भारतीय मानक

कंक्रीट और चिनाई वाले बाँधों में विरुपण मापन युक्तियों के संस्थापन, रख-रखाव और प्रेक्षण की मार्गदर्शिका

भाग 1 रोधी किस्म के जोड़मीटर

(पहला पुनरीक्षण)

Indian Standard

INSTALLATION, MAINTENANCE AND OBSERVATION OF DEFORMATION MEASURING DEVICES IN CONCRETE AND MASONRY DAMS — GUIDELINES

PART 1 RESISTANCE TYPE JOINTMETERS

(First Revision)

ICS 93.160

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

April 2003 **Price Group 6**

Hydraulic Structures Instrumentation Sectional Committee, WRD 16

FOREWORD

This Indian Standard (Part 1) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Hydraulic Structures Instrumentation Sectional Committee had been approved by the Water Resources Division Council.

To minimize cracking, large straight gravity and arch gravity dams are made in blocks, separated from each other by transverse and longitudinal contraction joints. To restore the dam to its monolithic state for integrated behaviour, contraction joints are grouted with cement grout. Grouting of joints is done when the joints have opened to maximum. Measurement of joints movement during grouting operation will indicate how much grout should be pumped into the joints.

Measurements of joint movements subsequent to the completion of the grouting of contraction joints, provides information regarding the behaviour of the grouted joints.

Surface measurements and joint movements will be useful for watching shearing movement of joints. These measurements can be done with mechanical strain gauges applied to gauge inserts. However, full reliance cannot be placed on the surface measurements as all parts of joints do not open at the same time and not even the same amount. Internal joint movement may, therefore, also need to be measured. Vibrating wires type jointmeters for measurement of joint movement at the surface and in the interior of concrete and masonry dams are being separately covered.

This standard has been published in two parts. Part 2 of the standard covers foundation deformation measuring devices.

This standard was first published in 1982. This first revision is being taken up to incorporate the knowledge gained during the use of the standard. In this revision reference clause has been added and some addition has been made in the method of installation of resistance type jointmeter.

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

Indian Standard

INSTALLATION, MAINTENANCE AND OBSERVATION OF DEFORMATION MEASURING DEVICES IN CONCRETE AND MASONRY DAMS — GUIDELINES

PART 1 RESISTANCE TYPE JOINTMETERS

(First Revision)

1 SCOPE

This standard (Part 1) covers the details of installation, maintenance and observation of resistance type jointmeters of the embedded type for measurement of joint movements at the surface and in the interior of concrete and masonry dams.

2 REFERENCES

The following standards contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
6524 : 1972	Code of practice for installation and observation of instruments for temperature measurement inside dams; resistance type thermometers
10334 : 1982	Code of practice for selection, splicing, installation and providing protection to the open ends of cables used for connecting resistance type measuring devices in concrete and masonry dams

3 MEASUREMENTS OF JOINT MOVEMENTS OF SURFACE BY DETACHABLE GAUGES

3.1 Principle and Construction

Measurements of joint movements at surface or at the locations accessible from galleries are made by detachable gauges.

3.1.1 *Whittemore Type Gauge*

The gauge is a self-contained instrument consisting essentially of two frame members bounded together by two elastic hinges for parallel frictionless motion. One 450 conical contact point is attached to each member. For taking measurements the conical points are inserted into the inserts fixed in the drilled holes defining a predetermined gauge length. The essential features of the instrument are shown in Fig. 1A.

NOTE — The gauge is available in two gauge lengths (254 mm and 508 mm) and appropriate gauge suitable for the given situation should be used.

3.1.2 *Inserts*

Inserts may be made of mild steel or stainless steel, but stainless steel inserts are recommended though they may be expensive. The mild steel inserts also last well without rusting, if due care is taken, such as cleaning and greasing. Inserts of nylon or any other suitable material may also be used. The insert shall have conical depressions at the centre for providing line of contact with the conical points and a typical insert is shown in Fig. 1B.

3.1.2.1 The inserts are placed in such a position as to indicate opening and closing movements of the joint and any sliding movement of the adjacent block.

