

**OFFICE OF THE  
SUPERINTENDING ENGINEER  
WEST CIRCLE  
MUNICIPAL ENGINEERING DIRECTORATE  
PATAL BAZAR, 3RD FLOOR, TINKONA  
PURBA BARDHAMAN, PIN : 713101**



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**Memo No. :- MED/SE(W)/762 /W-268/2022**

**Dated:-03.03.2023**

## **NOTICE INVITING e-TENDER**

*Notice Inviting e-Tender No: 08 of SE (WC)/MED/2022-23.*

The Superintending Engineer, West Circle, Municipal Engineering Directorate, Patal Bazar, 3<sup>rd</sup> Floor, Tinkona, Purba Bardhaman, Pin 713101 invites sealed competitive Bid on Turnkey Basis (Two part System) from reliable and resourceful Companies / Firms / Contractors having experience and acumen in construction work as noted below the eligibility and depicted hereunder for participating in the e-Bid.

### **1) Name of the Work:-**

Surveying, investigation, Planning, Designing, Construction & commissioning of Collector well with a storage capacity for 5 minutes detention time for the demand of 72.87 ML at ultimate year, 48.72 MLD capacity infiltration gallery, foot way bridge, with pumping station of 16 hours operation, Supply & installation of suitable capacity Transformer, construction of Substation Building, Supplying & laying of 2 nos. M.S. Pipe line from Collector well to MS manifold line at the starting point of foot way bridge on the river bank and Supply & laying of DI pipe (K-9) from manifold line to the existing Ground Level Reservoir with necessary valves and accessories, boundary wall (if required), approach road, drain, necessary civil, electrical (according to Indian Electricity rules), mechanical & all other allied works at DAMRA for Jamuria area

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**INFILTRATION GALLERY, COLLECTOR WELL & ALONG WITH OTHER ALLIED WORKS AT DAMRA FOR JAMURIA AREA UNDER AMRUT 2.0 SCHEME WITHIN ASANSOL MC**

including yard lightening and internal illumination complete in all respect including satisfactory completion and commissioning, three (3) months trial run, necessary training of maintenance staffs & thereafter (subsequently) five (5) years operation and maintenance with security and guarding arrangement on turnkey basis within Asansol MC under AMRUT 2.0.

**2) Location of Work:- DAMRA for Jamuria Area, District Paschim Bardhaman.**

**3) Eligibility to participation of Bid:-**

Having experience and technical acumen in Surveying, design and execution / Construction and Completion of similar nature of work in a single contract having capacity of at least 19 MLD as stated below on turnkey basis during last five financial years in any Govt. / Board / Semi Govt. / Municipal Corporation / Statutory Authority /Govt. undertaking etc. organization including Civil & Electro Mechanical works

OR

Intending tenderers should produce credentials of one single running work of similar nature as stated below which has been completed to the extent of 80% or more and capacity of which is not less than the desired capacity (19 mld), as stated above .

Note: for running work, capacity will be considered as 80% of the allotted work which is due to be completed in future.

OR

Intending tenderers should produce credentials of 2 (two) similar nature of completed work as stated below, each of the minimum capacity of 14 MLD capacity during 5 (five) years prior to the date of issue of the tender notice.

Similar nature of works means-

- Infiltration Gallery with Radial Collector well and Construction of H.T. Substation and allied works including Civil & Electro Mechanical works.

Note: 1) if sub-station work is not covered by the bidder for above noted work in requisite credential, the bidder may submit separate supplementary credential certificate along with BOQ, work order of the Sub-station work.

AND

Having sufficient qualified technical personnel (to be employed under the firm for at least 3 consecutive years) with sound knowledge and experience in execution of similar nature of works.

AND

Having annual turnover of at least Rs. 30.00 Core or above in any one year of last five financial years.

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**AND**

**Bank solvency of not less than Rs. 10.00 Crore by the Banker during issued after the date of publication of the NIT.**

**AND**

**Having valid electrical HT license, GST, P. Tax clearance Certificates, PAN Card and Electrical supervisory license, ESI and PF registration certificates etc station work.**

**Note: a) The credential certificate for completed works / running work should contain (a) Name of work (b) Estimated Amount / Tendered amount, (c) Value of executed work (d) Date of Completion of project along with telephone number & detail address for communication of client must be indicated in the Credential Certificate.**

**AND**

**Particular of ownership / partnership or board of directors pertaining to the organization / company / firm.**

**AND**

**List of machineries & equipment necessary for fields and list of technical personals employed under the organization in details with name, qualification, experience and address with contact number.**

**AND**

**Corresponding address, fax & telephone numbers, contact mobile number and email number of the organization.**

#### **4) Documents to be produced in support of Credential for Bid:-**

**A successful performance and completion certificate supplemented with work order along with payment certificate issued by the competent authority, shall have to be furnished in support of credibility in terms with eligibility criteria depicted in this Notice (Ref: Sl. No. 3 : Eligibility to participate in the Bid). In brief the following documents shall have to be furnished:**

- a) Particulars of ownership / partnership or Board of Directors pertaining to the Organization / Company / Firm.**
- b) Copies of valid GST certificate, Electrical Supervisory license Certificate (HT & LT).**

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- c) Bank solvency Certificate
- d) Valid documents in support of annual Turnover.
- e) List of machines & equipment necessary for fields.
- f) List of Technical Personnel employed under the organization in details with names, qualification, experience and address with contact number.
- g) Corresponding address, fax & telephone nos. Contact mobile no. & Email no. of the Organization.

All documents in original to be produced in due course of time as & when asked by the Tender Inviting Authority

### **5) Earnest Money:-**

- a) 2% of the Quoted Bid price in two parts, vice. Rs. 25,00,000.00 (Rupees Twenty-five Lakhs only) as an initial Earnest Money with Bid Proposal and rest as mentioned below.
- b) Initial earnest money is to be deposited with bid proposal and may be remitted by selecting from either of the following payments modes:
  - i) **Net Banking:** (any of the banks listed in the ICICI Bank Payment Gateway) in case of payment through ICICI Bank Payment Gateway. Bank Acknowledgement Slip to be uploaded during online bid submission:
  - ii) RTGS / NEFT in case of offline payment through bank account in any bank and also to be documented through e-filling.
- c) Earnest Money Deposit i.e. 2% of bid amount beyond Rs. 25,00,000.00 (if any) shall have to be deposited after acceptance of Bid Proposal in the form of Bank Draft from any nationalised / scheduled Bank in favour of “Executive Engineer, Asansol Division, MED”, Payable at Asansol and/or as per direction of TIA.

Additional Performance Security Deposit @ 10% of the accepted amount is to be deposited in due course as per GoWB norms if the accepted amount to be found

to be @80% or less than the departmental justified amount in terms of GO No. 4608 f(Y) dated 18.07.2018.

**6) Date and time schedule:-**

Sl. No.	Particulars	Date & Time
1	Date of uploading of NleB. and Bid Documents (online) (Publishing Date)	03/03/2023
2	Date of Pre-Bid Meeting with the intending bidders In the office of the Superintending Engineer, West Circle, Municipal Engineering Directorate, Patal Bazar, 3rd Floor, Tinkonia, Purba Bardhaman, Pin 713101.	15/03/2023 at 1.00 p.m.
3	Documents download start date (Online)	04/03/2023 at 03.00 p.m.
4	Documents download end date (Online)	28/03/2023 at 03.00 p.m.
5	Bid submission start date (On line)	04/03/2023 at 04.00 p.m.
6	Bid Submission closing (On line)	28/03/2023 at 03.00 p.m.
7	Bid opening date for Technical Proposals (Online)	30/03/2023 at 4.00 p.m.
8	Date of uploading list for Technically Qualified Bidder (online)	To be notified later
9	Date for opening of Financial Proposal (Online)	To be notified later
10	If necessary for further negotiation through off line for final rate	To be notified later

**7) Cost price of Bid Document:- “Nil”**

**8) Time of completion:-**

Time of completion of the Contract is 480 days from the date of issue of Work Order.

**9) Site inspection & general information:-**

Intending Bidders are required to inspect the site of the Project with particular reference to location and infrastructure facilities. They are to make a careful study of all relevant data with regard to availability of Sufficient Quantum of Water as per the

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Requirement for the project and all relevant factors as might affect the rates and prices. They should make themselves acquainted with the relevant IS specifications, CPHEEO manuals, Clauses & Sub Clauses of the Bid documents and to have fully acquainted with all details of work front, communications, underground utility services, seasonal weather and its variation including High Flood level, labour, water supply, existing & proposed site levels, position and diversion of transportation and barricading if required, electricity and any other general information including topological condition & existing level which are needed for the work to be completed in scheduled time properly.

The work as mentioned in the scope of work in Turnkey nature job. Any work which is not mentioned in the scope of work but is required to complete the job within the limit of contract, the same has to be done by the bidder without any extra claim. So, the participating bidder should survey the site properly before making any offer

#### **10) Bid documents:-**

A full set of Bid documents consists of 2 Parts. These are;

a) Part I containing all documents in relation to the name of the firm applied credentials possessed by them, all documents as depicted in Sl. No. 4 along with this NleB and its all corrigenda's.

**AND**

**Section A: Description of the Project.**

**Section B: Conditions & requirements for Bidding.**

**Section C: General conditions of the contract.**

**Section D: Special provisions.**

**Section E: General specifications of Workmanship & materials for Civil Works.**

**Section F: General technical specification.**

**Section G: Detailed Technical Specification for Civil works for Intake Jetty Pumping Station with HT Substation**

**Section H: General Technical Specification for RCC pile foundation**

**Section I: Technical Specification of Pumps.**

**Section j: Mechanical works**

**Section K: Motor Control Panel**

**Section L: Electrical Motor Works**

**Section M: Specification of Substation Building**

**Section N: Laying of Rising Main**

**Section O: Annexures**

- i. Soil/Sand investigation
- ii. List of documents to be furnished
- iii. List of tools / Electrical equipment.
- iv. List of vendors
- v. List of deviation
- vi. Hydraulic survey report
- vii. Site Plan

b) Part II containing following documents; Bid Price / Price Schedule (BOQ).

**11) Validity of Bid:-**

A Bid submitted shall remain valid for a period of 120 calendar days from the date set for opening of Bids. Any extension of this validity period if required will be subject to concurrence of the Bidders.

**12) Withdrawal of Bid:-**

A Bid once submitted shall not be withdrawn within the validity period. If any Bidder/Bidders withdraw his / their Bid(s) within the validity period then Earnest

Money as deposited by him / them will be forfeited and necessary legal action will be applied as per Govt. order.

**13) Acceptance of Bid:-**

The Superintending Engineer, West Circle, Municipal Engineering Directorate will accept the Bid on recommendation of the Competent Authority. He does not bind himself to accept otherwise the lowest Bid and reserves to himself/herself the right to reject any or all of the Bids received without assigning any reason thereof.

**14) Intimation:-**

The successful Bidder will be notified in writing of the acceptance of his Bid. The Bidder then becomes the “Contractor” and he shall forthwith take steps to execute Formal Contract Agreement in appropriate Superintending Engineer, West Circle, Municipal Engineering Directorate and fulfil all his obligations as required by the Contract.

After the Bid is provisionally accepted, the Bidder shall submit detail Design, Drawing and working specifications phase wise based on existing site condition & proposed levels at site. If it is found technically correct and acceptable with proper examination by the Superintending Engineer (West Circle), M.E. Dte. & Chief Engineer / Superintending Engineer, (E/M), K.M.D.A. Provisional approval of the submitted drawings will be accorded phase wise for execution. Eventually, all the parts, Design, Drawings etc. of the successful Bidder shall be taken as a part of the agreement.

**15) Escalation of Cost:-**

There will be no escalation in cost for materials or labour and the contract price mentioned in the contract stands valid till completion of the operation and maintenance of the contract.

**15) Name & address of Engineer-In-Charge (EIC) of the Work**



Executive Engineer, Asansol Division, M.E. Dte. and For Electro Mechanical Work  
Executive Engineer (E/M) M.ED.

**17) Execution of Work:-**

The Contractor is liable to execute the whole work as per direction and instruction of the Executive Engineer, Asansol Division, M.E.Dte. and For Electro Mechanical Work Executive Engineer (E/M) MED. who are the Engineer in Charge of the work.

**18) Payment:-**

Payment will be made to the successful Bidder from the Executive Engineer, Asansol Division, M.E.Dte.

**19) Influence:-**

Any attempt to exercise undue influence in the matter of acceptance of Bid is strictly prohibited and any Bidder who resorts to this will render his Bid liable to rejection.

<b><u>FOLLOWING CLAUSES ARE TO BE ADHERING TO BY THE CONCERNED BIDDER DURING THE PROCESS OF BIDDING.</u></b>	
19.	In case office faces sudden closure owing to reason beyond the scope and control of the Superintending Engineer, West Circle, Municipal Engineering Directorate any of last date / dates as schedule in Sl. No 7 may be extended up-to / to next and following working day without issuing further and separate notice should the TIA feel it to be necessary and exigent.
20.	Persons having authenticated and having registered Power of Attorney may be considered lawfully becoming to be acting on and for behalf of the Bidder.
21.	Sufficient care has been taken to avoid variance in between the contents of the listed documents in the Bid documents. However, if there is any variance between the contents of different documents, the provision of documents appearing earlier in the list shall prevail over the same provided in the contents coming later.

22.	Imposition of any duty / tax / rule etc. owing to change / application in legislations / enactment shall be considered as a part of the contract and to be adhering to by the Bidder / contractor strictly.
23.	Bid Acceptance Authority is the Superintending Engineer, West Circle, Municipal Engineering Directorate.
24.	In case of any dispute arising from any clauses of similar nature between bid documents and Municipal tender form, the decision of the Superintending Engineer West Circle, MED and Engineers of E/M Section of MED will be final and binding.
25.	All usual deductions for GST, IT, and Labour welfare Cess etc. as applicable will be made from the bills from time to time which is inclusive in cl.57 of section C.
26.	No conditional / incomplete Bid shall be entertained.
27.	In the event of e-Filing intending bidder may download the tender document from the website <a href="http://wbtenders.gov.in">http://wbtenders.gov.in</a> directly by the help of Digital Signature Certificate free of cost. Technical Bid & Financial Bid both will be submitted concurrently duly digitally signed in the Website <a href="http://wbtenders.gov.in">http://wbtenders.gov.in</a> . Tender document may be downloaded from website & submission of Technical Bid/Financial Bid as per Tender Schedule.
28.	The requisite cost of Earnest Money, as specified in this NleB shall be paid to ICICI bank by online internet bank transfer or NEFT or RTGS in favour of Asansol Municipal Corporation (as per GO No. 3975-F(Y) dt. 28.07.2016 of Finance Department, Govt. of West Bengal). Every such Transfer shall be done on or after the date of publish of NleB. Any Bid without such Transfer of EM (Except exemption as per G.O.) shall be treated as informal and shall be automatically cancelled. Online transfer of Earnest Money receipt (Scanned copy) shall be uploaded as Statutory document.
29.	The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the site of works and its Surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for the work as mentioned in the Notice inviting Tender, the cost of visiting the site shall be at the Bidder's own expense. Traffic management and execution shall be the responsibility

	of the Agency at his / her / their risk and cost.
30.	The intending Bidders shall clearly understand that whatever may be the outcome of the present invitation of Bids, no cost of Bidding shall be reimbursable by the Corporation. The TIA reserves the right to reject any application for purchasing Bid documents and to accept or reject any or all the offered bid / bids without assigning any reason whatsoever and is not liable for any cost that might have incurred by any Bidder at any stage of Bidding.
31.	Prospective applicants are advised to note carefully the minimum qualification criteria as mentioned in 'Instructions to Bidders' before bidding.
32.	During scrutiny, if it is come to the notice to tender inviting authority that the credential or any other papers found incorrect / manufactured / fabricated, that Bidder will not be allowed to participate in the tender and that application will be out rightly rejected without any prejudice.
33.	Before issuance of the work order, the tender inviting authority may verify the credential & other documents with the original of the lowest bidder if found necessary. After verification, if it is found that such documents submitted by the lowest bidder is either manufacture or false, in that case, L.O.A. / work order will not be issued in favour of the bidder under any circumstances.
34.	If any discrepancy arises between two similar clauses on different notifications, the clause as stated in later notification will supersede former one in following sequence: i) Form 2911 ii) NleB iii) Special terms & Condition iv) Technical bid v) Financial bid
35.	Contractor shall have to comply with the provisions of (a) the contract labour (Regulation Abolition) Act. 1970 (b) Apprentice Act. 1961 and (c) minimum wages Act. 1948 of the notification thereof or any other laws relating thereto and the rules made and order issued there under from time to time.

36.	Where an individual person holds a digital certificate in his own name duly issued to him against the company or the firm of which he happens to be a director or partner, such individual person shall, while uploading any tender for and on behalf of such company or firm, invariably upload a copy of registered power of attorney showing clear authorization in his favour, by the rest of the directors of such company or the partners of such firm, to upload such tender. The power of attorney shall have to be registered in accordance with the provisions of the Registration Act, 1908.
37.	Any legal matter will be settled within the jurisdiction of Hon'ble District Judges Court at Purba Bardhaman, Dist:- Purba Bardhaman, West Bengal.
38.	Bidder would be at liberty to point out any ambiguities, contradictions, omissions etc. seeking clarifications thereof or interpretation of any of the conditions of the Bid documents before the Bid Inviting Authority in writing 48 hours prior to Pre Bid Meeting, beyond such period no representation in that behalf will be entertained by the Bid Inviting Authority.
39.	The successful Bidder will remain liable for following with West Bengal Contract Labour (Regulation & Abolition) Act 1970 and necessary certificates from appropriate authority to be submitted within 07 (seven) days from the date of issue of work order, otherwise the work order may be cancelled.
40.	<p>Operation &amp; maintenance: (Sl. No. 18) Operation and maintenance including supply of all accessories of the same for a period of 60 (Sixty) months after the completion of specified period of Successful Trial Run 3 months.</p> <p>The work is of maintenance in nature, the Defect Liability Period of the work shall be Sixty months from the actual date of completion of the work i.e. after three months Trial Run.</p> <p>For work with 5 Years Defect Liability Period:</p> <p>(i) Security Deposit amount which is deducted from every running bill shall be refunded to the contractor as per Govt. norms vide PWD Order No. 5784-PW/L&amp;A/2M-175/2017 dated 12.9.2017 for the item 1 of BOQ.</p> <p>(ii) The Maintenance and operation cost as per BOQ item No. 2 shall be paid after satisfactory completion of work per annum basis for 5 years and as per payment break up schedule.</p>

	(iii) S.D. Money shall be refunded after completion of success full maintenance and operation of 5 Years i.e. in the time of releasing of 5 <sup>th</sup> year operation & maintenance cost.
41.	The successful bidder has to provide detailed estimate along with rate analysis (if any) for all civil and electro mechanical works including planning, designing and drawings as per the clause 57 of Section C with all necessary break up elaborately for comparison of rate with departmental estimate if asked by the concerned authority before acceptance of bid which will be treated as part of the bid document.
42.	Clause 57 of Section C has been prepared on the basis of major items of the work so that contractor may get payment after completion of major items in a phase wise way . If any item the contractor feels as major item but not reflected in the clause will be pointed out during pre-bid meeting. All other items (if any) not shown in the payment schedule or in bid document but required for successful completion and commissioning of the project will be in the scope of Bidder.
43.	Agency's whole responsibility is to ensure that the require quantum of the water should available from the structure and for this extensive survey work to be done in all respect.
44.	If there is any contradiction between any clauses of the NieB, decision of the Superintending Engineer, West Circle, MED will be final.

**Superintending Engineer, West Circle,  
Municipal Engineering Directorate  
Patal Bazar, Tinkona, Purba Bardhaman.**

## **INSTRUCTION TO BIDDERS/BIDDERS**

### **SECTION – A**

#### **1. General guidance for e-tendering**

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**INFILTRATION GALLERY, COLLECTOR WELL & ALONG WITH OTHER ALLIED WORKS AT DAMRA FOR JAMURIA AREA UNDER AMRUT 2.0 SCHEME WITHIN ASANSOL MC**

Instructions / Guidelines for Bidders for electronic submission of the tenders have been annexed for assisting them to participate in e-tendering.

## ***2. Registration of Bidder***

Any Bidder willing to take part in the process of e-tendering will have to be enrolled and registered with the Government e-procurement system, through logging on to <http://wbtenders.gov.in>. The Bidder is to click on the link for e-tendering site as given on the web portal.

## ***3. Digital Signature certificate (DSC)***

Each Bidder is required to obtain a class-II or Class-III Digital Signature Certificate (DSC) for submission of tenders, from the service provider of the National Information's Centre (NIC) or any other bonafide service provider on payment of requisite amount. Details are available at the Web Site stated in Clause 2 of Guideline to Bidder. DSC is given as a USB e-Token.

4. The contractor can search and download NIB and Tender Documents electronically from computer once he logs on to the website mentioned in Clause 2 using the Digital Signature Certificate. This is the only mode of collection of Tender Documents.

## ***5. Submission of Tenders.***

General process of submission, Tenders are to be submitted through online to the website stated in Cl. 2 in two folders at a time for each work, one in Technical Proposal and the other is Financial Proposal before the prescribed date and time using the Digital Signature Certificate (DSC) the documents are to be uploaded virus scanned copy duly Digitally Signed. The documents will get encrypted (transformed into non readable formats).

### **A. Technical proposal**

The Technical proposal should contain scanned copies of the following further two covers (folders).

***A-1. Statutory Cover Containing***

**1. Prequalification Document**

**i. Prequalification Application (Sec-B, Form – I)**

**ii. Scanned Copy online Transaction of earnest money**

**(EMD) as prescribed in the NleB against each of the serial of work in favour of “The TIA, Asansol Municipal Corporation,” payable at Asansol.**

**2. NleB with Bid Documents (downloads and upload the same Digitally Signed)**

**3. Technical Document (*To be filled, scanned & digitally signed*)**

**i. Financial Statement (Section – B, Form – II).**

**ii. Affidavits( (Ref:- format for general affidavit shown in “Y” Part “B”. )**

**iii. Bank Solvency Certificate.**

**iv. Form III & IV Of Section B.**

***A-2. Non statutory Cover Containing / My Documents***

**i. GST Certificate (up to date).**

**ii. Registration Certificate under Company Act. (if any).**

**iii. Registered Deed of partnership Firm/ Article of Association and Memorandum**

**iv. Power of Attorney (For Partnership Firm/ Private Limited Company, if any)**

- v. Tax Audit Report along with Balance Sheet and Profit and Loss A/c for the last five years(year just preceding the current Financial Year will be considered as year – I)
- vi. Clearance Certificate for the Current Year issued by the Assistant Registrar of Co-Op (S) (ARCS) bye laws are to be submitted by the Registered labour Co-Op(S) Engineers' Co.-Opt.(S).
- vii. List of machineries possessed by own/arranged through lease deed along with authenticated documents of lease / sub-lease / hire basis etc.
- viii. List of laboratory Instrument.
- ix. List of technical staff along with structure and organization (Section – B, Form – III).
- x. Credential: Scanned copy of Original Credential Certificate as stated in NleB

Note: - Failure of submission of any of the above mentioned documents (as stated in A1 and A2) will render the Bid liable to be summarily rejected for both statutory and non statutory cover.

**INTENDING BIDDERS SHOULD UPLOAD NON-STATUTORY DOCUMENTS AS PER FOLLOWING FOLDERS IN MY DOCUMENT:**

E-Bidding system of



**Government of West Bengal****Bidder Document Sub Category Master**

<b>Sl. No.</b>	<b>Category Name</b>	<b>Sub Category Name</b>	<b>Sub Category Description</b>
<b>A</b>	<b>CERTIFICATES</b>	<b>A1. CERTIFICATES</b>	<b>1. GST Certificate 2. Valid Electrical License 3. E.S.I Registration Certificate.</b>
<b>B</b>	<b>COMPANY DETAILS</b>	<b>B1. COMPANY DETAILS</b>	<b>1. Proprietorship Firm (Trade License). 2. Registered Deed of partnership Firm 3. Registration Certificate under Company Act. (if any). Ltd. Company (Incorporation Certificate, Trade License) 4. Power of Attorney (For Partnership Firm / Private Limited Company, if any) 5. Society (Society Registration copy, Trade License)</b>
<b>C</b>	<b>CREDENTIAL</b>	<b>C1. CREDENTIAL1</b>	<b>Similar nature Work &amp; Completion Certificates along with work order and payment certificate issued by competent authority (as per Sl. No. 3 of NleB)</b>
<b>D</b>	<b>EQUIPMENT</b>	<b>D1. LABORTARY</b>	<b>1. List of Machineries and equipment necessary for field as well as laboratory test of all materials as per NleB</b>
		<b>D2.CIVIL MACHINERIES</b>	
		<b>D2. ELECTRICAL MACHINERIES</b>	
		<b>D2. MECHNANICAL MACHINERIES</b>	
		<b>D2. MISCELLENEOUS MACHINERIES</b>	
<b>E</b>	<b>FINANCIAL INFO</b>	<b>E1. P/L &amp; BALANCE SHEET 2011- 2012</b>	<b>P/L &amp; BALANCE SHEET (as per NleB)</b>
		<b>E2. PAYMENT CERTIFICATE 1</b>	<b>Payment Certificate in support of valid Credential only to be submitted</b>

		<b>E3 PAYMENT CERTIFICATE 2</b>	
<b>F</b>	<b>MANPOWER</b>	<b>F1. TECHNICAL PERSONNEL</b>	1. List of sufficiently qualified technical person (as per SI No 3 of NleB)
		<b>F2. TECHNICAL PERSONNEL ON CONTRACT</b>	1. List of technical personnel employed under the organisation (or on contact basis) in details with name, qualification, experience and, address with contact number.
<b>G</b>	<b>DECLARATION</b>	<b>DECLARATION 1</b>	1. Bank Solvency Certificate (As per NleB)
		<b>DECLARATION 2</b>	2. Valid Document in support of annual turnover as per NleB.
		<b>DECLARATION 3</b>	3. Corrigendum and additional document (if any).

**Note:-** Failure of submission of any of the above mentioned documents (as stated in A1 & A2) will render the Bid liable to summarily rejected for both statutory & non statutory cover. All Corrigendum & Addendum Notices, if any, have to be digitally signed & uploaded by the contractor in the Declaration Folder of My Documents.

**B. Bid Evaluation**

i. Opening and evaluation of Bid :- If any Bidder is exempted from payment of EMD, copy of relevant Government order needs to be furnished (applicable in case of Registered Labour Co-Operative Society).

ii. Opening of Technical proposal: - Technical proposals will be opened by the Bid Inviting Authority electronically from the website using his/ her Digital Signature Certificate.

iii. Cover (folder) of statutory documents (vide Cl. No. 5.A-1) should be opened first and if found in order, cover (Folder) for non-statutory documents (vide Cl. No.– 5.A-2) will be opened. If there is any deficiency in the statutory documents the Bid will summarily be rejected.

iv. Decrypted (transformed in to readable formats) documents of the non-statutory cover will be downloaded and handed over to the Bid Evolution Committee. Scrutiny of technical proposal and recommendation thereafter and processing of comparative statement for acceptance etc. will be made by the Municipal Engineering Directorate, under the department of Municipal Affairs, Govt. of West Bengal. Comparative Statement may be forwarded to appropriate authority depending on the value of the work as applicable as per existing norms and guidelines under AMRUT programme.

v. Uploading of summary list of technically qualified bidders.

vi. Pursuant to scrutiny and decision of the screening committee the summary list of eligible Bidder and for which their proposal will be considered and uploaded in the web portals.

vii. While evaluation, the committee may summon the bidders and seek clarification / information or additional documents or original hard copy of any of the documents already submitted and if these are not produced within the stipulated time frame, their proposals will be liable for rejection.

### **C. Financial proposal**

As per Sl. 9 Part II (a) , Bid Price / Price Schedule. To be uploaded digitally signed by the Bidder.

6. Financial capacity of a Bidder will be judged on the basis of working capital and available bid capacity as mentioned in the N.I.T. to be derived from the information furnished in FORM-I and II (Section-B) i.e., Application (for Pre-qualification) and Financial Statement. If an applicant feels that his / their Working Capital beyond own resource may be insufficient, he/they may include with the application a letter of

guarantee issued by a first class Bank to supplement the applicant. This letter of guarantee should be addressed to the Tender Inviting / Accepting Authority and should guarantee duly specifying the name of the project that in case of contract is awarded to the Bidder, the Bidder will be provided with a revolving line of credit. Such revolving line of credit should be maintained until the works are taken over by the Authority.

The audited Balance sheet for the last five years, net worth bid capacity etc. are to be submitted which must demonstrate the soundness of Bidder's financial position, showing long term profitability including an estimated financial projection of the next two years.

**7. Penalty for suppression / distortion of facts:**

Submission of false document by Bidder is strictly prohibited and in case of such act by the Bidder the same may be referred to the appropriate authority for prosecution as per relevant IT Act with forfeiture of earnest money forthwith.

**8. REJECTION OF BID**

The Employer (tender accepting authority) reserves the right to accept or reject any Bid and to cancel the Bidding processes and reject all Bids at any time prior to the 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 ground for Employer's (tender accepting authority) action.

The Bidder who's Bid has been accepted will be notified by the Tender Inviting and Accepting Authority through acceptance letter/ Letter of acceptance. The Letter of acceptance will constitute the formation of the Contract.

The Agreement in Printed Tender Form will incorporate all necessary documents e.g. N.I.B., all addenda-corrigendum, special terms and condition (Section –C), different filled-up forms (Section –B), Price Schedule and the same will be executed between the Tender Accepting Authority and the successful Bidder.

**Superintending Engineer, West Circle,  
Municipal Engineering Directorate**

**SECTION – B  
FORM –I  
PRE-QUALIFICATION APPLICATION**

To  
Superintending Engineer, West Circle,  
Municipal Engineering Directorate

Ref: - Tender for \_\_\_\_\_

(Name of work) \_\_\_\_\_ N.I. B. No.:

Dear Sir,

**21**

**INFILTRATION GALLERY, COLLECTOR WELL & ALONG WITH OTHER ALLIED  
WORKS AT DAMRA FOR JAMURIA AREA UNDER AMRUT 2.0 SCHEME WITHIN  
ASANSOL MC**

Having examined the Statutory, Non statutory and NIT documents, I /we hereby submit all the necessary information and relevant documents for evaluation. The application is made by me / we on behalf of \_\_\_\_\_ in the capacity \_\_\_\_\_ duly authorized to submit the order.

The necessary evidence admissible by law in respect of authority assigned to us on behalf of the group of firms for Application and for completion of the contract documents is attached herewith. We are interested in bidding for the work(s) given in Enclosure to this letter. We understand that:

(a) Tender Inviting and Accepting Authority/Engineer-in-Charge can amend the scope and value of the contract bid under this project.

(b) Tender Inviting and Accepting Authority/Engineer-in-Charge reserves the right to reject any application without assigning any reason.

Enclose: - e-Filling:-

1. Statutory Documents
2. Non Statutory Documents

Date: -

Signature of applicant

Including title and capacity in which application is made.

**SECTION - B**  
**FORM - II**  
**FINANCIAL STATEMENT**

B.1 Name of Applicant:

B.2 Summary of assets and liabilities on the basis of the audited financial statement of the last five financial years.

(Attach copies of the audited financial statement of the last five financial years)

	1st Year  (Rs. In lakh)	2nd Year  (Rs. In lakh)	3rd Year  (Rs. In lakh)	4th Year  (Rs. In lakh)	5th Year  (Rs. In lakh)
<b>a) Current Assets :</b>  (It should not include investment in any other firm)					
<b>b) Current liabilities :</b>  (It should include bank over draft)					
<b>c) Working capital :</b>  (a) – (b)					
<b>d) Net worth : (Proprietors Capital or Partners Capital or Paid up Capital + Reserve and surplus )</b>					
<b>e) Bank loan/ Guarantee :</b>  (As per clause G.2. with all sub clauses)					

Work in hand i.e. Work order issued	As on 31.03.2022	As on 31.03.2021	As on 31.03.2020	As on 31.03.2019	As on 31.3.2018

Signed by an authorized officer of the firm

\_\_\_\_\_

Title of the officer

\_\_\_\_\_

Name of the Firm with Seal

Date \_\_\_\_\_



**AFFIDAVIT "Y"**

**DECLARATION OF THE BIDDER**

(Affidavit to be affirmed on a Non Judicial Stamp Paper of Appropriate Value And Duly Notarized)

I, ....., son of  
....., aged about  
..... years by occupation ..... do hereby  
solemnly affirm and confirm as follow:

1. That, I am the ..... of  
..... have duly authorized by and competent to affirm this  
affidavit on behalf of the said Bidder.

2. That, I have inspected the site of work covered under NIB (NIB No\_\_\_\_\_)  
circulated through Office memo bearing No -----dated ----- and have  
made myself fully acquainted with the site conditions existing level/proposed level and  
local conditions in and around the site of work. I have also carefully and meticulously  
gone through the Bid documents. Bid of the above named Bidder is offered and  
submitted upon due consideration of all factors and if the same is accepted, I on and for  
behalf of the aforesaid Bidder, being lawfully and duly authorized, promise to abide by all  
the covenants, conditions and stipulations of the Contractual documents and to carry  
out, complete the works to the satisfaction of the Bid accepting Authority of the Work  
and abide by all instructions as may given by the Engineer in Charge of the work time to  
time. I also hereby undertake to abide by the provisions of Law including the provisions

of Contract Labour (Regulation & Abolition) Act, Apprentice Act 1961, GST Act as would be applicable to the Contractor upon entering into formal Contract / agreement with the Bid Inviting/Accepting authority.

3. That I declare that, no relevant information as required to be furnished by the Bidder has been suppressed in the Bid documents.

4. That the statement above made by me is true to my knowledge.

Deponent

Solemnly affirmed by the said

.....

Before me.

.....

(1st class Judicial Magistrate / Notary Public)

**SECTION - B**

**FORM- III**

**STRUCTURE AND ORGANISATION**

**A.1 Name of applicant:**

**A.2 Office Address:**

**Telephone No. and Cell Phone No. :**

**Fax No. :**

**E mail id:**

**A.3 Attach an organization chart showing the structure of the company with names of Key personnel and technical staff with Bio-data. :**

**Note: Application covers Proprietary Firm, Partnership, Limited Company or Corporation,**

**Signature of applicant including title**

**and capacity in which application is made.**

**SECTION -B**

**FORM - IV**

**DEPLOYMENT OF MACHINERIES (IN FAVOUR OF OWNER / LESSEE):-**

(Original document of own possession arranged through lease deed to be annexed)

(If engaged before Certificate from E.I.C. to be annexed in respect of anticipated dated of release of Machineries.)

Name of Machine / Instrument	Make	Type	Capacity	Motor / Engine No.	Machine No.	Possession Status		Date of release If Engaged
						Idle	Engaged	

For each item of equipment the application should attach copies of

- (i) Document showing proof of full payment, (ii) Receipt of Delivery,
- (iii) Road Challan from Factory to delivery spot, is to be furnished.

Signature of applicant including title  
and capacity in which application is made.

Successful agency shall have to make an agreement (in two copies) with the Superintending Engineer, west Circle, Municipal engineering directorate in the prescribed pro-forma by depositing requisite cost in cash stating that the agency is agreeable to supply the Pipe materials as and when require (as per the rates quoted and terms and conditions laid down in the quotation papers) to the Municipal engineering directorate with in the Municipal / Adjoining areas (as the case may be).

