भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन, नदी विकास
और गंगा संरक्षण विभाग
केन्द्रीय जल आयोग
जल विज्ञान मंडल

सत्यमेव जयते

GOVERNMENT OF INDIA
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
CENTRAL WATER COMMISSION
Hydrology Division

NEERVALAM Complex, No. R-81, TNHB Colony, West Velachery, Chennai-600042.
Phone: 044-29530653. e-mail: ee.chn-cwc@nic.in

Tender No. 07/HD/HQS/NIT/2021-22/2378-81 **Date: 25.09.2021**

NOTICE INVITING E - TENDER

CPWD-6

On behalf of the President of India, EXECUTIVE ENGINEER, HYDROLOGY DIVISION, CENTRAL WATER COMMISSION, "NEERVALAM", PLOT NO.81, TNHB COLONY, NEAR TELEPHONE EXCHANGE, WEST VELACHERY, CHENNAI - 600 042 invites **online tenders** for the following works from eligible firms under **single cover envelope system.**

Name of the work	**:**	**Supply of Hydro-Meteorological Equipments**
Period of Supply	**:**	**45 days**
Estimated cost	**:**	**Rs. 5,90,820/-**
Earnest Money Deposit	**:**	**NIL (Bid Securing Declaration to be provided)**
Tender Fee	**:**	**NIL**

1. The Eligibility Criteria for technical bid is as follows:

   a) The firm should have registered with Central or State Government departments.

   b) The firm should have valid PAN and GST number.

   c) The firm should have minimum 3 years experience from the date of registration in the business of supplying hydro-meteorological equipments. Any firm claiming exemption on these criteria shall produce documentary proof to substantiate it.

   d) Satisfactory/Performance Certificate for supplying hydro-meteorological equipments to any State / Central Government / PSU during the financial year 2018-21.

   e) Turn over certificate and Income Tax Returns for the FY 2018-19, FY 2019-20, FY 2020-21.

   f) Agencies having valid MSME/NSIC certificate are exempted from paying EMD and Tender Fee.

   The firm should enclose all documentary proof / evidence to substantiate the eligibility criteria as given above along with the e-tender.

2. The NIT and tender can be downloaded from **www.cwc.gov.in or www.eprocure.gov.in.** However in order to be able to participate in the tender, it is mandatory to download official copy of tenders from **www.eprocure.gov.in.**

3. The bidder has to submit following documents **on or before 04/10/2021 @ 10.00 hrs**, otherwise the bid will not be considered for opening:
   - Bid Securing Declaration in original in sealed envelope.

4. However, the technical and financial bid of the tenders will be opened by the department on receipt of the Bid Securing Declaration

5. **Tenders, in single cover envelope system, (both technical and financial bid) will be received online up to 04/10/2021 @ 10.00 hrs** by the Executive Engineer, Hydrology Division, Central Water Commission, R-81, TNHB colony, West Velachery, Chennai – 600042. **The tenders (both technical and financial bid) will be opened online by the Executive Engineer or his authorized representative on 05/10/2021 at 10.00 hrs.**

6. The competent authority on behalf of the President of India does not bind himself to accept the lowest or any other tender, and reserves his right to reject any or all of the tenders received without assigning any reason thereof. The competent authority on behalf of President of India reserves to himself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rate quoted.

7. In case of a partnership/consortium, the agreement signed between various partners will be submitted with the bid clearly identifying the parts and components of the system for which the concerned partner is responsible for execution. However, each of the partners of the consortium will be jointly responsible for execution and completion of the works.

8. One of the partners of the firm will be identified in the agreement as a lead partner and will be authorized to execute the contract with the department. All financial transactions and liabilities shall rest with the lead partner.

9. The bid shall include all the relevant documents supporting the technical competence of the offers and shall indicate by proper cross referencing with such supporting documents. Any additional information requested by the department during the course of evaluation of the technical bid shall be supplied within the time limits set by the department. Duration of Two working days will be given to bidders for responding to the clarification (if any) requested by the Tender inviting Authority beyond which response from bidder will not be considered

10. Order No. P-45021/2/2017-PP (BE-II) dated 16.09.2020 issued by Department for Promotion of Industry and Internal Trade on Public Procurement (Make In India) Shall be valid on this tender.

11. Purchase preference to Micro and small enterprises as defined in Public procurement policy for MSEs order 2012 dated 23.03.2012 is valid on this tender. If L-1 is not an MSE and MSE Seller (s) has/have quoted price within L-1+ 15% (Selected by Buyer)of margin of purchase preference /price band defined in relevant policy, such Seller shall be given opportunity to match L-1 price and contract will be awarded for 25%(selected by Buyer) percentage of total QUANTITY. Relevant documentary evidence in this regard shall be uploaded along with the bid in respect of the offered product or service.

12. All tenders, in which any of the prescribed conditions are not fulfilled or are incomplete in any respect are liable to be rejected.

13. The tender shall be valid for a period of 60 days from opening date of the bid.

14. Tenderer are encouraged to examine the work location where the items are to be delivered and its surroundings and satisfy / apprise themselves as to the nature of the location, the means of access and in general, shall obtain themselves all necessary information as to risks, contingencies and other

circumstances which may influence or affect their tender and rates, before submitting their tenders. A tenderer shall be deemed to have full knowledge of the delivery place whether he/ she inspects the site or not and no extra payment / compensation consequent upon any misunderstanding / mis-happening or otherwise shall be allowed.

15. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware *of* the scope and specifications *of* the supply to be done and local conditions and other factors having a bearing on the execution *of* the supply.

16. All tenders in which any *of* the prescribed conditions are not fulfilled or any condition including that of conditional rebate is put forth by the tenderer shall be summarily rejected.

17. Contractors whose near relatives are Divisional Accountant or Engineering Officers between the grades of Chief Engineer and Junior Engineer (both inclusive) in the Central Water Commission (CWC) will not be allowed to tender for the supply in the respective Regional office responsible for award and execution of contract where the near relative is working. For this purpose, a near relative shall mean father, mother, wife/husband, son(s), daughter(s), brother(s), sister(s).

18. No Engineer or any other official employed in Engineering or Administrative duties in the Engineering/Administrative Department of the Government of India is allowed to work in CWC either as contractor or as employee of a contractor for a period of one year after his retirement from Government service unless he has obtained prior permission of Government of India to do so. Even after enlistment, if either the contractor or any of his employees is found to be a person who had not obtained prior permission of Government of India as aforesaid, the Contract shall be cancelled.

25.9.21

(वसंतकुमार वी)/(VASANTHAKUMAR V)
अधिषासी अभियंता/Executive Engineer

प्रतिलिपी/Copy to:

1. The Superintending Engineer, C&SRC, CWC, Bengaluru.
2. The Sub Divisional Engineer, CWC, PPSD/Chennai, CDSD/Karaikal, PSD/Kadapa.

TERMS AND CONDITIONS OF THE CONTRACT

Introduction:

Central Water Commission is a premier Technical Organization of India in the field of Water Resources and is presently functioning as an attached office of the Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation, Government of India. The Commission is entrusted with the general responsibilities of initiating, coordinating and furthering in consultation of the State Governments concerned, schemes for control, conservation and utilization of water resources throughout the country, for purpose of Flood Control, Irrigation, Navigation, Drinking Water Supply and Water Power Development. Cauvery and Southern Rivers Organization, Coimbatore under CWC is mainly associated with collection, compilation of Hydrological & Meteorological data at various locations of the rivers flowing through the States of Kerala, Tamil Nadu, Puducherry, Parts of Karnataka & Parts of Andhra Pradesh. The data collected by the organization is extensively used for the water resources development, planning, management, research etc. The work proposed is supplying hydro-meteorological equipments to various site offices under Hydrology Division, Chennai.

1. One Bid per Bidder:

i). Each bidder shall submit only one bid either by himself or as a partner in a joint venture. Bidder who submits or participates in more than one bid will be disqualified. A Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for this bidding process, if the Bidder:

a. directly or indirectly controls, is controlled by or is under common control with another Bidder; or
b. receives or has received any direct or indirect subsidy or funding from another Bidder; or
c. has the same legal representative (i.e. Members of Board of Directors or Managing Directors or any person who is figures in Top management etc.) as another Bidder; or
d. has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the bid of another Bidder, or influence the decisions of the Purchaser regarding this bidding process; or
e. participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which such Bidder is involved; or

any of its affiliates has been hired (or is proposed to be hired) by the Purchaser for the Contract implementation

2. Signing the tender:

In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power-of attorney authorizing him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act, 1952(documents to be enclosed).

Receipts for payment made on account of work, when executed by a firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.

3. Contents of bidding documents: The set of bidding document comprises the documents listed below

a) Notice Inviting E-Tender

b) Bid Securing Declaration

c) Terms and Conditions of the contract

d) Contract/Agreement form – CPWD 9

e) Schedule of work

f) Performance Guarantee in the form of DD or Bank Guarantee.

4. Amendment of Bidding Document:

At any time prior to the deadline for submission of bids, the department may amend bidding documents by issuing addendum. Any addendum thus issued, shall be part of the bidding document and shall be communicated in writing to all bidders of the bidding document. To give perspective bidders, reasonable time in which to take an addendum into account in preparing their bids, the Employer shall extend as necessary the deadline for submission of bids.

5. Language of the Bid:

All documents relating to the bid shall be in the English language or Regional language.

6. Instructions for Online Bid Submission:

(Department User may attach this Document as an Annexure in their Tender Document which provides complete Instructions for on line Bid submission for Bidders)

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app**.**

REGISTRATION

1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: https://eprocure.gov.in/eprocure/app) by clicking on the link "**Online bidder Enrollment**" on the CPP Portal which is free of charge.

2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.

3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.

4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.

5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.

6) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / e-Token.

SEARCHING FOR TENDER DOCUMENTS

1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-

mail in case there is any corrigendum issued to the tender document.

3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

PREPARATION OF BIDS

1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.

2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or ''Other Important Documents'' area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

Note: *My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.*

SUBMISSION OF BIDS

1) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

2) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

3) Bidder has to select the payment option as “offline” to pay the tender fee / EMD as applicable and enter details of the instrument.

4) Bidder should prepare the EMD as per the instructions specified in the tender document. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the tender documents. The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise the uploaded bid will be rejected.

5) Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

6) The server time (which is displayed on the bidders’ dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc. The bidders should follow this time during bid submission.

7) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener’s public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.

7) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.

8) Upon the successful and timely submission of bids (i.e. after Clicking “Freeze Bid Submission” in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.

9) The bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any bid opening meetings.

ASSISTANCE TO BIDDERS

1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.

2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk.

8. Performance Bank Guarantee:

Performance Bank Guarantee @ 3% of the contract value will be deducted from the final bill. +The same will be returned after 12 months from the date of supply of all equipments successfully without any lapses. During this period, any fault/defect in the performance of equipments have to be attended by the firm at no extra cost.

9. Bid Prices:

a) The bid shall be for the full quantity as described in the schedule of work, corrections, if any, shall be made by crossing out, initialling, dating and re writing.

b) Rates quoted shall be inclusive of all charges, taxes and other levies and incidental expenses, if any payable.

c) The rate quoted by the tenderers shall remain fixed for the duration of the contract and shall not be subject to adjustment on any account.

d) No additional charges will be paid over and above the quoted rates of the Agency and the department shall also not pay any extra amount on any account.

e) If there is any discrepancy between unit rate and total amount, the unit rate will prevail.

f) The rates shall be quoted in Indian Rupee only.

g) If two or more agencies have quoted the same service charges, then agency will be selected based on draw of lots as per relevant guidelines or norms of CPWD.

