TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

BID DOCUMENT

NAME OF WORK: Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost **(Period of completion 6 months)**

Last date of submission : Upto 03.00 P.M. on 14.07.2021

Contractor

Sd/-
Superintending Engineer, TWAD,

NAME OF THE SCHEME: Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost **(Period of completion 6 months)**

CHECK LIST TO BE ENCLOSED BY BIDDER(along with Bid Documents)

The check list is only indicative to assist the bidder in satisfactorily enclosing all required major documents for Technical Qualification. The list is not exhaustive and the bidder should read all clauses of the bid document so as to enclose all documents as required.

A. BID SECURITY:

I) Bid security for a value of **Rs. 50,000** to be furnished

II) Furnish the details of Bid Security as under

Sl. No	Name of the Bidder	Amount and type of security	Issued by

B.ELIGIBILITY / QUALIFICATION CRETERIA

Sl. No	Description	Requirement as per Bid document	Particulars as furnished by the bidder	Page No. with ref. no. if any where the particulars are furnished by bidder.
	Financial Turnover & Cashflow.			
1.	Annual Turn over in any one of the last three financial years Rs. in lakhs (2017-2018, 2018-2019, & 2019-20) – 75 % of BOQ value	**58.46 lakhs**		
2	Minimum Annual Turn over in last three financial year Rs. in lakhs (2017-2018, 2018-2019, & 2019-20) – 33% of BOQ value	**25.72 lakhs**		
3	Minimum cash flow required in Rs. in lakhs = 3 months X BOQ Value / Period of completion	**38.98 lakhs**		

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4	The bidder should have satisfactorily completed and commissioned a Supervisory Control and Data Acquisition (SCADA) for Water supply scheme of value not less than Rs. -------- Lakhs during the last five years			
	i) If single agreement 40 % of BOQ value	**31.18 lakhs**		
	(OR)			
	ii) If Two agreements 60 % of BOQ value	**46.77 lakhs**		
5	**Physical (Work Experience)** Minimum aggregate during last five years			
5.a	Minimum aggregate number of Providing Supervisory Control and Data Acquisition (SCADA) system for any CWSS should have completed and commissioned	**1 No.**		
6.	Bid capacity Assessed Available Bid capacity = (A*N*1.5 - B)	**77.95 lakhs**		

7 Whether performance eligibility for 5 (a) above are based on certificate issued by the officer not less than the rank of Executive Engineer of that user departments and in the case of Private organization from the General Manager of that Organisation (Yes / No)

8 Whether Annexure - I to XII are all filled up fully and enclosed (Yes / No)

If Yes, give details as under (Notarised as per requirement)

Sl.No	Description	Page Nos. in the Bidders Document
1.	Performance of the bidder showing total monetary value of similar nature of work executed for the past five years (Annexure– I)	
2.	Average Annual Instrumentation / SCADA Turn over (Annexure – II)	
3.	Experience in works of similar nature of Magnitude within a period of 5 years (Annexure – III)	
4.	Commitment of works on hand (Annexure – IV)	
5.	Works for which Bids are already submitted (Annexure-V)	

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6.	List of equipments available with bidder (Annexure – VI)	
7.	Qualification / Experience of key personnel proposed for technical and administrative functions under this Contract (Annexure – VII)	
8.	Sample Format for evidence of access to or availability of credit facilities (Annexure – VIII)	
9.	Details of Litigation if any (Annexure – IX)	
10.	Declaration by the bidder pertaining to blacklisting / debarment etc., (Annexure – X)	
11.	Details of components proposed to be sublet and sub contractor involved (Annexure – XI)	
12.	Technical staff to be employed (Annexure – XII)	

10. List of Certificates to be enclosed by the Bidder.

Sl.No	Description	Page Nos. in the Bidders Document
1.	Signature of the proprietor or proprietress attested by the Notary public.	
2.	Signature of all the partners / power of attorney attested by the Notary public	
3.	Registration of the firm, Signature of all the authorized person attested by the Notary public	
4.	A copy of the listed Power of Attorney authorizing the signatory of the bidder.	
5.	Proof of Registration of firm / company	
6.	Audited Balance sheets	
7.	Credit line certificate from Financial institutions	
8.	Income Tax clearance certificate.	
9.	Sales Tax verification certificate.	
10.	Certificate of performance issued by not less than the rank of Executive Engineer / Responsible person of the organization.	

Contractor

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Superintending Engineer, TWAD,

BID DOCUMENTS

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Contractor

Sd/-
Superintending Engineer, TWAD,

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45. Income Tax
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1) Performanace of the Bidder showing total monetary value of Civil Engineering works for the past three years (Annexure-I)
2) Average Annual Instrumentation / SCADA Turnover (Annexure-II)
3) Experience in works of similar nature and Magnitude within a period of 5 years (Annexure-III)
4) Commitment of works on hand (Annexure-IV)
5) Works for which Bids are already submitted (Annexure-V)
6) List of Equipments available with bidder (Annexure-VI)
7) Qualification/Experience of key personnel proposed for technical and administrative functions under this contract (Annexure-VII)
8) Sample Format for evidence of access to or availability of credit facilities (Annexure-VIII)
9) Details of Litigation if any (Annexure-IX)
10) Declaration by the bidder pertaining to blacklisting/debarment etc.,(Annexure-X)
11) Details of components proposed to be sublet and Sub contractor involved (Annexure-XI)
12) Technical staff to be employed (Annexure-XII)

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Certificates:

1) Signature of the Proprietor or Proprietress attested by the Notary Public
2) Signature of all the Partners/Power of attorney attested by the Notary Public.
3) Registration of the firm, signature of the authorized person attested by the Notary public.
4) A copy of the listed Power of Attorney authorizing the signatory of the bidder
5) Proof of Registration of firm/company.
6) Audited Balance sheets.
7) Credit line certificate from Financial Institutions.
8) Income Tax clearance certificate.
9) Sales Tax verification certificate
10) Certificate of Performance issued by not less than the rank of Executive Engineer/Responsible person of the organization.

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Contractor

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TWAD BOARD

INVITATIONS FOR BIDS - TWO COVER - PERCENTAGE TENDER SYSTEM

IFB No :	02 / F. Tender Notice/ DO / 2021/ Dt.18. 06. 2021
Eligibility	Class I Contractors
Invitee	The Superintending Engineer, TWAD Board, MDT Circle, Opp.to Dr.M.G.R. Bus Stand, Ganesh Nagar, Mattuthavani, Madurai-625 007
Sale of Bid & Place of Sale	23.06.2021 to 13.07.2021 upto 5.45 PM at O/o the Executive Engineer, TWAD Board, RWS Division, Dindigul by cash or Demand Draft payable at Dindigul for Rs 1120/- each. Rs.250/- additional for sending through post
Down loading	www.tenders.tn.gov.in and www.twadboard.gov.in. (Free of Cost)
Pre Bid meeting	06.07.2021 at 11.00 AM at the office of the Tender Invitee
Bid Submission	14.07.2021 upto 3.00 PM at the office of the Tender Invitee
Bid opening	14.07.2021 at 3.30 PM at the office of the Tender Invitee

Sl No.	**Name of work**	**Approximate value of work (Rs.in Lakhs)**	**Bid security (in Rupees)**
1	Providing SCADA arrangements to WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District	78.00	50,000/-

Sd/- Er. S.V.S.Murugesan, 18.06.2021. Superintending Engineer, TWAD, MDT Circle, Madurai

Contractor

Sd/-
Superintending Engineer, TWAD,

II. LETTER OF APPLICATION

(Letter head paper of the Applicant, including full postal address, telephone no., fax no., cable address, and E.Mail)

Dated

To
The Superintending Engineer, TWAD Board,
MDT Circle, Genesh Nagar, Melur Road,
Opp to Mattu thavani Bus stand,
Madurai –625 007.

Sir,

Being duly authorised to represent and set on behalf of
(hereinafter "the Applicant"),
and having reviewed and fully understood all the information provided, the undersigned hereby apply for consideration as a bidder for the following

INVITATION FOR BID NO. 02 / F. Tender Notice/ DO / 2021/ Dt.18. 06. 2021

Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost (Period of completion 6 months)

Attached to this letter please find copies of original documents defining

- the Applicant's legal status
- the principal place of business and
- the place of incorporation (for applicants who are corporation) or the place of registration and the nationality of the owners (for applicants who are partnerships or individually owned firms)

Your Agency and its authorized representatives are hereby authorized to conduct any inquiries or investigations to verify the statements, documents and information submitted in connection with this application, and to seek clarification from the bankers and clients regarding any financial and technical aspects. This 'Letter of Application' will also serve as authorization to any individual or authorized representative of any institution referred to in the supporting information, to provide such information deemed necessary and requested by yourselves to verify the statements and information provided in this application, or with regard to the resources, experience and competence of the Applicant.

This application is made in the full understanding that

- bids by the applicants will be subject to verification of all information submitted for consideration, at the time of bidding.

Contractor

Sd/-
Superintending Engineer, TWAD,

Your Agency reserves the right to

- amend the scope and value of any contract bid under this project
- and reject or accept any application, to cancel the entire bidding process and reject all the applications and
- your Agency shall not be liable for any such action and shall be under no obligation to inform the Applicants of the grounds for them

It is hereby certified that the unit rates and price for all the items covered in the Bill of Quantities set out in the Price Schedule have been furnished clearly in figures and words and it is hereby agreed to execute the works at the rates and prices mentioned therein and to receive the payments on measured quantities as per the Conditions of the Contract.

It is hereby distinctly and expressly declared and acknowledged that before the submission of the bid, the instructions therein have been carefully followed and the conditions of the Contract and other terms and conditions have been read. It is also declared and acknowledged that careful examination of the bid documents has been carried out with reference to the specifications, quantities, location where the said work is to be done, investigation of the works to be done, materials required for this contract and their source and other requirements, covenants, stipulations and restrictions. It is distinctly agreed that no claim or demand will be made on the TWAD Board by the applicant, arising out of any misunderstanding or misconception or mistake of the said requirements, covenants, stipulations, restrictions, conditions etc on the part of the Applicant .

The Income Tax Clearance Certificate and GST Certificate are enclosed

The Bid Security of **Rs.50,000/- (**Rupees fifty thousand only **)** is enclosed in the shape of _____ (enter the form and other details of the bid security) drawn in favour of the **Executive Engineer, TWAD Board, RWS Division, Dindigul.** It is hereby agreed that in case the bid is accepted, the Performance Security to the value and in the manner/form prescribed by the Employer will be submitted and agreement entered into within the time frame stipulated for the due fulfillment of the contract. It is agreed that in the event of non remittance of the required Performance Security and execution of the Agreement within the stipulated time frame, the Bid Security deposited with the bid will be forfeited. In the event of non acceptance of the bid offered by the Applicant, the Employer shall intimate the applicant of the rejection of his bid, upon which the applicant can get his Bid Security refunded on an application for the same. Any notice required to be served on the applicant shall be deemed to have been sufficient if delivered personally or left at the address given herein or sent by post either by registered mail or ordinary. Such notice shall, if sent by post shall be deemed to have been served on the applicant at the time when in due course of post it would be delivered at the address to which it is sent. For all purposes, the address given herein will serve as permanent address and any change therein will be promptly intimated then and there.

It is fully understood and agreed that on receipt of communication of acceptance of the bid from the accepting authority, there emerges a valid contract between the Applicant and TWAD Board represented by the officer accepting the bid and is expressly agreed that the bid documents with the schedules, conditions of the contract, negotiation

Contractor

Sd/-
Superintending Engineer, TWAD,

communications and other correspondence connected to this contract will all constitute the contract for this purpose and be the foundation of rights on both the parties.

It is agreed that time shall be considered as the essence of this contract and the work will be commenced immediately on getting information of the acceptance of the bid and any slow progress will be subjected to the relevant penal clauses contained in the Conditions of the Contract

It is hereby agreed that the professionally qualified personnel to execute and supervise the works shall be deployed as required in clause 10 of General Conditions of Contract.

The Applicant hereby agrees to undertake full responsibility for the stability and soundness of the works executed.

The Applicant hereby agrees that the bid will not be withdrawn during the period of validity as indicated in the bid documents and also during such extended periods agreed to by the applicant The Applicant agrees that in the event of withdrawal of the bid during the validity period or extended period, the Bid Security is liable to be forfeited by Employer

It is explicitly understood that the Employer is not bound to accept the lowest or any bid the Board may receive. It is hereby agreed that the Employer reserves the rights to reject any or all the bids without assigning any reasons therefor

Dated this day of
Month of

Signature of the Applicant
(To be signed by the authorized
signatory with seal)

Contractor

Sd/-
Superintending Engineer, TWAD,

NAME OF WORK:

Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost (Period of completion 6 months)

III . INSTRUCTIONS TO BIDDERS

Contractor

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Superintending Engineer, TWAD,

A. GENERAL

1. Scope of the Bid

This is a "Procurement, Construction Contract" and the contractor is responsible for the execution of the water supply works including the supply and installation of all materials, machineries, equipment etc in accordance with the specifications stipulated in the Bid Document and in conformity with the Quality Parameters laid down in the relevant BIS, TNBP, Bid Documents etc and completing the entire works in all respects satisfactorily and commissioning within the stipulated period and maintaining the scheme for the specified period

1.1 The Superintending Engineer, TWAD Board, MDT Circle, Madurai (hereinafter referred as "Employer" in these documents) invites bids for the construction of works (as defined in these documents and referred as "the works") as detailed in the Bill of Quantities. The bidder shall offer their/his price for all the items of works detailed in the Bill of Quantities.

Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost (Period of completion 6 months)

MAINTENANCE

1.2 Maintenance of the above work for **one year at free of cost**

1.3 The successful bidder will be expected to complete the works within the period stipulated for completion in the programme schedule.

1.4 In these bidding documents, the terms bid and tender and their derivatives (bidder/ tenderer, bid/tender, bidding/tendering etc) are synonymous.

1.5 **Down loading the documents from web site**.
The documents can be down loaded free of cost from the web site www.tenders.tn.gov.in & www.twadboard.gov.in. by the tenderer. Tender should, thereafter be submitted duly filled and signed along with all required documents to the tender inviting authority as notified in the IFB subject to the following:

a) The bidder shall furnish a certificate to the effect that **no correction/ alteration on the bid document as found in the web site** was made by him and he shall abide by all the terms, conditions and specifications contained in the bid document.

b) **No cost towards bid document shall be required to be paid by the bidders who are using the forms downloaded from the designated website.**

The bidder shall submit the tender to the tender inviting authority as prescribed in the IFB.

1.6 The Bid Document can be purchased from the **Executive Engineer, TWAD Board, RWS Division, Dindigul** by remitting the required cost of Bid Document as stipulated in Invitation for Bid.

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2. Method of Bidding

2.1 If the bid is made by an individual, the bid documents shall be signed by the individual with his full name and current address.

2.2 If the bid is made by a proprietary concern, the bid documents shall be signed by the proprietor with his full names as well as the name of the firm and full address. In the case of an authorised person holding power of attorney signing the bid documents, a certified copy of the registered power of attorney should accompany the bid documents. The signature of the proprietor shall be attested by a notary public and enclosed as a documentary evidence.

2.3 If the bid is made by a partnership firm, the bid documents shall be signed by all the partners of the firm along with their full names and current address with specific mention on the registered address of the firm. In the case of a partner holding power of attorney signing the bid documents, a certified copy of the registered power of attorney should accompany the bid. It is also mandatory to furnish a certified copy of the registered partnership deed, current address of the partners, registered address of the firm along with the bid. The signature of all the partners/ power of attorney shall be attested by a notary public and enclosed as a documentary evidence.

2.4 If the bid is made by a limited company or a limited corporation, it shall be signed by a duly authorised person holding power of attorney for signing the bid documents in which case a certified copy of the registered power of attorney shall accompany the bid. Such limited company or corporation may be required to enclose satisfactory evidence of its existence along with the bid.

2.5 The bids from the contractors / firms shall be accompanied by an attested copy of the Income Tax Clearance Certificate and GST Certificate relating to the previous financial year. (2020-21)

3. One Bid per Bidder

3.1 Each bidder shall submit only one bid for the whole scheme and in the case of packages, only one bid for a package. A bidder who submits or participates in more than one bid (other than sub contractors) will be disqualified.

4.Cost of Bidding

4.1 The bidder shall bear all the costs associated with the preparation and submission of his bid. The Employer will in no case be responsible for those costs, regardless of the conduct or the outcome of the bidding process.

5.Site Visit.

5.1 The bidder, at the Bidder's own responsibility and risk is advised to visit and examine the site of works and its surroundings and obtain on his own all information that may be necessary for preparing the bid and entering into contract for the construction of the works. The costs of visiting the site and its surroundings shall be at the bidder's expense. Site levels, Soil data made available are only for the information of bidder and the employer is not responsible for their correctness.

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5.2 The bidder and any of his personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the bidder, his personnel or agents, will release and indemnify the Employer and his personnel or agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs and expenses incurred as a result of the inspection.

5.3 Deleted.

5.4 The employer will arrange a site visit for the bidders **on 06.07.2021 at 11.00 A.M.** to enable the bidders to have an understanding of the site conditions and to clarify any issues relating to the site conditions in the pre bid meeting.

B. Eligibility / Qualification Criteria

B. Eligibility / Qualification Criteria

6. Eligible Bidders

6.1 The Invitation to Bid is open to any bidder meeting the following requirements:

6.2 A bidder shall not be associated nor has been associated in the past, directly or; indirectly, with the Consultant or any other entity that has prepared the design, specifications and other documents for the project.

6.3 A bidder shall not be associated directly or indirectly with the firm engaged by the Board for providing consultancy services for the preparation and supervision of the works and any of its affiliates.

6.4 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer as the Employer shall reasonably request.

6.5 Joint Venture will not be accepted.

7. Qualification of the Bidder

7.1 General

7.1.1 Bidders shall provide the following as part of their bid in the prescribed formats.

7.1.2 A registered Power of Attorney authorizing the signatory of the bid to commit on behalf of the bidder should be enclosed.

7.1.3 Proof of Registration of the firm/company under Companies Act should be enclosed.

7.1.4 Total monetary value of civil engineering works performed during each of the last three financial years should be furnished in Annexure-I.

7.1.5 Annual turnover for the past three financial years (Audited balance sheet for the last three financial years) should be enclosed. Annual turnover for the past three financial years should be certified by a registered Chartered

Accountant. The certificate should be affixed with the seal of the office of the Chartered Accountant with the registration number legibly in Annexure-II.

7.1.6 Experience in works of similar nature and magnitude during each of the previous FIVE years, the details of works on hand and works for which bids are already submitted should be furnished in the Annexures-III, IV and V respectively.

7.1.7 List of equipments available with the bidder for deployment in the project should be furnished in Annexure-VI.

7.1.8 Technical, administrative and managerial personnel proposed to be employed for key site management in this work with their qualification details should be furnished in Annexure VII.

7.1.9 Evidence of access to lines of credit and availability of other financial resources, credit line certificates from financial institutions should be enclosed in the prescribed Annexure-VIII.

7.1.10 Litigation details of the bidder with the details of the parties concerned and the amount involved should be furnished in Annexure-IX.

7.1.11 The bidder should declare clearly whether the bidder has been black listed, banned or debarred in Central Government Department/Under-taking/Organization or any State/Union Territory/Department Undertaking/ Organization in Annexure-X.

7.1.12 Proposals to Sub-contract components of the works with experience details of the Sub-contractor in similar nature of works proposed to be sublet should be furnished in Annexure-XI.

The Sub-contractors shall have experience of successfully completing and commissioning of at least two works of similar nature and magnitude to the work to be sublet during the last 5 years.

The Sub-contractors shall not further Sub-contract any portion of their work, Sub-contracted to them by the Contractor.

The value of sub contracted work under any such sub contract shall not exceed 15% of the contract value and total sub contracted work shall not exceed 60% of the contract value. The contractor shall notify the Executive Engineer concerned in writing for objections, if any, about the sub-contractor that he proposes to appoint if the value of a sub contract work exceeds 10% of the contract value. If nothing is heard from the Executive Engineer within 15 days of the receipt of the Contractor's notice, then the contractor may proceed with the appointment of the sub-contractor concerned. If any objections are received about the appointment of the sub contractor from the Exe. Engineer concerned, the contractor shall give due weightage to such objections and either change the sub contractor, or refer the matter to the Superintending Engineer concerned for his decision, which shall be final.

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7.1.13 Income Tax Clearance Certificate in currency as proof of having remitted the income tax for the previous financial year (with reference to the year in which the bid is opened)

7.1.14 GST Registration Certificate, a valid certificate issued by the competent authority to this effect.

Conditions to be satisfied:

7.2 **Performance Eligibility:**

a) Financial & Physical capacity:

Sl. No.	**DESCRIPTION**	CRITERIA
	Financial Turn over and Cash Flow	Rs. in Lakhs
1	Annual Turn over in any one of the last three financial years Rs. in lakhs (2017-2018, 2018-2019, & 2019-20) - 75% of BOQ value	**58.46**
2	Minimum Annual Turn over in last three financial year Rs. in lakhs) (2017-2018, 2018-2019, & 2019-20) - 33% of BOQ value	**25.72**
3	Minimum Cash flow required in Rs in Lakhs	**38.98**
4	The bidder should have satisfactorily completed and commissioned a Supervisory Control and Data Acquisition (SCADA) for Water supply scheme of value not less than Rs. -------- Lakhs during the last five years	
	i) If single agreement 40 % of BOQ value	**31.18**
	OR	
	ii) If Two agreements 60 % of BOQ value	**46.77**
5	**Physical (Work Experience**): Minimum Aggregate during last five years:	
5.a	Minimum aggregate number of Providing Supervisory Control and Data Acquisition (SCADA) system for any CWSS should have completed and commissioned	1 No.

Note : in Addition to the above requirements the following criteria also to be satisfied.

Contractor

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Superintending Engineer, TWAD,

b) Bid capacity:

- Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

  Assessed Available Bid Capacity = [A*N*1.5-B]

  Where A = Maximum value of civil engineering works executed in any one year during the last three financial years [updated to 2021-22 price level @ 6% per annum] taking into account the completed as well as works in progress.

  N = Number of years prescribed for completion of the works for which bids are invited i.e. 0.5 year.

  B = Value of existing commitments and on-going works to be completed during the next 6 Months. [Updated to 2021-22 price level]

Unless otherwise stated in the Contract, the Accepted Contract Amount covers the entire Contractor's works under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper design, installation, test, commission and trial operation at Section I of the Works and operation and maintenance at Section II of the Works. The Accepted Contract Amount shall cover the completion of both Sections of the Works and the re-modifying of any defects.

Note:

i. The performance eligibility shall pertain to the similar works executed by the tenderer in any of the Central/State Government Departments/Quasi Government Organizations and Government Undertakings, a Private Organization. The performance experience for Central/State Government Department/Undertaking/ Quasi Government Organization should be supported by performance certificates issued by the concerned organization by an officer not less than the rank of Executive Engineer. **The experience certificates issued by an officer below the rank of Executive Engineer or on behalf of Executive Engineer will not be considered.**

In case of experience certificate of a Private Organization, the following criteria should be satisfied:

a) The Photographs of the works undertaken for the Private Organization should be enclosed as a proof.
b) The certificate of the work done for the Organization be enclosed by a Senior Official who should be at least of the rank of the General Manager or Equivalent.
c) The above certificate should be countersigned by a Government Department Engineer at least of the rank of Assistant Executive Engineer and should also be Notarised.

ii. For the experience certificates furnished by the bidders which are obtained from the Departments outside the State, clarification will be obtained by the Employer from the concerned Department whenever felt necessary as to whether the details furnished in the certificates are genuine, before finalization of evaluation.

iii. The bills / claims should be prepared by the contractor as per Agreement and in accordance with the agreement executed and submitted to the Department

iv. Sub contractors' experience for the particular works to be sublet **shall not be taken into account for arriving at the eligibility of the contractor/firm.**

v. The tenderer should enter into proper agreement with sub contractor proposed to be sub let and furnish the documentary evidence along with bid.

Special Condition:

In case if a contractor/firm worked as sub contractor previously, then their experience in those particular components of work will be considered **only if** their sub contract/sublet work **was properly approved by the User Department**. A certified copy to that effect from Engineer in charge (not below the rank of Executive Engineer) must be produced for arriving at the performance eligibility for the particular work to be sublet.

7.4. Disqualification:

Even though the bidders meet the above qualifying criteria, they are subject to be disqualified at any point of time if they have

i) made misleading or false representation in the form statements and attachments submitted and/or

ii) Record of poor performance during the last **5** years as on the date of application such as abandoning the work rescinding of contract for which the reasons are attributable to the non performance of the Contractor inordinate delays in completion, consistent history of litigation awarded against the applicant or any of its constituents or financial failure due to bankruptcy etc.

iii) been debarred/blacklisted as on the date of application by any Central/State Government Department/Undertaking/Organization and their bid will not be taken up for evaluation.

Contractor

Sd/-
Superintending Engineer, TWAD,

SPECIAL ATTENTION TO BIDDERS.

I. Copies of experience certificates obtained from the Officer not below the Rank of **Executive Engineer** of respective user departments must be attested by Notary Public and produced.

II. These Certificates should contain the following details

1) Name of Scheme (Name of the State also to be specified) :
2) Contract No. and date :
3) Value of Contract : Rs.
4) Name of Contractor with full address :
5) Period of completion as specified in the Contract :
6) Date of commencement of work:
7) Actual date of completion/ commissioning :
8) Reason for the delay if any:
9) Full details of components executed under this contract :
10) **Performance of the work should contain the following details:-**

Component	Performance

Signature of Officer with Seal

Contractor

Sd/-
Superintending Engineer, TWAD,

C. BID DOCUMENTS

8. Contents of Bid Documents

8.1 The Bid Documents will comprise the following documents & addenda issued in accordance with clause 10 below:

Invitation for Bids

Instruction to Bidders

Eligibility/Qualification Criteria

Forms of Bid

Programme Scheme and Financial Milestone

Payment Schedule

General Conditions of the Contract

Special Conditions

Technical Specifications

Bill of Quantities

Drawings

Forms of Agreement

Indemnity Bond

9. Clarification of Bid Documents.

9.1 A prospective bidder requiring clarification may raise the same at the time of Pre-bid meeting in writing or by cable (hereinafter the term cable is deemed to include telex and facsimile) at the employer's address indicated in the invitation for bid. The employer will respond to any clarification sought for.

10. Amendment to Bid Documents

10.1 At any time prior to 48 hours to the deadline for submission of bids, the Employer may amend the bid documents by issuing Addenda.

10.2 Any Addendum thus issued shall be part of the bid documents and shall be communicated in writing or by cable to all purchasers of the bid documents. Prospective bidders shall promptly acknowledge the receipt of each addendum by cable to the Employer.

10.3 To give prospective 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, in accordance with Clause 21.2 of "Submission of Bids".

D. PREPARATION OF BIDS

11. Language of the Bid

11.1 The bid, and all correspondences and documents related to the bid exchanged by the bidder and the Employer shall be written in English. Supporting documents and printed literature furnished by the bidder may be in other language provided they are accompanied by an accurate translation of the relevant passages in either English or Tamil language, in which case, for purpose of interpretation of the bid, the translation shall prevail.

12. Documents comprising the Bid

12.1 The bid submitted by the bidder shall comprise the following:
Cover – 1 (Technical Bid)

i. The Bid Documents duly filled and signed

ii. List of Annexures

a) Performance of the Bidder showing value of similar nature of work executed for the past three years – (7.1.4) **– Annexure-I**

b) Average Annual Instrumentation / SCADA Turnover of last three years – (7.1.5) **– Annexure-II**

c) Experience in works of similar nature and Magnitude within a period of 5 years – (7.1.6) **– Annexure-III**

d) Commitment of works on hand – (7.1.6) **– Annexure-IV**

e) Works for which Bids are already submitted – (7.1.6) **– Annexure-V**

f) List of Equipments available with Bidder – (7.1.7) **– Annexure-VI**

g) Qualification/Experience of key personnel proposed for technical and administrative functions under this contract – (7.1.8) **– Annexure-VII**

h) Sample Format for evidence of access to or availability of credit facilities – (7.1.9) **– Annexure-VIII**

i) Details of Litigation – (7.1.10) **– Annexure-IX**

j) Declaration by the bidder – (7.1.11) **– Annexure-X**

k) Details of components proposed to be sublet and sub contractors involved – (7.1.12) **– Annexure-XI**

l) Technical staff to be employed (Para 10 of General Conditions) – **Annexure-XII**

Contractor

Sd/-
Superintending Engineer, TWAD,

iii. List of Certificates.

a) Signature of the Proprietor or Proprietress attested by the Notary Public (2.2)

b) Signature of all the Partners/Power of Attorney attested by the Notary Public – (2.3)

c) Registration of the firm, signature of the authorised person attested by the Notary Public – (2.4)

d) A copy of the listed Power of Attorney authorising the signatory of the bidder – (7.1.2)

e) Proof of Registration of firm/Company (7.1.3)

f) Audited Balance Sheets – (7.1.5)

g) Credit line Certificate from Financial institutions – (7.1.9) (Format-VIII)

h) Income Tax Clearance Certificate – (7.1.14)

i) GST Certificate – (7.1.15)

j) Certificate of performance issued by not less than the rank of Executive Engineer of the organization concerned/responsible person of the private organization – (7.3)

iv. Bid Security

v. Any other material required to be completed and submitted by the bidders in accordance with these instructions.