**Superintending Engineer, West Circle,**  
**Municipal Engineering Directorate**

**Copy Forwarded for information and for favour of wide circulation to:**

- 1. The Mayor, Asansol Municipal Corporation,**
- 2. The District Magistrate, Paschim Bardhaman.**
- 3. The Commissioner, Asansol Municipal Corporation,**
- 4. The State Mission Director AMRUT, ILGUS Bhawan, HC Block, Sector-III,  
Saltlake, Kol106.**
- 5. The Joint Secretary, UD&MA for wide circulation in a day by National News Paper in  
Bengali, English and Hindi News Paper.**
- 6. The Secretary, Asansol Municipal Corporation,**
- 7. The Chief Engineer, M.E.Dte., Bikash Bhawan, Saltlake, Kol-106.**
- 8. The Chief Engineer KMDA (E/M), Unnayan Bhawan, Saltlake Kolkata,**
- 9. The Chief Engineer, Asansol Municipal Corporation.**
- 10. The Superintendent Engineer KMDA (E/M), Saltlake Kolkata**
- 11. The Divisional Accountant, Municipal Engineering Directorate, Asansol Division**
- 12. The Finance officer, Asansol Municipal Corporation.**
- 13. The Executive Engineer, M.E.Dte. Asansol Division.**
- 14. The Executive Engineer, Asansol Municipal Corporation,**
- 15. The Office Notice Board of Superintending Engineer, West Circle, for wide circulation.**
- 16. The Guard File.**

**Superintending Engineer, West Circle,  
Municipal Engineering Directorate**

## SECTION – A

### DESCRIPTION OF THE PROJECT

#### **1.0 GENERAL**

Surveying, investigation, Planning, Designing, Construction & commissioning of Collector well with a storage capacity for 5 minutes detention time of capacity 72.87 MLD, 48.72 MLD capacity infiltration gallery, foot way bridge, with pumping station of 16 hours operation, Supply & installation of suitable capacity Transformer, construction of Substation Building, Supplying & laying of 2 nos. M.S. Pipe line from Collector well to MS manifold line at the starting point of foot way bridge on the river bank and Supply & laying of DI pipe (K-9) from manifold line to the existing Ground Level Reservoir with necessary valves and accessories, boundary wall (if required), approach road, drain, necessary civil, electrical (according to Indian Electricity rules), mechanical & all other allied works at DAMRA for Jamuria area including yard lightening and internal illumination complete in all respect including satisfactory completion and commissioning, three (3) months trial run, necessary training of maintenance staffs & thereafter (subsequently) five (5) years operation and maintenance with security and guarding arrangement on turnkey basis within Asansol MC under AMRUT 2.0.

#### **2.0: LOCATION**

The site of proposed collector well cum foot way bridge structure with filter water pumping station will be at Damra, Jamuria, District : Paschim Bardhaman, West Bengal.

#### **3.0 SCOPE OF WORK**

The Bid is a design-cum-execution Bid on turnkey basis. The Bidder is advised to go through the documents meticulously. In case of any doubt about any data the Bidder may seek clarification before the Bid Inviting Authority by uploading 48 hour prior of the Pre bid meeting and clarification of the same will be discussed in pre bid meeting and will be uploaded later on.

The Bid comprises of following major works. The works includes surveying, Planning, design, drawing and construction of civil works including supply, carriage of all materials with foundation for the various units of Collector well. The scope also includes Trial Run and testing commissioning the Plant for three months, after successful Commissioning, operating and maintaining the same for a period of 60

(sixty) months after the completion of specified period of Successful Trial Run, under the overall supervision of the Employer / his representative and from the date of commissioning.

All survey work (hydraulic, geo-technical and general), designs, drawing will be in the scope of the bidder/contractor. These are to be submitted to EIC after duly vetted from IIT, Khargpur/ Jadavpur University/ IEST Shibpur. However final approval will be given by the undersigned or E/M section of MED.

Sl. No.	Name of the work	Approx quantity
01.	<b>COLLECTOR WELL:-</b> surveying, Planning, design, drawing and construction of Civil, Electrical and Mechanical works including supply, carriage of all materials with foundation for the various units of Collector well. The RCC central radial collector well will be the storage capacity with a detention time of 5 minutes for the demand of 72.82 ML for ultimate year, internal dia. will be designed by agency (minimum 10.0 meter so that all the pumps & other accessories accommodate), bottom of collector well stay stable soil strata as per the soil investigation report to collect water from the Infiltration gallery to collector well.	01 Items
1.01	Investigation of bed deposit along three sections at 200 meter apart at proposed location at river bed of Damodar, hydraulic parameters (radius of influence and hydraulic conductivity) of sub surface profile, design of infiltration gallery considering least saturated depth of water of 8.00 to 9.00 meter (as provision of sand depth) in river deposit on continuous pumping from gallery to CWR, scour depth etc. Detail design along with drawing of Infiltration gallery, pumping system to harvest 48.72MLD + 5 % overloading of sub surface water by 16 hours pump running per day by infiltration gallery from river of Damodar. The Minimum Level of top of Infiltration gallery will be 8.00 to 9.00 meter (the depth may vary ) below the river bed.	02 rows. (2 pipes in each rows)
1.02	Construction of temporary approach road with supply of stone boulder (two layers of boulder 300 mm thickness) rolling the same including spreading and consolidating brick bats 200 mm	1 items

	thick, morrum 75 mm thick, placing necessary Hume pipe for under pass flowing water of river to facilitate movement of construction equipment / materials from river bank to gallery site path way for transporting materials from river bank up to construction site as per requirement of agency.	
1.03	Suitable round type platform 1.00 meter width inside the collector well including stair from each platform to other and fixed at top & bottom of collector well.	3 Layer
1.04	Suitable inclined type M.S. ladder from the top of the outsider platform of the collector well to the river bed including suitable support at top, middle & bottom of well.	1 No.
1.05	Requisite no. & dia. of inlet hole with paddle collar Including supplying and fixing of sluice valve, as required ISI marked as per IS: 14846 with test certificate with necessary extended spindle, Plummer block, head stock with gear arrangement, spacer with anchor bolt etc. to operate from inspection gallery just after pump platform.	1 Items
1.06	Construction of pump house building upon intake well having good architectural view including machine foundation for pumps and motors will be constructed on the collector well pumping station on the river Damodar as per Bid drawing. The height of the pumping station is to be designed in such a manner that the no obstetrical will be allowed for repair maintenance of the vertical pump motor unit. Required length of cantilever platform for suitable place of pump house(if required and another cantilever for works in outer periphery will be in bidder scope	1 Item
02.	<b>INFILTRATION GALLERY:-</b> Construction of infiltration gallery of capacity 48.72 MLD+5% by 10 mm thick(minimum) SS 304 by “V” groove slotted strainer pipe of required diameter (not less than 700 mm) & length (not less than 4 x 420 meter =1680.00 meter) designed by bidder, including surveying, investigation Planning, design, drawing and construction of Civil, Electrical and Mechanical works including supply, carriage of all materials . The 10 mm thick “V” grooves SS 304 pipes of requisite dia. And	1 items



	length as noted above. On every meter length of pipes with “V” groove slotted holes of required nos. slotted holes of size 75 mm X 2.5 mm, is made in required nos. rows so that opening will not less than 30 to 35% of area.	
2.01	Execution of an infiltration gallery with supply, fitting, fixing of 10 mm thick SS 304 by “V” groove slotted strainer pipe of required diameter (not less than 700 mm) & length (not less than 4 x 420 meter = 1680.00 meter) designed by bidder, including with necessary SS 304 flange joint and nut, bolt, gasket. On every meter length of pipes with slotted holes size 75 mm X 2.5 mm in each row is made in required nos. rows so that opening will not less than 30 to 35% of area.	1 items.
2.02	The gallery pipe top SI should be at least 8.00 to 9.00 meter (as provision of sand depth & survey report) below existing river bed level near Collector well and should be placed after over pumping for development of formation. Open excavation of sand including sand stone, rock; debris etc. as is necessary up to a depth of at least 9.50 to 10.50 meter (as provision of sand depth) from bed level with excavator, sand pump, grab etc. and grading the bottom of trench to lay the strainer pipe at a slope of 1: 500 (around) towards well under the supervision of divers. Placing the pebble from top of water level along the gallery at under and above strainer as per design & drawing submitted by bidder duly approved. The slots of the strainer should be cleaned and joining of flange joints should be done by divers. The depth of gallery should be mentioned in the drawing by the bidder is a binding criteria after necessary investigation has to be done. Localized rock, debris etc under water have to be cleared to complete the gallery as per drawing and direction of E.I.C. to achieve required yield 48.72 MLD+5% with sand & turbid free water from the gallery to well during the month of end. To achieve the said yield, necessary increase of gallery depth/length, may be considered during execution without any additional cost.	Required length & diameter as per design by bidder
2.03	Stone boulder sausage work on top of gallery after carrying it up to gallery site as per drawing of boulder size more than 200 mm.	1 item

	with 0.800 meter depth and 5.00 meter width(minimum) and 4 mm thick G.I. wire net of 150 x 150 mm opening along with studs.	
2.04	<p>Providing pea gravel as per IS: 8419 1977 for gallery bottom and outer periphery as per IS and free from foreign materials especially iron bearing materials of size to support the sand above gallery. Gravel size should be so as to eliminate sand in gallery water (sieve analysis report and supporting document from authentic book / literature is to be produced). Arrangement of stacked measurement by Engineer in Charge should be done for packing Pea gravel minimum 1000 mm thick surrounding the pipe. Filtering medium near pipe line - 38 mm pea gravels.</p> <p>2nd layer- 38 to 19 mm pea gravels.</p> <p>3rd layer - 12 to 6 mm pea gravels.</p> <p>4th layer - Course sand passing through a sieve of 3.35 mm size and retained on a sieve 1.70 mm size.</p> <p>5th layer: - Fine sand retained on 70 micron sieve and passing through 1.70 mm sieve.</p>	1 item
2.05	Back filling of sand on top of gallery from excavated bed material as shown in drawing.	1 item
03.	<b>COLLECTOR WELL FOOTWAY BRIDGE :-</b> Construction of 3320 mm wide suitable Structural foot way bridge including surveying, planning, design, drawing and construction of civil, electrical and mechanical works with joist and angle frame including supply, carriage of all materials providing and installing the all items and calculating the all the loads as per IS standard. (Approx length 330.00 meter, which may vary as per site condition).	1 item
3.01	Bridge piles column designed by the bidder (Suitable double column 30.00 meter (Max.) centre to centre with tie-brassier 3.00 meter centre to centre difference for support of foot way bridge. For every column foundation will be R.C.C. Piling with one pair columns (as designed by Bidder.) above well / pile cap. will be set up upon pile cap (as designed by Bidder).	1 item
3.02	Supplying, Laying and fabricating of 10 mm thick 2 X 700 mm dia. M.S. Pipe line(approx.500 mtr. Length which may vary at per site	1 item

	condition) on both sides of foot way bridge including all necessary different types of valves and accessories all complete (as per design). MS Common manifold of 750 mm dia to be constructed at starting point of foot way bridge at bank of river as per direction of EIC and after that Supply & laying of 900mm Dia K9 DI pipe (Approx. length 9750mtr.) upto proposed GLR at KENDULIA including road restoration, crossing of Pipe line(Railways/NH/SH) by Jack Push etc. all complete as per direction of EIC.	
3.03	Tub line should be as per Railway Line of IRCR 60 (60 LBS) section and suitable for running of tub for transportation of materials from river bank to collector well. (Approx length 400.00 meter may vary as per site requirement).	1 item
3.04	5 Nos. cable on each side of 300 sq mm 3 / 3.5 core aluminium armoured cable on both side of pipe line by suitable U clamp on the vertical / side frame (Length will be from Substation building PDB Panel to Intake well MCC Panel.(Please refer Section-I)	1 Items
04.	Planning, Design, Construction of retaining wall / Boulder Sausage (2 X 30.00 meter) on in the river bank on both side of foot way bridge 1.50 meter high (From FGL) boundary wall with RCC Column, tie beam and lintels frame structure and fencing with barbed wire 600 mm height over boundary wall, one no. big gate (6000 mm width) and one no. small gate of 1200 mm width, approach road by RCC pavement, drain, Filling & Land development of Whole Premises up to HFL with ramming, compacting, levelling, and finishing complete in all respect as per approved drawing and direction of E.I.C.	1 item
05.	Collector well internal illumination, yard lighting including necessary conceal wiring. As per detailed scope of work as Section -I	1 item
06.	Vertical Turbine pump: As per detailed scope of work as Section -I	
07.	E/M works for Panel at Pump House & Substation Building (As per Section-I)	1 Set
08.	Digital flow and discharge meter water (as per Section-I)	1 Set

09.	Planning, Design, Construction of Sub-Station building of 8 nos. room 5.00 meter x 5.00 meter size 1) 1 No. for WBSEDCL Switch Gear room, 2) 1 No. for H.T. VCB Panel room, 3) 1 nos. for Transformer room, 4-5) 2 Nos. for PDB Panel & APFC Panel Room, 6-7) 1 No. operator room and 1 No. office room with toilet facility by porcelain tiles on wall, vitrified tiles flooring, wall putty finishing. The Floor level of Sub-station building will be 1.5 meter above the H.F.L(Highest Flood Level)	1 item
10.	Electrical & Mechanical works for the Substation Building (Details scope of work as per Section-I)	1 item
11.	Operation & maintenance: (Sl. No. 18) Operation and maintenance including supply of all accessories of the same for a period of 60 (Sixty) months after the completion of specified period of Successful Trial Run 3 moths. The work is of maintenance in nature, the Defect Liability Period of the work shall be Sixty months from the actual date of completion of the work i.e. after three months Trial Run.	5 Years
12.	Supply & laying(over ground/underground) of 900mm dia. DI pipe(K9) of length 9750.00mtr including all types of valves, valves chamber & specials including permanent road restoration. DI pipes should be relevant IS standard. The restoration to be done as per direction of EIC. In case Railway/NH/SH crossing, Jack pushing to be done as per direction & specification of E.I.C (if necessary). The length is approx.9750 mtrs. Length may vary as per Site condition..	1 Item

#### **4.DEAILED SCOPE OF WORK**

**A. 3046.90CUM/HR(+5%) CAPACITY IG FILTER WITH INTAKE WELL: (48.72 MLD+5% CONSIDERING 16 HRS. RUNNING OF PUMPING A DAY)**

i) The Bid includes Survey, investigation, Planning, Design, Supply, Erection, Fabrication, Operation & maintenance of Collector well filter water Pumping Station, Supplying, Laying and fabricating of M.S. Pipe line on both sides of foot way bridge 700 mm dia. from Collector well to MS manifold pipe line at the starting point of foot way bridge along with supply and fixing of 1 no Butterfly valve, 2 nos approved make

expansion joint and discharge flow meter (from 750 mm dia MS manifold line to proposed Clear Water Reservoir at Kendulia for Jamuria area including all necessary different types of valves (one no non Return Valve) and accessories all complete up to ground level reservoir of high lift pump house.

ii) The total work includes design, supply, fitting, fixing, commissioning trial run (for three months) and thereafter operation and maintenance of (5) five years for the pumping machinery, motors etc. and allied equipment's including proper engagement of operating personnel. The essential prerequisite of the operation and maintenance work is to maintain uninterrupted water supply from the pumping station to ground level reservoir.

iii) The Bidder has to submit in due course the specific size and capacity of all machineries & equipment offered along with data related to static & dynamic loads in different operating conditions. The size of all the equipment's should be so selected to match with the civil works.

iv) The installation of all electrical equipment should be strictly as per I.E. Rules and as per IS specification.

v) For Electrical/Mechanical works please refer ANNEXURE-I

vi) The Bidder has to consider all butter fly valves electrical actuator control, NRV, dismantling joints in individual pump delivery pipe lines as per detail technical specification.

vii) The puddle collars/wall casting needed to be fixed into the wall for entry & exit of delivery pipelines are also to be considered (if required).

viii) The Bidder must work out the natural frequency analysis for the structural work and the same should be verified with the RPM & critical speed of the rotating equipment's to eliminate any chance of vibration.

**(B) COLLECTOR WELL PUMPING STATION AND RCC WALK WAY:**

i) Designing, drawing and construction of intake Structural walkway with pump house building having good architectural view including machine foundation for pumps and motors will be constructed on the collector well pumping station on the river Damodar as per Bid drawing. The height of the pumping station is to be designed in such a manner that the no obstetrical will be allowed for repair maintenance of the vertical pump motor unit.

ii) One electrically operated crane 10.00 MT of sufficient capacities shall have to be provided to handle pump and motor sets for repairing and maintenance purpose in the pump house. In order to accommodate control panel room equipment / appliances will be housed at a level of pumps floor. The common delivery line with valves unit is to be placed opposite to the entry of the pump house as well as in front of the control panel for easy movement of the operator. The control panel room shall have to be covered by wooden glass frame room.

ii) Designing, drawing and construction of Collector Well Structural bridge is to be made minimum 3.320 meter width of Structural walkway with hand railing of TATA medium G.I. pipe (25 mm and 40 mm dia) all along and arrangement for Supplying, Laying and fabricating of M.S. Pipe line (TATA / SAIL/JINDAL make) on both sides of foot way bridge 700 mm dia. including all necessary different types of valves and accessories all complete up to the ground level reservoir, supply & laying of 5 Nos. aluminium armoured cable 300 sq mm 3 / 3.5 core cable and two nos. earthing GI (25 mm X 6 mm) strip, illumination system, aviation lighting arrangement and lightening arrester with separate earthing arrangement (For details please refer Annexure-I)

iii) The design of Collector well has to be made on the basis of the Static load of pump house as prescribed and dynamic loading pattern thereof, taking into account of the vibration both horizontally and vertically that will be generated due to operation of each pump motor set as well as parallel operation of the pumping unit. Also bidder will be planning and designing for one Cantilever will be constructed by the bidder over the well of adequate width so that sufficient place will be made for incorporated of Pump-Motor, MCC Panel, extra round of Cable, and Manifold pipe line.

iv) The Bidder, whose Bid is accepted in the Course will have to furnish details of the design of the pump house and Collector well in all level duly incorporating the requirement of the pump manufacturer.

**(C) COLLECTOR WELL L.T. PANEL AND SOFT STARTER:-**

The design and drawing of HT VCB Panel, Transformer, Cable, LT PDB, APFC and MCC panel will be submitted by the bidder work will be started after approval by Chief Engineer, KMDA (E/M) and E.E. (ME. Dte) E/M submitted by agency.

**(D) SUPPLY & LAYING OF PIPE LINE**

Supplying, Laying and fabricating of M.S. Pipe line (TATA / SAIL/JINDAL make) on both sides of foot way bridge 700 mm dia. including all necessary different types of valves and accessories all complete from common manifold length 2 X 500 meter (approx) and Supply & Laying of 900 mm dia DI(K9) pipe line from common manifold line to ground level reservoir at Kendulia (approx. length 9750 meter) after supplying and installation all types of sluice valve, non-return valve, pressure release valve and air release valves along with valve chamber construction. Adequate air release valves will have to be provided by the bidder. Digital discharge meter and flow meter will be provided by the agency at the out late of collector well pump house.

**E) RETAINING WALL / BOULDER SAUSAGE WORK:** - Both sides (2 X 30.00 Meter approx) of connecting portion of foot Way Bridge will be protected by a RCC retaining wall / Boulder Sausage work up to FGL and above it 1.8 m RCC retaining. Boundary wall, approach road, surface dressing, beatification and gardening will be under bidder scope. A steel gate of width not less than 6.00 m will be provided for entrance. All internal roads will be of 4.0 m RCC (M20 grade) of 150 mm thickness & Minimum 0.12% Reinforcement over compacted and consolidated soil. All roads will be covered by designer paver block of thickness not less than 60 mm.

**5.0 LIMIT OF CONTRACT:**

The limit of contract starts from construction of collector well with pumping station including arrangement and installation of vertical turbine pumping unit with its electro-mechanical works and clear water delivery line with valves arrangement and

interconnected with Supplying, Laying and fabricating of spiral welded mild steel M.S. Pipe line on both sides of foot way bridge 700 mm dia. including all necessary different types of valves and accessories all complete which will be bidder's scope up to the ground level reservoir.

The minimum length of the total Collector well bridge with pumping station from the river bank will be as per design and drawings submitted by agency and approved by undersigned, Chief Engineer / Superintending Engineer, (E/M), KMDA A full bore digital discharge meter and flow meter with valve chamber at outlet of the collector well of pumping station will be in the bidder scope. The LT sources of Electric Power would be taken from High Lift LT panel room. Necessary arrangements to connect the cables of appropriate size with full satisfaction of Engineer in Charge are within the limit of this work. The excavation of cables trenches, laying the cables within boundary of intake jetty pumping station units, covering the cable trenches, insert plates, cable trays etc. also includes under this contract.

It is the responsibility of the contractor to make good or reconstruct the part or whole of a structure if gets damaged or demolished / crushed / settled down due to water thrust or similar external reasons or faulty design at his own cost. Faulty Design submitted by the contractor even if accepted by the department will not relieve the contractor from above responsibility. Contractor will be considered total responsible for any accident caused due to negligence on his part/poor workmanship/faulty design.

Contractor has liberty to go for design mix for achieving Rich concrete having minimum cement content as stipulated in I.S. code or go for variation if so required at the subject to the satisfaction & permission of E.I.C. The same is also applicable when contractor opt to adopt alternative methodology for facilitating any construction work.

The length of Pipe carrying bridge, Pipe lines, Bank protection etc. may vary as per site condition. Bidder should visit the site before offer.

Superintending Engineer, west Circle



SECTION- B

CONDITIONS & REQUIREMENTS FOR BIDDING

1. Submission of eBid document will not be allowed beyond the schedule time indicated in the eBidding.
2. Each Bidder shall upload his offer in envelopes (statutory and non statutory)& .xls sheet after digitally signed super scribing the name of the work, name & address of the bidder, NIB No and date of submission of the eBid.
3. Each page of the eBid documents, drawing etc. has to be digitally signed / initialled by the authorized signatory.
4. No eBid proposal will be entertained without the earnest money being submitted as indicated in the eNIB. No interest will be allowed for the said earnest money and the Bid issuing authority will hold the same till finalization of the eBid.
5. Any conditional eBid will be liable for rejection.
6. eBids will be opened in presence of the Bidder or their authorized representatives who opt to be present.
7. The Bid inviting Authority reserves the right to reserve or amend the eBid documents prior to the date notified for submission of the eBid or also to extend the time mentioned in the eNIB under intimation to the Bidders.

8. eBid once offered cannot be withdrawn within a period of 120 calendar days from the date set for opening of eBids. Any extension of this validity period if required will be subject to concurrence of the Bidders.
9. Bidders would be at liberty to point out any ambiguities, contradictions, omissions, etc. seeking clarifications thereof or interpretation of any of the conditions of the eBid documents before the Bid Inviting Authority by uploading his/her doubt within a period of seven days from the date of publishing of Bid documents. The bidder shall submit his/her queries in writing at least four working days in advance from the date of pre-bid meeting.
10. Written clarification or amendments etc. as may be issued by the Bid Inviting Authority in pursuance to the representation made by the intending Bidders under Clause 10 above shall be final and binding on the Bidders and shall form a part of the eBid documents. Bid Inviting Authority however, reserves the right to have pre Bid conference with the intending Bidders if deemed necessary.
11. Intending Bidders are required to inspect the site of the Project with particular reference to location and infrastructure facilities. They are to make a careful study with regard to availability of materials and their sources and all relevant factors as might affect their rates and prices.
12. If expenses incurred for site inspection and all activities in the preparation and uploading of the eBid shall be borne by the Bidders.
13. Extra claim or any concession on the ground of insufficient data or information and absence of knowledge of conditions prevailing at the site or situation arising during the execution of the work shall not be entertained.
14. eBid, which have been considered valid on the result of general examination (Prequalification stage) at the time of opening, shall be subjected to subsequent detail scrutiny. Notwithstanding the general examination carried out earlier, the Bid Inviting authority reserves the right of rejection of any eBid, which may be found to be defective during the detail scrutiny.
15. Bidders before uploading the eBid documents shall have to ensure that "Declaration by the Bidder" in the pro-forma set out in the eBid documents is to

be filed separately with the eBid documents in the form of Affidavit to be affirmed by the same person signing the Bid documents.

16. The Bid inviting authority reserves the right to accept or reject any or all of the eBid received or to split up the work in groups or to relax any clause without assigning any reason thereof.
17. This set of Bid documents consists of: a) Main Bid Documents consists of PART I & PART II (Technical) & financial (.xls sheet).

## SECTION - C

### General Conditions of Contract

#### **1.0 DEFINITIONS AND INTERPRETATION**

- (1) In the Contract, as hereinafter defined, the following words and expressions shall have to be meanings hereby assigned to them, except where the context otherwise requires:
  - (a) "Approved" means provisionally approved in writing, including subsequent written confirmation of previous verbal approval and "approval" means provisional approval in writing, including as aforesaid. However in spite of approval from Competent Authority contractor is solely responsible for design-cum-execution of the whole project as it is turnkey job.
  - (b) "Authority" means the TIA or his authorized representatives of Asansol Municipal Corporation.
  - (c) "Bank" means the "State Bank of India" or any other Scheduled Bank.
  - (d) "Calendar day" means a period of twenty four hours extending from midnight to midnight.
  - (e) "Cash" includes cheque, bank drafts and any other payment voucher authorizing payment from any bank or treasury.

- (f) "Contractor" means the person or persons, firm or Corporation who have entered into the contract for the performance of the work.
- (g) "Contract price" means the sum as stated in the Bid submitted by the contractor subject to such additions thereto or deductions therefrom as may be made under the provisions of; the contract documents and accepted by the Employer.
- (h) "Constructional Plant" means all appliances or things of whatsoever nature required in or about the execution or maintenance of the works but do not include materials or other things intended to form or forming part of the permanent works.
- (i) "District" or Asansol Municipal Area means the area described as such in Schedule-I of The Act;
- (j) "Drawings" means the drawings referred to in the Bid documents and any modification of such drawings approved in writing by the undersigned from time to time or approved in writing by the Superintending Engineer, WEST Circle, MED, Asansol Municipal Corporation.
- (k) "Employer" means the Superintending Engineer, WEST Circle, MED
- (l) "Engineer in Charge" means the Executive Engineer, Asansol Division of Municipal Engineering Directorate to whom the Superintending Engineer, WEST Circle, MED, delegate his Authority by the way of declaring him as EIC in the Bid documents.
- (m) "Engineer's Representatives" means any Assistant 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 Clause 2 hereof, whose authority shall be notified in writing to the Contractor by the Engineer-in Charge.
- (n) "Ground Level" means the level of the referred point of the exposed surface of the ground, road or pavement free from extraneous materials;
- (o) "Holidays" means a public holiday for the purpose of Section 25 of the Negotiable Instruments Act, 1881 or such other day on which the office of the Authority remains closed for the day;

- (p) "Local Authority" not only means a Municipal Corporation or Municipality or other authority legally entitled to the control or manage local funds but also includes the West Bengal State Electricity Board.
- (q) "Month" means English calendar month;
- (r) "Permanent Work" means the permanent works including equipment to be supplied, executed, erected and maintained in accordance with the Contract;
- (s) "Road" shall include a street, avenue, lane, by-lane or any other access routes over which a person authorized by a Local Authority has a right of way;
- (t) "Rupees" (or Rs. in abbreviation) shall mean Rupees in Indian Currency.
- (u) "Site" means the land and other placed on, under in or through which the Permanent. Works or Temporary Works are to be executed and any other lands and places provided or arranged by the employer for working space or any other purpose as may be specifically designated in the Contract as forming part of the Site,
- (v) "Specification" means the specification referred to in the Bid and any modification thereof or addition thereto as may from time to time be furnished or approved in writing by the Superintending Engineer, WEST Circle, MED, Asansol Municipal Corporation.
- (w) "Store" means such storage areas including depot, go down, stockyard, dumping yard etc. maintained by the Authority) or where supply of any material for the construction or any work has been undertaken by any authorized agent, by such agent within the District.
- (x) "Temporary Works" means all temporary works of every kind required in or about the execution or maintenance of the Permanent Works.
- (y) "Bid Date" means the date fixed for receipt of Bids as per Notice Inviting Bids or as extended by subsequent notification(s).
- (z) "Bidder" means the person, or persons, firm or corporation submitting a Bid for the work contemplated either directly or through a duly authorized representative.
- (aa) "The Act" West Bengal Municipal Act, 1975

- (bb) "Time" expressed by hours of the clock shall be according to the Indian Standard Time.
- (cc) "Water main" means any pipe or conduit of cast iron, DI (Ductile Iron) pipe, steel or of any other material intended to convey or distribute water;
- (dd) "Works" shall include both Permanent Works and Temporary Works.
- (ee) "Work" means all of the work of the project called for or shown in the Bid documents including preparation, construction improvement and cleans up.
- (2) Singular and Plural: Works importing the singular only also include the plural and vice versa where the context demands.
- (3) Headings or Notes: The headings and marginal notes in these Conditions of Contract shall be deemed to be part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.
- (4) Cost: The work "cost" shall be deemed to include overhead costs whether on or off the Site.

## **2.0 ENGINEERS IN CHARGE AND HIS REPRESENTATIVES**

**1) Duties and Powers of Engineer in Charge and his Representative** - The Engineer shall carry out such duties in issuing decisions, certificates and orders as are specified in the Contract. Fixation and acceptance of rates for altered or substituted items of work or for additional items of work or their deletion shall however always rest with the same authority (by designation) as had accepted the original Bid.

**2) Representative(s) shall be responsible to the EIC** and his / their duties are to watch and supervise the Works and to test and examine any materials to be used or workmanship employed in connection with the works. He shall have no authority to relieve the Contractor of any of his duties or obligations under the Contract, not, accept as expressly provided hereunder or elsewhere in the Contract, to order any work involving delay or any extra payment by the Employer, nor to make any variation of or in the Works.

The Superintending Engineer, WEST Circle, MED may delegate in writing to the EIC any of the power and authorities vested in the engineer and shall furnish to the Contractor

and to the Employer a copy of all such written delegations of Power and authorities. Any Written instructions or approval given by Engineer's representative to the contractor within the terms of such delegation, but not otherwise, shall bind the Contractor as though it had been given by the Superintending Engineer, WEST Circle, MED, Asansol Municipal Corporation provided always as follows:

a) Failure of the Engineer's Representative to disapprove any work of materials shall not prejudice the power of the Superintending Engineer, WEST Circle, MED thereafter to disapprove such work or materials and to order the pulling down, removal of breaking up thereof.

b) If the Contractor shall be dissatisfied by reason of any decision of the Engineer's Representative he shall be entitled to refer the matter to the TIA, who shall thereupon confirm, reverse or vary such decision.

## **ASSIGNMENT AND SUB LETTING**

### **3.0 ASSIGNMENT**

The Contractor shall not assign the Contract or any part thereof, or any benefit or interest therein or there under, otherwise than a change in the Contractor's bankers of any money due or to become due under this contract, without the prior written consent of the Superintending Engineer, WEST Circle, MED.

### **4.0 SUBLETTING**

The Contractor shall not sublet the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not sublet any part of the Works without the prior written consent of the Superintending Engineer, WEST Circle, MED, which shall not be unreasonably withhold and such consent, if given, shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of the said sub-contractor including his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen, provided always that the provision' of labour on a piece-work basis shall not be deemed to be a subletting under this clause.

### **5.0 CONTRACT DOCUMENTS**

1a) **Language:** The Contract documents shall be drawn up in the English language. All correspondence, orders, notices etc. shall also be in English.

1b) **Law:** The law of India and of the State of West Bengal shall apply to the Contract and the Contract is to be construed accordingly.

2) **Documents Mutually Explanatory:** 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 Superintending Engineer, WEST Circle, MED, who shall thereafter issue to the Contractor instructions thereon. Provided always that if, in the opinion of the Engineer, compliance with any such instructions shall involve the Contractor in any cost, which by reason of such ambiguity or discrepancy could not reasonably have been foreseen by the Contractor, the Engineer shall certify and the Superintending Engineer, WEST Circle, MED shall pay such additional sum as may be reasonable to cover such costs.

## **6.0 DRAWINGS**

1) **Custody of drawing:** All the approved Drawings shall remain in the safe custody of the Executive Engineer, Asansol Division, MED, one copy of original approved drawing and design to be submitted to Asansol Municipal Corporation but one copy thereof shall be furnished to the Contractor free of charge. The Contractor shall provide and make at his own expenses any further copies required by him. At the Completion of the Contract, the Contractor shall return to the Executive Engineer, Asansol Division, and M.E.Dte. All drawings as provided under the Contract.

2) **Copy of drawing:-** One copy of drawings to be kept on site. One copy of the Drawings furnished by the Contractor as aforesaid, shall be kept by the Contractor on the site and the same shall at all reasonable times be available for inspection and use by the Engineer and his/municipal Representatives and by any other persons authorized by the Engineer in writing.

3) **Disruption of progress:** The Contractor shall give written notice to Superintending Engineer, WEST Circle, MED whenever planning or progress of the works is likely to be delayed or disrupted unless any further approval of drawing or order, including a direction instruction or approval is issued by the Superintending Engineer, WEST Circle, MED on recommendation of Executive Engineer within a reasonable time. The notice shall include details of the drawing or order required, and



of why and by whom it is required and of any delay or disruption likely to be suffered if it is further delayed.

## **7.0 FURTHER DRAWINGS**

The Superintending Engineer, WEST Circle, MED shall have full power and authority to supply to or demand from the Contractor, from time to time, during the progress of the Works, such further drawings as shall be necessary for the purpose of the proper and adequate execution and maintenance of the Works. The Contractor shall carry out and be bound by the same. Adequacy as determined by the Superintending Engineer, WEST Circle, MED shall be final and binding on the Contractor.

## **8.0 GENERAL OBLIGATION**

(1) Contractor's General Responsibilities - The Contractor shall, subject to the provision of the Contract, and with due care and diligence, execute and maintain the Works and supply all labour, including the supervision thereof, materials, equipment, Constructional Plant and machinery, tools and all other things whether of a temporary or permanent nature, required for such execution and maintenance, so far as necessary for providing the same is specified in or is reasonably to be inferred from the Contract. The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction, erection etc.

## **9.0 CONTRACT AGREEMENT**

The Contractor shall, when called upon to do so, enter into and execute a Contract Agreement, to be prepared and completed in the form annexed with such modification as may be necessary.

## **10.1 GUARANTEE**

The contractor shall stand guarantee for successful operation of the plant for 60 months from the date of successful commissioning of the pump and shall within the O & M period after 3 months trial run, remove / rectify / make good any such deficiency forthwith at his own cost. During the guarantee period (after the trial run period) the firm's representative shall visit the site once in a month and advise in writing the Superintending Engineer, WEST Circle, MED about the condition, state of health, and operation & maintenance procedure of the equipment. The successful Bidder shall also give the following guarantee in respect of the equipment supplied by him.

- i) All equipment shall be free from any defects due to faulty design of the components, materials and/or workmanship
- ii) The equipment shall operate satisfactory. The performance and efficiency shall not be less than guaranteed values.
- iii) Formal acceptance of the work or equipment covered under the contract will not be made by the Superintending Engineer, WEST Circle, MED until all the work done by the contractor has satisfactorily passed all tests required and run for a reasonable period to his satisfaction.

If during testing of work, including equipment prior of formal acceptance, the same or the material thereof must satisfy in respect of meeting the specification guaranteed or otherwise the Contractor shall replace all such equipment etc. in a condition which will meet the guaranteed performance and be up to the specification, in both material and workmanship.

Any such work shall be carried out by the contractor at his own expense, if such work shall, in the opinion of the Engineer-in-Charge, be necessary due to the use of materials or workmanship not in accordance with the contract and/or to the neglect or failure on the part of the contractor to comply with any obligation expressed or implied on the contractor's part under the contract. If the contractor shall fail to do any such work as per aforesaid requirement of the Engineer-in-Charge, the Superintending Engineer, WEST Circle, MED shall be entitled to have such work carried out by its own workman, or by others hired for the purpose, and if such work is in the opinion of the Engineer-in-Charge for which the contractor should have carried out at the contractor's own cost, the department shall be entitled to recover from the contractor the supervision cost deemed fit together with the cost increased for the purpose and may deduct the same from any money due to or that may become due to the Contractor.

## **10.2 PERFORMANCE GUARANTEE**

The contractor will have to entered into an agreement through banker to ensure performance guarantee on non-judicial stamps Rs.10/-. Suitable proforma will be supplied in due course of time.