10. Bid Validity:

Bid shall remain valid for the period of 60 days from the date of technical bid opening. In exceptional circumstances prior of the original bid validity period, the Executive Engineer may request the bidders to extend the period of validity in a specified additional period. The request and the responses thereto shall be made in writing only.

11. Corrupt and fraudulent practices:

It is expected that Bidders under this contract observe the highest standard of ethics during the execution of this contract. In pursuance of this policy, the Executive Engineer.

(a) Defines for purpose of these provisions, the terms set forth below as follows:-

(i) 'Corrupt practice' means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the contract execution, and

(ii) 'Fraudulent practice' means a misrepresentation of facts in order to influence the execution of a contract to the detriment of the employer, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid process at artificial non-competition levels and to deprive the Executive Engineer of the benefits of

free and open competition.

(b) Will reject a proposal for award of work if he determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for contract in question.

12. Clarification of Bidding Documents:

To assist in the examination, evaluation and comparison of bids, the department may at its discretion, ask any bidder for clarification of its bid. The request for clarification and the response shall be in writing, but no change in the price or substance of the bid shall be sought or offered or permitted except as required to confirm the correction of arithmetic errors discovered by the department in the evaluation of the bids.

13. Examination of Bids and Determination of Responsiveness:

A substantially responsive bid is one that confirms to all the terms and conditions of the bidding document without material deviation or reservation. A material deviation or reservation is one which affects in any substantial way the scope, quality or performance of the work and which limits in any substantial way inconsistent with the bidding documents, the Executive Engineer's rights or the bidder's obligations under the contract, or whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids. If a bid is not substantially responsive, it will be rejected by the Executive Engineer and may not subsequently be made responsive by correction or withdrawal and the non-confirming deviations or reservations.

14. Award criteria:

The Executive Engineer shall award the contract to the Bidder(s) whose Bid has been found to be substantially responsive and who has offered the lowest evaluated Bid Price. Supply order may be given to more than one bidder based on lowest rate quoted subjected to condition of each supply order not less 30% of the total estimated cost.

15. Notification of Award:

The bidder(s) whose bid has been accepted will be notified of the award by the Executive Engineer prior to expiration of the Bid validity period. This letter of acceptance will state the sum that the Executive Engineer will pay the contractor in consideration of the execution of the works by the contractor.

16. Dispute Resolution Mechanism:

Any disputes arising on the contract will be referred to SE, C&SRC, CWC, Bengaluru and the decision of SE, C&SRC, CWC, Bengaluru will be final and binding to the bidder**.**

17. Signing of Contract:

The successful bidder(s), on acceptance of his bid by the Accepting Authority shall, within 15 days from the stipulated date of start of the work, sign and execute the Contract in the contract/agreement form.

18. Changes in Contractor's organization to be approved:

Where the contractor is a partnership firm, the previous approval in writing of the Executive Engineer shall be obtained before any change is made in the constitution of the firm. If previous approval from the Executive Engineer is not obtained action may be taken against the contractor as per relevant rules in force.

19. The Details of location where the specific items are to be delivered:

S No.	Item	Quantity	Delivery Address	Contact Person
1.	Cup Type Current Meter with accessories like wading rod with base plate, connecting cable, carrying case, spanner, oil etc	2	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		2	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		1	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
2	Pygmy Type Current Meter with accessories like wadding rod with base plate, connecting cable, carrying case spanner,oil etc	1	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		2	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		2	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
3.	Rainfall Measuring Jar 200cm^2	7	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		5	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		3	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465

4.	Evaporimeter Measuring Jar	2	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		2	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		1	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
5.	Pan Evaporimeter	1	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		1	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		1	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
6.	Single Stevenson Screen with stand	2	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		2	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		1	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
7.	Maximum & Minimum Thermometer	7	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		2	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		1	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465

8.	Dry Bulb Thermometer	7	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		1	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		2	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
9.	Wet Bulb Thermometer	7	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		1	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		2	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
10.	Auto Level with Stand	5	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
11.	Digital Revolution Counter	5	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		2	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		3	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
12	Fishweight (15 kg)	8	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119
		1	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937

		1	O/o The sub-Division Engineer,Cauvery Delta Sub-Division,Central Water Commission, (Opp) Mazjid-E.Hussaini,puliyankottai Salai, Karaikal-609602	V Vijaya Durai 9665266465
13	Fish Weight (10 Kg)	1	O/o The sub-Division Engineer,Pennar Sub-Division,Central Water Commission, No.95/169,Telugu Ganga Project Colony, Kadapa-516004	B Chandran 7032683937
		2	O/o The Executive Engineer, Central Water Commission, Hydrology Division, Chennai – 600042	B Sathish 9790229119

20. Payment Terms:

The payment will be released to the agency by the Executive Engineer after obtaining the Bill in triplicate from the agency. TDS on IT and GST will be deducted as per prevailing Government of India orders.

21. Termination of Contract:

If the contractor does not comply with tender conditions, the Executive Engineer may terminate the contract and the Performance Bank Guarantee will be forfeited.

22. Delivery Period:

The equipments must reach the designated location within 45 days from the date of award of work. No extension will be entertained except for any specific administrative reason/natural calamity/disaster. Extension request shall be given prior to the expiry of original delivery period. Items that require IMD certification may generally take longer time. Agency has to plan accordingly, so that the equipments are delivered on time.

23. Warranty:

The Department will not be responsible for any damage caused to the equipments during transit. Necessary precautionary measures and good packing has to be taken care by the supplier. The equipments will be under specific warranty period for 1 year from the date of supply of each item. Any defect/fault during the warranty period has to be attended by the firm at no extra cost.

24. Liquidated Damages:

Liquidated Damages shall be levied upon the agency as determined by the Superintending Engineer not exceeding 5% of contract value failing to attend the contract as per conditions.

25. Technical Evaluation of the agency / firm:

i) Bidder should have experience of having successfully completed similar works during last 3 years ending FY 2021 (FY 2017-18, FY 2018-19, FY 2019-20) and should be either of the following **(Agency may opt to submit any one of the below criteria along with supply order and satisfactory certificate for a particular contract)**:

a. Three similar completed works costing not less than the amount equal to 40% of the estimated cost; or

b. Two similar completed works costing not less than the amount equal to 50% of the estimated cost; or

c. One similar completed works costing not less than the amount equal to 80% of the estimated cost.

ii) Average annual financial turnover in the last three FY 2017-18, 2018-19, 2019-20 shall be at least 50% of estimated cost.

iii) Profit and loss statement during the last three FY 2017-18, 2018-19, 2019-20.

iv) Income Tax Return during the last three FY 2017-18, 2018-19, 2019-20.

v) The norms pertaining to prior experience and prior turnover for micro and small enterprises registered as per guidelines of Ministry of Micro, Small and Medium Enterprises, Government of India, New Delhi (MSME) may be relaxed as per the policy circular No.1 (2) (1)/2016-MA dated 10.03.2016 of Ministry of Micro, Small and Medium Enterprises, Government of India, New Delhi. Relevant relaxation certificate issued from Competent Authority or Department shall be submitted in this regard.

vi) Agency has to submit an undertaking on each of the following "not blacklisted/issued show cause notice", "not under any litigation", "no criminal proceedings" by any Government Department/PSU during last three Financial Year.

vii) GST certificate along with latest filed GST returns.

viii) Copy of PAN card.

ix) Certificate of incorporation

Note: Agency satisfying all above conditions laid in technical bid evaluation will only be considered for financial bid evaluation.

25.9.20

अधिषासी अभियंता/Executive Engineer

SCHEDULES

SCHEDULE 'A'	:	Applicable (enclosed)
SCHEDULE 'B'	:	Not Applicable
SCHEDULE 'C'	:	Not Applicable
SCHEDULE 'D'	:	Not Applicable
SCHEDULE 'E'	:	Applicable
SCHEDULE 'F'	:	Applicable

SCHEDULE 'E' : **Reference to general conditions of the work**

Name of the work	:	Supply of Hydro-Meteorological Equipments
Estimated Cost	:	Rs. 5,90,820/-
Performance Bank Guarantee	:	3% of contract value

SCHEDULE 'F'

Office Inviting Tender	:	Executive Engineer, Hydrology Division, Central Water Commission, Plot No R-81, TNHB colony, West Velachery, Chennai – 600042.

Definitions:

Engineer-in-charge	:	Asst Director-II, Hydrology Division, CWC, Chennai
Accepting Authority	:	Executive Engineer, Hydrology Division, CWC, Chennai
Department	:	Central Water Commission
Clause 1	:	Applicable
Clause 2 Authority for fixing compensation	:	Superintending Engineer, C&SRC, CWC, Bengaluru
Clause 3 Authority for determination of tender	:	Executive Engineer, HD, CWC, Chennai
Clause 3A	:	Applicable
Clause 11	:	Applicable
Clause 15	:	Applicable
Clause 16	:	Applicable
Clause 17	:	Applicable
Clause 19 (A – L)	:	Applicable
Clause 20	:	Applicable
Clause 23	:	Applicable
Clause 24	:	Applicable
Clause 25	:	Applicable
Clause 37	:	Applicable
Clause 38	:	Applicable
Clause 39	:	Applicable

Note: All other clauses are not applicable.

FINANCIAL BID

HYDRO-METEOROLOGICAL EQUIPMENTS

S.No.	Description of items	Qty (Nos.)	Rate(Rs.)	Amount
1.	Cup Type Current Meter with accessories like wading rod with base plate, connecting cable, carrying case, spanner, oil etc	5		
2.	Pygmy Type Current Meter with accessories like wadding rod with base plate, connecting cable, carrying case spanner,oil etc	5		
3.	Rainfall Measuring Jar 200cm^2	15		
4.	Evaporimeter Measuring Jar	5		
5.	Pan Evaporimeter	3		
6.	Single Stevenson Screen with stand	5		
7.	Maximum & Minimum Thermometer	10		
8.	Dry Bulb Thermometer	10		
9.	Wet Bulb Thermometer	10		
10.	Auto Level with Stand	5		
11.	Digital Revolution Counter	10		
12.	Fish Weight (15 kg)	10		
13.	Fish Weight (10 Kg)	3		
			Sub Total	
			IGST @	
			Grand Total	

Note:

1. These Items (Cup Type Current Meter, Pygmy Type Current Meter, Pan Evaporimeter, Dry Bulb Thermometer, Wet Bulb Thermometer, Auto Level) need IMD certification.

2. Single LCD Digital revolution Counter need.

3. Combined Maximum & Minimum Thermometer need.

TENDER ACCEPTANCE LETTER

(To be given on Company Letter Head)

Date:

To,

The

EE, (name of Division with address)

Sub: Acceptance of Terms & Conditions of Tender.

Tender Reference No. 07/HD/HQS/NIT/2021-22/2378-81 dated 25.09.2021

Name of Tender / Work: - Supply of Hydro-Meteorological Equipments

Dear Sir,

1. I/ We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from the web site(s) namely: _____ _____ as per your advertisement, given in the above mentioned website(s).
2. I / We hereby certify that I / we have read the tender document of above mentioned work (including all documents like annexure(s), schedule(s), etc.,), which form part of the contract agreement and I / we shall abide hereby the terms / conditions / clauses contained therein.
3. The corrigendum(s) issued from time to time by your Division/ organization, if any, too have also been taken into consideration, while submitting this acceptance letter.
4. I / We hereby unconditionally accept the tender conditions of above mentioned tender document(s) / corrigendum(s) in its totality / entirely.
5. In case any provisions of this tender are found violated, your Division/ organization shall be at liberty to reject this tender/bid including the forfeiture of the full said earnest money deposit absolutely and we shall not have any claim/right against Division in satisfaction of this condition.