NOTE — Adequate protective covers over each installation of inserts may be provided to guard against damage due to misuse.

3.2 Number, Location and Layout

The inserts should be installed on the surface at points corresponding to the locations of jointmeters inside the dam. These should also be fixed inside galleries across joints, where these are accessible and at points corresponding to the jointmeter locations.

3.2.1 Where surface cracks are present and are considered capable of influencing the structural integrity of the dam, inserts shall also be placed across such cracks for observation of crack behaviour under imposed loadings.

3.2.2 The arrangement for fixing the inserts across the joint is shown in Fig. 1 C and 1 D. The arrangement shown in Fig. 1 C is preferable as it gives the width of opening simply by the difference in readings.

3.3 Method of Installation

After the concrete is well set, holes should be drilled carefully at specified locations. The holes shall be cleaned of all loose material. The insert shall then be placed in the holes and aligned so as to be normal to the surface of concrete in which it is being fixed. The space around the insert shall be backfilled with expansive mortar. Suitable gauges shall be used in aligning the axes of inserts and in getting the gauge length accurately.

3.4 Observations

The inserts shall be well cleaned for taking the readings so that the instrument pins are placed in exactly the same position. The detachable gauge shall be placed into the inserts and the readings on the dial gauge shall be observed. In order to correct the detachable gauges for the effect of temperature variations, readings of the gauge shall be taken on a standard unstressed invar bar placed in the immediate vicinity of observation station.

3.4.1 A proforma for the record of observations is given in Annex A.

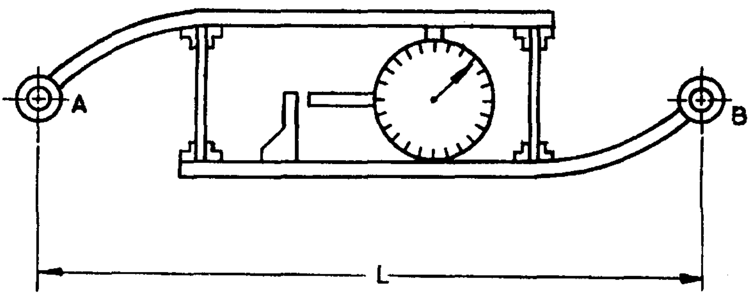
3.5 Analysis of Data

Analysis of observed data in case of the instrument not compensated for temperature correction is made as under:

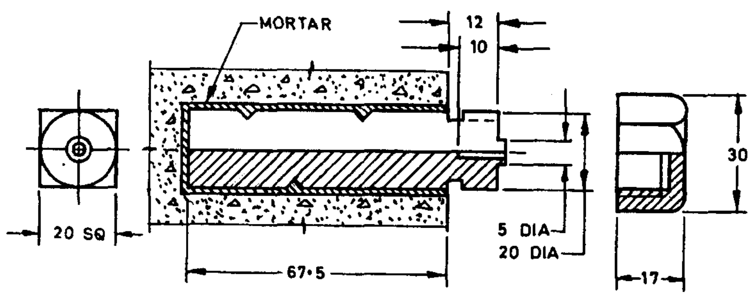
If readings at time t_1 are ρ_1 and i_1 for the concrete and invar and for time t_2 are ρ_2 and i_2, the variation in the joint opening is given by:

$$\Delta x = \left(\rho_2 - \rho_1\right) - \left(i_2 - i_1\right)$$

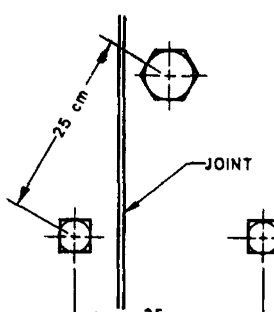
In the case of arrangement of inserts shown in Fig. 1 D, measurements are made to determine the distances A_1, B_1 and C_1.



