इंटरनेट मानक

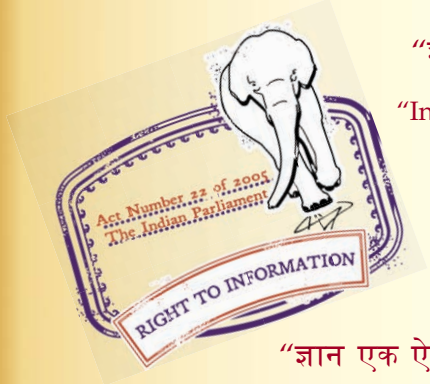
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 2442 (1963): DC Moving Coil Galvanometers [ETD 12: Measuring Equipment for Basic Electrical Quantities]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

IS: 2442 - 1963

Indian Standard

SPECIFICATION FOR DC MOVING COIL GALVANOMETERS

(Third Reprint OCTOBER 1989)

UDC 621.317.715

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

Gr 2 ***September* 1963**

Indian Standard

SPECIFICATION FOR DC MOVING COIL GALVANOMETERS

Electrical Instruments and Meters Sectional Committee, **ETDC 6**

Chairman	*Representing*
PROF. H. N. RAMACHANDRA RAO	Indian Institute of Science, Bangalore
Members	
ADDITIONAL CHIEF ENGINEER, P&T, JABALPUR	Directorate General of Posts & Telegraphs (Ministry of Transport & Communications)
DIRECTOR OF TELEGRAPHS (L) (*Alternate*)	
DIVISIONAL ENGINEER TELEGRAPHS (P) (*Alternate*)	
SHRI N. M. ATHAVALE	Bajaj Electricals Ltd., Poona
SHRI A. N. ATHAVALE (*Alternate*)	
SHRI N. BALASUNDARAM	Eastern Electronics, Faridabad
SHRI S. K. BASU	Voltas Ltd., Bombay
SHRI S. RANGASWAMY (*Alternate*)	
SHRI A. N. BHARGAVA	Electricity Department, Government of Uttar Pradesh
SHRI R. S. GARG (*Alterrnate*)	
SHRI M. G. BHAT	Automatic Electric Private Ltd., Bombay
SHRI C. K. CHANDRAN	Central Water & Power Commission (Power Wing)
SHRI V. R. NARASIMHAN (*Alternate*)	
SHRI J. DASS	Meter Manufacturers' Association of India, Bangalore
SHRI JOSEPH LOPEZ (*Alternate*)	
MR. V. C. EAGLETON	The General Electric Co. of India (Private) Ltd., Calcutta
MR. A. L. MACKENZIE (*Alternate*)	
EXECUTIVE ENGINEER	Delhi Electric Supply Undertaking, New Delhi
SHRI A. K. GHOSE	The Calcutta Electric Supply Corporation Ltd., Calcutta
PROF. C. S. GHOSH	University of Roorkee, Roorkee
SHRI D. T. GURSAHANI	Inspection Wing, Directorate General of Supplies & Disposals (Ministry of Economic & Defence Co-ordination)
SHRI P. L. KAPOOR (*Alternate*)	
WG CDR D. J. LAWYER	Directorate of Technical Development & Production (Air) (Ministry of Defence)
SQN LDR S. B. PURANIK (*Alternate*)	
DR. K. N. MATHUR	Central Scientific Instruments Organization (CSIR), New Delhi
SHRI S. K. SHRI (*Alternate*)	
SHRI K. MARIHAN	The Bombay Electric Supply & Transport Undertaking, Bombay
SHRI P. J. DAMANY (*Alternate*)	
SHRI S. K. MOHILE	Crompton Parkinson (Works) Ltd., Bombay
SHRI S. N. MUKERJI	Government Test House, Calcutta
SHRI B. K. MUKHERJEE (*Alternate*)	

(*Continued on page* 2)

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

(*Continued from page* 1)

Members	*Representing*
SHRI H K. RAMASWAMY	Federation of Electricity Undertakings of India, Bombay
SHRI T. S. RAO	In personal capacity (*Jayanagar, Bangalore*)
SHRI T. RAVINDRANATHAN	Electronics Research and Development Establishment (Ministry of Defence), Bangalore
SHRI D. N. GROVER (*Alternate*)	
SHRI B. N. SEN GUPTA	Electricity Department, Government of West Bengal
SHRI R. K. TANDAN	National Physical Laboratory (CSIR), New Delhi
DR. G. R. TOSHNIWAL	All India Instrument Manufacturers' & Dealers' Association, Bombay
SHRI H. S. VISWESWARIAH	Radio & Electricals Manufacturing Co. Ltd., Bangalore
SHRI Y. S. VENKATESWARAN, Deputy Director (Electrotechnical)	Director, ISI (*Ex. officio Member*)