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

Bid-Securing Declaration

[The Bidder shall fill in this Form in accordance with the instructions indicated.]

Date: [date (as day, month and year)]

Bid No.: [number of bidding process]

Alternative No.: [insert identification No if this is a Bid for an alternative]

To: [complete name of Purchaser]

We, the undersigned, declare that:

We understand that, according to your conditions, bids must be supported by a Bid-Securing Declaration.

We accept that we will automatically be suspended from being eligible for bidding in any contract with the Purchaser for the period of time of *five year* starting on *[date]*, if we are in breach of our obligation(s) under the bid conditions, because we:

(a) have withdrawn our Bid during the period of bid validity specified in the Letter of Bid; or

(b) having been notified of the acceptance of our Bid by the Purchaser during the period of bid validity, (i) fail or refuse to execute the Contract; or (ii) fail or refuse to furnish the Performance Security, if required, in accordance with the ITB.

We understand this Bid Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) twenty-eight days after the expiration of our Bid.

Name of the Bidder*****_____

Name of the person duly authorized to sign the Bid on behalf of the Bidder******_____

Title of the person signing the Bid_____

Signature of the person named above_____

Date signed _____ day of _____, _____

*****: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder

**: Person signing the Bid shall have the power of attorney given by the Bidder attached to the Bid

[Note: In case of a Joint Venture, the Bid-Securing Declaration must be in the name of all members to the Joint Venture that submits the bid.]

10.007 CURRENT METER, CUP-TYPE

Approval Date: 23 October 2007 **Version: 1**

Purpose

The current meter will be used for flowing water velocity and thus discharge measurements in rivers and canals. It may be used in wading or suspended mode.

Conditions & Requirements

- The current meter shall be of such a design that it operates reliably and accurately under the prevailing flow and environmental conditions.
- The current meter shall be easy to operate and maintain.
- The current meter shall be supplied with the accessories as needed for effective deployment.
- All materials of the current meter shall be non-corrosive.
- An operator's manual, related to the type and model of the current meter, shall be part of the delivery.
- The current meter shall come with the calibration data, i.e. actual calibration velocity versus actual revolutions per second as collected during the calibration process. Calibration data should uniquely identify the instrument body, the rotor, observer, rating tank, way of suspension, methodology and similar information.
- The current meter shall come with a rating table and a rating chart in m/s versus revolutions per second.
- The current meter shall have a provision to adjust its trimming.
- The design shall be sediment resistant and have an air-filled bearing chamber.
- The bearings should be field adjustable.
- The current meter shall come without a protection ring/yoke in front of the rotor. Such a yoke would make the current meter sensitive to its alignment into the flow, which should be avoided.
- The bearing chamber shall be as slim as possible to avoid excessive drag.
- The electrical connections shall not protrude into the current, but backwards instead.
- The electrical connections shall be of a reliable and sturdy construction.
- The current meter and accessories shall be supplied in a sturdy carrying case.
- An appropriate tool-set shall be included in the delivery.
- The current meter shall generally comply with IS 3910-1992
- For suspended operation, adequate fish weight shall be attached below the current meter.
- The fish weight shall have a streamlined form and shall be suspended from a bar of adequate strength
- The current meter shall have a facility to balance it into a horizontal attitude while submersed.
- Horizontal and vertical tail fins at the rear end shall align the fish weight in the direction of flow.
- Except for the suspension bar, no elements shall protrude from the body.
- The fish weight shall generally comply with IS 4073-1967 and ISO 3454-1983.

Specifications

1. Sensor

model	6 cup wheel
contact	every one revolution
range	0.05 to 3.5 m/s (starting up to maximum operational velocity)
accuracy	for velocities up to 0.3 m/s 1 % Full Scale

	for velocities >0.3 m/s	0.5 % FS
contact chamber	magnetic or optic fibre	

2. Suspension

Wading

wading rod	total length 3 m, graduation in cm
electrical cable	running from current meter to counter, 10 m

From a cable

suspension cable	electrical cable integrated in suspension cable
	electrical cable from winch to counter, 7 m
cable torque	torque free suspension cable

The suspension cable should not exert any torque that may adversely affect the alignment of the flow sensor into the direction of flow. In particular in case a heavy suspension weight is used, there is a risk of cable induced torque.

suspension-rod	for cable suspended measurements with light weight sinkers
tail fin length	>0.25 m beyond the attach point of the suspension

The tail fin shall be capable of aligning the current meter in the direction of flow and keep it stable in that position throughout the full velocity range.

3. Fish weight

model	USGS Columbus or similar
material	cast iron or lead
finish	smooth, painted surface
mass	25, 50 and 100 kg as required for depth and current velocity

If the instrument is used from a cable way then an integrated bottom detector is required

suspension	bar fitting current meter and cable terminal

Accessories

- standard instrument tools
- spare bearings
- carrying case for current meter with counter
- carrying case for fish weight(s)

10.008 CURRENT METER, PYGMY-TYPE

Approval Date: 20 May 1998

Reviewed on : 23 October 2007 **Version: 1**

Purpose

The current meter will be used for flowing water velocity and thus discharge measurements in shallow rivers, streams and canals. It will be used for wading gauging only.

Conditions & Requirements

- The current meter shall be of such a design that it operates reliably and accurately under the prevailing flow and environmental conditions in shallow water.
- The current meter shall be easy to operate and maintain.
- The current meter shall be supplied with the accessories as needed for effective deployment.
- All materials of the current meter shall be non-corrosive.
- An operator's manual, related to the type and model of the current meter, shall be part of the delivery.
- The current meter shall come with the calibration data, i.e. actual calibration velocity versus actual revolutions per second as collected during the calibration process. Calibration data should uniquely identify the instrument body, the rotor, observer, rating tank, way of suspension, methodology and similar information.
- The current meter shall come with a rating table and a rating chart in m/s versus revolutions per second.
- The current meter shall have a provision to adjust its trimming.
- The design shall be sediment resistant and have an air-filled bearing chamber.
- The bearings should be field adjustable.
- The current meter shall come without a protection ring/yoke in front of the rotor; such a yoke would make the current meter sensitive to its alignment into the flow, which should be avoided.
- The bearing chamber shall be as slim as possible to avoid excessive drag.
- The electrical connections shall not protrude into the current, but backwards instead.
- The electrical connections shall be of a reliable and sturdy construction.
- The current meter and accessories shall be supplied in a sturdy carrying case.
- An appropriate tool-set shall be included in the delivery.
- The current meter shall generally comply with IS 3910-1992.

Specifications

1. Sensor

sensor type	6 cup wheel	
contact	every one revolution	
range	0.015 to 0.9 m/s (starting up to maximum operational velocity)	
accuracy	for velocity up to 0.3 m/s:	1 % Full Scale
	for velocity >0.3 m/s:	0.5 % FS
contact chamber	magnetic or optic fibre	

2. Suspension

wading rod	total length 3 m, graduation in cm
cables	wading application, from meter to counter, 10 m

Accessories

- standard instrument tools
- spare bearings

Indian Standard

REQUIREMENTS FOR WATER FLOW MEASUREMENT IN OPEN CHANNELS — ROTATING ELEMENT CURRENT METERS

(First Revision)

1 SCOPE

This standard specifies the operational requirements, constructional guidelines and maintenance of rotating element current meter for the measurement of flow velocities in the open channel.

2 REFERENCES

The Indian Standards listed below are necessary adjuncts to this standard:

IS No.	*Title*
1191 : 1971	Glossary of terms and symbols used in connection with the measurement of liquid flow with a free surface (*first revision*)
1192 : 1981	Velocity area method for measurement of flow of water in open channels
3918 : 1966	Code of practice for use of current meter (cup type) for water flow measurement

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1191 : 1971 shall apply.

4 PRINCIPLE OF OPERATION

4.1 Proportionality

The rotating element of a current meter is driven by the fluid at an angular velocity which is proportional to the local velocity of the fluid at the point of immersion when that velocity exceeds a critical value.

The velocity of fluid is determined by counting the number of revolutions of the rotor during a specified time interval or by observing the time required by the rotor to turn a given number of revolutions and consulting the meter calibration table or rating equation. The velocity of fluid movement may be determined from the sensing of signals emitted (such as electrical pulses) through the rotation of the rotor. The velocity may be determined from a direct reading of the speed of rotation of the rotating element by means of equipment designed for this purpose.

NOTE – The axis of the rotating element may be at right angles or it may be parallel to the direction of flow.

5 TYPES OF CURRENT METER

5.1 They have been classified according to the type of rotating element used.

5.2 Cup Type Current Meter

A rotor (bucket wheel) generally formed out of conical cup and curved vanes attached at equal intervals around the perimeter of the hub which will rotate when placed in the fluid flow. It is usual to mount the rotor with the axis vertical. Typical constructional features are given in Annex A.

5.3 Propeller Type Current Meters

Assembly consisting of 2 or more helical screw blades formed around a hub or a number of flat plates attached at equal intervals around the perimeter through twisted spoke that will rotate around a horizontal axis when placed with fluid flow.

5.4 Savonious Type Current Meters

The rotor is an assembly of a number of curved vanes (of the formation of a turbine rotor) attached at equal intervals formed around a vertical axis.

NOTE – Miniature current meters generally are of cup type and propeller type as mentioned above in 5.2 and 5.3.

6 OPERATIONAL REQUIREMENTS

6.1 Positioning

6.1.1 The longitudinal axis of the free suspension type current meter shall take-up stable position parallel to the direction of flow without excessive twisting and turning under the influence of local eddy currents.

6.1.2 It shall dynamically balance in the stream with its longitudinal axis parallel to the water's surface and shall have sufficient freedom of movement in the vertical plane to ensure the assumption of the position.

NOTE – Generally for miniature current meters, conditions under 6.1.2 are difficult to practise.

6.2 Relationship of Rotor Movement and Stream Velocity

The rotating element of the current meter shall be such

that when driven by the fluid, it rotates at an angular velocity which has a known relation to the velocity of the flow within the calibrated velocity range stated by the rating laboratory.

6.3 Limits of Use

6.3.1 *Various Liquids*

The current meter shall be used only in liquid with properties similar to those in which the meter was calibrated. If the liquid properties are significantly different, the meter shall be recalibrated in a liquid with properties similar to that in which the meter is to be used.

Unless otherwise indicated, the current meter shall be capable of being used in waters containing suspended sediment and in saline waters.

6.3.2 *Cup Type Current Meters*

Vertical components of velocity may cause rotation of a hollow-cup type current meter. When there is considerable turbulence in a stream or where there are otherwise significant vertical components of velocity, hollow-cup-type meters may over-register. Usually the over-registration will be small unless large vertical components of velocity relative to the horizontal components are encountered.

6.3.3 *Savonius Type Current Meters*

Under combined action of flow and wave, rotors with blades having higher curvature over-reads, usually the over-registration will be small unless waves with high energy content are encountered.

7 FUNCTIONAL REQUIREMENTS

7.1 The meter shall respond rapidly and consistently to changes in velocity: the manufacturer shall state the expected response rates.

7.2 Spare parts shall be fully interchangeable, so as to have uniform functional characteristics to cause less than 2% divergence from the normal rating curve and to facilitate easy replacement of worn of damaged elements.

7.3 The current meter shall offer minimum resistance to flow.

7.4 The construction shall be simple to admit all parts being taken but easily cleaned and refitted and also sufficiently rugged to maintain calibration under conditions normally encountered in the final.