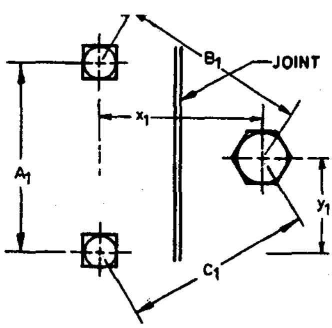
1A Schematic View of Whittemore Type Gauge



1B Whittemore and Marion Gauge Inserts



1C Position of the Gauge Inserts Relative to the Joints



1D Position of the Gauge Inserts Relative to the Joints

All dimensions in millimetres.

FIG. 1 INSTRUMENTS FOR MEASUREMENTS OF JOINT MOVEMENTS AT SURFACE

The horizontal distance x_1 at time t_1 is obtained from the equation:

$$x_1 = \sqrt{C_1^2 - \gamma_1^2}$$

and vertical distance

$$\gamma_1 = \frac{A_1^2 - B_1^2 + C_1^2}{2A_1}$$

where, at time t_1

A_1 = measured distance between inserts on line parallel to joint plane,

B_1 = distance between upper two inserts across the joint, and

C_1 = distance between lower two inserts across the joint.

Similarly x_2 and y_2 at time t_2 are calculated. Between times t_1 and t_2, the horizontal movement of the joint is $x_2 - x_1$ and slide movement is $y_2 - y_1$.

3.6 Source of Error

Seating the gauge is one of the chief sources of error. Application of excessive longitudinal force should be avoided for seating the points in the inserts. Other sources of error are the dial indicator and temperature changes.

4 MEASUREMENT OF INTERNAL JOINT MOVEMENTS BY JOINTMETERS

4.1 Jointmeters

Two kinds of jointmeters for internal joint movement measurements are in use:

a) Unbonded resistance type, and
b) Vibrating wire type.

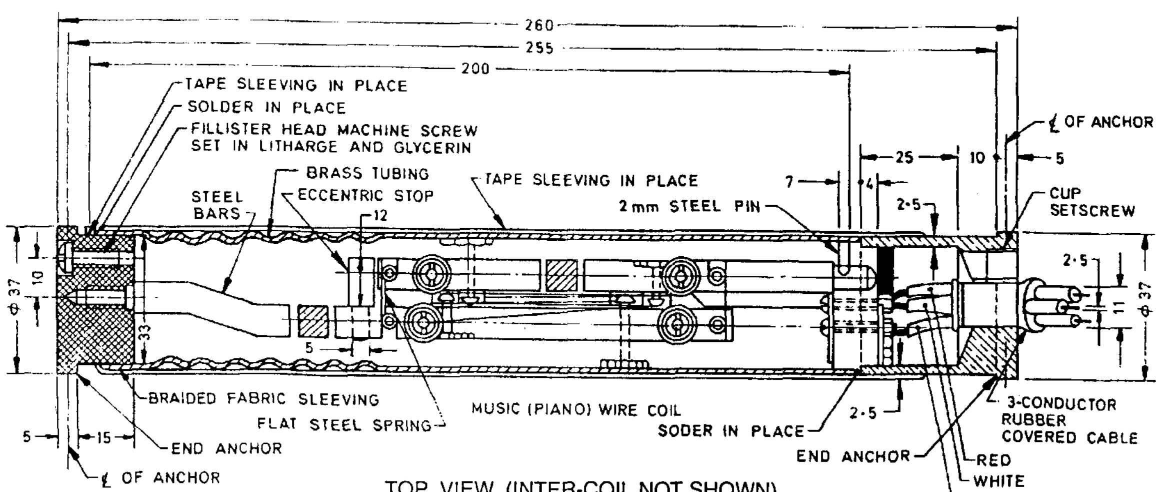
4.1.1 *Unbonded Resistance Type Jointmeter (Carlson Type)*

4.1.1.1 *Construction and principle*

The meter is in the form of a long brass cylinder with a flange at one end and a threaded hub on the other to fit a tapped socket. In practice, the socket is embedded in the concrete of a leading monolith to form the anchorage for the meter on one side of the contraction joint to be measured. The flange on the meter is engaged and held by the embedding concrete in the following monolith on the opposite side of the joint. Inside the brass case, a steel framework supports ceramic pulleys and a long single loop of steel wire, which is held in tension by small coil springs. A greater part of the displacement which the meter undergoes in use is taken up by the springs (*see* Fig. 2). The brass tube is completely filled with a corrosion resistant oil. A separate sealing chamber is provided for terminating the three rubber covered conductor cables that connect the jointmeter to the terminal boxes in the galleries.