Secretary

SHRI K. K. TANEJA

Extra Assistant Director (Electrotechnical), ISI

Instruments Subcommittee, ETDC 6 : 2

Convener

SHRI N. M. ATHAVALE	Bajaj Electncals Ltd., Poona

Members

SHRI N BALASUNDARAM	Eastern Electronics, Faridabad
DR. G. N. BHATTACHARYA	University College of Technology, Calcutta
PROF. C. S. GHOSH	University of Roorkee, Roorkee
SHRI N. L. GUPTA	All India Instrument Manufacturers' & Dealers' Association, Bombay
PROF. P. N. DUA *(Alternate)*	
SHRI D. T. GURSAHANI	Inspection Wing, Directorate General of Supplies & Disposals (Ministry of Economic & Defence Co-ordination)
SHRI P. L. KAPOOR (*Alternate*)	
SHRI K. MATTHAN	The Bombay Electric Supply & Transport Undertaking, Bombay
SHRI P. J. DAMANY (*Alternate*)	
COL K. K. MEHTA	Chief Inspectorate of Electronics (Ministry of Defence), Bangalore
CAPT C. D. MALANEY (*Alternate*)	
SHRI S. K. MOHILE	Crompton Parkinson (Works) Ltd., Bombay
SHRI B. K. MUKHERJEE	Government Test House, Calcutta
SQN LDR S. B. PURANIK	Directorate of Technical Development & Production (Air) (Ministry of Defence)
PROF. H. N. RAMACHANDRA RAO	Indian Institute of Science, Bangalore
SHRI T. S. RAO	In personal capacity (*Jayanagar, Bangalore*)
SHRI R. K. TANDAN	National Physical Laboratory (CSIR), New Delh
SHRI MADAN G. TOSHNIWAL	Toshniwal Bros. Private Ltd., Ajmer
SHRI H. S. VISWESWARIAH	Radio & Electricals Manufacturing Co. Ltd., Bangalore
SHRI V. R. CHANDER (*Alternate*)	

Indian Standard

SPECIFICATION FOR DC MOVING COIL GALVANOMETERS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 8 July 1963, after the draft finalized by the Electrical Instruments and Meters Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Galvanometers with widely differing characteristics are required for many types of applications requiring indication of very small current, voltage or charge. DC moving coil galvanometers are used both as null indicators and as deflectional instruments. Due to their application in many holds and the likelihood of considerable demand for them, this standard has been prepared to assist the indigenous manufacturers in achieving the required quality of the product.

0.3 Galvanometers may be of pivoted or suspended types, with a mechanical or optical pointer system. Basically a galvanometer works on the same principle as a DC moving coil instrument but in the former the scales are only marked in convenient divisions and not in any electrical quantity, the important requirement being the sensitivity rather than long-term stability of readings. The requirements for the galvanometers are, therefore, quite different from those for the indicating instruments mentioned above.

0.4 The introduction of climatic tests for DC moving coil galvanometers is receiving attention and it might be possible to include them at a later date if the results of the investigations being carried out so indicate.

0.5 Wherever a reference to any Indian Standard appears in this specification, it shall be taken as a reference to the latest version of the standard.

0.6 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, 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.

0.7 This standard is chiefly intended to cover the technical provisions relating to the DC moving coil galvanometers, and it does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This standard gives the definitions of terms, requirements and tests for DC moving coil galvanometers. Both pivoted and suspended types of galvanometers with either mechanical or optical pointer systems are covered.

1.2 This standard does not cover differential galvanometers.

2. TERMINOLOGY

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

2.1 Galvanometer — An instrument intended for measuring or detecting currents that are usually very small.

2.1.1 *Moving Coil Galvanometer* — A galvanometer in which the moving element, comprising a coil, moves in a constant magnetic field when a current flows through it.

2.1.2 *Differential Galvanometer* — A galvanometer designed to measure the difference of two currents.

2.1.3 *Pivoted Galvanometer* — A galvanometer in which the moving element is supported on pivot or pivots which are held in suitable bearings or jewels.

2.1.4 *Suspended Galvanometer* — A galvanometer in which the moving element is suitably suspended.

2.1.5 *Mechanical Pointer* — A needle like device attached to the moving element and moving over a scale to indicate the movement of the element.

2.1.6 *Optical Pointer* — An optical device a component of which (generally a mirror) is attached to the moving element so that its movement is indicated by a spot of light moving over a scale.

2.2 Sensitivity (or Factor of Merit) — The magnitude of the deflection produced by a given change in quantity measured.

NOTE 1 — The sensitivity of a galvanometer is referred to as the quantity required for causing deflection of one millimetre. In the case of separate scale type galvanometer, the sensitivity is measured with a scale at a distance of one metre from the galvanometer.