## **11.0 INSPECTION OF SITE**

The Executive Engineer, M.E. Dte or his authorized person shall have made available to the Bidder with the Bid documents such data like its location, distance from fixed point including the layout drawing and location of the primary grid point, level drawing data, the source of filling the reservoir and the Bid shall be deemed to have been based on such data. But the Bidder shall be responsible for his own interpretation thereof. The Bidder may also undertake investigations at his own cost on such levels or any other levels prior to submission of his offer.

The Bidder shall also be deemed to have inspected and examined the site and its surroundings and information available in connection therewith and to have satisfied himself, so far as is practicable, before submitting his Bid; as to the form and nature thereof, including the sub-surface conditions, topographical level of proposed site, the hydrological and climatic conditions, the extent and nature of work and materials necessary for the completion of the Works, the means of access to the Site and the accommodation he may require and, in general 'shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Bid.

#### **12.0 SUFFICIENCY OF BID AND ADVERSE PHYSICAL CONDITIONS, ARTIFICIAL OBSTRUCTIONS**

The Bidder shall be deemed to have satisfied himself before Biding as to the correctness and sufficiency of his Bid for the Works and 'of the rates and prices quoted in the Schedule of prices, which Bid rates and prices shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper execution and maintenance of the Works.

If, however, during the execution of its Works the Contractor shall encounter physical conditions, other than Climatic conditions on the Site, or artificial obstructions, which conditions or obstructions could, in his opinion, not have been reasonably foreseen by an experienced contractor, the Contractor shall forthwith give written notice thereof to the Engineer and if, in the opinion of the Engineer, such conditions or artificial obstructions could not have been reasonably foreseen by an experienced contractor, then the Engineer shall certify and the Superintending Engineer, WEST Circle, MED shall pay the additional cost to which the Contractor shall have been put by reason of such conditions, including the proper and reasonable cost.

- a) Of complying with any instruction which the Engineer may issue to the Contractor in connection therewith, and
- b) Of any proper and reasonable measures approved by the Superintending Engineer, WEST Circle, MED on recommendation of Engineer in charge which the Contractor may take in the absence of specific instructions from the Superintending Engineer, WEST Circle, MED as a result of such conditions or obstructions encountered.

### **13.0 WORK TO BE TO THE SATISFACTION OF ENGINEER IN CHARGE**

Save in so far as it is not legally or physically impossible, the Contractor shall execute and maintain the Works in strict accordance with the Contract to the satisfaction of the Superintending Engineer, WEST Circle, MED and shall comply with and adhere strictly to the Superintending Engineer, WEST Circle, MED's instructions and directions on any matter whether mentioned in the Contract or not touching or concerning the Works.

### **14.0 WORK PROGRAM**

(1) Program to be furnished: Within thirty (30) calendar days, the Contractor shall, after the acceptance of his Bid, submit to the Superintending Engineer, WEST Circle, MED for his approval a program showing the order of procedure in which he proposes to carry out the Works. The Contractor shall, whenever required by the Superintending Engineer, WEST Circle, MED, also provide in writing for his information, general description of the arrangements and methods, which the Contractor proposes to adopt for the execution of the Works.

(2) If at any time it should appear to the Superintending Engineer, WEST Circle, MED that the actual progress of the Works does not conform to the approved program referred in sub-clause (1) of this Clause, the Contractor shall produce, at the request of the Superintending Engineer, WEST Circle, MED, a revised program showing the modifications to the approved program necessary to ensure completion of the Works within the time for completion as defined in Clause 42 hereof.

(3) The submission to and approval by the Superintending Engineer, WEST Circle, MED of such program or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

#### **15.0 CONTRACTOR'S SUPERINTENDENCE**

The Contractor shall give or provide all necessary superintendence during the execution of the Works and as long thereafter as the Superintending Engineer, WEST Circle, MED may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor or a competent and authorized agent or representative approved of in writing by the Superintending Engineer, WEST Circle, MED, which approval may at any time be withdrawn, is to be constantly on the Works and shall give his whole time to the Superintendence of the same. If such approval be withdrawn by the Superintending Engineer, WEST Circle, MED, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned after receiving written notice of such withdraw, remove the agent from the works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another agent approved by the Superintending Engineer, WEST Circle, MED.

Such authorized agent or representative shall receive, on behalf of the Contractor, direction and instruction from the Superintending Engineer, WEST Circle, MED or, subject to the limitations of Clause 2 hereof the Engineer's Representative. The agent or representative of the Contractor must be able to speak and communicate in English / Bengali. In the absence of the Contractor's designated agent or representative for a particular operation on any site of the works the Contractor's supervisory staff or sub-agent or leading hands shall be instructed to receive and carry out any instruction or direction issued or given by the Superintending Engineer, WEST Circle, MED or the EIC.

#### **16.0 EMPLOYEES**

- (I) Contractor's Employees - The Contractor shall provide and employ on the Site in connection with the execution and maintenance of the Works
- a) Such technical assistants as are skilled and experienced in their respective calling and such sub-agents, foreman and leading hands as are competent to give proper supervision to the work they are required to supervise, and

b) Such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely execution and maintenance of the Works.

c) Employees covered under (a) and (b) may have to be provided with identity cards as specified by the Superintending Engineer, WEST Circle, MED.

2) The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Work any person employed by the Contractor in or about the execution or maintenance of the Works who, in the opinion of the Superintending Engineer, WEST Circle, MED, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose employment is otherwise considered by the Superintending Engineer, WEST Circle, MED to be undesirable and such person shall not be again employed upon the Works without the written permission of the Superintending Engineer, WEST Circle, MED. Any person so removed from the Works shall be replaced as soon as possible by a competent substitute approved by the Superintending Engineer, WEST Circle, MED.

#### **17.0 SETTING-OUT**

The Contractor shall be responsible for the true and proper setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing and for the correctness, subject as above mentioned, of the position levels, dimensions and alignment of all parts of the Works and for the provision of all necessary instruments, appliances/and labour in connection therewith. If, at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on hem), required to do so by the Engineer or the Engineer's Representative, shall at his own cost, rectify such error to the satisfaction of the Engineer or the Engineer's Representative, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the expense of rectifying the same shall be borne by the Employer. The checking of any setting-out or of any line or level by the Engineer or the Engineer's Representative shall not in any way relieve the contractor of his responsibility for the correctness thereof and the Contractor shall carefully protect and reserve all bench-marks, sigh trails pegs and other things used in setting out the Works.

#### **18.0 WATCHING AND LIGHTING**

The contractor shall in connection with the works provide and maintain at his own cost all lights, guards, fencing, as and when/where necessary or as required by the Superintending Engineer, WEST Circle, MED or the Engineer's Representative, for the protection of the works, contractor's employees, employees supervisor or for any other reason deemed fit by the Engineer.

#### **19.0 WORKS & RISKS**

**(1) Care of Works:** From the commencement of the Works until the date stated in the Certificate of Completion for the whole of the Works, pursuant to Clause 47 hereof, the Contractor shall take full responsibility for the care thereof. Provided that if the Superintending Engineer, WEST Circle, MED shall issue a Certificate of Completion in respect of any part of the Permanent Works, the Contractor shall cease to be liable for the care of that part of the Permanent Works (O & M not counted) from the date stated in the Certificate of Completion in respect of that part and the responsibility for the care of that part shall pass to the Superintending Engineer, WEST Circle, MED provided further that the Contractor shall take full responsibility for the care of any outstanding work which he shall have undertaken to finish during the period to Maintenance until such outstanding work is completed.

In case any damage, loss or injury shall happen to the Works, or to any part thereof, from any cause whatsoever, save and except the expected risks as defined in sub-clause (2) of this Clause, while the Contractor shall be responsible for the care thereof the Contractor shall, at his Own cost, repair and make good the same, so that at completion the permanent Works shall be in good order and condition and in conformity in every respect with the requirements of the Contract and the Superintending Engineer, WEST Circle, MED instructions. In the event of any such damage, loss or injury happening from any of the excepted risks, the Contractor shall, if and to the extent required by the Superintending Engineer, WEST Circle, MED and subject always to the provisions of Clause 62 hereof, repair and make good the same as aforesaid at the cost of the Employer. The Contractor shall also be liable for any damage to the Works occasioned by him in the Course of any operations carried out by him for the purpose of completing any outstanding works or complying with his obligations under Clause 48 or 49 hereof.

**(2) Expected Risks:** The 'expected risks' are war, hostilities, invasion, act of foreign enemies, rebellion, revolution insurrection or military or usurped power,

civil war or unless solely restricted to employees of the Contractor or of his sub-contractors and arising from the conduct of his workers, riot commotion or use or occupation by the Superintending Engineer, WEST Circle, MED of any part of the Permanent Works, or a cause solely due to the Engineer's design of the Works, or ionizing radiations or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive, or other hazardous properties of any explosive, nuclear assembly or nuclear component thereof, pressure waves cause by aircraft or other aerial devices travelling at sonic or supersonic speeds, or any such operation of the force of nature as an experienced contractor could not foresee, or reasonably make provision for or insure against all of which are herein collectively recurred to as "the expected risks."

#### **20.0 INSURANCE OF WORKS, ETC.**

Without limiting his obligations and responsibilities under Clause 19 hereof the Contractor shall insure in the names of the Employer and the Contractor against all loss or damage from whatever cause arising, other than the expected risks, for which he is responsible under the terms of the Contract and in such manner that the Employer and Contractor are covered for the period stipulated in Clause 19(1) hereof and are also covered during the Period of Guarantee for loss or damage arising from a cause, occurring prior to the commencement of the Period of Guarantee, and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clause 48 or 49 hereof.

- a) The Works for the time being executed to the estimated current contract value thereof together with the materials for incorporation in the Works at the replacement value.
- b) The Constructional Plant and other things brought on the Site by the Contractor to the replacement value of such Constructional Plant and other things. These shall include materials belonging to the Superintending Engineer, WEST Circle, MED but issued to or intended to be issued to the Contractor for use in the Works. Such insurance shall be effected with an insurer and in terms approved by the Employer, which approval shall not be unreasonably withheld, and the Contractor shall whenever required, produce to the Superintending Engineer, WEST Circle, MED or the Engineer's



Representative the policy or policies of insurance and the receipts for payment of the current premiums.

## **21.0 DAMAGES**

**i) Damage to persons and property:** The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Superintending Engineer, WEST Circle, MED against all losses and claims in respect of injuries or damage to any person or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution, operation and maintenance of the Works and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation or damages for or with respect to :

- a) The permanent use of occupation of land by the Works or any part thereof.
- b) The right of the Superintending Engineer, WEST Circle, MED to execute the Works or any part thereof on over under, in or through any land.
- c) Injuries or damage to persons or property which are the unavoidable result of the execution, operation or maintenance- of the Works in accordance with the Contract.
- d) Injuries or damages to persons or property resulting from any act or neglect of the Employer, his agents, servants or other contractors, not being employed by the Contractor, or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the Contractor, his servants or agents such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the Superintending Engineer, WEST Circle, MED, his servant or agents or other contractors for the damage or injury.

**2) Indemnity of Secretary:** The Contractor shall indemnify the Superintending Engineer, WEST Circle, MED against all claims, proceedings, damages, costs charges and expenses in respect of the matters referred to the provision to sub-clause (1) of this Clause.

## **22.0 INSURANCE**

**1) Third Party Insurance:** Before commencing the 'execution of the Works the Contractor, but without limiting his obligations and responsibilities under Clause 21 hereof, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property, including that of the Superintending Engineer, WEST Circle, MED, or to any person, including any employee of the Superintending Engineer, WEST Circle, MED, by or arising out to the execution of the Works or in the carrying out of the Contract, otherwise than due to the matters referred to in the proviso to Clause 21 (I) thereof.

**2) Minimum Amount of third party insurance** - Such insurance shall be affected with an insurer and in terms approved by the Superintending Engineer, WEST Circle, MED, which approval shall not be unreasonably withheld, and for a least the amount started in the Appendix to the Bid. The Contractor shall, whenever required, produce to the Superintending Engineer, WEST Circle, MED or the Engineer's Representative the policy or policies or insurance and the receipts for payment of the current premium. However, the Bidder should insure for an amount commensurate with the risk involved subject to the minimum amount prescribed elsewhere in the Bid.

**3) Provision to indemnify Employer** - The terms shall include a provision whereby, in the event of any claim in respect of which the Contractor would be entitled to receive It1dcnJmty under the policy being brought or made against the Superintending Engineer, WEST Circle, MED, the insurer will indemnify the Employer against such claims and any costs, charges and expenses in respect thereof.

### **23.0 ACCIDENT, INJURIES**

**1) Accident or injury to Workmen:** The Superintending Engineer, WEST Circle, MED shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any subcontractor, save and except an accident or injury resulting from any act or default of the Superintending Engineer, WEST Circle, MED, his agents, or servants. The Contractor shall indemnify and keep indemnified the Superintending Engineer, WEST Circle, MED against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

**2) Insurance Against Accident, etc. to workmen:** The Contractor shall insure against such liability with an insurer approved by the Superintending Engineer, WEST Circle, MED, which approval shall not be unreasonably withheld, and shall continue such insurance during the whole of the time that any person is employed by him on the works and shall, when required, produce to the Superintending Engineer, WEST Circle, MED or the Engineer's Representative such policy of insurance and the receipts for payment of the current premium. Provided always that, in respect of any person employed by any sub-contractor, the Contractor's obligation to insure as aforesaid under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that the Superintending Engineer, WEST Circle, MED is indemnified under the policy, but the Contractor shall require such sub-contractor to produce to the Superintending Engineer, WEST Circle, MED when required, such policy of insurance and the receipt for the payment of the current premium.

**3) Notification to insurer:** It shall be the duty of the Contractor to notify the insurers under any of the insurance referred to in Clause 20, 22 and 23 hereof any matter or count which by the terms of such insurance are required to be notified and the Contractor shall indemnify and keep indemnified the Superintending Engineer, WEST Circle, MED against all losses, claims, demands, proceedings, costs, charges and expenses whatsoever arising out of or resulting from any default by the Contractor in complying with the requirements of this sub-clause whether as a result of the avoidance of such insurance or otherwise.

**4) All Insurances at Contractor's cost -** The insurances referred to in Clause 21, 22 & 23 hereof shall be entirely at the cost and expenses of the Contractor and be included within his rates.

#### **24.0 REMEDY ON CONTRACTOR'S FAILURE TO INSURE**

If the Contractor shall fail to effect and keep in force the insurance referred to in Clause 20, 22 and 23 hereof, or any other insurance which he may be required to effect under the terms of the Contract, then and in any such case the Superintending Engineer, WEST Circle, MED may effect and keep in force any such insurance and pay such premium or premiums including fines as may be necessary for that purpose and from time to time and deduct double the amount so paid by the employer as aforesaid

from any moneys due or which may become due to the Contractor or recover the same as a debt due from the Contractor.

**25 I) GIVING OF NOTICES AND PAYMENT OF FEES:** The Contractor shall give all notices and pay all fees required to be given or paid by any National or State Statute, ordinance, or other law, or any rules regulation, or bye-law of any local or other duly constituted authority 111 relation to the execution of the Works and by the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works.

**ii) Compliance with Statutes, Regulations, etc.** - The Contractor shall conform in all respects with the provisions of any such Statute, Ordinance or Law as aforesaid and the Rules, regulations or bye-laws or any local or other duly constituted authority which may be applicable to the Works and with such rules and regulations of public bodies and companies as aforesaid and shall keep the Superintending Engineer, WEST Circle, MED indemnified against all penalties, fines and liability of every kind for breach of any such Statute, ordinance of Law, regulation of bye law.

#### **26.0 FOSSILS, ETC.**

All fossils, coins articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the site of the Works shall as between the Employer and the Contractor be deemed to be the absolute property of the Employer.

#### **27.0 PATENT RIGHTS AND ROYALTIES**

The Contractor shall save harmless and indemnify the Superintending Engineer, WEST Circle, MED from and against all claims and proceedings for or on account of infringement of any patent, rights, design Trade mark or name or other protected right in respect of any Constructional Plant, machine works, or material used for or in connection with the Works or any of them and from and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof in relation thereto. Except where otherwise specified, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensations, if any, for

getting stone, sand, gravel, clay or other materials or equipment required for the works or any of them.

## **28.0 INTERFERENCE WITH TRAFFIC AND ADJOINING PROPERTIES**

All operations necessary for the execution of the Works shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with the convenience of the existing plant workers, member of the public, or the access to use and occupation of public or private roads, railways and footpaths to or of properties whether in the possession of the Superintending Engineer, WEST Circle, MED or of any other person or local authority.

## **29.0 TRAFFIC**

**1) Extraordinary Traffic:** The Contractor shall use every reasonable means to prevent any of the highways, railways or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of this sub-contractors and, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of plant and material from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such highways, railways and bridges.

**2) Special Loads:** Should it be found necessary for the Contractor to move one or more loads of Constructional plant, machinery or pre-constructed units or parts of units of work over part of a highway, railway or bridge, the moving whereof is likely to damage any highway, railway or bridge unless special protection or strengthening is carried out, then the Contractor shall before moving the load on to such highway, railway or bridge give notice to the Superintending Engineer, WEST Circle, MED or Engineer's Representative or the local authority of the weight and other particulars of the load to be moved and his proposals for protecting or strengthening the said highway, railway or bridge. The Contractor at his own cost and expenses shall carry out such proposals, including any modifications thereto that the Engineer or the local authority may require.

**3) Settlement of Extraordinary Traffic Claims:** If during the Carrying out of the Works damage or injury to railways, railway or bridge occurs due to moving of one

or more loads of Constructional Plant machinery or pre-constructed units or parts of units of work, the Employer shall conduct the necessary investigation for the purpose of determining the Contractor's liability. If the damage is due to failure on the part of the Contractor to observe and perform his obligations under sub-clause (1) and (2) of this Clause then the restoration / repair of the damaged portion of road or structure certified by the Engineer or local authority to be due to such failure shall be undertaken by or be chargeable against the Contractor.

**4) Water-borne Traffic:** Where the nature of the Works is such as to require the use by the Contractor of water-borne transport the foregoing provisions of this Clause shall be construed as though "highway" included a lock, dock, sea wall or other structure related to a waterway and "vehicle" included craft, and shall have effect accordingly.

### **30.0 RESTRICTION**

**a) Restriction of Movements:** The work shall have to be executed within the protected area of existing water works. The existing rules and regulation related to ingress and egress of labour and material shall have to be followed strictly in consultation with and as per direction of the Superintending Engineer, WEST Circle, MED or the local authority as the case may be. No labour, Supervisor or Engineer of the contractor shall enter inside the treatment plant, pump house or any other existing installations without prior permission of concerned officers Superintending Engineer, WEST Circle, MED.

**b) Opportunities for other contractors:** The Contractor shall in accordance with the requirements of the Superintending Engineer, WEST Circle, MED, afford all reasonable opportunities for carrying out their work to any other contractors employed by the Employer and their workmen and to the workmen of the employer and of any other duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the Works. If, however, the Contractor shall, on the written request of the Superintending Engineer, WEST Circle, MED or the Engineer's Representative, make available to any such other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible, or permit the use by any such of

the Contractor's scaffolding or other plant on the Site, or provide any other service of whatsoever nature, the Employer shall pay to the Contractor in respect of such use or service such sum or sums if at all as shall, in the opinion of the Engineer, be reasonable.

### **31.0 CONTRACTOR TO KEEP SITE CLEAR**

During the progress of the Works the Contractor shall keep the site reasonable free from all necessary obstruction and shall store or dispose of any Constructional Plant and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.

### **32.0 CLEARANCE OF SITE ON COMPLETION**

On the completion of the Works the Contractor shall clear away and remove from the site all Constructional Plant, surplus materials, rubbish and Temporary Works of every kind, and leave the whole of the Site and Works clean and in a workmanlike condition to the satisfaction of the Superintending Engineer, WEST Circle, MED.

**33.0 LABOUR :** 1) Engagement of labour: The Contractor shall make his own arrangements for the engagement of all labour, local or otherwise, and save in so far as the Contract otherwise provides, for the transport, housing, feeding and payment thereof.

**2) Supply of water:** The Contractor shall, so far as is reasonably practicable having regard to local conditions, provide on the Site, to the satisfaction of the Superintending Engineer, WEST Circle, MED representative, an adequate supply of drinking and other water for the use of the Contractor's staff and work people.

**3) Alcoholic Liquor or Drugs:** The Contractor or his workmen shall not consume or sale or gift or be under the influence of any drug/narcotics or Alcoholic liquor within the vicinity of the Construction site.

**4) Arms and Ammunition:** The Contractor shall not give, barter or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

**5) Festivals and Religious Customs:** The Contractor shall in all dealing with labour in his employment have due regard to all recognized festivals days of rest and religious or other customs.

**6) Epidemic:** In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities for the purpose of dealing with and overcoming the same.

**7) Disorderly Conduct etc.:** The contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees or workers and for the preservation of peace and protection of persons and property in the neighbourhood of the Works against the same.

**8) Compliance with Laws, regulation etc. relating to labour:** In respect of the engagement, employment, transport, payment, feeding, housing and working conditions of labour and all matters connected there with the Contractor shall at all times during the continuance of the Contract, comply in all respects with and carry out all obligations imposed on him by the provisions and requirements of the following statutes.

a) The Apprentices Act 1961 (Act 52 of 1961) and Rules and Regulations issued there under from time to time.

b) The Contract Labour Regulation and abolition Act 1970 (Act 37 of 1970) and Rules made there under (West Bengal Contract Labour Regulation and Abolition Rules 1972) from time to time.

c) The Payment of Wages Act 1936, the Minimum Wages Act 1948, the Employees Liability Act 1938, the Industrial Disputes Act 1947, the Maternity Benefits Act 1961, the Employees State Insurance Act 1948 including modifications thereto the Rules and Regulations framed there under from time to time.

d) Other existing National or State Statute, Ordinance or other Law or any Regulation or Bye-law of any local or other duly constituted authority which may be applicable, including any such Law, Regulation or Order that may be passed or ordered from time to time and come into force during the tenure of the Contract.



**9) Employees Provident Fund:** The Contractor shall comply with the provisions of the relevant Employees Provident Fund Act or Rules in force in the State along with the provisions of all rules and Regulations made there under from time to time, and shall in particular be responsible for the payment of all contributions as laid down under the Act/Rules.

**10) Trade union rights:** The Contractor shall recognize the freedom of all workmen employed by him in and for performance of the Contract to be members of registered Trade Unions and shall not in any manner prevent or discourage any such workman from becoming a member of a registered Trade Union or discriminate against any workmen who is a member of a registered Trade Union.

**11) Local Labour:** As far as possible local labour shall be engaged as unskilled labour.

**12) Fair Wages -** The Contractor shall in respect of all workmen employed by him in and for the performance of the Contract pay rates of wages and observe the conditions of employment not less favourable than those provided under the relevant labour law as applicable to the State.

**13) Medical Attendance:** The Contractor shall provide, to the satisfaction of the Government or Local Authorities Concerned, adequate medical attendance for his employees and labour.

**14) Report or Accident:** The Contractor shall, within twenty four (24) hours of the occurrence of any accident at or about the site or in connection with the execution of the Work, report such an accident to the Engineer. The Contractor shall also report such accident to the competent authority whenever law requires such a report.

**15) Report REQUIRED BY LABOUR Commissioner:** The Contractor shall submit, at the request of the Labour Commissioner or of the Assistant Commissioner of the State such returns as may be called for from time to time in respect of labour employed by the Contractor and by his subcontractors in the execution of the Contract. If so required, the Contractor shall furnish the names and address of all subcontractors to the Labour Commissioner. Statutory provisions in these regards are to be also complied with.

16) The Contractor shall be responsible for observance by his subcontractor of all the foregoing provision of sub-clause (1) to (15) of this Clause 33.

#### **34.0 RETURNS OF LABOR ETC.**

The Contractor shall, if required by the Superintending Engineer, WEST Circle, MED, deliver to the Superintending Engineer, WEST Circle, MED, or at his office a return in detail in such form and at such intervals as the Superintending Engineer, WEST Circle, MED may prescribe showing the supervisory staff and the number of the several classes of labour from time to time employed by the Contractor on the Site and such information respecting Constructional Plant as the Superintending Engineer, WEST Circle, MED his Representative may require.

#### **35.0 MATERIALS AND WORKMANSHIP**

1) All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instructions and shall be subjected from time to time to such tests as the Engineer may direct at the place of manufacture or fabrication, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places. The Contractor shall provide such assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples or materials before incorporation in the Works for testing as may be selected and required by the Superintending Engineer, WEST Circle, MED, be it at site or at the manufacturer/Vendors premises or elsewhere.

**2) COST OF SAMPLES:** The Contractor at the cost and expense of him shall furnish all samples of materials as may be required by the Superintending Engineer, WEST Circle, MED.

**3) COST OF TESTS:** The cost of making any test shall be borne by the Contractor if such test is clearly intended by or provided for in the Contract and in the cases only of a test under load or of a test to ascertain whether the design of any furnished or partially finished work in appropriate for the purpose which it was intended to fulfill, is particularized in the Contract in sufficient detail to enable the Contractor to price or allow for the same in his Bid.

**4) COST OF TESTS NOT PROVIDED FOR, ETC.:** If the Superintending Engineer, WEST Circle, MED orders any test, which is either;

a) Not so intended by or provided for, or

b) (In the cases above mentioned) is not so particularized, or

c) Though so intended or provided for is ordered by the Engineer to be carried out by an independent person or organization at any place other than the Site or the place of manufacture or fabrication of the materials tested, then the cost of such test shall be borne by the Contractor, if the tests shows the workmanship or materials not to be in accordance with the provisions of the Contract or the Engineer's instruction.

### **36.0 INSPECTION OF OPERATIONS**

The Engineer and any person authorized by him shall at all times have access to the Works and to all workshops stores and places where work is being prepared or from where material manufactured articles or machinery are being obtained for the Works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

### **37.0 EXAMINATION**

**1) Examination of work before covering up:** No work shall be covered up or put out or view without the approval of the Engineer or the Engineer's Representative and the Contractor shall afford full opportunity for the Superintending Engineer, WEST Circle, MED or the Engineer's Representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The Contractor shall give due notice to the Engineer's Representative where any such work or foundations is or are ready or about to be ready for examinations and the Engineer's Representative shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly attend for the purpose of examining and measuring such work or of examine such foundations

**2) Uncovering and making openings:** The Contractor shall uncover any part or parts of the Works or make opening in or through the same as the Engineer may from time to time direct and shall reinstate and make good such part or parts to the

satisfaction of the Engineer If any such part or parts have been recovered up or put out of view after compliance with the requirement of sub-clause (l) of this Clause and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating and making good the same shall be, borne by the Employer, but in any other case all costs shall be borne by the Contractor.

### **38.0 REMOVAL**

**1) Removal of improper work and materials:**The Superintending Engineer, WEST Circle, MED shall during the progress of the works have power to order in writing from time to time.

a) The removal from the Site, within such time or time as may be specified in the order, of any materials, which in the opinion of the Engineer, are not in accordance with the Contract.

b) The substitution of improper, substandard and unsuitable materials, and

c) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefore, of any work which in respect of materials or workmanship is not in the opinion of the Engineer, in accordance with the Contract.

**2) Default of Contractor in Compliance:** In case of default on the part of the Contractor in carrying out such order, the Employer shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any sum due or' which may become due to the Contractor.

### **39.0 SUSPENSION**

**1) Suspension of work:** The Contractor shall, on the written order of the Engineer, suspend the progress of the works or any part thereof for such time or times and in such manner as the Engineer may consider necessary and shall during such suspension properly protect and secure the work, so far as is necessary in the opinion of the Engineer. The extra cost incurred by the Contractor in giving effect to

the Engineer's instruction under this Clause shall be borne and paid by the Employer unless such suspension is

- a) Otherwise provided for in the Contract, or
- b) Necessary by reason of some default on the part of the Contractor, or
- c) Necessary by reason of climatic conditions on the Site, or
- d) Necessary for the proper execution of the work or for the safety of workmen or Works of any part thereof in so far as such necessity does not arise from any act or default by the Engineer or the Employer or from any of the expected risks defined in Clause 19 hereof provided that the Contractor shall not be entitled to recover any such extra cost unless he gives written notice of his intention to claim to the Employer within twenty-eight days of the Engineer's order. The Superintending Engineer, WEST Circle, MED shall settle and determine such extra payment and/or extension of time under Clause 43 hereof to be made to the Contractor in respect of such claim as shall in the opinion of the Employer be fair and reasonable.

**2) Suspension lasting more than 90 days:** If the progress of the Works or any part thereof is suspended on the written order of the Superintending Engineer, WEST Circle, MED and if permission to resume Work is not given by the Superintending Engineer, WEST Circle, MED within a period of ninety days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of sub-clause (1) of this Clause, the Contractor may serve a written notice on the Employer requiring permission within twenty eight days from the receipt thereof to proceed with the Works, or that part thereof in regard in which progress is suspended and, if such permission is not granted within that time, the Contractor by a further written notice so served may, but is not bound to, elect or treat the suspension where it affects part only of the Works as an omission of such part under Clause 50 hereof, or where it affects the whole Works, as an abandonment of the Contract by the Employer.

#### **40.0 COMMENCEMENT TIME AND DELAYS**

**Commencement of works:** The Contractor shall commence the Works on Site within the period named in the Appendix to the Bid after the receipt by him of a written order to this effect from the Engineer and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by the Engineer, or be wholly beyond the Contractors' Control.

The successful contractor shall within four weeks from the date of issue of Letter of Intent furnish one or more drawing stating and showing the following:

- 1.0 Dimensioned area requirement of the pumping station
- 1.1 Cut-outs at the operating platform.
- 1.2 Layout of motors, pumps, valves and other electrical units like MCC, Capacitors etc.
- 2.0 Centre line of VT Pumping units
- 2.1 Foundation level of pumps & valves
- 2.2 Centreline and sizes of pump delivery pipes, bends etc.
- 2.3 Top of the Pump casing
- 2.4 Electrically operated sufficient capacity Crane rail.
- 3.0 Forces and Moments developed at different locations.
- 3.1 Static and Dynamic loads of pumps, motors, valves, etc. (showing dead loads separately) & load of various electrical equipments and machinery.
- 3.2 Moments and stresses developed at different locations.
- 3.3 Vibrations at different locations expected.
- 4.0 Foundation details showing bolt sizes and extent of embedding of the foundation bolts.
- 5.0 RSJ sizes, locations and fixing arrangements for motor support, RSJ/girder requirement for fixing HOT crane as clamp-on chain pulley blocks for attending of valves etc. at the pump floor level stating the maximum load that is required to be lifted.
- 6.0 Layout of cable trenches, cable trays showing the locations and levels together without position of hooks at the underside of the operating platform stating the maximum load required to be withstood.
- 7.0 Any other data that the Bid considers relevant for construction of civil structure.
8. Any other reasonable data that may be asked for.

#### **41.0 POSSESSION**

**1) Possession of site:** Save in so far as the contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time and the order in which such portions shall be made available to him and subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's written order to commence the Works, give to the Contractor possession of so much of the Site as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the Programmed referred to in Clause 14 hereof, if any, and otherwise in accordance with such reasonable proposals, of the Contractor as he shall, by written notice to the Engineer, make and will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with the said Programmed or proposals, as the case may be.

If the Contractor suffers delays or incurs cost for failure on the part of the Employer to give possession in accordance with the terms of this Clause, the Employer shall grant an extension of time for the completion of the Works and certify such sum as, in his opinion, shall be fair to cover the cost incurred, which sum shall be paid by the Employer.

#### **42.0 TIME :-**

**1) Time of Completion and progress of Works:** The progress of the work shall conform to the approved Work Programmed in terms of Clauses 14 hereof, and subject to any requirement in the contract as the completion of any section of the Works before completion of the whole, the whole of the Works shall be completed, in accordance with the provisions of Clause 47 hereof, within the time stated in the Contract calculated from last days of the period named in the Appendix to the Bid as that within which the Works are to be commenced, or such extended time as may be allowed under Clause 43 hereof.

**2) Failure in keeping to stages of work Programmed:** If the Contractor does not keep to the approved program and continues at any stage to fall behind his schedule by as much as twenty percent (20%) of the said approved work programmed, within thirty (30) days from receipt by him of a written notice from the Engineer, or if in

the opinion of the Engineer the delay will substantially affect operation activities or execution of a major work item and it is ascertained by the Engineer that the Contractor cannot remedy the occasion within the stipulated time, the Superintending Engineer, WEST Circle, MED on recommendation of Engineer shall have full authority to undertake measures to recover from such adverse condition in terms of the provisions of Clause 62 thereof.

#### **43.0 EXTENSION OF TIME FOR COMPLETION**

Should the amount of extra or additional work of any kind or any cause of delay referred to in these Conditions, or other special circumstances of any kind whatsoever which may occur, other than through a default of the Contractor, be such as fairly to entitle the Contractor to an extension of time for the completion of the works, the Superintending Engineer, WEST Circle, MED on recommendation of Engineer shall determine the period of such extension and shall notify the Employer and the Contractor accordingly. Provided that the Engineer is not bound to take into account any extra or additional work or other special circumstances unless the Contractor has within twenty-eight days after such work has been commenced, or such circumstances have arisen or as soon as is practicable, submitted to the Engineer full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

#### **44.0 NO NIGHT OR SUNDAY WORK**

Subject to any provision to the contrary contained in the Contract, none of the Permanent Works shall, save as hereinafter provided, be carried on during the night or on Sundays, if locally recognized as days of rest, or other locally recognized equivalent without the permission in writing of the Engineer, except when the works 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 always that the provisions of the Clause shall not be applicable in the case of any work which it is customary to carry out by rotary of shifts.

#### **45.0 RATE OF PROGRESS AND NIGHT WORK WHEN PERMITTED**



If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any section is at any time, in the opinion of the Engineer, too slow to ensure completion by the prescribed time or extended time for completion, the Superintending Engineer, WEST Circle, MED on recommendation of the Engineer shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer may approve to expedite progress as to complete the Works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps. If as a result of any notice given by the Superintending Engineer, WEST Circle, MED under this Clause, the Contractor shall seek the Superintending Engineer, WEST Circle, MED permission to do any work at night or on Sundays, If locally recognized as days of rest, or their locally recognized equivalent, such permission shall not be unreasonable refused. When work at night has to be carried out, the Contractor shall, at his own cost and expense, make adequate arrangements for lighting and provide necessary facilities for safety etc. and comply with all stipulations as may have been imposed by the Superintending Engineer, WEST Circle, MED in granting permission for night work.

#### **46.0 DAMAGES FOR DELAY**

**1) Liquidated Damages for Delay:** If the Contractor shall fail to achieve completion of the Works within the time prescribed by Clause 42 hereof, then the Contractor shall pay to the Employer the sum stated in the Contract as liquidated damages for such default and not as a penalty for every day of part of a day which shall elapse between the time prescribed by Clause 42 hereof and the date of certified completion of the Works, the Employer may without prejudice to any other method of recovery, deduct the amount of such damages from any money in his hands, due or which may become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

**2) Reduction of liquidated Damages:** If, before the completion of the whole of the Works any part or section of the Works has been certified by the Engineer as completed, pursuant to Clause 47 hereof, and occupied or used by the Employer, the liquidated damages for delay shall, for any period of delay after such certificate and in the absence of alternative provision in the contract be reduced in the proportion which

the value of the part or section so certified bears to the value of the whole of the Works.

**3) Extent of Liquidated Damages:** The liquidated damages referred to in sub-clause (1) for delay of each day or part thereof, shall be at the rate of one percent (1 %) or such smaller amount as the Employer may decide, or the total value of the Contract Price excluding the value of such part or section of the works as may have been covered by certificate of completion in terms of the provisions of sub-clause (2) above, Provided however that in no case shall be total amount of liquidated damages exceed ten percent (10%) of the total Contract Price for whole Works.

**4) Liquidated Damage as Reasonable Compensation:** The 'Liquidated damage' referred to in sub-clause (1) to (3) above, shall be considered as reasonable compensation to be applied to the use of the Employer without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

**5) No bonus for early completion:** The Contractor shall not be entitled to payment of any bonus for early completion of the Works.