7.5 The current meter shall be provided with facilities for dynamic balancing (*see* **6.1.1** and **6.1.2**) in the form of a counterweight adjustment.

7.6 It shall be provided with facilities for mounting on a cable suspension as well as on a hanger bar or a wading rod.

7.7 It shall be provided with facilities for attaching to it sounding (fish) weight.

8 CONSTRUCTION FEATURES OF CURRENT METERS

8.1 General

8.1.1 *Cup Type*

A cup type current meter shall generally consist of:

a) a rotor revolving about a vertical shaft;
b) a hub assembly;
c) bearings;
d) a main frame or yoke;
e) a chamber containing the signal generation mechanism;
f) tail fin; and
g) a means of attaching the instrument to the suspension equipment.

8.1.2 *Propeller Type (Including Savonius Type Rotors)*

a) a rotor that is either a propeller revolving about a fixed axis or a revolving set composed of the propeller and axis;
b) two bearings;
c) a device giving a signal indicating movement of the rotor;
d) a means of attaching the instrument to the suspension equipment;
e) a streamlined body (not applicable to savonius type);
f) tail fin; and
g) a means of attaching the instrument to the suspension equipment.

NOTE —A means of providing directional control to the meter in the current meter in the current will generally be provided. This may be either a part of the suspension equipment or an integral part of the meter.

8.2 Rotor

8.2.1 *Cup Type*

The rotor will generally be constructed of six hollow conical cups, fixed in the same horizontal plane at equally spaced intervals (equal angles) to a frame mounted on a vertical shaft. The assembly shall be retained in the yoke by means of the upper shaft bearing and a lower pointed bearing consisting of a central pivot and a bearing cup.

8.2.2 *Propeller Type*

The current meter may be provided with a single propeller type rotor or with several interchangeable ones each having a different pitch and/or diameter. Each propeller shall consist of multiple vanes or helical screw blades that generally rotate about a horizontal axis. The propellers should be made from material which will not allow them to be easily distorted.

8.2.3 *Savonius Type*

The rotor consists of an assembly of about six to eight turbine type curved vanes (or straight blades) built

around a vertical axis. The rotors shall be made from a material which will not allow it to be easily distorted or corroded even in saline waters.

8.3 Bearings

The resisting torque of the bearings shall be as small as possible and shall be constant during use. Bearings shall be lubricated as stated by the manufacturer. Provision shall be made to ensure that silt and water do not enter the bearings except as required for water-lubricated bearings.

8.4 Means of Registering Rotor Revolutions

8.4.1 *Signals*

The revolutions of the rotor shall, by means of mechanical contacts or by means of optical or other devices, generate a clear and positive signals at all velocities within the effective range of the meter. It is permissible to provide a means of multiplying or dividing the signal pulse rate to suit counting equipment with a limited range of operation. If electrical connections are used in the equipment, they should be appropriately protected against short-circuiting and appropriately waterproofed.

8.4.2 *Registration Device*

Arrangements shall be provided to indicate by audible note or visual display or registration on a suitable media (printer/magnetic tape) number of revolutions or revolution rate or velocity of flow.

8.5 Directional Control

Directional control shall be provided by means of tail fins or other devices to enable the meter to align itself with the stream flow and to remain stable in that position throughout the full range of calibrated velocities. The directional control may be either provided by the suspension system or provided by tail fins or other devices that are attached to or are an integral part of the meter.

8.6 Response Behaviour

The manufacturer shall specify the minimum speed of response which is defined as the lowest speed at which the current meter will initiate and maintain steady motion. The manufacturer shall also state the consistency of response together with tolerances to changes in velocity.

8.7 Hydrostatic Pressure

The manufacturer shall state the maximum hydrostatic pressure to which the instrument may be subjected.

8.8 Conductivity of Water

The manufacturer shall stipulate the maximum conductivity of water in which the meter can be used.

9 CONSTRUCTIONAL MATERIALS

9.1 The meter shall be constructed of corrosion-resistant materials throughout or of materials that are effectively protected against conditions encountered in natural medium where measurement are proposed to be taken. The use of the meter in silty or saline waters may reduce the life of the meter.

9.2 The rotors preferably be constructed of such material whose specific gravity should be as close to that of the fluid whose flow velocity is intended to be measured (to enable the energy transference from the fluid to the rotor with least delay).

10 CALIBRATION (OR RATING)

10.1 General

10.1.1 The calibration of current meters involves experimental determination of the relationship between velocity of flow and rate of revolution of rotor (usually expressed as revolutions per second) and provided as a calibration curve or calibration (rating) relationship.

10.1.2 The calibration (rating) of a current meter will normally be valid only for that range of velocities for which it has been manufactured and calibrated and for use with a similar liquid to that which was used in its calibration. Extrapolation is permissible to higher velocities provided that sufficient calibration data exist for meters of a similar type at these higher velocities and that a greater uncertainty is accepted. Any current meter new or old requires periodical calibration.

10.2 Conformity

10.2.1 All calibration shall be carried out in accordance with relevant Indian Standard on calibration.

10.3 Type of Calibration (Rating)

A current meter shall have individual calibration (rating) where the relation of velocity to response is based on a rating of that particular meter. Each meter shall be calibrated to produce individual ratings.

10.4 Equation

10.4.1 From the calibration data, manufacturer or rating laboratories shall supply a rating table for convenience for use in the field and shall also specify the equation of the rating curve derived from the data and the minimum speed necessary to produce a representative sensing of the fluid motion. This speed is the lowest speed at which the current meter will initiate and maintain steady motion. The actual limits of the rating shall be stated.

10.5 Recalibration

Each meters shall be recalibrated (re-rated) whenever its performance is doubtful. Recalibration on routine basis shall be carried out at yearly intervals or after 300 h of use, whichever is the shorter.

10.6 Type of Suspension

The performance of a meter may be affected by its mode of suspension and the sounding weight used.

For individual ratings, it is advisable that the calibration be carried out using the means of suspension and the sounding weight intended to be used during a measurement. The distance from the bottom of the sounding weight to the meter, for the calibration configuration, shall be specified by the rating laboratory or manufacturer.

It is possible to derive by experimental coefficients which can be applied to gauging data to correct for the effects (if any) of different sounding weight and different means, size and shape of suspension.

Such coefficients are applicable only to the specific combination for which data have been experimentally obtained.

10.7 Uncertainty

As a check for goodness of fit of the rating curve, the manufacturer or rating laboratories shall state the standard error of the data for the lower and upper limits of calibration, and for at least two intermediate points. The standard error shall be stated as a percentage of the velocity class and shall be related to the 95% confidence limits.

The scatter of the points about the rating curve for each velocity class shall be approximately normal so that the errors will be compensating.

10.8 Operating Conditions

Attention should be paid to possible variations in the rating due to changes in liquid density or viscosity.

11 TOLERANCE

Maximum permissible tolerances in the velocity measurement with new current meters shall be as follows:

Velocity around 0·3 m/s	± 1 percent
Velocity greater than 0·3 m/s	± 0·5 percent

12 MAINTENANCE

12.1 General

Under conditions of normal operation, the user should follow recommended check procedures before and after each discharge measurement, as laid down in the manufacturer's operation and servicing manual. In the event of more comprehensive instructions not being provided the procedures specified in **12.1.1** to **12.1.3** should be followed.

12.1.1 *Examination*

The meter shall be examined before and after each discharge measurement for worn or damaged bearings, proper shaft alignment, correct operation of contact points and deformation of the yoke or cup-wheel in the case of cup type meters or as rotor assembly in case of savonius type meters. All moving parts should be carefully inspected and checks performed to ensure operation in accordance with specifications. Particular attention should be paid to equipment which has been in storage for a long period of time.

12.1.2 *Inspection*

For inspection, it shall be possible to dismantle and reassemble the current meter assembly in the field, without specialized workshop facilities and by personnel without specialist training. Such tools as are required to carry out this operation shall be supplied as standard accessories.

On-site removal and replacement of the rotor on its shaft shall be possible with minimum disturbance to the bearing assembly, and preferably without removing the bearing assembly from the instrument.

12.1.3 *Signal Test*

Before use, the meter shall be tested for correct operation. By turning the rotor slowly, the number of rotations shall be compared with the number of pulses received. For current meters with a generator it shall be checked that output varies with rotor speed.

12.2 Spin Test

12.2.1 *Current Meters with Ball Bearings or with a Pivot Bearing*

If no, special instruments are provided by the manufacturer, the test described below may be carried out after the meter has been lubricated and assembled ready for use. For a new cup type current meter the spin time shall be a minimum of 75 seconds.

Place the meter in the normal operating attitudes, with the rotor protected from air currents. Spin the rotor by hand. As it nears its stopping point, observe its motion carefully to see whether the stop is abrupt or gradual. If the stop is abrupt, the cause shall be found and corrected before the meter is used. A pre-specified minimum spin time should be observed for a meter in good condition.

12.2.2 *Current Meters Without Ball Bearings*

The design of meters without ball bearings prevents the meter from working properly in air. The manufacturer shall recommend a simple check procedure to ensure proper operation.

12.3 Cleaning and Lubrication

After each discharge measurement, or more frequently for extended measurements, all bearing surfaces (including any pivot) shall be thoroughly cleaned and, where appropriate, lubricated. If bearings require lubrication to be applied for use of the current meter in the field, the lubricant used shall have the same viscosity characteristics as the lubricant used at the time of calibration; this lubricant shall have the same or equivalent specifications as that recommended by the manufacturer.

12.4 The history sheet of the current meter shall be maintained in the proforma given below :

HISTORY SHEET AND CALIBRATION DATA

Name of manufacturer .....

Date of manufacture .....

Serial number .....

Source of manufacture .....

Sl No.	Date of Start and Stoppage of Use and Re-use	Date of Calibration	Place of Calibration	Result of Test	Equations	Remarks Giving Condition of Meter, Repair If Any, Reason for Stoppage, Use and Re-use, etc
(1)	(2)	(3)	(4)	(5)	(6)	(7)

12.5 Transport and Storage

A suitable protective instrument case shall be provided by the manufacturer in which the current meter may be stored when not in use. Suitable storage shall also be provided in the case for the tools required for instrument maintenance.

Provision shall be made for the storage and transportation of the current meter and its components in such a manner that the bearings and other parts of the meter can be protected from wear and from damage resulting from vibration or shock.

13 OPERATIONAL AND SERVICING MANUAL

A comprehensive operational and servicing manual should be supplied with each instrument. It should present full instructions, illustrated where necessary and include appropriate circuit diagrams with component values. The manual should contain sections on the following:

a) normal maintenance, servicing on site, checking procedure including recommended screw torques;

b) spares list, including a list of contributing manufacturers;

c) lubricant and sealant details, including lubricant and compound specifications;

d) preparations necessary for transport and storage;

e) details of power source, if any and appropriate rates and duration of recharge;

f) details of electrical and (or) electronic circuitry (including component values) with circuit diagrams and test procedures.

14 ACCESSORIES AND SPARES

14.1 Essential site spares and maintenance spares for at least two years, as well as accessories are to be provided as per recommendation of the manufacturer.

14.2 Appropriate fish weights shall be provided to cover the velocity ranges for which it is expected to be used.

15 MARKING

Current meter shall be engraved with source of manufacture, trade mark, year of manufacture and the serial number for each delivery.

ANNEX A
(*Clause* 5.2)

TYPICAL DETAILS OF A STANDARD SIZE CUP TYPE CURRENT METER WITH FRONT HOOP

A-0 GENERAL

A-0.1 Details of various parts and their arrangement of the such type of current meter are shown in Fig. 1, 2, 3, 4. The counter is of electronic type. The signal generating system has magnet and read switch assembly.