Cover – II (Price Bid)

12.2 Priced Bill of Quantity duly signed.

12.3 The Bid should be submitted only in the original documents as issued by the Employer or as downloaded from the website. No alteration or correction should be made under any circumstances in the Bid Documents issued by the Employer.

12.4 Conditional tenders are liable for rejection

13. Bid Prices

13.1 The contract shall be for the whole works as described in sub clause

13.2 (1.1), based on the overall tender excess/less percentage over/than total departmental value in Schedule A in the bill of quantities submitted by the bidder.

Contractor

Sd/-
Superintending Engineer, TWAD,

13.3 The bidder shall fill overall tender excess/less percentage over/than total departmental value in Schedule A (both in figures and words) for the works described in the Bill of quantities. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting.

13.4 All duties, taxes and other levies admissible for the respective items are included in the schedule A . The bidder shall quote the tender excess / less percentage considering the above and after verifying the items in the schedules.

13.5 The final tender percentage excess/less quoted by the Bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account.

14. Currencies of Bid and Payment

14.1 The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees.

15. Bid Validity

15.1 Bids shall remain valid for a period not less than **one hundred and twenty days** from the date of opening of Technical Bid. A bid valid for a shorter period shall be rejected by the Employer as non responsive.

15.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request the bidders to extend the period of validity for a specific additional period. The request and the bidders' response shall be made in writing or by cable. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend his bid security for; the period of extension.

16. Bid Security

The bidder shall furnish, as part of his bid, as bid security of **Rs.50,000 (Rupees fifty thousand only)** in the following forms.

16.1 The bid security duly pledged in favour of **the Executive Engineer, TWAD Board, RWS Division, Dindigul** in any one of the following forms Demand draft / Deposit call receipt / Fixed deposit receipt/ Bank Guarantee (Prescribed format of the Bank Guarantee (Unconditional) for the bid security issued by a Nationalised Bank/Scheduled Bank located in India/National savings certificate/Post office Savings Bank deposits.

- Unconditional Bank Guarantee in the prescribed format for the bid security issued by a Nationalised Bank/Scheduled Bank located in India & valid for 45 days after the end of the validity period of the bid

FDR and deposits at call receipts should contain lien certificate issued by the Bank for encashment by department. The FDR furnished by the firm should also bear the signature of the authorized signatory on a revenue stamp at the back of the FDR.

16.2 Any bid not accompanied by bid security in stipulated form shall be rejected by the Employer as non responsive

16.3 The bid security of the unsuccessful bidders will be returned as promptly as possible, but not later than 30 days either after the expiration of the period of bid validity or after finalizations of the bid whichever is later.

Contractor

Sd/-
Superintending Engineer, TWAD,

16.4 The bid security of the successful bidder will be returned after the bidder has furnished the required performance security and signed the agreement. No interest is payable on Bid security by the Employer.

16.5 The bid security shall be forfeited.

- In the case of bidder withdrawing or modifying his bid during the period of bid validity
- If the bidder does not accept the corrections of the bid price, pursuant to clause 28 of "Bid Opening and Evaluation"
- In the case of a successful bidder failing to furnish the performance security in the specified form within the stipulated time.
- In the case of successful bidder failing to enter into agreement within the stipulated time.
- In the case of the bidder severing the conditions after intimation of the acceptance of the bid.

17. Compliance to Technical Design and Specifications.

17.1 Bidders shall submit their offers that comply with the requirements of the bidding documents including the basic technical design as indicated in the drawing and specifications.

18. Format and Signing of Bid

18.1 The bid document submitted to the Employer shall be typed or written in indelible ink and shall be signed by a person duly authorised to sign on behalf of the bidder in accordance with "Instructions to Bidders". All pages of the bid and where entries or corrections have been made shall be initialed by the person signing the bid.

18.2 The bid shall contain no alteration or additions, except those to comply with the instructions issued by the Employer and wherever necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person signing the bid.

18.3 The technical and price bids (BOQ) as issued by the Employer should be submitted duly signed at the bottom of each page, failing which the bids will be summarily rejected.

19. Pre Bid Meeting:

19.1 The bidder or his authorised representative, who are desirous, may attend the pre bid meeting which will take place at **Office of the Superintending Engineer, TWAD Board, MDT Circle, Genesh Nagar, Melur Road, Opp to Mattu thavani Bus stand, Madurai –625 007 on 06.07.2021 at 11.00 am**

19.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter than may be raised at that stage.

Contractor

Sd/-
Superintending Engineer, TWAD,

19.3 The bidder is requested, as far as possible, to submit the questions in writing or by cable, to reach the Employer not later than one week before the meeting. It may not be practicable at the meeting to answer questions received late.

19.4 Minutes of the meeting, including the text of the questions (without Identifying the source of enquiry) and the responses given together with any responses prepared after the meeting, will be transmitted without delay to all purchasers of the bidding documents. Any modification of the bidding documents listed in clause 23.1 of "Submission of Bids", which may become necessary as a result of the pre bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to clause 10 of the "Bid Document" and not through the minutes of the pre bid meeting. Then will be hosted on www.tenders.tn.gov.in & www.twadboard.gov.in.

19.5 Attendance at the pre bid meeting is not mandatory and non attendance will not be a cause for disqualification of the bidder.

Contractor

Sd/-
Superintending Engineer, TWAD,

E. SUBMISSION OF BIDS

20. Sealing and Marking of Bids

20.1 Two cover system shall be adopted for submission of bids.

20.2 The first cover shall contain the technical bid documents, supporting material relating to the eligibility criteria, Bid Security in the proper form and other connected Certificates.

20.3 No indication either direct or indirect, implicit or explicit regarding the rates and prices should be made in the technical bid or any other documents submitted in the first cover.

20.4 The second cover shall contain the Price Bid alone.

20.5 The bids should be submitted in the original bid documents as issued bv the Employer.

20.6 The bid documents, under no circumstances, are transferable.

20.7 The first cover containing the Technical Bid and Bid Security and the second cover containing the Price Bid, should be pasted properly, sealed and super scribed indicating clearly the name of work and marking specifically as under:

Cover I - Technical Bid
Cover II - Price Bid

Both the covers containing the Technical bid and Price Bid should be placed in a common envelope, pasted, sealed and super scribed properly.

20.8 All the envelopes shall be addressed to the Employer at the following address.

The Superintending Engineer, TWAD Board,
M.D.T Circle , Ganesh Nagar,Madurai
.

20.9 Format and signing of Tender

20.10 All the envelopes shall be addressed to the Employer **"THE SUPERINTENDING ENGINEER, TWAD BOARD,MDT Circle, MADURAI"** and bear the following identification

Bid for **"Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost (Period of completion 6 months)"**

Contractor

Sd/-
Superintending Engineer, TWAD,

INVITATION OF BID NO. 02 / F. Tender Notice/ DO / 2021/ Dt.18. 06. 2021

Do Not Open Before **14.07.2021 at 03.30 PM** (Time and date of bid opening as per Clause 24 of "Bid Opening and Evaluation")

and should be submitted to the following Address:

TWAD Board, Genesh Nagar, Melur Road, Opp to Mattu thavani Bus stand, Madurai –625 007.

20.10 In addition to the Identification required in sub clause above, the envelope shall indicate the name and address of the bidder to enable the bid to be returned in case it is declared late, pursuant to Clause 22 of "Submission of Bids".

20.11 If the envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

21. Deadline for Submission of the Bids

21.1 Bids must be received by the Employer at the address specified in clause 20.9 above not later than **3.00 P. M** on **14.07.2021** In the event of the specified date for the submission of bids declared a holiday for the Employer, the bids will be received upto the appointed time on the next working day.

21.2 The Employer may extend the deadline for the submission of bids by issuing amendment in accordance with clause 10 of "Bid Documents" in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

22. Late Bids

22.1 All bids received by the Employer after the deadline prescribed in clause 21 of "Submission of Bid" will be returned unopened to the bidder.

23. Modification, Substitution and Withdrawal of Bids

23.1 The bidder may modify, substitute or withdraw his bid after submission, provided that written notice of the modification, substitution and withdrawal is received by the Employer prior to the deadline for submission of bid.

23.2 The bidder's modification, substitution or withdrawal notice shall be prepared, scaled, marked and delivered in accordance with provisions of clause 20 and 21 of "Submission of Bid", with the envelope additionally marked **'MODIFICATION', 'SUBSTITUTION' or 'WITHDRAWAL'** as appropriate.

The modification / substitution for price bid cover should be super scribed as **PRICE 'MODIFICATION' / SUBSTITUTION COVER.**

23.3 No bid shall be modified, substituted or withdrawn after the deadline for submission of bids.

Contractor

Sd/-
Superintending Engineer, TWAD,

23.4 Modification, substitution or withdrawal of a bid between the deadline for submission of bids and the expiration of the original period of validity specified in clause 15.1 of “Preparation of Bids” or as amended pursuant to clause 15.2 of ”Preparation of Bids” may result in the forfeiture of the Bid Security pursuant to Clause 16 of “Preparation of Bids”.

Contractor

Sd/-
Superintending Engineer, TWAD,

F. BID OPENING AND EVALUATION

24. Bid Opening

24.1 The Employer will open all the bids received (except those received late) including modifications made pursuant to clause 23 of "Submission of Bids", in the presence of the bidders or their representatives who choose to attend on the date at the time in the address specified in clause 20 of "Submission of Bids".(In the event of specified date of bid opening being declared a holiday for the Employer, the bids with be opened at the appointed time and location on the next working day).

24.2 Envelopes marked "withdrawal", "substitution" and "modification" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to clause 23 of "Submission of Bids" shall not be opened. Envelopes super scribed as **'MODIFICATION' / SUBSTITUTION to price bid will be opened at the time of opening of the price bid.**

24.3 The Bidders' names, the Bid prices, the total amount of each Bid, any discounts, bid modification, (substitution) and withdrawals, the presence or absence of Bid Security and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. Bids (and modifications) sent pursuant to clause 22 of "Submission of Bids" that are not opened and read out at the bid opening will not be considered for further evaluation regardless of the circumstances. Withdrawn bids will be returned unopened to the bidders.

25. Process to be Confidential

25.1 Information relating to the examination. Clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other person not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by a bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his bid.

26. Clarification of Bids.

26.1 To assist in the examination, evaluation and comparison of bids, the Employer may, at his discretion, ask any Bidder for clarification of his bid, including breakdown of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 28 of "Bid Opening and Evaluation".

27. Examination of Bids and Determination of Responsiveness

27.1 Prior to detailed evaluation of Bids, the Employer will determine whether each Bid
(a)meets the eligibility criteria set out in clause (7) ;
(b)has been properly signed,
(c) is accompanied by the required securities and
(d)is substantially responsive to the requirements of the Bid Documents,

27.2 A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bid Documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality or performance of the works. (b) which limits in any substantial way, inconsistent with the Bid Documents, the Employer's rights to the Bidder's obligations under the contract, or (c) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive Bids.

27.3 If a Bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non conforming deviation or reservation. The decision of the Employer on the issue whether the Bid is responsive or not" will be final and binding on the bidders. The Employer is not bound to disclose the reason in case a bid is determined by him as non responsive.

28. Correction of Errors

28.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic error. Errors will be corrected by the Employer as follows:

- If any variation in the rates in words and figures , the lesser of the two will only be taken into consideration.
- Where there is a discrepancy between the unit rate and line item total resulting from multiplying the unit rate by the quantity , the unit rate as quoted will govern.
- Where there is an arithmetical discrepancy in the page total as well as grand total, the corrected total by the Employer will govern

28.2 The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount of the Bid, his bid will be rejected and his bid security may be forfeited in accordance with Clause 16.5 of "Preparation of Bids".

29. Evaluation and Comparison of Bids

29.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Clause 27 of "Bid Opening and Evaluation".

29.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid Price by adjusting the Bid price as follows:

- making any correction for errors pursuant to Clause 28 of "Bid Opening and Evaluation". or
- making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Clause 23 of "Submission of Bids"

29.3 The Employer reserves the right to accept or reject any variation/deviation.

29.4 If the Bid of a successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed.

After evaluation of the price analysis, the Employer may require that the amount of the Performance Security set forth in Clause 34 of; "Award of Contract" be increased at the expense of the successful Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

For tenders received with 5 to 15% less than the departmental value the successful tenderer should remit additionally 2% towards security deposit on departmental value.

For tenders received with beyond 15% less than the departmental value, the successful tenderer should remit 50% of the difference between the departmental value and the value of tender as additional security deposit.

Contractor

Sd/-
Superintending Engineer, TWAD,

G. AWARD OF CONTRACT

30. Award Criteria.

30.1 Subject to Clause 29 of "Bid Opening and Evaluation", the Employer will award the contract to the Bidder, whose Bid has been determined to be substantially responsive to the Bid Documents and who has offered the lowest evaluated Bid Price, provided that such Bidder has been determined to be (a) eligible in accordance with the provision of clause 6 of "Eligibility/Qualification Criteria" and (b) qualified in accordance with the provisions of Clause 7 of "Eligibility / Qualification Criteria".

31. Employer's Right to Accept any Bid and to Reject any or all Bids

31.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders of the grounds for the Employer's action.

32. Notification of Award

32.1 The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance"), will state the sum that the Employer will pay to the contractor in consideration of the execution, completion and maintenance of the works by the Contractor as prescribed by the Contract (hereinafter and in the conditions of Contract called the "Contract Price".

32.2 The notification of award will constitute the formation of the Contract.

33. Registration in TWAD

33.1 The successful contractor/firm, if not a registered contractor in Tamil Nadu Water Supply and Drainage Board, he / they shall get himself / themselves registered in TWAD Board.

34. Performance Security

34.1 A) Within 15 days from the date of the Letter of Acceptance, the successful bidder shall deliver to the Employer a Performance Security

i in the form of National Savings Certificate/Post Office Savings Deposit account purchased within the State of Tamil Nadu and pledged in favour of the Executive Engineer, TWAD Board, **RWS Division, Dindigul.**

(OR)

i. Unconditional and irrevocable bank guarantee issued by any one of the branches of Nationalized Bank or scheduled Bank within the State of Tamilnadu, provided they are in prescribed format (enclosed in this

Document) in favour of the Executive Engineer, TWAD Board, **RWS Division, Dindigul** for an amount

- For tenders with any plus Percentage and up to minus 5 percentage of department value – 2 % of contract value

- For tenders with minus 5 Percentage and up to minus 15 percentage of department value – 4 % of contract value

- For tenders with more than minus 15 Percentage of department value – 5 % of contract value.

34.2 The bidder along with the performance security, shall deliver a non judicial stamp paper for Rs.100/- (Rupees One Hundred only) at his cost for executing the agreement.

35. Signing of Agreement

35.1 The Employer on receipt of the performance security and non judicial stamp paper, will furnish to the bidder the Agreement in the form prescribed, incorporating all terms and conditions between the Employer and the successful bidder.

35.2 The Bidder should remit the performance security prescribed by the Employer in the form as in Clause 34 above and sign the agreement in the presence of the Employer within 28 days from the date of Letter of Acceptance notifying the award of contract.

35.3 Upon furnishing the performance security by the successful bidder, the Employer will promptly notify the other bidders that their bids have been unsuccessful.

35.4 Failure of the successful bidder to comply with the requirements of Clause 34 & 35 and 35.2 of "Award of Contract" shall constitute a breach of contract, cause for annulment of the award, forfeiture of the bid security and any such other remedy the Employer may take under the contract

Amendment to Agreement:

35.5 Any amendment shall be issued by mutual consent between the Employer and the contractor only with out any contrary to the bid conditions.

36. Forfeiture of Performance Security

36.1 The performance security is liable to be forfeited in cases where the firm/contractor fails to carry out the work in accordance with the specifications, terms and conditions of the contract leading to termination of the contract.

Contractor

Sd/-
Superintending Engineer, TWAD,

IV. PROGRAMME SCHEDULE

37. Project completion and Financial Milestone

37.1 The **twenty eighth day** from the date of issue of work order shall be reckoned as the start date of the contract period.

37.2 Entire project must be completed in all respects within **Six** months for installation work and successful commissioning & proof of guarantee performance and one year Maintenance at free of cost.

The mile stone for each component would be as under.

Sl. No.	Description	% of achievement	Cumulative % of achievement
1.	Upto I Quarter (3 Months)	50	50
2.	Upto II Quarter (6 Months)	50	100

38. Programme Schedule / Rate of Progress / Milestone

38.1 The Contractor, within seven days from the date of signing of the agreement shall submit to the Engineer for approval **an Activity Chart showing the general methods, arrangements, order, and timing for all the activities in the Works .**

38.2 An update of the Activity Chart shall be a Programme showing the actual progress achieved on each activity and the progress to be achieved on the remaining work including any changes to the sequence of activities. The Contractor shall submit to the Engineer in charge, for approval, an updated Activity Chart . The Employer reserves the right to approve or reject the updated Activity Chart without prejudice to levying of liquidated damages for slow progress.

39. Penalty for Defective Construction

If any defect is noticed by the Employer in the construction of any portion of work/component, the Employer shall levy penalty upto 10% of the total value of the defective work as assessed by the Engineer in charge, in addition to rectification of defective works at his cost.

40. Liquidated damages

40.1 Provided the firm/contractor fails to maintain the required rate of progress/mile stones liquidated damages will be invoked at the rate of 0.05% per week for the unfinished work. The firm/ contractor achieve the next mile stone within the stipulated period cumulatively (i.e., including the first mile stone) the levied Liquidated Damages will be revoked The amount recoverable towards liquidated damages shall not be more than 10% of the total value of contract value. The imposition of the liquidated damages clause will be without prejudice to the rights of the Employer to terminate the contract as time barred.

Contractor

Sd/-
Superintending Engineer, TWAD,

40.2 For imposing liquidated damages, detailed show cause notice shall be served on the defaulting firm/contractor either by RPAD or through personal service. The first notice shall be served allowing 15 days time to the firm/contractor for furnishing the reply by them. In case of non receipt of reply on expiry of 15 days time from the date of first notice, the second notice shall be served allowing 7 days of time to the firm/contractor for furnishing the reply by them. Again in case of non receipt of reply on expiry of 7 days time from the date of second notice, the third notice shall be served allowing 3 days of time to the firm/contractor for furnishing the reply by them. On receipt of the reply, it shall be verified by the Engineer in charge and liquidated damages clause shall be invoked by issuing an explicit speaking order to the firm/ contractor, Similarly, the non receipt of any reply from the firm/ contractor shall attract imposing the liquidated damages clause automatically and in this case also, the liquidated damages shall be imposed by issuing an explicit speaking order to the firm/contractor.

41. Foreclosure of Works

The Employer shall have the right to issue notice to the firm/contractor, for any reason whatsoever does not require the whole or part of the works to be carried out after the award of the contract. The contractor shall not have any claim towards compensation or whatsoever, on account of any profit or advantage, which he might have derived from the execution of such works. For the works executed which could not be utilised in view of the foreclosure, the firm/contractor shall be paid a eligible amount as certified by the Engineer in charge.

Contractor

Sd/-
Superintending Engineer, TWAD,

V. PAYMENTS AND RECOVERIES

42. Payment Schedule

Payment shall be made as envisaged under:

Payment may be released up to

90 % of the of total value , after supply, delivery ,erection, testing, and satisfactory commissioning of SCADA arrangements

10 % after completion of free maintenance and based on the satisfactory performance certificate issued by the Executive Engineer in-charge of the SCADA system

Note:

- The percentage of payment mentioned above is with reference to the total value of each component as per the agreement entered into by the firm / contractor.
- The payment shall be made for each component as per the actual measurement upto the percentages mentioned above for the stage of progress of each component. In the case of actual value of works carried out becoming lesser than the percentage limits prescribed for the stages, the payments shall be restricted to the actuals.
  If commissioning is delayed due to other reasons not to related to the deficiency of the contractor, the pending payment shall be released against Bank Guarantee.
- 5% of the value of every running bill shall be retained by the Employer as additional performance security.
- Payments shall become eligible only for finished items of works in all respects

42.1 **Preparation of bills**:

The Contractors will submit their bills every month in the M.Book format for the Quantity only of the relevant running bill duly signed. This will be treated as claim of the Contractor to consider payment every month.

The Contractor shall submit their bills to the Executive Engineer or any of his subordinate officer under his control as directed by the Executive Engineer. The Executive Engineer shall be responsible to scrutinize and make payment to the Contractor within 6 weeks from the date of submission of bills by the Contractor concerned.

43. Release of Performance Security & Retention Amount

43.1 If defects are noticed within the stipulated period of 24 months of satisfactory performance, the defects should be rectified by the contractor at his own cost and the performance period again shall be reckoned from the date of completion of the rectification of defects by the contractor.

Contractor

Sd/-
Superintending Engineer, TWAD,

43.2 The security deposit less any amount due to the Board and 2 ½ % out of the total 5% of the retention amount made in every running bill shall be released in final bill which shall be prepared after the works are completed in all respects and completion of the maintenance period.

43.3 The balance 2 ½ % out of the total 5% retention amount from final bill in respect of contract for original works etc., will be retained by Engineer in charge and paid to the contractor after a period of 24 months including one year maintenance of satisfactory performance of entire civil works and on production of irrevocable Bank Guarantee in a prescribed form for the above amount for a further period of 3 years beyond the above said 2 years to ensure stability.

44. Recovery of money payable to the TWAD Board

44.1 All losses, costs, damages and expenses and other money payable to the Board by the contractor under any stipulation in the contract, may be retained out of any money due or which may subsequently become due from the Board to the contractor under any contract or otherwise whatsoever and in case such money then due or to become due to the contractor by the Board shall be insufficient to pay such losses, costs, damages, and other money payable to the TWAD Board by the contractor, it shall be lawful for the Engineer in charge without any further consent on the part of the contractor to sell or dispose of any securities deposited in the Board by the contractor as aforesaid and with and out of the proceeds of such sale, after payment of all expenses connected therewith or reimburse and pay to the Board all such losses, cost, damages and expenses and other money payable to the contractor. And in case such proceeds of sale of the said securities shall be insufficient for such purpose then and in that case it shall be lawful for the Board to recover the residue thereof, if necessary by legal proceedings and or by resorting to revenue recovery act against the contractor.

45. Income Tax

45.1 During the course of the contract period, deduction of income tax shall be made at the prevailing rates from every payment as may be specified by the Income Tax Department.

46. GST

GST is applicable as per GO. 296, Finance(salaries) Dept. Dt. 09.10.2017, GOI, Ministry of finance – central tax (Rate) New Delhi, notification No. 12/2017/ Dt. 28.06.2017 and 20.10.2017 and as amended from time to time.
From every payment made to the firm/ contractor, deduction at source towards GST shall be made for civil works contract as per Government of India, Ministry of Finance/ Department of Revenue, New Delhi Notification No. 20 / 2017 – Central Tax (Rate) / Dt.22.08.2017 subject to issue of amendments from time to time

47. EXCISE DUTY Deleted

48. FUND CONTRIBUTION FOR MANUAL WORKERS

Towards contribution of fund for the benefit of manual workers employed in the construction works an amount equivalent to one percent of total estimated cost of

the construction work proposed will be paid by the Employer direct to the respective welfare Board, as per G.O. Ms. No. 295/ Labour and Employment (I2) Department/ Dated: 17.12.2013, subject to issue of amendments from time to time by the respective department of Government of Tamil Nadu.

(Lump sum provision for this contribution may be appropriately made in the Estimates sanctioned for the schemes and the amount would be remitted at the end of the financial year to the labour welfare Board, as per G.O Ms. No.283, MAWS Dept, Dated: 11.11.2010)

49 Price Adjustment Deleted

50. Mobilization Advance : NIL

Contractor

Sd/-
Superintending Engineer, TWAD,

VI. LIST OF ANNEXURES

Sl. No.	Description	Para No.
I.	Performance of the bidder showing value of similar nature of work executed for the past three years	7.1.4
II.	Average Annual Instrumentation / SCADA Turnover	7.1.5
III.	Experience in works of similar nature and Magnitude within a period of 7 years	7.1.6
IV.	Commitment of works on hand	7.1.6
V.	Works for which Bid already submitted	7.1.6
VI.	List of Equipments available with Bidder	7.1.7
VII.	Qualification/Experience of key personnel proposed for technical and administrative functions under this contract	7.1.8
VIII.	Sample Format for evidence of access to or availability of credit facilities	7.1.9
IX.	Details of Litigation	7.1.10
X.	Declaration by the bidder	7.1.11
XI.	Details of components proposed to be sublet and sub contractors involved	7.1.12
XII.	Technical staff to be employed	Para 10 of General Conditions

Contractor

Sd/-
Superintending Engineer, TWAD,

VI. LIST OF CERTIFICATES

Sl. No.	Description of Certificate	Para No.
1	Signature of the proprietor or proprietress attested by the Notary Public	2.2
2	Signature of all the partners/power of attorney attested by the Notary Public	2.3
3	Registration of the firm, signature of the authorised person attested by the Notary Public	2.4
4	A copy of the listed power of attorney authorising the signatory of the bidder	7.1.2
5	Proof of registration of firm/Company	7.1.3
6	Audited Balance Sheets	7.1.5
7	Credit line Certificate from Financial institutions	7.1.9 Format-VIII
8	Income Tax Clearance Certificate	7.1.14
9	Sales Tax Verification Certificate	7.1.15
10	Certificate of performance issued by not less than the rank of Executive Engineer/Rresponsible person of the private organisation.	

Contractor

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Superintending Engineer, TWAD,

ANNEXURE I

Performance of the Bidder showing Total Monetary Value of similar nature of works executed in the last Three Financial Years

Year	Monetary Value of similar nature of work (Rs. In lakhs)
2017-2018	
2018-2019	
2019-2020	

Seal of the Firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE II

Annual Instrumentation / SCADA Turnover

Each Bidder must fill in this form

Annual Turnover Data (SCADA Work) in the Last Three Financial years.		
Sl. No.	**Year**	**Amount Currency**
1	2017-2018	
2	2018-2019	
3	2019-2020	
Average Annual **Instrumentation / SCADA**		

The information supplied should be the Annual Turnover of the Bidder in terms of the amounts billed to clients for each year for work in progress or completed.

Seal

……..
……

(Signature of the Bidder)

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE III

Experience in works of similar Nature and Magnitude within a period of 5 years

Sl. No	Contract No. and Name of the Project	Description of the work	Name of the employer with full address	Value of the Contract (Rs. In lakhs)	Date of Issue of Work Order and stipulated period of completion	Actual date of completion	Reason for the delay, if any in completing the Project

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE IV

Commitments of works on hand

Sl. No	Contract No and Name of the Project	Description of the work	Name of the employer with full address	Value of the contract (Rs. In lakhs)	Date of Issue of work order and stipulated period of completion	Value of works remaining to be completed (Rs. In lakhs)	Antici pated date of comple tion

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE V

Works for which Bids are Already Submitted

Sl. No	Contract No and Name of the Project	Description of the work	Name of the employer with full address	Value of the contract (Rs. In lakhs)	Stipulated period of completion	Date when decision is expected	Remarks if any

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

Annexure VI

List of Equipment Available with Bidder

Sl. No.	Equipment Name	Requirement for the project		Availability Status			Remarks
		Nos.	Capacity	Owned/ leased/ To be procured	Nos and capacity	Age/condition	

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE VII

Qualification/Experience of key personnel proposed for technical and administrative functions under this contract

Sl. No	Name of the person	Position for which proposed	Qualification	Total Years of experience	Years of experience in the proposed position	Remarks

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE VIII

SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES – CLAUSE 7.1.9

BANK CERTIFICATE

This is to certify that M/s…….
is a reputed company with a good financial standing.

If the contract for the work, namely…… is awarded to the above firm, we shall be able to provide overdraft/ credit facilities to the extent of Rs…….. to meet their working capital requirements for executing the above contract.

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE IX

Details of Litigation, if any.