#### **4.7.0 CERTIFICATION OF COMPLETION OF WORK**

**1) Erection:** Erection of Mechanical and electrical equipment shall be construed to have been completed where equipment in question is placed in position undergoes all necessary tests such as those for alignment, verticality, leak proof mess, insulation etc. as may be specified elsewhere in the Bid documents and put to operation.

**2) Completion:** Completion is a stage when the equipment and the structure as a whole are certified by the Employer. The date shall only be indicative for the purpose of reckoning the period of Maintenance Period and shall not be co-related with the release of any payment provided that non-continuous or sporadic functioning shall not be deemed as commissioning and also provided that non-commissioning of minor works, the decision on determination of major or minor works resting with the employer, shall not nullify the act of completion for the aforesaid purpose.

An item shall be considered as minor work where its non-completion may not in the opinion of the employer, stand in the way of commencement of plant operation.

**3) Trial Run:** The Trial Run period shall be for three months including 72 hours with load operation of 8 hours at a stretch operation of all equipments as per specification and to the satisfaction of Engineer-in-Charge.

#### **48.0 MAINTENANCE**

**1) Operation Maintenance Period:** Operation and maintenance including supply of all accessories of the same for a period of 60 (Sixty) months after the completion of specified period of Successful Trial Run 3 months.

**2) Cost of Execution of work of repair, etc.:** The repair work shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer, be due to the use of materials or workmanship not in accordance with the Contract, or to neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract. If, in the opinion of the Engineer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it was an additional work.

**3) Remedy on contractor's failure to carry out work required:** If the Contractor shall fail to do any such work as aforesaid requirement by the Engineer, the Employer shall be entitled to employ and pay other persons to carry out the same, which in the opinion of the Employer, the Contractor was liable to do at his own expense under the Contract. In the said event, all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any sum due or which may become due to the Contractor.

#### **49.0 CONTRACTOR TO SEARCH**

The Contractor shall, if required by the Superintending Engineer, WEST Circle, MED in writing, search under the directions of the Engineer, for the cause of any defect, imperfection or fault appearing during the progress of the Works or in the period of Maintenance. Unless such defect, imperfection or fault shall be one for which the contractor is liable under the contract, the cost of the work carried out by the contractor in searching as aforesaid shall be borne by the Employer. If such defect, imperfection or fault shall be one for which the contractor is liable as aforesaid, the cost of the work carried out in searching as aforesaid shall be borne by the contractor

and he shall in such case repair, rectify and make good such defect, imperfection or fault at his Own expense in accordance with the provisions of Clause 48 hereof to the satisfaction of the Engineer.

#### **50.0 ALTERATIONS, ADDITIONS AND OMISSIONS**

1) Variations: The Employer may make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be desirable, he shall have power to order the Contractor to do and the Contractor shall do any of the following:

- a) Increase or decrease the quantity of any work included in the contract.
- b) Omit any such work.
- c) Change the character or quality or kind of any such work.
- d) Change the levels, lines position and dimensions of any part of the Works and
- e) Execute additional work of any kind necessary for the satisfactory completion of the works or for deriving satisfaction of the Employer. It is expressly provided that no such variation shall, in any way vitiate or invalidate the Contract, but the value, if any, of all such variations shall be taken into account in ascertaining the amount of the Contract Price.

**2) Orders for variations to be in writing:** The Contractor shall make no such variations without an order in writing from the Employer. Provided that no order in writing shall be required for insignificant increase or decrease in the quantity of any work where such increase or decrease is not the result of an order given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Schedule of prices. Provided also that if for any reason the Employer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order and any confirmation in writing of such verbal order given by the Employer whether before or after the carrying out of the order, shall be deemed to be an order in writing within the meaning of this Clause. Provided further that in the event of non-receipt of written confirmation from the Employer, the Contractor shall, within eleven working days, confirm the same from his end in writing to the Employer, and If such

confirmation is not contradicted in writing within fourteen working days by the employer, it shall be deemed to be an order in writing by the Employer.

## **51.0 VALUATION**

**1) Valuation of variations:** All extra or additional work done or work omitted or substituted by order of the Employer shall be valued at the rates and prices set out in the Contract if, in the opinion of the Employer, the same shall be applicable as it is or with addition to or subtraction from an accepted item, if the Contract does not contain any rates or prices applicable to the extra or additional work, then the rates or prices shall be obtained from the western Circle, Public Works Department schedule of rates as was in vogue on the date of submission of the Bid. The same is being escalated to an extent determined by comparing the cost of a similar item appearing in the Schedule of Prices with those in PWD schedule. Where such rates are not available in P.W.D. schedule of rates, the market-analysed rate as approved by the Employer shall be final and binding. In case of such analysed rates, 10% profit including overhead consultant's fees, ST. Turnover Tax etc. shall be allowed. No other overhead, or other expenses shall be taken into account shall be considered to be inclusive of contractors profit.

**2) Variation Exceeding 20 Percent:** - If, on certified completion of the whole of the Works, it shall be found that a reduction or increase greater than twenty percent (20%) of the sum named in the Letter of Acceptance, excluding all fixed sums, provisional sums if any, results from

a) The aggregate effect of all Variation Orders, and

b) All adjustments upon measurement of the estimated quantities set out in the Schedule of Prices excluding all provisional sums, and adjustments of price made under Clause 66 (1) hereof but not from any other clause, of the Contract Price shall be adjusted by such sum as may be agreed between the Contractor and the Employer or, failing agreement, fixed by the Employer having regard to all material and relevant factors, including the Contractor's site and general overhead costs.

**c) Claims:** The Contractor shall send to the Superintending Engineer, WEST Circle, MED once in every month an account giving particulars, as full and detailed as possible, of all claims for any additional payment to which the Contractor may consider himself entitled and of all extra or additional work ordered by the Employer which he has executed during the preceding month. No final or interim claim for

payment for any such work or expense will be considered which has not been included in such particulars. Provided always that the Employer shall at his discretion be entitled to authorize payment to be made for any such working expense, notwithstanding the Contractor's failure to comply with this condition, that the Contractor has, at the earlier practicable opportunity, notified the Employer in writing that he intends to make a claim for such work, provided always that a release of payment shall be preceded by the claim and valuation of variation, in that order.

## **52.0 PLANT TEMPORARY WORKS AND MATERIALS**

**1) Plant, etc. exclusive use for the works:** All Constructional Plant, Temporary Works and materials provided by the Contractor shall, when brought to the Site be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent, in writing, of the Engineer which shall not be unreasonably withheld.

**2) Removal of plant, etc.:** Upon completion of the Works the Contractor shall remove from the Site all the said Constructional Plant and Temporary Works remaining thereon and any unused material provided by the Contractor to the satisfaction in the Engineer.

**3) Employer not liable for damage to plant, etc.:** The employer shall not at any time be liable for the loss of or damage to any of or damage to any of the said Constructional Plant, Temporary Works or materials same as mentioned in Clause 19 and 62 hereof.

**4) ) GST, Cess and other imposts.** The Contractor shall pay GST, Cess, and all other taxes, duties and charges as may be applicable from time to time in respect of materials purchased by him or plants and equipment brought to Site. No separate payment shall be made for all these and they shall be deemed to have been covered within the Contractor's rates for the finished items of work.

**5) Temporary Works:** At least fourteen (14) days in advance of taking up any temporary works, the contractor shall submit to the Engineer for approval complete

drawings of all temporary works he may require for the execution of the Works. He shall, so required by the Engineer, submit his calculations relating to the strength of the temporary works proposed. Modifications that the Engineer may require shall be made by the Contractor at the latter's cost and expenses. At the discretion of the Engineer, a higher stress up-to a maximum of twenty five percent (25%) in excess of the stress normally allowed for permanent structures may be permitted in the design of temporary works.

Notwithstanding the approval by the Engineer of any of the temporary works, the contractor shall remain wholly responsible for their adequacy, safety, proper maintenance and of all obligations in regard to such works specified or implied in the Contract, until the removal of such works.

### **53.0 APPROVAL OF MATERIAL, ETC. NOT IMPLIED**

The operation of Clause 52 hereof shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to therein shall not interfere with rejection of any such materials at any time by the Engineer.

**54.0 MEASUREMENT :** For measurement, the **metric** system should be used.

### **55.0 WORKS TO BE MEASURED**

The engineer shall, except as otherwise stated, ascertain and determine by measurement the value in terms of the Contract of work done in accordance with the Contract. He shall, when he requires any part or parts of the works to be measured, give notice to the Contractor's authorized agent or representative, who shall forthwith attend or send a qualified agent to assist the Engineer or the Engineer's Representative in making such measurement, and shall furnish all particulars required by either of them. Should the Contractor not attend, or neglect or omit to send his agent on two consecutive occasions, then in the third occasion the measurement shall be made unilaterally by the Engineer, which shall be taken to be the correct measurement of the work. For the purpose of measurement such permanent work as is to be measured by records and drawings at suitable intervals of such work and the Contractor, as and when called upon to do so in writing shall, within fourteen days, attend to examine and agree upon such records and drawings, with the Engineer or Engineer's Representative and shall sign the same when so agreed. If the Contractor does not so attend to examine and agree upon such records and drawings on two

consecutive occasions they shall be taken to be correct. If, after examination of such records and drawings, the Contractor does not agree with the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor shall, within fourteen days of such examination, lodge with the for decision by the Engineer, a notice in writing giving details of the respects in which such records and drawings are claimed by him to be incorrect together with reasons thereof.

#### 56.0 METHOD OF MEASUREMENT

The Works shall be measured but, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract.

#### 57.0 PAYMENT

Sl. No.	<b>TERMS OF PAYMENT : ITEM WISE BREAK UP</b>	
1	<u>Construction of Collector Well with Pump House:-</u> Planning, designing and construction of 72.87 MLD Collector well, pumping station in the River Damodar considering bid documents as per approval from competent authority and direction of EIC. (A = 20% of BOQ item no. 1)	
	<i>Break up :</i>	
A.	On placing of cutting edge and completion of 50% below river bed level including supply fixing of 6 Nos. Sluice valve, paddle collar etc.	20% of A
B.	On Completion up to bed level and bottom plugging.	20% of A
C.	On completion up to deck level slab casting	20% of A
D.	On completion of superstructure up to roof casting.	20% of A
E.	On completion of all mechanical works i.e. inside three layer platform, Electrically operated crane including frame structure for crane and outside cantilever path way, inside stair, outside stair all complete.	15% of A
F.	On completion coloring of concrete and plaster work, painting the frame structure, lift, stair, inside platform, outside stair all complete.	5% of A



	<b>Total =</b>	<b>100% of A</b>
<b>2</b>	<b><u>Foot Way Bridge Pier and Intake jetty footway bridge:-</u> Planning, designing and construction of Pile foundation of Foot way bridge pier / column, and intake jetty footway bridge by joist and angle frame structure on River Damodar. (B = 20% of BOQ item No. 2)</b>	
<b>A.</b>	<b>Foundation up to River Bed Level of all Pier</b>	<b>20% of B</b>
<b>B.</b>	<b>Column up to deck (i.e. frame structure) Level of all Pier</b>	<b>10% of B</b>
<b>C.</b>	<b>Fabrication and placing of Joist, angle and U Chanel frame structure</b>	<b>30% of B</b>
<b>D.</b>	<b>Construction of deck slab and fixing the same on frame structure</b>	<b>10% of B</b>
<b>E.</b>	<b>Supply, fixing and fabrication of 700 mm dia. 10 mm thick M.S. Pipe, Valves, cables, tub line including tub and all necessary fittings on both side of footway bridge.</b>	<b>20% of B</b>
<b>F.</b>	<b>Painting of total Piers, M.S. bridge , M.S. Pipe, valves, deck slabs etc.</b>	<b>10% of B</b>
	<b>Total =</b>	<b>100% of B</b>
<b>3</b>	<b><u>Vertical turbine Pump-Motor:-</u> (C = 12% of BOQ Item No. 1)</b>	
<b>A.</b>	<b>Supply of V.T. Pump &amp; Motors.</b>	<b>30%</b>
<b>B.</b>	<b>Installation of VT Pumps with column pipes and commissioning the same.</b>	<b>15%</b>
<b>C.</b>	<b>Supply of L.T. Panel, Soft Starter, internal cable, Materials for earthing arrangement all other materials.</b>	<b>20%</b>
<b>D.</b>	<b>Installation of L.T. Panel, Soft Starter, internal cable, earthing arrangement and commissioning the same.</b>	<b>20%</b>
<b>E.</b>	<b>Supply, fixing and fabrication of M.S. Manifold line, actuator control butterfly valve, full bored type digital flow meter etc. all complete.</b>	<b>15%</b>
<b>D</b>	<b>After successful trial run of the plant.</b>	<b>10%</b>
	<b>Total =</b>	<b>100%</b>
<b>4.</b>	<b>Planning, Design, Construction of Substation building, 8 nos. room 5.00 meter x 5.00 meter size 1) 1 No. for WBSEDCL room, 2) 1 No. for H.T. VCB Panel room, 3) 1 nos. for Transformer room, 4-5) 2 Nos. for PDB Panel room and APFC Panel Room 6-7) 1 No. operator room and 1 No. office room (decorative type room) with vitrified tiles flooring, wall putty finishing wall</b>	

	and toilet facility by porcelain tiles on wall.(D = 14% of BOQ Item No. 1)	
<b>A</b>	Construction of all Structural work complete in all respect	50% of D
<b>B</b>	All finishing work completion of inside of building, outside campus in all respect.	40% of D
<b>C</b>	After successful trial run of the plant.	10% of D
	Total	100% of D
<b>5.</b>	<b><u>Electrical Wiring and Lighting arrangement:-</u></b> Electrical wiring and lighting arrangement including supply delivery & erection of illumination fittings fixture, aviation lamp fittings, exhaust fan. Ceiling fan, lightening arrestor with its wiring and earthing arrangement of inside of building, outside campus, foot way bridge and collector well, pumping station all complete by suitable Led light as per direction of E.I.C. complete in all respect considering bid documents as per approval from competent authority and direction of EIC (E = 1% of BOQ Item No. 1)	
	Break up :	
<b>A</b>	Supply of all Electro-Mechanical equipments required to complete the item.	50% of E
<b>B</b>	Installation of LED light fittings (indoor & outdoor), Ceiling fan, Exhaust fan, other lighting arrangement and any other work required to complete the item in all respect.	40% of E
<b>C</b>	After successful trial run of the plant.	10% of E
	Total =	100% of E
<b>6.</b>	<b><u>Infiltration gallery:-</u></b> Construction of requisite dia. and suitable length (required length as per designed by the bidder) Infiltration gallery including surveying, investigation Planning, design, drawing and construction of Civil, Electrical and Mechanical works including supply, carriage of all materials with foundation for the various units of Infiltration gallery of collector well and provision of following accessories. (F = 30% of BOQ Item No. 1).	
<b>A.</b>	Supply of Slotted pipe including fabricated flange, man machineries etc.	30 % of F
<b>B.</b>	On 50% completion of excavation of trench and laying of MS strainer pipe, Packing suitable size gravels and back filling the same with different graded sand.	20% of F
<b>C.</b>	On rest 50% completion of excavation of trench and laying of MS strainer pipe, Packing suitable size gravels and back filling the same with different graded sand.	20% of F

<b>D.</b>	On completion of bouldering with netting arrangement and sausage work.	20 % of F
<b>E.</b>	After 3 months from trial run	10% of F
	<b>Total =</b>	<b>100% of F</b>
<b>8</b>	<u>RCC Retaining wall / Boulder Sausage work (at river bank starting point of foot way bridge 2 X 30.00 meter long) and boundary wall as required:-</u> Planning, Designing & Construction of R.C.C retaining wall to retain earth up to FGL along with plastering, Boundary walls of campus for protection the sites approx length 500.00 meter. The boundary wall will be column structure 250 mm X 250 mm size, Tie beam 250 x 350 mm size, 125 mm thick brick work, 250 x 150 mm size lintels, 2.00 meter height and supply fixing of barbed wire 600 mm height above lintels of boundary wall including coloring, painting all complete. Approach road, Drain & surface dressing, beatification and gardening will be under bidder scope along with 6.0 m Steel gate with anti corrosion paint, Filling & Land development of Whole Premises up to FGL With good earth with proper compaction & consolidation, 4 m wide road on consolidated pavement with M20 grade of concrete having min. Thickness of 150 mm and nominal reinforcement (min. 0.15% of Gross area) at top and bottom both ways and over it Paver Block (not less than 60 mm in thickness) inside the premises etc and Finishing complete in all respect per approved drawing and direction of E.I.C. (G = 3% of BOQ Item No. 1)	
<b>A</b>	Construction of RCC retaining wall / Boulder Sausage work	15% of G
<b>B</b>	1.5 M Masonry boundary wall over Retaining wall & steel gate	45% of G
<b>C</b>	Barbed fencing over boundary wall	10% of G
<b>D</b>	Filling & land development up to FGL	10% of G
<b>E</b>	4.0 m wide internal road	10% of G
<b>F</b>	After successful trial run of the plant.	10% of G
	<b>Total =</b>	<b>100% of G</b>
<b>9.</b>	Operation & maintenance: (Sl. No. 11) Operation and maintenance including supply of all accessories of the same for a period of 60 (Sixty) months after the completion of specified period of Successful Trial Run 3 moths. (H = 100% of operation & maintenance cost BOQ item No. 5)	

	<b>Break up :</b>	
<b>A.</b>	On completion of running at the end of 1 <sup>st</sup> year	20% of H
<b>B.</b>	On completion of running at the end of 2 <sup>nd</sup> year	20% of H
<b>C.</b>	On completion of running at the end of 3 <sup>rd</sup> year	20% of H
<b>D.</b>	On completion of running at the end of 4 <sup>th</sup> year	20% of H
<b>E.</b>	On completion of running at the end of 5 <sup>th</sup> year	20% of H
	<b>Total =</b>	<b>100% of H</b>
<b>Note</b>		
	<p><i>The Payment breakup is an indicative only. Revised breakup of payment to be done as per direction of Superintending Engineer, West Circle, MED</i></p> <p><i>Operation &amp; maintenance: (Sl. No. 18) Operation and maintenance including supply of all accessories of the same for a period of 60 (Sixty) months after the completion of specified period of Successful Trial Run 3 months.</i></p> <p><b>A</b> <i>The work is of maintenance in nature, the Defect Liability Period of the work shall be Sixty months from the actual date of completion of the work i.e. after three months Trial Run.</i></p> <p><i>(ii) The Maintenance and operation cost as per BOQ item No. 5 shall be refunded after satisfactory completion of work per annum basis for 5 years.</i></p> <p><i>(iii) Deducted S.D. Money shall be refunded after completion of success full maintenance and operation of 5 Years i.e. in the time of releasing of 5th year operation &amp; maintenance cost.</i></p>	
<b>B</b>	<i>The total amount to be quoted &amp; uploaded by the bidder in .xls format of BOQ under Financial document will be as per the clause 57 of section C.</i>	
<b>C</b>	<i>The items which is not covered here but required for successful completion of the project in all respect are to be considered by the bidder while quoting their rates in uploaded BOQ.</i>	

#### **58.0 APPROVAL ONLY BY MAINTENANCE CERTIFICATE**

No certificate other than the maintenance certificate referred to in clause 59 hereof shall be deemed to constitute final approval of the works.

#### **59.0 MAINTENANCE CERTIFICATE**

**1) The Maintenance Certificate** stating that the Works have been completed and maintained to the satisfaction of the Engineer, shall be issued by him within twenty eight days after the expiration of the period of Maintenance, or if different periods of maintenance shall become applicable to different sections or parts of the Works, the expiration of the latest such period, or as Soon thereafter as any works ordered during such period, pursuant to Clauses 4) and 48 hereof (shall have been completed to the Satisfaction of the Engineer). With regard to defects that may arise during the Period of Maintenance, the Contractor shall be responsible to carry out restoration/rectification of damages as are attributable to defects in works carried out under this Contract. The decision of the Employer in the regard shall be final and binding on the contractors.

**2) Cessation of Employer's liability:** The Employer shall not be liable to the Contractor for any matters or thing arising out of or in connection with the Contractor for any matters or thing arising out of or in connection with the Contract or the execution of the Works, unless the Contractor shall have made a claim in writing in respect thereof before the delivery of the Maintenance Certificate under this Clause.

**3) Unfulfilled obligations:** Notwithstanding the issue of the Maintenance Certificate the Contractor and, subject to the sub-clause (2) of the Clause, the Contractor shall remain liable for the fulfilment of any obligation incurred under the provisions of the Contract prior to the issue of the Maintenance Certificate which remains imperforated at the time such Certificate is issued and for the purpose of determine the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties hereto,

#### **60.0 REMEDIES AND POWERS**

**1) Default of contractor:** If the Contractor shall become bankrupt, or have a receiving order made against him, or shall present his petition in bankruptcy, or shall made an arrangement with or assignment in favour of his creditors, or shall age 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 shall certify in goods, or if the Engineer shall certify in writing to the Employer that in his opinion the Contractor :

a) Has abandoned the Contract, or

b) Without reasonable excuse has failed to commence the Works or has suspended the progress of the Works for twenty-eight days after receiving from the Engineer written notice 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 from the Engineer written notice that the said materials or work had been condemned and/or rejected by the Engineer under these conditions, or

d) Despite previous warnings by the Engineer, in writing, is not executing the Works in accordance with the Contract, or is persistently or flagrantly neglecting to carry out his obligation under the Contract, or

e) Has, to the detriment of good workmanship, or in defiance of the Engineer's instructions to the contrary, sublet any part of the Contract.

Then the Employer may, after giving fourteen day's notice in writing to the Contractor, enter upon the Site and the Works and expel the Contractor therefore without thereby avoiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor or agency to complete the Works. The Employer or such other contractor may use for such completion so much of the 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 he or they may think proper and the Employer may, at any time, sell any of the said Constructional Plant, Temporary Works used 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 the Contract.

**2) Valuation at date of forfeiture:** The Engineer shall, as soon as may be practicable after any such entry and expulsion by the Employer, fix and determine expert, or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract and the value of any of the said unused or partially used materials, and Constructional Plant and any Temporary Works.

**3) Payment after forfeiture:** If the Employer shall enter and expel 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 sums or sums, if any, as the Engineer may certify would have been 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.

#### **61.0 URGENT REPAIRS**

If, by reason of any accident, or failure, or other event occurring to in or in connection with the Works, 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 or the Engineer's 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, the Employer may employ and pay other persons to carry out such work or repair as the Engineer or the Engineer's Representative may consider necessary.

If the work or repair so done by the Employer is work which in the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, all expenses properly incurred by the Employer in so doing shall be recoverable from the

Contractor by the Employer, or may be deducted by the Employer from any sums due or which may become due to the Contractor, Provided always that the Engineer or the Engineer's 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.

## **62.0 SPECIAL RISKS**

Notwithstanding anything in the Contract contained:

**1) No liability for war, etc., Risks-** The Contractor shall be under no liability whatsoever whether by way of identity or otherwise for or in respect of destruction of or damage to the Works, same to work condemned under the provision of Clause 38 hereof prior to the occurrence of any special risk hereinafter mentioned, or to property whether of the Employer or third parties, or for or in respect of injury or loss of life which is the consequence of any special risk as hereinafter defined The employer shall indemnify and save harmless to Contractor against and from the same and against and from the same and against and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising there out or in connection therewith.

**2) Damage to works, etc., by special risks -** If the Works or any materials on or near or in transit to the Site, or any other property of the Contractor used or intended to be used for the purposes of the Works, shall sustain destruction of damage by reason or any of the said special risks the Contractor shall be entitled to payment for:

a) Any permanent work and for any materials so destroyed or damaged and so far as may be required by the Engineer, or as may be necessary for the completion of the Works, or the basis of cost plus such profit as the Engineer may certify to be reasonable;

b) Replacing or making good any such destruction or damage to the Works;

c) Replacing or making good such materials or other property of the Contractor used or intended to be used for the purposes of the Works.

**3) Projectile missile etc.:** Destruction, damage, injury or loss of life caused by the explosion or impact whenever and wherever occurring of any mine, bomb, shell,



grenade, or other projectile, missile, ammunition, or explosive of war, shall be deemed to be a consequence of the said special risks.

**4) Increase cost arising from special risks:** The Employer shall repay to the Contractor any increased cost of or incidental to the execution of the Works, other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 38 hereof, prior to the occurrence of any special risk, which is howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall as soon as any such increase of cost shall come to his knowledge forthwith notify the Superintending Engineer, WEST Circle, MED thereof in writing.

**5) Special Risks:** The special risks are war, (whether war be declared or not), invasion, act of foreign enemies, the nuclear and pressure waves risk described in Clause 19(2) hereof, or in so far as it relates to the country in which the works are being or are to be executed or maintained, rebellion, revolution, insurrection, military or usurped power, civil war, or unless solely restricted to the employees of the Contractor or of his Sub-Contractor and arising from the conduct of the Works, riot, commotion or disorder.

**6) Outbreak of war:** If, during the currency of the Contract, there shall be an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavours to complete the execution of the Works. Provided always that the Employer shall be entitled at any time after such outbreak of war to terminate the Contract by giving written notice to the Contractor and upon such notice being given, this Contract shall, except as to the rights of the parties under this Clause and to the operation of Clause 64 hereof, terminate but without prejudice to the rights of either party in respect of any antecedent breach thereof

**7) Removal of plant of termination:** If the Contract shall be terminated under the provisions of the last preceding sub-clause, the Contractor shall, with all

reasonable dispatch, remove from the Site all constructional Plant and shall give similar facilities to his Sub-Contractors to do so.

**8) Payment if Contract terminated:** If the Contract shall be terminated as aforesaid, the Contractor shall be paid by the Employer, in so far as such amounts or items shall not have already been covered by payments on account made to the Contractor, for all work executed prior to the date of termination at the rates and prices provided in the Contract and in addition

a) The amounts payable in respect of any preliminary items, so far as the work carried out or performed, and a proper proportion as certified by the Engineer of any such items, the work or service comprised in which has been partially carried out or performed.

b) The cost of materials or goods reasonably ordered for the Works which shall have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery such materials or goods becoming the property of the Employer upon such payments being made by him.

c) A sum to be certified by the Engineer, being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works in so far as such expenditure shall not have been covered by the payments in this sub-clause before mentioned.

**d) Any additional sum payable** under the provisions of sub-clause (1), (2) and (4) of this Clause. Provided always that against any payments due from the Employer under this sub-clause, the Employer shall be entitled to be credited with any outstanding balances due from the contractor for advances in respect of Constructional Plant and materials and any other sums which at the date of termination were recoverable by the Employer from the Contractor under the terms of the Contract and provided that if the termination be made in exercise of Clause C-60(1), no payment shall be released under ClauseC-62(8) (a) to (d).

### **63.0 FRUSTRATION**

**Payment in event of Frustration:** A war, or other circumstances outside the control or both parties, arises after the Contract is made so that either party is prevent from fulfilling his contractual obligations, or under the law governing the Contract, the

parties are released from further performance, then the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as would have been payable under Clause 62 hereof if the Contract had been terminated under the provisions of Clause 62 thereof.

#### **64.0 SETTLEMENT OF DISPUTES**

**Settlement of Disputes:** If any dispute or difference of any kind whatsoever shall arise between the Employer and the Contractor or the Engineer and the Contractor in connection with, or arising out of the Contract, of the execution of the Works, whether during the progress of the Works or after their completion and whether before or after the termination, abandonment or breach of the Contract, it shall be settled in the court of law having jurisdiction within Nadia District, provided that such a recourse shall not be resorted to without exhausting all other reasonable avenues of redresser.

#### **65. NOTICES**

**1) Contractor's local office and service of notices to contractor:** The Contractor shall have a local office at or near the Site of work; full address thereof shall be intimated by the Contractor or his authorized Agent to the Employer as well as to the Engineer. All Certificates notice or written orders to be given by the Employer or by the Engineer to the Contractor under the terms of the Contract shall deemed to have been served by sending by post to or delivering the same to the Contractor's local office.

**2) Service of notice to employer:** All Notice to be given to the employer under the terms of the Contract shall be served by sending by Registered post or delivering the same to the address given below:

**(3) Change in Address of the Employer,** the Engineer or the Contractor may change a nominated address to another address by prior written notice to the other two and in that event shall resume receiving of communication 28 days after delivery of such notice.

#### **66.0 PRICE ADJUSTMENT**

(1) The prices to be paid to the contractor for the whole work shall remain firm during the stipulated contract period or extension thereof and no price adjustment shall be allowed.

(2) The statutory changes in price in the form of Taxes, duties etc. shall however be taken into account. For this purpose the taxes and duties prevailing on the last date of submission of the technical bid (or revised price bid, if applicable) shall be taken as the base. Such taxes and duties for different bought out items shall be specified by the contractor, falling which the assessment of the Employer shall be final and binding. Changes in price of Petrol, Diesel Lubricants, and Electricity etc. shall not be considered.

#### **67.0 MISCELLANEOUS**

**Dangerous materials:** Explosive, chemicals, combustible articles and items and similar materials intended for the Works shall be conveyed, stored and used by the Contractor and his sub-contractors In accordance with all laws, decrees, instruments, orders and regulations imposed by the Government or any of its instrumentalists. Observance of all safety provisions shall be the obligation of the Contractor and nothing herein shall release him from full responsibility for damage or injury to persons or properties resulting from his use of these dangerous materials.

#### **67.0 CONTRACT CONFIDENTIAL**

Except with the prior written approval of the Employer and to subject the such conditions as may be prescribed, the Contractor and/or any member of his organization shall not in any case communicate to any person or entity and information connected with the performance of the Services or in carrying out the Works not make public any information for the purpose of publication or advertisement. The Contractor shall treat all matters related to the Contract as private and confidential.

#### **68.0 CONTRACTOR TO PROVIDE FACILITIES**

The Contractor shall provide such labour, materials and other facilities that the Engineer or his Representative may require to assist them in carrying out normal tests and checks on materials and workmanship and in measurement of works.

### **69.0 INTERFERENCE WITH EXISTING FACILITIES**

The Contractor shall carry out the works in such a way as to the minimum extent of interference to the use of existing facilities of any kind.

### **70.0 ACTS OF INFLUENCE**

Neither the Contractor nor any of his Agents, Representatives, Employees or members of his organization shall commit any act which may influence the judgment or decision of the Employer or the Engineer or any their agents, representatives, employees or members of their respective organization. Any breach of this provision shall constitute a breach of Contract on the part of the Contractor and apart from penal measures against the Contractor according to the law the Employer shall have the Authority to take action for the Contractor's default in terms of the provisions of Clause 60 hereof.

### **71.0 INDIVIDUALS NOT PERSONALLY RESPONSIBLE**

No personal liability shall be imposed on the members or the Employer or on the Engineer or their duly authorized representatives, agents or employees for acts performed or discharged in the exercise of their authorized duties or responsibilities or in carrying out their obligations by virtue of the provisions or scope of work contained in the Contract, if being understood that they are acting solely as agents and representatives of the Employer in good faith.

### **72.0 CONTRACT EMBODIES WHOLE ARRANGEMENT**

The Contract becomes effective immediately on Issue of the letter of acceptance to the successful Bidder. The Contract (with annexure if any) as subsequently executed embodies the whole arrangement between the parties entering into the Contract All previous correspondence, negotiations, representation, explanations statements, promises or guarantees (whether oral or written) as are not included with the Contract as executed, shall normally be excluded in the interpretation of the Contract.

### **73.0 COMPLETION DRAWING**

Completion drawing including detailed construction drawing shall have to be submitted in original with 6 (six) copies of prints of each. The original drawings shall be drawn on thick polyester film approved by the Engineer-in-Charge. Scale and size

of drawings shall also be as specified by the Engineer-in-Charge. Soft copy of drawing copied in CD/DVD should be submitted in addition. No extra payment will be made for it. The Completion drawings are to be got approved by the Employer and shall have to be submitted before the issue of certificate of final acceptance as in Clause C-57 (6).

Superintending Engineer, West Circle  
Municipal Engineering Directorate

**SECTION - D**  
**SPECIAL PROVISIONS**

**1.0 GENERAL**

**1.1 Extended scope of the contract:-**

The contract comprises the surveying, planning, designing, drawing supplying materials and equipment, construction, testing of the plant, Trial Run for 3 months, commissioning of E/M Equipments with continuous operation for 72 hrs and maintenance for a period of (60) sixty months after successful trial run upon completion of the works and commissioning and except in so far as the contract otherwise provides, the provision of all labour, materials, constructional plant, temporary works and everything (whether of a temporary or permanent nature) required red in and for such planning, design, construction, completion and maintenance so far as the necessity for providing the same is specified in or reasonably to be inferred from the contract.

**1.2 ITEM WISE DETAILS OF THE LUMP SUM PRICES AND INTERIM PAYMENT SCHEDULE:-**

The successful contractor will, against each of the job items quoted in the schedule or prices on lump sum basis, submit a detailed break up of lump sum prices for the approval of the Superintending Engineer, WEST Circle, MED for the purpose of preparing interim payment schedule and calculating the consumption of materials to

be issued by the Authority. The break ups will be such as to fairly agree with the lump sum price quoted. The Superintending Engineer, WEST Circle, MED, on recommendation of Superintending Engineer of Western Circle of Municipal Engineering Directorate shall have the authority to modify the breakup of prices keeping, however, the total of the prices fairly equal to the lump sum amount quoted. Lump sum prices quoted in the schedule of prices shall remain fixed irrespective of the variations (i) in Items and quantities during actual execution compared with those provided in the break-ups.

Such break-ups for Civil Works shall include for each of the unit of the intake jetty pumping station with HT substation, laying of 800mm dia. pipe lines up to the inlet well of the clear water treatment plant following broad items of works:

- i) Piling
- ii) Cement Concrete
- iii) Reinforcement
- iv) Brick Work
- v) Structural Steel Work
- vi) Doors, Windows, Rolling Shutters, Gates etc.
- vii) Roof Treatment
- viii) Plumbing and Sanitary Works
- ix) Pipe Lines and appurtenant structures
- x) Finishing works and other miscellaneous works (to be specified by the Contractor). Break-ups for Mechanical Equipment shall be into the following broad items:
  - i) Pumping unit of intake jetty
  - ii) Electrical actuator control valves, and penstocks
  - iii) Structural Steel Works if any
  - iv) Pipes and specials
  - v) Flow meters & Flow measuring meter

- vi) Discharge meter
- vi) Miscellaneous (to be specified by the Contractor)
- vii) Supply & Laying of rising main 800 mm dia. with valves and jack pushing Break-ups for Electrical Equipment shall be into the following broad

items:

- i) Motors
- ii) Cables
- iii) Motor control panel with APFC panel
- iv) HT Switch gears
- vi) Other electrical equipment (to be specified by the contractor)

The above-mentioned details should be submitted by the contractor as early as possible after receipt of the Letter of Intent in order to enable him to start any sub-items of work and to receive interim payments. Where a component includes civil mechanical and electrical equipment, the break ups should invariably be submitted.

### **1.3 STORE SHED**

The Contractor shall provide at his own cost a store shed of adequate capacity for storing materials. The shed should be of such construction that it must protect the materials against deterioration. A raised platform well above the highest flood level shall be made for stacking cement in such a way that the cement procured earlier can be consumed first so as to avoid deterioration due to prolonged stacking. If any modifications to the store shed is suggested by the Superintending Engineer, WEST Circle, MED recommendation of the Engineer for better storing of materials that should be carried out by the Contractor at his own cost.

### **1.4. LAND FOR CONTRACTOR'S ESTABLISHMENT**

For the purpose of constructing Contractor's Store yard, go-downs, site office and ancillaries, he may utilize portion of the land belonging to the Employer at such location as would not interfere to execute other co works. For all these, the Contractor shall have to obtain the requisite permission of the Engineer. The Contractor shall for this purpose submit to the Engineer for his approval a plan of the proposed layouts



for the site facilities. The Engineer reserves the right to alter and modify the Contractor's proposals as the Superintending Engineer, WEST Circle, MED may deem fit.

### **1.5 WATER AND ELECTRICITY FOR CONSTRUCTION**

1.5.1. The Contractor shall have to make his own arrangement for supply of water and for electrical power that may be required for or in connection with the works. No payment on this account will be entertained. However, Municipality may assist in getting power.