NOTE 2 — The following kinds of sensitivities may be distinguished:

a) *Current Sensitivity* — This is the current required to give the deflection of one millimetre. All other expressions of galvanometer sensitivity are derived from the current sensitivity.

b) *Megohm Sensitivity* — This expresses the resistance in megohms which shall be in series with a galvanometer in order that an impressed e.m.f. of one volt shall produce deflection of one millimetre. Neglecting the resistance of galvanometer coil itself, the number representing the megohm sensitivity is the reciprocal of the number representing the current sensitivity.

c) *Voltage Sensitivity* — This is the voltage that shall be impressed in the circuit made up of a galvanometer coil and the external critical damping resistance in order to produce the deflection of one millimetre. The voltage sensitivity equals the product of the current sensitivity and the total circuit resistance.

d) *Ballistic Sensitivity* — This is the quantity of electricity that shall be discharged through the galvanometer in order to produce the deflection of one millimetre. When critically damped the sensitivity of a ballistic galvanometer is about a third of its undamped sensitivity.

2.3 Resistance of Galvanometer — The resistance of the coil and the control springs or suspensions as measured at the galvanometer terminals.

2.4 Period — The time for one complete undamped oscillation of the moving coil.

2.5 Critical Damping — The least value of damping necessary to prevent oscillation.

NOTE — In practice the galvanometer is used in a slightly underdamped condition.

2.6 Zero Shift — The change in the rest position of the pointer from the zero position before and after a deflection.

NOTE — The zero shift may be due to the hysteresis in suspension or change in the residual magnetization of the moving element.

2.7 Dead Beat Galvanometer — A galvanometer which is so damped that the oscillatory motion of its moving part rapidly dies away.

2.8 Magnetic Shunt — An adjustable piece of magnetic material (soft iron) used to shunt the magnetic field of the permanent magnet thereby varying the strength of the magnetic field in which the coil moves.

2.9 Electrical Shunt — A resistor connected in parallel with the galvanometer in order to reduce the amount of current passing through the galvanometer coil.

2.10 Critical Damping Resistance — The resistance of the circuit of the galvanometer corresponding with critical damping condition.

2.11 Type Tests — Tests carried out to prove conformity with the requirements of this specification. These are intended to prove the general qualities and design of a given type of galvanometer.

2.12 Routine Tests — Tests carried out on each galvanometer to check requirements likely to vary during production.

3. GENERAL REQUIREMENTS

3.1 The galvanometer shall be constructed out of materials suitable for each purpose or use.

3.2 The permanent magnets shall have high coercivity with the required flux density.

3.3 The resistance wires used shall be suitable from the point of view of temperature co-efficient, thermal e.m.f. to copper, and resistivity.

4. WORKMANSHIP AND FINISH

4.1 All parts liable to rust or corrosion shall be given a suitable corrosion preventive finish.

4.2 Magnets shall be well aged.

4.3 Paint, lacquering or any other surface finish shall be hard and smooth so that clearing of accumulated dust shall be facilitated.

4.4 Spring washers and lock nuts or similar devices shall preferably be used for fixing binding posts to ensure that they do not become loose in use.

4.5 A device to lock the moving element in position during shifting or transport shall be provided in suspended type of galvanometers.

4.6 Suspended type of galvanometers shall have levelling device to enable it to be adjusted to have the moving system in a freely hanging condition.

4.7 The galvanometer case shall be so made as to prevent to ingress of dust and other particles.

4.8 Soldering and brazing shall preferably be done with non-corrosive flux. When corrosive flux is used it shall be completely removed. Soldered joints shall present smooth and continuous appearance. All excess solder and flux shall be removed.

4.9 A zero adjustment accessible from outside shall be provided.

5. INFORMATION TO BE SUPPLIED

5.1 The following information shall be supplied with the galvanometer:

a) Galvanometer resistance,

b) Periodic time,

c) Sensitivity, and

d) Critical damping resistance.

AMENDMENT NO. 1 NOVEMBER 1980

TO

IS:2442-1963 SPECIFICATION FOR

DC MOVING COIL GALVANOMETERS

Alterations

(Page 6, clause 4.5) - Substitute the following for the existing clause:

'4.5 A device to lock the moving element in position during shifting or transport shall be provided in freely suspended type of galvanometers. For the freely suspended types there should be a limit stop beyond which the suspension cannot move.'

(Page 6, clause 4.6, line 1) - Substitute 'Freely suspended type' for 'Suspended type'.

Addendum

(Page 6, clause 4.9) - Add the following new clause after 4.9:

'4.10 A convenient arrangement for shorting the terminals, when the galvanometer is not in use, should be provided.'

(ETDC 48)

Reprography Unit, BIS, New Delhi, India

6. MARKING

6.1 The galvanometers shall be marked with the following:

a) Name of manufacture, or his trade-mark,

b) Country of manufacture,

c) Manufacturer's serial number and type,

d) Nominal coil resistance, and

e) Indication of current type (DC or AC).