Sl. No	Name of the Govt. Dept./Private Organisation (Other party)	Cause of the litigation	Amount involved (Rs. In lakhs)	Award for (or) against bidder	Remarks / present stage

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE X

Declaration by the Bidder:

It is to certify that our firm

…….

……has not been black listed, banned, debarred in any Central Government Department or Undertaking/Organization or any State or Union Territory, Department or Undertaking/Organization.

Seal

……..
……

(Signature of the Bidder)

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE XI

Details of Components proposed to be sublet and sub-contractors involved

Sl. No	Name of component proposed to be sublet	Name of the Sub Contractor	Details of experience in similar work	Annual turnover of Sub-Contractor for the last 3 years (Rs. In lakhs)

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

ANNEXURE XII

Technical Staff to be employed

I/We shall/Will employ the following technical staff as per the prescribed rules

Sl. No	Name of the technical staff to be employed	Designation	Qualification

Seal of the firm **Signature of the bidder with date**

Contractor

Sd/-
Superintending Engineer, TWAD,

VII. GENERAL CONDITIONS OF CONTRACT

1. DEFINITIONS

In the Contract (as hereinafter defined) the following words and expressions shall have its meanings hereby assigned to them, except where the context otherwise requires.

“Board” means the Tamil Nadu Water Supply and Drainage Board, a statutory body constituted under the Tamil Nadu Water Supply and Drainage Board Act 1971 having its office at No.31,Kamarajar Salai, Chepauk, Chennai – 600 005 and any officer authorised to act on its behalf

“Employer” means the Tamil Nadu Water Supply and Drainage Board and shall include the officers duly authorised to act on its behalf

“Contractor” means the person or persons, firm or company whose tender has been accepted by the Employer and includes the authorised representatives, successors, heirs, executors, administrators

“Subcontractor” means any person or persons, firm or company named in the Contract as a Subcontractor for a part of the Works or any person or persons, firm or company to whom a part of the Works has been subcontracted with the consent of the Engineer and includes the authorised representatives, successors, heirs, executors, administrators of such Subcontractors

“Engineer” means the Executive Engineer or any other Engineer appointed from time to time by the Employer to act as Engineer for the purposes of the works brought under this contract

“Engineer in charges” means the Executive Engineer or any other Engineer authorised by him.

“Engineer’s representative” means any Resident Engineer or assistant of the Engineer or any clerk of works appointed from time to time by the Employer or/the Engineer to perform the duties set forth in respect of this Contract.

“Contract” means the Invitation for Bids and amendment made thereof, Letter of Acceptance, the formal Agreement executed between the Employer and the Contractor together with the documents referred to therein, General Conditions of the Contract, Special Conditions, Specifications, Minutes of the pre Bid conference, Design, Drawings, Schedule of Rates and Prices, Bill of quantities, Rate of Progress etc., All these documents taken together shall be deemed to form one contract and shall be complementary to one another.

The quality parameters laid down in relevant BIS, TNBP, Bid Documents etc., are to be followed and it is stipulated to compete the entire works in all respects satisfactorily and commission within the stipulated period and maintain the scheme for the specified period.

“Contract Price” means the sum stated in the Letter of Acceptance as payable to the contractor for the execution, completion and maintenance of the works, subject to such additions thereto or deductions therefrom as may be provided under this Contract and the remedying of any defects therein in accordance with the provisions of the contract.

“Constructional Plant” means all appliances or things of whatsoever nature required in or about the execution, completion or maintenance of the works but does not include materials or other things included to form or forming part of the permanent works.

“Works” shall include both permanent works and temporary works. “Permanent works’ means the works of permanent nature to be executed, completed and maintained (including Plant) in accordance with the contract. ‘Temporary works’ means all temporary works of every kind required in or about the execution, completion or maintenance of the works and remedying of the defects therein

Specification” means the schedules, detailed designs, technical data, performance Characteristics and all such particulars referred to in the bid/contract and any modification thereof or addition thereto as may from time to time be furnished or approved by the Employer.

Drawings” means the drawings, calculations and technical information referred to in specification and any modification of such drawings approved in writing by the Engineer and such other drawings, calculations and technical information as may to time be furnished or approved in writing by the Engineer.

“Site” means the land and other places on, under, in or through which the Permanent works and/or Temporary Works are to be executed and any other lands and places provided by the Employer for working space or any other purpose as may be specifically designated in the Contract as forming part of the site.

Approved means approval in writing including subsequent written confirmation of previous verbal approval

“Test” means such test or tests as are prescribed in the specifications or considered necessary by the Engineer

‘ISS” means Indian Standard Specifications

“BIS” means Bureau of Indian Standards

“TNBP” means Tamil Nadu Building Practice

“Day” means a Calendar day from midnight to midnight)

“Week” means seven consecutive days.

“Month” means from the beginning date of a given date of a calendar month to the end the preceding date of the next calendar month

“Quarter” means a period of three months reckoning from the Ist date of January April, July and October and counted to the last date of March, June, September and December respectively.

Rupees means Rupees in Indian Currency

“Bill of Quantities” means the priced and completed bill of quantities forming part of the tender

“Tender” means the Contractor’s priced offer to the Employer for the execution, completion and maintenance of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of acceptance

Letter of Acceptance” means the formal acceptance by the Employer of the Tender

“Contractor Agreement” means the contract agreement referred to in clause(..)

Appendix to Tender” means the appendix comprised in the form of Tender annexed in these conditions.

“Commencement Date” means the date of signing the agreement or the date of handing over the site to the successful firm/contractor, whichever is earlier and this shall be reckoned as the start date of the project.

“Time of Completion” means the time for completing the execution of and passing the Tests on Completion of the Works of any section or part thereof as stated in the Contract (or as extended under Clause...) calculated from the Commencement Date

“Maintenance” means the successful maintenance of the completed and commissioned project as a whole or in parts as the case may be for the stipulated period

“Joint Venture” means two or more firms/contractors aspiring to take up the contract jointly with the lead partner and other partner/partners possessing the required qualifications.

2. INTERPRETATION

In interpretation of these Conditions of Contract, headings shall not be deemed part thereof or be taken into consideration. Words importing persons or parties shall include firms and corporations and any organization having legal capacity. Words importing the singular only also include plural and vice versa where the context requires.

The Employer will provide instructions clarifying the queries about the contract

3. Authority of Engineer in Charge

It shall be accepted that the authority of the Engineer in charge shall be an integral part of the contract in all matters regarding the quality of materials, workmanship, removal of improper work, interpretation of the contract drawings and specifications, mode and procedure of carrying out the works where the decision of the Engineer in charge shall be final and binding on the contractor. The Engineer in charge shall have absolute authority on all technical matters and payment considerations.

Contractor

Sd/-
Superintending Engineer, TWAD,

4. Sufficiency of Bid

The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the bid and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.

5.Priority of Contract Documents

The several, documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract. The priority of the documents forming the Contract shall be as follows:

- The Contract Agreement
- The Letter of Acceptance
- The Tender
- Conditions of the Contract
- Technical specifications
- Any other document forming part of the Contract

6.Secrecy of the contract document

The Contractor shall treat all documents, correspondence, direction and orders concerning the contract as confidential and restricted in nature by the contractor and shall not divulge or allow access to these matters to any unauthorized person.

7. Instruction in Writing

Instructions given by the Engineer or Engineer's Representative shall be in writing, provided that if for any reason, the Engineer or the Engineer's Representative considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer or Engineer's Representative, whether before or after the carrying out of the instructions given by the Engineer or Engineer's Representative, shall be deemed to be an instruction.

8. Commencement of Works

The Contractor shall commence preliminary works after the receipt by him of the LOA to this effect from the Engineer in charge. Thereafter, the contractor shall proceed with the Works with due expedition and without delay and in accordance with the programme schedule set out in the Contract.

Contractor

Sd/-
Superintending Engineer, TWAD,

9.Reference Marks

The basic centre lines, reference points and bench marks shall be fixed by the Engineer in charge of the works.

The contractor shall establish additional reference points and bench marks as may be necessary at his cost. The contractor shall remain responsible for the accuracy and sufficiency of the reference and bench marks. The contractor shall take proper precautionary steps to ensure that the reference lines and bench marks established for the works are not disturbed and shall make good any damages caused.

10. Supervision

The Contractor shall provide all necessary superintendence during the execution of the works and thereafter as may be necessary for the proper fulfillment of the obligations under this contract. The contractor shall arrange for the deployment of proper qualified personnel at the site of work constantly, such supervising staff, apart from those separately set out as the requirements of the contract, shall be skilled and experienced technical assistants, foremen and others competent enough to produce proper supervision.

The Contractor shall employ the technical staff as per the prescribed rules. The details of value, scale and minimum qualification prescribed for the employment of technical staff, the rate of penalty for the failure on the part of the contractor to employ the technical staff for the work etc are as follows

Sl. No	Scale and minimum qualification prescribed for the employment of technical staff	Number of persons required	Rate of Penalty
	Up to Rs. 50.00 Crore		
1)	**Project Manager, B.E.(EEE/ E&C/E&I)** or equivalent with 15 years experience	1	Rs. 25,000/- per month/ person
2)	**Deputy Project Manager, B.E. (EEE/ E&C/E&I)** or equivalent with 10 years experience	1	Rs. 15,000/- per month/ person
3)	**Resident Engineer, B.E.(EEE/ E&C/E&I)** Mechanical/Electrical or equivalent with 5 years experience	2	Rs. 10,000/- per month/ person

If the contractor fails to employ the technical staff to the departmental requirements, the contractor is liable to pay the penalty as indicated above during the period of such non employment of technical staff.

Contractor

Sd/-
Superintending Engineer, TWAD,

In the event of any staff of the contractor being non co-operative, negligent, incompetent of misconduct, the Engineer in charge shall have the liberty to object to the placement of such staff at the site or other place of works and will promptly issue notice in writing to the contractor for the removal of such staff members. It will be obligatory on the part of the contractor to remove/change such persons in the larger interests of the works.

11. Subletting of Contract

Assignment of the contract is not permissible

Transfer of the contract is not permissible on any grounds

The contractor shall sublet any portion of the contract only with the written consent of the Engineer in charge. It should be clearly understood that any subletting shall in no way absolve the contractor of his responsibilities and obligations under this contract

12. Specifications and Checks

Stated dimensions in the drawings are to be taken for consideration and no measurements based on scaling of the drawings shall be considered. In case of discrepancy between the description of items in the schedule of quantities and the specifications, the later shall prevail. In case of the description, any work having not fully described or doubts prevail, the contractor shall forthwith write to the Engineer in charge and clarify himself before executing that portion of the work. However, this cannot be a cause for any delay in the progress and the contractor should take advance action in this regard ensuring timely completion of the works. Before commencement of the work, it will be obligatory on the part of the contractor to furnish a detailed plan of action along with layouts showing the position of the construction plants and other facilities required and proposed to be provided for this contract.

The contractor shall execute the works true to alignment, grade and levels as set out in the drawings and as directed by the Engineer in charge from time to time. The Engineer in charge or his representative is at liberty to check the correctness of the works, the suitability of the materials used, design mix etc., The contractor will raise no objections for such checks land shall provide necessary labour and instruments to carry out such check to the Engineer in charge as well as his representative and co-operate in the checks. However, such checks will not absolve the contractor of his responsibility of maintaining the accuracy of the work.

13. Custody and Supply of Drawings and documents

The drawings shall remain in the sole custody of the Engineer in charge, but two copies thereof shall be provided to the contractor free of charge. The contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the contract, the drawings specifications and other documents provided by the Employer or the Engineer in charge shall not, without the consent of the Engineer in charge, be used or communicated to a third party by the contractor. One copy of the Drawings, provided to or supplied to the Contractor as aforesaid, shall be kept by the Contractor at the site and the same shall be made available for inspection and use by the Engineer and by any other person authorized by the Engineer.

Contractor

Sd/-
Superintending Engineer, TWAD,

14. Bill of Quantities

The Bill of quantities shall contain items for the construction, installation, testing, commissioning and maintenance of the Works to be carried out by the Contractor. The Bill of Quantities will be used to calculate the Contract Price. The contractor shall be paid for the quantum of work done at the rate mentioned for each item in the Bill of quantities.

15. Change in the Quantities

If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item/items, the rates as in the agreement for the relevant items shall be paid as per the actual quantity.

16. Additional items

If additional items that are not contemplated in the contract are to be executed, the Engineer in charge will execute the works either through the main contractor/firm or through any other agency. Payment for such works shall be made based on the rates derived by the Engineer in charge as per rules in force.

17. Order Book

An order book will be kept by the Officer in charge of the site (Junior Engineer/Assistant Engineer) of the particular component of the works. Orders entered in this book by the Engineer in charge or any higher authority shall be held to have been formally communicated to the contractor/firm. The Officer in charge of the site will sign each order as it is entered and will hand over the duplicate to the contractor/firm or his agent, who shall sign the original in acknowledgement of having received the order.

18. Independent Inspection

The Engineer shall delegate inspection and testing of materials or Plant to an independent inspector/Agency. Any such delegation shall be considered as prerogative of the Engineer. In addition to third party inspection, wherever felt necessary, the engineer shall be empowered to test the PVC Pipes for its quality such as specific gravity, diameter, thickness etc in the TWAD Board laboratory. **The cost of the third party quality check pipes, valves and pumpsets shall be borne by the employer.**

19. Covering and Opening of Works.

No work shall be covered or put out of view without the approval of the engineer in charge. The contractor shall give due notice to the Engineer in charge whenever such works are ready for examination and the Engineer in charge within a reasonable period, arrange for the inspection and measuring of the work as may be necessary. No portions of the work shall be covered up without the consent of the Engineer in charge. The cost of opening any portion of the works that was covered without the consent of the Engineer in charge and the cost of covering thereafter shall be borne by the contractor. The contractor shall open the covered portion of the works for inspection by the Engineer in charge on a request and the inspection or examination shall be carried out promptly by the Engineer in charge. In the case of defects notified by the Engineer in charge, the contractor shall rectify the same as may be instructed by the Engineer in charge. All costs of opening, covering and rectification shall be on to the account of the contractor. Should the contractor refuse to open such portions of works the Engineer in charge shall

open such portions with other persons and inspect the part of the works as he may feel necessary. On inspection, the works being not in accordance with the requirements of the contract documents, the Engineer in charge shall carry out necessary rectification and the entire cost of opening, rectification and closing shall be on to the contractor's account.

20. Temporary Diversion of Roads and Commencement of Work.

During execution of the works, the contractor/firm shall make at his cost all necessary provision for the temporary diversion of roads, car tracks, footpaths,. drains, water courses, channels etc. , Should the contractor/firm fail to do these arrangements, the same shall be done by the Engineer in charge and the cost thereof shall be recovered from the contractor/firm.

21. Notice to Telephone, Railway and Electric Supply Undertaking.

The Contractor/firm shall give all notices required by any law or custom or as directed by the Engineer in charge and irrespective of whether notice be so required so directed or not, shall in all cases give due and sufficient notices to all persons and authorities having charge of the telegraph, water and other pipes, sewers, culverts drains, water courses, railway, telephone, highways, roads, streets, foot and carriage highways, payment and other works, prior to commencements and at the completion of any work under this contract in order to enable the proper bodies or persons in respect of the matters aforesaid to attend and see the works within their jurisdiction and all matters and things incidental and pertaining thereto are secured, re-laid or reinstated in a proper and satisfactory manner. The notices by the contractor/firm shall also serve the purpose of enabling such bodies and persons to attend and secure, shore up, alter the position or remove, relay and reinstate the works and things belonging to them not withstanding the notices given as aforesaid the Contractor/firm shall be chargeable and responsible for the proper protection and restoration of all matters and things herein referred to.

22. Watching and Lighting

The Contractor/firm shall at his expense shall provide at the site of works sufficient fencing, barricading, watching and lighting during day and night. The contractor/firm shall in every respect conform to the police regulations in these matters and shall free and relieve the Board on all such matters. Should the contractor/firm fail/neglect to do these arrangements, the same shall be carried out by the Engineer in charge and the costs thereof shall be recovered from the contractor/firm.

23. Measurement of Work

The work will be measured by the site engineer (Junior Engineer/Assistant Engineer) and recorded in the measurement book. The contractor/firm will be at liberty to accompany the site engineer in order that they may agree on the measurements but should they neglect to do so, the measurements as recorded by the site engineer shall be taken as final and conclusive. The measurements of works will be recorded as prescribed in the TNBP and as amended from time to time.

24. Tools and Plants

All tools, plants and equipments required for this contract will be arranged by the Contractor at his own expense. The Contractor shall erect necessary construction plant as may be necessary and shall use such methods and appliances for the proper

performance of all the operations connected with the work brought under the contract ensuring satisfactory quality of work and maintenance of the programme schedule. The non availability of any tool, plant or equipment shall not be relied upon as a reason for non functioning or slow progress.

25. Information and Data

The information and data made available to the contractor in respect of the works and site conditions are only general and the contractor is advised to get himself fully acquainted with the nature of the location of the works and the surroundings, quarries, local conditions and such other aspects that are relevant to the works.

26. Co-existence with other Contractors.

Where two or more contractors are engaged on work in the same vicinity, they shall work together harmoniously with the spirit of cooperation and accommodation. The contractor shall not disrupt or disturb the works or labour arrangements of the neighboring contractors. In case of disputes and difficulties arising between the contractors in the execution of the respective works, the Engineer in charge shall interfere and give directions for the smooth functioning of the entire works and it shall be the bounden duty of the contractors to abide by these instructions.

27. General Responsibilities and Obligations of the Contractor

The contractor shall, subject to the provisions of the contract, execute and maintain the works with proper care and diligence and provide all labour including the supervision thereof, materials, constructional plant and all other things, whether of a temporary or permanent nature required for such execution and maintenance.

The contractor shall take full responsibility for the adequacy, stability and safety of all site operation and methods of construction.

The contractor shall promptly inform the Employer and the Engineer in charge if any error omission, fault and other defects in the specification or design of the works which are identified at the time of reviewing the contract documents or during the execution for proper rectification thereof.

All notices, certificates connected with the work served by the employer relating to the contract shall be sent by post or by hand to the contractor' principal place of business as mentioned in the document or at other places as may nominated by the contractor in writing for this purpose. Any change in the address of the contractor should be promptly intimated to the Employer in writing then and there.

The contractor shall visit the spots of work and ascertain the site conditions. The contractor shall satisfy himself of the conditions prevailing in the spots where the work is actually to be executed and its environs and the precise offered by him shall be treated as those which were worked out taking fully into consideration the prevailing site conditions, hydrological conditions, extent and nature of work to be executed, the material availability, etc., Any claim on this ground at a later date shall be summarily rejected.

However during the execution of the works, if the contractor has to encounter artificial obstructions, which in his opinion could not have been reasonably foreseen, then the contractor shall write forthwith to the Engineer in charge of such obstruction and remedial

measures needed. The Engineer in charge, if opined that the conditions cannot be possibly foreseen by an experienced contractor, he shall extend possible assistance to the contractor to overcome such obstructions. The opinion of the Engineer in charge shall be final and binding and the contractor is not entitled to advance these as reasons for any delay that may be caused to the completion of the project.

The contractor shall execute and maintain all works in accordance with the specification and to the satisfaction of the Employer. The contractor shall strictly adhere to the instructions and directions of the engineer in charge, whether included in the contract agreement or not but concerning the safe and proper execution of the works.

28. Labour

The contractor shall not employ any person who has not completed fifteen years of age in connection with the works under this contract.

The contractor shall furnish the information on various categories of labour employed by him to the Engineer in charge in the form prescribed for this purpose

The contractor shall in respect of labour employed by him comply with or cause to be complied with the provisions of various labour laws, rules and regulations as applicable to them in regard to all matters provided therein and shall indemnify the Employer in respect of all claims that may be made against the Employer for non compliance thereof by the contractor.

Now withstanding anything contained herein, the Employer reserves the right to take such action as may be deemed fit and proper for the compliance of various labour laws and recover the costs thereof from the contractor.

29. Restriction of Working Hours

Subject to any provisions contained in the Contract, none of the works shall, save as hereinafter provided, be carried on during the night or on locally recognized days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer, Provided that the provisions of this clause shall not be applicable in the case of any work which is customary to carry out by multiple shifts

30. Right of Way and Facilities

The Contractor shall bear all costs and charges for special or temporary rights of way required by him in connection with access to site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works

31. Removal of Improper Work, Material and Plant

The contractor shall make his own arrangements for the procurement, supply and use of the construction materials and shall ensure that the materials either procured within the country or abroad conform to the relevant specifications set out in the bid documents. In case of alternatives being used, they should be of equal or higher quality than those specified subject to the review and written approval of the Engineer in charge.

Differences between the standards specified and the proposed alternatives must be described in writing to the Engineer in charge at least 30 days in advance from the date on which the approval of the Engineer in charge is needed. The disapproval of the proposal by the Engineer in charge shall result in the contractor confining to the standards set forth in the contract documents. The contractor shall arrange for the inspection of the material at the manufacturing place or other places by the department personnel

All materials and workmanship shall be in accordance with the specifications set out in the contract document and as directed by the Engineer in charge and shall be subjected to tests by the Engineer in charge or his representative at the place of manufacture or at the site of work or places wherever felt necessary. The contractor shall provide all the assistance necessary including instruments, machines and materials that are normally required for carrying out the testing/measuring the quality/quantity of the materials and workmanship. Any material rejected after testing by the Engineer in charge or his representative will not be used on the works. The contractor shall without claiming any extra cost, shall arrange for the testing of materials and supervision of the works. The Engineer in charge or his authorized representative will have access at all ties to the places of manufacture, storage to ascertain as to whether the manufacturing process wherever mentioned is in accordance with the drawings and specifications

The Engineer in charge shall have the right to order the removal of such materials which in his opinion are substandard stipulating a time limit for the removal of the same and replacement with quality material

Notwithstanding the previous tests of the materials by the Engineer in charge or his representative, if any portion of the work, in the opinion of the Engineer in charge is not in order, the contractor shall redo such work to the satisfaction of the Employer at no extra cost. In case of default on the part of the contractor in carrying out such orders, then the Employer shall have the right to carry out such works through some other persons and the expenses thereon or incidental thereto shall be recoverable from the contractor.

32. Default of Contractor in Compliance

In case of default on the part of the Contractor in carrying out such instruction within the time specified therein, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and shall be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer

33. Default by Contractor

If the contractor shall become bankrupt or have a receiving order made against him or shall present his petition in bankruptcy or shall make an arrangement with or assignment in favour of his creditors or shall agree to carry out the contract under a committee of inspection of his creditors, or being a corporation shall go into liquidation (other than a voluntary liquidation for the purpose of amalgamation or reconstruction), or if the contractor shall assign the contract, without the consent in writing of the employer first obtained, or shall have an execution levied on his goods, or if the engineer in charge shall certify in writing to the employer that in his opinion, the contractor.

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a) Has abandoned the contractor or

b) Without reasonable excuse has failed to commence the works or has suspended the progress of works for twenty eight days after receiving a written notice from the Engineer in charge to proceed or

c) Has failed to remove materials from the site or to pull down and replace work for twenty eight days after receiving the written notice from the engineer in charge stating that the said materials or work stands condemned and rejected under these conditions, or

d) Despite previous warnings in writing by the Engineer in charge, not executing the works and achieving the progress as stipulated in the programmed schedule drawn for the contractor is persistently or flagrantly neglecting to carryout the obligations under this contractor

e) Has, to the detriment of good workmanship, or in defiance of the instructions of the Engineer in charge or in contract sublet any part of the contract, then the Employer, may at his option, after giving two weeks notice in writing to the contractor, enter upon the site and the works and expel the contractor therefrom without thereby voiding.

f) The contract, or releasing the contractor from any of his obligation or liabilities under this contract, and may himself complete the works or may employ any other contractor to complete the work. The employer or such other contractor may use the construction plant, temporary works and materials which have been deemed to be reserved exclusively for the execution of the works under the provisions of the contract as may be thought fit and proper for the completion of the work. The employer may, at anytime, sell any of the said constructional plant, temporary works and materials which have been deemed to be reserved exclusively for the execution of the works under the provisions of the contract as may be thought fit and proper for the completion of the work. The employer may, at any time, sell any of the said constructional plant, temporary works and unused materials and apply the proceeds of sale in or towards the satisfaction of any sums due or which may become due to him from the contractor under this contract.

g) has carried out the work in a defective manner.

h) has not made payment of labour dues.

i) has become eligible for maximum compensation under the “Liquidated damages clause” leading to Termination of the contract.

The Engineer in charge shall as soon as may be practicable after any such entry or expulsion by the employer, fix and determine expert or by after reference to the parties, or after such investigation or enquiries as maybe thought fit to make or institute, and shall clarify what amount, if any had at the time of such entry and expulsion been reasonably occurred to the contractor in respect of work then actually done by him under this contract and the value of any of the said unused or partially used materials, any constructional plant and any temporary woks.

Contractor

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Superintending Engineer, TWAD,

If the employer shall enter and expel the contractor under this clause, the employer shall not be liable to pay to the contractor any money on account of the contract until the expiration of the period of maintenance and thereafter until the costs of execution and maintenance, damages for delay in completion, if any and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the engineer. The contractor shall then be entitled to receive only such sum or sums, if any as the engineer in charge may certify would have payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the contractor on due completion by him, then the contractor shall, upon demand, pay to the employer the amount of such excess and it shall be deemed a debt due by the contractor to the Employer and shall be recoverable accordingly.

If, by reason of any accident, or failure, or other event occurring to or in connection with the work, or any part thereof, either during the execution of the works, or during the period of maintenance, any remedial or other work or repair shall in the opinion of the Engineer in charge or his authorized representative, be urgently necessary for the safety of the works and the contractor is unable or unwilling at once to do such work or repair as the Engineer in charge or his representative may consider necessary, such works shall be carried out by the Engineer in charge. If the work or repair so done, which in the opinion of the Engineer in charge, liable to have been done by the contractor at his expense under this contract, all expenses incurred by the Employer in carrying out such works shall be recoverable from the contractor or shall be deducted by the Employer from the money due to the contractor provided always that the Engineer in charge or his representative, as the case may be, shall as soon after the occurrence of any such emergency as may be reasonably practicable, notify the contractor thereof in writing.

34. Power to vary work

The description of the works required to be executed by the contractor/firm are set out in the specifications, schedules and drawings, but the Engineer in charge reserves the power to vary, extend or diminish the quantities of work, to alter the line, level or position of any work, to increase, change or decrease the size, quality, description, character or kind of any work, to order the contractor/firm to execute the works or any part thereof, by day or night work, or to add or take from the work included in the contract as he may deem fit and proper without violating the contract and the contractor/firm shall not have any claim upon the Employer for any such variation, extension, diminution, alteration, increase, change or decrease other than for the work actually done, calculated according to the prices tendered and accepted in this contract.

35. Extra for Varied Works

Any unforeseen additional work that may become necessary and is accordingly carried out under this contract based on proper written orders shall be measured and valued by the Engineer in charge at the rates contained in the contractor's/firm's original bill of quantities. If these rates do not apply to the additional works ordered to be carried out, then prior to execution of the additional work, a rate for such work shall ordinarily be agreed upon and entered in a supplemental schedule and signed by both the Engineer in charge and the contractor/firm.

36. Omissions

In the event of anything reasonably necessary or proper to the due and complete performance of the work (Engineer in charge will be the sole judge on these things) being

omitted to be shown or described in the drawings, specifications and schedules, the contractor/firm shall notwithstanding execute and provide at the rates noted in the bill of quantities all such omitted works and things as if they have been severally shown and described and the execution should be according to the directions of the Engineer in charge and to his satisfaction.

37. Notices Regarding Shoring etc.,

Wherever shoring or other works for the protection or security of the buildings/structures are necessary, the contractor/firm shall within a reasonable period before the execution of such works, shall serve notices upon the occupiers of the buildings/structures to be shored up or otherwise secured and upon all other parties entitled to notice, apprising them respectively that such works are necessary, that the contractor/ firm about to execute the same and will, at a time to be specified in such notice, enter upon the premises for the purpose of executing such works.

38. Cost of Repairs

Loss or damage to the Works or materials to be incorporated in the works between the Start Date and the end of the Defects correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions. **Contractor shall attend to the defect in the work noticed during defects correction period within 3 days from the date of issue of notice to attend to the defects, failing which the defect will be remedied by engaging other Contractors at any cost and that cost will be recovered from the Contractor's money available with the Employer and balance alone will be paid when it is due.**

39. Suspension of Work

The Contractor shall, on the instructions of the engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer in charge.