1.5.2. Arrangement for supply of piped water may not be possible. The Contractor will have to make arrangement for supply of drinking water and water required for constructions works by sinking tube wells or other suitable alternatives. The Tenderer shall investigate this matter during site inspection before submission of tenders: No payment will be entertained on this account.

1.5.3. Nevertheless electrical power from usual supply agencies may not be continuously available due to various reasons including load shedding. In case of non-availability of electrical power the contractor will have to make his own arrangements for electrical power through generations. Contractor should include such aspects while quote his rate. No payment will be entertained on this account. When drawing power from the Municipality power point, the contractor shall have to bear the cost of electrical charges. The route of conveyance shall be subject to approval by the Engineer-in-Charge and will be in accordance with prevailing I.E. Rules.

**1.6 FIRST-AID FACILITIES:-** The Contractor shall arrange for medical attentions to be promptly available when necessary. He shall for this purpose provide a number of First-Aid stations at suitable locations within easy reach of the workmen and other staff engaged in the Works. Each First-Aid station shall be properly equipped and will remain in charge of a suitably qualified person. The Contractor shall also provide for transport of serious cases to the nearest hospital. All these arrangements shall be to the approval of the Superintending Engineer, WEST Circle, MED.

**1.7 FIRE FIGHTING ARRANGEMENT / FIRE EXTINGUISHING ARRANGEMENT:-** The Contractor shall provide suitable arrangement for fire fighting / fire Extinguishing. For this purpose he shall provide requisite number of Fire Extinguishers and adequate

number of buckets, some of which are to be always filled with sand and some with water. These equipments shall be provided at suitable prominent and easily accessible places and shall be properly maintained.

**1.8 SAFETY MEASURES:** - The Contractor shall be responsible for the safety of all workmen and other persons entering or in the works and shall at his own expense and to the approval of the Superintending Engineer, WEST Circle, MED, take all measures necessary to ensure their safety.

Such measures shall include the provisions of helmets (Specially where work at a height is involved), provision of gum-boots to workers engaged in cement concrete or other works, scaffolding or other measures required for working at a height, shall be strong and rigid and have to be provided with suitable and convenient access. Shoring required for deep excavation must be adequate and rigidly braced and strutted. The Contractor shall provide depending on the exigencies of the location and nature of work and other relevant factors, other safety measure that the Superintending Engineer, WEST Circle, MED may direct.

**1.9 SUPERVISORY STAFF:-**

The Contractor shall engage an experienced and qualified Site Manager to be in day-to-day charge of the work and he should be authorized to receive instructions from the Engineer. He shall receive orders given by the Engineer from time to time and shall act on them promptly. The Contractor shall, during working hours, maintain engineer and supervisors of sufficient training and experience to supervise the various items and operations of the work. Orders and directions as given to such engineers and supervisors or other staff of the Contractor shall be deemed to have been given to the Contractor. The Chief Engineer of the Contractor responsible for this work, by whatever designation he may be known, but who will be specified on award of the Contract shall at least once in a fortnight inspect the works and shall discuss with the Engineer the conduct and progress of the work.

**1.10 JOINT SURVEY**

The Contractor shall satisfy himself regarding the correctness of the layouts, levels etc. as are shown in the drawings or given in the specifications. Before starting the work he shall also carry out at his own cost, survey of the whole work site jointly with the representative(s) of the Authority. Discrepancies noticed between drawings and

the joint survey shall be informed in writing to the Superintending Engineer, WEST Circle, MED and got set right before execution of works. Such deviations as may arise out of the joint survey shall not violate the provisions of contract or entitle the Contractor to any extras in any way.

#### **1.11 LAYOUT AND CHECKING**

The contractor shall provide all labour, skilled and unskilled and all materials needed for carrying out, as directed, survey, laying out, setting out, checking of works, taking measurements, testing hydraulic and other structures, without any extra payment. The Contractor shall also provide approach and access to all the works and stores without any extra cost.

#### **1.12 REFERENCE POINTS**

After the joint survey has been plotted and approved by the Superintending Engineer, WEST Circle, MED recommendation of the Engineer, permanent base lines, cross line and bench marks shall be established by the Contractor so as to serve as reference points and "Dimensional Control Basis" of works. He shall prepare and submit a plan showing such reference points with their full description.

#### **1.13 CO-OPERATION WITH OTHER CONTRACTORS**

Some works in plant site, have been already done/are being done/will be done through other contractors. In the event of any such work the contractor shall have to work in full co-operation and in close co-ordination with other contractor/contractors. Any difficulty that may arise in this connection will have to be amicably settled by the contractors amongst themselves. If that be not possible, the matter shall be referred to the Superintending Engineer, WEST Circle, MED whose decision shall be final and binding on all the parties.

However, the site allocated to the contractor may be fenced at the Contractor's cost provided any necessary access to others as it required is given. The contractor will be permitted to use only the access to the site as indicated on the site plan of Tender Drawing.

#### **1.14 APPROVAL OF MATERIALS AND EQUIPMENT TO BE USED**

Samples in large enough quantity of materials and descriptive data therefore requiring prior approval shall be furnished by the contractor to the Superintending Engineer, WEST Circle, MED in good time before the collection of such materials and equipment so as to permit inspection and testing. The samples shall be properly marked to show the name of the materials, name of the manufacturer and place of origin and item for which it is to be used. Only upon approval, the materials of approved quality shall be brought to site. Samples approved shall be on exhibition at all times, properly stores and prevented from deterioration for the purpose of comparison with the materials brought to site of work from time to time for use in work.

### **1.15 TESTING & TESTING EQUIPMENT**

1.15.1. Testing of materials to be used in the permanent work or of the quality of finished items, shall have to be done from approved laboratory at the expense of the contractor.

The contractor shall afford at his own cost necessary facilities in providing the requisite materials and other assistance that may be required by the Engineer including transport of the test specimens to the laboratory referred to above,

1.15.2 The Contractor shall provide at his own cost necessary equipment for such testing which by the nature of work may have to be done at site or for taking samples for testing in laboratories. These include sufficient number of slump cones, standard 150 mm metal cube moulds, sets of I.S sieves, weighing balances, graduated measuring cylinders, complete set of equipment for in-site density test, thermometers and any other miscellaneous equipment that may be required by the Engineer or his Representative. The Contractor shall also provide necessary arrangement for curing of concrete cube specimens as instructed by the Engineer.

### **1.16 CONSTRUCTION RECORDS**

The Contractor shall keep and supply to the Engineer the up-to-date records of the dimensions and positions of all permanent works (showing therein any approved deviation between the drawing and the work as actually executed), The information available from the records must be adequate and complete to enable preparation of "as-made" drawing by the Contractor from these records,

### **1.17 PROGRESS PHOTOGRAPHS**

The Contractor shall at his own cost and expense arrange to take periodic photographs to show the progress of work or interesting features thereof. The time and the position where from a photograph is to be taken should be as per direction of the Engineer or his Representative, Three copies of each of these photographs to an enlarged size of about 25 cm x 20 cm together with the CD / DVD, shall be supplied to the Superintending Engineer, WEST Circle, MED and these shall become the property of the Employer. Each photograph shall be suitably captioned with the date of the photograph, location and other relevant particulars, further prints and CD of the photograph, location and other relevant particulars shall not be kept by the Contractor or reproduced without written permission of the Employer. Digital Camera with 10.0 Mega pixels should be used for taking photos.

Restrictions to photography or security restrictions that may be applicable to any particular area must be carefully and rigidly observed.

The number of photographs (each consisting of three prints and the CD/DVD as aforesaid) for the complete works is not expected to exceed 100 (one hundred), No photograph of the plant and other installations shall be taken without prior approval of the concerned officers

### **1.18 SATISFACTORY COMPLETION OF VARIOUS ITEMS**

The sub-works included in the Schedule of Prices are job works on lump sum basis. The various items of the sub-work are to fit in perfectly in the whole plant in every respect so as to form effective working parts of the whole plant as per satisfaction of the Superintending Engineer, WEST Circle, MED. Each sub-work will be considered as complete when it is completed as per specifications and put into commission, as per standards, as a successful component part of the whole plant.

### **1.19 CHECKING QUALITY OF WORK**

Should the Engineer consider it necessary to satisfy himself as to the quality of the work, the Contractor shall, at any time during continuance of the contract, offer sample of work done or if necessary pull down a reasonable part of the work enough for such inspection and testing as the Engineer may direct and the Contractor shall

make good the same at his cost and to the satisfaction of the Engineer without any extra cost.

## **1.20 RECORDING MEASUREMENTS**

Though the offer is on lump sum basis, the Contractor shall give not less than five days notice, in writing to the Engineer, about the work which is proposed to be covered or placed beyond the reach of measurements so that measurements may be taken before the work is covered, bar bending schedule is to be provided five days before the casting date. If any work is covered without such written notice, the same shall be uncovered at the cost of the Contractor and in default hereof no payment or allowances shall be made for such work. These requirements apply for all the component items executed for the sub-work for which lump sum price is quoted

## **1.21 REPORTS AND RETURNS**

The Contractor shall maintain at Site daily records of progress with regard to the works carried out, labour engaged and construction equipment deployed. These will form the basis of preparing periodic reports and returns as may be required by the Engineer and in the manner as directed by him.

These daily records shall be made accessible to the Superintending Engineer, WEST Circle, MED& Engineer or his Representative as and when desired by him.

## **1.22 SITE ORDER BOOKS**

1.22.1 For the purpose of quick communication between the Engineer or his Representative and the Contractor or his Agent or Representative, Site Books shall be maintained at site in the manner described below. Any communication relating to the works may be conveyed through records in the Site Books. Such a communication from one party to the other shall be deemed to have been adequately served specified elsewhere in the General Conditions of Contract. Each Site Book shall have machine-numbered pages in triplicate and shall be carefully maintained and preserved.

1.22.2 The Contractor shall keep Site Books at various places Site work is being carried out so as to be readily available to the Engineer or his Representative. Any instruction or order which the Engineer or his Representative may like to issue to the Contractor may be recorded by him in the Site Book and two copies thereof taken by him for his record. The Contractor or his Agent or Representative may similarly

maintain separate Site Book for any communication he may like to send to the Engineer or his Representative. Two copies thereof when sent to the Engineer's Representative and receipt obtained thereof, will constitute adequate service of the communication to the Engineer.

## **2.0 MATERIAL**

2.1 The Contractor is liable to procure materials like Cement and Steel of required specifications from his own for smooth progress of the work under terms and conditions stipulated hereinafter.

Procurement of cement and steel materials require prior permission from appropriate authorities (Superintending Engineer, Municipal Engineering Directorate) for approval of Brand & quality of materials to be procured by the Contractor.

2.2 However, if, in the interest of the Works, any material be issued to the Contractor, the provisions of Clause 2 shall apply mutates mutants and the issue rate thereof shall be as fixed by Superintending Engineer, WEST Circle, MED.

## **2.3 CEMENT :-**

The Cement shall be (53 Grade) complying with IS: 12269; 1987 and premium quality e.g. **Ambuja Plus, Lafarge Concrete, Ultratech Premium, ACC F to R make.**

## **2.4 STEEL**

Steel bars for use in reinforcement shall be cold twisted bars complying with IS: 1786; 1985 (Reaffirmed 1990) specifications **TATA, SAIL or RINL make.**

## **3. TECHNICAL ASSISTANCE**

Training of Technical Personnel: - The Contractor shall undertake to train one technical personnel selected and sent by the ULB to the works of the Contractor. These engineers shall be given special training in the shop and drawing office where the equipment will be designed and manufactured and where possible in any other plant where Contractor's manufactured equipment of similar type is under installation tests or maintenance, to enable them to become fully familiar with the equipment being supplied by the Contractor. The period of training shall be as decided by the ULB but in any case shall not exceed six months for any individual. During the period of training the Contractor shall arrange for reasonable accommodation of the engineers and transport from the place of accommodation to the works or plant.

The Contractor's supervisory personnel at site shall continuously and intensively instruct and train an adequate number of the ULB authority operating and maintenance personnel at site during erection and commissioning of the plant to

enable them to take over the operation and maintenance of the plant after the maintenance period. No extra payment shall be made by ULB for the training of personnel under this clause.

**4. TERMS OF PAYMENT:- AS PER CLAUSE 57 OF SECTION C**

**5. NO INTEREST ON DUES:** -No interest will be payable by the Employer on the amount due to Contractor pending final settlement.

**6. DISPOSAL OF THE EXCAVATED MATERIALS**

All materials obtained from any excavation required to be carried out under this contract will be the property of the ULB and the Contractor shall not have any claim on it. It will not be used for any purpose other than refilling the excavations as needed or levelling the compound or in construction of any embankment or in any manner as directed by the Engineer. After completion of work or earlier if so directed by the Employer the surplus excavated materials shall be disposed off by the contractor to any distance without any extra cost, but only after being so directed by the Employer.

**7. POSSESSION PRICE TO COMPLETION**

The Authority shall have the right to take possession for use of any completed or partly completed part of the work. Such possession or use shall not be deemed to be an acceptance of any work not completed in accordance with the agreement.

**8. TENDER TO STRICTLY COMPLY WITH SPECIFIED CONDITIONS AND ALL OTHER SPECIFICATIONS**

It should be clearly noted that the Bidders have to strictly comply with the specifications and other terms and conditions laid down in this document and no variations are permissible. This is necessary for the purposes of comparison of tenders received.

The Contractor shall stand guarantee for producing potable water as per the standards laid down in the tender and for the works carried out under this Contract.

**Superintending Engineer, West Circle**  
**Municipal Engineering Directorate**



## **SECTION - E**

### **GENERAL SPECIFICATIONS OF WORKMANSHIP AND MATERIALS FOR CIVIL WORK**

#### **1.0 GENERAL**

#### **1.1 GENERAL MATERIALS**

1.1.1. All materials used in the permanent works shall be of the best quality of the kind and to the approval of the Engineer-in-Charge. Any material not covered by these Specifications, shall comply with the relevant latest Indian Standard Specifications (Referred to as IS as revised or modified up-to the date one month prior to Tender date). British or American Standard Specifications shall be referred to in case any particular specification is not available in any of the aforesaid Specifications. For materials not specified in the aforesaid, direction of the Engineer-in-Charge shall be followed. All disputes shall be referred to the Employer, whose decision shall be final and binds.

1.1.2. Samples of materials to be supplied and used, by the Contractor in the works shall be to the prior approval of the Engineer-in-Charge. For this purpose the Contractor shall furnish in advance representative samples in quantities and in the manner as directed by the Engineer-in-Charge for his approval. Materials brought to the Site, which in the option of the Engineer-in-Charge do not conform to the approved sample and if so directed by him shall be removed by the Contractor from the Site and replaced by the materials of approved quality.

1.1.3. In spite of approval of the Engineer-in-Charge of any materials brought to the site, he may subsequently reject the same if in his opinion the materials has since deteriorated due to long or defective storage or for any reason whatsoever and is thereby considered unfit for use in the permanent works. Any material thus rejected shall be immediately removed from the Site at Contractor's cost and expense.

1.1.4. All materials brought to the Site shall be properly stored and guarded in the manner as directed by the Engineer-in-Charge and to his satisfaction.

1.1.5. The Engineer on written request of Superintending Engineer, WEST Circle, MED may carry out test of materials as he may decide. The Contractor shall, at his cost and expenses, for this purpose supply requisite materials and render such assistance to the Engineer-in-Charge as he may require.

## **1.2 WORKMANSHIP**

All works are to be carried out in proper workman like manner. Items of works not covered by these Specifications or by other tender documents shall be carried out as per best practice according to the direction of the Engineer-in-Charge and to his satisfaction. The relevant IS Specifications or in case of necessity British or American Standard Specifications shall be taken as guide for the purpose.

## **1.3 WORKS INCLUDED**

The rates for all items, unless specifically stated otherwise in the Contract, must cover the cost of all materials, labour, tools, machinery, plant, pumps, explosives, scaffolding, staging strong props, bamboos, ropes, templates, pages and all appliances and operations whatsoever necessary for efficient execution of work.

## **1.4 GROUND CONDITIONS**

The Contractor is to visit the site and ascertain local conditions, traffic restrictions and obstructions in the area and allow for extra expenses likely to be incurred due to any limitations whatsoever.

## **1.5 SETTING OUT AND LEVELLING**

The Contractor is to set and level the works, and will be responsible for the accuracy for the same. He is to provide all instruments and proper qualified staff required for checking the Contractor's work.

## **1.6 SAFETY**

The Contractor shall take adequate precaution to provide complete safety for prevention of accidents on the site.

## **1.7 KEEPING WORKS FREE FROM WATER**

The Contractor shall provide and maintain at his own cost, electrically or other power driven pumps and other plant and equipment to keep site excavated foundation pits and trenches free from surface as well as subsoil/leakage water from any other source thereof and continue to do so to the complete satisfaction of the Engineer-in-Charge till the site is handed over. Method of dewatering shall need approval of the Engineer-in-Charge but no payment whatsoever is allowed on this count.

## **1.8 RUBBISH**

1.8.1. The Contractor shall clear all rubbish, vegetation, roots, soda etc., and dump them in the area indicated to the satisfaction of Engineer-in-Charge. No separate rate shall be allowed for the above work.

1.8.2. After the work is completed, the Contractor shall clear the area surrounding the buildings, all hutments and excess stores and remnants of building materials such brick bats, metal, sand, timber, steel etc.

## **1.9 BENCH MARKS AND GROUND WATER GAUGES**

The Contractor shall protect surveyor's benchmarks and ground water gauges, zero line marks and base line marks and base line marks from damage of movement during work.

## **1.10 INSPECTION**

The Contractor shall inspect the Site of works and ascertain site condition and the nature of soil to be excavated.

**1.11 CONTRACTOR'S STAFF** :- The Contractor must provide at all times efficient staff of trustworthy, skilful and experienced assistance capable of carrying out the work in accordance with the drawings and specification and to correct levels. The cost this establishment should be included in his rates.

**1.12 METHOD OF MEASUREMENT;** - Unless otherwise specified, the method of measurement for building works shall be as per IS: 1200.

**1.13 SPECIFICATIONS REFERRED TO**

1.13.1 The specification contained herein is not exhaustive and for such items of works which may arise and which are not covered by these specifications, the provisions in the relevant Indian Standard (Latest Edition) shall apply.

1.13.2 A list of some Indian Standards is given herein.

1.13.3 Wherever reference to the Indian Standard mentioned below or otherwise appears in the specification, it shall be taken as reference to the latest version of the Standard.

<b>IS Code No</b>	<b>Description</b>
IS: 1200	Method of measurement of building and Civil Engineering works.
IS: 1542	Sand for plaster.
IS: 383	Aggregates-Coarse and fine, from natural source for Concrete.
IS: 515	Aggregates for use in Mass Concrete, natural and manufactured.
IS: 456	Code of Practice for Plain and Reinforced Concrete for General Building construction.
IS: 3370	Code of Practice for Concrete Structures for the Storage of Liquids.
IS: 12269	Specification for 53 Grade Ordinary Portland cement.
IS: 1786	Specification for High Strength Deformed bars& wires for concrete reinforcement.
IS: 1077	Common Burnt Clay Building Bricks.
IS: 1235	Flooring Tiles, Cement Concrete, Floor Finish
IS: 1443	Cement Concrete, Flooring Tiles, Laying and finishing.

IS: 1661	Cement and Cement Lime Pointing Plaster finishes on walls and Ceilings.
IS: 226	Structural Steel (Revised) Iron Work
IS: 800	Code of Practice for use of Structural Steel in General Building Construction.
IS: 1199	Workability of Concrete
IS: 1893	Earth quake code

## **2.0 EARTH WORK IN EXCAVATION & FILLINGS**

**2.1 GENERAL :-** Applicable provisions of Conditions of contract shall govern work under this section.

### **2.2 EXCAVATION FOR FOUNDATION, TRENCHES, PIT ETC.**

The excavation work shall be carried out in all kinds of Soil including Sand in workman like manner without endangering the safety of the nearby Structures or works without causing any hindrance to other activities in the area. The existence of old buildings, boundary walls, hutment, sewer lines, water lines, if any very close to the area of excavation should be given careful consideration while designing carrying out the excavation work. The excavation shall be done in such method as would technically be appropriate and befitting the site conditions subject to the approval of the Engineer-in-Charge. All foundation trenches shall be excavated to the full width and depths shown on the approved drawing or to such ordered to the Contractor.

The Contractor shall not undertake any earthwork without having obtained prior approval from the Engineer-in-Charge to the methods he proposes to employ in order to execute the work in the most efficient manner. He shall not modify such methods without the approval of the Engineer-in-Charge. This approval, however, shall not in any way make the Engineer-in-Charge responsible for any consequent loss or damage.

2.2.2. Should any excavation be taken down the specified levels, the Contractor shall fill in such excavation at his own cost with concrete as specified for foundations, well rammed in position until it is brought up to the specified level.

2.2.3. The Contractor shall notify when the excavation is completed and no concrete or masonry shall be laid until the soil for each individual footing, rafts etc. is approved.

2.2.4. The Contractor shall keep the site clear of water at all times. To this end he shall provide arrangements for bailing and pumping or any special arrangements as required within his quoted prices.

2.2.5. All foundation pits shall be refilled to the finished ground level (formation level) with approved materials, which shall be suitably consolidated in layers to the satisfaction of the Engineer-in-Charge.

2.2.6. Nothing extra will be paid for bailing out water collecting in excavation due to rains, ordinary springs, leakage from any other sources etc., or any other reason.

2.2.7. For the work of excavation the Bidder shall include in his quotation the shoring, sheeting, bracing and sheet piling (if required). The quotation shall also include the cost of compaction of foundation sub-base, removal and storage of excavated materials and back filling.

**2.3 SHORING:-** Timber shoring whenever required shall be closed boarded with minimum 50mm thick good and seasoned timber planks of sufficient length driven side-by-side to the required depth. The gaps between adjacent timber planks shall such would not allow any flow of soil particles, if necessary, the sides of the planks shall be planed smooth to ensure this. Sufficient numbers of bracing struts, walling etc. are to be provided to make the shoring rigid and non-yielding by earth pressure. Where necessary, sheet piling shall be done to ensure safety to the adjoining structures, if it is found that it is not feasible to protect the structure by timber shoring only. The Bidder is strongly advised to inspect the site before tendering and apprise himself of the requirement of any Sheet piling in addition to the timber shoring before submitting his Quotation accordingly.

#### **2.4 BACK FILLING**

The space around the foundations in trenches or sites shall be cleared of all trash and loose debris and filled with approved excavated earth, all clods being broken up to the finished G.I. Filling shall be done in 200mm layers, each layer to be properly moistened and well rammed. Any Excavated materials which is surplus or which is

consolidated unsuitable for back filling is to be disposed of in spoil dumps as directed by the Engineer-in-Charge. No extra payment will be made for this.

## **3.0 CONCRETE**

### **3.1 GENERAL**

3.1.1 Applicable provisions of Conditions of Concrete shall govern work under this section.

3.1.2. All concrete work, plain or reinforced shall be carried out strictly in accordance with this specification and any working drawing or instructions given from time to time to the Contractor.

3.1.3. The Contractor's states shall allow for wastages in all materials as well as for all tests of materials and concrete.

3.1.4. No concrete shall be cast in the absence of the Engineer-in-Charge or any other person duly authorized by him. The Contractor's Engineer shall personally check that both the form work and reinforcement have been correctly placed and fixed, and shall satisfy himself that all work preparatory to the casting is completely ready, before informing the Engineer-in-Charge for final inspection and approval and for which purpose at least 24 hours' notice shall be given by the Contractor.

3.1.5. The Indian Standards wherever referred to herein shall be the latest addition of such standards.

## **2.3 CEMENT**

Cement shall conform for IS: 12269; 1987 Cement tests shall have to be carried out at Contractor's expense as and when directed. Cement, which has or practically set, shall not be used under any circumstances. The important structures should be constructed with the grade of cement not below 53 (Grade-53). No extra payment will be made for using Grade-53 cement or more grades available in departmental store.

The brand of cement will be of Lafarge Concreto / Ambuja Plus / Ultratech Premium / ACC F 2 R make.

## **2.4 AGGREGATES**

The fine and coarse aggregates shall conform to all provisions and test methods of IS: 383 and/or IS: 515. Samples of aggregates, proposed to be used in the work shall be

submitted free of charge in sufficient quantities to the Engineer-in-Charge with sieve analysis and other physical and chemical analysis data for his approval. He will preserve approved samples for future reference. This approval will not in any way relieve the Contractor of his responsibility of producing of specified qualities.

## **2.5 COARSE AGGREGATES**

Coarse aggregates for use all reinforced and other plain cement concrete works shall be crushed black granite trap stone obtained from approved source and shall consist of uncoated, hard, strong dense and durable pieces of crushed stone, and be free from undesirable matters, viz. Disintegrated stones soft, friable, thin, elongated or laminated pieces, dirt, salt, alkali, vegetable matter or other deleterious substances. The aggregates shall be thoroughly washed with water and cleaned before use to the satisfaction of the Engineer-in-Charge at no extra cost of the Employer.

The maximum size of coarse aggregates shall be as follows unless specified otherwise elsewhere.

Reinforced Concrete	:	20 mm
Plain Concrete Thin R. C. C. Members	:	20 mm
With very narrow space	:	12 mm.
Mat/Lean Concrete	:	20/40 mm.

(The actual size to be agreed by the Engineer-in-Charge)

Grading of coarse aggregates for a particular size shall generally conform to relevant I.S Codes and shall be such as to produce a dense concrete of the specified proportions and or strength and consistency that will work readily in position without segregation.

## **2.6 FINE AGGREGATES**

Sand shall be clear River sand brought from approved source and consist of siliceous material, having hard, strong, durable uncoated particles, free from undesirable matters viz. dust lumps, soft or flaky particles or other deleterious substances. The amount of undesirable shall not exceed the percentage limits by weights as specified in relevant IS Codes. Washing of aggregates by approved means shall be carried out, if desired by the Engineer-in-Charge, at no extra cost to the Employer.



Coarse and fine sand shall be well graded within the limits by weight as specified in relevant IS Code. Fineness Modulus shall not vary by more than plus or minus 0.20 from that of the approved sample. Fineness Modulus for sand should not be less than 2.5.

### **3.0 REINFORCEMENT: - REINFORCEMENT WILL BE OF SAIL / TATA / RINL MAKE**

3.1 The Contractor shall prepare and furnish to the Engineer-in-Charge, Bar Bending Schedules in considerations of the approved drawings for all R.C. C. works for review and checking by the Engineer-in-Charge well before taking up the work.

3.2 The High Yield strength deformed bar (HYSD) shall conform to IS: 1786-1990. All steel for reinforcement shall be free from loose, oil, grease, paint or other harmful matters immediately before placing the concrete.

3.3 The Reinforcement shall be bent to the shapes shown on the approved drawings prior to placing and all bars must be bent cold. The Steel shall be placed in such a way that it is rigidly held in position while concrete is being cast. The correct clearance from the form shall be maintained by either pre-cast mortar blocks or by metal supporting chairs to be supplied by the Contractor free of charge.

The intersection of roads crossing one another shall be bound together with soft pliable with No. 16 to 18 SWG at every intersection so that reinforcement will not be displaced in the process of depositing concrete. The loops of binding wire should be tightened by pliers and welding of reinforcement for lapping & binding should be done if desired by E.I.C. No extra payment will be made for this purpose.

3.4 The work of reinforcement shall also be inclusive of stirrups distribution bars, binders, initial straightening and removing of loose rust, if necessary, cutting to requisite length, hooking and bending to correct shape, placing in proper position including supplying and binding with block annealed wire as stated in clause 3.4.3 above.

3.5 The brand of steel used for the work will selected & approve by the E.I.C in writing before execution of work.

### **3.5 WATER**

The Water shall be clean and free from Alkali oil or injurious amounts of deleterious materials. As far as possible, the water is of such quality that it is potable. If any chemical analysis of water is necessary and ordered, the same shall be carried out at an approved laboratory at the Contractor's cost and expenses.

### **3.6 CONCRETE PROPORTIONING**

3.6.1 The concrete proportions shall be as indicated on the approved drawings and shall conform to IS: 456 & IS: 3370. The quality and character of concrete shall be governed by IS: 383. It should be sampled and analyzed as per IS: 1199. The concrete should stand the test specified in IS: 516.

3.6.2 The minimum cover of main reinforcement shall be as per relevant IS: Codes. Cover to any reinforcement of R.C.C. piles shall be minimum 65 mm in case in-situ and 50 mm in case of pre-cast piles. Suitable spacer blocks shall be provided at intervals not exceeding 1.2 m. throughout the length of the pile.

3.6.3 The workability shall be measured by slump. Slump for different grades of concrete shall not exceed following unless specifically permitted by the Engineer-in-Charge.

- i) For M 15 concrete - 3.75 cm.
- ii) For M 20 concrete - 2.50 cm.
- iii) For M 25 concrete – 2.00 cm

3.6.4 All concrete works shall be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures and into comers of the form work.

The Concrete shall be thoroughly and shall be efficiently vibrated during laying. The use of mechanical vibrators shall comply with IS: 2608, IS: 2506 and IS: 4656. Whenever vibration has to be applied externally, the design of formwork and deposition of vibration shall receive special consideration to ensure efficient compaction and to avoid surface blemishes.

### **3.6.5 TEST FOR WATER TIGHTNESS OF STRUCTURES / PIPES**

For liquid retaining structures including inlet chambers etc. shall be deemed to be satisfactory water tight as per relevant clause of IS: 3370. The Contractor at his own expenses, if necessary, shall undertake approved corrective measures.

As regards the pipelines, the tests shall be performed for the Hydrostatic Pressure of 10 Kg./Sq. cm in case of S.W.M., D.I. Pipes and 2 Kg./Sq. cm. for P. S. C. respectively. The tests shall be carried out as per relevant IS Codes and pipes shall be considered satisfactory if the tests results satisfy the requirements of the relevant clauses of the Codes. The Contractor shall give all these Hydraulic Tests by making his own arrangements for water supply and filling and disposing the water after the tests. The Contractor shall rectify the defects noticed and carry out the tests again and repeat the testing operation till successful result is obtained and accepted by the Engineer. The rates Quoted for the work shall be considered as inclusive of cost of all Labour, materials and equipment required to give successful tests for Water tightness.

### **3.7 WORKMANSHIP**

3.7.1 All Concreting work shall be carried out according to the IS: 456, IS: 3370, and other related codes. It should, however, be noted that for every 15 M<sup>3</sup> of concrete placed or for every one day's volume of concrete whichever is lower, a minimum of 3 (three) Cubes shall be kept for test purpose, and tested at the Contractor's cost and expenses at a Laboratory as approved by the Authority. The number of test cubes may, however, be altered at discretion of the Engineer-in-Charge. It is compulsory to test 3 (three) cubes in each case.

**3.7.2 STRUCTURAL CONCRETE:** - Design mix Concrete shall be on all concrete works except in case of Mud-mat concrete lean concrete where nominal mix concrete will be allowed. Design mix Concrete will be used in Reinforced Concrete Structures shall be in Grade of M20, for works other than water training structure & water retaining structure Grade of concrete as per latest amendment of IS:3370. The mix shall be designed to produce the grade of concrete having required workability and a Characteristic Strength not less than appropriate values given in IS: 456 - 2000. For mix design, procedure given in Indian Standard recommendation or any other standard procedure shall be adopted. As long as the quality of materials does not change a mix design done earlier may be considered adequate for later work. Batching mixing, sampling and Strength Test of concrete shall be carried out in compliance with the relevant clause of IS: 456-2000 and all other relevant Indian Standards recommended therein.

The mix design by the Contractor shall be used for works only after obtaining written approval of the Engineer-in-Charge. Mix design shall be entirely the responsibility of

the Contractor and any approval by the Engineer-in-Charge shall not relieve him of his responsibility in respect thereof.

The Contractor shall prepare all the Calculations, Tabulations, Graphs etc. pertaining to Mix Design Test result and supply copies of such Calculations, tabulations, Graphs etc. required by the Engineer-in-Charge.

On proportioning concrete, the quantity of both cement and aggregate shall be determined by weight, where the weight of cement is determined on the basis of weight per bag a reasonable number of bags be weighed periodically to check the net weight or should be either weighed or measured by volume in calibrated tanks, All measuring equipments shall be maintained in a clean serviceable condition and shall periodically checked for accuracy.

The grading of coarse and fine aggregates shall be checked frequently and frequency of testing shall be determined by the Engineer-in-Charge. Where weight batching is not possible or practicable, the quantities of coarse and fine aggregates may be determined by volume but cement in any case shall be weighed by weight only. If fine aggregate and volume batching is adopted, allowance shall be made for bulking. The bulking shall be determined in accordance with IS: 2386 (Part-III).

The Water-Cement Ratio shall be maintained to its correct value. Surface moisture content of aggregate shall be determined as per IS: 2386 (Part-III) and the amount of water to be added shall be adjusted accordingly to maintain the correct Water-cement ratio.

During the progress of work in order to ensure correct strength of concrete proper control should be exercised by the Contractor as specified in Specifications mentioned in the Clause 3.7.1 above. Test strength of every sample shall be determined in accordance with the recommendations of IS: 456-2000. If one out of ten consecutive test cubes shows a deficiency in strength up-to a maximum limit of 10%, the concrete will be deemed satisfactory. If two of the test cubes out of ten shows a deficiency in strength up to a limit of 10%, the concrete shall be deemed to be less satisfactory and a reduction of 1 % will be made on the cost of such concrete. If three out of ten test cubes show deficiency in strength up to a limit of 10%, a reduction of 5% will be made on the cost of such concrete. If more than three test cubes show a deficiency in strength up-to a limit of 10% a reduction of 10% will be made on the cost of such concrete. If more than five shows a deficiency in strength up-to a limit of 10%,

the concrete shall be rejected. Such rejected concrete work shall have to be dismantled and replaced to the satisfaction of the Engineer-in-Charge by the Contractor free of cost to the Employer. No payment for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures etc. wasted in the dismantled portion, shall be made. In the course of dismantling, if any, damage is done to the embedded items or adjacent structures, the same shall also be made good free of charge by the Contractor to the satisfaction of the Engineer-in-Charge.

If the deficiency in strength of one-test cubes exceeds the 10% limit, a reduction of 5%) will be made on the cost of such concrete. if the deficiency in strength to two out of ten test cubes exceeds the 10% limit, a reduction of 10% will be made on the cost of such concrete. If the deficiency in strength of three out of ten test cubes exceeds the 10% limit, a deduction of 20% on the cost of such concrete will be made.

With permission of the Engineer-in-Charge for any above mentioned grades of concrete, if the quantity of water has to be increased in special cases, cement shall also be increased proportionally to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment for additional cement will be made.

### **3.8 PRE-CAST CONCRETE**

Pre-cast Concrete items shall conform to relevant IS Specifications. Pre-cast items shall be suitably marked with the date of casting identification marks and shall show the right way up as may be required. The arrangements to be made by the Contractor for Site manufacture and handling of pre-cast items shall be done to the approval of the Engineer-In-Charge. Each pre-cast unit shall be cast in one operation and no construction joints shall be permitted. No damaged or defective units shall be built into the works and units shall be so stored that they are not over' stressed.

Pre-cast units shall be provided in places as shown in the approved drawings. The pre-cast units shall be cast at site strictly following the Specifications of Pre-cast Concrete work. Proper care shall be taken to ensure that the units are obtained from the moulds without any damage. Before erecting in position the units shall be cured adequately by keeping units immersed in water.

### **3.9 FRAME WORK**

3.9.1. The Form Work shall conform to IS: 456. Whenever necessary, shuttering must be provided. The work shall also include providing all necessary staging, centring, formwork and moulds for placing concrete. Shuttering may be of approved dressed timber true to line, not less than 37 mm. thick. Surface to be in contact with concrete are to be planed smooth. Alternatively, sufficiently rigid plywood shuttering or steel shuttering may be used. In every case, joints of the shuttering are to be such as to prevent the loss of liquid from the concrete. In timber shuttering the joints shall, therefore, be either tongued or grooved or the joints must be perfectly close and lined with draft paper polythene films or other types of approved materials. In case of plywood or steel shuttering also the joints are to be similarly lined. All shuttering and framing must be adequately stayed and braced to the satisfaction of the Engineer-in-Charge for properly supporting the concrete, during concreting and the period of hardening. It shall be so constructed that it may be removed without shock or vibration to the concrete. No through bolts are allowed for holding the shuttering in water retaining structure.