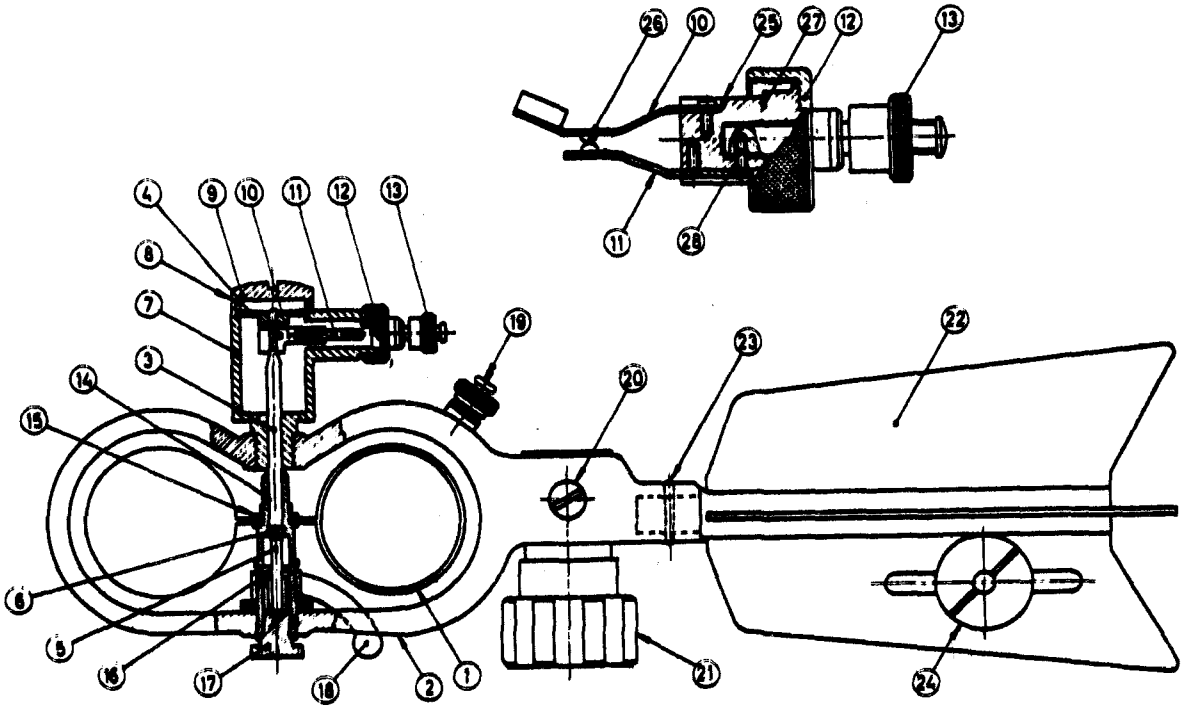
A-0.2 Material to be Used

A-0.2.1 The meter shall be constructed of non-corrosive materials and for:

a) *Yoke (Main Frame)* — Manganese bronze casting.
b) *Bucket Wheel Cups* — Brass sheet.
c) *Pivot* — Rust proof, hardened, and tempered close grained tool steel with minimum Vicats diamond pyramid hardness No. 640 (Rockwell C-57).
d) *Pivot Bearing* — Rust proof, hardened and tempered steel with minimum Vicats diamond pyramid hardness No. 720 (Rockwell C-61).
e) *Contact Chamber* — Brass sheet.
f) *Contact Point* — Platinum.
g) *Contact Spring*

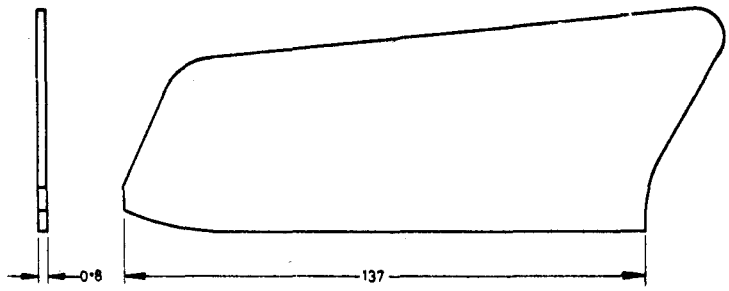
NOTE — The construction of miniature (Pigmy), which is without front hoop is similar except for:

a) The size of the bucket wheel is 5 cm instead of 12·7 cm and all other parts are suitably diminished.
b) Contact chamber being an integral part of the yoke.
c) There being no provision for mounting on a cable suspension as it is always mounted on a wading rod or hanger bar.
d) There are no tail fins.
e) Sometimes it may not have bucket wheel raising nut and under those conditions a soft metallic plug should be provided to replace the pivot while the meter is being transported or stored.

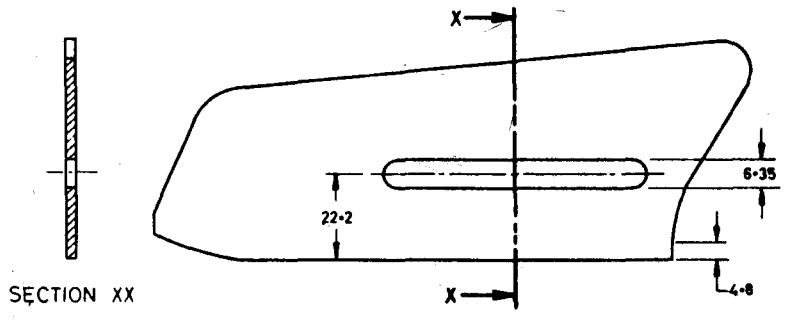


1. Bucket-wheel cup
2. Yoke
3. Spindle
4. Upper spindle bearing
5. Pivot
6. Bearing cup
7. Contact chamber
8. Sealing washer
9. Cap for contact chamber
10. Contact spring
11. Insulated contact bar
12. Contact breaker clamping ring
13. Terminal knob
14. Spindle collar
15. Bucket Hexagonal lock nut
16. Pivot lock nut
17. Pivot holder
18. Bucket-raising level
19. Earth terminal
20. Central adaptor pivot
21. Adaptor clamp
22. Tail fin
23. Tail fin securing pin
24. Tail fin counter-weight
25. Contact to earth
26. Platinum contacts
27. Vulcanite mount
28. Insulated contact-bar securing screw

FIG. 1 CURRENT METER (CUP TYPE)



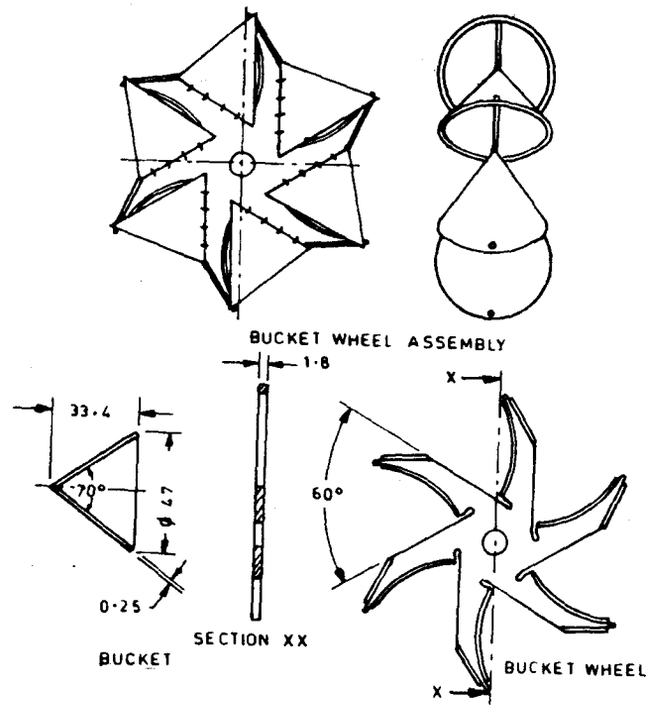
FINS (3-OFF)



FIN WITH SLOT (1-OFF)

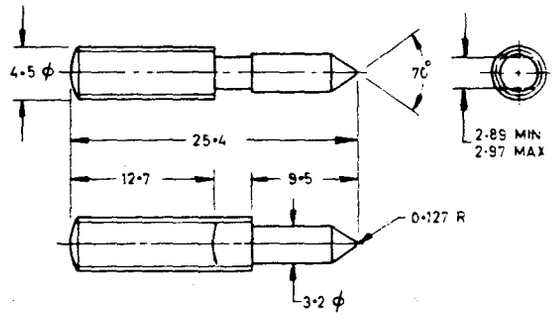
All dimensions in millimetres.

FIG. 2 DETAILS OF FIN

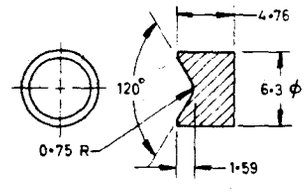


All dimensions in millimetres.

FIG. 3 BUCKET WHEEL FOR CURRENT METER



4 A PIVOT



4 B PIVOT CUP

All dimensions in millimetres.

FIG. 4 PIVOT AND PIVOT CUP

30.012 EVAPORIMETER, US CLASS A PAN

Approval Date: 20 May 1998 **Version: 1**

Purpose

Estimation of evaporation from the surface

Conditions & Requirements

- The pan shall comply with IS 5973 - 1970.
- Civil works will be finalised in collaboration with the supplier.

Specifications

1. Pan

size	1.22 x 0.255 m (diameter x height)
accuracy of reading	0.1 mm
pan evaporimeter	copper sheet of thickness 1.0 ±0.1 mm point gauge and still well brass

2. Measuring cylinder

material	clean cast seamless acrylic plastic tubing or brass sheet
bottom plate	acrylic plastic sheet
thermometer clamp	brass
platform	rot resistant timber treated with creosote or other effective wood preservative
inner diameter	122 mm
graduation	in cm.

Indian Standard

PAN EVAPORIMETER — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard specifies the requirements for pan evaporimeter consisting of a pan, wire mesh cover, fixed-point gauge, measuring cylinder, thermometer with clamp and wooden platform.

2 REFERENCES

2.1 The following standards contain provisions which through reference in this text, constitute provision 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*
1550 : 1967	Copper sheet and strip for utensils and for general purposes *(first revision)*
3150 : 1982	Specification for hexagonal wire netting for general purpose *(second revision)*
5522 : 1992	Stainless steel sheets and strips for utensils *(second revision)*
5912 : 1997	Anemometer, cup counter *(first revision)*
6500 : 1972	Thermometers for masurement of sea surface temperature

3 DESCRIPTION

3.1 The pan evaporimeter consists of a cylindrical reservoir of fixed diameter and depth, filled with water to a few centimetres below the rim. A fixed-point gauge in a stilling well serves to indicate the level of water in the pan. A calibrated measuring cylinder is used to add or remove water at each observation to bring the water level to the fixed point. The cross-sectional area of the measuring cylinder is such that, the number of millimetres of water added from the measuring cylinder divided by 100 gives the amount of water in millimetres which has evaporated from the pan during a given interval of time. The reservoir is covered with wire-mesh netting to protect the pan from birds and animals. A thermometer suspended from a mounted clamp to the side of the reservoir, records the temperature of the water in the pan. A totalizing anemometer (*see* IS 5912) installed nearby records the wind speed at the level of the instrument.

4 MATERIAL

4.1 The pan evaporimeter shall be made from copper or non-rusting, non-magnetic stainless steel sheet of 1.0 ± 0.1 mm thickness conforming to IS 1550 or IS 5522.