40. Suspension of Progress

The contractor/firm shall, without recompense, claim or demand, delay or suspend the progress of works as a whole or any part thereof, if and when or so often as directed by the Engineer in charge and for such time or times, as may be in the judgement of the Engineer in charge be necessary for the purposes or advantages of the undertaking. Upon all such occasions, whether directed or not, the contractor/firm at his/their expense, properly cover down and secure so much of the work as may be liable to sustain damage from whether or any other cause and shall at all times and forthwith when required properly make good all the damage or injury which such works or any part thereof may gave sustained and these should be done to the entire satisfaction of the Engineer in charge.

41. Termination

The Employer may terminate the Contract for any reason that is regarded as breach of the Contract.

If the contract is terminated, the contractor shall stop work immediately, make the site safe and secure and leave the site as soon as reasonably possible on termination of the contract, the Engineer shall issue a certificate for the value of work done less payments

received upto the date of the issue of certificates, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be treated as debt payable to the Employer and can be recovered from any amount due or may become due to the contractor.

In the case of termination, works that are pending for the proper completion of the project, shall be carried out by the Employer either by themselves or through any other agency. Any additional expenditure over the value finalised in the contract for any component or for the whole project, incurred by the Employer by the Employer due to such termination, shall become recoverable from the contractor/firm whose contract stands terminated, from the money due or may become due to him/them. All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of Contractor's default

42. Plant etc., not to be removed

The plant, tools and materials provided by the contractor/firm shall, from the time they are brought to the site of the works, during the construction and until the satisfactory completion of the contract, shall become and continue to be the property intended for the proper fulfillment of the contract and the contractor/firm shall not remove the same or part thereof without the consent of the Engineer in charge in writing.

43. Contractor not to occupy Land etc

In no case shall the contractor/firm continue to use or occupy or allow to be used or occupied any land or property either for the deposit of materials or plant or for any purpose whatever, after written notice from the Engineer in charge served on the contractor/ firm to the effect requiring the contractor/firm to remove or cause to be removed all such materials from any such land or property as aforesaid and to give vacant possession of such land or property to the Engineer in charge. All such notices shall be served through post office or other modes of delivery to the contractor/firm at his/their usual or last known place of business, It is enough for the Engineer in charge to send the notice through any mode of delivery as he may prefer and implement this clause irrespective of the receipt of the notice by the contractor/firm. Should any materials or plant remain upon any such property or land or should any such land or property continue to be occupied or be used after such notice for any purpose whatsoever as aforesaid, then and in every such case and as often as the same shall happen, the contractor/firm shall forfeit and on demand pay to the Employer the charges fixed by the Engineer in charge as and for liquidated and ascertained damages for each and every day during which the said lands or property are so used and occupied as aforesaid from the time of such notice shall have been served.

44.Power Supply

The power supply connection from the TNEB has to be obtained by the contractor himself and the charges thereon shall be borne by the contractor. However, necessary vouchers in original for the payment made to the TNEB shall be produced to the Employer by the contractor which will be reimbursed by the Employer.

45.Completion and Delivery of the Works

The completion and delivery of the works shall be deemed to be full, complete and sufficient only when the Engineer in charge accepts the same and issues a certificate in writing viz. " Certificate of Completion" under the hand of the Engineer in charge to the effect that all the works contracted for and directed to be executed have been completed and are in a sound, water tight, workmanlike and complete and usable condition and the contractor has in the opinion of the Engineer in charge reasonably fulfilled and completed his contract and undertaking except so far as it relates to the maintenance of the works as hereinafter provided. Provided always and notwithstanding anything contained in the contract, it shall be lawful for the Employer to undertaker and execute either departmentally or through other parties at any period during the continuance of this contract, any kind of work, matter or thing whatsoever, which they mat consider necessary or proper to be performed and executed for the purpose of any in connection with any or all of the works under this contract and that without in any way relieving the contractor/firm from any of his/their liabilities and responsibilities under this contract or in any way violating or voiding this contract.

46.Final Certificate

When the works covered under this contract are completed in all respects, the contractor / firm shall submit a request to the Engineer in charge to make a final measurement of the works and take over the whole of the works on behalf of the Employer and issue a final certificate to enable him/them to submit a final bill for payment. The Engineer in charge shall thereupon, unless he records reasons in writing to the contrary, make a final measurement of the works and take them over on behalf of the Employer and sign a certificate purporting to be a last certificate. Nothing in this clause or in the agreement shall prohibit the Employer taking over and using any portion of the works which may be completed prior to the completion of the whole works of this contract.

47.Completion Certificate

The Contractor shall request the Engineer to issue a certificate of Completion of the Works and the Engineer shall issue certificate of completion after satisfactory completion of the works in all respects

48. Taking Over

The Employer shall takeover the Site with the works within thirty days after satisfactory completion of the maintenance of the entire project for the stipulated period as contemplated in this contract.

49. Performance Guarantee

The period of guarantee for the entire works shall be 24 months from the date of completion and commissioning of the project to the satisfaction of the Engineer incharge of the work. This will include the maintenance of the entire project by the firm/contractor for a period of 12 months. If defects are noticed during the guarantee period, the firm/contractor shall rectify/replace wherever necessary at its/his own cost within 30 days of such intimation. If the contractor/firm fails to carry out rectification within the stipulated time, the rectification works shall be carried out by the Employer at the risk and cost of the contractor/firm and contractor/firm will become ineligible for the payment of the retention amount for the said purpose.

Contractor

Sd/-
Superintending Engineer, TWAD,

50. Maintenance of the project

The contractor / firm shall successfully maintain the project for the stipulated period from the successful commissioning of the works in this project. **During the period of maintenance, all costs towards Onsite Service and Maintenance of all hardware and software including UPDATE OF SOFTWARES but not limited to LCPs communication equipments, Field instruments, Computers, Printers etc., (complete system) including cost of spares, repair charges, transportation, labour charges complete for five years from the date of commissioning and renewals shall be paid as per BoQ. <u>The electrical energy charges payable to the TNEB during the maintenance period shall be borne by the Employer.</u>**

51. Operating and Maintenance Manual

"As built" drawings and operating and maintenance manuals shall be supplied by the contractor/firm at the time of handing over the completed works at his/their cost

52. Work on Private Property

The contractor/firm shall not commence any work in or upon, under, across of through any land, house building, shed, yard, area, roadway, ground, garden or any other place being private property until authorised in writing by the Engineer in charge to do so.

53. Protection

It will be the responsibility of the contractor to take adequate precautions and protect the adjoining sites against structural, decorative and other damages. The contractor shall be responsible for the safety of the public properties wherever the works are executed. Whenever damages are caused to the adjoining structures, roads, bridges etc due to the execution of this contract, it will be the responsibility of the contractor to restore them to their original level at his cost.

54. Accident or Injury to Workmen

The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto

55. Risk Insurance

The firm/Contractor shall provide risk insurance at their/his cost against loss or damages to the construction to cover from the start date to the end of the Defects Liability Period, for the following events

- Loss of or damage to the Works, Plant and Materials
- Loss of or damage to Equipment
- Loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract and
- Personal injury or death

Contractor

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Superintending Engineer, TWAD,

Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred. The contractor will not be eligible for any payment on this account.

If the Contractor does not provide any of the policies and certificates required, the Employer shall effect the insurance which the Contractor should have provided land recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due

Alterations to the terms of an insurance shall not be made without the approval of the Engineer.

56. Care and Risk

From the date of commencement to the date of completion of the work and during the period of maintenance, the contractor shall take full responsibility and care thereof for the safety of the installation connected with the works. Any damage or loss are to be made good at the risk and cost of the contractor and shall ensure conformity in every respect with the requirements of the contract. The contractor shall be liable for any damage to the works occasioned by him in the course of any operation carried out by him for the purpose of completing any outstanding work and the damage so occurred shall be rectified at the cost of the contractor.

57. Safety Provisions

The Contractor shall be responsible for the safety of all activities on the Site.

1) Suitable scaffolds shall be provided for workers for all that cannot safely be done from the ground or from solid construction, except such short period work, as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination no steeper than 1\4 to 1 (1\4 horizontal to 1 vertical). IS code for scaffolding and ladders I.S 3696 Part -I and Part II and its latest revisions is to be followed.

2) Scaffolding or staging more than 3.25 meters above the ground or floor swung or suspended from an overhead support or erection with stationary support, shall have guard rail properly attached bolted, braced and otherwise secured atleast 1 metre high above the floor or platform of such scaffolding of staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or the structure.

3) Working platform, gangways and stairways shall be so constructed that they do not sag unduly or unequally, and if height of a platform or gangways or stairway is more than 3.25 metres above ground level, it shall be closely boarded, having adequate width and be suitably fenced, as described in 2 above. Every opening in floor of a building or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing with a minimum height of 1 meter. Safe means of access shall be provided to all working

platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 7 metres in length. Width between side rails in a rung ladder shall in no case be less than 30 cm, for ladders, this width shall be increased by atleast 6mm for each additional 30cm length. Uniform steps spacing shall not exceed 30cm.

4) Adequate precautions shall be taken to prevent danger from electrical equipment. No material on any of the sites shall be so stocked or placed as to cause danger or inconvenience to any person or to the public. The Contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defence of every suit, action or proceedings at law that may be brought by any person for injury sustaining, owing to neglect of the above precautions and to any such suit, action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

5) All necessary personal safety equipment as considered adequate by the Engineer shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned

    a) Workers employed on mixing asphalt materials, cement and lime mortars/ concrete shall be provided with protective footwear, hand gloves and goggles.
    b) Those engaged in handling any materials, which is injurious to eyes, shall be provided with protective googles.
    c) Stonebreakers shall be provided with protective goggles and protective clothing.
    d) When workers are employed in sewers and manholes, which are in use, the Contractor shall ensure that manhole covers are opened and manholes are ventilated atleast for an hour before workers are allowed to get into them. Manholes so opened shall be cordoned-off with suitable railing and warning signals or boards provided to prevent accident to public.
    e) The Contractor shall not employ men below the age of 15 and women on the work of painting with products containing lead in any form. Whenever men above the age of 18 are employed on the work of lead painting the following precautions shall be taken:

        i. No paint containing lead or lead products shall be used except in the form of paste of ready-made paint.
        ii. Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scraped.
        iii. Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of works.

6) When the work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps shall be taken for prompt rescue of any person in danger and adequate provisions shall be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

Contractor

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Superintending Engineer, TWAD,

7) Use of hoisting machines and tacks including their attachments, anchorage and supports shall conform to the following:

a) i) These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good working order.

ii) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects

b)Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in-charge of an hoisting machine, including any scaffold winch or giving signals to operator.

c) In case of every hoisting machine and of every chain ring hook, shackle, swivel and pulley block used in hoisting machine or lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with safe working load. In case of hoisting machine having a variable safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.

d) In case of departmental machine, safe working load shall be notified by the Engineer. As regards Contractor's machine, the Contractor shall notify safe working load of each machine to the Engineer whenever he brings to the site of work and he shall get it verified by the Engineer.

8) Motors, gearing, transmission, electrical wiring and other dangerous parts or hoisting appliance shall be provided with such means so as to reduce to minimum risk and accidental descending of load; adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energized, insulating mats, wearing apparel such as gloves, sleeves and boots, as may be necessary shall be provided. Workers shall not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.

9) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold ladder or equipment shall be altered or removed, while it is in use. Adequate washing facilities shall be provided at or near place of work.

10) The safety provision shall be brought to the notice of all concerned by displaying on a notice board at a prominent place at the work spot, persons responsible for ensuring compliance with the safety provision shall be named therein by the Contractor.

11) To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Engineer or his representative and the inspecting Officer.

Contractor

Sd/-
Superintending Engineer, TWAD,

12) The Contractor shall obtain prior permission of the competent authority such as Chief of Fire services for the site, manner and method of storing explosives near the site of work. All handling of explosives including storage, transport shall be carried out under the rules approved by the "Explosive Department of the Government".

13) The Contractor shall at his own cost provide and maintain at the sites of works, standard first aid box as directed and approved by the Engineer, for the use of his own as well as the Employer's staff on site.

14) Notwithstanding the above provision 1 to 15 Contractor is not exempted from the operation of any other Act or rules in force relating to safety provisions.

58. Provision of Health and Sanitary Arrangements

The contractor/firm, shall provide at his/their own expenses, first aid appliances and medicines including an adequate supply of sterilized dressing and sterilized cotton wool kept in good order under the charge of a responsible person who shall be readily available during working hours.

Water of good quality fit for drinking purposes shall be provided for the work people on a scale of not less than 15 litres per head per day. Each water supply storage shall be at a distance of not less than 15 metres from any latrine, drain or other source of pollution. Where water has to be drawn from an existing well which is within such proximity of latrine, drain or other sources of pollution, the well shall be properly chlorinated before water is drawn from it for drinking.

Adequate washing and bathing places shall be provided separately for men and women and such places shall be kept in clean and drained condition. Latrines and urinals shall be provided within the precincts of work place and the accommodation separately for each of them shall be at the rate of 2 seats upto 50 persons, 3 seats above 50 persons but not exceeding 100 persons, and 3 seats for every additional 100 persons. The contractor/firm shall employ adequate number of scavengers and conservancy staff to maintain the latrines and urinals in a clean condition.

Two sheds one for meals and the other for rest shall be provided separately for the use of men and women workers and properly maintained.

All the above amenities shall be provided at the contractor's/firm's own expenses besides providing sheds for his/their workmen.

59. Patent Rights

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Contractor's Equipment, material or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto

60. Royalties

Except where otherwise stated, the Contractor shall pay all seignorage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

61. Old Curiosities

All old curiosities, relics, coins, minerals and any other item of archeological importance found at the site shall be the property of the Government and shall be handed over to the Engineer in charge for depositing to the Government exchequer. Should any structure be uncovered, the instruction of the Engineer in charge shall be provided before demolition or removal of the structure.

62. Contractor Dying, becoming Insolvent or Insane

In the event of death or insanity of the contractor, the contract may be terminated by notice in writing, pasted at the site and advertised in the issue of the local newspaper. All acceptable works shall thereafter, be paid at appropriate rates after recovering all the contractor's dues to Employer, to the persons entitled to receive and give a discharge for such payments.

In the contractor is imprisoned because insolvent compound with his creditors has a receiving order made against him or carriers on business under receiver for the benefit of the creditors of any of them or being a corporation goes into liquidation or commences to be wound up not being a voluntary winding up for the purpose only of amalgamation or reconstruction, the employer shall be at liberty.

a) To give such liquidator, receiver or other persons in whom the contract may become vested the option of carrying out the contract or a portion there of to be determined by the employer, subject to his providing an appropriate guarantee for the performance of such contractor.
b) To terminate the contract forthwith by notice in writing to the contractor the liquidator, the receiver or person in whom the contract may become vested and take further actions as provided in the clause pertaining to default by contractor, treating as if this termination is ordered under the respective clause.

63. Force Majeure

The works taken by the contractors under the contract shall be at the contractor's risk until the work is taken over by the Executive Engineer. The contractor shall arrange his own insurance against fire, flood, volcanic eruption, earth quake and other convulsions of nature and all other natural calamities, risks arising out of acts of God, Acts of Terrorism, Civil disturbances, Riots during such period and that the TWAD Board / Government shall not be liable for any loss or damages occasioned by or arising out of any acts of God.

Provided however that the contractor shall not be liable for all or any loss or damages occasioned by or arising out of acts of foreign enemies, invasion, hostilities or war like operations (before or after declaration of war) rebellion military or usurped power.

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64. Payment out of Public Funds

The payments to the contractor/firm shall be made out of the funds under the control of the Employer in their public capacity and no member or officer of the Employer shall be personally responsible to the contractor/firm.

Contractor

Sd/-
Superintending Engineer, TWAD,

65. Bribery and Collusion

In the event of the contractor offering or giving any official of the employer, any gift or consideration of any kind as an inducement or regard for doing, or for bearing to do, any action in relation to obtaining or in the execution of the contract or any other contract with the employer, or for showing favour to any person in relation to the contract or any other contract with the employer, or if any of the such acts shall have been done by any person employed by the contractor or acting on his behalf, either with the knowledge of the contractor or not which are all grounds for the employer to terminate the contract awarded to the contractor. Similarly if the contractor colludes with another contractor or number of contractors whereby an agreed quotation or estimate shall be offered as a bid, that will also form the basis for the employer to terminate the contract.

66. Technical audit

It is a term of this contract that department shall have the right to carry out post payment audit and technical Audit by the Engineers of Technical audit cell (or by an approved consultant of repute). The Technical audit officer shall have the powers to inspect the work or supply running account bill, final bill and other vouchers, measurement books, test reports and other documents either during progress of work or after completion of the same and order recoveries from the contractor for recorded reasons even though the contractor might have been paid earlier. These recoveries are enforceable against the contractor from any amount due to him, from performance security or withheld amounts or any amounts due to the contractor or may become due to him from the department in any work or supply.

67. Settlement of dispute

a. Dispute Redressal Committee

In order to ensure a dispute Redressal mechanism, a Committee headed by the Managing Director / Joint Managing Director and consisting of Engineering Director, TWAD Board and Engineereing Director, CMWSS Board as Member, will comprise the " Dispute Redressal Committee" for each package in order to resolve any disputes between the Employer / Engineer - incharge concerned and the contractor

b. Jurisdiction of Court

In the event of non settlement of any dispute by the Dispute Redressal Committee arising between the parties hereto in respect of any matter comprised in the contract, the same shall be settled by a competent court having jurisdiction over the place where the contract is awarded and agreement is concluded and by no other court.

68. Reservation of Right

The Employer reserves the right to accept or reject any or all the bids and to annul the entire process of bidding at any time. Under such circumstances, the Employer will neither be under any obligation to inform the bidders of the grounds for the action of the Employer nor the Employer will be responsible for any liability incurred by the bidder on this account.

Contractor

Sd/-
Superintending Engineer, TWAD,

VIII. SPECIAL CONDITIONS OF CONTRACT

Section-1 – Supply, Installation period of the Contract.

Section-2 – Operation & Maintenance by the Contractor.

In Section I of the Works, the Contractor shall, except as stated below, be responsible for the provision of all electricity power, water, gas, consumables, chemicals and other services he may require. In Section II of the Works, the **Contractors shall be responsible for the provision of all costs towards Onsite Service and Maintenance of all hardware and software including UPDATE OF SOFTWARES but not limited to LCPs communication equipments, Field instruments, Computers, Printers etc., (complete system) including cost of spares, repair charges, transportation, labour charges complete up to Guarantee period from the date of commissioning and renewals** not listed in Schedule of Technical Particulars VIII but actually be required for the Works. **The electricity power cost as related to the normal operation and maintenance at Section II of the Works shall be borne by the Employer**. **During the erection period EB power has to be borne by the bidder only.** However, the electricity power being used by the Contractor in Section II of the Works to carry out any outstanding pre-commissioning tests, final commissioning tests or to repeat these tests as a result of failure during the 'Test on Completion for Section I of the Works', shall be borne by the Contractor. The cost **towards Onsite Service and Maintenance of all hardware and software including UPDATE OF SOFTWARES but not limited to LCPs communication equipments, Field instruments, Computers, Printers etc., (complete system) including cost of spares, repair charges, transportation, labour charges complete up to Guarantee period from the date of commissioning and renewals** shall be borne by the Contractor, as mentioned above, except when such items are explicitly entered in the Schedule of Prices of the Contract such that the Contractor shall be entitled to obtain reimbursement after they are provided by the Contractor.

Unless otherwise stated in the Conditions of Particular Applications, at each of the two Sections of the Works, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report of each of the two Sections shall cover the period up to the end of the first calendar month following the commencement date of that Section. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Contractor

Sd/-
Superintending Engineer, TWAD,

Reporting shall continue until the Contractor has completed all works in each of the two Sections of the Works, which are known to be minor outstanding at the completion dates stated in each of the Taking-Over Certificate for each of the two Sections of the Works.

Each report in Section II of the Works shall include:

a) Photographs showing status of each equipment and plant at all sites of the Works
b) Logs of all alarms, events, trends that can be obtained in the SCADA System to show the operational status of the Works
c) Logs to show the maintenance record to all equipments
d) Logs to show the replacements of damage and defective components of each equipment or the whole equipment of a Plant
e) Logs to show the attendance records of all the operation and Maintenance staff and
f) Comparisons between the recommendations from the Operation and Maintenance Manual with the actual maintenance, defective parts replacement records as described in (c) and (d) above.

Contractor's Operations on Site:

Upon the issue of the Taking-Over Certificate for Section I of the Works, the Contractor will be handed over the whole Works by the Employer such that the whole Work will be under possession by the Contractor. The Contractor shall be responsible for all works that are required for possession of the whole Works. Upon the issue of the Taking-Over Certificate for Section II of the Works, the Contractor may retain on Site, during the Defects Notification Period for Section II of the Works, as that are required for the Contractor to fulfill the works under the Contract.

General Design &Obligations :

The requirements to As-Built Documents to Section I and Section II of the Works are described in Part A – General Specification of the Contract. The requirements to Operation and Maintenance Manuals to Section I and Section II of the Works are described in Part A – General Specification of the Contract.

The Contractor shall allocate his operation and maintenance staff at the Works everyday to conduct operation and maintenance work to the Works, in multiple shifts, with details as specified in the Employer's Requirement Facilities for Staff and Labour Save insofar as the Contractor may otherwise provide, the Contractor shall provide and maintain such accommodation and amenities as he may consider necessary for all his staff and labour, employed for the purposes of or in connection with the Contract, including all fencing, water supply (both for drinking and other purposes), electricity supply, sanitation, cookhouses, fire prevention and firefighting equipments, cookers, refrigerators, furniture and other equipments in connection with such accommodation or amenities. On completion of Section I of the Contract, unless otherwise agreed with the Employer, the temporary camps/housing provided by the Contractor shall be removed and the site reinstated to its original condition, all to the approval of the Engineer.

LETTER OF NEGOTIATION

In pursuance of negotiation with the Executive Engineer/Superintending Engineer/Superintending Engineer of Division/Circle/Region on

I/We agree to reduce the percentage as follows.

Signature of Contractor

Contractor

Sd/-
Superintending Engineer, TWAD,

TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

Forwarding Slip to The Lump sum Agreement No.

1. Name of Work :

Estimate Amount :

Sanctioned in Original Estimate No. :

Revised Estimate No. :

2. Name of Contractor and Address :

3. Original or Supplemental :

4. If Supplemental, Original Agreement No. :

5. Approximate value of work :
to be done under this Agreement :

6. If this is Supplemental, approximate value of works to be done under Original Agreement :

7. If bids have been called for, is the lowest tender accepted? :
If not reasons to be recorded

8. Has the contractor; signed the divisional copy of TNBP and Its addenda volume brought upto date. :

9. Is data furnished for all items of works noted in the Schedule :

Contractor

Sd/-
Superintending Engineer, TWAD,

10. Are the rates in Agreement within the estimate rates or schedule of rates whichever is less and the Lump sum provision sufficient or likely to be exceeded. :

II. Additional Information

A. Original Agreement

1. Original Agreement amount of tender excess and percentage over the estimate rate. :

2. If concessional rate of EMD & SD have been allowed ref. to sanction thereof :

B. Supplemental Agreement

1. Whether the approval of the competent authority has been obtained for the rates as required as per B.P.Ms.No.27/CMW/ dated 5.2.2002 :

2. If entrusted without tenders whether sanction is necessary with reference to total value of work covered by the supplemental agreement so far accepted. :

Contractor

Sd/-
Superintending Engineer, TWAD,

TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

Form of Agreement (Lump sum)
Articles of Agreement made this----------

Day of ----------
between Thiru----------

---

hereinafter referred to as the contractor which expression shall where the context so admits include his heirs, executors, administrators and legal representatives of the one part and the Superintending Engineer, Tamil Nadu Water Supply and Drainage Board (hereinafter called the Employer) which expression shall where the context so admits include its successors in office and assigns) of the other part. Whereas the contractor delivered to the Employer the bid which was opened on ----------
---
whereby the contractor offered and undertook to carryout the works specified under this contract and allied work, i.e. (name of work) ----------
---

In the State of Tamil Nadu in India, and provide the works, materials matters and things described or mentioned in these presents at the prices set forth in the schedule annexed to such bid and the contractor also undertook to do all extra and varied works which might be ordered as part of the contract on the terms provided for in the conditions and specifications hereto annexed and the Employer accepted such tender in pursuance where of the parties hereto have entered into this contract.

And whereas the contractor in accordance with the terms of the said Bid has deposited in the Office of the ----------Engineer, TWAD,----------as performance security for the due and faithful performance by the contractor of this contract, the sum of Rs.----------(Rupees----------)

And whereas the contractor fully understands that on receipt of communication of acceptance of bid from the accepting authority, there emerges a valid contract between the contractor and the Employer represented by the Officer accepting the agreement and the bid documents, i.e. invitation for bids, letter of application, bill of quantities and other schedules, general conditions of the contract, technical specifications of the bid, negotiation letter, communications of acceptance of bid, shall constitute the contract for this purpose and be the foundation off rights of both the parties, as defined in clause 8.1 of ""Bid Documents "Now hereby agreed that in consideration of payment of the said sum of Rs. (Rupees)
or such other sum as may be arrived at under the clause of the General conditions of the contract relating to payment by final measurement at unit prices, the contractor shall and well within the time specified in his bid thoroughly and efficiently and in a good workman like manner perform, provide, execute and do all the works, materials matters of things incidental to or necessary for the entire completion of the works specified under this contract and necessary works including all works shown in the drawings hereinafter referred to or described or set forth the said specifications and schedule hereto annexed and in accordance with such further drawings and instructions as the Engineer of the Board or other Engineer duly authorised in that behalf (therein after) and in the annexed

Contractor

Sd/-
Superintending Engineer, TWAD,

documents referred to as the Engineer) shall at any time in accordance with the said schedule (Bill of Quantities) and specifications provide and give together, with any alterations in the works or additions thereto, in the time and manner in such schedule (Bill of Quantities) and specifications stipulated to the entire satisfaction of the Engineer, the Employer for themselves and their successors convenient and agree with the Contractor that during the progress of the works and on the completion of contract to the satisfaction of the Engineer, the Employer shall and will from time to time on receiving the certificates in writing of the Engineer pay to the contractor according to such certificates and the terms of this contract the price or sum mentioned in such certificates as due to the contractor under the terms of this contract subject nevertheless to deductions or additions thereto or therefrom which may be lawfully made under terms of his contract. It is hereby mutually agreed and declared as follows.

a) All certificates or notice or orders for items or for extra varied or altered works which are to be the subject of an extra or varied or altered works charge shall be in writing whether so described in the contract or not and unless in writing shall not be valid or binding or be of any effect whatsoever.

b) The term contract include these presents and the invitation for bid, bid documents, bill of quantities and other schedules, general conditions and specifications hereto annexed and the plans drawings herein and hereafter refered to.

c) If the contractor claims that the decisions or the instructions of the Employer are unjustified and that accordingly, he is entitled to extra payments on account thereof he shall forthwith notify this to the Employer to record his decisions and reasons therefor in writing and shall within two weeks state his claims in writing to the Employer thereafter. The Employer shall thereafter within four weeks of the receipt of the claim, reply to the points raised in the claim. Unless resolved by negotiation or discussions immediate thereafter, within further four weeks the question of liability for such payment will be treated as a dispute.

d) In the contract whenever, there is as discretion or exercise of will, by the Employer during the progress of the work, the mode or manner of the exercise of discretion shall not be a matter for dispute.

e) The decision of the Employer shall be final conclusive and binding on all, Parties to the Contract upon all questions relating to the meaning of specifications, designs, drawings and instructions, and as to the quality of workmanship or material used on the work or any matter arising out of or relating to the specifications, designs and drawings and instructions concerning the works or the erection of or failure to execute the same arising during the course of works. The above shall not be the subject matter of dispute and in no case shall the work be stopped consequent on such a dispute arising and the work shall also be carried out by the contractor strictly in accordance with the instructions of the Employer.

g) In case any question, difference or dispute shall arise on ,matters other than clauses (d) and (e) above and except any of the “excluded matters” mentioned in bid documents touching the construction of any clause herein contained on the rights, duties and liabilities of the parties hereto or any other way touching or arising out of these presents, the same shall.

h)

Contractor

Sd/-
Superintending Engineer, TWAD,

Settlement of dispute

Dispute Redressal Committee

In order to ensure a dispute Redressal mechanism, a Committee headed by the Managing Director ,Joint Managing Director and consisting of Engineering Director, TWAD Board and Engineering Director, CMWSS Board as Member, will comprise the " Dispute Redressal Committee" for each package in order to resolve any disputes between the Employer / Engineer - incharge concerned and the contractor

i) In the event of any dispute arising between parties here to in respect of any of the matter comprised in this contract, the same shall be settled by a competent court having jurisdiction over the place where contract is awarded and agreement is concluded and by no other court.

ii) Provided always the contractor shall not except with the consent in writing of the Engineer in any way,. delay carrying out works in any such matter, question or dispute being referred to court but shall proceed with the works with all the diligence and shall until the decision of the Employer and no award of Competent Civil Court shall relieve the contractor of his obligations to adhere strictly to the instructions of the Engineer with regard to the actual carrying out of the works.

g) Time shall be considered as essence of the contract and the contractor hereby agree to commence the work immediately after taking over of site or signing the agreement whichever happens earlier, complete the work within _____ months and to show progress at the stipulated milestone.