The instrument is designed to take advantage of two electrical properties of steel wire, namely, resistance varies directly with temperature and resistance varies directly with tension. When the ends of the jointmeter are pulled apart by opening of a joint, the outer or expansion loop elongates and increases in tension and consequently in resistance as well. At the same time, the inner or contraction loop decreases in resistance as it shortens. The ratio of the resistance of the expansion loop divided by the resistance of the contraction loop is used as a measure of joint opening. Temperature is measured by taking the sum of the resistances of expansion and contraction coils.

Since there may be considerable shearing or movement in contraction joints as adjacent blocks cool at different rates, the jointmeter is designed to withstand a shearing movement of 2.5 mm by reducing the frame section at the ends to serve as elastic hinges. A flexible bellows forms the central section of the



All dimensions in millimetres.

FIG. 2 ELASTIC WIRE STRAINMETER (CARLSON TYPE) jointmeter to take the longitudinal and shear motions of the case without undue straining.

Measurements of resistance ratio and resistance are made by connecting the three conductor cables to the binding posts of a standard wheatstone bridge, circuit test set in specified order in accordance with the manufacturer's instructions.

4.2 Number and Location

4.2.1 Number of jointmeters required to be provided in any given dam will depend upon the dimensions, block layout, provision of transverse and longitudinal joints or transverse joints only, configuration of the foundation profile, presence of specially treated foundation features under the dam, and the extent to which measurements of joint behaviour would prove adequate in representing the joint movements for the entire structure.

4.2.2 In the case of dams built in V-shaped canyon, jointmeters should be installed in at least three blocks, namely, one central block representing deepest and maximum section of the dam, and a block each in the abutment portions representing blocks built on steeply sloping abutments. In other cases they may be installed one in the overflow section and one in the non-overflow section or any other representative block as may be decided. At a given elevation, the jointmeters in each of these blocks should be installed at the centre of the transverse dimensions of the monoliths in the blocks, and should be spaced about 15 m vertically in the height of the longitudinal and transverse contraction joints as the grouting lifts (zoning of joints by provision of metal seal) are limited to about 15 m in height. This spacing may be modified in the top portion of the joint if joint height does not permit of 15 m spacing for the entire height.

4.3 Method of Installation

4.3.1 *Unbonded Resistance Type Jointmeter*

4.3.1.1 Prior to the embedment of the jointmeters, each instrument should be thoroughly checked for the meter resistance as also for the lead resistance and these should be entered in the proforma given in Annex B. The resistance ratios before splicing and after splicing should also be recorded in the above proforma.

4.3.1.2 Jointmeters are supplied equipped with a socket which should be first embedded in the high block. The socket is further provided with a slotted plug in which two holes are drilled. Procedure for the installation of jointmeter at a contraction joint consists of the following steps:

a) Nail the plug, slotted side out, to the wooden form at the jointmeter location. This should be not more than 15 cm below the top of the lift for easy installation.
b) Screw the socket on the plug.
c) When socket installation is complete, care should be taken by the workmen not to hang things on the socket or use it as a step in getting out of the form or misuse it in any other way as to cause misalignment. As a precaution it is good practice to run a few stay wires to the form to keep the socket in position and prevent its misalignment. The arrangement is shown in Fig. 3.
d) If it is considered that for the particular concrete being used, the force exerted by the nails in the plug and ties is greater than the bond resistance on the socket, to prevent pulling it out during form removal. The anchor should necessarily be provided in the case of masonry dams.
e) If the cable leads are to run in the block in which the socket is embedded, recess should be provided adjacent to the socket into which not less than 1 m of the cable should be coiled.

