भारतीय मानक **IS 5793 : 2023**

Indian Standard

निर्द्रव वायुदाबमापी — विशिष्टि

(पहला पुनरीक्षण)

Aneroid Barometers — Specification

(First Revision)

ICS 07.060

भारतीय मानक ब्यूरो
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FOREWORD

This Indian Standard (First Revision) 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.

Barometer is an instrument used for measuring atmospheric pressure. Barometers can be used for the atmospheric reduction of electronically measured distances or as barometric altimeters. Atmospheric pressure is generally measured by means of a mercury or aneroid barometer. Aneroid barometer is an instrument in which atmospheric pressure is balanced by some elastic elements as a method that does not involve liquid.

The greatest advantages of conventional aneroid barometers over mercury barometers are their compactness and portability, which make them particularly convenient for use at sea or in the field. The principal components are a closed metal chamber, completely or partly evacuated, and a strong spring system that prevents the chamber from collapsing under the external atmospheric pressure. At any given pressure, there will be an equilibrium between the force caused by the spring and that of the external pressure. The requirements of mercury barometer are covered in IS 5798.

This standard has been prepared in the interests of standardization of aneroid barometers and the accurate measurement of atmospheric pressure. While revising this standard due consideration has been given to the requirements laid down by the World Meteorological Organization, Geneva, in addition to the special requirements obtained in this country.

This standard was first published in 1970. This revision has been taken up to include the changes with the latest guidelines published in the 'World Meteorological Organisation' Guide (WMO Guide 2018).

The following major changes have been made to this standard:

a) UDC number has been replaced by ICS number on first cover page; and
b) The calibration and maintenance requirements are given as per WMO Guide 2018.

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

For the purpose of deciding whether a particular requirement of this standard complies 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

ANEROID BAROMETERS — SPECIFICATION

(First Revision)

1 SCOPE

This standard specifies the requirements of aneroid barometers suitable for use both on land and on board ships.

2 TYPES

The aneroid barometers are of following two types:

a) Short range, graduated from 850 hPa to 1 050 hPa in units of whole hPa; and

b) Long range, graduated from 400 hPa to 1 050 hPa in units of 2 hPa.

NOTE — 1 hectopascal (hPa) = 1 millibar (mb).

3 CONSTRUCTION

An aneroid barometer consists of a closed metal chamber or capsule completely or partly evacuated and a strong spring system which prevents the chamber from collapsing due to the external atmospheric pressure. The aneroid chamber expands and contracts with the variations of the external pressure and these variations are magnified by a system of levers and indicated by a pointer on a graduated dial. The aneroid barometer is usually compensated for the effect changes in ambient temperature. A screw in the base plate enables the position of the carriage to be adjusted slightly and the zero to be altered. The complete mechanism is housed in a cylindrical brass case with a bevelled glass front. A movable index fitted to the glass face may be set independently of the pointer and is useful in showing changes in pressure (*see* Fig. 1).

4 MATERIAL

4.1 The aneroid element shall be made from steel, beryllium copper or other suitable alloys.

4.2 The spring shall be made of spring steel and the arbour chain from steel.

4.3 The spindles and pivots in the linkage system shall be of silver steel.

4.4 The axle which holds the needle shall revolve in jewel bearings.

4.5 All other parts, unless otherwise specified, shall be of good quality brass.

5 DIMENSIONS

The dimensions of the various components of the aneroid barometer are left to the manufacturer and no rigid dimensional restrictions are indicated, provided the product satisfies all the other requirements prescribed in the specification.

6 GENERAL REQUIREMENTS

6.1 The graduated dial of the aneroid barometer shall have a diameter of not less than 125 mm. Larger diameters giving greater accuracy of reading shall be preferred.

6.2 The aneroid barometer shall have the graduations on the disc either in one circle or two. In the latter case, the design shall be such that the pointer is capable of making two complete revolutions over the dial when it is subjected to the extremes of pressure within its range.

6.3 The aneroid barometer shall be compensated for the effects of temperature such that the temperature errors do not exceed the limits of tolerance given in **8** over the full range of the instrument.

6.4 A zero adjusting screw shall be provided for operation through an orifice located at the back of the case. The screw shall have the capacity to alter the position of the pointer by at least 50 hPa.