In witness where of the contractor and the Employer on behalf of the Board have caused their common seal to be affixed the day and year first above written Signed, sealed and delivered by the said.

In the presence of
Signature of Contractor
Name and Seal.

Signature, Name and
Designation of Witness.
Signed by on behalf of
TWAD Board.

Signed, Name and
Designation of Witness

SUPERINTENDING ENGINEER
TWAD BOARD

Contractor

Sd/-
Superintending Engineer, TWAD,

INDEMENITY BOND

This deed of indemnity bond executed at (place) on this Day of (month) year by and between Thiru/Tmt. (Name) widow/Wife/Son/Daughter of Thiru / Tmt residing at (Full Address) (hereinafter called "Contractor" which expression unless excluded by or repugnant to the context include his/her heirs, executors administrators and legal representatives) to and in favour of the TWAD Board (hereinafter called" the Engineer, which expression shall unless excluded by or repugnant to the context include its successor and assigns) represented by the Superintending Engineer of Circle/Executive Engineer of division. Assistant Executive Engineer of sub division(Place)shown as follows.

2. Whereas the contractor has submitted the bid for (description of work) at (place of work or supply) and such bid has been accepted subject to the relevant conditions to contract appended to Tamil Nadu Building Practice and other conditions issued along with bid documents.

3. And where as in pursuance of the terms of contract, that a sum equal to 21/2% of the total value of work done have been retained with the Employer for a period of two years reckoned from the date of completion of the work in order to enable the departmental officers to watch the effect of all seasons on the work and the structural stability of the work executed by the contractor.

4. And whereas it was decided to refund the said sum equal to 21/2% of the total value of the work done retained with the Employer on the expiry of two years period reckoned from the date of completion of work provided that the contractor execute an indemnity bond for a period of three years indemnifying the Board against any loss or expenditure incurred to rectify any defect noticed due to the faulty workmanship by the contractor or substandard material used by the contractor during the period of three years.

5. Now this deed of indemnity witness that in consideration of the contract entrusted to the contract or by the Employer, the contractor has agreed to the following terms and conditions and executed this indemnity bond in conformation of all and undertakes to comply with the terms referred to infra.

Contractor

Sd/-
Superintending Engineer, TWAD,

6. The contractor both hereby indemnify the Employer against any loss or damage that may be caused to the Employer in respect of rectification of any defect noticed due to the faulty workmanship by the contractor, or substandard material so used by other contractor in the execution of work entrusted to the contractor during the period of three years i.e. from up to (dates to be specified)

7. It is hereby confirmed that in all other respects, the agreement conditions will be binding between the parties.

In witness whereof Thiru / Tmt / Miss

Contractor has signed this deed on this day of month

year.

Witness:

Contractor

Sd/-
Superintending Engineer, TWAD,

PERFORMANCE BANK GUARANTEE (UNCONDITIONAL)

To

The Executive Engineer, TWAD BOARD, RWS Division, Dindigul

—---------- (Name of Employer)

----------(Address of Employer)

WHEREAS————————————————(name and address of contractor) (hereinafter called" the contractor" has undertaken, in pursuance of contract No.---------- ---------- Dated ———————— to execute---------- ---------- (name of contract and brief description of works) hereinafter called " the contract*"

AND WHEREAS it has been stipulated by you in the said contract that the contractor shall furnish you with a Bank Guarantee by a recognised bank for the sum specified therein, as security for compliance with his obligations in accordance with the contract.

AND WHEREAS the contractor has requested us to give the Bank Guarantee

AND WHEREAS we have agreed to give the contractor such a Bank Guarantee unconditionally and irrevocably to guarantee as primary obligator and not as mere surety, all the payments to the ----------

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the contractor, upto a total of ———————————— (amount of Guarantee) ————————————————————————— (amount in words such sum being payable in the types and proportion of currencies in which the contract price is payable, and we undertake to pay you unconditionally and irrevocably upon your first written demand and without cavil or argument, any sum or Sums within the limit of ————————————(amount of Guarantee) as aforesaid without you needing to prove or to show grounds or reasons for your demand for the sum specified therein.

Contractor

Sd/-
Superintending Engineer, TWAD,

We hereby waive the necessity of your demanding the said debt from the contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the contractor or of the Works to be performed thereunder or of any of the contract documents which may be made between you and the contractor shall in any way release as from the liability under this guarantee and we hereby waive notice of any such change, addition or modification.

The Bank Guarantee is drawn at ——————————branch of—————— -———- bank in -————————-—-Town in Tamil Nadu only.

This guarantee shall be valid until 28 days from the date of expiry of the defects liability period. '

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank ——----------

Address ——————————————

————————————————

Date ——————————

Contractor

Sd/-
Superintending Engineer, TWAD,

BID SECURITY (BANK GUARANTEE)

WHEREAS, _____ *[name of Bidder]* (hereinafter called "the Bidder") has submitted his Bid dated _____ *[date]* for the construction of _____*[name of Contract]* (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that We _____ *[name of bank]* of _____ having our registered office at _____ (hereinafter called "the Bank") are bound unto _____*[name of Employer]* (hereinafter called "the Employer") in the sum of _____[1] for which payment well and truly to be made to the said Employer the Bank binds itself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____ **2021 .**

THE CONDITIONS of this obligation are:

1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;
or
2) If the Bidder having been notified of the acceptance of his bid by the Employer during the period of Bid validity:

(a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or
(b) fails or refuses to furnish the Performance Security, in accordance with the Instruction to Bidders; or
(c) does not accept the correction of the Bid Price pursuant to Clause 28.2;

we undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or any of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date _____[2] days after the deadline for submission of Bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

DATE _____ SIGNATURE OF THE BANK

WITNESS _____ SEAL _____

[signature, name, and address]
_____

Contractor

Sd/-
Superintending Engineer, TWAD,

1 The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 16.1 of the Instructions to Bidders.

2 45 days after the end of the validity period of the Bid.

Contractor

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Superintending Engineer, TWAD,

BILL OF QUANTITIES

(To be furnished separately as Price Bid)

General

The Bill of Quantities shall contain items for the construction, installation, testing, commissioning and maintenance of the Works to be carried out by the Contractor

The Bill of Quantities will be used to calculate the Contract Price. The contractor shall be paid for the quantum of work done at the rate quoted for each item in the Bill of Quantities.

Where there is a discrepancy between the rates in words and figures, the lesser of the two will only be taken in to consideration.

Where there is a discrepancy between the unit rate and line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

Where there is an arithmetical discrepancy in the page total as well as grand total, the corrected total by the Employer will govern

The rates in the BOQ shall be for carrying out the work in conformity to the BIS, TNBP and Technical Specifications and other Terms and Conditions set out in the Bid Document

All pages in the BOQ should be signed without omission. All corrections/over writing should be properly attested by the Bidder.

Change in the Quantities

If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item/items, the rates as in the agreement for the relevant items shall be paid.

Name of Work: Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost (Period of completion 6 months)

Item No.	Description of work	Probable quantity Figures	TNBP No. Other specification	Units in	Rates in		Amount in figures
					Figures	Words	
1	2	3	4	5	6	7	8
Vide separate sheets attached.							

Contractor

Sd/-
Superintending Engineer, TWAD,

TECHNICAL SPECIFICATIONS

INDEX

Contractor

Sd/-
Superintending Engineer, TWAD,

PROPOSED SYSTEM

It is proposed to implement a system with the following parameters to be monitored at the Pump house, Booster stations and OHTs / Reservoirs, group sumps, Master Service Reservoir, Master Balancing Reservoir and at the Major tapping points or Branch point and the real time data made available. Master Control Room (MCR) shall be retrievable in Division, Circle, Regional Superintending Engineer offices and Head office.

1. Level in the collection well or sumps.
2. Pressure at the discharge line.
3. Flow at the discharge line of pump houses.
4. Energy monitoring of each pump outlet.
5. Control valves actuator in the tender specified locations.
6. Flow at the inlet of Master Service Reservoirs/Sumps.
7. Level at each Sumps and at OHTs/reservoirs.
8. Control valves at the Outlet line of the OHT's/Reservoirs
9. Data recording at the Pump houses, Booster station group sumps, MSR, MBR, Major tapping points and at Reservoir.
10. Data transfer from RTU/PLC to SCADA monitoring Master Control Room (MCR) and retrievable in Head office, Division, Circle Regional Superintending Engineer offices.
11. Centralized data Storage and monitoring at the Master Control Room of the project.

Level monitoring in the collection wells

The level in the collection wells are an important parameter in the water distribution system, which needs to be monitored round the clock. This data is required to ensure the smooth functioning of the discharge pumps. The level in the collection well also determines the effective functioning of the pumps in the infiltration wells and also empowers the operator to decide on the number of infiltration pumps to be run to maintain the optimum level in the collection well.

A suitable level monitoring system is recommended depending on the depth and diameter of the Collection Well and also taking into consideration the turbulence created by the water inflow from the infiltration pumps.

Contractor

Sd/-
Superintending Engineer, TWAD,

The level transmitter should have a provision to continuously transfer the data to the local RTU/PLC for monitoring, recording and generation of alarms based on LOW and Low-Low level of the water in the collection well.

PLC/RTU should have facility to send SMS, when reaching the set points of low or very low levels through GPRS Modem. The data can trigger an alert though an SMS to the mobile phone of the Local JE/AE.

Pressure at the discharge line

The common discharge line carries water from the pump house to various reservoirs through pipelines over several kilometers.

The pressure in the common discharge line is to be monitored using suitable pressure transmitter with local display and should have a provision to continuously transfer the data to the PLC.

SCADA shall used for monitoring, recording and generation of alarms based on High and Low pressure levels of the water in the discharge line.

Pressure monitoring is required

- To Switch ON the Standby Pumps on Low Pressure.
- To Trip the Pumps on High Pressure.
- To ascertain any Leakage/Block in the delivery line.

If VFD is already available in the scheme, it can be connected to SCADA system by Ethernet connections/MODBUS/PROFIBUS/DEVICE NET. VFD should not be included in the scope of SCADA works.

SCADA system should have facility to print, Send SMS and transfer the alarm information to the triggers alarms, when reaching the set points of High and low pressure levels. The data can trigger an alert though mobile and the same can be viewed through the SMS to the mobile phone of the Local JE / AE through GPRS Connectivity.

Flow at the discharge line of pump houses and inlet of OHT's/Reservoirs

The Flow of water in the delivery line of each pump house and the Inlet Line of OHT/Reservoir is monitored using a suitable Flow measurement device taking into consideration on the accuracy and the diameter of the discharge pipeline.

A Full bore type electromagnetic Flow meter with a local digital display is recommended for the monitoring of the flow in the discharge line for the line Size above 250 MM & Woltman type flow meter for Line size below 250mm.

The flow-measuring device should have a provision to continuously transfer data to the local RTU/PLC for monitoring and recording of the water flow in the discharge line.

The flow rate data would help in arriving at the cost of production for every 1000Litres of water being pumped.

Energy Monitoring of each pump

Three different types of pumps of varying capacity functions at each pump houses such as

- Vertical turbine pumps
- Centrifugal Pumps
- Submersible pumps

The energy monitoring of each pump is utmost required to monitor the healthiness of each motor of the pump. A suitable Energy meter along with Current Transformers and Power transformers can monitor the following parameters on continuous basis

- Power factor
- Reactive Power
- Actual power
- Voltage
- Current
- Frequency

The data is fed into the RTU/PLC and based on the set points an alert is to be sent to the JE/AE through mobile and other on-line parameter shall be viewed using mobile SMS. Electrical safety by tripping the motors when the set levels are breached is incorporated in the electrical circuitry. Energy monitoring of parameters as stated above is necessary to prevent malfunctioning of the pump as it will lead to undesirable conditions.

Level at each Sumps and at OHT's/reservoirs.

The water level at the Reservoir/OHT is an important parameter in the water distribution system, which needs to be monitored round the clock.

A suitable level monitoring system is recommended depending on the depth and diameter of the OHT's / reservoirs and also taking into consideration that the turbulence created by the water inflow.

The level transmitter should have a provision to continuously transfer the data to the local RTU/PLC for monitoring, recording and generation of alarms based on LOW level.

PLC/RTU shall continuously monitors the various parameters and compares the set points of low or very low levels The data can trigger an alert though mobile and other on-line parameter shall be viewed through the SMS to the mobile phone of the Local JE / AE.

Installation of Control Valves at Pump houses & OHT's / Reservoirs

It is suggested to install a rising spindle type valve with electrical actuators of suitable size at the discharge line as specified in the tender document and at the inlet lines for the controlling operation, which upon given command from the RTU opens or close. New valves may be provided wherever needed, in place of defective existing valves. Valves at the major tapping points shall be retrofitted with valve actuators subject to availability of space, 3 phase power supply etc.

Data recording at the Pump houses, Booster Stations group sumps, MSR, MBR, Major tapping points and at OHTs / Reservoirs.

The RTU/PLC Unit is hard wired to all above instruments and data monitoring devices to record the data and display it graphically in a local touch screen display at the pump houses/booster stations and a viewing display at the Over head tanks. The detailed specification of the RTU / PLC unit is given separately.

The purpose of this unit is to collect and assimilate the data in a user-friendly format and display the trends on real time. A unit of international reputed make with sufficient data storage and data transfer facility to multiple storage points is to be selected.

Adequate RTU/ PLC handling capacity is envisaged considering the need to support Communication ports like serial RS 485, RS 232, Ethernet port and GSM cards for GSM and Ethernet connectivity, must be able to reprogram the external device connected to it and also support future add-ons cards, the memory and speed requirement.

RTU /PLC should be capable of the following

- Integrated Colour Graphic display with Touch/viewer screen and all specified memory units Built-in.
- Complete automation of local pumping station operations.
- Accurate recording of all events
- Effective alarm management for the personnel concerned
- Complete remote surveillance.

Data transfer from RTU/PLC to SCADA monitoring Master Control Room and retrievable in Head office, Division, Circle and Regional Superintending Engineer offices.

The data generated at the RTU / PLC in each head works and reservoirs and reservoirs shall be transmitted on continuous basis to the Master Control Room. The data from the RTU/ PLC shall be transmitted over wireless network using GSM/GPRS/ BROADBAND communication technology from the head works& booster stations and from the Over head tanks.

Every RTU/ PLC at the head works to be connected via an intelligent switch to GSM/GPRS/ BROADBAND (from any service provider available locally) and the RTU/PLC at the OHT's to be connected to the communication Modem.

The wireless communication shall enable seamless data transfer from each RTU/PLC to a centralized reception at the Master Control Room, wherein the data are stored in a suitable high-density storage data server. The Daily Performance Report is segregated and transferred to the respective Circle, Regional Superintending Engineer offices through suitable communication modem.

The communication technology services require a service provider who shall set up and maintain necessary transmission devices at each location such as head works, Booster station, MSR, MBR and OHTs. The transmission set up at each station shall include necessary equipments like Switches /Modem etc. for network Connectivity .

Network bandwidth should be sufficient enough to handle the required traffic. Max bandwidth required for the data transfer for the current setup as well as future expansions shall be considered while determining the necessary capabilities of the system. It is recommended to use adequate data transmission rate for a smooth and uninterrupted data transfer.

The communication network requires statutory requirements (licensing, structural design, lightening arrestor, aviation lamp etc) of telemetry tower and the same to be considered. The communication network should be sufficient enough to handle the required traffic.

The data transmission over the entire wireless network shall be secured and same shall be envisaged by setting up required equipments at each transmission/reception points.

Centralized data Storage and monitoring at Master Control Room of the project.

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The Master Control Room shall be equipped with the following:

- Data Base Server
- Operator Work Stations
- Ethernet Switch
- B/W Laser Printer
- Communication equipments and peripherals.

a. Data Base Server

The data from the remote terminal units shall be received through the communication system at the Master Control Room continuously from Head works/booster stations and OHT's respectively. The data received is stored in a High density Data server. The High-density data server shall not only save the data in the hard disk of the system but also have provision to take backup data, through other media such as tape disc, compact disc, DVD etc.

The server shall have necessary licensed software to enable the large volume data management.

b. Operator stations

The operator stations are PC's for monitoring purposes of the data received from the RTU'/PLC. Status, trends and other Information from all offices can be viewed at these stations.

All parameter settings can be monitored and modified at this station for all the RTU/PLC's at the head works.

All SCADA software's shall be licensed and are to be loaded into this station for enabling the above-mentioned operation.

All the operator stations shall be loaded with necessary licensed software like SCADA, Operating system, Antivirus, etc for its intended operation.

Data monitoring .

The data received at the Master Control Room from all the RTU's will be segregated and transferred to the respective Circle Regional Superintending Engineer offices with the real-time data and trends to the respective office.

The Master Control Room is equipped with a telemetry unit to receive the data over recommended communication. The Daily Performance Report shall be sent to Division, Circle, Regional Superintending Engineer office and Head Office.

SCOPE OF WORKS

The scope of the above-proposed system can be implemented as below.

Monitoring at the head works and data collection at Division and head offices:

Field instruments for Data access, such as flow meters, level meters, pressure transmitters, and energy meters are hardwired with the RTU's/ PLC housed in all the pump houses at Head works, Booster Stations and reservoirs in various places.

Sensing & Collection of process parameters such as Energy of the motors, water levels in collection wells, Pressure & Flow in the discharge line and transmitting the Daily Performance Report to the head office / Regional Superintending Engineer office /Circle office/Division office.

Wide Area Network and Transmission of data, using GSM/GPRS/ BROADBAND to enable data transfer from various head works and using recommended Communication from RTU/PLC to the Master Control Room is to be set up.

Storage of collected data and provide Management Information System in the form of informative screen displays and reports using SCADA package and install Servers Master Control Room, along with other components and peripherals.

Installation of Actuator Valves and providing supervisory control of the pumps at the head works

Rising spindle type valve with electrical actuators of suitable diameters, are to be installed at the discharge line of each pump and hardwired with the Remote Telemetry Units (RTU's /)PLC housed in all the pumping stations as specified in the tender locations installed at the inlet line of the Over Head Tanks and hardwired to the respective RTU's/PLC's.

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TECHNICAL SPECIFICATIONS FOR

INSTRUMENTATION AND SCADA EQUIPMENT

1. INSTRUMENTATION AND SCADA SYSTEM.

Description of work.

Furnish and install instrumentation and controls hereinafter specified to perform the intended function. Work shall include all necessary materials, equipment, labour and services.

In order to insure the inter changeability of parts, the maintenance of quality, the ease of communications between the various subsystems and the establishment of minimum standards of quality, all equipment manufacturers' standard offerings, shall be of the same product family of a single manufacturer. In order to issue this compatibility between all equipment, it shall be the responsibility of the Contractor to enforce this requirement with the equipments suppliers.

Equipment shall be fabricated assembled, installed and placed in proper operating condition in full conformity with these specifications, engineering data, instructions and recommendations of the equipment manufacturer as approved by the Tamil Nadu Water Supply and Drainage Board (TWAD).

The contractor shall engage a single system supplier, who shall provide all of the services equipment and appurtenances required to achieve a fully integrated and operational instrumentation and control system. To facilitate the Board's future operation and maintenance, products shall be of the same major instrumentation manufacturer.

1.2 Quality Assurance.

Eligibility criteria: The bidder should have satisfactorily completed atleast one project in Water Supply scheme involving PLC/RTU, SCADA for any Government/Semi Government.

The system supplies shall be required to demonstrate a minimum of 3 years recent experience in the design, manufacture and commissioning of instrumentation and control systems of comparable size type (Water Supply pipeline SCADA involving Pressure, Flow, Level and Energy parameters) and complexity (Hybrid communication involving GSM/ GPRS/ BROADBAND etc) to the proposed project. The system supplies shall have in house engineering programming, fabrication, and testing capability to expedite the project in its entirety. The supplier shall have a permanent local office with experience on similar projects and capable of maintaining or upgrading the SCADA system and other instrumentation systems.

The proposed SCADA system shall be open system architecture utilizing standard operating and communication systems. The System Supplier shall provide documentation of successful and field performance of the proposed system, including hardware and software for application of similar type, size and complexity. The Supplier shall demonstrate that such system has been successfully employed in water and wastewater applications. Unproven or proprietary systems shall not be acceptable.

The system supplier shall employ full time personnel for detail engineering, co-operating, drafting, procurement and expediting, scheduling construction, testing, inspection installation, start-up service for calibration and commissioning and warranty compliance for the period specified.

The following evidence shall be submitted at the time of tender.

A. Firm-wide experience in performing projects similar to this one.
B. Information on the proposed SCADA system hardware and software system to

allow Tamil Nadu Water Supply and Drainage Board (TWAD) to determine if the proposed system is both “state-of the-art” as well as proven at other, similar installations.

C. Information on the local office capabilities (location, description of physical facilities, organisation chart of complete staff, list of projects/clients most similar to this project)

Should TWAD review this information during the tender evaluation period and determine the submitted information is not sufficient to determine the capabilities of the supplier, the tenderer shall submit additional information as requested. Should TWAD determine the proposed single system supplier for the instrumentation system does not meet the experience requirements listed above, an alternate supplier shall be proposed and new experience information on a supplier acceptable to TWAD by the time the tender review period is closed, the Tender will be viewed as non-responsive.

1.3 Shipping precautions.

Special instructions for proper field handling, storage and installation required by manufacturer for proper protection, shall be securely attached to each piece of equipment prior to packaging and shipment. None of the central control and monitoring equipment shall be shipped to the site until the room(s) are environmentally suitable.

1.4 Identification.

Each component shall be tagged to identify its location and function in the system identification shall be prominently displayed on the outside of the package.

1.5. Test Equipment.

Test equipment shall be provided, together with items such as instruction manuals carrying / storage cases, unit battery charger where applicable, special tools, calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for checking field operation of equipment supplied under this contract.

1.5.1 Deleted

1.5.2 One portable (DMM) digital multi-meter with rechargeable battery and charger and test leads, and carrying-case.

1.5.3 One toolkit consists of screw driver, testers etc.

1.6. Source Quality Control.

The manufacturer of the equipment and fabricators of RTU/PLC cabinet supplied under this contrast shall allow the TWAD to inspect and witness the testing of the equipment at the site of fabrication. Equipment shall include the cabinets, special control systems, flow measuring devices, pressure measuring devices, level measuring devices, transmitters and other pertinent systems and/or devices. a minimum of ten working days notification shall be provided to the TWAD prior to testing. No shipments shall be made without the TWAD’s approval

STANDARD SPECIFICATIONS - PART-I

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PART-I – INSTRUMENTATION STANDARD SPECIFICATION

2.17 Panel labels

2.18 Panel finish

3.0 INSTRUMENTATION EQUIPMENT

3.1 Components, equipment and system design

3.2 Instruments and ancillaries – General

4.0 FLOW-MEASURING EQUIPMENT

4.1 Differential pressure flow meters

4.2 Electromagnetic flow meters

4.2.1 Construction

4.2.2 Performance

4.2.3 Testing

4.3 Variable-area flow meters

4.4 Helix-type flow meters

5.0 LEVEL-MEASURING EQUIPMENT

5.1 Float-operated level indicators

5.2 Float operated level transmitters

5.3 Ultrasonic level measuring system

5.4 Conductivity type level detection system

5.5 Pressure transducer type level and depth measuring systems

5.6 Hydro-static level transmitters

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6.0 PRESSURE-MEASURING EQUIPMENT

6.1 Pressure gages and transmitters

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7.0 ENERGY MONITORING SYSTEM.

7.1 Energy measuring equipment

7.2 Valve actuators

8.0 CHEMICAL-MEASURING EQUIPMENT

8.1 Residual chlorine meters

8.2 Turbidity meter in case of surface water as source.

9.0 RECORDING EQUIPMENT

9.1 Electrical indicators and integrators

10.0 ALARMS AND PANEL EQUIPMENT

10.1 Alarm systems

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10.2 Alarm annunciators

10.3 Push-buttons and indicator lights

10.4 Analogue signal transmission

10.5 Analogue process controllers

10.6 Programmable logic controllers

- 10.6.1 General
- 10.6.2 Memory
- 10.6.3 Diagnostics
- 10.6.4 Communications
- 10.6.5 Input/output
- 10.6.6 Operator interface
- 10.6.7 Failure
- 10.6.8 Operating system

10.7 Signal-conditioning devices

11.0 INSTALLATION OF INSTRUMENTATION

11.1 Plant instrument piping

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Present proposal

Providing Supervisory Control and Data Acquisition (SCADA) system for WSS to Arulmigu Dhandayuthapani Swamy Thirukoil at Palani in Dindigul District including maintenance for a Period of one year at free of cost (Period of completion 6 months)

Field Instruments:

The following filed instruments are proposed to be installed at the above locations:

1. Level sensor
2. Pressure transmitters
3. Insertion type flow meters in the inlet to Sumps
4. Woltman type flow meter with pulse unit in the pumping mains and branch mains
5. Energy monitoring equipments.

All the above instruments should be capable of continuously measuring the variables and give an output in the form of electric signals. The signals from the remote instruments to be collected in the PLCs/RTU and send through the communication medium to the Master Control Station.

Communication System:

As the telemetry system now proposed involves automatic regulations of rate of pumping at upstream pumping installations to maintain the required water level in downstream sump availability of continuous reliable communication is absolutely necessary. Hence dual redundancy communication is required. The bidders may propose minimum of two or more of the following communication system.

(1) GSM/GPRS/ BROADBAND.

Master Control unit

The MCU has to be equipped with three Pentium computers, a dot matrix printer, a laser printer, a master terminal and uninterrupted power supply units. The MCU has to be provided with required software working on Windows environment. The software will process data and generate reports in different forms. These include graphic displays of system layout with the value of pressure, water level and flow at appropriate location and the pump on/off status at head works and Water Treatment Plant and other booster stations. Periodic reports covering a day, week, month or year of operation will also be generated. An automatic alarm system will notify the system operator of abnormalities in pressure, flow or water level indicating pipe breaks, sump overflows, etc. Air-conditioning arrangement should be provided in MCU. UPS should also be provided.

1.2 Reference standards

Unless otherwise approved, instrumentation shall comply with relevant quality standards test procedures and codes of practice collectively referred to as Reference Standards including those listed below in accordance with the requirements detailed elsewhere in this specification.

IEC 60381-1:1982	Analogue signals for process control systems. Specification for direct current signals.

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IEC 60947-4-1:2000	Specification for low-voltage switchgear and controlgear. Contactors and motor-starters. Electromechanical contactors and motor-starters.
IEC 60947-4-2:1999	Specification for low-voltage switchgear and controlgear. Contactors and motor-starters. A.C. semiconductor motor controllers and starters.
IEC 60947-4-3:1999	Specification for low-voltage switchgear and controlgear. Contactors and motor-starters. Contactors and motor-starters. AC semiconductor controllers and contactors for non-motor loads.
IEC 60770-1:1999	Transmitters for use in industrial-process control systems. Methods for performance evaluation.
BS ISO 1217:1996	Displacement compressors. Acceptance tests.
ISO 2112:1990	Specification for aminoplastic moulding materials.
ISO 6817:1997	Measurement of conductive liquid flow in closed conduits. Method using electromagnetic flowmeters.
BS EN 837-1:1998	Pressure gauges. Bourdon tube pressure gauges. Dimensions, metrology, requirements and testing.
BS EN 1057:1996	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications.
BS EN 1092-1:2002	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges.
BS EN 1563:1997	Founding. Spheroidal graphite cast iron.
BS EN 60529:1992	Specification for degrees of protection provided by enclosures (IP code).
BS EN 60534-1:1993	Industrial-process control valves. Industrial-process control valves. Control valve terminology and general considerations.
BS EN 60546-1:1993	Controllers with analogue signals for use in industrial-process control systems. Controllers with analogue signals for use in industrial-process control systems. Methods for evaluating performance.
BS EN 60584-2:1993	Thermocouples. Tolerances.