### **3.9.2 CLEANING, TREATMENT AND REMOVAL OF FORMS**

All forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish loose concrete chippings, shavings, saw dust etc. shall be scrupulously removed from the interior of the forms before the concrete is poured. Formwork shall not be used/reused, if declared unit or unserviceable by the Engineer-in-Charge.

If directed by the Engineer-in-Charge, compressed air jet/or water jet shall be kept handy along with wire brushes, brooms etc. for the purpose of cleaning. Before shuttering is placed in position, the form surface in contact with the concrete shall be treated with approved non-staining oil or composition. Care shall be taken that the oil or composition does not come in contact with reinforcing steel or existing concrete surface. They shall not be allowed to accumulate at the bottom of the shuttering. Forms shall be struck in accordance with the relevant clause of IS: 456 or as directed by the Engineer-in-Charge. The Contractor shall record on the drawings or in other approved manner, the date in which the concrete is placed in each part of the work and the date on which the form work is removed there from and have this recorded checked and countersigned by the Engineer-in-Charge.

The Contractor shall be responsible for the safe removal of the formwork, but the Engineer-in-Charge may delay the time of removal if he considers it necessary. Any work showing signs of damage through premature removal of formwork or loading shall be entirely reconstructed without any extra cost to the Employer.

### **3.10 PROTECTION AND CURING OF CONCRETE**

Newly placed concrete shall be protected by approved means; from rain, sun and wind and extreme temperature. Concrete placed below the ground level shall be protected from failing earth during and after placing. Concrete placed in ground containing deleterious substance shall be kept free from contact with such ground or, with water draining from such ground during placing of concrete and for a period of at least 3 (three) days or as otherwise directed by the Engineer-in-Charge, the ground water around newly poured concrete shall be kept to an approved level by pumping or other approved means of drainage at the cost of the Contractor. Adequate steps shall be taken to prevent flotation or flooding. Steps, as approved by the Engineer-in-Charge, shall be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently for the surface to be marked it should be covered with Hessian, canvas, or similar materials and kept continuously wet for at least 7 (seven) days after final setting. This period may be extended at the discretion of the Engineer-in-Charge, up-to 14 (fourteen) days. Concrete slabs and floors shall be cured by flooding with water of minimum 25 mm depth for the period mentioned above.

Approved curing compounds may be used in lieu of moist curing with the permission of the Engineer-in-Charge. Such compound shall be applied to all exposed surface of the concrete as soon as possible after the concrete has set. No extra payment is allowed on such count.

### **3.11 CONCRETE FINISH**

The Concrete surface on removal of form work shall be such that no finish is necessary, If, however, the surfaces is not satisfactory the Contractor shall, if so instructed, remove unwanted, projecting parts by chipping and smoothing the surface with cement rendering at his own expenses. The shutter marks shall

invariably be removed by rubbing with carborandum stone. The Contractor shall therefore take all precaution for avoiding the shutter marks.

### **3.12 CONSTRUCTION JOINTS**

These shall be in according with IS: 337 or as directed.

**3.13 Expansion Joints:** - Expansion joints shall be provided at position as directed and the spacing shall not exceed the limits specified in IS: 456. These shall comply strictly with the details shown on approved construction drawings. Reinforcement shall not extend across any expansion Joint and the break between the two sections must be complete.

**3.14 Details of typical expansion joints and construction joints** should comply with the suggestive arrangements shown in IS: 3370 (Part-I), Clause 8.1 (a)(2), Figure 2 (for expansion Joints) and Clause 8.1(a) Figure 1, Clause 8.1 (b) Figure 4 (for construction joints).

**3.15 PVC WATER STOPS:** - The materials shall be durable and tough and as per approval of the Engineer-in-Charge. The minimum thickness of PVC sealing strips shall be 6 mm. and the minimum width 225-mm actual shape and size shall be as per drawings. The materials should be of good quality polyvinyl chloride highly resistant to learning abrasion and corrosion as well as to chemicals likely to come in contact with during use. The physical properties will generally be as follows:

Specific Gravity	1.3 to 1.35
Shore Hardness	60 A to 80 A
Tensile Strength	100 to 150 Kg./Cm <sup>2</sup>
Minimum Safe Continuous Temperature	75 <sup>0</sup> C
Ultimate Elongation	Not less than 275%
Water Absorption	Not more than 5% by weight in a 7 day test.

### **3.16 RUBBER WATER STOPS**

The materials must be very durable and tough and as per approval of the Engineer-in-Charge. The ribs shall be sufficient to ensure proper bonding with concrete. The width



shall be minimum 225 mm and thickness minimum 6 mm. The rubber water stop must be used in long lengths to avoid splicing as far as practicable. Ends shall have at least 200 Cu M overlaps and vulcanised. The materials shall be natural rubber and be resistant to corrosion tear and also to attacks from acid, alkalis and chemicals normally encountered in service. The physical properties will generally be as follows:-

Specific Gravity	1.1 to 1.15
Shore hardness	65 A to 75 A
Tensile Strength	250 to 300 Kg/ Cm <sup>2</sup>
Maximum safe continuous temperature	750C
Ultimate elongation	not less than 350%
Water Absorption	Not more than 350% by weight in a 7 day test

### **3.17 CONTRACTOR'S SUPERVISION**

The Contractor shall provide constant and strict supervision of all the items of construction during progress of work, including the proportioning and mixing of the concrete and bending and placing of reinforcement. Before any important operation, such as concreting or stripping of form work adequate notice shall be given.

The cement and sand shall be thoroughly mixed dry in specified proportions. Water shall then be added just sufficient to make a stiff and workable paste. The mortar shall be used within half an hour of mixing.

4.1 The Contractor shall build all brickwork uniformly no one portion being raised more than 1 meter above another at a time. The joints shall not exceed 12 mm. in thickness and should extend the full thickness of the brickwork. All joints shall be properly raked and the surface washed down.

4.2 All the bricks shall be kept fully immersed in water at least for a minimum period of six hours till they are completely soaked and only thoroughly soaked bricks shall be used in the work.

4.3 The Contractor shall keep wet all brickwork for at least 10 (ten) days after laying. The surface of unfinished work shall be cleaned and thoroughly wetted before joining new work to it.

## **5.0 PLASTERING, PAINTING AND SURFACE TREATMENT**

### **5.1 CEMENT PLASTER**

**5.1.2** The plastering work shall be governed by IS: 1661. Unless otherwise specified cement plaster shall be composed of 1 part of cement and 6 parts of sand. For ceiling plaster, the composition shall be 1 part of cement and 4 parts of sand. The thickness of ceiling plaster shall be 6 mm. The thickness of plaster to the fair faces of brickwork shall be 19 mm. The thickness mentioned shall be minimum thickness. The Contractor shall allow in his rate for any rubbing out due to inequalities of brickwork.

**5.1.2** The rate shall also include for forming of any moulding drip course etc., and for extra thickness due to corbelling of brick work in parapet or at any other place, If required, all internal angles shall be rounded off as per drawing or as directed by the Engineer-in-Charge without any extra charges.

**5.1.3.** Cement and sand shall be measured and mixed dry thoroughly to a uniform colour on a platform specially constructed for the purpose. Care should be taken to see that no foreign matters get mixed with the mixture. Only enough water shall be mixed to make the mixture workable. The mix shall then be turned over and again to a uniform colour and texture number more cement mortar shall be mixed at a time than cannot be used within thirty (30) minutes of mixing.

**5.1.4.** Surface to be plastered are to be brushed clean, wetted for 24 hours before the plaster is put in and the joints of the brick work raked out 12 mm. deep minimum. The concrete faces to be plastered shall be chipped, roughened and soaked with water for achieving required bond with the plaster without any extra cost.

**5.1.5** The surface of the plaster shall be finished absolutely in one plane. The Contractor shall rub down any unevenness with carborandum stones at his cost and expenses. Care shall be taken to see that no mark remains at the junction of plastering done at different times. If necessary, the junctions shall be rubbed with carborandum stones to eliminate such undesirable marks. The Contractor may be required to use normal sprinkling of thin cement slurry on the surface for satisfactory finishing of the plastering work for which no extra payment shall be made.

**5.1.6** Plaster shall be protected and cured by keeping it thoroughly wet with sprinkling of water for 10 (ten) days continuously.

5.1.7 The cost of plastering work shall also include the cost of necessary scaffolding, staging etc. as would be required for the work.

## **6.0 SURFACE FINISHING**

**6.1 GENERAL:** - The cost of all the items of work under this section should include the cost of necessary scaffolding, staging, preparing sub base, removing stains from the floor, skirting, wood work, glass etc. caused through execution of the work.

### **6.2 APPEX Emulsion Exterior & Interior Distemper colouring**

6.2.1 APPEX Emulsion Exterior & Interior distemper colouring shall be done with approved make of colouring as per direction of Engineer-in-Charge. The surface of the wall is to be brushed thoroughly cleaned before the colouring is applied. Each coat of colouring has to be laid on with brushes. Each coat of colouring means one continuous strike of brush with the prepared wash from top downwards. Another similar strike bottom upward over first strike followed by another similar strike from right to left and another from left to right over the right application of brush before it dries. Each coat must be perfectly uniform when finished and free from brush mark etc.

6.2.2. Three coats of colouring will mean a minimum of 3 (three) coats to produce on opaque white surface to the entire satisfaction of the Engineer-in-Charge. If the surface is blotchy or otherwise unsatisfactory, number of coats shall be applied till the desired effect is produced to the satisfaction of the Engineer-in-Charge without any additional cost.

6.2.3 Interior wall shall be finished by acrylic distemper (two coats) over interior grade acrylic primer as per manufacturer's specification.

### **6.3 EXTERIOR WALL FINISH**

6.3.1 External surface shall be finished with two coats of Protective and decorative acrylic emulsion paint of approved colour, shade and manufacture over acrylic primer. The surface to be finished shall be previously cleaned down to remove loose dust or dirt by use of stiff wire brush. All inequalities to be rubbed down and defects rectified. The surface to be wetted well with water and the surface water is to be allowed to run off. The acrylic emulsion paint to be applied strictly as per manufacturer's specification. The first coat should be well brushed into the surface to form a good

bond. Second coat should be applied carefully to give a good finished appearance may be applied by brushing or spraying. Each acrylic emulsion paint application shall be wetted at the end of the day with a fine water spray.

#### **6.4 PAINTING TO STEEL WORKS**

6.4.1 Any shop coat of paint shall not be considered as a coat of paint for the purpose of specification.

6.4.2. Ready mixed synthetic enamel paint of 'Jenson & Nicholson' 'British Paints', 'Shalimar Paints or similar other approved make and approved colour and shade shall only be used. The primer shall be red oxide zinc chromate primer (IS: 2074) or any other anticorrosive primer as approved and directed by the Engineer-in-Charge. The Contractor shall furnish the details of paints to the Engineer-in-Charge for approval of paints before commencement of painting work.

6.4.2. The surface to be painted shall be properly cleaned, de-rusted, all loose scales removed and smoothed with emery papers. Then a coat of anticorrosive priming shall be evenly applied. After this has dried up, two successive coats of best quality ready mixed synthetic enamel paint shall be given to the entire satisfaction of the Engineer-in-Charge. Brushes of approved size and make shall only be used for application of paint and use of cloth is definitely prohibited.

#### **7.0 DAMP PROOFING WORK**

7.1. Unless otherwise specified, damp proof course shall be 25-mm thick cement concrete (1:2:4) with stone chips graded 10 mm to 3 mm with 3% cico or similar approved water proofing compound conforming of IS: 2645 by weight of cement. The proportioning, laying etc., shall be done in conformity with specification for cement concrete work. The damp proof course shall be used for all brick walls of the building.

#### **8.0 ROOF WATER PROOFING TREATMENT**

8.1. Both flat and curved roofs, whether accessible or inaccessible, shall have to be provided with polyurethane based water proofing paint. Specification for Roof Water Proof Treatment with Polyurethane based Water Proof Paint

8.2 **PREPARATION OF SURFACE:** - The top surface of the roof shall be chipped off where necessary and all loose particles, dust impurities, are to be removed by rubbing

the entire roof surface with wire brush and by application of High Pressure Compressed Heated Air to have a complete dust free and moisture free surface.

The roof surface, receiving polyurethane based Water Proofing paint, shall be provided with cement punning having smooth finish. A cross slope of 1 in 300 shall be provided in the roof of Building to allow proper drainage of rainwater.

**§.3 SPECIFICATION OF MATERIALS:** - The polyurethane based paint is essentially an elastic and water proof film having a good adhesion to concrete; water and abrasion resistant properties and shall have long term weather proof characteristics. The paint / film material shall be of two components which are to be mixed and processed as per manufacturer's specification. The mixture shall be homogeneous before applications, as it has tendency to settle.

The polyurethane based water proofing system shall be manufactured by reputed manufacturers of proven recorded and shall be approved by the Central Building Research Institute (CBRI)/ National Chemical Laboratory (NCL)/ The Council of Scientific and Industrial Research/New Delhi (CSRI)/ National Test House, Kolkata or similar such Government/ Public Sector Undertakings. The materials are to be inspected / approved by the Engineer-in-Charge as per procedure to be mutually agreed upon the agency and in charge of the work.

8.4 Since the product has a very short self-life, the materials are to be used in the work shall not be older than four (4) months from the date of manufacture (i.e. the date of bottling). Necessary Test Certificate of CBRI/NCL/CSIR/National House etc. are to be furnished by the contractor or the Department, for the materials procured for the water proofing work.

**§.5 APPLICATION:** - The two components of polyurethane based water proofing system should be mixed as per manufacturer's specification before application. The tack coat should be applied by brushing or roller to the entire surface in normal temperature and 406 hours setting time should be allowed before application of the second coat. The record and final coat of polyurethane based mixed waterproofing sealing over the priming coat to be applied at normal temperature and curing time between 36 to 48 hours should be allowed. The application to be made by technically trained and approved applicators duly certified by the manufacturers.

**§.6 GUARANTEE PERIOD**

The entire waterproofing job shall be covered with a written guarantee of leak proof performance for a minimum period of 10 (ten) years.

### **8.7 DEFECTS LIABILITY PERIOD**

As per PWD order No. 5784-PW/L&A/2M-175/2017 Dated: 12.09.2017

The work of maintenance in nature, the Defect Liability Period of the work shall be three months from the actual date of completion of the work & construction of new building / new bridge the Defect Liability Period of the work shall be five years from the actual date of completion of work.

### **9.0 FLOORING**

9.1. Patent Stone Floorings shall be 25mm. thick in M20 grade concrete with 10mm. to 6mm. stone chips laid in rectangular panel with diagonal length not exceeding 3.00M and finished smooth with neat cement punning 1.5mm thick. After finishing, the surface shall be left undisturbed for two hours and then with wet bags and after 24 hours cured by flooding with water and kept wet for at least 7 (seven) days. Required Camber or Slope should be provided in floor draining wash water, if necessary.

9.2. Cast-in-Situ Mosaic in floor shall be 25mm.thick (finished) laid in panels as directed with necessary underlay of cement concrete (1:2:4) with stone chips with 12mm. thick terrazzo topping finished to 9 mm. after final grinding with 0 to 10 mm. size Mosaic chips highly polished etc. - complete as per specification of IS; 2114-1962. Cast-in-situ Mosaic in Skirting and dado shall be 12mm. thick. The Mosaic work shall be of approved colour and to the entire satisfaction of the Engineer-in-Charge.

9.3. 'Ferro site' or 'Ironies' Flooring shall be 50 mm. Thick to be laid in two layers. First a layer of 25mm. thick patent stone flooring shall be laid in M20 grade concrete and allowed to dry. Then the second layer of 25mm.thick flooring of M20 grade concrete with 10mm.to 6mm. stone chips using at least 1Kg. / sq. m. of floor hardening compound of approved quality and make shall be laid and cured. The flooring shall be laid in rectangular panel with diagonal length not exceeding 3.0 meters.

**10.0 IRON MONGERY:** -10.1. The rain Water pipe of the materials and of size as specified shall be of approved manufacture end jointed as follow:

10.1.1 For heavy cast iron pipes with gasket and lead properly caulked.

**10.1.2.** Where required these are to be run in chase left out in walls, columns, slabs and to be encased in cement concrete 1:2:4 (1 Cement, 2Sand 4 washed Stone Chips 19mm. down) with metal wrapping or with M.S: loops placed at approximately 325mm centre to centre or as directed by the Engineer-in-Charge. All pipes encased in walls, columns or under floors must be heavy cast iron with lead caulked joints. For exposed lengths of pipes, these are to be neatly secured clear from the finished wall face with nails and bobbing in the case of cast iron pipes, nails or screwed to hard wood tapping pugs embedded in wall.

**10.1.3.** All cast iron rain water pipes shall be painted two coats inside with approved anticorrosive paint. The exposed cast iron pipes shall be painted outside with two coats of ready mixed Synthetic Enamel Paints of approved makes, shade and colour over a coat of priming of approved make.

**10.1.4.** The mouth of rain water pipes shall be fixed with C.I grating and the pipe jammed in position in 1:2:4 cement concrete with stone chips and neat finish on the surface.

**10.1.5.** The work shall include all supply, fitting and fixture of materials cutting, making chases, encasing, painting, jointing, etc. complete in all respect. The work shall include supplying, fitting, fixing, and jointing of all the specials required for the completed work.

**10.1.6.** Rain water Spouts shall be of C.I pipes cut to exact length as per approved drawing or direction of the Engineer-in-Charge and laid in position in 1:2:4 cement concrete with stone chips, adjoining roof being finished in neat cement. The interior faces shall be painted two coats with anticorrosive paint and the faces shall be painted with two coats of ready mixed Synthetic Enamel paint of approved make, shade and colour over a coat of priming of approved make.

## **10.2 METAL CASEMENT**

**10.2.1.** Unless specified otherwise, all doors, windows and ventilation in general should be of mild steel casement with sections as per IS: 1038. They shall be of approved make. The Contractor will submit the name and address of the manufacturer whose metal casements he intends to use for approval of the Engineer-in-Charge. The workmanship shall be of high quality and shall be up to the entire satisfaction of the Engineer-in-Charge.

**10.2.2 All the steel doors and windows sashes shall be given a shop coat of Red Oxide Zinc Chromate Primer IS: 2070 after these are thoroughly cleaned off dust, dirt, scales etc., and passed after inspection by the Engineer-in-Charge.**

**10.2.3. Windows are to be prepared for puffy glazing from the outside and for opening outwards unless otherwise mentioned. All steel sashes shall have holes drilled at suitable places for inserting glazing clips which shall also be supplied by the Contractor All glazing shall be fixed to the shutters or frames in addition to glazing clips with quality putty of Shalimar or equivalent make. Glass must not be placed directly against the metal. A thin layer of putty must be evenly spread over the glazing rebate and the glass pressed firmly against it.**

**10.2.4. Ventilators shall be constructed from solid rolled universal casement section being double weathered at all points to ensure water tightness and bedded in mastic and screwed to the sashes.**

**10.2.5. The fitting shall be of heavy pattern bronze oxidized brass and of approved quality, side hung casement will have two point locking handle and casement fasteners. The hung windows shall have 200mm. long adjustable casement stay, arrange to lock the windows from inside horizontally at the centre, hung windows shall have spring catch designed for hand cord or pole operation as approved by the Engineer-in-Charge. The fittings to be fitted either by screwing to the window sections or to steel bracket welded to the window section as approved by the Engineer-in-Charge.**

**10.2.6. Galvanized weather bars shall be provided to sills of all windows.**

**10.2.7. Metal casement is on no account to build in at the time the walls are constructed. Holes to accommodate the fixing lugs are to be left or cut and the casement fixed after all rough masonry plaster works have been finished. The lugs of the casement shall be jammed in 1:2:4 cement concrete with stone chips after holding the casement in proper position, line or level.**

**10.2.8. Glazing for windows and ventilators shall weight not less than 8.0 Kg. /Sq. m for doors; 6mm thick wire net reinforced glazing shall be used as approved by the Engineer-in-Charge. The glasses shall be cut to size accurately to suit all openings to glaze with slight margin of about 1.50mm on all sides or as directed. These shall be securely fixed in position in the manner described earlier. On completion of the**



building, the Contractor shall clean all the glass and leave the same perfectly in a tidy condition.

10.2.9. The cost of marginal doors, windows and ventilations shall include supplying fixing, fitting, glazing cleaning, necessary scaffolding, staging etc. and shall be for the complete work in all respects to the satisfaction of the Engineer-in-Charge.

10.2.10. The Contractor shall without any extra charge, submit three sets of shop drawings from the manufacture showing full details of each type of doors, windows and ventilators including section, position of all fittings and fixtures for the approval of the Engineer-in-Charge before manufacture and finally six sets of approved final drawings with notes on the method of fixing.

10.2.11. Where specified, mosquito fly proof brass wire screen of approved gauge and mesh shall be used in combination with windows. The screen shall be fixed to the inside of the frames and the windows to be opened outside and be fitted with 'Flow operator' for opening to any position and closing. Additional intermediate members are fixed to the frames to receive the fly screen so that the clear span of the screen does not exceed 300 m or as approved by the Engineer-in-Charge.

10.2.12. All windows shall be provided with grills of approved design made of 25 mm x 6 mm M.S. Flats and the other clean openings not exceeding 100 mm.

10.2.13. The work for metal casements shall also include the cost of painting with 2 coats of ready mixed synthetic enamel paint of approved make, quality colour and shade over a coat of approved anticorrosive primer.

**10.3 COLLAPSIBLE GATE:** - The M.S. collapsible gates will be obtained from manufacturer as approved by the Engineer-in-Charge. These shall be of mild bar type, out of 20 mm. channels and shall be top hung with roller bearing and shall have locking arrangement. Collapsible gates under 2.700 m height shall be with 4 sets of lattices. Guide tracks shall be to the entire satisfaction of the Engineer-in-Charge. The gates shall be fixed in position, de-rusted, discaled and painted with 2 "coats of approved ready mixed paint over a coat of approved anticorrosive primer.

#### **10.4 ROLLING SHUTTER**

10.4.1. The GI roller shutter shall be obtained from manufacturer as approved by the Engineer-in-Charge. The roller shutter shall be of 18 G x 75 mm galvanized mild steel

lath of convex corrugation complete with one piece construction. These shall be fitted with pressed side guides and pressed bottom rail, brackets, door suspension shafts, top rolling springs (of strong English Continental Spring Steel Wire) with a four lever concealed lock as also separate locking arrangements for padlocks, pulling hooks, handles and top cover. The roller shutters shall be fixed in position with all accessories and the workmanship shall be to the entire satisfaction of the Engineer-in-Charge. This shall be finished with two coats of approved read/ mixed paint over a coat of approved anti corrosive primer.

## **11.0 STRUCTURAL STEEL WORK**

11.1. All Structural Steel to be used for gantry beam etc. shall be of tested quality conforming to IS: 226 and IS: 2062 latest addition.

Finished steel shall be free from cracks, lamination and other visible defects. Section shall be adequately protected from rusting and scaling. Rivets and bolts, nuts and washers shall be of mild steel and comply with requirements of relevant IS Codes. Steel used for rails shall have tensile strength of about 50-60 Kg/Sq. mm. and yield point at 26 Kg/Sq. mm. The electrodes for welding shall conform to IS: 814. All steel work shall be fabricated and erected as per IS: 800 and IS: 806. Welding shall be carried out as per IS: 814, IS: 815, IS: 816 and IS: 823, all of the latest editions.

11.2. All steel work, after preparation of surface, shall be given a coat of red oxide zinc chromate primer (IS: 2074) and finished with two coats of Synthetic enamel paint. Surface to be painted shall be thoroughly cleaned of mill scale, oil grease, rust etc. over coating and finishing paints shall be of well-known make (vice Jenson & Nicholson/ Berger Paints/ Shalimar Paints). The Contractor shall furnish details of Paints to the Engineer-in-Charge for approval of paints before commencement of painting work.

11.3. Steel work shall be hoisted and erected in position in a safe and proper manner. No riveting or permanent bolting shall be done until proper alignment has been made. For grouting, cement and clean fine sand shall be used in a proportion of 1:2 and properly mixed with water. All trapped pockets shall be fully vented for full penetration of grout. All grouting shall be cured for a minimum period of seven days.

## **12.0 CABLE TRENCHES**

**12.1.** The cable trenches should normally be of dimension 750mm x 600 mm (D x W) with insert plates made of M.S. of dimension 100 mm x 75 mm x 12 mm (W x D x T) are to be provided on the wall side of the cable trench 600 mm apart all along.

**12.2.** The Cable Trenches shall be covered with pre-cast concrete slabs of dimension 650 x 600 adequate thickness to withstand a load of 500 Kg/m<sup>2</sup> are to be provided as covers of trench all along. For easy access of cable from room to room, the design of the tie beam and level of the rooms may be adjusted to avoid bend in the cable.

**12.3.** The cable trenches shall be absolutely free from any obstructions as to allow the cables to be lowered in the trenches from top only during laying. The space inside the trenches throughout the entire lengths shall in no case be encroached by any beam or columns.

### **13.0 POCKETS & HOLDING DOWN BOLTS**

Provision has also to be kept for pockets and holding down bolts as per requirement of the electrical and mechanical equipment's at no extra cost. The exact details of such pockets and holding down bolts will be supplied to the Contractor as per specifications of the suppliers of the equipment after award of the contract. It is contemplated that M.S. hangers shall be provided from the underside of slab/beam of the operating floor, and is to be executed in a separate contract. However, for the above arrangement suitable pockets and holding down bolts are to be left.

### **14.0 CHEQUERED PLATES ETC.**

These shall be manufactured from structural steel conforming to IS: 226. They shall be of the specified size, thickness and pattern as per relevant drawings or as directed by the Engineer-in-Charge. Cover plates will generally be of Chequered plates with or without stiffeners as detailed in the drawings. For convenience, the Contractor shall prepare detailed floor plans of the layout of cover plates for floors and platforms so as to include all openings, cuts etc. and so as to match the patterns of adjacent cover plates/gratings. Where necessary, the floor will have to be made leak proof by properly welding cover plates. If necessary, packing shall be welded to the bottom of cover plates to raise the cover plates on sides, so as to provide necessary slopes as shown in the drawings or as directed by the Engineer-in-Charge in the floors and platforms to drain away any liquid falling on the floors and platform. Necessary gutters at the ends of platforms shall be provided for sloping floors and platforms as

shown in the approved drawings or as directed by the Engineer-in-Charge. Krebs of flats shall be provided where necessary, around openings and cuts in order to prevent liquids falling to lower floors or platforms.

#### **15.0 HAND RAILING**

Double rows of 32 mm diameter G.I. (TATA Medium) tubular hand railing fixed in G.I. stanchions shall be provided on the edge of walkways and platforms as specified. The stanchions shall be fixed with mild steel rag bolts with chromium plated cap nuts. The stanchions shall not be less than 1000 mm. high and placed at a distance not exceeding 2500 mm. The hand railing shall be fixed true to exact line and level. G.I. stanchions and hand railing layout shall be of architectural design with pleasing appearance.

#### **16.0 SANITARY INSTALLATIONS**

16.1. The Urinals shall be of flat back, front lipped having a size of 46.5 cm. x 36.5 x 26.5 cm. or nearest available size. The Indian type W.C. shall be of minimum 58 cm. Complete with footrest in one piece.

16.2. All Sanitary works shall be of "Parry, "Nicer", or any other equivalent make. They shall be of approved quality conforming to relevant IS Codes and shall bear ISI Certification marks. All G.I. pipes shall be of ITC or equivalent make heavy quality conforming to relevant IS Code. Wheel valves and stop cocks shall be of gun metal and of "Leader" or "Annapurna" or equivalent make as approved by the Engineer-in-Charge and shall conform to relevant IS Codes.

16.3. Two urinals, one Indian W.C., one European W.C. (Commode) have to be provided in the toilet block.

#### **17.0 MANHOLE COVERS**

Heavy-duty plastic fiber reinforced concrete manhole covers shall be of heavy duty type conforming to IS: 1726.

#### **18.0 TIMBER DOOR**

The timber door shall be of 1<sup>st</sup>. Class CP Teak Wood for both frame (100 mm x 100 mm) and shutters (49 mm thick). All such doors shall be fully panelled. All timber shall be of best' quality, well seasoned and/or well treated for prevention and protection

against decay etc. It shall be uniform in substance, straight in fibbers, free from large or dead knots, sap, flaws, sub cracks, shakes, or blemishes of any kind. Any insect damage or spoils across the grain shall not be permissible. The colour of the timber shall be uniform throughout, firm and shining with a silky lustre when placed and shall not emit dull sound when struck. The doors shall be made as per approved drawings and as directed by the Engineer-in-Charge and the timber shall be sawn in direction of the grains and shall be straight and square. The door fittings shall be highly polished as per direction of the Engineer-in-Charge.

## **19.0 M.S. PIPELINES**

M.S. Pipe line (TATA / SAIL make)s in required lengths and should be spiral welded mild steely welded from reputed manufacturers and M.S. specials will be fabricated from the said MSSW pipe or from M.S. Plates cut to exact size and shape, bent true to curvature and welded using standard electrodes after necessary edge preparations. Both the inside and outside surfaces of the MSSW pipes and specials shall thereafter be thoroughly cleaned after de-rusting and brushing. The outside surface shall then be wrapped and coated with a protective coal tar based insulating tape of 4 mm. average thickness as approved over one coat of approved primer leaving 150 mm. on either end of pipes unwrapped. The inside-surfaces will be provided with 3 (three) coats of non-toxic paint over one coat of primer.

The pipes and specials will be lowered in trenches for laying only after testing the same with spark test by holiday detector so as to ensure that the pipes and special are free of holidays. The pipes thus lowered will then be interconnected by welding and the portions of 150 mm. width left unwrapped on either side of pipes will then the wrapped with said insulating tape. The thickness of SWMS pipes and specials of 900 mm diameter shall be 12 mm.

## **20.0 P.S.C. PIPLINES / N.P.-2 CLASS PIPELINE**

P.S.C./ N.P.-2 Class Pipes will be laid on suitably designed 1:3:6 concrete bedding of 150 mm thickness. The pipes will join by rubber rings. Bends and specials will be of mild steel. The P.S.C./N.P.-2 Class pipes will be joined with M.S. special and machined ends will be wrapped and coated with an approved protective coal tar based insulting

tape of 4 mm. average thickness over one coat of approved primer. The inside surface will be provided with 3 (three) coats of non-toxic paint over one coat of primer.

#### **21.0 ELECTRICALLY OPERATED OVERHEAD CRANE**

Provisions have to be made for an electrically operated sufficient capacity travelling Crane suitable for inching operation with a lift up to motor floor level and longitudinal travel of 12 M for handling pump, motor and other accessories. They shall be of reputed make as per vendor list and as approved by Engineer-in-Charge. Suitable type of crane rails, girders and all other accessories as necessary for installation and operation of the crane are to be designed and provided by the contractor within the Lump Sum pipe quoted. The two travels and two hoists i.e. long cross & main Auxiliary etc. must be mechanical operation. The buffers must be spring-loaded operation. Suitable vertical clearance is to be provided over the rail level to the bottom of the roof beam

#### **22.0 LIGHTNING ARRESTOR AND AVIATION LIGHT**

Required sets of Lightning Arrestor and Aviation lighting arrangement shall be provided by the Bidder at the highest point or such places or of the Pump House Building conforming to the I.E. Rules specifications as per standard practice. The job includes supplying, fixing and commissioning of sufficient no. of lightning arrestors which includes air-terminals, separate earth electrodes, grid earthing and individual earthing with approved size of air-terminals, earth electrodes, earthing strips as per IE rules/IS codes. Detail Calculations to be vetted by the department in the final design.

#### **23.0 MOTOR FLOOR AND CONTROL ROOM**

There must not be any column in the motor floor for easy movement of the HOT Crane. Similarly in the Control room cum office room, there must not be any columns in the room. The motor floor should have suitable openings at appropriate location as per requirement of the pump manufacturer for lowering and taking up of pumps, motors, valves, entry of cable etc. The motor floor shall be suitably designed to take care of the vibration generated from the motor pump assembly while in operation.

#### **24.0 WRAPPING COATING**

This work is to be completed in all S.W.M.S. pipe at ground level with 4 mm. thick coal tar based tape. Necessary 'Holiday Test' to be done to ensure perfection. This job is to be done before commencement of work of respective stretch.

#### **25.0 TRIAL RUN**

When in the opinion of the Engineer the initial performance tests as specified in Section- I are satisfactory the Contractor shall arrange for trial run of the plant at its rated capacity and also their performance tests. During such tests, the Contractor shall arrange to collect samples of effluents from the clarifier and representative. Samples minimum of SLX samples of each effluent shall be collected at intervals specified by the Engineer each day for 14 consecutive days. These samples shall be sent by the Engineer or his authorized representative to the plant laboratory or any other laboratory nominated by the Engineer, for analysis and determination of the quality of the two effluents. All costs of the sample collection, delivery to the laboratory and test shall be borne by the Contractor.

The Plant shall be deemed to be ready to be put into normal use when trial run of the plant and the quality of the clarified water and filtered water are certified satisfactory by the Engineer. The period of maintenance shall be reckoned from the date of the Engineer's certificate.

#### **26.0 OPERATION AND MAINTENANCE**

After the plant is deemed to be ready to be put into Contractor shall operate and maintain the same for a period 5 years. Operation and maintenance including supply of all accessories of the same for a period of 60 (Sixty) months after the completion of specified period of Successful Trial Run 3 months in his own establishment under the overall supervision chemicals and other consumable stores required for the operation of the plant shall be provided by the contractor at his cost. During the aforesaid period of operation of the plant the Contractor's supervisory staff shall train and instruct technicians and other staff deputed by the Employer about the correct method of operation and maintenance of the plant as a whole and its various mechanical and electrical components. The Training shall be such as would enable the Employer's staff to take over the plant from the Contractor for its operation and maintenance independently. The Contractor's training personnel shall give special attention to this.

During the period of operation and maintenance the Contractor shall arrange to take regular samples of the clarified and filtered effluents as directed by the Engineer and shall have such samples tested at his cost in the plant laboratory or any other laboratory nominated by the Engineer, to determine the quality of the samples and the performance of the plant. Such tests shall be continued up-to the penultimate week prior to the end of the maintenance period and the plant shall be taken over by the Employer subject to the final performance tests being certified as satisfactory by the Engineer.

#### **27.0 GUARANTEE PERIOD**

The Contractor shall stand guarantee for the successful operation of the plant for 60 (Sixty) months period from the date of the certified commissioning as stated in clause within which any defects and short coming due to faulty design of the plant, defective mechanical and electrical equipment or defective construction will have to be made good without any extra cost to the Authority. During the guarantee period the Contractor shall ensure thorough checking of the plant at least once every month and arrange for immediate rectification of any defects detected during this special drive by his experts.

#### **28.0 GUARANTEES:-**The Contractor shall give the following guarantees

**28.1 CIVIL AND STRUCTURAL WORKS:** - The Contractor shall guarantee the plant against any structural failure due to faulty design, bad workmanship, substandard materials, etc. for a period of Sixty months. Any defect found during the guarantee period shall be rectified by the Contractor to the satisfaction of the Engineer without any extra cost.

**28.2 PLANT AND EQUIPMENT:** - Even when a plant or equipment has been manufactured and / or marketed by a vendor, it would be deemed to have been supplied and installed under the contractor's supervision. The Contractor shall provide back-to-back guarantee along with the vendor but shall solely be responsible for its repair / replacement. He shall not cite the vendor and claim absolvent. In addition, all equipment shall be free from any defects due to faulty designs, materials and / or workmanship. The equipment shall operate satisfactorily and performances and efficiencies shall not be less than the values guaranteed by the manufacturer and endorsed by the Contractor.



