiving amounts of water from the right and left buckets is adjusted by the tipping bucket stopper screw, and the adjustment of the total amount is carried out by moving the balance weight up and down.

5.6 The drain cylinder shall be of such construction that it drains the rain-water in the tipping buckets securely to the outside and no water rebounds when the tipping bucket tips. It shall be provided with a mosquito net which is easily attached and detached to prevent mosquitoes and splashing of drain water at the lower part of the drain cylinder.

5.7 The purpose of the base plate is to attach the water filter, tipping buckets, rotary shaft, bearing and tipping bucket stopper screw. Its bottom part shall be attached to the basic stand.

5.8 The basic stand shall be of such construction that the drain cylinder and round-level vial can be attached. It shall be provided with the vent hole and the hole for taking out the lead wire, with a mosquito net.

5.9 The fixing legs are used for the installation of the rain gauge. Three fixing legs shall be attached underside of the basic stand, and the under face of the legs be provided with a bolt hole (*see* Fig. 3).

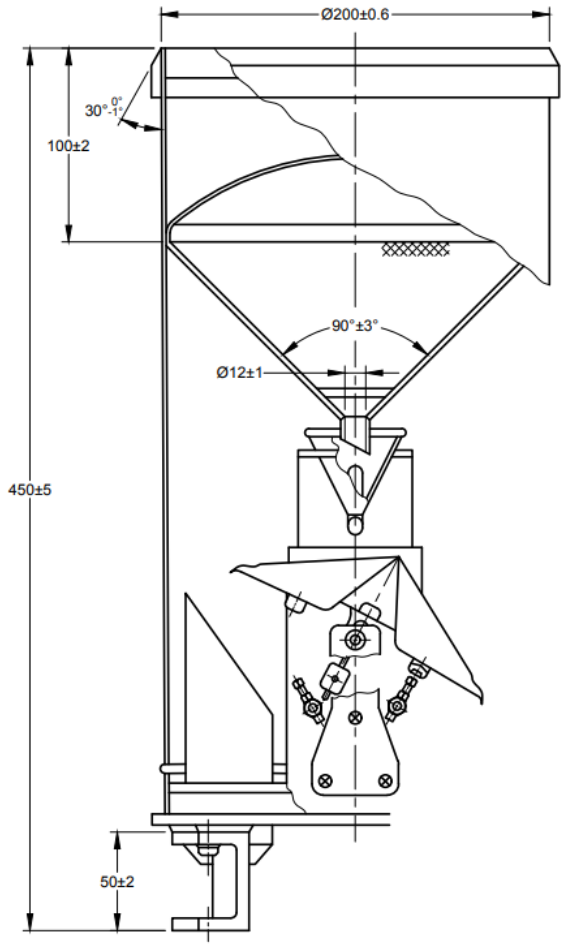
5.10 For the switch of the electrical circuit, the mercury switch or lead switch with the capacity of 3 V and 0.2 A shall be used, and a terminal for fixing lead wires shall be provided. The actuating period of the switch shall be from 0.1 s up to and including 0.2 s, ensuring its secure actuation.