6.5 The case shall have an eye bolt fitted to it for suspending the instrument.

6.6 The material of the aneroid barometer capsule and the spring shall be subjected to suitable treatment such that the secular change of the instrument defined as the gradual change in the error

which goes on constantly irrespective of the current changes due to its immediate pressure and temperature history, is minimum.

6.7 A moveable index shall be fixed to the glass plate on top. It shall carry a short-knurled head to enable it to be set by hand at any desired position on the dial. The free movement of the pointer, however, shall not be obstructed by the index.

7 WORKMANSHIP AND FINISH

7.1 The outer brass case shall be well-polished and gold lacquered.

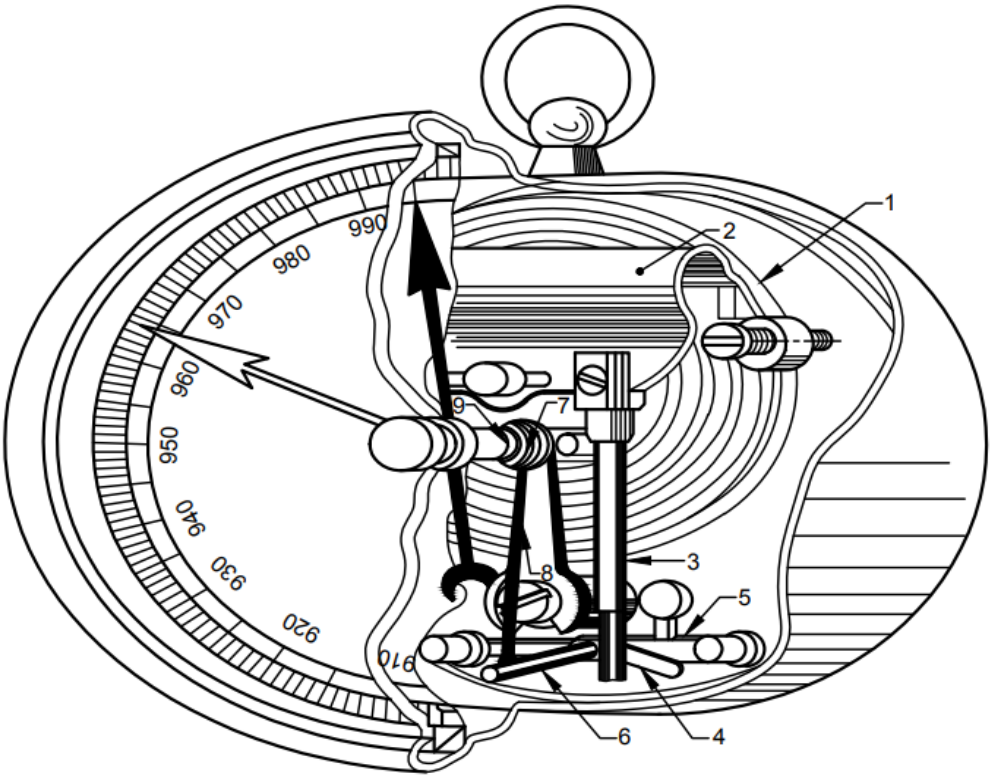
7.2 The dial shall be matte white and the graduations shall be fine black lines of uniform thickness and depth throughout.

7.3 The pivots and bearings shall be well-polished and smoothened to minimize friction. The pivots and spindles shall be in correct alignment and lubricated very lightly.

7.4 The surface of the aneroid barometer capsule shall be nickel plated and bright finished.

7.5 The complete mechanism shall be sturdy and be capable of withstanding ordinary transit risks without introducing inaccuracies outside the limits given in **8**.

7.6 The pointer needle shall be well-balanced.



1) Vacuum chamber
2) Spring
3) Arm
4) Connecting link
5) Rocking bar
6) Projecting arm
7) Hairspring
8) Arbor chain
9) Pulley

FIG. 1 ANEROID BAROMETER

8 ACCURACY

8.1 The aneroid barometer shall be so compensated for temperature that the reading does not change more than 0.03 hPa for a change of temperature of 30 °C.

8.2 When tested in a suitably designed and operated vacuum chamber against a standard barometer whose errors are known and allowed for, the scale errors at any point shall not exceed 0.03 hPa. The scale errors shall remain within these limits over periods of at least a year when in normal use.