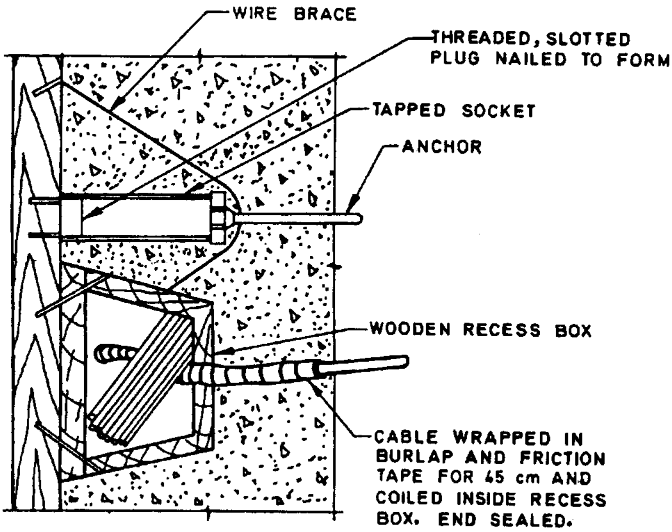
4.3.1.3 After the low block reaches the elevation in which the jointmeter itself is to be embedded, the following procedure shall be followed:

a) After the form is removed, remove the plug, fill greased cloth and screw in the hexagonal headed plug;
b) Complete the lift at the jointmeter location;
c) Dig back at the location until the plug is uncovered leaving a small trench about 30 cm × 30 cm;
d) Back out the plug and greased cloth and insert the jointmeter, screwing it upright;
e) While fixing the moveable end of jointmeter, allowance may be given for the meter, to respond for expansion and contraction that is in both the directions.
f) Tie the jointmeter cable lead out of the pour (if cable is embedded in the high block) and backfill with 75 mm maximum concrete, hand puddling the concrete around the meter; and
g) Next day, splice the meter cable; and the cable extension may preferably be done at the time of embedment to allow observation to be made.

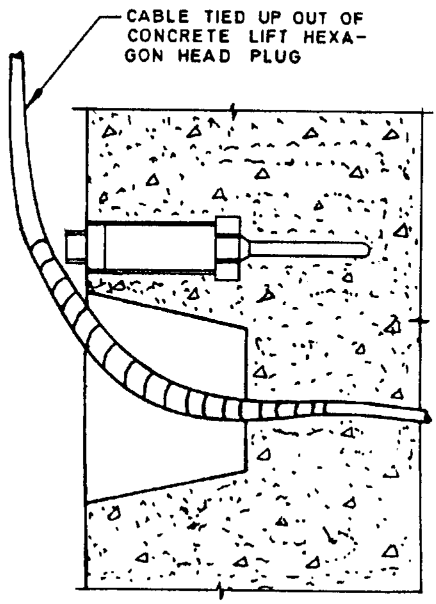
4.4 Cables and Conduits

Guidelines regarding this aspect are provided in IS 10334.

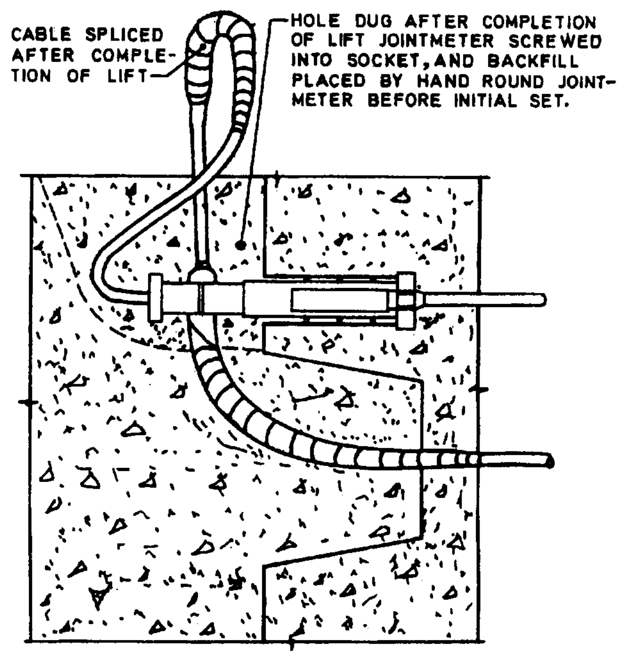
4.4.1 Additional length of cable should be attached to the jointmeter by means of splicing, done either with the help of electric heat vulcanizer or by applying self bonding tape.