5.11 The gauge shall be fitted with a magnetic reed switch sensor with a life period guarantee of 5 years.

5.12 It shall be able to be used in the operating temperature range from 1 °C to 70 °C

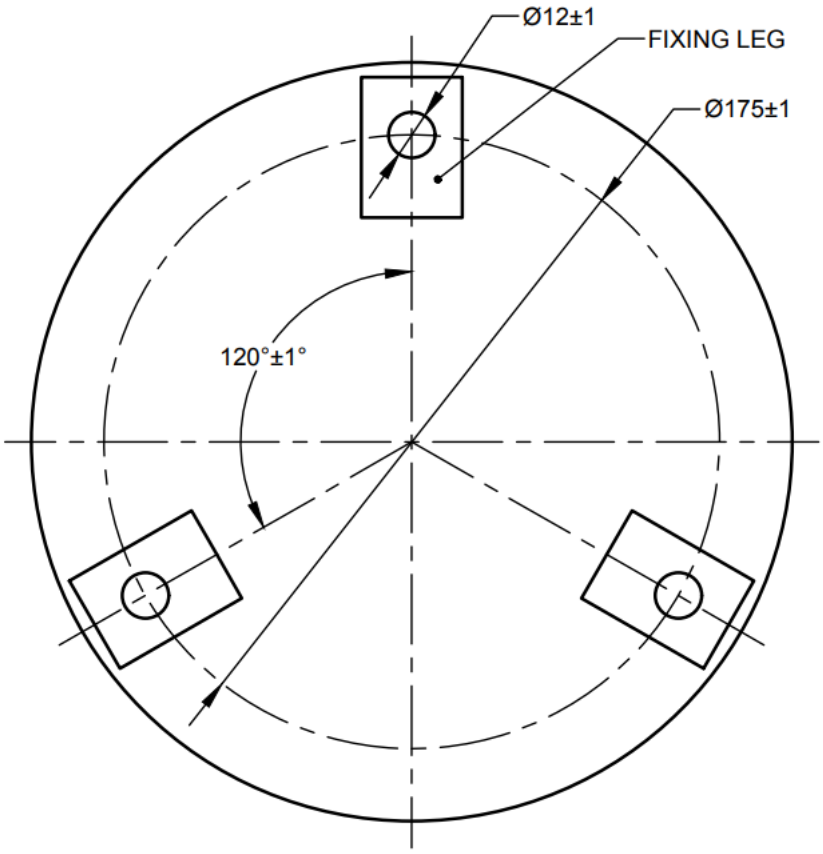
6 DIMENSIONS OF MAIN PARTS

The dimensions of main parts of the rain gauge shall be as shown in Fig. 2 and Fig. 3.



All dimensions in millimetres.

FIG. 2 DIMENSIONS OF MAIN COMPONENTS OF TIPPING BUCKET RAIN GAUGE



All dimensions in millimetres.

FIG. 3 DIMENSIONS OF BASIC STAND OF TIPPING BUCKET RAIN GAUGE

7 PERFORMANCE TEST

The rain gauge when tested as per 8, shall tip when the rain-water received by the water receiver has reached the amount corresponding to rain-fall of 0.5 mm and the amount of rain-fall shall be able to be indicated or recorded on indicator or logger by pulse signals. Furthermore, when the amount of rain-fall has reached 50 mm, the number of tipping of the tipping buckets shall be 100 ± 3.

8 TESTING METHOD

8.1 Detach the water receiver of the rain gauge, and place the measuring part on the test stand so that the upper surface of the basic stand is horizontal, and arrange it such that the water can be dropped to the water filter from the amount of rain-fall testing device made of glass set (*see* Fig. 4).

8.2 Measure the received water amount in the right and left buckets of the tipping buckets using a burette with a scale interval of 0. 2 ml (*see* Fig. 5)

8.3 Connect a contact time measuring apparatus with a switch of electrical circuit for tipping buckets, and measure the actuating period of the switch at the time of tipping of bucket by dropping water from the water filter. Further, examine whether the switch actuates twice or more at one tipping or not.

8.4 Set the dropping speed of water from the amount of rain-fall testing device corresponding to rain-fall of 20 mm/h and 80 mm/h by adjusting the degree of opening of the titration cock at the lower part of the tank or by using a fine tube of adequate size.