8.3 The hysteresis shall be sufficiently small to ensure that the differences in reading before a change of pressure of 50 hPa and after return to the original value does not exceed 0.03 hPa.

8.4 The positional error of the instrument, that is, the difference in reading in the vertical and horizontal positions shall not be greater than 0.003 hPa. It should be capable of withstanding ordinary transit risks without introducing inaccuracies beyond the limits specified above.

8.5 Recommendations for accuracy of readings as per WMO Guide 2018 are given in Annex A.

9 TESTING AND INSPECTION

Each barometer shall be tested individually for conformity to all the requirements of this specification.

10 MARKING

10.1 All aneroid barometers shall have engraved on their dials the name of the units in which the barometer indicates the pressure, for example 'hectopascal (hPa)'. The name of the instrument 'Aneroid Barometer' and the serial number and year of manufacture, for example, No. 123/2023, shall also be engraved on the dial.

10.2 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 products may be marked with the Standard Mark.

11 PACKING

Each aneroid barometer shall be provided with a leather carrying case with a strap or a suitable wooden box. In either case, the inside shall have a suitable soft lining to protect the glass cover from damage and provide some degree of cushioning against shocks to the mechanism.

ANNEX A

(*Clause* 8.5)

RECOMMENDATION FOR ACCURACY OF READINGS

A-1 READING ANEROID BAROMETERS

A-1.1 Accuracy of Readings

An aneroid barometer should always be read in the same orientation (vertical or horizontal) as during calibration. It should be tapped lightly before being read. As far as possible, it should be read to the nearest 0.1 hPa. Optical and digital devices are available for improving the reading accuracy and reducing the errors caused by mechanical levers.

A-1.2 Corrections Applied to Aneroid Barometers

In general, aneroid barometers should be set to read the pressure at the level of the instrument. On board a ship or at low-lying land stations, however, the instrument may be set to indicate the pressure at mean sea level, provided that the difference between the station pressure and the sea level pressure can be regarded as constant. The readings should be corrected for instrumental errors, but the instrument is usually assumed to be sufficiently compensated for temperature, and it needs no correction for gravity.

A-1.3 Errors and Faults with Aneroid Barometers

A-1.3.1 *Incomplete Compensation for Temperature*

In an aneroid barometer, if the spring is weakened by an increase in temperature, the pressure indicated by the instrument will be too high. This effect is generally compensated for in one of the following ways:

a) by means of a bimetallic link in the lever system; or
b) by leaving a certain amount of gas inside the aneroid chamber.

A-1.3.2 In most ordinary aneroid barometers, the compensation obtained by these methods is complete only at one particular compensation pressure. It is desirable that all aneroid barometers and barographs used at meteorological stations should be properly compensated for temperatures over the full range of pressure. In digital read-out systems suitable for automation, such complete corrections can be applied as part of the electronic system.

A-1.4 Elasticity Errors

A-1.4.1 An aneroid barometer may be subjected to a large and rapid change in pressure. For example, a strong gust of wind would cause an aneroid barometer to experience a rapid increase in pressure followed by a more gradual return to the original value. In such circumstances, the instrument will, owing to hysteresis, indicate a slightly different reading from the true pressure; a considerable time may elapse before this difference becomes negligible. However, since aneroid and barographs at surface stations are not usually directly exposed to such pressure changes, their hysteresis errors are not excessive.

A-1.4.2 There is also a secular error caused by slow changes in the metal of the aneroid barometer capsule. This effect can be allowed for only by comparison at regular intervals, for example, annually, with a standard barometer. A good aneroid barometer should retain an accuracy of 0.1 hPa over a period of one year or more. In order to detect departures from this accuracy by individual barometers, a regular inspection procedure with calibration and adjustment as necessary should be instituted.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Meteorological Instruments Sectional Committee, PGD 21

Organization	*Representatives(s)*
India Meteorological Department, Pune	SHRI K. S. HOSALIKAR **(*Chairperson*)**
Central Water Commission, New Delhi	SHRI DEEPAK KUMAR SHRI PANKAJ KUMAR (*Alternate*)
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Member Secretary
SHRI ASHUTOSH RAI
SCIENTIST 'B'/ASSISTANT DIRECTOR
(PRODUCTION AND GENERAL ENGINEERING), BIS

Bureau of Indian Standards

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Review of Indian Standards

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