6.1.1 The galvanometers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certilication 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 Certilication Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. TESTS

7.0 General — The tests given in **7.1.3, 7.1.4, 7.1.5, 7.1.6** and **7.1.7** shall be carried out at 27°C (*see* *IS: 196-1950 Atmospheric Conditions for Testing).

7.1 Type Tests

7.1.1 *Insulation Resistance Test* — When the moving system is insulated from the body of the galvanometer, the insulation resistance between the two terminals connected together and the metallic body or case when measured at 500 V DC after one minute of electrification shall be not less than 100 megohms.

7.1.2 *High Voltage Test* — When the moving system is insulated from the body of the galvanometer, no breakdown, arcing or sparking shall occur when 1 000 V RMS are applied across the two terminals connected together and the metallic body or case for a period of one minute.

7.1.3 *Sensitivity Test* — The sensitivity of the galvanometer when new as measured at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and † full scale deflections on both side of centre zero on the scale shall not differ by more than 5 percent of the stated value and shall not differ among themselves by more than 2 percent of the stated value.

*Under revision.

†The full scale deflection in the case of lamp and scale galvanometer shall be 10° from either side of zero.

7.1.4 *Periodic Time Test* — The measured periodic time of a galvanometer when new shall not differ from the stated value by more than 5 percent.

7.1.5 *Zero Shift Test (for Suspended Type Galvanometer Only)* — The zero position of the pointer shall he noted and the galvanometer given a *full scale deflection on one side of zero. The cause of deflection shall be removed and the zero position noted again. The galvanometer shall then be redeflected to *full scale in the opposite direction and reading repeated. The shift of the zero position of the pointer from the original position shall not exceed 2 percent of *full scale reading in either direction.

7.1.6 *Needle Balance Test (for Pivoted Type Galvanometer Only)* — The departure from zero due to want of balance shall not exceed 2 percent of the *full scale reading when the galvanometer is moved in any direction within an angle of 45 from the normal position of use.

7.1.7 *Test for Optical System (for Galvanometer with Optical Pointer)* — The component or components used in the galvanometer for use as optical pointer shall be capable of giving a clear and well defined pointer line whose thickness is not more than 1/10 of the distance of one smallest division on the scale when tested using the associated lamp, scale, etc.

7.2 Routine Tests

7.2.1 The tests mentioned in **7.1.1, 7.1.3, 7.1.6** and **7.1.7** shall be carried out as routine tests.

*The full scale deflection in the case of lamp and scale galvanometers shall be 10° from either side of zero.

BUREAU OF INDIAN STANDARDS

***Headquarters*:**

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 331 01 31, 331 13 75 **Telegrams: Manaksanstha (Common to all Offices)**

Regional Offices:	*Telephone*
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	331 01 31 331 13 75
*Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	36 24 99
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	2 18 43 3 16 41
Southern : C. I. T. Campus. MADRAS 600113	41 24 42 41 25 19 41 29 16
†Western : Manakalaya. E9 MIDC, Marol, Andheri (East), BOMBAY 400093	6 32 92 95

Branch Offices:

'Pushpak', Nurmohamed Shaikh Marg, Khanpur. AHMADABAD 380001	2 63 48 2 63 49
‡Peenya Industrial Area 1st Stage, Bangalore Tumkur Road BANGALORE 560058	38 49 55
Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, BHOPAL 462003	38 49 56 6 67 16
Plot No. 82/83. Lewis Road, BHUBANESHWAR 751002	5 36 27
53/5. Ward No 29, R.G. Barua Road, 5th Byelane, GUWAHATI 781003	3 31 77
5-8-56C L. N. Gupta Marg (Nampallv Station Road), HYDERABAD 500001	23 1083
R14 Yudhister Marg, C Scheme, JAIPUR 302005	6 34 71 6 98 32
117/418 B Sarvodaya Nagar, KANPUR 208005	21 68 76 21 82 92
Patliputra Industrial Estate, PATNA 800013	6 23 05
T.C. No. 14/1421. University P.O.. Palayam TRIVANDRUM 695035	6 21 04 6 21 17

Inspection Offices (With Sale Point):

Pushpanjali, First Floor, 205-A West High Court Road, Shankar Nagar Square, NAGPUR 440010	2 51 71
Institution of Engineers (India) Building, .1332 Shivaji Nagar, PUNE 411005	5 24 35

*Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street. Calcutta 700072 — 27 68 00

†Sales Office in Bombay is at Novelty Chambers, Grant Road. Bombay 400007 — 89 66 28

‡Sales Office in Bangalore is at Unity Building, Narasimharaja Square. Bangalore 560002 — 22 36 71

Reprography Unit, BIS, New Delhi, India