Formal acceptance of the work or equipment covered under the Contract by the Engineer shall not be made until all the work done by the Contractor has satisfactorily passes all tests required by the specifications.

If, during testing of work and / or equipment prior to formal acceptance, any equipment or materials shall fail in any respect to meet the guarantees, the Contractor shall replace such equipment in a condition, which will meet the guaranteed performance. Any such work shall be carried out by the Contractor at his own cost and expenses in necessity thereof, shall in the opinion of the Engineer be due to the use of materials or workmanship not in accordance with the Contract or to neglect or failure on the part of the Contractor to comply with any obligation expressed or implied on the Contractor's part under the Contract. If in the opinion of the Engineer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

If the Contractor shall fail to do any such work as aforesaid, required by the Engineer, the Employer shall be entitled to carry out such work by its own workman or by others and if such work is supposed to be carried out by Contractor the cost thereof, or may deduct the same from any money due or that may become due to the Contractor.

## **29.0 IMPORTANT GUIDELINES AND SPECIFICATIONS**

29.1 Unless otherwise Collector well and foot Way Bridge specified elsewhere, the work shall be carried out as per the following specifications.

29.1.1. All civil works shall be carried out as per specifications contained in other section of these tender specifications.

29.1.2. All electrical works including supply of all electrical equipment shall be carried out as per specifications contained in other section of the tender specification.

29.1.3. All mechanical works including supply of equipment shall be carried out as per specifications contained in other section of these tender specifications.

29.1.4. The erection and commissioning works shall be carried out as per specifications contained in other section of these tender specifications.

29.1.5. Walkways and operating plant forms shall be provided with hand railings as specified in other section.

29.1.6 Roofs shall be provided with polyurethane paint.

29.1.7. All the exterior doors and windows shall be provided with R.C.C. chaja of approved design.

29.1.8. All windows and ventilators/skylights shall be provided with mild steel grills of approved design.

Superintending Engineer, West Circle  
Municipal Engineering Directorate

## SECTION – F

### GENERAL TECHNICAL SPECIFICATION

The structure of the Collector well and foot way bridge and pumping station with LT PDP panel , soft starter will be constructed above **1.5 M** of the High Flood Level in the area of the Asansol Municipal Corporation. The Bidder shall verify the location by inspection of the site and shall apprise himself of the local condition before submitting the Bid.

#### **2.0 SUB-SOIL REPORT**

Sub-soil investigation is to be carried out by soil-experts engaged by the contractor at the site of the Collector well and foot way bridge and collector well pumping station site.

The Bidder should satisfy himself about the adequacy of the data for the design of pile foundation for the Collector well and foot way bridge and collector well pumping station. The Bidder must carry out sand investigation of collector well before submission of his Bid by drilling bore hole at work site at his own cost for his own satisfaction. The successful Bidder shall have to undertake fresh investigation of sand at the exact location of collector well of the structure at his own cost to design the foundation properly. Records of such sub-sand investigation such as borehole logs, soil samples, SPT values etc., shall be done by the contractor duly witnessed and authenticated by the Engineer in Charge or his competent authorized representative.

In the event of variation in soil data between that of Bid inviting authority and those obtained by the contractor during execution, the more conservative values obtained from the two sets of reports shall be adopted for design without any extra claim over the quoted price as accepted by the Department, unless otherwise permitted by the undersigned.

#### **3.0 BID DRAWINGS**

The General Arrangement of the Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 12 mm thick 600 mm dia. M.S. spiral welded mild steel rising main pipe line (TATA / SAIL make) up to Ground level Reservoir will be reflected in the enclosed site lay out plan by the bidder. These lay out drawing is meant for giving the Bidder a general idea of

the proposed site of Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station. The various levels and dimension of the Collector well Pumping station and laying of rising main up to the ground level reservoir of High lift pump house is to be fixed by the Bidders as per the conditions mentioned in the Bid document.

#### **4.0 DESIGN CRITERIA OF THE DESCRIBED PROJECT**

4.1. The basic layout plan and elevation of the Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 600 mm dia. M.S. rising main pipe line (TATA / SAIL make) up to Ground level Reservoir shall be as per Bid drawings drawn by suitable Architectural design based on the Bid drawings. The Bidder shall submit with his Bid, the Architectural Elevation of the Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 600 mm dia. M.S. rising main pipe line (TATA / SAIL make) up to Ground level Reservoir. However, the architectural Elevation with fixation of Plinth level may have to be modified at the time of approval by the undersigned and Chief (E/M), KMDA for which no extra charge will be paid. Design and construction of all R. C. C. Structures, brick masonry walls and Foundation shall conform to the latest edition of the following IS Codes.

- |    |                                 |  |
|----|---------------------------------|--|
| a) | Loading Standards               | IS: 875                                  |
| b) | Earthquake Resistant Design     | IS: 1893 & IS: 4326                      |
| c) | Reinforced and Plain Concrete   | IS: 456, 2000                            |
| d) | Foundations                     | IS: 1080, IS: 2950 , IS: 2911 & IS: 2974 |
| e) | Liquid Retaining Structures     | IS: 3370                                 |
| f) | Structural Steel                | IS: 800                                  |
| g) | Reinforcement Mild Steel        | IS: 456 & IS: 432                        |
|    | Ribbed Tor Steel                | IS: 1786 & IS: 1139                      |
| h) | Masonry and Brickwork           | IS: 1905 & ISS: 2212                     |
| i) | National Building Code of India | IS: 2910                                 |

**j) Design & Construction of Pile Foundation IS: 2911**

**(Considering the latest edition of the code)**

**4.1. The Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 450 mm dia. M.S. rising main pipe line (TATA / SAIL make) up to Ground level Reservoir shall be designed as per requirement based on the Report of soil investigation.**

**If pile foundation is obligatory as per Report, piles shall be bored Cast-in-situ R. C. C. Piles. The design, construction and workmanship for these piles shall fully conform to and satisfy the requirements of IS: 2911 (Latest Edition). Concrete to be used in Piles shall be of M-35 Grade having Cement content not less than 440 kg/m<sup>3</sup>. Reinforcement in piles shall be in conformity with the requirements contained in IS: 2911 (ii). The minimum area of Longitudinal Reinforcements shall be as per requirements and such requirements shall be provided for the full length of piles. For piles subject to Upward Tension, reinforcement shall be provided throughout the full length and such reinforcement shall be designed on the basis of upward load they are supposed to carry.**

**The safe working loads of the R. C. C. Cast-in-situ bored piles should be that as computed as per IS: 2911 on the basis of Sub-soil Parameters of the Site with a minimum Factor of Safety 2.5 (Compression) and 3.00 (Up lift) applied there on or that indicated in a table, whichever is less.**

**Pile termination levels shall be chosen carefully. The safe working load of the piles shall be substantiated by Routine Load Test. The Pile termination level shall not be reduced from that stated herein above unless otherwise permitted by the Engineer-in-Charge.**

**These Piles shall be designed for Seismic Condition also. The Importance factor for Seismic Analysis of Structure shall be 1.50. The Bidder shall include in his Lump Sum price the cost for Load Test of at least working pile (Routine Test) per 100 piles or part thereof. The testing should be as per Code Stipulations.**

**4.2. While designing the Foundation of different structures, the Bidder may use the Soil Investigation results enclosed in the Bid.**

## 5.0 DESIGN PARAMETERS PUMPING STATION

5.1 Loadings: - The pump floor is to be designed for a live load of 500 kg/M<sup>2</sup> and the superimposed Load of saturated earth of 450 mm depth.

A) i) Live Load on Roof	150 Kg/m <sup>2</sup> .
ii) Live load on pump house Floor/walkway	500 Kg/m <sup>2</sup> .
iii) Live load on Control Room Floor	300 Kg/m <sup>2</sup> .
iv) Weight of each Empty Pump (approx.)	2000 Kg.
v) Weight of each Motor (approx.)	2000 Kg.
vi) Weight of 500 mm diameter Sluice Valve (approx.)	1200 Kg.
vii) Weight of 400 mm diameter Sluice Valve (approx.)	900 Kg.
viii) Load due to Electric Panel (approx.)	800 Kg/m <sup>2</sup> .
ix) Weight of 400 mm diameter pipe (approx.)	300 Kg/m <sup>2</sup> .

**N.B.** Loading details given herein above are tentative and subject to verification during final execution. No extra cost will be paid to the Contractor on account of variation within  $\pm 30$  % limit. Vertical load data for pumps and motors are inclusive of impact factor subject to confirmation of the Pump Manufacturer during final design. The cost in this regard shall be included in the lump sum offer by the Bidder and no additional claim will be entertained in future due to variation in load data, if any.

The floor slab is to be designed for the worst loading conditions that the floor will be subjected due to the equipment to be housed and may be put anywhere on this floor. The floor slab should be so designed as to withstand such loads.

The floor supporting M.S suspenders / Cable trays are to be designed for a concentrated static load of 200 Kg at any point. The Cable Trenches shall be absolutely free from any obstruction so as to allow the Cables to be lowered in the trenches from top only during laying.

Load of M.S Chequered Plates 50 Kg/ sq. m.

For trench covers over opening in Floor 500 Kg/ sq. m.

**Loading up to sufficient capacity H.O.T electrically operated crane:- As per Crane Manufacturer's specifications**

A surcharge of 500 Kg/Sq. is to be taken into consideration while designing the sidewalls of the Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 12 mm thick 600 mm dia. M.S. spiral welded mild steel rising main pipe line (TATA / SAIL make) up to Ground level Reservoir.

The Bidder has to design in such a way that the permissible limit of vibrations of Rotor dynamic Equipment shall be within the limit as specified in IS: 11724-1985. The R. P. M. of pump Motor set will be not less than 750 R.P.M. Sync, subject to confirmation award of equipment contract.

*N.B.:- For calculating earth pressure on the boundary cum retaining wall, the worth value among co-efficient of active earth pressure ( $K_a$ ) and that of Earth pressure at rest ( $K_o$ ) is to be considered. Standard backfill materials with conservative soil data are to be considered. No extra claims are to be entertained in this regard.*

**5.2. Special Notes on vertical turbine pump in vertical Execution Pump Foundation Design is to be considered**

**5.3.1. Foundation system for support of Rotary machines such as vertical pumping unit shall strictly comply with the requirements of Code IS: 2974 (Part-IV) - latest edition. The Rotary Machine support system require careful study of the foundation system with due consideration of vibration characteristics. For satisfactory design and construction, the following precautions need be taken with careful dynamic analysis of machine foundation and its supporting structures:**

- i) The natural frequency of the Foundation System shall be analysed and the mass of the Foundation System shall be considerably larger than the mass of the whole machine.**
- ii) Dynamic Analysis due to insufficient clearance between impeller and casing of Pumps should be checked and frequency out of this type of vibration need to be made as per relevant IS Code.**
- iii) Dynamic Response check of the block foundation may be carried out as per relevant IS Code.**

iv) Permissible amplitude of Vibration of displacement as per IS Code 2974 (Part-IV), is to be calculated and the design will be checked accordingly.

v) Permissible stresses in Soil / Concrete be suitably as per IS Code.

vi) Natural frequency of Foundation System shall be such as will avoid resonance with the Operating Speed of the Machine. The natural frequency of the foundation system should not be within +20% of the operating speeds of the machine.

vii) The foundation system shall be so dimensioned that the resultant force due to mass of the machine and mass of the Foundation passes through the Centre of gravity of the base area of the Foundation.

5.3.2: The Bidder is required to submit a "Technical Write-up" with relevant details of Foundation System along with the Part-I of this Bid. This would help the Department to fix up the accepted Parametric Norms of the foundation System that would finally be adopted in the design and construction of the Building and Structures after award of the contract.

#### **6.0 ARRANGMENT OF ROOF & LEAKAGE TREATMENT:**

6.1: It is proposed that the intake cum pumping station with HT substation top should be open with requisite Roof Treatment.

#### **7.0 DESIGN DRAWING AND OTHER INFORMATIONS TO BE SUBMITTED BY THE CONTRACTOR (SUCCESSFUL BIDDER)**

7.1. On the award of the Contract Contractor shall submit to the Superintending Engineer, Western Circle, Municipal Engineering Directorate and detailed design and drawings of different structures within fourteen (14) days from the date of issue of Letter of Acceptance and thereafter the balance drawings and design calculations will have to be submitted phase wise keeping pace with the work Program.

If called upon the Contractor shall also submit within reasonable time relevant books and other references, which have been referred to or used in the design. Such books and other relevance will be returned to the Contractor when done with. Secrecy in regard to details of design materials and equipment etc. shall not be pleaded by the Contractor in the name of "Trade Secret" for not furnishing the requirement details asked for by the undersigned. The design and drawings shall be subjected to



modifications at no extra cost, if found necessary and such modifications shall not vitiate the contract. Similarly, the Contractor shall submit any additional new drawings as found and the drawings shall form part of the Contract Drawings.

Notwithstanding what has been stated above the Contractor shall be responsible for the correctness and soundness of the design and if any provisions are found inadequate or faulty necessary modification will have to be carried out at any stage up-to the expiry of the Guarantee period at no extra cost.

The Contractor will not be permitted to commence the Actual Work at site unless the EIC on written recommendation to concerned Chief Engineer, MED / undersigned / Chief Engineer (E/M) KMDA and EE, M.E. Dte (E/M) approves detailed design and working drawings. Four copies of the approved design and six copies of the approved drawings are to be furnished by the Contractor free of cost for use by the Employer during execution of the work. Any additional copies of same drawings, if required, should also be submitted by the Contractor free of cost at the request of the EIC. If the drawings are done with Auto Cad, then copy of the folders containing drawings in CD/DVD may be submitted for records only. If required on the urgent basis the soft copy of any drawing is to be sent by E- Mail to undersigned / Chief Engineer (E/M) KMDA and EE, M.E. Dte (E/M) as per verbal discussion or Telephonic discussion within 2 hours.

A tentative work Program in Network Diagram using CPM & Bar Chart technique is required to be submitted by the successful Bidder within a fortnight from the date of issue of the letter of acceptance. The drawings from foundation onward will have to be submitted by the successful Bidder successively as per the work Program to be approved by the Engineer-in-Charge. Adequate resources are to be mobilized during execution of the work, for which no extra payment shall be made.

**7.2 Completion of Drawings and Other Documents to be submitted the Contractor.**

The Contractor shall submit within one month after the completion of all construction works the followings drawings and documents free of cost.

a) Six copies of all approved Completion drawings. These drawings shall be on black and white prints of thick paper and there shall be one transparency of each drawing.

These drawings are to be submitted in a presentable form as directed by the undersigned / Chief Engineer (E/M) KMDA and EE, M.E. Dte (E/M). In addition to this,

CD/DVD's with folders of these drawings drawn in Auto CAD or scanned copies are to be submitted.

b) Three copies of final designs in properly bound form as directed by the Superintending Engineer, Western Circle Municipal Engineering Directorate and one copy in original approved drawing & design should be submitted to Asansol Municipal Corporation.

c) Four copies of detailed specification and schedules of the completed intake jetty pumping station and substation of intake jetty pumping station and one copy in original approved drawing & design should be submitted to Asansol Municipal Corporation.

d) Six copies of Instruction Manuals for the Operation, Maintenance and overall of intake jetty plant and one copy in original approved drawing & design should be submitted to Asansol Municipal Corporation.

i) The Instruction Manuals shall contain the following basic categories of information in practical, complete and comprehensive manner prepared for use by operating and/or maintenance personnel:

a) Relevant information as regards initial installation.

b) Instruction for operation, maintenance and repair.

c) Recommended inspection points and period of inspection.

d) Ordering information for all replaceable parts, etc.

ii) The information shall be organized in a logical and orderly sequence. A general description of the system including important technical characteristics shall be included in order to familiarize operating and maintenance personnel with the system.

iii) Necessary reproducible drawing and/or other illustrations shall be included or copies of appropriate certified drawings shall be bound in the manual. Test, adjustment and calibration information, as appropriate, shall be included and shall be identified to the specific equipment. Safety and other warning notices and installation, maintenance and operating cautions shall be duly emphasized.

iv) A part list shall be included showing part nomenclature, manufacturer's part numbers and/or other information necessary for accurate identification and ordering of replacement parts.

v) If a standard manual is furnished covering more than the specific equipment purchased, the applicable model (or other identification) number, parts number and other information for the specific equipment purchased shall be clearly identified.

vi) The instruction Manual shall include list of all special tools and tackle furnished with complete drawings and instructions for use of such tools and tackle.

vii) The Instruction Manual shall also include recommendations for consumable supplies e.g. packing, lubricants, etc., for the plant installed as well as for chemicals for treatment and laboratory reagents.

viii) All the pages of the Instruction Manual shall be clearly legible and prepared on good quality paper.

ix) The Instruction Manual shall need the approval of the Superintending Engineer, Western Circle of Municipal Engineering Directorate. All the copies of the Instruction Manual shall be presented in durable and bound form as directed by the undersigned.

7.3 Release of Security Deposit (Retention Money):- The Security Deposit (Retention Money) shall not be released until all the above-mentioned Completion Drawings and Documents (as per Clause 7.2) are submitted by the Contractor.

**SUPERINTENDING ENGINEER, WEST CIRCLE**  
**MUNICIPAL ENGINEERING DIRECTORATE**

## **SECTION - G**

### **DETAILED TECHNICAL SPECIFICATIONS FOR CIVIL WORKS FOR INTAKE JETTY PUMPING STATION WITH HT SUBSTATION**

#### **1.0 SPECIAL NOTES**

1.1 The layout of the plant as shown on the drawing attached is not binding on the Bidder but is only indicative.

1.2 The Bidder shall not quote for works differing from the specifications of the Bid unless specifically permitted elsewhere in the Bid documents.

1.3 The suitability of the intake jetty pumping station with HT substation will not be decided only by the low capital cost but the economy in the operational & maintenance costs will also be considered. For this purpose all relevant details should be furnished.

1.4 There shall not be any ambiguity in the offer. Bid containing any ambiguity may be interpreted in a manner advantageous to the Employer.

1.5 If not mentioned elsewhere in the Bid documents, the contractor shall provide the following arrangements:

a) The Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 12 mm thick 450 mm dia. M.S. spiral welded mild steel rising main pipe line (TATA / SAIL make) on both side of footway bridge up to Ground level Reservoir shall be erected that the filter water from the river Damodar shall be such that water pumped out by the vertical pumping unit at the highest flood level as well as at the time of lowest flood level, filter water shall be pumped out to the ground level reservoir. The total quantity of the raw water shall be pumped to at lowest flood level as well as highest flood level in respect of 24.97 MLD (considering 16 Hrs. Pumping in a day) from Collector well for Asansol Town.

1.6) All valves, sluice gates, Butterfly, Kinetic non-return, Air release, pressure release etc. shall be of Kriloskar / Kalpana / Upadhyay make having PN 1.6.

1.7) The Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 12 mm thick 600 mm dia. M.S. spiral welded mild steel rising main pipe line (TATA / SAIL make) on both side of footway bridge up to 750 mm dia. manifold is under Bidder scope. The V.T. pump-

motor will be designed such that water from manifold line will be fall in G.L.R. including all necessary valves, specials. It is imperative that the layout of the plant inclusive of all Civil, Mechanical and Electrical Components should meet the requirements of Indian Factory Act, Indian Explosives Act and all other relevant statutes of the State and Central Government.

1.8 In order to provide a net output of 2657.50 m<sup>3</sup> / hour(+10%) filter water (16 hours operation) at whatever condition of water level of the river Damodar the pumping unit shall be placed on the floor of the pump house. The common manifold and valves shall be placed in such a way that that no obstacles found at the entry gate of the pumping station.

## **2.0 ITEMS OF WORKS**

The items of works have already been detailed in these documents. However, it is repeated below:

a) Collector well, footway bridge, 4 nos. 700 mm dia. of required length (designed by the bidder, minimum 420 meter) Infiltration gallery, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 700 mm dia. M.S. rising main pipe line on both side of footway bridge to River bank in a 750 mm dia. 12 mm thick spiral mild welded manifold line and discharge to GLR approx 9750 meter apart (civil & electro-mechanical part).

b) Back filling shall have to be done from the excavated earth (if required), in case of short fall the same shall have to be arranged by the bidder free of cost.

c) Retaining cum boundary wall & Illumination of the Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 700 mm dia. M.S. rising main pipe line make) on both side of footway bridge up to Ground level Reservoir, the scope is to be finalized after given view consideration of the actual site condition and soil report.

Components should meet the requirements of Indian Factory Act, Indian Explosives Act and all other relevant statutes of the State and Central Government.

1.8 In order to provide a net output filter water (16 hours operation) at whatever condition of water level of the river Damodar the pumping unit shall be placed on the floor of the pump house. The common manifold and valves shall be placed in such a way that that no obstacles found at the entry gate of the pumping station.

a) The above scope of works is to be indicative not to be exhaustive. Anything not covered in NIB but required for successful commissioning of the plant in all respect are to be provided by the e-Bid.

## **2.1 SOURCES OF CLEAR WATER SUPPLY & DESIGN FLOW**

The source of raw water supply is the river Damodar. Collector well, footway bridge, 4 nos. 700 mm dia. of required length (designed by the bidder minimum 420 meter) Infiltration gallery, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 700 mm dia. M.S. rising main pipe line on both side of footway bridge to River bank in a mild welded manifold line and discharge to GLR (civil & electro-mechanical part).

## **2.2 QUALITY OF THE CLEAR WATER**

For designing the Collector well pumping station the quality test of clear water should be done in presence of representative of E.I.C and quality of raw water should be checked from authentic Govt. Department by the bidder at his own cost for getting actual data required for pumping unit designing.

## **3.0 DESIGN SUBMITTED BY THE BIDDER**

### **3.1 COLLECTOR WELL PUMPING STATION:-**

Collector well, footway bridge, Infiltration gallery length and diameter will be designed by the bidder, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 10 mm thick 700 mm dia. M.S. spiral welded mild steel rising main pipe line on both side of footway bridge to River bank in a 750 mm dia. 12 mm thick spiral mild welded manifold line and discharge to GLR approx 9750 meter apart from Collector well to Ground level (civil & electro-mechanical part). The Collector well pumping station slab including foot Way Bridge should be supported on RCC piers / piles at least 1.5 M above the HFL and piers / piles should rest in suitable RCC cap. The grade of the concrete should be of M 30 for structure coming in contact with water or susceptible to come in contact of water. The construction of loading on the deck slab to be made such that it includes 2 (two) Nos. of M.S pipe line with other

live loading of 250 kg/ m<sup>2</sup> finished load 150 kg/ m<sup>2</sup> and normally trolley loading 2T for transportation of electro-mechanical loading. The pump delivery line should be placed on the Collector well, footway bridge, PDB Panel, soft starter and collector well pumping station with Supplying, laying and fabricating of 12 mm thick 700 mm dia. M.S. spiral welded mild steel rising main pipe line on both side of footway bridge up to Ground level Reservoir and butterfly valve of 450 mm dia., a full bore flow meter and discharge meter in a temper proof double throat required dia. air release valve are to be used for proposed rising main at the bank of the river Damodar. The floor of the pump house should be Kota stone flooring and approach deck slab / walkway should be finished chequered tiles (rough) with necessary cement backing.

The roof slab of the pump house shall have proper roof treatment together with water proofing treatment on it. The standard lime roof treatment is not acceptable. Pre-cast R. C. C. roof will also not be acceptable. The external and internal faces of the wall of pump house shall be rendered smooth. The exposed face will not be allowed to have any shutter mark and be rendered smooth by rubbing with carborandum stone.

The inside faces shall be provided with 3 (Three) coats cement wash after brushing off and finishing the shutter mark. External exposed faces shall have 2 (two) coats of weather coat (exterior) or equivalent paint of approved colour as directed by E.I.C.

There will be one entry points to the pump house both fitted with rolling shutters and the arrangement window to be made properly. All the widows of the pump house shall be sliding type made of anodized aluminium section and protection with grill to be provided on outer surface of pump house should be made from M.S grill.

One electrically operated crane of sufficient Capacity is also included for loading / unloading pumps & motors and other equipment as specified in technical details. The control valve chamber shall be of adequate dimensions as would conveniently accommodate the inlet control system comprising S.W. M. S (spiral welded mild steel) mains and one butterfly valves of required diameter should be placed on river bank for interconnecting the rising main. There shall remain minimum 350 mm clearance all rounds inside the valve chamber. The chamber will be in brickwork. All other provision shall be made as per direction of Engineer-in-Charge.

The Bidder shall make in his design all the provisions of safety of the structures and foundations thereof. Any deviation in quantities from the design and drawings

approved by the Authority during actual execution compared with those provided in the Bid shall not entitle the Contractor to any extra payment.

**3.2. Supplying, laying and fabricating of 10 mm thick 700 mm dia. M.S. spiral welded mild steel rising main pipe line (TATA / SAIL/Jindal make) on both side of footway bridge to River bank in a 750 mm dia. 12 mm thick spiral mild welded manifold line and discharge to GLR approx 9750 meter apart from Collector well (civil & electro-mechanical part) including fixing of all necessary valves and specials which are under the bidder scope.**

**1. EXCAVATION AND PREPARATION OF TRENCHES-**The trenches shall be so dug that the pipe may be laid to the required alignment and at a required depth. When the pipe lines is under / site the road way, a minimum cover of 1.5 M is recommended for adaptation but it may be modified to suit local condition.

**2. WIDTH OF THE TRENCH-**The width of the trench at the bottom shall be such as to provide not less than 20 cm clearance on the either side of the pipe. Additional width shall be provided at positions of sockets and flanges for jointing to be made properly. Depth of pits at such places shall also be sufficient to permit finishing of joints. Boulder and large stones shall be removed to provide a clearance at least 15 cm bellow and on each side of pipe, valves and fittings for pipes 600 mm in dia. or less and 20 cm for pipes larger than 600 mm in dia.

**3. TRIMMING OF TRENCH BOTTOM –** Before laying the pipes, bottom of pipe trench shall be cleaned of to present a plain surface and all irregularities shall be levelled.

**4. LAYING OF PIPES-** Where unloading, pipes shall not be thrown off on the hard roads. In order to avoid damage to the pipes and especially to the spigot ends, pipe should not be dragged along concrete and similar pavements with hard surfaces. All department Supply pipes(if any) , fittings, valves shall be carefully lowered into trench, piece by piece by means of derrick , or ropes or other suitable tools or equipment so as to prevent damage to pipes , fittings protective coatings and linings. Any negligence during unloading and handling of pipes results damage to the pipes and development of hair cracks, which if not detected at the time laying results in bursts during hydraulics testing will be serious offence and all liabilities goes to the concern.



#### **4.0 TOOL BOX AND TOOLS**

Bidders shall supply two toolbox (overall dimensions 1200 mm x 900 mm x 750 mm) made of best quality wood / NUWUD and polished or painted as per direction of the Engineer. The box shall be compartmentalized suitable to hold different types of tools separately. The edges of the box shall be protected by aluminium angles and the box shall be fitted with lock and key arrangement.

In addition, Bidders shall quote separately on their own letter heads for supply of one set special tools and tackles that they feel shall be necessary for maintenance, overhaul or replacement of the equipment under this contract. The quotation shall be attached with the Schedule of Prices.

#### **5.0 LEVELLING OF THE SITE**

After completion of the work, the entire site all round the intake jetty pumping station and other allied structures within the scope of this contract shall be cleared and all construction equipment shall be removed within a period not exceeding 3 (three) months from the date the plant is put into trial run. The site shall be graded and levelled to the required High Flood Level with boundary or retaining wall as required and as per instruction of E.I.C.

#### **6.0 PROCUREMENT OF EQUIPMENT ETC.**

Whenever in this Section or elsewhere, equipment, contrivance, special or this like are specified to be of 'reputed', 'approved' or similarly worded make, the List of Vendors should be consulted first and the scope of procurement limited to the same. In cases where the name of such equipment etc. do not figure in this list of vendors, written approval of the Employer about the make should invariably be obtained, failing which the equipment etc. even if procured may be subject to rejection.

7.0 Bank protection- River bank will be protected by retaining wall or boulder soling by filling with M-20 concrete as per direction of E.I.C

**SUPERINTENDING ENGINEER, WEST CIRCLE  
MUNICIPAL ENGINEERING DIRECTORATE**

## SECTION – H

### GENERAL TECHNICAL SPECIFICATION FOR R.C.C. PILE FOUNDATION

#### 1.0 GENERAL

The Design of the bidder should be based mainly on cast-in situ Bored reinforced concrete piles on driver piles on Damodar River as per site situation so arises subject to the approval of EIC. Sub-sand or soil investigation was carried out by the Department and the summary report is placed in Annexure-I (Section – N). Interested bidders may have a look at the full report which will be available in the office of the undersigned. Beside this the bidder himself is to be carrying Soil investigation report and safer data has to be taken for Sub-structure design.

This information is given as a guidance and is indicative only, and for any variation in strata at any location at site during actual execution of work, the employer shall not be held responsible for shall the contract be null and void on this count. In case of any variation in cut off level, necessary adjustment of safe working load will be made as per IS stipulation. The specialist firm may quote any proprietary system of piling subject to approval of the Engineer-in-Charge consistent with the load, moment and forces to be encountered by each pile.

The Bidders shall submit with his bid drawings, calculations explaining his scheme draw up specification and submit the schedules of prices following the format of the schedules of prices accompanying this bid documents.

#### 2.0 DESIGN AND CONCRETE QUALITY

2.1 The safe working loads of the RCC cast in site bored piles should be that as computed as per IS: 2911 on the basis of sub soil parameter of site with a minimum factor of safety 2.5 (compression) and 3.00 (up lift) applied there on. For boring / driving pile under water IS stipulation as well as **SWID**/Other Govt Organisation & Municipal Engineering Directorate suggestions will be strictly honoured. The grade of concrete of all types of R. C. C. pile shall be minimum M-25 / IS stipulation unless otherwise specified elsewhere. The cement content in concrete to piling work shall be minimum 400 kg/M<sup>3</sup> with ordinary Portland cement. Water cement ratio and slump shall be as per I. S. Specification for relevant piling work. Maximum size of coarse aggregate shall not exceed 20 mm.

**2.2 Grading and other requirement of coarse and fine aggregates, water and concrete shall be as specified for reinforced cement concrete work under this Contract.**

**2.3 The average basis length of the piles is to be assumed from cut off level to the tip of the pile (however for piles with muff the basic length shall be from tip of the pile up to underside of muff). The final length will be decided by the contractor with approval of the Engineer on the basis of driving / boring resistance actually observed at site. It will be the responsibility of the contractor to prove by subsequent load test / pullout tests that the adopted length of pile shall carry the specified safe load, tension and the resulting deflections being within the permissible limits. In no case extra claim over the originally quoted price will be entertained for any increase in number / length / cross sectional area / reinforcement of piles and in the site of other foundation structures if requires if required at the time of execution after the load tests of piles. Similarly no deduction in payment will be made from the lump sum price quoted for decrease in number / length / cross-section of area / reinforcement and in the size of other foundation structures at the time of execution or after the load tests of piles provided that the complete safety of the Structures is fully assured.**

**2.4 For Collector well, Foot Way Bridge, pumping station pile foundation should have permanent steel casing / approved alternative methodology. Scour depth below bed level will be a major guiding factor. All relevant provision of I.S. code for R.C.C. Structure on river bed (under water) will have to be strictly followed. However bidders may suggest other methodology without deviating from major objectives & cost keeping the working well within I.S. standards. In any case he has to be ensured the stability of the structure.**

**2.5 Bidders/ contractor will be given full liberty to opt for design mix as per satisfaction of E.I.C. with minimum cement content as mentioned.**

### **3.0 SPECIFICATION FOR BOREDCAST-IN-CITU PILES**

**3.1 Unless specified otherwise in the following paragraphs, stipulations of relevant section of I. S. 2911 (latest edition) shall be followed. However in case of any conflict of stipulations laid here in and IS code of practice occurs, IS stipulations will stand as final subject to satisfaction of EIC.**

The bidder shall submit within his bid the layout and number of piles based on allowable load carrying capacity, tension on the pile section design by him.

**3.2 Boring equipment and accessories shall generally conform to IS: 2911 relevant section. Boring may be done by either rotary or percussion equipment or grouting equipment using reverse or direct non circulation method. In case of unstable soils the boring tools used shall be such that suction effects are minimized.**

Stabilization of the sides of bore hole shall be done by the use of bentonite slurry or casing. The size of cutting tool shall not be less than the diameter of the pile by more than 75 mm.

In case of boring with casing, the casing shall be used from the ground level. The casing shall be kept ahead of boring in cases where there is danger of carrying in due to subsoil entering into the borehole or where soil is loose.

While boring below sub-soil water, precaution shall be taken so that no boiling of the bottom of the hole occurs due to difference in hydrostatic head.

**3.3 Concreting of bore holes shall start soon as possible after its completion. Should a borehole, be left without concreting for more than two hours it shall be cleaned thoroughly as directed by the Engineer-in-Charge before placing concrete. Concrete under water shall be placed by means of a termite pipe. It shall, however, be ensured that concrete entering the termite pipe does not get mixed up with the slurry and ¼ kg of granulated vermiculite shall be poured in the termite pipe before pouring concrete as directed by the Engineer.**

**3.4 The termite pipes and funnel shall be filled and lifted just 15 cm above bottom before releasing the concrete column to facilitate flushing out of the bottom. The concrete levels in the termite shall be checked every meter in order to judge the difference, if any, between the theoretical quantity that should have been placed and the actual quantity that has gone in. This is to locate the position of cut off during boring. In addition to the normal precautions to be taken in termite concreting as per relevant Section of IS: 2911 the following specifications shall be particularly applicable for the use of termite concrete in pipes.**

i) The concrete shall be coherent, such in cement (not less than 400 kg/m<sup>3</sup>) and of slump not less than 150 mm I S stipulations

ii) The hopper and termite shall be closed system.

iii) The termite shall be large enough with due regard to the size of the aggregate. For 20 mm aggregate the termite pipe shall be of diameter not less than 200 mm.

iv) The first charge of concrete shall be placed with a sliding plug pushed down the tube of it or with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug shall not be left in the concrete as a lump.

v) The termite pipe shall always penetrate into the concrete with an adequate margin of safety against withdraw of the pipe surged to discharge the concrete.

vi) The pile shall be concreted wholly by termite and the method of deposition shall not be charged way up the pile to prevent into laitance from being trapped within the pile.

vii) All termite tubes shall be scrupulously cleaned after use. Normally concreting of the piles shall be carried out without any interruption. In the exceptional case of interruption in concreting, but which can be resumed within 1 or 2 hours, the termite shall not be taken out of the concrete. Instead, it shall be raised and lowered slowly, from time to time to prevent the concrete around the termite from setting. Concreting shall be resumed by introducing a little richer (5% additional amount) concrete with a higher slump for easy displacement of the partly set concrete.

If the concreting cannot be resumed before final set of concrete already placed, the pile so cast may be rejected or accepted with modifications at the sole discretion of the Engineer-in-Charge or his representative.

In case of withdrawing of termite out of the concrete, either accidentally or to removed a blockage in the termite, the termite may be reintroduced in the following manner to prevent impregnation of laitance or sewer laying on top of the concrete already deposited in the bore.

The termite shall be gently lowered on the old concrete with very little penetration initially. A vermiculite plug shall be introduced in the termite. Fresh concrete of slump between 150 mm and 180 mm. shall be filled in the termite which will push the plug forward and will emerge out of the termite displacing laitance / sewer. The termite will be pushed further in steps, watering fresh concrete sweeping away laitance / scum in its way. When termite is buried by about 60 to 100 cm. concreting may be resumed.

3.5 The top of concrete in a pile shall be brought above the cut off level to permit removal of all laitance and weak concrete before capping to ensure good concrete at the cut off level for proper embedment into the pile cap. Where cut off level is less than 1.5 M. below the working level concrete shall be cast to a minimum of 500 mm above cut off level. For each additional 0.3 m. increase in cut-off level below the working level additional coverage of 50 mm. minimum shall be allowed. Higher allowance may be necessary depending on the length of the pile as directed by the Engineer-in-charge. When concrete is placed by using termite material, concrete shall be cast to the piling platform level to permit overflow of concrete for visual inspection or to a minimum of one meter above cut-off level. In the circumstances where cut off level is below ground water level the need to maintain pressure on the freshly laid concrete equal to or greater than water pressure shall be formed out and accordingly the length of extra concrete above cut-off level shall be determined and provided in works.