4.2 The fixed-point gauge shall be made from brass rod of 10 mm diameter. The stilling well shall be made from hard drawn seamless brass tube or ERW brass tube of 102 mm outside diameter with a wall thickness of $3.0^{+0.5}_{-0.0}$ mm and the base from cast brass. The inner and outer surfaces of stilling well should be smooth and free from burrs.

4.3 The measuring cylinder shall be made from clear cast seamless acrylic plastic tubing and the bottom plate of clear acrylic plastic sheet.

4.3.1 The measuring cylinder may also be made from brass sheet or other suitable material and provided with 'a wired rim', 'a lip' and 'a drop handle'.

4.4 The thermometer clamp shall be made from brass or any other suitable material.

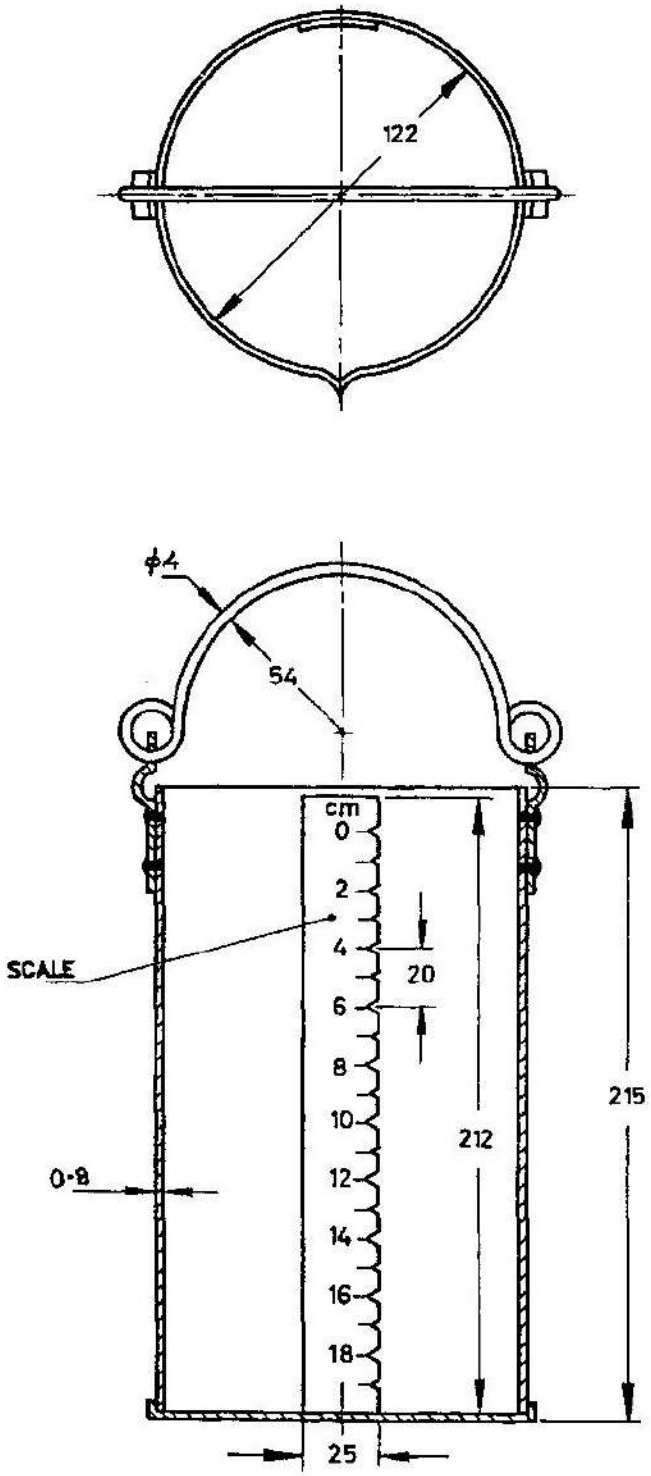
4.5 Rot resistant lumber treated with creosote or other effective wood preservative shall be used for the platform.

5 DIMENSIONS

5.1 The dimensions of the pan evaporimeter shall be as given in Fig. 1.

5.2 The dimensions of the measuring cylinder made from acrylic plastic, brass or other suitable material shall be as given in Fig. 2 and 3 respectively.

5.3 The shape and dimensions of the clamp for thermometer shall be as shown in Fig. 4. Alternatively any suitable clamp shall be fixed for holding the thermometer, so that its bulb is well immersed in the water.



All dimensions in millimetres.

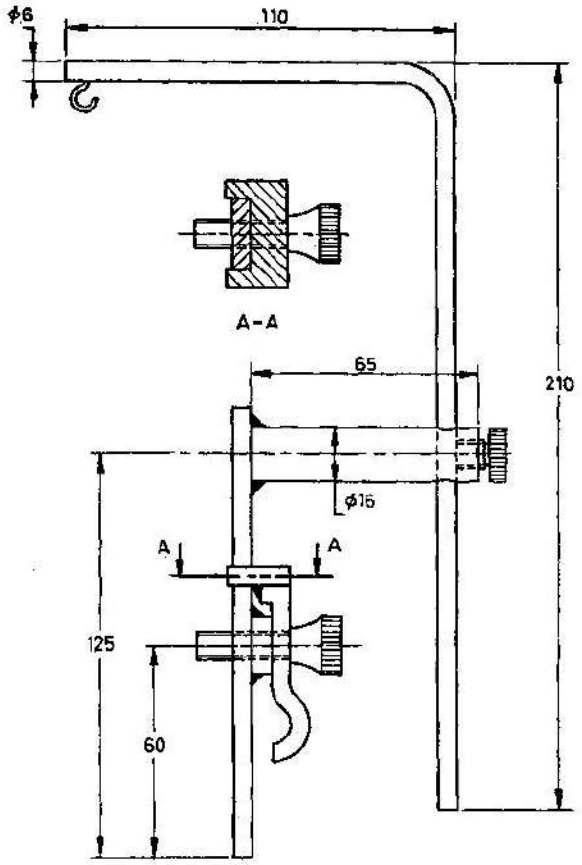
FIG. 3 DIMENSIONS FOR MEASURING CYLINDER (BRASS)

wire. It shall also be fastened to the cross pieces along their length at intervals of 75 mm.

6.2.3 The complete wire-mesh cover shall be painted with three coats of chlorinated white rubber paint.

6.3 Fixed-Point Gauge

The fixed point gauge shall consist of a stilling well mounted on a heavy base and provided with a pointed rod with a rounded tip of 2 mm diameter fixed centrally



All dimensions in millimetres.

FIG. 4 DIMENSIONS FOR CLAMP FOR THERMOMETER

in it. The stilling well shall conform to the requirements specified in **4.2**. The dimensions of fixed point gauge shall conform to Fig. 1.

6.3.1 Three small openings approximately 5 mm in diameter shall be provided in the sides of the cylinder near the base, at an angle of 120° apart, to permit the flow of water into or out of the stilling well and at the same time restrict surging action of water at the point of measurement.

6.3.2 The stilling well shall have three coats of chlorinated white rubber paint. The fixed-point shall be left unpainted.

6.4 Measuring Cylinder

The measuring cylinder shall be perfectly watertight.

6.4.1 The graduation lines and numerals on the acrylic plastic cylinder (*see* Fig. 2) shall be moulded, sand-blasted, etched or stamped on the exterior surface of the tube. The graduated scale for the brass cylinder graduation lines in both shall be deep cut, well defined and filled with a permanent black colour. The colouring used in these markings shall have the essential properties to withstand indefinitely daily submersion in water, frequent handling and occasional exposure to the natural elements.

6.4.2 The workmanship shall be of the highest quality to ensure proper serviceability. The brass cylinder shall be painted with two coats of chlorinated white rubber paint.

6.5 Thermometer

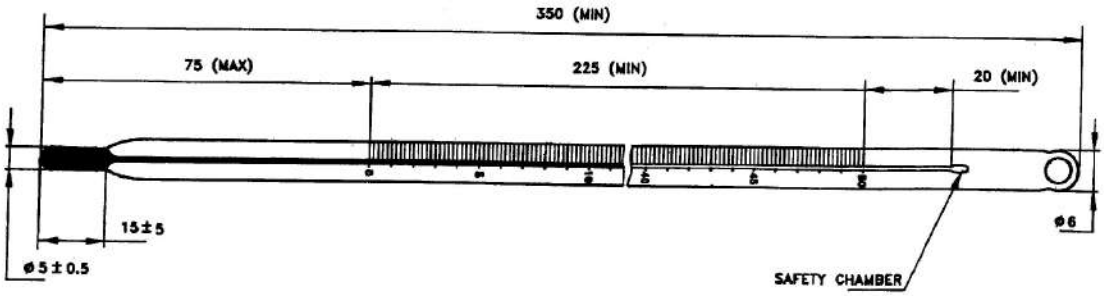
The thermometer shall conform to the requirements specified in IS 6500 in all respects except for the top which shall have a bent hook instead of a bent nib (*see* Fig. 6).

6.6 Thermometer Clamps

The thermometer clamp shall be painted with three coats of chlorinated white rubber paint.

6.7 Wooden Platform

The wooden platform shall be painted with two coats of white enamel paint. The wooden platform shall be properly fabricated and finished so that the pan is perfectly levelled and there is no wobbling (*see* Fig. 5).



NOTE — Maker's name/Trade name if any, serial number and year of manufacture shall be legibly engraved on the back side of the thermometer.
Length of Graduations
0.2°C — 2mm long
1°, 5° and 10°C — 4 mm long
1 Division = 0.2°C

All dimensions in millimetres.

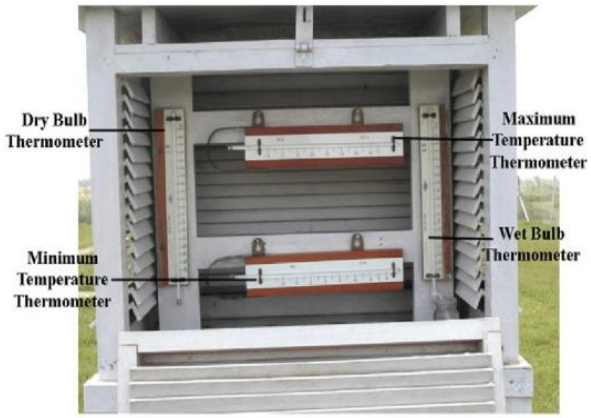
FIG. 6 THERMOMETER FOR OPEN PAN EVAPORIMETER RANGE : 0°C TO 50°C

NAME OF THE EQUIPMENT: SINGLE STEVENSON SCREEN

➢ PURPOSE OF STEVENSON SCREEN:

- Stevenson screen is a wooden box specifically designed for housing four thermometers which record the surface air temperature in ^{0}C.
- These four thermometers are maximum, minimum, dry and wet bulb thermometers.
- Thomas Stevenson designed this screen in 1866.

➢ DETAILS OF EQUIPMENT:



- A Stevenson screen is a rectangular wooden box of dimension length 56 cm, width 30 cm and height 40 cm.
- Double roof-side walls are louvered providing free movement of air to the thermometers bulb.
- The air space between the double roof and white painting prevent direct heating from the intensity of sunlight.
- Stevenson screen is painted white and is mounted on four wooden supports, the bottom of the screen being at 1.22 m (4 ft) above the ground.
- The screen is set up with its door facing north side (opening downward) so that minimum sunlight would enter while the observer is reading the instruments.
- The use of the screen is to protect the thermometers from direct heating from ground and neighbouring objects and from losing heat by radiation at night.
- Stevenson screen also protect instruments from rain and snow and allows free air circulation.
- The maximum and minimum thermometers are laid in horizontal positions on the upper and lower wooden brackets, respectively and rest at an angle of 2^0 to horizontal.
- The dry and wet bulb thermometers are kept vertical on the wooden bracket in the left and right hand sides, respectively.