Step 1 Installation in High Block



Step 2 Preparation in Low Block



Step 3 Jointmeter Installation

FIG. 3 JOINTMETER INSTALLATION

4.4.2 Provision of 10 percent or 1.5 m whichever is more, over the estimated length of cable should be allowed for possible variation from selected route.

4.4.3 Each meter should be identified by a letter prefix. The normal prefix used for jointmeter is JM-1, JM-2, etc. After splicing, a copper band with the instrument identification number stamped or punched on it is crimped to the cable about 1 m from the free end. In addition a few more marks consisting of the identification number marked on white tape should be placed around the cable near the reading end.

4.4.4 Provision contained in **4.3** of IS 6524 shall also apply to the jointmeter installations.

4.5 Terminal Boards

Cables shall be terminated in suitable terminal boards. Jointmeter numbers shall be indicated in the terminal boards also as described in **4.4.3**. If the terminal boards are to be placed in the inspection gallery, they shall be mounted in a nitch, preferably on the downstream side. The terminal boards shall be moisture proof.

4.6 Observations

4.6.1 Observations of the resistance ratio and resistance of the jointmeter should be made by connecting the meter conductors (until these are soldered to the terminal contacts on terminal boards in galleries) to the binding posts of the standard wheatstone bridge in the order specified by the manufacturer. Subsequent to their terminations on the terminal boards in galleries, observations of jointmeter should be made by connecting the jointmeter terminations to the test set binding posts through the test lead equipped with a female plug in socket at one end and the individual conductors equipped with metallic terminations for connections to the test set binding post at the other end. Care should be taken to connect the cable leads in the order specified by the manufacturer to ensure correct and reliable measurements.

4.6.2 The following reading schedule shall be adopted:

a) Immediately after embedment,
b) Every 3 h for the next 30 h,
c) Every 12 h for the next four days,
d) Once a day till the concrete temperature rises to a maximum (usually about two weeks),
e) Twice weekly for the next one month,
f) Weekly for next two months or until the completion of contraction joint grouting, and
g) Fortnightly afterwards.

4.6.3 *Forms of Record*

Observations shall be recorded directly on the printed field reading form shown in Annex C. These forms should be got printed sufficiently in advance and kept ready. Duplicate copy of observations should be prepared simultaneously. The original should be sent to design office, or to the office entrusted with the analysis of the data and the duplicate retained in the field record office for future reference.

4.7 Sources of Error

4.7.1 *Unbonded Resistance Type Jointmeter*

The error may be due to:

a) Presence of moisture on the terminal panels,
b) Loose circuit connections of the test set,
c) Faulty cable leads,
d) Presence of deposit on terminal contacts, and
e) Low voltage of test set batteries.

4.7.2 *Vibrating Wire Type Jointmeter*

Accuracy of the reading is not impaired due to resistance of cables. However, the test set has electronic circuits and the components are affected by temperature and shock.

4.8 Collection of Complimentary Data

The following properties of the concrete or mortar in which jointmeters are embedded shall be defined:

a) Coefficient of thermal expansion, and
b) Autogenous growth.

4.9 Analysis of Data

4.9.1 *Unbonded Resistance Type Jointmeter*

Analysis of the data should be done by transcribing the observed data to the 'Jointmeter Data Sheet' shown in Annex D and following the procedure given in **4.9.2**.

4.9.2 The calibration data of the meter as supplied by the manufacturer shall be filled in the space provided in the top portion of the form, against particular items. The value of the corrected calibration constant may be calculated by using the following equation:

$$C' = \frac{\gamma . C . (0.89)}{R}$$

where

C' = calibration constant (corrected),
C = original calibration constant,
γ = resistance of a pair of conductor cables, and
R = meter resistance at 0°C.