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BS EN 60654:1998	Operating conditions for industrial-process measurement and control equipment. All relevant parts.
BS EN 60751:1996	Industrial platinum resistance thermometer sensors.
BS EN 60873:1993	Methods of evaluating the performance of electrical and pneumatic analogue chart recorders for use in industrial-process control systems.
BS EN 61000-6:2001	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments.
BS 89:1990	Direct acting indicating analogue electrical measuring instruments and their accessories. All parts.
BS 90:1975	Specification for direct-acting electrical recording instruments and their accessories.
BS 476	Fire tests on building materials and structures. All parts.
BS 1042-1.4:1992	Measurement of fluid flow in closed conduits. Pressure differential devices. Guide to the use of devices specified in Sections 1.1 and 1.2.
BS 1041-2.1:1985	Code for temperature measurement. Expansion thermometers. Guide to selection and use of liquid-in-glass thermometers.
BS 1041-2.2:1989	Code for temperature measurement. Expansion thermometers. Guide to selection and use of dial-type expansion thermometers.
BS 1041-3:1989	Temperature measurement. Guide to selection and use of industrial resistance thermometers.
BS 1041-4:1992	Temperature measurement. Guide to the selection and use of thermocouples.
BS 1042-1.4:1992	Measurement of fluid flow in closed conduits. Pressure differential devices. Guide to the use of devices specified in Sections 1.1 and 1.2.
BS 1123-1:1987	Safety valves, gauges and fusible plugs for compressed air or inert gas installations. Code of practice for installation.
BS 1203:2001	Hot-setting phenolic and aminoplastic wood adhesives. Classification and test method.

BS 1553-1:1977	Specification for graphical symbols for general engineering. Piping systems and plant.
BS 1571-2:1975	Specification for testing of positive displacement compressors and exhausters. Methods for simplified acceptance testing for air compressors and exhausters.
BS 1646-1:1979	Symbolic representation for process measurement control functions and instrumentation. Basic requirements.
BS 1646-2:1983	Symbolic representation for process measurement control functions and instrumentation. Specification for additional basic requirements.
BS 1646-3:1984	Symbolic representation for process measurement control functions and instrumentation. Specification for detailed symbols for instrument interconnection diagrams.
BS 1646-4:1984	Symbolic representation for process measurement control functions and instrumentation. Specification for basic symbols for process computer, interface and shared display/control functions.
BS 1794:1952	Specification for chart ranges for temperature recording instruments.
BS 2765:1969	Specification for dimensions of temperature detecting elements and corresponding pockets.
BS 3680	Measurement of liquid flow in open channels. All relevant parts.
BS 3693:1992	Recommendations for design of scales and indexes on analogue indicating instruments.
BS 4675-2:1978	Mechanical vibration in rotating machinery. Requirements for instruments for measuring vibration severity.
BS 4999-142:1987	General requirements for rotating electrical machines. Specification for mechanical performance: vibration.
BS 5169:1992	Specification for fusion welded steel air receivers.
BS 5728-3:1997	Measurement of flow of cold potable water in closed conduits.

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	Methods for determining principal characteristics of single mechanical water meters (including test equipment) .
BS 6004:2000	Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750 V, for electric power, lighting and internal wiring.
BS 6739:1986	Code of practice for instrumentation in process control systems: installation design and practice.
BS 7671:2001	Requirements for electrical installations. IEE Wiring Regulations. Sixteenth edition.

Instrument Society of American Standards and Recommended Practices:

S 5.1	Instrumentation symbols and identification
S 5.4	Instrument loop diagrams
S 7.3	Quality standard for instrument air
RP 16.1	Terminology, dimensions and safety practices for indicating variable 2, 3 area meters
RP 16.4	Nomenclature and terminology for extension-type variable-area meters (rota meters)
RP 16.5	Installation, operation, maintenance instructions for glass tube variable area meters (rota meters)
RP 16.6	Methods and equipment for calibration of variable area meters (rota meters)
RP 18.1	Specifications and guides for the use of general purpose annunciators
S 26	Dynamic response testing of process control instrumentation
RP 31.1	Specification, installation and calibration of turbine flow meters
S 37.1	Electrical transducer nomenclature and terminology
S 37.3	Specifications and tests for strain gauge pressure transducers
S 50.1	Compatibility of analog signals for electronic industrial process instruments
S 51.1	Process instrumentation terminology

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1.3 Statement of compliance

The Contractor shall provide a list of the reference standards used and shall provide a compliance/non-compliance statement.

All standards which the Contractor intends to use but which are not referenced herein shall be submitted to the Engineer for consent before any design against that standard proceeds.

Installation works shall comply with all relevant local Indian Regulations including the Code of Practice for Electrical Wiring Installations – IS 732.

1.4 Submissions by Contractor

1.4.1 General

The Contractor shall make submissions to the Engineer of all design drawings and schedules relating to instrumentation and control equipment and systems provided under this Contract. These submissions shall include, where relevant, the following:

1.4.2 Functional design specification

The Contractor shall submit a complete functional design specification (FDS) for approval by the Engineer. This document shall serve as the primary mechanism by which the Engineer may confirm that the Contractor possesses an accurate understanding of the system and its control requirements. The Contractor is encouraged to obtain clarifications and to suggest refinements to the control descriptions contained in this Specification.

The FDS shall comprise an overall description of the plant, its functioning and control, and a detailed description of each section of the control system covering modes of operation, manual overrides, set-point and parameter selection and adjustment. The detailed description shall include a step-by-step control description which defines the function of each piece of equipment and each control action and interlock, including details of the program in each programmable item. The format of the program details may be chosen by the Contract, however it is suggested that this format be chosen to satisfy the requirements of the software design documentation, if applicable, as described elsewhere.

The FDS shall describe the 'fail-safe' features incorporated into the design for the event of failure of a plant item or system, or loss of an input signal affecting a control loop or process sequence.

The FDS shall describe control actions taken and monitoring functions which remain available during a power failure, and any automatic controls or sequencing which take place during system start-up and shut-down.

The FDS shall be presented in a clear and precise manner and shall include figures or drawings where appropriate.

The Contractor shall submit and obtain approval of the FDS from the Engineer before beginning the detailed control system design. The contractor should take note of the importance of this obligation.

1.4.3 Drawings and schedules

(a) Process and instrumentation diagram which shall comply with BS 1646 (all parts) and BS 1553-1:1977.

(b) General arrangement drawings of field-mounted instruments showing installation details.

(c) General arrangement drawings of instrument and control panels, fully-dimensioned in plan and elevation views, showing foundation and fixing details, access doors, clearances, cable-entry positions, weight and lifting arrangement.

(d) Layout drawings of panel fascias showing instruments, controls and details of all labels.

(e) Layout drawings of panel interior showing equipment, terminal blocks and cable ways.

(f) Annunciator arrangement and engraving details.

(g) Internal circuit and wiring diagrams for instrument and control panels.

(h) Schematic control diagrams.

(j) Instrument loop diagrams.

(k) Instrument wiring and piping diagrams.

(l) Interconnection wiring diagrams.

(m) Cable block diagrams, drawings and schedules.

(n) Instrument system and panel power distribution diagrams.

(p) Programmable-device functional design specifications which shall include hardware details, logic flow charts, ladder diagrams and program listings.

(q) Schedules of inputs to and outputs from programmable controllers and telemetry outstations.

(r) Labeling schedules.

(s) Comprehensive testing schedules for all off-site, on-site, pre-commissioning and commissioning tests and take-over tests.

All other drawings necessary for the provision of ducts, openings, trenches, fixing holes for panels and the like and for the complete understanding of the operation, maintenance and extension of the system including any required for the Purchaser to dismantle, repair, maintain, modify or extend the Plant.

1.4.4 Data and calculations

(a) Manufacturers' catalogues and data sheets.

(b) Calculations to support control system design.

(c) Specification for protective coatings and painting.

1.4.5 Certificates

(a) Manufacturers' works tests.

(b) Pre-installation checks.

(c) Pressure-testing schedules.

(d) Instrument loop test check sheets.

(e) Pre delivery inspection certificate to be issued by the competent independent inspecting agency.

(f) Installed instrument performance tests.

(g) System tests.

(h) Statutory certificates of compliance (such as hazardous area equipment).

1.4.6 Operation and maintenance instructions

Composite manual describing the functional and operation of each piece of equipment.

Composite manual for testing and servicing every system and individual item.

1.5 Basic features

Each instrumentation system shall be designed, manufactured and installed to achieve the following basic requirements:

- to maintain the highest standards of availability, reliability and accuracy and to give clear warnings of any deterioration in performance;
- to suit the abilities of the staff who will:

  (a) use the systems;
  (b) service the systems.
- to measure, indicate, process, store and control the relevant parameters, as specified;
- to give clear warnings of dangerous and other abnormal conditions and to initiate plant safety procedures, shutdowns and corrective measures as specified to assure the safety of 'operations and maintenance' personnel and plant and to store and collate the data, as required;
- to derive, present and utilise, as required, such additional data as required to facilitate:
  (a) the most efficient operation of the plant;
  (b) the routine maintenance of the plant.

1.6 Design requirements for instrumentation systems

The instrumentation, control and automation installations shall fully comply with design standards, regulations and the material and workmanship requirements of the Specification.

The electrical plant installations associated instrumentation control and automation systems shall also comply with and be tested in accordance with the latest edition of 'Requirements for Electrical Installations' BS 7671:2001, and with the relevant standards of Indian in which the plant is to be installed. All electrical consumable items shall be readily available within Indian.

All installations, shall also comply in conjunction with associated mechanical and electrical power plant installations with the UK's Health and Safety at Work Act 1974 (or the latest edition) and the Electricity at Work Regulation 1989 (or the latest edition), which specify standards of safety for industrial plant installations, and with the relevant standards of the Country in which the plant is to be installed.

All equipment and materials incorporated in the system shall be selected, designed and rated to operate under the defined performance duties and specified site conditions and to maintain a high level of operational reliability.

The instrumentation control and monitoring system equipment and materials shall have an operational life of not less than 15 years, unless otherwise consented to by the Engineer.

1.7 SCADA – Description of work

Supervisory Control and Data Acquisition System

Description of work

SCADA package will be used to deliver an effective plant monitoring and control system. This system will be fast, efficient, and completely scalable with the flexibility to choose own system design.

SCADA package with sufficient tags for development and customisation will be installed in the computers, located at the Master Station..

Supervisory Control and Data Acquisition system (SCADA) will be used for acquiring data from the field devices through RTU/ PLC.

SCADA Package for Monitoring & Data collection at Central station

SCADA software

i. Shall be installed in Server at Division office and should be capable of controlling and monitoring at least 50 Remote Telemetry Units with a SCADA development cum server software with min 250 tags.

ii. Shall be installed in client PC's at the Division office, should be capable of monitoring respective head works connected to the respective zone with a client software with min 250 tags for each computer.

iii. Shall be installed in computers at Circle office, Regional Superintending Engineer office should be capable of controlling and monitoring respective head works connected to the respective scheme with Runtime software with min 300 tags for each computer.

SCADA software should acquire data from all RTU's/ PLC and display in the HMI screen. In addition to the display action, the logs of each station should be transferred using data export to database processing software (MS SQL, MS ACCESS, EXCEL, etc.,).

Description of System

The supervisory data acquisition and control system (SCADA) specified herein shall be designed, installed, tested and customized as follows:

- To collect, store and accurately analyze, reliable operating information for present and future uses
- To perform Real-time process control.
- To assist plant operating personnel by noting and announcing off-normal operating conditions and equipment failures
- To perform calculations based on sensor (automatic) / manual operator data inputs
- To accumulate and store equipment running times
- Store and retrieve all operation information
- Compile and prepare daily, weekly and monthly reports
- Provide central or local control using clear, concise, resizable graphics pages screens.
- Graphical control buttons to pages, to perform single or multiple tasks.
- Animations to display the operating status and performance of Water Distribution Stations and OHT status.
- Display text messages and graphics to show the status of a process or the state of an alarm.
- Monitor, control, log, and display all alarms.
- Provide historical and real-time trending in graphical format.
- Monitor performance and efficiency as it happens by using trend and data logging facilities.

END USER will provide information required on the graphic displays and report formats.

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2.0 PANEL DETAILS

2.1 Enclosures and mounting boards

Enclosures shall be any form of board, cabinet, panel, desk, box or case used to protect, contain or group instrumentation, telemetry or control equipment.

All equipment in or on enclosures shall be arranged logically and, as far as possible, symmetrically, with projections kept to a minimum. Each enclosure and board shall be designed on ergonomic principles and shall permit in-situ and safe access for any normal adjustment, maintenance and servicing. The tops of plant-mounted enclosures shall be sloped downwards from front to rear.

The minimum degree of protection shall be IP 31 in purpose designed control rooms and IP 54 for other indoor locations.

Enclosures for use outside buildings or in places where splashing may occur shall have a minimum rating of protection to BS EN 60529:1992, IP 56 and have tops which project sufficiently to protect the vertical faces of the enclosure and any component mounted thereon from splashing, inclement weather and direct sunlight. Also, when enclosures for use outside buildings are located where exposure to direct sunlight will give rise to high top-panel surface temperatures such that the internal temperature rises above the manufacturer's recommendation (normally 40⁻C), the enclosure shall include a sun shield fitted to the top of the enclosure.

Fixing arrangements for surface-mounting enclosures shall be external to the enclosure and shall ensure that the rear face of the enclosure is not in contact with the surface to which it is fixed.

Enclosures shall have hinged access doors, fitted with recessed lockable handles. Doors shall be of rigid construction and provided with close-fitting flexible seals in recesses to prevent the ingress of liquids, moisture, dust and vermin. Hinges shall be of the lift-off pattern and one hinge shall engage before the other for ease of fitting. Wherever necessary, removable access covers secured by quick-release fasteners shall be provided to ensure ease of maintenance for all installed apparatus. Mounting plates, brackets and racks shall be provided for all other internal equipment which shall be hinged or otherwise arranged with quick-release fasteners or captive screws to give quick and easy access to equipment, securing screws, terminals and wiring.

Enclosures for two or more devices with electrical circuits shall have gland plates and terminal blocks as specified elsewhere.

Each enclosure shall be designed for the safe testing and servicing of equipment with the power on. Each part which may be live under any circumstances shall be so covered or shielded as to prevent inadvertent contact.

2.2 Panel isolation

Clearly-labeled isolating circuit breakers shall be provided for each incoming power supply. Switches shall be of the quick make-and-break type with spring-loaded contacts that close fully without requiring full operation of the handle. The handle and cover shall be interlocked so that the handle cannot be operated when the cover is open and the cover cannot be opened unless the switch is in the 'off' position. The 'on' and 'off' positions of each switch shall be indicated clearly.

Circuit breakers for panel power supplies shall be mounted near an access point and in positions where they may be operated easily from a standing position.

Plug-in isolating links or devices of an approved type shall be provided in any circuit that may still be live when the power supply isolators are in the 'off' position, as, for example, in circuits controlling equipment whose power supply is independent of the panel. Such links or devices shall be properly screened and, if not incorporated in or adjacent to their associated outgoing terminals, shall be labeled with suitable warning notices.

Any item of panel equipment to which panel internal wiring is connected with a plug and socket instead of terminals shall be wired in flexible cable of adequate rating between the 'free' plug and a socket mounted adjacent to the device.

The power supply connector shall be a socket.

2.3 Panel terminal blocks

External wiring for panel power supplies shall be terminated on the appropriate isolator. Signal cables from strain gauges, analysers, resistance thermometers, re-transmitting slide-wires and thermocouples may be terminated at their appropriate instruments.

A terminal block shall be provided as the interface between the corresponding conductors of each internal and external wire and each internal and external connection except those listed above. The terminal blocks shall be mounted vertically where possible and not nearer than 230mm to the floor or less than 230mm from an incoming cable gland.

Terminal block rows shall be spaced apart by not less than 150mm and arranged to permit convenient access to wires and terminals and to enable ferrule numbers to be read without difficulty.

Other circuits shall be grouped on the terminal blocks according to the classification given in the clause for 'Panel internal wiring' which shall be clearly marked along the corresponding section of each terminal board. Groups of different voltages on the same board shall be separated by insulated barriers.

All connections shall be made from the front of terminal blocks and no live metal shall be exposed at the back. All terminal blocks shall be of the type which clamps the wire securely and without damage between two plates by means of a captive screw and which permits removal of any terminal without disturbance to adjacent terminals. Pinch-screw type terminal blocks will not be accepted. Terminal mouldings shall be in melamine to ISO 2112:1990, polyamide or equivalent. Terminal rails shall be hot-dip galvanised. Current bars between the two connection points of each terminal block shall be of copper or brass with tin/lead alloy plating. All steel parts shall be zinc-plated and passivated with a yellow chromate layer. Terminal blocks for input and output analogue signals and for circuits containing volt-free contacts internal or external to the cabinet shall be of the Klippon type SAKC or equivalent which permit the connection of a test milliam meter or continuity meter without disconnecting any wiring. Terminal blocks for power supplies for equipment external to the panel shall permit the isolation of the item of external equipment without affecting the operation of any other circuit within or outside the panel.

No more than one core of external cables, or one internal wire shall be connected to any terminal. If terminal blocks are used as common points for two or more circuits, individual terminals with the appropriate number of permanent cross-connections shall be provided. The lengths of exposed cable cores shall be sufficient to reach any terminal in the appropriate row or rows. The cores shall be formed into a neat loom and a separate loom shall be provided for each cable. Identification ferrules as specified in the clause for 'Panel wiring identification and termination' shall be fitted on each core of all external cables and on each internal wire.

The size of the terminals shall be appropriate to the size and rating of the cable cores which will be connected to them but shall not be smaller than Klippon type SAK2.5 or equivalent unless otherwise agreed with the Engineer.

Each row of terminal blocks shall contain at least 25% spare terminals over the number required for terminating all cores of external cables in that row. Unless otherwise specified or shown in the Specification drawings, each external cable shall contain at least 20% spare circuits, with a minimum of one spare circuit.

Terminal blocks shall be numbered consecutively in a sequence different from that used for identifying wiring. The terminal numbers, voltage grouping and terminal board layout shall correspond precisely with wiring diagrams so that quick and accurate identification of wiring can be made.

All the terminal boards shall be provided with covers of transparent insulating material that does not sustain combustion and shall be sectionalised where possible to give access to groups of terminals without uncovering all boards. Terminals which may be live when the panel is isolated from its main supplies shall be suitably labeled to minimise the risk of accidental contact.

2.4 Panel internal wiring

Panel circuits shall be segregated into the following categories:-

Group 1: Power control and very-high-level signal wiring (above 50V):

1.1 ac power supplies;

1.2 dc power supplies;

1.3 ac current signals above 50mA (such as CT circuits);

1.4 ac voltage and control signals above 50V (such as PT circuits).

Group 2: High-level signal wiring (6V to 50V dc):

2.1 signals from conventional electronic transmitters and controllers (such as 4mA to 20mA);

2.2 circuits to alarm annunciators and other solid-state devices (excluding those in categories 2.1, 2.5, 3.1, 3.2 and 3.3);

2.3 digital signals;

2.4 emergency shut-down and tripping circuits;

2.5 on/off control circuits;

2.6 intrinsically safe circuits;

2.7 speech-frequency circuits.

Group 3: Low-level signal wiring (5V dc and below):

3.1 signals from thermocouples;

3.2 signals from resistance thermometers and re-transmitting slide-wires;

3.3 signals from analytical equipment and strain gauges.

For Group 3 wiring, internal connections to the instruments shall be made by one of the following methods:

(a) the twisted, screened conductors of the external cable shall be led direct to their appropriate instruments via ducting systems installed for this purpose during construction of the panel;

(b) he conductors of the external cables shall be terminated on terminals segregated from all other categories and the connections to the appropriate instruments shall be made using twisted pairs with individual screening installed for this purpose during construction of the panel.

Internal wiring for all circuits in Group 2 except those sharing a common connection shall be multi-stranded, twisted pair, 0.75mm² minimum copper conductor with HPDE or PVC-insulated cable of adequate grade and rating in accordance with BS 6004:2000. Wiring for circuits in other Groups or sharing a common connection shall be run in stranded, 1.0mm² minimum copper conductor with 250V grade, PVC-insulated cable of adequate grade and rating. Wiring sheath colours shall be black for ac circuits, and grey for dc circuits (excluding thermocouple circuits) and blue for Group 2.6 circuits. Circuits operating at 240Vac and 110V dc, shall also be physically segregated from each other and from other circuits. Access to wiring and components of circuits having voltages exceeding 240V shall not be possible unless and until the circuit has been isolated.

Separate ducts, trunking, cable looms, tray work and the like shall be provided within the panel for each category with at least 150mm between parallel paths of Group 1 and those of any other Group. Intrinsically-safe circuits and their terminals shall be segregated from other circuits and terminals.

All wiring shall be neatly and securely fixed by insulated cleats, bunched and secured by approved plastic strapping or run in approved insulated wiring trunking or non-corrodible flexible tubing. Not more than 75% of the capacity of trunking, ducts, looming, or tubing shall be used. Insulated earth wiring shall be so arranged that access to any equipment or connection point or the removal of any item of equipment is unimpeded. Wiring for future equipment shall be secured and terminated on terminal blocks. Lacing for wiring looms shall be of rot-proof cord or plastic strips. Inter-section wiring in multi-section cabinets shall be via a terminal block in each section.

2.5 Panel wiring identification and termination

Identification ferrules shall be fitted at both ends of each wire. The numbers or letters used shall correspond with the appropriate wiring diagram. The ferrules shall be of plastic insulating material with permanent black characters on a colour-coded background for numbers and on a white background for letters, unaffected by oil or water. They shall be so arranged that they can be read logically from left to right when viewed normally.

The system of wire identification shall be such that wires in the same circuit on opposite sides of a terminal shall have the same reference, and this system shall be continued through all external cabling.

Terminal ferrules (spade, tongue, crimped connections) shall be provided on each conductor.

2.6 Panel earthing

A continuous copper earth bar of not less than 25mm x 6mm cross section shall run the full length of each panel and shall be securely fixed and bonded electrically to the main frame. The cable gland-plates and the earth bar shall be provided with suitable brass terminals of not less than 6mm diameter for connecting the metal cladding or armouring of all incoming and outgoing cables to the station earthing system.

A second continuous copper earth bar of not less than 25mm x 6mm cross section, electrically isolated from the steelwork of the panel and metal cladding and armouring of cables, shall be provided for earthing the signal earth connection of each instrumentation and control device and the screen(s) of each instrument cable not earthed elsewhere to the station instrumentation earth plate. The earth bar shall have sufficient brass terminals as specified above for each instrumentation and control device and the screen of every shielded cable plus 25% spare terminals.

In multi-section panels, each earth bar shall be electrically bonded to the corresponding bars in the adjacent section(s).

Instrumentation and instrument cable screen earthing shall comply with BS 6739: 1986, Section 10, unless otherwise stated in this clause.

2.7 Panel lighting

Each panel shall be adequately illuminated internally, as evenly and as free from dazzle as possible, by fixed fluorescent lighting controlled from totally-enclosed light switches and by totally-enclosed door-operated switches positioned so as not to interfere with access. There shall also be one installed inspection lamp per three metres of panel length or part thereof with adequate flexible connection cable to reach any point in the panel. The control switch for an inspection lamp shall form part of the lamp assembly. Lighting circuits shall be fused independently of any instrumentation and control circuit and designed to allow lamps to be replaced safely and shall be fed from a distribution board and circuit breaker connected on the live side of the main panel ac supply circuit breaker.

2.8 Panel ventilation

Each panel shall be provided with ventilation fans as required to ensure that equipment within the panel is maintained within manufacturer's recommendations, with due regard to the environment in which the panel will be mounted. Fans shall be controlled by a suitably-labeled enclosed switch mounted internally in an accessible position.

Fans shall be mounted with their axis horizontal and shall be arranged to draw clean air into the panel. Air entries shall have filters which can be renewed from outside the panel and shall be designed to prevent the entry of rain, spray, injurious fluids, sand or dust.

2.9 Panel labels

Labels shall be provided for every panel to describe the duty or otherwise identify the panel and its sections and every instrument, component and item of equipment mounted internally and externally. The Contractor shall submit drawings to show the general arrangement of all labels with their proposed inscription clearly identified. Wording shall be clear, concise and unambiguous and shall be subject to review by the Engineer before manufacture. Each label shall be permanently secured to the surface near the item to which it refers. Externally-fitted labels shall be of per spex or other approved transparent plastic, with letters and numbers rear-engraved and filled with black. The rear surface of each per spex label shall be finished with a coat of paint of the same colour as the panel external finish. Instrument duty labels fitted externally shall be below the item to which they refer. Embossed tape or similar adhesive labels will not be approved.

Laminated materials or rear-engraved and filled plastic shall be used for internally-fitted labels, which shall be white with engraved black letters.

Labels conforming with the requirements of the preceding paragraphs or other approved means shall be provided:

- to describe or identify circuits or circuit components;
- to identify dc polarity;
- to warn or remind about dangerous or potentially-dangerous circumstances; wherever elsewhere specified.

Unless otherwise specified, all engraving shall be in plain block letters, 4mm high. The minimum practicable number of different sizes shall be used.

Manufacturers' nameplates shall not be fitted on panel external surfaces.

2.12 Panel finish

For control and instrument panels, desks and cubicles a hard, smooth, durable finish, free of blemishes, shall be provided. Before painting, all external welds and any rough areas shall be smoothed, and all surfaces shall be thoroughly cleaned and free from scale, contaminates, corrosion or grease. If rust-proof or Zintec steel has not been used in the construction, the panel shall be treated with a passivating agent such as phosphoric acid. All internal surfaces shall have a minimum of three coats of paint of which the first shall be an approved anti-rusting priming coat and the final coat shall be an opaque gloss white enamel. All external surfaces shall have not less than five coats of paint of which the first shall be an approved etch-priming coat, and the second and third suitable undercoats, all of which shall be rubbed smooth when dry before application of the next coat. The undercoats shall be easily distinguished in shade or colour from the priming and finishing coats. The two final coats shall be of stove enamel paint, gloss or semi-matt finish, to a colour and finish to be advised by the Engineer. Stoving shall be carried out in accordance with the recommendation of the paint manufacturer. The overall dry film thickness (DFT) shall be between 85 and 120 microns.

Nuts, bolts, washers and other fixing devices which may have to be removed for transit or maintenance purposes shall be galvanised or otherwise finished to an approved standard.

A 500ml tin of matching touch-up paint shall be provided and packed with each panel. The colour of glass reinforced plastic panels shall be to the approval of the Engineer.

3.0 INSTRUMENTATION EQUIPMENT

The technologies and types of instruments listed hereunder are suggestive only. They will have to take total responsibility and ensure uninterrupted operation of the SCADA System in its entirety.

3.1 Components, equipment and system design

All equipment shall be designed for rapid fault-diagnosis and replacement of major sub-assemblies and components, which shall be mounted on printed-circuit boards or plug-in type bases with high-grade, non-ageing plugs and sockets with gold-plated contacts. Components on printed circuit boards shall be tropicalised and varnished. All transformers shall be double-wound with an earthed screen between primary and secondary windings. All transformers shall be vacuum-impregnated and all except power transformers shall be epoxy-resin encapsulated. Routine maintenance and repair shall, as far as possible, require neither highly-skilled personnel nor soldering and wire-wrapping techniques.

Integrated circuits shall be used and, except in protection and shut-down circuits, solid-state devices shall be used in preference to moving-armature relays and electro-mechanical timers. Relays shall be of the plug-in type and shall have polycarbonate covers. When used in tropical locations, the relays shall be hermetically sealed. The standards of reliability for moving armature relays and electro-mechanical timers shall not be less than specified in IEC 60947-4:1999 or equivalent for medium-voltage contactors of Class 3 mechanical endurance. Operating coils shall be vacuum impregnated or epoxy-resin encapsulated.

Electronic units shall be fully solid state and the selection and installation of components shall give the maximum life possible. Wire-wound resistors shall be on ceramic formers and embedded in fire-proof and damp-proof material.

Plant state indication systems shall be designed so that a failure of any component or circuit or power supply associated with the indication system cannot lead to the masking or inhibition of the indication of a potentially dangerous state.

Plant protection and control systems shall be designed so that their outputs are de-energised or neutralised whenever a failure occurs of any component or circuit or power supply associated with that protection or control circuit.

No single equipment fault shall prevent the correct operation of any protection or shut-down circuit whenever necessitated by a plant fault condition or control action.

Under emergency, failure or shut-down circumstances, each regulating device shall move to the appropriate safe condition or stay-put in accordance with the relevant part of the Specification.

3.2 Instruments and ancillaries — general

All instruments, gauges and control equipment which perform similar duties shall be of uniform type and manufacture throughout the Works in order to facilitate maintenance and the stocking of spare parts.