30.008 LIQUID IN GLASS THERMOMETERS

Approval Date: 20 May 1998 **Version: 1**

Purpose

Accurate measurement of air temperature

Conditions & Requirements

- The thermometers shall comply with IS 5681-1983.
- The delivery shall include matching muslin wicks for the wet-bulb measurements, in a number sufficient for one year of continuous operation.

Specifications

1. Maximum thermometer

type	Mercury in glass
range	-35 to 55 °C
accuracy	0.2 °C
graduation interval	0.5 °C

2. Minimum thermometer

type	Alcohol in glass
range	-40 to 50 °C
accuracy	0.3 °C
graduation interval	0.5 °C

3. Ordinary thermometers (for dry and wet bulb measurements)

type	Mercury in glass
range	-35 to 55 °C
accuracy	0.2 °C
graduation interval	0.5 °C

10.028 AUTO LEVEL

Approval Date:6th October,1999

Reviewed on : 23 October 2007 **Version: 2**

Purpose

The auto level will be used for general topographic levelling applications, in particular to connect staff gauges to established benchmarks or GTS levels.

Conditions & Requirements

- The instrument shall be of reliable and simple design, adequate for the application.
- The tripod shall generally comply with IS 8330-1997
- The levelling instrument shall generally comply with IS 4590-1980.
- An operator's manual shall be part of the delivery

Specifications

image	erect
magnification	≥ 25 x
aperture of objective	≥ 30 mm
field of view	1°20′ to 1°30′
shortest focussing distance	maximum 1.5 m
max distance for mm	100 m
resolving power	1.5 mm @ 60 m
stadia multiplying constant	100
stadia additive constant	0
centring plumb bob with adopter	one
sensitivity of level plate	20 sec / 2 mm run
tribarch circular bubble	8 min / 2 mm run
compensation range	12 to 16 seconds
compensation accuracy	0.3 second
accuracy for levelling the line of sight	± 0.8 second
levelling accuracy in 1 km of double levelling	± 2 mm in 1 km
tripod with clamping screw – one unit	1600 mm well seasoned wood or light & strong alloy telescopic with mounting for battery, illumination unit & clamping arrangement for the instrument
centring provision	30 – 50 mm
carrying case – one unit	light metallic or plastic (unbreakable type) or well seasoned wood with padded inserts and receptacles for holding accessories with lock, handle, carrying shoulder strap etc.,
instrument life time	>5 years of continuous operation
temperature range	0 to 50 °C
housing	splash waterproof

Accessories

cleaning brush	one unit
tool-set	spanner, tommy pins, screw driver, etc. – one set
lens cover set	one set
oil bottle	one unit
chamois leather	one
plumb bob with adopter plug	one
waterproof cover	made of durable plastic material - one
silica gel - re-usable	one packet 200 g
telescopic levelling staffs and accessories	2 nos., complying with IS 11961-1986
measuring tape 30 m (fibre glass)	two nos

Indian Standard

SPECIFICATION FOR SECONDARY LEVEL

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 September 1980, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 This standard, first published in 1967 as 'Specification for engineers level', has been revised so as to make it applicable exclusively for secondary level. The technical and other requirements covered in the earlier edition have been suitably modified so that it is possible to attain a standard deviation of $\pm$ 2 mm in 1 km of double levelling which is the desired accuracy for secondary levelling. The requirements of primary and tertiary levels have been separately covered in IS : 9613-1980* and IS : 9607-1980†.

0.3 Secondary level is a medium accuracy level used for second order levelling operations. These operations are undertaken for height determination for topographical works, installation of machinery, construction of roads and railways, building works, etc.

0.4 Secondary level (*see* Fig. 1) consists of an internal focussing telescope having medium magnification and resolution. These levels are normally of two types, namely tilting level and automatic level. The tilting level is one in which the axis is approximately levelled with a small circular bubble and more accurate levelling is done by centring a more sensitive bubble by means of a tilting screw. The automatic type is one in which the axis is approximately levelled by a circular bubble and more accurate levelling of axis is achieved automatically by a prism system suspended under gravity inside the instrument. This standard deals with the tilting type level.

*Specification for primary level.
†Specification for tertiary level.

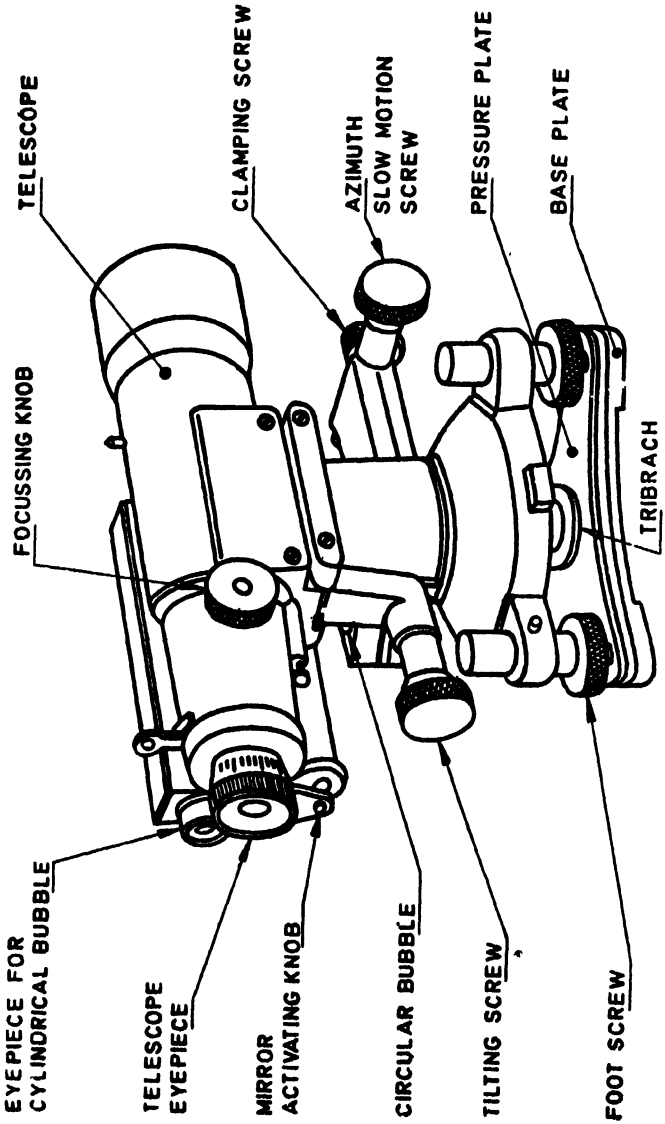


FIG. 1 SECONDARY LEVEL

1. SCOPE

1.1 This standard specifies the requirements of tilting type secondary level capable of attaining standard deviation (mean square error) of ± 2 mm in 1 km of double levelling.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions and the definitions given in IS : 1399-1959* shall apply.

2.1 Levelling Staff — A vertical wooden rod having divisions (*see* IS : 1779-1961†).

2.2 Tribrach — The lowest part of a level carrying the levelling-*cum*-mounting system.

3. GENERAL REQUIREMENTS

3.0 The secondary level shall conform to the requirements laid down in IS : 988-1959‡ and to the requirements laid down in 3 of IS : 2754-1964§.

3.1 The base plate of the instrument shall have provision for fitting the level on the stand. It shall have a central hole of such dimension that a clamping screw of size M16 × 2 may be fitted well into it.

3.2 A pressure plate shall be provided to keep the foot screws firm in the sleeves of the base plate.

3.3 The level shall be provided with a cylindrical axis and bushing made of special high grade alloy steel which ensures reliable operation at any temperature without special attention to oiling, cleaning and adjustment, etc.

3.4 The instrument shall be compact, solid and highly stable.

3.5 All optical parts shall be provided, except the face marked with graticule markings, with antireflection coatings. The quality of anti-reflection coating shall conform to IS : 8248-1976‖.

3.6 Bubbles

3.6.1 The bubbles provided with the level shall conform to the requirements of IS : 1632-1960¶ as far as applicable.

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*Glossary of terms used in optical technology.
†Specification for 4-metre levelling staff, folding type.
‡General requirements for optical components.
§General requirements for optical instruments.
‖Specification for antireflection coating on glass optical components.
¶Specification for bubbles.

3.6.2 The instrument shall be provided with a circular bubble for quick levelling in the beginning. It may be fitted with a plane circular reflector (mirror) for ease of observations of the air bell. The bubble shall be provided with capstan or square head screw for adjustment. This type of screw shall be adopted to enable the use of tommy pin/spanner during adjustment and thus avoiding undue pressure on bubble.

3.6.3 The level shall be fitted with a cylindrical bubble having provision of a plane mirror. In order to facilitate its use in different lighting conditions, one side of the mirror shall have a good reflecting surface. The plane mirror shall be fitted over the bubble in such a way that it can easily be retained in any position and shall not fall due to its own weight. The cylindrical bubble shall be capable of adjustment by means of capstan or square head screw.

3.6.4 Provision shall be made to see the two ends of cylindrical bubble by coincidence principle. This shall be achieved by means of prisms. An eyepiece shall be provided to see the coincidence of bubble ends.

3.6.5 The cylindrical bubble shall be capable of adjustment by means of capstan or square head screw.

3.7 Horizontal Circle — If agreed to between the supplier and the purchaser, the level shall be provided with a horizontal glass circle. The circle shall be graduated in 360° with provision to read directly 10′ and by estimation 1′. The figuring shall be done at each degree.

3.8 Telescope

3.8.1 The telescope shall be provided with an internal focussing arrangement and its optics shall be provided with antireflection coating conforming to IS : 8248-1976*.

3.8.2 The graticule of the telescope shall be provided with cross and stadia lines, the latter being provided in the vertical cross line. The distance of stadia lines from the horizontal cross line shall be equal. Provision shall be made for adjusting collimation of the telescope both in the field and the laboratory.

3.8.3 The telescope shall be provided with a clamping screw, a screw for slow motion in the horizontal plane and a tilting screw for slow motion in the vertical plane. The head of the tilting screw shall be graduated and figured suitably to facilitate at the time of adjustment of bubbles as given in **5.2.1.1.**

3.8.4 A sighting arrangement shall be provided on the telescope for quick alignment with the staff.

*Specification for antireflection coating on glass optical components.

3.9 Technical Data

3.9.1 The secondary level shall conform to the following technical requirements:

a) Magnification	25 to 30 ×
b) Clear aperture of objective	40 mm
c) Field of view	About 1·5 degrees
d) Addition constant	Practically 0
e) Multiplication (stadia) constant	100
f) Shortest sighting distance	About 1·6 m
g) Largest aiming distance for mm evaluation	100 m
h) Levelling accuracy attainable that is standard deviation (mean square error) in 1 km of double levelling	± 2 mm
j) Accuracy of levelling the line of sight	± 0·8 seconds
k) Sensitivity of circular bubble	10 minutes per 2 mm
m) Sensitivity of cylindrical bubble	30 seconds per 2 mm
n) Horizontal circle's graduations	(*see* **3.7**)

3.10 Case — The instrument shall be provided with a light metallic or well seasoned wooden case fitted with receptacles to hold the instrument and accessories. The case shall have suitable locking arrangement. A carrying handle or belt shall be provided with the case.