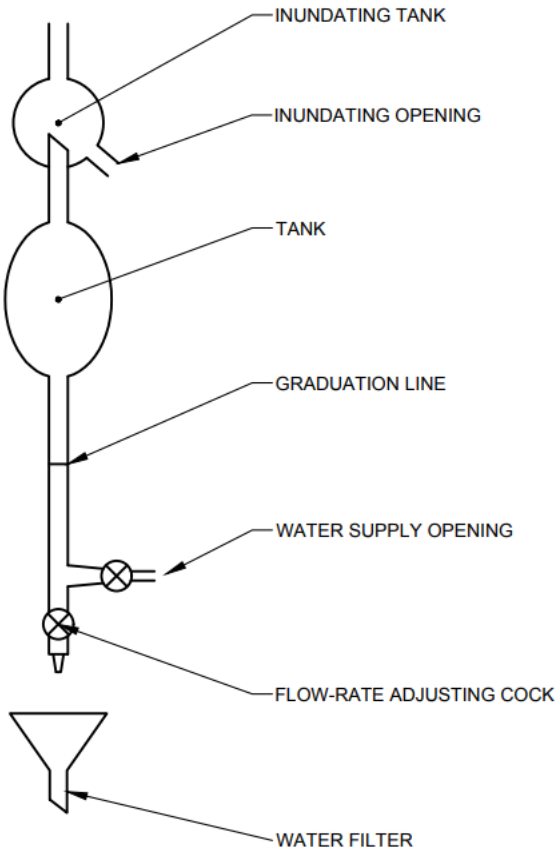


FIG. 4 TYPICAL TESTING DEVICE TO CHECK THE AMOUNT OF RAINFALL

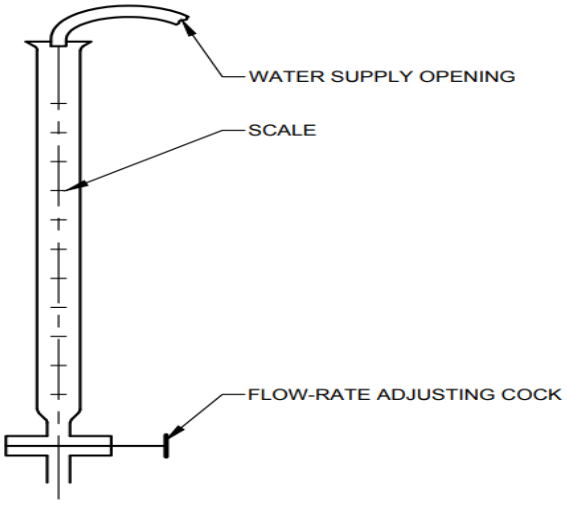


FIG. 5 BURETTE FOR MEASURING THE AMOUNT OF RAIN-FALL

8.5 Connect the counter to the terminal for fixing the lead wires of tipping buckets, drop the water corresponding to the amount of rain-fall of 50 mm from the amount of rain-fall testing device, and measure the tipping number of the tipping bucket.

9 INSPECTION AND ACCURACY REQUIREMENTS

9.1 The inspection of rain gauge shall be carried out on the material, construction and workmanship, dimensions and performances and shall comply with the specifications of 4 to 7.

9.2 The gauge shall conform to the following accuracy requirements:

a) ± 1 percent (0 mm/h to 500 mm/h intensity of rain-fall);

b) ± 1° (tilt);

c) ± 0.25 °C (temperature); and

d) ± 0.5 V (supply voltage).

10 ATTACHMENT AND CAUTIONS ON USE OF RAIN GAUGE

The recommended attachment and cautions on the use of rain gauges are given in Annex A.

11 MARKING

The rain gauge shall be marked on the adequate portion with the following:

a) Amount of rain-fall per one tipping 0.5 mm;

b) Month and year of manufacture; and

c) Manufacturer’s name or its abbreviation.

12 BIS CERTIFICATION MARKING

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

ANNEX A

(*Clause* 10)

ATTACHMENT AND CAUTIONS ON USE OF RAIN GAUGE

A-1 ATTACHMENT

A-1.1 The place of attaching the rain gauge effects on collection of rain-water, therefore care shall be taken on the following items in the selection of place:

a) Where there are buildings, standing trees, other measuring apparatus, etc. in the neighbourhood, the place as distant therefrom, as possible, shall be selected. It is desirable to be distant by four times the height of the interfering substance;

b) The place where the ground surface is flat and the air current is horizontal as far as possible shall be selected, and the concave or convex place or inclined ground surface shall be avoided; and

c) The place where the wind blows up or drifts shall be avoided.

A-1.2 The method of attachment of the rain gauge shall be as follows:

a) It is desirable to carry out the attachment by embedding and fixing the foundation bolts in a concrete foundation. The concrete foundation shall be higher than the ground surface by 5 cm, and the height of mouth piece from the ground surface is adequate to be about 50 cm; and

b) The rain gauge shall be so attached as to be horizontal.

A-2 CAUTIONS ON USE

For use of rain gauge, cautions shall be taken on the following:

a) It is necessary to carry out the check once a month and to make it clean because the dust, sand in the water receiver and water filter, and stains on the inside surface of tipping buckets are causes of measurement error;

b) Tipping bucket stopper screw and balance weight shall not move, because if the tipping bucket stopper screw and balance weight move, the amount of receiving water in the right and left buckets get out of order;

c) It is desirable to drain off the inside water and to cover the mouth piece part with a lid, because the water remaining in the water filter and tipping buckets freezes in winter, it may damage the rain gauge; and

d) For observation in freezing region, it is desirable to use rain gauge treated with freezing prevention.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Meteorological Instruments Sectional Committee, PGD 21

Organization	*Representatives(s)*
India Meteorological Department, Pune	SHRI KS HOSALIKAR (***Chairperson***)
Central Water Commission, New Delhi	SHRI DEEPAK KUMAR SHRI PANKAJ KUMAR (*Alternate*)
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Member Secretary
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SCIENTIST 'B'/ASSISTANT DIRECTOR
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