All equipment shall be fully tropicalised and suitable for the worst environmental operating conditions. Panel-mounted instruments shall have damp-proof and dust-proof cases. Instruments mounted outside instrument panels shall have weatherproof and dust-proof cases. Instrument cases shall be of corrosion-resistant material or finish. Instrument screws (unless forming part of a magnetic circuit) shall be of brass or bronze. Access to terminal compartments of instruments mounted outside panels or other enclosures shall not expose any working part. Moving parts and contacts shall be adequately protected from the ingress of dust.

Unless otherwise specified, instruments shall be finished in the manufacturer's standard colour. Instrument dials shall be of such material that no peeling or discolouration will take place with age under tropical conditions.

Plant-mounted indicators and gauges shall be sized to give full legibility when viewed from a position with convenient and easy access or from the point at which any operation requiring observation of the gauge is performed. The minimum diameter for any gauge shall be 100mm except where forming part of standard instruments and accessories such as air-sets.

Dials and bezels shall be of bronze and internal components shall be of stainless steel, bronze or other corrosion-resistant material.

Unless otherwise specified, all functions shall be transmitted electrically and all analogue signal-transmission systems shall be in accordance with IEC 60381-1:1982 or equivalent and shall use a signal of 4mA to 20mA dc or communication protocol Field Bus, Device Net or equivalent using RS485 connection. Where possible, measuring systems shall be designed so that any necessary power supply is taken from the appropriate instrument panel.

Transmitting devices shall have integral indicators to monitor the output signal or connections suitable for use with a portable test meter, and shall be capable of meeting the performance requirements specified in the appropriate part of IEC 60770-1:1999 or equivalent.

Equipment mounted in enclosures shall be suitable for continuous operation at the maximum internal temperature possible in service, due account being taken of internally-generated heat and heat dissipated by other plant. All components shall be rated adequately and circuits shall be designed so that change of component characteristics within the manufacturers' tolerances shall not affect the performance of plant. All equipment shall be designed to operate without forced (or fan) cooling.

Equipment provided with anti-condensation heaters shall be capable of operating without damage if the heaters are left on continuously. Unless provided with unalterable factory configured ranges, measuring instruments shall have zero and span adjustment.

Instruments not mounted in panels shall be supplied complete with all brackets, stands, supporting steelwork and weatherproof enclosures (separate from the instrument cases) necessary for securing them in their working positions and affording complete protection at all times including periods of servicing, adjustment, calibration and maintenance. The installation arrangements for meters measuring conductivity, pH, dissolved oxygen, chlorine residual and ionic concentration shall include a sample bench and other facilities for operating portable test meters. Each installation shall incorporate a valve and pipe work for obtaining a sample representative of the fluid at the position of the permanent meter, tundish and drain. If the measuring and sampling points are remote from each other, the test and sample facilities shall be provided at both points. Sample transport times shall be minimised by provision of a by-pass and drain with control and isolating valves and a local flow meter to enable the correct sample flow to be adjusted.

4.0 FLOW-MEASURING EQUIPMENT

Specifications & conditions are as per Schedule A

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PART-II – DATA ACQUISITION AND CONTROL SYSTEMS

1.0 DATA ACQUISITION - GENERAL

This part covers the requirements for the supply, installation, inspection and testing of the data acquisition and control (control) system, associated plant and materials.

1.1 Reference Standards

Unless otherwise specified or approved, the data acquisition and control system shall comply with the current version of the relevant Reference Standards including those listed below:—

IEC 60381-1:1982	Analogue signals for process control systems. Specification for direct current signals.
IEC 60381-2:1982	Analogue signals for process control systems. Specification for direct voltage signals.
BS EN 60529:1992	Specification for degrees of protection provided by enclosures (IP code).
BS EN 60546-1:1993	Controllers with analogue signals for use in industrial-process control systems. Controllers with analogue signals for use in industrial-process control systems. Methods for evaluating performance.
BS 1646-1:1979	Symbolic representation for process measurement control functions and instrumentation. Basic requirements.
BS 1646-2:1983	Symbolic representation for process measurement control functions and instrumentation. Specification for additional basic requirements.
BS 1646-3:1984	Symbolic representation for process measurement control functions and instrumentation. Specification for detailed symbols for instrument interconnection diagrams.
BS 1646-4:1984	Symbolic representation for process measurement control functions and instrumentation. Specification for basic symbols for process computer, interface and shared display/control functions.
BS 6739:1986	Code of practice for instrumentation in process control systems: installation design and practice.

Instrument Society of American Standards and Recommended Practices:

S 5.1	Instrumentation symbols and identification
S 5.4	Instrument loop diagrams

S 26	Dynamic response testing of process control instrumentation
S 50.1	Compatibility of analog signals for electronic industrial process instruments
S 51.1	Process instrumentation terminology
RP 60.08	Electrical Guide for Control Centres

IEE Guidelines for the documentation of computer software for real-time and interactive systems. International and local guidelines for programmable electronic systems in safety-related applications.

1.2 Submissions by the Contractor

The submissions by the Contractor pertaining to the data acquisition and control system shall be in accordance with the requirements detailed elsewhere and shall comprise the following as a minimum:-

(a) A functional design specification (FDS) for the data acquisition and control system. This shall be combined with the FDS for instrumentation, control and automation to form a complete document and shall comply with the specification of the FDS for instrumentation, control and automation. This document shall serve as the primary mechanism by which the Engineer may confirm that the Contractor possesses an accurate understanding of the system and its control requirements. The Contractor is encouraged to obtain any necessary clarifications and to suggest refinements to the control descriptions contained in this Specification. The FDS shall include a detailed block diagram of the control system with a description of the communications scheme to be provided. The FDS shall include operational details of the control system which have an effect on plant operations, such as power failure response, communication failure response, and automatic shut-down and start-up of the system. The FDS shall include a description of the interface of the control system with any existing or planned future control equipment. The Contractor shall submit a preliminary FDS and obtain approval before the system architecture design is finalised or detailed design takes place. The Contractor shall formally notify the Engineer for approval of any amendments or additions to the approved FDS. The final FDS shall be submitted for approval before submission of the factory acceptance test definition documents. The Contractor should take note of the importance of this obligation.

(b) Layout drawings for each piece of equipment fabricated or assembled by the Contractor, showing the position of each component with required clearances where applicable, and with overall dimensions.

(c) Wiring diagrams indicating each component of the system and all wiring and cabling thereto, showing manufacturers, types, duties, ranges and nomenclature, referencing the P&I diagram where applicable, with inputs, outputs, cable wiring and terminal identifications clearly marked.

(d) Mimic video displays in the form of hard copies or photographs which are clearly legible and are notated to indicate dynamic data and control pick points where applicable.

(e) Control video displays in the form of hard copies or photographs which are clearly legible and are notated to indicate dynamic data and control pick points.

(f) Logic diagrams of plant operation and control system interaction (including modes of failure and shutdown routines).

(g) Complete input and output list giving type, circuit number, tag name, short description, outstation, database reference, associated field device, range (if applicable), critical/non-critical alarm status and the like.

(h) Description of quality control methods and approvals.

(j) Detailed works and acceptance test procedures.

(k) Programme for manufacture, delivery, installation and commissioning.

(l) Appendices, as necessary, to include manufacturer's literature for each item of equipment supplied.

(m) Operation and maintenance manuals detailing the following:

- general description and operating principles;
- technical description of the equipment - manufacturer's standard brochures only being acceptable if the particular item of equipment described is clearly designated, adequate information is supplied, and irrelevant information is deleted or otherwise delineated;
- complete operating instructions defining the sequence of operations, including flow charts;
- procedures for dismantling, cleaning, servicing, replacing parts and reassembling, including recommended clearances and tolerances;
- details of all instrument and equipment settings as applicable to this contract;
- maintenance and lubrication schedules;
- fault diagnosis procedures;
- dated and priced list of significant spare parts and special tools, including identification numbers and sources of supply;
- simplified arrangement drawings showing all components of the equipment.

(n) General operating manual comprising the following:

- general description and operating principles;
- operating instructions for normal procedures in a step-by-step format including control operations, requirements for display or printing of data, performance monitoring, response to alarms or failures, changing of operational parameters, and manual data entry.

1.3 Format of submissions

The above documentation shall be on A4-size loose-leaf numbered sheets, bound in hard-cover ring or lever-arch type files, labelled on the cover and spine with the Employer's name, title of Scheme and/or Contract, Contractor's name, volume number and reference numbers.

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All sketches shall be on A4-size, or A3-size folded to A4; all drawings shall be on A1 or A3-size sheets folded to A4 and bound in a separate volume and include:

- Employer's name and title of Contract;
- Contractor's name;
- Title of drawing and drawing number;
- Date and originator;
- signature of Contractor to the effect that the drawing has been checked by him before submission.

2.0 SOFTWARE DOCUMENTATION

The Contractor shall provide complete software documentation for each programmable piece of equipment. The material to be provided shall include, as a minimum:-

(a) All of the manufacturer's standard published reference materials and user's guides.

(b) Complete documentation for any packaged software incorporated into the system including software written by other manufacturers.

(c) A working copy and complete documentation for any program-development software used for this project. This software and documentation shall be of the same version and revision numbers used for development under this contract.

(d) A working copy and complete documentation for any database management, report generation, screen graphic builder or other similar software used for development under this contract. This software and documentation shall be of the same version and revision numbers used for development under this contract.

(e) Hard-copy documentation of all configuration data, all user-accessible source code including control program code, reports and database contents including listings. All program listings shall be clearly and completely commented so as to convey to the reader a full understanding of the function of the program. So-called 'self-documenting' code without additional, supplementary comments will not be acceptable.

(f) A complete input and output list giving type, circuit number, tag name, short description, outstation, database reference, associated field device, range (if applicable), critical/non-critical alarm status and the like.

(g) A Software System Specification document which describes all control programs furnished with the system. Design documentation shall include, as a minimum:
    - a description of the software development environment, including development procedures, limitations, restrictions, configuration management, documentation standards and compatibility;
    - an overall description of the software design, including application structure and subsystem divisions, control strategy, monitoring and display hierarchy, data acquisition and storage, notational and operational

conventions and operator access restrictions;
- a description of each application sub-system;
- an English-language description of each control scheme;
- a flow chart or 'pseudo-code' description of each program module detailing the flow of control throughout the module;
- a list of files used by the system, including location and a brief description.

All packaged and system software licenses shall be registered by the Contractor in the name of the Employer.

3.0 MASTER STATION

3.1 General requirements

The master station shall consist of a computer system complete with central processor(s), VDU console(s), input/output devices, communication facilities and all peripheral equipment required for proper operation, as specified herein. Master station equipment shall be from a standard line of equipment manufactured and supported by a manufacturer approved by the Engineer.

If an uninterruptible power supply is not specified to power the master station, power to the equipment shall be provided with a transient protection barrier. Protected power cabling shall be provided with sheath colour coding or another method which distinguishes it from other service cables.

Programming of an outstation shall be possible from the master station.

3.2 Central processor

The central processor(s) shall be of industrial quality and of proven high reliability suitable for continuous operation.

The processor shall be furnished with a real-time calendar clock with battery back-up which provides the current time and date during system boot-up with no operator action required.

The processor shall contain sufficient memory for all requirements described herein, including future requirements, and 400% spare capacity when all application programmes are loaded and operating, but not less than 20 G-byte. The memory shall be field-expandable to 4 Gegabytes minimum and shall consist of high-speed semi-conductor RAM which is capable of detecting data corruption or memory failure.

The central processor shall be equipped with storage facilities consisting of:
- Random access memory (RAM) for the storage of all current data (real-time database);
- Large capacity, fast access, mass storage magnetic (hard) disks for on-line data storage;
- High density cartridge or streaming tape drive or optical disk system or Removable Hard Disk Drive, with removable media, for off-line archiving of data;

- An IBM PC compatible CD drive with removable media;
- DVD Read/Writer, for off-line archiving of data;
- Hard disk of not less than 300GB capacity.

Additional high capacity fixed and removable storage media, in the form of magneto-optical devise shall be supported.

The cassette tape drive shall store data in a format readable by and compatible with the PC/AT standard unless otherwise approved by the Engineer. Each USB or CD/DVR drive shall be located to allow convenient access by operators.

At least 67% of the hard disk shall remain unused and available for other uses after all database, program, historical and working files required by the system are resident. The disk drive shall possess a maximum access time of 15 milliseconds.

The operating system and application software shall reside on the hard disk. Upon power-up, power restoration after power failure or warm start, the system shall automatically load and become fully operational without the need for operator action.

The operating system and application software shall also be stored on removable media. Should data corruption or hardware failure occur to the hard disk such that the system will not function or re-boot properly, it shall be possible to reload this software onto an operable hard disk and the system brought on-line by an operator following step-by-step procedures, which shall be supplied by the Contractor as part of the O&M manual, without the need for outside support.

The central processor shall be provided with self-test diagnostic routines which are automatically executed every time the processor is powered up or the bootstrap routine is initiated.

3.3 Dual redundant processors

The master station shall be provided with two identical central processors configured such that either may provide full autonomous functioning of the system.

The system shall be designed and implemented such that the failure of a single processor does not inhibit full functioning of the system for more than 4 minutes. In the event of such a failure, full functioning shall resume automatically.

The Tender shall include a full description of the method by which his system meets this specification including a block diagram and step by step narrative.

3.4 Visual display unit console

Visual display unit consoles shall be provided either as individual units comprising a visual display unit (VDU), a keyboard, a cursor positioning device and any processor required for complete man-machine interface functioning, or as a console on which more than one set of the above hardware is available as an integrated system, together with the associated logging and graphic printers as specified. Space for up to two telephones shall be provided on the console. Console construction shall be as defined in the general requirements for panel construction unless otherwise agreed by the Engineer.

3.5 Visual display unit

The VDUs shall be designed for continuous operation, ie 24 hours per day. Polarizing filters shall be provided by the Contractor to minimise reflected glare.

VDUs shall be a minimum of 21" TFT and have at least 25 lines and 80 characters per line and full graphics with a minimum resolution of 1280 x 1024 pixels, displaying ASCII characters and graphical symbols.

The workstation shall have a structured, segmented, multiple window screen. A window is defined as an area of the screen through which the user can view any display produced by the system. Use of a WIMP (Windows Icons, Mouse and Pull-down Menus) environment shall be preferred as long as this does not compromise other requirements of this Specification.

3.6 Keyboard

Unless otherwise specified, keyboards shall be equipped with upper and lower case alphanumeric keys as well as a minimum of 10 function keys. Each key shall be clearly and permanently labelled to show its purpose.

Standard editing keys such as tab, insert, delete and backspace shall be provided.

Cursor control shall be available for the keyboard giving right, left, up, and down movements.
Keyboards located in the process area shall be protected from dust and splashed water.

Certain keys shall be programmable. A minimum of 8 keystroke-sequences, apart from the standard functions, shall be available after project completion for assignment of programmable functions.

Contractors proposing alternative keyboards shall submit full details for approval.
Keyboards for use in program modifications shall be of the standard QWERTY configuration with separate 10-key pad for numeric input.

The key boards shall be of cordless type.

3.7 Cursor-positioning device

Cursor-positioning devices shall be of the optical mouse or track-ball type or otherwise approved by the Engineer. Three select buttons and a scroll button shall be provided as a minimum. The mouse shall be of cordless type.

3.8 Printer Requirements

Two types of printers shall be supplied for reports, alarms and events as detailed below. It shall be possible to configure any text based output from the master station to either of these printers.

It shall be possible to add additional printers if required. Additional printers shall be capable of being assigned the functions of alarm/event logging, or report printing.

Alarm/Event printers, shall offer at a minimum of 100 characters per second, upper and lower case ASCII character set with true descenders, a minimum of 132 characters per line, and a self-test facility capable of printing automatically the entire character set.

The minimum size of printer buffers shall be 4k characters.

Each printer type shall connect to the system using the standard interfaces such as RS232/Ethernet with both RTS/CTS control signal and XON / XOFF data transfer control methods supported.

All printer types shall be of a low noise type or shall be provided with acoustic hoods to ensure the ambient noise level never exceeds 30dBA.

Printer types shall be provided with all necessary cables and connectors.

Should a printer be off-line when an output is ready, the control system shall send a message to the operator.

3.9 Alarm/Event printers

3.10 Report printers

The report printer shall be multi function Laser Printer (Print-scan-fax-copier) capable of producing high quality text and graphical reports for plant and management purposes and full colour high quality prints of screen display mimics, trends etc.

The printer shall have the following capabilities:

Automatic duplex (two-sided) copying, scanning and faxing
Print and copy at up to 30ppm
Ethernet, High-Speed USB 2.0 and Parallel interfaces
1200 x 1200 dpi Laser Printing.

It shall be located in the control room. The Contractor shall supply and install all necessary cables, and connectors etc.

3.11 Programmer's console

For systems which require it for modifications or additions to be made to the operating system or application programmes, a programmer's terminal shall be provided of the type recommended by the system software and hardware manufacturers.

3.12 Diagnostic capability

The system shall be provided with the capability to diagnose hardware malfunctions in the master station and related peripheral equipment. Diagnostic programmes shall be password-protected to prevent unauthorised use. The diagnostic procedures shall be able to be performed by operations personnel with a minimum of training. Software routines shall be provided which can isolate a single problem to the circuit board level. The routines shall be menu-driven to allow for ease of use. Complete documentation of diagnostic procedures shall be provided as part of the system documentation.

3.13 Master-station earthing

The master station and all related equipment earths shall be electrically bonded to the instrumentation earthing system or be provided with a separate independent isolated earth terminal bonded directly to the main station earth terminal in accordance with BS 6739.

3.14 Master station power and UPS

The master station processor(s), VDUs, logging printer and communications equipment shall be powered through an uninterruptible power supply (UPS) via a dedicated distribution system. The UPS shall provide for full functioning of this equipment for a minimum of four hours in the event of a power failure. UPS capacity shall be over-sized in terms of rating and power duration by 100% to provide for future additional equipment. UPS batteries shall be sealed lead acid maintenance free type.

The UPS distribution cable sheaths shall be of a colour which distinguishes them from other service cabling. Each master station device shall be provided with a local isolating device such as a fused spur or switched socket outlet.

3.15. Air conditioning Unit for Master station.

Air-conditioner of required capacity shall be provided at the Master Control Unit. The air conditioner shall be sized to maintain a temperature of 24 + 1 degree Celsius. 50% relative humidity insider at all time. Air conditioner and its part shall be constructed with the strength and rigidity adequate for normal conditions of handling, transport and usage.

4.0 MASTER-STATION SOFTWARE

4.1 General requirements

The Contractor shall provide all software and licenses, fully configured to accomplish the requirements of the Specification, including any supporting or configuration software used to generate the system.

The Contractor shall provide all necessary licenses to use all items of software on all processors in the system for the projected life of the installed system. All licenses shall be in the name of the Employer.

All software shall be standard, fully-debugged programs currently in use by the system supplier on similar systems. All software shall be of the most recent version and revision available at the completion of the Contract unless otherwise agreed by the Engineer. All software shall be fully-maintained by the Contractor throughout the Contract and warranty periods.

Contractor supplied enhancements to the operating system shall be accepted only if the following conditions are satisfied and demonstrated to the Engineer:

- The warranty validity shall not be affected.
- Upgrades, fixes and future releases of the operating system shall be implemented without modification to the application software.

The system shall be provided with a pre-emptive multi-tasking operating executive, capable of simultaneously executing multiple background tasks.

4.2 System security

The system shall be protected from unauthorised changes to the operating system and application programs.

The system shall prevent unauthorised users from re-booting the system or aborting or suspending system-related programs.

The system shall provide three levels of operator access to the system as a minimum, with the first level permitting access to viewing selected plant conditions as described below and the highest level intended for the system manager.

A mechanism shall be provided which prevents users operating at a lower level from accessing functions assigned to a higher level.

The system shall provide a password-protected, user log-on facility for definition of the user access level. Passwords entered during the log-on process shall not be printed or displayed. The system shall log the current user off after a definable extended period of no operator interaction with the system and produce a printed log-off message.

System-generated log messages relating to operator actions, such as alarm acknowledgements or set-point changes, shall include the identification of the current logged-on user.

The Contractor shall provide the following defined user access levels, unless otherwise instructed by the Engineer:

(a) Normal viewing only (default level):
The default level shall permit users to view all displays except those specifically assigned to a higher level of access.

(b) Daily access:
The daily access level shall allow viewing (ie default level) and printing of trend displays.

(c) Operator level (remote control):
The operator level shall permit authorised users to access lower levels and to carry out the following actions:

- perform control actions;
- acknowledge alarms;
- enter or modify manually-entered data for inclusion into reports.

(d) Monthly and yearly data archiving:
The level shall permit authorised users to access lower levels and shall provide the facility to down load specific data to long term data storage for archive purposes.

(e) System builder level:
The system builder level shall permit authorised users to access lower levels and to carry out and use the following facilities:

- modify alarm and control set points, dead bands and time delays;
- enter or modify historical data;
- add, delete or modify individual I/O points or point attributes;
- add, delete or modify field device configurations;
- create, delete or modify control algorithms;
- create, delete or modify graphic displays;
- create, delete or modify system reports;
- configure trend displays;
- access the operating system;
- perform any other system maintenance function.

(f) System administrator:
The system administrator level shall allow full access to the system (ie all lower levels) including the facility to view and assign user log-on access levels.

4.3 Signal processing

The system shall continuously receive data from the field devices, unless otherwise specified, such that a 'significant' change in field conditions shall be detected, processed and displayed by the system in less than 5 seconds. A 'significant' change is defined to mean any change of state of a discrete point or any change of an analogue point outside a definable deadband.

The scan rate to individual site units shall be configurable between 2 seconds and one hour with a 1 second resolution for local and directly connected remote site units and 5 minutes to 24 hours with a 5 minute resolution for GSM/GPRS/ BROADBAND connected site units.

A report by exception method for acquiring field data is acceptable. However, in this case, no change of an analogue variable outside a dead band, in percent of full span, shall go undetected by the system. A full scan of each field device shall take place at least every 30 minutes for site based communications and every 6 hours for GSM/GPRS/ BROADBAND connected sites.

An analogue or discrete input point shall be definable by the authorised operator from the master station as blocked, in which case the input value of the point shall not be scanned by the system. The operator shall be able to assign a fixed value to a blocked point. The O&M manual shall point out the risks associated with leaving points in the blocked condition. Defining a point as blocked shall be a system manager level function.

4.4 Alarm processing

The system shall process alarm conditions in the form of process abnormalities, field device failures, sequence faults, outstation system component malfunction and other configurable events. Alarm processing and display shall comply with the following as a minimum:-

(a) A minimum of two alarm priorities shall be provided to distinguish between critical and non-critical alarms. The Contractor shall define critical or non-critical status to all alarm conditions in the system, unless otherwise defined in the Specification, and shall submit these definitions for approval by the Engineer.

(b) An alarm acknowledgement function shall be provided. Acknowledged alarms where field conditions revert to normal (see also (c) below) shall clear. Unacknowledged alarms where field conditions revert to normal shall not clear until acknowledged. Alarm conditions which clear shall generate a log entry.

(c) An hysteresis band shall be definable for analogue points such that a change of value from an alarm condition to the normal condition will not clear the alarm until the value has crossed back over the limit value by at least the hysteresis bandwidth. A limit alarm shall not re-trigger unless the alarm has previously cleared.

(d) The system shall provide a convenient method for acknowledgement of alarms by the user. Systems requiring the user to type the point name of each point to be acknowledged are not acceptable. Each alarm acknowledgement shall be logged. The log entry shall include as a minimum the point identification, the time and date of acknowledgement, the operator identification and the type of alarm. If the Contractor provides a

'global' alarm-acknowledgement function as part of his standard package this function shall be assignable to any of the security access levels to prevent unauthorised usage.

(e) Each new alarm condition shall activate an audible alarm and generate an alarm log entry as specified in the clause entitled 'Alarm and event logging'. The audible alarm shall be able to be disabled through use of a keyboard function. This function shall be assignable to any of the security access levels to prevent unauthorised usage.

(f) Any alarm condition shall be designated as such on any dynamic display which depicts the process involved. Unacknowledged alarms shall be distinguishable from acknowledged alarms. Symbols for discrete alarm conditions shall change colour and/or the symbol itself shall change when an alarm condition is present.

(g) The system shall allow an authorised user to inhibit alarm processing for any desired analogue, discrete or calculated point. All other processing by the system of an alarm-inhibited point shall continue. The O&M manual shall point out the risks associated with leaving points in the alarm-inhibited condition. Defining a point as alarm-inhibited shall be a system manager level function.

(h) Limit alarms shall be definable for all analogue points for over range, extra high alarm, high alarm, low alarm, extra low alarm and under range. Over-range and under-range alarms shall be provided for all analogue points.

(j) A delay-before-alarm interval shall be definable for each analogue point such that an alarm condition is not registered until the current value remains outside alarm limits for a period of time exceeding the interval. Each discrete point designated as an alarm shall have a definable delay-before-alarm interval.

(k) A change of state of a discrete point shall be definable as either an alarm, a logged condition or information only. A change of state of a point designated as a logged condition shall generate a log entry but not an alarm event.

(l) Control alarms shall be generated whenever control actions are attempted by the system and no status is received by the system indicating that the requested action has taken place.

(m) The occurrence of an alarm shall be definable as an event which can be used by the system to trigger subsequent definable actions.

The processing specified in (b), (c), (h), (j) and (l) above shall take place in the field device unless otherwise approved by the Engineer.

4.5 Alarm and event logging

The system shall provide for the generation of a log of events detected by the system. Events to be logged shall minimally include: all alarm and alarm-clear conditions, all alarm acknowledgements by the operator, all changes of state of discrete points which have been designated as a logging condition, all user operations which cause a change in the data base including control actions.

Log entries associated with events detected by a field device shall include the date and time of occurrence as detected by the field device. Other types of log entry such as operator actions shall include the current date and time.

If the event is associated with a particular process variable, the log entry shall include:

- the point name and short description;
- the current state or value in engineering units;
- the current alarm status if appropriate; and
- a descriptive phrase of the event.

If the event is associated with a user operation, the entry shall include:

- the point name and short description;
- the operation;
- the operator identification;
- the previous state or value; and
- the new state or value.

An authorised user shall be able to inhibit logging through use of a user function. The alarm-logging-inhibited condition shall be defined as a non-critical alarm.

The system shall provide for display and/or printout of all logged events for the previous 1000 events. The user shall be able to page forwards and backwards through the event log display.

The user shall have the option of defining which items appear in the event display/printout with the following query conditions as a minimum:-

- Process area(s): define which process areas/sites are selected for inclusion.
- Point name(s): define which points are selected for inclusion.
- Date/time window: the earliest and latest date and time for which the events are to be included.
- Maximum: the maximum number of entries to be included.

4.6 Control commands

An authorised user shall be able to control the operation of each piece of controllable equipment and override each automatic control scheme through use of control commands at the VDU console. Each

command shall follow a sequence which requires operator confirmation of the command before the command is executed by the system.

Control and alarm parameters, such as set-points, shall be modifiable by an authorised user through use of commands at the VDU console. Parameters which are intended to be modified on a regular basis shall be modifiable through use of graphic mimic displays.

4.7 Calculations capability

The system shall be provided with calculations capability which allows the user to define calculated points, either discrete or analogue, for use in control and reporting. Actual discrete and analogue points as well as calculated points shall be usable in calculations. As a minimum, the following functions shall be provided:-

- arithmetic operations: add, subtract, multiply and divide;
- square root;
- absolute value;
- exponential (base e);
- natural logarithm;
- average, maximum and minimum values (from historical data);
- Boolean functions: AND, OR, NOT and exclusive OR;
- conditional function: IF... THEN;
- tests for equivalence, less than, greater than, zero, alarm status, out of range;
- dates and times.

The user shall be able to define the calculation to be performed through an interactive screen-based method, with on-screen syntax error checking.

The system shall permit the user to input data manually into calculated points during on-line operations.

4.8 Database definition

The system shall be supplied with an interactive database definition (DBD) utility. The DBD utility shall permit only authorised users to define, delete or modify elements of the system data base including but not limited to: point descriptions, field devices and communications network configuration.

The DBD utility shall prompt the user for required data on a step-by-step basis through use of VDU displays in a simplified 'fill in the blanks' format.

The DBD utility shall provide for the definition of the following points as a minimum:-

- analogue inputs;
- analogue outputs;
- 2-state status: indication from a two-state device;
- 3-state status: indication from a three-state device using two discrete inputs;
- pulse accumulator: maintains a pulse or rising-edge count for flow accumulation and
- kWh measurement, 'number of starts' tally and the like;

- calculated point: a discrete or analogue point whose value is derived from manual entry by the user or from other points using the calculation facilities described herein. It shall be necessary to manually enter a value once only;
- discrete outputs.