3.11 Accessories — The following accessories shall be supplied with each instrument:

a) Camel hair brush	1
b) Tommy pin/spanner	2
c) Chamois leather	1 piece
d) Silica gel	1 bag of about 200 g
e) Screw driver	1
f) Tripod with clamping screw and plumb bob	1

4. FUNCTIONAL REQUIREMENTS

4.1 The movement of the clamping, slow motion and tilting screws and the motion of the different parts of the instrument shall be easy and smooth without undue stiffness, looseness or backlash.

4.2 The clamping screw shall be such that it does not exert any strain on the clamped parts.

4.3 The motion of foot screws shall be smooth and these shall be protected from dust.

4.4 The rotation of the telescope on its vertical axis shall be strain-free and smooth.

4.5 The mount for the cylindrical bubble shall be adjustable both sideways and in the vertical plane.

4.6 The capstan screws provided for adjustment of different part shall be such as not to exert any undue pressure on the respective parts.

5. TESTS

5.1 General Requirement Tests

5.1.1 *External* — The level shall be initially checked for the following external defects:

a) Loose, missing or damaged screws, nuts and other small parts; and

b) Damage to telescope, bubble, engraving and external finish, etc.

5.1.2 *Internal* — The instrument shall be checked for the following internal defects:

a) Scratched, chipped or dirty optics;

b) Damage to optical parts, graticule, deterioration of optical cement and antireflection coatings;

c) Filming or fungus growth on optical surfaces; and

d) Cloudiness or milky appearance on lenses and lack of clarity of graticule lines, etc.

5.1.3 The level shall be checked for smooth and adequate movement of different parts.

5.1.4 *Mechanical*

5.1.4.1 *Clear aperture* — The clear aperture of the objective shall be measured by a slide gauge or any suitable device. The measured value shall conform to the specified value.

5.1.4.2 *Bubbles* — The sensitivity, consistency and all other parameters of the bubbles shall be tested in accordance with 6.1 to 6.7 of IS : 1632-1960* and the values so obtained shall conform to the specified values within the tolerances laid down in Table II of IS : 1632-1960*.

*Specification for bubbles.

5.1.5 *Optical*

5.1.5.1 *Graticule alignment* — The alignment of the graticule shall be tested with the help of a collimator and any misalignment shall be corrected by seeing the collimator's graticule.

5.1.5.2 *Definition* — The definition of the telescope shall be tested with the help of a definition board given in Appendix E of IS : 2754-1964*. The circles, lines and squares of the board shall appear sharply defined without any distortion and colour over at least two-thirds of the field of view. The definition and freedom from colour and distortion over the remaining field shall also be reasonably satisfactory.

5.1.5.3 *Magnification* — The magnification of the telescope shall be tested by the methods specified in Appendix C of IS : 2754-1964*. The measured value shall not differ by more than 5 percent from the specified value.

5.1.5.4 *Resolving power* — The resolving power of the telescope shall be measured by the method specified in Appendix F of IS : 2754-1964*. The measured value shall not differ by more than 5 percent from the specified value.

5.1.5.5 *Parallax* — The level shall be tested for parallax with the help of collimator. After levelling the instrument with the help of two bubbles, the telescope shall be focussed on the collimator's graticule. There shall not be any apparent movement between the image of the collimator's graticule and the telescope's graticule on viewing the former through the eyepiece and moving eye at right angles to the axis of eyepiece.

5.1.5.6 *Collimation* — The collimation shall be tested in the laboratory with the help of a collimator. The instrument shall be accurately levelled with the help of the two bubbles† provided and the collimator's graticule shall be focussed by it. Any deviation in the coincidence of image of the collimator's graticule and telescope graticule shall represent collimation error. This shall be corrected by moving the graticule with the help of adjusting screws provided in its mount.

5.1.5.7 The field of view of the telescope shall be tested by the method specified in Appendix D of IS : 2754-1964*. The measured value shall not differ by more than 5 percent from the specified value.

5.1.5.8 *Strain* — The optics of the telescope shall be free from strain. It shall be tested as under:

The level shall be so held that its telescope is in the path of light between two crossed nicols in a sensitive polariscope or strain

*General requirements for optical instruments.

†The bubbles shall be first adjusted as given in 5.2.1.1.

viewer. The strain present in the telescope shall be revealed by the colour of the transmitted light. Before introducing the telescope of the level, the nicols shall be set for magenta colour. The strained areas in the optics of the telescope shall not show colour beyond indigo in the optical spectrum.

5.2 Operational Tests

5.2.1 *General*

5.2.1.1 *Bubbles* — The instrument shall be placed on a perfectly flat and firm surface, The telescope shall be put parallel to any two foot screws facing the observer and the instrument shall be levelled by these two foot screws using the cylindrical bubble only. The bubble shall be seen in U-shape in this situation. This shall be called the first position. The telescope shall then be rotated through 90° from this position in the clockwise direction and levelled (U-shape made) with the help of the third foot screw only. This shall be called the second position. The telescope shall then be rotated through 90° from the second position in clockwise direction so that it becomes again parallel to the first two foot screws as in the beginning (first position). The instrument shall then be lavelled by making U-shape of the bubble, half with the help of two foot screws and half by using the tilting screw of the telescope. This process shall be repeated (that is, to level in the first position, half by two foot-screw parallel to telescope and half by tilting screw while in the second position by the third foot screw only) till cylindrical bubble is perfectly levelled in all the positions of the telescope (that is, U-shape is not disturbed in all the positions of the telescope).

The circular bubble shall then be brought in centre with the help of its adjusting screws without using foot screws and tilting screw till it remains in centre in all the positions of the instrument.

5.2.1.2 *Reading accuracies*

a) The instrument shall be focussed on an appropriate vertical staff and the readings with three graticule lines shall be taken. The mean of the three readings shall agree with the middle line readings within 0·9 mm.

b) The height difference between two staff points shall be determined by the level in its two different set ups on the same station. The two values shall agree within 1·2 mm.

5.2.2 *Field Test of Collimation* — The collimation shall be tested in the field by making observations on appropriate staves at equal and unequal distances. The two staves shall be placed 80 m apart and the instrument shall be placed in the middle of the line, that is at 40 m from each staff. The difference in heights of the two staff points, say X, shall be determined

in this situation. The instrument shall then be shifted to another point in the line such that the distance of one staff is 20 m while that of the other staff is 60 m from the instrument; retaining the staves precisely on their original points. The difference in heights, say Y, of the two staff-points shall again be determined in this situation. In case, there is no collimation error, the height difference as determined in both the positions of the instrument shall remain the same within a tolerance of 1·0 mm. Beyond this limit, the collimation error shall be corrected as follows:

For this, the instrument (at this position of unequal staff distances) shall be focussed on the farther staff, say B, and the horizontal wire is made to intersect the farther staff B at original reading $+ (Y - X) \times \frac{3}{4}$ by means of micrometer screw. This will disturb the bubble which should be brought to the centre of its run by means of capstan or square head screw at the end of the bubble tube.

5.2.3 *Field Test for Determination of Standard Deviation* — The standard deviation (error) of the level shall be determined by the test method given in Appendix A.

5.3 Climatic and Environmental Test

5.3.1 The following tests shall be carried on as given in IS : 2352-1963*. These are only type approval tests to be carried on sample basis as agreed to between the purchaser and the manufacturer. These are not to be used in routine testing during bulk production.

5.3.2 *Temperature Test* — The level shall be subjected to cold and dryheat test on severities — 10°C and 55°C respectively and checked thereafter for collimation, parallax, deterioration of cementing and antireflection coating.

5.3.3 *Rain Test* — The level, in its case, shall be tested in a rain chamber and after the test the level shall be checked for ingress of moisture or water drops and for deterioration to any part of the instrument.

5.3.4 *Fungus (Mould) Growth Test* — The level shall be tested for the fungus growth and checked thoroughly after the test.

5.3.5 *Vibration Test* — The level, in its case, shall be clamped on to a vibration table giving approximately 450 vibrations per minute with an amplitude of 3 mm for a period of 5 minutes. After the test, the instrument shall be in perfect adjustment.

*Procedure for basic climatic and durability tests for optical instruments.

6. MARKING

6.1 The level shall be marked with the manufacturer's name or trade-mark and the year of manufacture.

6.1.1 Level 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. The ISI 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 which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. 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.

7. PACKING

7.1 The level shall be placed in its case together with its accessories and also an instruction booklet containing the guidelines for its use and adjustment. The case shall be suitably packed for transit.

APPENDIX A

(*Clause* 5.2.3)

METHOD OF TESTING STANDARD DEVIATION (ERROR) OF LEVEL

A-1. PROCEDURE

A-1.1 In order to test for standard deviation, the following requirements shall be fulfilled:

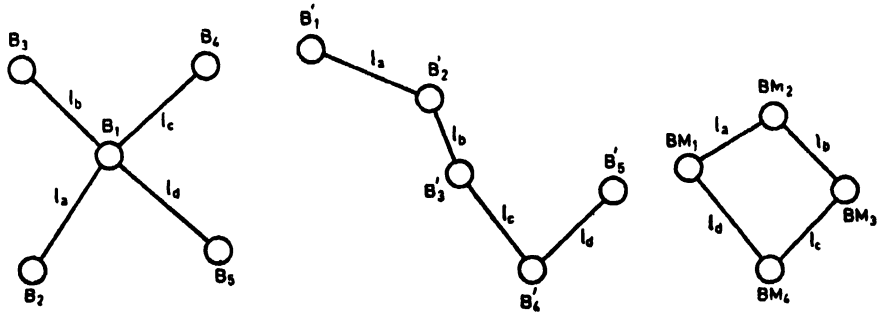
a) Instrument concerned in good adjustment.

b) Good staves and experienced staffmen.

c) Good and experienced observers.

d) Four test lines (legs) connecting at least four and maximum five bench marks, established by levelling of high precision. The length of each leg shall be 250 m so that the total length of levelling line may be 1 km. The bench marks shall be selected in such a way that the four differential heights may be between 0·5 m to 2·5 m.

A-1.2 The four test legs (l_a, l_b, l_c and l_d) shall be used in either of the following patterns (p), (q) or (r) (*see* Fig. 2).



(p) (q) (r)

B_1, B_2, B_3, B_4, B_5 B'1, B'2, B'3, B'4, B'5 BM_1, BM_2, BM_3, BM_4

FIG. 2

B_1, B_2, B_3, B_4, B_5, B'1, B'2, B'3, B'4, B'5, BM_1, BM_2, BM_3 and BM_4 denote the bench marks. It may be seen that patterns (p) and (q) shall involve five bench marks while (r) shall involve only four bench marks.

A-1.3 On each test leg five fore and five back lavellings shall be carried on so that 10 differential heights may be observed. The mean of these measurements shall be calculated and deviations of each value from the mean found out. The squares of deviations shall be taken and sum of such 10 squares of deviations shall be found out in case of each leg. These shall be denoted as $\Sigma v^2/_a$, $\Sigma v^2/_b$, $\Sigma v^2/_c$ and $\Sigma v^2/_d$. If Σv^2 is denoted as the sum of the squares of deviations on four legs, then $\Sigma v^2 = \Sigma v^2/_a + \Sigma v^2/_b + \Sigma v^2/_c + \Sigma v^2/_d$. The standard deviation shall be calculated by the formula:

$$S \text{ per km of double levelling} = \pm\sqrt{\frac{\Sigma v^2}{18}}$$

A-2. PRECAUTIONS

A-2.1 While carrying out the above test the following precautions shall be observed:

a) The discordance between the fore and back values shall be kept within the specified tolerance for that particular type of level.

b) All usual precautions and errors shall be strictly taken into consideration.

(*Continued from page* 2)

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