ANNEX A

(*Clause* 3.4.1)

PROFORMA FOR RECORD OF OBSERVATIONS FOR MEASUREMENT OF JOINT MOVEMENT BY SURFACE GAUGES

Project: .... Location of Joint: ....

Observer: .... Location of Surface Gauge: ....

Date	Time	Reservoir water level	Tail water level	Observed distance between inserts fixed at right angle joint		$(\rho_2 - \rho_1)$	Observed length of invar base		$(i_2 - i_1)$	Movement of joint (+Ve indicates opening of joint) $(\rho_2 - \rho_1) - (i_2 - i_1)$	Remarks
				Initial, ρ_1	Subsequent, ρ_2		Intial, i_1	Subsequent, i_2			
1	2	3	4	5	6	7	8	9	10	11	12

ANNEX B

(*Clause* 4.3.1.1)

PROFORMA FOR RECORD OF OBSERVATIONS

UNBONDED RESISTANCE TYPE JOINT METERS

PRE-EMBEDMENT TESTS

Project: ....

Instrument No.: .... Air temperature: ....

Manufacturers No.: ....

Project No.: ....

Location: .... Wet bulb temperature: ....

1 Resistance Before Cables Splicing:

i) White-black
ii) White-green
iii) Green-black
iv) Resistance one pair

2 Resistance Ratio (instrument only):

i) Direct ratio (white-green-black)
ii) Reverse ratio (black-green-white)

3 Individual Conductor Resistance:

i) Length
ii) Black
iii) Green
iv) White

4 Resistance of Instrument after Cable Splicing:

i) White-black
ii) White-green
iii) Green-black
iv) Resistance one pair

5 Resistance Ratio (instrument with cable):

i) Direct ratio (white-green-black)
ii) Reverse ratio (black-green-white)

Date of test:

Date of embedment:

Name and signature of observer

NOTES:

ANNEX C

(*Clause* 4.6.3)

PROJECT ....

PROFORMA FOR RECORD OF OBSERVATIONS UNBONDED RESISTANCE TYPE JOINTMETERS FIELD READINGS AFTER EMBEDMENT

Instrument No.	Previous Readings		Date	Time	Resistance	Ratio	Observer's Signature
	Date	Resistance Ratio					
JM 1							
2							
3							
4							
5							
6							
7							

ANNEX D

(*Clause* 4.9.1)

PROFORMA FOR RECORD OF OBSERVATIONS DATA SHEET FOR UNBONDED RESISTANCE TYPE JOINTMETER

Project :	Sheet No. : ....
Jointmeter No. :	Location : ....
Calibration data	Block : Chainage and Location: ....
Meter resistance at (A)°C[1)] ....[B[1)]] ohm	
Change in temperature per ohm change in resistance ....[C[1)]]°C	
Ratio in closed position..%	
Original calibration constant.................................. [D[1)]] mm per 0.01% ratio change	
Calibration constant corrected for leads..................(D) mm per 0.01% ratio change	
Resistance of leads at...°C..............................ohm (pair)	

Date	Time	Total Resistance ohms	Lead Resistance ohms	Meter Resistance ohms	Temperature °C	Resistance Ratio %	Change in Ratio %	Indicated Movement mm	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

Explanations for columns including analysis:

Col 3 : Total resistance of meter as measured in the field. With a 4-conductor cable the cell resistance is measured directly, and this column may be left blank.

Col 4 : Resistance of the white and black conductors, as measured directly during the splicing operations. As an alternative, a reasonably accurate value may be determined by subtracting the total resistance of the contraction and expansion coils measured in series from the sum of the resistances of the contraction and expansion coils measured separately.

Col 5 : Resistance of meter excluding cable leads. It is obtained by subtracting col 4 from col 3 with 4-conductor cable the meter resistance is measured directly.

Col 6 : Temperature of the meter, obtained by subtracting (B) from the cell resistance in col 5, multiplying the difference by (C) and adding the product to (A).

Col 7 : The resistance ratio of the meter as measured with the test set.

Col 8 : Total change in resistance ratio (col 7) from a selected initial value when the joint is known to be closed. This is usually taken at about 24 h after the concrete/masonry has been placed. Proper algebraic sign should be shown.