4.9 On-line data storage

The control system shall include automatic data logging, storage and retrieval of plant data, configuration information, alarms, events, operator commands, help pages, etc., to the disk system. This on-line archive store shall consist of the past 100 days worth of data to the following specification :

(a) All data logged or derived by the control system for a maximum of 2048 real or derived analogue data points. The resolution of storage of data values shall be according to user configurable selection and shall be either the same as or less than the scanning rate;

(b) All alarms and events logged or derived by the control system for a maximum of 6144 real or derived alarm/event points. The maximum size of the 100 day store shall be calculated and submitted to the Engineer for approval.

The on-line archives shall also provide the following functions:

(a) Generate system alarms, with configurable priority, as the hard disk becomes, 75%, 90% and full;

(b) A menu driven system with password protection of facilities for the management of the files on the disk, (eg. for off-line storage or deletion);

(c) All historical and event logs shall be in the form of rolling circular buffers or files, which shall operate over the periods specified above. Following this period the oldest data in the buffer or file shall be overwritten with new data.

4.10 Storage capacity

The size of the fast access, hard disk system shall be based on, but not be limited to, the sum of the storage required by each of the items identified below. The Contractor shall allow for any additional storage required due to the design offered.

(a) The computer operating system, which shall include disk space set aside for the following:
- Control system software and management;
- Swap space;
- Paging file space.
-

(b) Configuration data, which shall include:

- 8192 point/tag information;
- 40 report pro forma's;
- Programmable controller sequences as defined in tender documents;
- 80 help pages;
- Control system housekeeping information;
- 100 mimic background static displays.

(c) Plant dynamics:

- 100 days on-line archive store size to be based on logging data points at 15 minute intervals and having an alarm/event store with sufficient capacity to hold 15 changes of state/point/24 hour period;
- One month of reports;
- Statistical Process Control data;
- Space required for the retrieval of a 100 day file from off-line storage.

(d) Third party software:

- Database environment and executable code;
- Spreadsheet environment and executable code;
- Wood processor.

The control system shall be supplied with the spare capacity as defined elsewhere within this specification.

4.11 Data Exchange

The control system shall provide a method of real-time data exchange with the following application programs:

(a) Relational database
(b) Third party PC spreadsheet packages
(c) Report generation and graphical manipulation packages

The Contractor shall provide and demonstrate a method of exporting data on-line across a network using the control system, standard transport protocols and an open communications architecture, which is independent of the associated operating systems.

Data exchange with third party PC spreadsheet packages shall also be provided via USB Storage transfer.

This data exchange facility shall enable an 'untrained' user to select a set of archived data points over a selected time frame and then automatically create text files which can be exported onto USB Mass Storage disks. The requirement is for the user to be able to load these text files directly into a Microsoft excel spreadsheet software package. The data

exchange facility shall include, but shall not be limited to, the features described below:

(a) The user shall have access to all data points (of all types, i.e. analogues, digitals, system and derived points) across the whole control system from any operator workstation and shall be able create and amend a list of data points for export to the USB Storageto the user's workstation.

(b) The user shall be provided with the facility to select the signal name using wildcard text search facilities to quickly locate the input/output point name description. In addition the user shall be able to select the required time frame for the data.

(c) The time period at which analogue data shall be exported shall be the default archived data interval of 15 minutes. Event type data shall be exported with the time at which the change of state occurred.

(d) For each analogue signal selected, the user shall also be able to select any combination or all the statistical data options, e.g. instantaneous value, mean value, minimum value and maximum value.

(e) Facilities shall also be provided to enable the user to create, save, save as, delete, and re-name the export files. In addition the user shall be able to list the files stored on the hard disk and USB . It is also a requirement that the user is able to select the files on the hard disk that are required to be transferred to the USB disk.

(f) Warning messages shall be provided prior to exporting the data if the size of the file(s) exceeds the capacity remaining on the USB Drive.

4.12 Historical data management

An historical data management (HDM) system shall be provided for archive storage and retrieval of operational data comprising field input data, manually-entered data and calculated points.

Archived historical data shall minimally include averages, minima and maxima for each analogue value compiled over hourly, daily and monthly time periods, with a minimum capacity of 1000 points. The HDM system shall be capable of selectively increasing the rate of data capture based on events, such as process variable status, discrete inputs, or operator command. Minimum and maximum data shall include the time and date of occurrence. Gaps in collected data caused by faulty instruments or control system equipment shall not be included in average, minimum and maximum compilations. Archived historical data shall also include flow totals, equipment run times and number of starts compiled over daily and monthly time periods.

The HDM system shall provide for a minimum of three hundred and sixty-five (365) days of data to be on-line at all times. These data shall be kept

current such that the most recent data obtained by the system are available. These data shall be written automatically to archive storage media at least once every 24 hours.

A data-retrieval facility shall be provided which permits the operator to retrieve selected data for display or reporting. The stored data shall include a 'time stamp' to facilitate accurate retrieval.

A user interface to the HDM shall be provided which allows the definition of data to be stored, and entry or modification to either on-line or archived data. Access to the HDM user interface shall be security protected.

Full details of the HDM scheme proposed by the Contractor shall be submitted to the Engineer for approval.

4.13 Report generation

The system shall be provided with a report generator utility which shall enable authorised users to create, delete or modify report definitions. The report definitions shall allow for retrieval of data from the on-line database and from historical data files and for formatting the data for output to the printer.

The format of each report shall be definable by the user to include: the definition of static or background data, the placement of data base values, the number of significant digits of a value, the date and time of the report and calculated values.
Calculation capabilities of the report-printing facility shall include but not be limited to:

- arithmetic operations: add, subtract, multiply and divide;
- square root;
- absolute value;
- average, maximum and minimum values (from historical data) including time and date stamp;
- Boolean functions: AND, OR, NOT and exclusive OR;
- conditional function: IF ... THEN;
- date and time manipulation;
- tests for equivalence, less than, greater than, zero, alarm status, out of range.

The system shall also be provided with a report-scheduling facility for the calculation and printing of the report. Report printing shall be schedulable either on a definable periodic basis, at a specific definable time and date, or on demand via an operator command from the system console.

4.14 Graphic display generation

The system shall be provided with an interactive on-screen graphic generation utility which shall allow an authorised user to create new graphic displays and modify or delete existing displays at any workstation including those associated with the LCP/outstations. The generation utility shall include an interactive linkage process allowing the user to link symbolic, numeric and bar graph representations and data entry locations to dynamic data base variables.

The graphic display system shall be capable of making full use of the VDU resolution in the composition and display of graphic information.

Graphic symbols shall be definable by the user for display of static and dynamic data. The user shall be able to assemble a library of symbols which shall be retrievable into any graphic display.

Text and symbols shall be able to be enlarged, shrunk, moved, mirrored or rotated with reference to a given display.

The system shall be able to represent dynamic analogue data on a graphic display as a variable-length, sizeable bar graph, as well as numeric text.

4.15 Displays - general

All displays, excepting those containing data derived from historical files, shall be completely displayed within 2 seconds of the operator request. Dynamic data shall be continually updated while being displayed.

All screen displays shall as a minimum provide the following displays which are fixed in their locations to normal operations:

(a) alarm banner window at the bottom of the screen display showing the last three highest priority unaccepted alarms. Where the system allows the contents of the banner to be limited (eg by the user name or group) then the selection criteria applied shall be displayed with the banner;
(b) Main display area for user selected displays e.g. mimics, alarm lists, etc;
(c) System dialogue banner window at the bottom of the screen shall display relevant system information such as error message and user prompts;
(d) A day, date and time indicator shall be able to show local time.

An alarm banner area shall be included on all displays which provides information regarding the most recent alarm events. The system shall allow the operator to obtain details of the most recent alarm event from any operational screen display through direct operation using a maximum of two keystrokes or selections.

The system shall allow the operator to obtain a print of any display, including graphics through use of a standard system command. Screen displays shall appear identical in printed form. Dynamic data contained on a display shall not change during screen print such that a ‘snapshot’ of conditions is portrayed.

Each display shall include the time of day in hours, minutes and seconds and the date in day, month and year format.

A facility shall be provided which allows 'paging' to related displays through the use of 'page' forward or backward keys, or through the use of pick points.

4.16 Generic displays

The system shall produce various generic displays automatically. The minimum requirements for generic displays are outlined in the following paragraphs. In addition, an on-line interactive graphic display generator utility shall be furnished as described herein:

(a) Alarm summary:
Alarm summary displays shall be provided which can be quickly called up by the operator through a maximum of two key strokes. Alarms of both analogue and discrete conditions shall be presented on the same screen in reverse chronological order. Unacknowledged alarms shall appear in flashing mode. The alarm summary screen shall update automatically to reflect any changes. As a minimum, the point name and short description, the current state or value in engineering units and the type of alarm shall be indicated for each alarm.

Alarm entries associated with events detected by a field device shall include the date and time of occurrence as detected by the field device. Other types of alarm entry shall include the current date and time.

(b) Dynamic graphic trend display:
Dynamic graphic trend displays shall be similar in appearance to chart recordings with the variable(s) plotted against a definable timescale. Points which may be plotted shall include analogue, discrete and calculated points.
The displays shall be selectable for a single-point or a multiple-point presentation of a minimum of 4 points simultaneously, with colour coding and a legend. The points to be displayed shall be selectable by the operator. A minimum of 50 trend display definitions shall be maintained by the system and shall be automatically available upon system boot-up.

(c) Historical graphic trend display:
The historical graphic trend display shall conform to the specification of the dynamic trend display with the exception that data for trending shall be retrieved from historical files. The system shall extract data appropriately from either the on-line storage or from archive files. The system shall detect if the requested data is not present and prompt the user for the correct archive file.
Through use of a cursor, it shall be possible for the operator to select a point on the plot and obtain a numerical reading of the value and the time and date of that point.

(d) Alarm-inhibited summary:

This display shall list all points whose alarming has been inhibited (see 'signal processing').

(e) Blocked-point summary:
This display shall list all points which have been blocked (see 'alarm processing')

4.17 Non-generic displays

The system shall be provided with the following displays, which may be either generic or non-generic, i.e. configurable.

(a) System display:
The system display shall provide a list of all outstations with the current status of each, i.e. scan status, service status and communication status. This display shall update automatically whenever any related status condition changes.

(b) Process control display:
A screen display shall be provided to give a working understanding of each process control strategy in the system. These displays shall be configured for use by operations personnel. Modifications to the control parameters shall be able to be made through use of this display. Any modified parameters residing in an outstation shall be downloaded to the outstation by the system and an alarm shall be generated if this downloading fails to take place correctly. As a minimum, the following information shall be displayed as applicable for each process control strategy:

- equipment or process identification;
- current set-point value;
- control output;
- current controlled measured variable value;
- intermediate calculated values;
- associated points and parameters;
- alarm status (alarm/normal/inhibit);
- tuning parameters;
- control status (manual/off/auto);
- set-point, measured variable and output range;
- alarm limits;
- output limits.

All numeric values not having the same engineering unit as the variable itself shall be displayed along with the appropriate engineering unit designation. A control loop output which has reached the maximum or minimum output limit shall be indicated on the display.

Set-point, control parameter and alarm setting modification shall be prohibited by the system for unauthorised users.

(c) Sequential control displays:
A screen display shall be provided to give a working understanding of each sequential control strategy in the

system, as described above for process control displays. The sequence state shall be readily ascertainable from the display. Fault conditions for each state shall be indicated when appropriate with textual detail such that a clear understanding of the nature of the fault is conveyed. Provisions for operator abort of the sequence shall be available from this display.

(d) Graphic mimic displays:

Graphic mimic displays shall be configured by the Contractor, similar to process and instrumentation diagrams, which depict the current status of equipment and process variables and which update dynamically whenever a change is detected by the system.

The system shall provide a menu of all mimic displays, which allows an operator to choose one for display.

The graphic mimic displays which shall be supplied with the system are to include but not be limited to the following:

- an overall plant summary diagram showing the basic process groups;
- a diagram of each process;
- a diagram of each grouping of major equipment, such as raw water pumps, filters, clear water pumps, Booster pumps, etc

The diagrams shall depict layers of progressive detail such that the lowest level contains each measured variable and equipment status associated with the process or equipment group and that no diagram contains more data than can clearly and comfortably fit on a screen display. The Contractor shall submit reproductions or drawings of proposed mimic displays to the Engineer for approval before factory acceptance testing.

Any point shown in a display which is in an unacknowledged alarm state shall be shown in a contrasting colour or highlight and as flashing. A point in an acknowledged alarm state shall be shown in a highlighted or contrasting colour and steady state.

The mimic displays shall allow the operator to control any controllable equipment which is being displayed. The Contractor shall provide sufficient graphic mimic displays for complete monitoring and supervisory control of the system by an operator.

The Contractor shall use consistent standards for all displays for the following details:

- symbols and symbol colours;
- process lines and colours;
- point/tag name representations;
- dynamic conditions of analogue and discrete variables.

The Contractor shall submit details of these standards for approval by the Engineer prior to configuration.

(e) Manual entry point summary:
This display shall list all manual entry points defined in the system and the current value of each point. This display shall allow authorised users to enter data into the system. The display shall update dynamically to reflect any related changes.

4.18 Electronic mail facility

If specified, the system shall be provided with a fully functioning electronic mail package linked to operator log-in passwords at each workstation. The system shall include server and modem facilities for linking the electronic mail facilities with off-site locations such as the Employer's regional offices and headquarters. The electronic mail software package shall be from a major supplier of such software and approved by the Engineer. The Contractor shall include details of the system software, hardware and functionality in his tender.

4.19 User help facility

The system shall be provided with help messages and screens that can be called by the operator with a single key press at any time regardless of the function being performed.

In particular the help facility shall be available for alarms. In this case, when an alarm is selected from an alarm list, the system shall automatically make available a pre-defined alarm help page which the operator can display if required through a standard and simple action. For alarms associated with the control system itself rather than site operational alarms, these system help pages shall be configured by the Contractor.

In addition the system shall provide specific plant related help pages that are accessible through help buttons that are located on the plant/process mimics.

This shall take the form of the Works Operations Manual imported on to the WCS in HTML format.

This shall than be 澱ookmarked using 滴TML functions and links provided from both the process / plant mimics via help buttons, and also from appropriate alarms.

The Contractor shall install the system manuals onto the WCS. It shall be possible to view and print pages of the documentation "on demand".

5.0 SYSTEM RESILIENCE AND REDUNDANCY

The system shall be designed and implemented such that the failure of a central processor or VDU console does not inhibit continuous automatic control of the plant. In the event of such a failure, historical data shall be

recoverable to a condition where a worst-case maximum of 15 minutes of historical data is lost.

Failure of a single outstation or communications to that outstation shall not effect control or operation of any other outstation, unless the failed outstation provides essential data to another outstation, in which case the signals associated with the control or operation shall be hard-wired. If such a failure does affect the control of other healthy outstations, the non-failed outstations shall revert to a fail-safe/stay-put mode as appropriate.

Dual redundant communications circuit cards and cabling shall be provided and implemented such that automatic switch-over to the back-up communications system shall take place upon failure of the duty communication system. An alarm shall be generated whenever a communications system failure occurs.

5.1 Environmental Requirements

The equipment shall be required to operate in a variety of locations with a wide variety of environmental conditions. It shall do so independently of external sources of heating, ventilation and air conditioning. All equipment shall be suitable for continuous operation in the environmental conditions for Tamil Nadu State which are given elsewhere within this specification.

(a) Storage

Equipment shall be suitably packaged to meet the requirements of the specification with a storage temperature range of -40−C to +85−C.

(b) Transportation

Equipment shall be transported to site and off-loaded in such a manner as to ensure no damage can be incurred and that it shall be ready for immediate installation.

(c) Normal Operation

All control system equipment, peripherals and outstations/PLCs shall be suitable for operating continuously without degradation of performance over the following temperature and humidity ranges:

- Ambient Temperature +0−C to +40−C
- Humidity 5% to 95% RH

6.0 SYSTEM EXPANSION

6.1 General

The control system shall be capable of expansion in the areas defined while still meeting the performance criteria as defined within this specification.

6.2 Software

The control system shall provide facilities to transfer process data in real-time to proprietary software packages (e.g. spreadsheet, database) for

further analysis. These programs shall be able to operate in either a multi-tasking mode running on the control computer, or in an independent system connected via a serial link to the control system. The system shall support data exchange to other computer systems in flat ASCII format.

6.3 Hardware

6.3.1 Works Operations Centre

The control system shall provide expansion space to increase the Works Operations Centre hardware:

- User workstations, up to a maximum of 4 fixed and 2 portable;
- Printers, up to a maximum of 7;
- Serial data communication links (including multidrop types) up to an additional 4 over and above those specified.

6.3.2 Field

The control system shall offer easy to use facilities to increase the number of field mounted programmable controllers, scanning I/O units, etc., without taking the control system off-line. The system shall support equipment from a number of site and field unit suppliers and shall include the necessary interface software to enable the easy integration of other (including future) site units.

6.3.3 System Inputs/Outputs

The control system shall allow I/O expansion for connected site units as follows:

- At least 100% spare I/O channels of each type to be delivered in the basic scope supply which shall enable an immediate increase with no further purchase of hardware;
- At least 100% increase in I/O channels of each type to be achieved by fitting new cards into available card slots;
- At least 100% increase in I/O channels of each type to be achieved by the addition of new I/O cards slots to the system;
- The system shall be able to address and scan the total system I/O defined above without a reduction in performance.

6.4 Capacity

The installed capacity of the control system shall be greater than that required to meet this specification by the stated amount in the following areas, unless otherwise stated in the tender documents:-

- 40% control system computer memory;
- The on line disk shall be of sufficient size to meet the needs specified elsewhere.

For particular requirements for the test regimes to be used to prove the system performance, see the testing and installation section.

7.0 COMMUNICATIONS

The system shall communicate with outstations via one or more networks. Communications along the outstation network shall incorporate state-of-the-art error-detection schemes to ensure error-free data transmission. The communications protocol shall include repeated attempts at error-free transmissions before a network node is declared as failed. The system shall automatically initiate a 'health check' periodically on a failed node which has not been removed from the active node list in an effort to re-establish communications.

Communications network shall be by fibre optic or copper network, as specified.

Communication failure at any one network node shall not affect communications at any other node.

Failure of the central processor to communicate with an outstation shall generate a 'communication failure' alarm and an alarm log including the outstation name, date and time as a minimum. Repeated alarm events shall not be generated unless error-free communications are re-established and then fail again as described above. Communication system diagonistic software shall allow the interrogation of communication error statistics.

8.0 CONTROL ROOM FURNITURE

In addition to the control system equipment, the Contractor shall provide furniture to complement or match both the colour and styling of the equipment. Control room furniture shall comply with relevant IEC standards for ergonomic design. Details of the control room furniture shall be submitted to the Engineer for approval.

The Contractor shall provide fabric-covered upholstered swivel-type adjustable arm chairs with casters, a rigid and lockable steel cupboard for the storage of operating and maintenance manuals, drawings, logger paper, charts, disks and the like.

The visual display unit consoles or VDU desk shall incorporate at least one drawer unit with drawers for operators' use and for standard files.

9.0 TESTING AND INSTALLATION

Various tests outlined in this section supplement testing clauses elsewhere within sections of the Specification. Where any discrepancy or contradiction arises between these various sections of the Specification, the control system testing clauses shall take precedence and supersede those other testing clauses.

9.1 Deleted

9.3.4 Reliability test

After successful completion of the functional tests a 48-hour continuous run of the system shall be performed. The test shall be passed if no system function is lost or no hardware or software failure occurs. Hardware failure is defined for this test as the loss of a major component such as the computer, an outstation, a VDU or a peripheral device. Non-repetitive mechanical failures of loggers, push-buttons, etc are excluded.

During this test, the system shall be exercised with simulated inputs and conditions in a manner which approximates the on-site operational environment. Unstructured testing by the Engineer shall be included during this test. Upon any system failure during this period, it shall be the decision of the Engineer whether the reliability test is to continue or be aborted. If testing is allowed to continue any changes to the system which are required shall be described in a system-modification document, signed by both Contractor and Engineer and the document shall be incorporated into the final factory acceptance test documentation.

9.4 Installation

The system shall be delivered to the Site after the factory acceptance test is successfully completed and its completion is approved by the Engineer. Before any item of equipment is delivered to the Site, the Contractor shall satisfy himself that the mounting place and environment are ready for that item and that there are no conditions present which can in any way be damaging to the equipment. If such conditions exist, but it is advantageous to deliver the item to Site, the Contractor may, after approval of the Engineer, provide a store which gives a standard of environmental protection equal to or better than that intended when the Plant is operational and keep the equipment in the store until installation can proceed.

Throughout the period from delivery to Site until the issue of the Taking-over Certificate, the Contractor shall ensure that each item of equipment is safeguarded against any potentially detrimental condition. In particular, equipment doors, covers and the like shall be closed except when work on them is in progress.

As soon as possible after delivery to Site, the Contractor shall inspect each item of equipment for damage and shall report accordingly to the Engineer and carry out any required remedial work to the approval of the Engineer.

The Contractor shall ensure that installation and commissioning of control system equipment is co-ordinated with work in the same area by other trades.

The location at which each item of equipment is installed shall be as shown in approved drawings or as otherwise agreed with the Engineer. Each mounting position shall be chosen to give correct operation of the equipment, ease of operation, reading, maintenance and servicing, freedom from any condition which could have adverse effects and with particular regard to the safety of personnel and plant.

9.5 Pre-commissioning tests

The Contractor shall perform pre-commissioning, or preliminary, testing of the control system in accordance with that specified for instrumentation. The purpose of pre-commissioning tests is to confirm readiness of the system for commissioning.

The scope of pre-commissioning tests shall be generally as specified for factory acceptance tests but real field inputs and final control elements shall be used wherever practical to provide inputs to the system and to confirm proper outputs. Where this is impractical, simulation signals shall be injected as near as possible to their ultimate sources so as to include in the tests as much of the cabling system as possible.

Each process system shall be set to work under manual control and the system tested to confirm proper operation.

After proper operation of manual control mode has be verified, tests of automatic controls of each process system shall be conducted wherever practical.

9.6 Commissioning tests

The Contractor shall submit all relevant draft operating manuals for the control system to the Engineer for approval prior to commissioning tests. Any faults or failures of the system detected during the previous tests shall be noted and corrected to the satisfaction of the Engineer before commissioning is allowed to commence.

The control system shall be commissioned in accordance with procedures described elsewhere in this Specification, and subject to routine tests as required by the Engineer.

9.7 Availability test

As part of commissioning, the control system shall be tested for availability for a continuous period of 14 days. During this period, the system shall perform the normal functions according to the procedures described in the Contractor's documentation.

The system shall have passed the availability test if all major components have been free from fault or failure and exhibit full error-free functionality for 98% of the total duration of the test, unless otherwise agreed by the Engineer. Major components include all master station equipment, outstations, communications facilities and instrument panel components, excluding push-buttons, switches and lamps and any equipment not supplied by the Contractor.

During the availability test, no modifications to the system shall be made by the Contractor without the written approval of the Engineer. Erroneous functioning which requires software modifications or re-configuration to correct, other than set-point or parameter changes, shall constitute a failure of the availability test. Any changes to the system which are required and approved shall be described in a system-modification

document, signed by both Contractor and Engineer and the document shall be incorporated into the final test documentation. The test shall be restarted after corrections have been completed.

Contractor

Sd/-
Superintending Engineer, TWAD,

VENDORS LIST

SL.No	Description	Make
1	Butterfly valve	Kirlosker Brother Ltd. (KBL) Indian Valve Company (IVC) Engineering (FOURESS) L&T (Audco)(Fabricated) R & D Multiples (R & D) upto 1800mm Hawa Engineers Ltd. Size upto 1200mm.
2	MotorizedValve ActuatorsotorizedValve Actuators	Rotork/Limitork/Auma /Antrieb/MARSH/Sdtork
3	Air Conditioners (Split Casing Type and5 Star rating only acceptable)	Voltas Ltd. (VOLTAS) Amtrax Ambiences Ltd. (AMTREX) Blue Star Ltd.(BLUESTAR)
4	Programmable Logic Controller /RTU SCADA software	Allen Bradley/ABB/Tata Honeywell/ Siemens/ Schneider/GE
5	SCADA Software	Allen Bradley/ABB/Tata Honeywell/ Siemens/ Schneider

6 Electro-Magnetic Full Bore Type / FlowMeasuring Device (Flow Meter)
Endress & Hauser / Siemens / ABB /Krohne-Marshall./

7 Ultrasonic type Level measurement Endress and Hauser (E&H) / Siemens Millitronics /Krohne Marshall / Emerson./Hycontrols.

8 Pressure Measurement system (Transmitter)
Fisher rose mount (Emerson)/Foxboro / /ABB / E & H / Ritimeyer (JSK Engg) / Siemens

9 Panel mounted Graphic user interface.
Rockwell automation/ Siemens/Honey well / ABB /Schneider/GE

10 M.S.Plate Steel Authority of India Ltd. (SAIL)
Tata Iron & Steel Co.ltd. (TISCO) Jindal
Essar Steel Ltd. ISPAT Ltd.

11 Instrumentation Control Cable Delton/Asian Cable Corporation of IndiaLtd./Cable Corporation of India Ltd. /Associated CablesLtd./ Thermo Cables Ltd.

12 System integrator. Any system integrator of specified make of PLC/RTUwith manufacturer's endorsement .

13 Receiver/Indicator Masibus/ABB/Nishko/Lectrotek!Yokogawa/Blue

14 Lightning Protection Rittmeyer /MTL Instruments/Crompton Greaves/ P & F Phoneix

15 UPS/Inverter Power/Numeric Hi-Rel/ Nelco /Tata Libert / APC / Sukam/DB

16 Computer: / Scada server Compaq / Hewlett Packard / IBM/ ZENITH / LG / HCL DWLL/wipro / Philips/Samsung

Contractor

Sd/-
Superintending Engineer, TWAD,

17 Panel Enclosure & PC Consoler : Rittal /Enclotek /President/BCH/ELDON/Hoffmann/Fabionix

18 Printer Epson /Wipro / HP

19 Analog signal multiplyer Masibus/Pyrotech/Redik/MTL instrument/Mishko

20 Indicating lamps L&T / Siemens / GEC – Alsthom / IEC / Technik / Rass Controls

21 Push -Buttons L&T / BCH / Siemens / Technik / Rass /Schnider

22 Indicating meters AE / IMP / MECO / Rashibh (L&T) /Schnider

23 Terminal blocks Elmex / Wago (C&S)

24 Lighting fixture Philips / Bajaj / Crompton / Glolite Electricals

25 Miniature Circuit breaker MDS / GEC / S&S / Siemens / Schnider

26 Annunciators Minilec / Peacon / ICA

27 Load Manager(electronic) Enercon / AE / L&T / SEMS / Schnider / Masibus

28 Energy Meters (Electromech)Simco / GEC / IMP / Jaipur Meters / Meco/MasibusSchnider

29 Breaker Control /Selector switche EE / Kaycee / Siemens / Jyoti / Schnider

30 Outdoor combinedCT/PT unit for GEB - Metering Niksan / Varsha Engrs / Indian Transformer / Apex Electricals

31 Current, Voltage and Power Traducers ABB / Situ / Meco / AE

32 Starters L & T / Siemens / Telemechanic Controls (Schnider)

33 Cables CCI / Universal / Prime Cab/ Poly Cab/Lapp/Torrent/ Plaza / Finolex / Asian / Avocab

34 Cable glands Commet / SMI

35 Cable termination Dowells

36 Current / Potential Transformer Kappa / Silkans / Gilbert / AE / Precise /Kirloskar

37.Routers and switches: CISCO

38 VDU LG /Samsung / Sony/GE

Note :- Vendors / make for the above shall be based on following.

1.Should have proven track record in similar type of application.

2.Should be preferably ISO 9001 -2000 and should be a system integrator .

3.Shall be subject to approval by TWAD Board.

4.PLC system / SCADA software at headworks / Pumping station and at village level and Junction Point shall be of same make which is specified in tender document.

Contractor

Sd/-
Superintending Engineer, TWAD,

PERIODICITY OF SERVICING

Please find below exact periodicity of servicing needs for all the field devices.

1.	Level Transmitter	:	Once in 2 months
2.	Flow transmitter	:	Once in 3 months
3.	Actuators	:	Once in 3 months
4.	Valves	:	Lubrication to the raising spindle on weekly monitoring basis
5.	RTU/PLC Panel	:	Once in 6 months

Contractor

Sd/-
Superintending Engineer, TWAD,