Col 9 : Multiply values in col 8 by the correlated calibration constant (D). The algebraic signs of col 8 are carried over into col 9, positive values indicating an opening of the joint with respect to the initial position and *vice-versa*.

NOTE — Since the magnitude of the thermal length changes of the meter and concrete/masonry due to changes in temperature are significantly small relative to the joint movements being measured and the range of the meter, no temperature correction is made. Temperature data is of general interest and provides a means for detecting faulty operation of the measuring point.

1) Calibration data furnished by the manufacturer.

ANNEX E

(Foreword)

COMMITTEE COMPOSITION

Hydraulic Structures Instrumentation Sectional Committee, WRD 16

Organization	*Representative(s)*
National Hydro Electric Power Corporation Ltd, Faridabad	SHRI BRIJENDRA SHARMA (***Chairman***)
AIMIL Ltd, New Delhi	SHRI S. P. GUPTA SHRI S. C. JAIN (*Alternate*)
Bhakra Beas Management Board, Nangal Township, Punjab	DIRECTOR/DAM SAFETY EXECUTIVE ENGINEER (*Alternate*)
Central Board of Irrigation & Power, New Delhi	SHRI S. P. KAUSHISH SHRI T. S. MURTHY (*Alternate*)
Central Building Research Institute, Roorkee	SHRI J. N. VAISH SHRI Y. PANDEY (*Alternate*)
Central Water & Power Research Station, Pune	SHRIMATI V. M. BENDRE SHRI C. K. HAYATNAGARKAR (*Alternate*)
Central Water Commission, New Delhi	DIRECTOR INSTRUMENTATION DIRECTOR ERDD (N&W) (*Alternate*)
Consulting Engineering Services (I) Ltd, New Delhi	SHRI S. S. NARANG SHRI S. R. TOLEY (*Alternate*)
Damodar Valley Corporation Ltd, Dhanbad	CHIEF ENGINEER (CIVIL) SUPERINTENDING ENGINEER (CIVIL) (*Alternate*)
Encardio-Rite Electronics Pvt Ltd, Lucknow	SHRI AMOD GUJRAL SHRI SABA QAMAR (*Alternate*)
Irrigation Department, Government of Andhra Pradesh, Hyderabad	DIRECTOR SUPERINTENDING ENGINEER (DAMS) (*Alternate*)
Irrigation Department, Government of Maharashtra, Nashik	CHIEF ENGINEER & DIRECTOR
Irrigation Department, Government of Punjab, Chandigarh	CHIEF ENGINEER DIRECTOR DAM (*Alternate*)
Irrigation Research Institute, Roorkee	CHIEF ENGINEER DESIGN SUPERINTENDING ENGINEER (*Alternate*)
Irrigation Department, Government of Gujarat, Vadodara	DIRECTOR
Karnataka Power Corporation Ltd, Karnataka	CHIEF ENGINEER (CIVIL DESIGNS) PROJECT ENGINEER DESIGNS (*Alternate*)
Kerala State Electricity Board, Kerala	CHIEF ENGINEER (CIVIL) EXECUTIVE ENGINEER (*Alternate*)
National Hydroelectric Power Corporation Ltd, Faridabad	SHRI BALRAJ JOSHI SHRI N. K. JAIN (*Alternate*)
Public Works Department, Government of Tamil Nadu, Tamil Nadu	SHRI M. DURAIRAJ JOINT CHIEF ENGINEER (*Alternate*)
Sardar Sarovar Narmada Nigam Ltd, Gandhinagar	SUPERINTENDING ENGINEER (NPHW CIRCLE)
University of Roorkee, Roorkee	DR NAYAN SHARMA
Vasi Shums & Co Private Ltd, Mumbai	SHRI Z. M. KARACHIWALA
BIS Directorate General	SHRI S. S. SETHI, Director & Head (WRD) [Representing Director General (*Ex-officio*)]

Member Secretary
SHRIMATI ROSY DHAWAN
Joint Director (WRD), BIS

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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