3.6 During piling, the sequence of construction and installation of piles shall as per direction of the Engineering-in-Charge.

3.7 In case defective piles are formed during construction, they shall be removed or left in place whichever is found convenient without adversely affecting the performance of the adjacent piles or the pile cap as a whole. Additional piles shall be provided at Contractor's cost to replace them as per direction of the Engineer-in-Charge and in this respect the Engineer-in-Charges' decision shall be final and binding upon the contractor. Any deviation from the designed location, alignment or local capacity of any pile shall be noted and adequate measures shall be taken well before concreting of the pile cap, etc. if the deviations are beyond the permissible limit. All such alternations shall be done at Contractor's own cost and expenses and to the entire satisfaction of the Engineer-in-Charge.

**3.8 Piles shall be installed accurately as per approved design and drawings. For vertical piles a deviation of 1.5 percent from vertical line shall not be exceeded. Piles shall not deviate more than 75 mm. or one tenth of diameter whichever is more (in case of piles having diameter more than 600 mm) from their designed positions at working level of the piling rig.**

**In case of piles deviating beyond the above mentioned limits and such an extent that the resulting eccentricity cannot be taken care of by a redesign of the pile cap & pile trees, the piles shall be replaced or supplemented by one or more additional piles by the contractor at his own cost and expenses along with any additional cost for pile cap, etc. being borne by him.**

**3.9 While manual chipping may be permitted after casting of pile, pneumatic chipping, if permitted by the Engineer-in-Charge, shall not be started before 7 days under any circumstances.**

**3.10 Main longitudinal reinforcement in the length of the piles and links or spiral welded mild steels shall be provided as per the approved drawing. Longitudinal bars where possible shall preferably be in one length. Every care shall be taken in handling of the reinforcing cage so that its shape is not damaged.**

**3.11 When working adjacent to existing structure every care shall be taken to avoid any damage to such structures, in the case of bored piles care shall be taken to avoid effect due to loss of ground. In the case of deep excavations adjacent to piles proper protection shall be provided to safeguard against the lateral movement of soil stratum or releasing the confirming soil stress.**

**3.12 During piling work the following data shall be recorded along with any other data as may be directed by the Engineer-in-Charge. These data shall be submitted to the Engineer-in-Charge in triplicate copies on completion of installation of each pile.**

- i) Sequence of installation of piles in a group.**
- ii) Dimensions of the pile including reinforcement details and mark of the pile**
- iii) Details of mild steel liners where provided along with the details of stiffeners**
- iv) Depth bored and founding level along with a bore log depicting the nature of strata encountered during boring.**

- v) Time taken for penetration of every 15 cm during last 2 m depth before founding level.
- vi) Method of cleaning bottom of hole at founding level before concreting.
- vii) Time taken for concreting.
- viii) Cement consumption and slump of concrete.
- ix) Cut off level / working level / R. L. of top concrete, any other relevant / important observation.

3.13 During execution at any stage if any variation is required to be made to suit the site on EIC to be technically satisfied and His decision will be regarded as final.

3.14 Any of data / information given if not found reasonable (this will also include data of parameters) will be given during detail engineering. Bidders / contractor therefore revised to consult with manufacturer/ experts at his own cost, if so felt, to reach more in figure for Biding purpose. The same is also advised for any other data supplied. But in no case it will be treated as a Fault of Biding Authorities. If any found in Variance in same chapter / section or anywhere of bid document, is to be into the notice of the biding Authority & his interpretation/ decision will be consider as final.

#### **4.0 LOAD TEST ON PILES**

4.1 The load tests shall be carried out as per IS: 2911 unless specified otherwise in the following paragraphs. The tests shall be carried out on test pile and a selected representative pile as approved by the Engineer-in-Charge. Sufficient time shall be allowed before tests to permit adjustment on the soil conditions following disturbance from the method of installation. The period between installation of the test pile or any other pile in the vicinity and the test loading of the pile shall be least 28 days.

4.2 The test load shall be applied by jacking against Kent ledge or any other structure approved by the Engineer-in-Charge. No working pile shall be permitted to be used for any loading for load test on pile. The design of the Kent ledge shall be such as to prevent instability, particularly in the event of a sudden change in the load reaction from the pile. The reaction from Kent ledge to be made available for the test shall be at least 25 percent more than the final test load to be applied. The test shall be carried out at cut off level or at maximum 1.5 m below G. L. as directed by the Engineer-in-Charge. Anchors, if provided, for load test shall be at specified distance away from test pile as per relevant I. S. Code of Practice and there shall be minimum



two anchors at two ends of the pile. Details regarding the testing arrangement shall be submitted well in advance to the Engineer-in-Charge for his approval. Load tests shall only be undertaken after obtaining the approval.

4.3 The jack is to be hydraulically operated. The load applied to the pile shall be recorded either by a gauge in the hydraulic system or a proving ring duly calibrated from an approved laboratory before load tests. The sensitivity of the full load and in any event, the accuracy and sensitivity of the system is to be checked against an approved instrument.

A test certificate and fresh calibration chart as obtained from an approved laboratory for jack as well as pump supplying hydraulic power shall be produced before the Engineer-in-Charge well in advance before use for any load testing pile.

4.4 The settlement of the pile shall be recorded by three dial gauges recording to 0.02 mm and placed at equal distance around the test pile. The dial gauges shall be fixed on datum bars whose ends rest upon non-movable supports. The supports for datum bars with reference to which the settlement of the pile would be measured shall be at least  $5d$  ( $d$  being the diameter of the circular pile or the side of the square pile) away and clear from the test piles, subject to a minimum of 1.5 meters.

4.5 The testing equipment employed shall be capable of loading a pile to failure or to three times the design loading.

4.6 Before testing the top of the pile shall be clipped off carefully till sound concrete is encountered. The projecting reinforcement shall be cut or bent suitably and the top finished smooth and level with plaster of Paris, when required or as directed by the Engineer-in-Charge. A series 25 mm thick bearing plates shall be placed on the head of the pile for jack to rest as directed by the Engineer-in-Charge.

4.7 The Contractor shall have to perform rotating load test on working piles on load as decided and selected by the Engineer-in-Charge and the results must satisfy the requirements of the test. At least one working pile of each diameter shall be tested. The test shall be carried out at cut-off level or at such level as per direction of the Engineer-in-Charge. The Contractor shall also have to carry out initial test on a non-working test pile as described below:

**A. INITIAL TEST ON A NON-WORKING PILE:**

i) The test load shall be applied in equal increments of amount one-fifth of the estimated safe load as directed by the Engineer-in-Charge. Each state of loading or unloading shall be maintained till the rate of movement of the pile top is not more than 0.02 cm per hour in the case of clayey soils and 0.1 mm per hour in 2 hours whichever is greater.

ii) The estimated safe load shall be maintained for 24 hours and settlements shall be observed and recorded every hour during the period.

iii) Time-settlement observation shall be made at the commencement and completion of each increment. The rebound observation shall be made with suitable unloading as per direction of the Engineer-in-Charge.

iv) The loading shall be continued till the settlement of the pile top equals one tenth of the diameter of the pile stem (one tenth of the side in case of square piles) or the load is two times the estimated safe load on the pile, whichever is earlier.

v) The safe load on pile shall be the minimum of the following:

a) Two thirds of the final load at which the total settlement attains value of 12 mm unless it is specified that a total settlement different from 12 mm is permissible or required in given case on the basis of nature and type of structure in which case the safe load shall correspond to actual total settlement permissible or required.

b) Fifty (50) percent of the final load at which the total settlement equal one tenth of the pile diameter of the size of the pile.

**B. ROUTINE TEST ON WORKING PILE:**

Load on the pile in routine test shall be applied up to and a half times the estimated safe load carrying capacity of the pile. The loading procedure and settlement observations shall be the same in initial test described hereinabove. The safe load on the pile shall be the minimum of the following:

a) Two third of the final load at which the total settlement attains a value of 12 mm unless it is specified that a total settlement different from 12 mm is permissible in a given case on the basis of nature and type of structure.

b) Fifty percent of the final load at which the total settlement equals one tenth of the pile diameter of size of the pile.

### **C. LATERAL LOAD ON WORKING PILE:**

i) The Contractor shall have to carry out lateral load test on one vertical working pile. Reaction may be obtained from suitable set up as approved by the Engineer-in-Charge and hydraulic jack shall be inserted in between the loading set up and pile in order to apply the lateral load. Thrust pieces need be inserted on either end of the jack to fill up the gap. Lateral deflections shall be measured at cut-off level or at maximum 1.5 M below G. L. as directed by the Engineer-in-Charge by means of dial gauges fixed to immovable supports.

ii) Loading shall be applied in increments of about 20% of the estimated safe load till the rate of deflection reduces to 0.02 mm per hour in the case of clayey soil and 0.05 mm per hour in the case of sandy soils or 2 hours whichever is earlier.

iii) Displacements shall be measured by issuing at least two dial gauges spaced at 30 cm and kept horizontally one above the other on test pile. Where it may not be possible to place one of the dial gauges on the line of jack axis, then the two dial gauges shall be kept at a distance of 30 cm at a suitable height and the displacement interpolated at load point from similar triangles To fix dial gauges on the pile surface, uneven surfaces shall be chipped of and 25 to 30 mm square glass piece shall be fixed to provide a smooth surface. The dial gauge tips shall rest on the East portion of the glass plate.

iv) The safe lateral load shall be the least of the following:

a) Fifty (50) percent of the final load at which the total displacement increases to 12 mm.

b) Final load at which total displacement corresponds to 5 mm.

d) Load corresponding to any other specified displacement due to performance requirements.

4.8 All pile test data i.e., load, displacement and time shall be recorded in a suitable chart along with other information about the pile in a manner as directed by the Engineer-in-Charge.

From the data, curves shall be drawn showing load displacements and displacement time and safe load shall be indicated on the graphs.

All data and curves shall be submitted to the Engineer-in-Charge in triplicate copies along with the originals.

If on load testing, it is found that the capacity of the pile is more than the designed capacity nothing shall be paid extra for such extra capacities.

**SUPERINTENDING ENGINEER, WEST CIRCLE**  
**MUNICIPAL ENGINEERING DIRECTORATE**

## SECTION -I

### DETAILS OF ELECTRO-MECHANICAL ARRANGNEMTS

## Technical Specifications

### A. 33 KV SUBSTATION

#### 1.0 33 KV VCB SWITCHBOARD

1.1. The rating of the VCB Switch board shall be 33 KV.

The Switchboard shall be multi panel switch board suitable for indoor installation and shall operate at 33 KV  $\pm 10\%$ , 3 $\phi$ , 50 Hz  $\pm 5\%$  AC earthed system. The Switchboard shall comprise of the following

- |     |                                   |   |        |
|-----|-----------------------------------|---|--------|
| i)  | Incomer panel                     | - | 1 no.  |
| ii) | Outgoing transformer feeder panel | - | 2 Nos. |

1.2. The switch gear shall be indoor, metal clad, floor mounted, horizontal isolation and horizontal draw out type and shall be suitable for trouble free and continuous operation at 33 KV  $\pm 10\%$ , 3 phases, 3 wire, 50 Hz  $\pm 5\%$ , grounded system. The switch gear will be located in a hot, humid and tropical atmosphere.

Design and construction shall be such so as to allow extension at either ends. The base channel frame of the switch gear along with all hardware shall be within the scope of the contract.

The switch gear enclosure shall conform to the degree of protection IP-4X. The minimum thickness of sheet used shall be 2 mm except the gland plate where the sheet thickness shall be 3 mm.

The switch gear assembly shall comprise a continuous dead front, line up of free standing, vertical cubicles. Each cubical shall have front hinged door with latches and a removable back cover. All covers and doors shall be provided with neoprene gaskets.

Circuit breakers, instrument transformer, bus bars, cable chamber etc. shall be housed in separate compartments.

1.3 The Switch gear shall be fully wired at the factory to ensure proper functioning of indications, control, protection, transfer and inter-locking scheme. Fuse & links shall be provided to permit individual circuit isolation without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired up-to terminal blocks.

Wiring shall be done with flexible, 1.1KV grade PVC insulated switchboard wires with stranded copper conductors of 2.5 sq. mm for control and current circuits and 1.5 sq. mm for voltage circuits. Each wire shall be identified with both ends with permanent marker bearing wire number as per contractor's wiring diagram. Wire termination shall be made with crimping

type connectors with insulating sleeves. Not more than two wires shall be connected to any terminal. At least 25% spare terminal shall be furnished in the terminal block.

- 1.4 Switch gear shall be designed for cable entry from bottom. Sufficient space shall be provided for ease of termination and connection. Power cables shall be XLPE insulated, armoured, overall PVC sheathed with stranded aluminum conductors. Control cables shall be XLPE insulated, armoured, overall PVC sheathed with 2.5 sq. mm stranded copper conductors. All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates (3 mm thick), cable supports, crimping type tinned copper / aluminum lugs, brass compression glands with washers and terminal blocks.
- 1.5 The main buses and connections shall be of high conductivity electrolyte grade copper, sized for specific current rating with maximum temperature rise limited to 90°C. Bus-bars and connection shall be fully insulated for working voltage with adequate phase / ground clearance. Insulating sleeves for bus bars and cast resin shrouds for joints shall be provided. All buses and connections shall be supported and braced to withstand stress due to maximum short circuit current and also to take care of any thermal expansion. Bus-bars shall be color coded for easy identification and the bus-bar chamber shall be provided with inter panel barrier with epoxy cast seal-off bushings through which the buses will pass through so as to prevent fire from one panel to other.
- 1.6 A copper ground bus, rated to carry maximum fault current for 3 sec., shall extend for full length of the switchgear. The ground bus shall be extended at both ends and the extended portion shall be tinned and provided with two bolt drilling with GI bolts, nuts and washers at each end to receive GI flat of adequate sizes to withstand earth fault current. CT & VT secondary neutrals shall be earthed through removable links so that earth of the one circuit may be removed without disturbing the others. Each stationery unit shall be directly connected to the ground bus.
- 1.7 The circuit breaker shall be vacuum type triple pole 1250 Amps, 26.2 KA for 3 sec, horizontal draw out, horizontal isolation having Service / Test / Isolated position with positive indication for each position. The V.C.B. shall have 220 V AC motorized spring charged trip free mechanism and mounted on a carriage complete with self contained manually operated fully interlocked, raising and lowering mechanism with integral earthing /earthing truck. The operating mechanism shall normally be operated from remote electrical control but arrangement should also be made for local electrical control. Mechanical device shall also be provided on the breaker for manually tripping and closing. Each set of the circuit breaker shall have the following features:
  - a) 1 set mechanical ON & OFF indicator.
  - b) 1 rear entry cable box with glands suitable for 33 KV (E) grade XLPE cable.
  - c) 1 set of indicating lamp ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY/ R-Y-B Phase Indications / Service & Test Position for each Breaker and in addition DC FAIL ( for Incomer only )
  - d) 3 double core current transformers of suitable ratio and accuracy class 5P10 shall be provided for protection & metering
  - e) Shunt trip coil, closing coil for 110 V DC.
  - f) 2 space heaters one each in front and rear chamber rated for 230 V
  - g) 15A / 15A 3 Pin Plug Socket
  - h) In – panel lighting with control switch
  - i) Space heater for each individual feeder
  - j) 240 V AC Alarm Bell & Buzzar for non – trip fault & trip with provision for alarm cancellation  
( common )
  - k) Auxiliary switches with required contact.

l) 1 suitable label

In addition, 1 no resin cast and draw out type PT shall be provided in the incoming breaker suitable for 3 phase, 3 wire 3 limb 50 Hz system with a ratio of 33 KV / 110 /  $\sqrt{3}$  / 110 /  $\sqrt{3}$  volts, 100 VA, class 1.0 / 3 P. Symmetrical breaking capacity of the circuit breaker shall be 26.2 KA.

The circuit breaker shall be capable of carrying rated current at 45°C ambient temperature without derating.

The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall have to be followed in accordance to the following list.

<b>Codes and Standards</b>	<b>Descriptions</b>
IEC 60529	Classification of degrees of protection provided by enclosures of electrical equipment.
IEC 60298	A.C metal-enclosed switchgear and control gear for rated voltages above 1KV and up to and including 72KV.
IEC 1330	High voltage/Low voltage prefabricated substations.
IEC 60694	Common specification for medium switchgear standards.
IEC 60265	General requirements for switchgear and control gear for voltages exceeding 1000V but less than 52 KV.
IEC 62271-100 & IEC 62271-200	Medium Voltage Alternating Current Circuit Breaker. Metal enclosed BS 5311 switchgear.
IEC 62271-102	High Voltage Alternating current disconnectors and earthing switches.
IEC 60185	Current Transformers
IEC 60186	Voltage transformers
BS 159	Busbar
IEC 60137	Bushings
CP 1013(British Code of Practice)	Earthing
IEC 60255	Specification for Static Protective Relays
BS 6231	Wires and wiring
IEC 61000	Electromagnetic compatibility
IEC 60376A & IEC 60376B	Filling of SF6 gas in RMU / HT SWGR.
IS 8686	Specification for Static Protective Relays.

IEC 60060-1 BS 923	High Voltage test technique
IEC 60034-1	Motors

\*\* The equipment shall conform in all respects with the requirements of the latest editions of the IEC standards stated above except where specified otherwise.

The switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards.

### **Routine Test**

The tests shall include but not necessarily limited to the following:

- a. Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme & proper functioning of the equipment.
- b. All wiring and current carrying part shall be given appropriate High Voltage test.
- c. Primary current and voltage shall be applied to all instrument transformers.
- d. Routine test shall be carried out on all equipment such as circuit breakers, instrument transformers, relays, meters etc. as per relevant standard.

### **Type Test Certificate**

The following type test certificate on identical VCB shall be furnished by the Successful Tenderer during detail engineering.

Impulse Test

Temperature rise Test

Short circuit Test

Internal Arc Test for 1 Sec.

The cost of such tests, if any, shall be included.

### **Test Certificate**

Certified reports of all the tests carried out at the works shall be furnished in 3 (three) copies for approval of the Owner/ Purchaser.

The equipment shall be dispatched from works only after receipt of Owner / Purchaser's written approval of the test reports.

Type test certificate as mentioned above, if not furnished to the Owner / Purchaser, the same shall have to be type tested, free of charge, to prove the design.

1.8 The feeder details of the 33 KV VCB Switch board shall be as under:



**A) Incoming feeder Panel: 1 No. (1250 A)**

- |       |  |   |                   |
|-------|--|---|-------------------|
| i)    | 96 sq mm ( 0 – 45 KV ) Voltmeter with 240 <sup>0</sup> scale and Selector Switch                         | - | 1 Set             |
| ii)   | 96 sq mm ( 0 – 75 – 150 A) Ammeter with 240 <sup>0</sup> scale and Selector Switch                       | - | 1 Set             |
| iii)  | Local/ Remote selector switch  | - | 1 No.             |
| iv)   | TNC Breaker Control switch   | - | 1 No.             |
| v)    | Double core Dual Ratio Cast Resin 150-75 / 1 + 1, Class 5 P10 & 1.0, 10VA burden CT's                    | - | 1 Set<br>(3 Nos.) |
| vi)   | Microprocessor based directional combined IDMTL over current & earth fault relay type P127 or equivalent | - | 1 No.             |
| vii)  | Master trip relay type VAJH-13   | - | 1 No.             |
| viii) | Trip Circuit Supervision relay type VAX-31   | - | 1 No.             |
| ix)   | Multifunction meter (For Amp. Voltage, frequency, power factor etc.) type ELITE445 or equivalent         | - | 1 No.             |
| x)    | Power Factor Meter   | - | 1 No.             |
| xi)   | KW Meter   | - | 1 No.             |
| xii)  | 8 Channel Alarm annunciator with indicating lamps  | - | 1 set             |
| xiii) | DC Selector Switch, Source I & II  | - | 1 No.             |

**B) Out going feeder panels (2 Nos.) for 3150 KVA Transformer**

- |   |   |            |
|---|---|------------|
| i) 0 – 75 A Ammeter with 240 <sup>0</sup> scale and Selector Switch   | - | 1 Set      |
| ii) Local / Remote selector switch  | - | 1 No.      |
| iii) TNC Breaker Control switch   | - | 1 No.      |
| iv) Dual core Cast Resin CT's 75 / 1 + 1, Class 5 P10, 1.0  | - | 1 Set      |
|   |   | ( 3 Nos. ) |
| v) Microprocessor based non-directional combined IDMTL over current & earth fault relay type P122 or equivalent | - | 1 No.      |
| vi) Master trip relay type VAJH-13  | - | 1 No.      |
| vii) Trip Circuit Supervision relay type VAX-31   | - | 1 No.      |
| viii) REF relay type CAG - 14   | - | 1 No.      |
| ix) Stand-by Earth Fault Relay type CDG 11  | - | 1 No.      |
| x) Auxiliary relay type VAA – 33 or equivalent  | - | 3 Nos.     |
| xi) Auxiliary relay type VAA – 23 or equivalent   | - | 1 No.      |

**D) Common for all above feeders:**

- |                         |   |       |
|-------------------------|---|-------|
| i) Anti – pumping relay | - | 1 Set |
|-------------------------|---|-------|

1.9. Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MV Switchboard to the switch-gear panels

DC Supply: 110V DC supply by duplicate feeders shall be made available from the station battery bank / Battery Charger / DCDB stated elsewhere. Hooking up with the station switchgear and other equipments is within the scope of the contractor and shall be done through cables.

1.10. All equipment, accessories and wiring shall have fungus protection. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects. All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease and rust.

After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stove after each coat. The switch gear shall be finished in RAL 7032 with two coats of epoxy paints

1.11 Notwithstanding whatever mentioned elsewhere in the document, following tests shall include but not necessarily limited to the following:

- (a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.

- (b) All wiring and current carrying part shall be given appropriate high voltage test.
- (c) Primary current and voltage shall be applied to all instrument transformers.
- (d) Routine test shall be carried out on all equipment such as circuit breakers, instruments, transformers, relays and meters.

All tests shall be performed in presence of owner's representative.

Certified copies of all the tests carried out at the manufacturer's premises shall be furnished in three copies.

## RATINGS AND REQUIREMENTS

### 1.0 SWITCHGEAR

1.1	General	
	Type	03 Panel Indoor Type, Extensible SWGR
	Service	Indoor
	Enclosure	IP – 4X
1.2	System	
	Rated Voltage (KV rms )	33 KV± 10%
	Phase	Three
	Rated Frequency	50 Hz ± 3%
	Design ambient temperature	50°C
	System grounding	Soild
	Rated Current inside the cubicle and at design ambient temperature of 50°C	
	i)Bus bar	1250 A
	ii)Circuit breaker	1250 A
	Rated short time withstand current	26.2 KA for 3 sec.
	Rated peak withstand current	2.5 X rated short time current
1.3	Insulation level	
	Rated Impulse withstand voltage	170 kV (peak)
	Rated one minute power frequency voltage	70 KV ( r.m.s) withstand voltage
1.4	AC/DC Power Supply	
	Control voltage	110 V DC
	Service voltage	230V ± 10%, 1 Ph, 50 Hz ± 5%
1.5	Type test required	Yes ( If Test report of similar rating is not available

1.6	Painting requirement	
	a) Finish paint	Powder coating
	b) Paint base	Epoxy / poly-urethane
	c) Paint shade	631 as per IS-5 / RAL-7032
2.0	CIRCUIT BREAKER	
	Type	Vacuum
	No. of poles	3
	Rated Voltage (KV RMS)	33000V $\pm$ 10%
	Rated Frequency (HZ)	50 $\pm$ 3%
	Rated normal current at site condition (Amps)	1250A
	Reference Standard	IEC-62271-100
	Mechanical Endurance Class	M1
	Electrical Endurance Class	E1
	Restrike Probability Class	C1
	Rated Operating Sequence	O - 3min - CO - 3min - CO
	Operating mechanism	Motor wound Spring charging
	Opening time (ms)	Not more than 60ms
	Closing time (ms)	Not more than 100ms
	Number of trip coils For 33 KV breakers	One
	Restriking voltage	2.5KV RMS
3.0	Rated Supply Voltage and Frequency for	
	Closing.	110 V DC, 2W (85% - 110%)
	Tripping	110 V DC, 2W (70% - 110%)
	Spring Charge Motor	110 V DC (85% - 110%)
	Heater/Lamp/Socket	230V, 1 Ph.

## CHECK LIST OF THE 33 KV SWITCHBOARD

### **1.0 Buses:**

- |             |  |             |
|-------------|--|-------------|
| 1.01        | Bus-bar material   | :           |
| 1.02        | Bus-bar size   | :           |
| 1.03        | Minimum Clearance of bare bus and connections<br>(a) phase to phase - mm<br>(b) phase to ground - mm | :<br>:<br>: |
| 1.04        | Bus-bar provided with<br>(a) Insulated Sleeve<br>(b) Insulating barriers                             | :<br>:<br>: |
| 1.05        | Current Ratings<br>(a) Continuous (Amp)<br>(b) 3-Second (KA rms)                                     | :<br>:<br>: |
| 1.06        | Temperature rise over 45°C Ambient (°C)  | :           |
| 1.07        | Standard to which buses conform  | :           |
| <b>2.0.</b> | <b>Vacuum Circuit Breakers:</b>  |             |
| 2.01        | Make   | :           |
| 2.02        | Type & Service   | :           |
| 2.03        | Execution  | :           |
| 2.04        | Rated Voltage:<br>(a) Nominal<br>(b) Highest   | :<br>:<br>: |
| 2.05        | No of Poles  | :           |
| 2.06        | Frequency  | :           |

2.07	Current Ratings	:	
	(a) Rated current at Standard ambient	:	
	(b) 3-second thermal rating (KA rms)	:	
	(c) Momentary (KA rms)	:	
2.08	Temperature rise over 45°C ambient	:	°C
2.09	Interrupting Capacity	:	
	(a) Symmetrical- KA (rms) at rated voltage	:	
	(b) Asymmetrical (if any)- KA (rms)	:	
2.10	Making Capacity	:	
	(a) Peak KA	:	
	(b) RMS symmetrical	:	
2.11	Closing time	:	Cycle/mille-sec
2.12	Opening time	:	Cycle/mille-sec
2.13	No of breaks per phase	:	
2.14	Insulation level	:	
		:	
	(a) 1-Minute dry withstand (KV rms)	:	
	(b) Impulse withstand (KV Peak)	:	
2.15	Standard to which conforms	:	
2.16	No load mechanical operation	:	
2.17	Number of operation at rated current	:	
<b>3.00</b>	<b>Operating Mechanism</b>		
3.01	Type	:	
3.02	Trip free or fixed	:	
3.03	Charging Time	:	

- 3.04 Closing : :
- (a) Closing voltage :
- (b) Tripping voltage :
- 3.05 Allowable variation in Control Voltage : :
- (a) Closing : :
- (b) Tripping : :
- 3.06 Current required for Tripping : :
- 3.07 No of auxiliary switch furnished : :
- (a) Normally open : :
- (b) Normally close : :
- (c) Breaking Capacity : :
- (d) Type : :
- (e) No of spare contacts furnished : :
- (f) Are the auxiliary contacts convertible type : :
- 3.08 Operation counter furnished or not : :
- 3.09 Mechanical trip furnished or not : :
- 3.10 Mechanical safety interlocks provided or not : :
- 3.11 Breaker provided with service/test and isolated position : :
- 3.12 Type of indication provided with above : :

position

3.13 Can cubicle door be closed when Breaker in :  
service or not in test Position

3.14 Impact for foundation design to include :  
dead load plus impact values on opening at  
maximum interrupting rating

3.15 Standard to which conforms :

**4.0. Panel Assembly**

4.1 Dimensions (LXBXH) :

4.2 Approximate weight :

4.3 Material of construction and thickness :

4.4 Degree of protection of external enclosure :

4.5 Space for power cable termination :

4.6 Space for multi core cable termination :

4.7. Space Heater Yes/No

(a) Thermostat controlled space heater  
furnished for each cubicle :

(b) Rating  
(i) Voltage  
(ii) Watts

4.8 Ground Bus

a) Material :



b) Size :

4.9 Wiring

a) Size of wire :

b) Insulation :

c) Voltage Class :

4.10 Minimum space required for insulation

a) Minimum rear space :

b) Minimum front space :

4.11 Current Transformer Details

a) Type :

b) Make :

c) Frequency & Voltage :

d) Pole :

e) Protection Class :

f) Metering Class :

g) Rated Burden :

h) Class of Insulation :

- i) Short time thermal rating :
- j) Dynamic current rating :
- k) Mounting :
- l) IS Standard to which conform :
- m) CT Ratio :
- a) Incoming Feeder :
- b) Transformer Feeder :

4.12 Voltage Transformer

- a) Type :
- b) Make :
- c) Frequency & Voltage :
- d) Pole :
- e) Accuracy Class :
- f) Rated Burden :
- g) Connection :
- h) Class of Insulation :
- i) Mounting whether withdrawal type :
- j) Standard to which conform :

4.13 Indicating Lamp

- a) Type :
- b) Make :
- c) Voltage :
- d) Wattage :

4.14 Fuses

- a) Type :
- b) Make :

- c) Voltage :
- d) Rupturing Capacity :
- e) IS Standard to which conforms :

**5.0 Tests**

- 5.1 Indicate the tests to be performed :
  - a) :
  - b) :
  - c) :
  - d) :
  - e) :

**6.0 Tests**

- 6.1 Whether GA drawing submitted or not :
- 6.2 Technical literature submitted or not :

**2.0 33 / 6.6 KV TRANSFORMER**

**2.1 SCOPE:**

S.NO.	DESCRIPTION	QUANTITY
1.	33/6.6 KV, 3.15 MVA Oil Filled Power Transformer ONAN with Off-Circuit tap switch having range (+) 5% to (-) 10% in steps of 2.5%, Dyn11 along with other accessories	2 Nos.

The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.

## 2.2 ELECTRICAL SUPPLY SYSTEM:

- |  |                   |
|--|-------------------|
| a) 33 kV Fault Level                   | : 26.2 KA         |
| b) 6.6 kV Fault Level                  | : 25 KA           |
| c) 415V Fault Level                    | : 35 KA           |
| d) Voltage Variation                   | : $\pm 10\%$      |
| e) Frequency Variation                 | : + 5% to -5%     |
| f) Comb. Voltage & Frequency Variation | : 10% (absolute)  |
| g) 33 KV System Earthing               | : Earthed         |
| h) 6.6 kV System Earthing              | : Solidly Earthed |
| i) 415V System Earthing                | : Solidly Earthed |

## 2.3 Specification

2.3.1 This specification covers the design, manufacture shop testing inspection and supply of above rating, 3 phase, 50 Hz, 33 / 6.6 KV power transformers complete with all fittings, accessories, OCTC & associated equipment with 10% extra Transformer Oil shall be supplied.

2.3.2 The offered rating transformer should have been tested for "Short Circuit withstand capability test" and Impulse test" and "Temperature rise Test" in an NABL accredited Government Laboratory as per relevant IS/IEC and valid Type Test certificates in complete shape shall be accompanied with the drawing during approval.

## 2.4 STANDARDS:

2.4.1 The transformer shall comply with the latest revision of IS: 2026/1977, IEC: 76, IS 1180 and with the relevant parts of standards mentioned below;

IS: 10561	Application guide for power transformers
IS: 10028	Code of practice for selection, installation and maintenance of transformers
IS : 1866	Code of practice for maintenance and supervision of mineral insulating oil.
IS: 2099	Bushing for alternating voltages above 1000 V.
IS: 335	New insulating oil for transformers.

IS : 3639	Fittings and accessories for power transformers.
IS: 2099	Bushings for AC voltage above 1000V
IS: 3637	Gas operated relays
CBIP Publication	Manual of transformers

2.4.2 The equipment covered under this specification shall comply with all the latest applicable statutory rules, regulations, acts and safety codes in force. Nothing in this specification shall be construed as to relieve the supplier of the responsibility for correctness of the design and construction of the equipment. All the standards being followed shall be listed out in the bid.

## 2.5 TECHNICAL REQUIREMENTS OF POWER TRANSFORMER

2.5.1 The transformers shall be core type construction, with two windings oil immersed, naturally cooled

weatherproof construction and shall be suitable for installation of step down transformers. The rating and electrical characteristics of transformers shall be as following.

1	Rated MVA of Transformer (ONAN rating)	:	3.15 MVA
2	No. of Phases	:	3
3	Type of Installation	:	Indoor

4	Frequency	:	50 HZ (+5% to -5%)
5	Cooling medium	:	Insulating oil (ONAN)
6	Type of mounting	:	On wheels, mounted on channels
7.	Rated Voltage		
	a)	High voltage winding	: 33 KV
	b)	Low voltage winding	: 6.6 KV
8.	Highest continuous system voltage		
	a)	Maximum system voltage ratio (HV/LV)	: 36 KV / 7.2 KV
	b)	Rated voltage ratio ( HV / LV )	: 33 KV / 6.6 KV
9.	No. Of windings	:	Two winding Transformers
10.	Type of cooling	:	ONAN ( Oil natural & air natural)
11.	MVA rating corresponding to ONAN cooling system	:	100%
12.	Method of connection		
	a)	HV	: Delta
	b)	LV	: Star
13.	Connection symbol	:	Dyn 11
14.	System of earthing	:	Neutral of LV side to be solidly earthed
15.	Percentage impedance voltage on normal tap and MVA base at 75°C corresponding to HV/LV rating and applicable tolerance	:	% impedance 6.25% ( tentative ) (Tolerance $\pm 10\%$ )
16.	Intended regular cyclic overloading of windings of winding	:	As per IEC-76-1, Clause 4.2
17.	a) Anticipated unbalanced loading	:	Around 10%
	b) Anticipated continuous loading of windings (HV/LV)	:	110% of rated current

18.	Tap Changer			
	a)	Type of Tap Changer	:	OFF Circuit
	b)	Range of Tapping	:	( + ) 5% to ( - ) 10 shall be in step of 2.5%  on HV winding, 7 tap positions. Tap No. 3  will be the Principal Tap position
19.	Neutral terminal to be brought out		:	On LV side
20.	Overvoltage operating capability and duration		:	125% of rated voltage (Continuous)
21.	Maximum Flux Density in any part of the core and yoke at rated MVA, rated voltage (33/6.6KV) and 50Hz.		:	1.70 Tesla
22.	Insulation levels of Windings:			33 KV      6.6 KV
	a)	1.2 / 50 micro second wave shape impulse withstand ( KVp )	:	170      60
	b)	Power frequency voltage withstand (Kvrms )	:	70      20
23.	Type of winding insulation			
	a)	HV winding	:	Uniform
	b)	LV winding	:	Uniform
24.	Withstand time for three phase short circuit		:	As per IS
25.	Noise level at rated voltage & frequency		:	As per NEMA Publication
26.	Permissible Maximum temperature rise over ambient temperature of 50°C			
	a)	Of Top oil measured by thermometer	:	40° C
	b)	Of winding measured by resistance	:	45° C
	c)	Hotspot Temperature rise	:	-----

27.	Minimum clearance in air ( mm )			Phase to Phase	
	a)	HV	:	315	
	b)	LV	:	90	
28.	Terminals				
	a)	HV winding line end	:	36 KV oil filled communicating type porcelain bushing (Antifog type)	
	b)	LV winding	:	12 KV, 630 A porcelain type of bushing (Antifog type)	
29.	Insulation level of bushing			<b>HV ( 33 KV )</b>	<b>LV ( 6.6 KV )</b>
	a)	Lighting Impulse withstand(kVP)	:	170	95
	b)	1 minute Power frequency withstand voltage (KV-rms)	:	70	38
	c)	Creep age distance in mm (minimum)	:	900	437.50
30	Material for HV & LV conductor		:	Electrolytic copper	
31	Maximum current density for HV and LV winding for rated current at normal tap		:	3.0 A / mm <sup>2</sup>	
32	Polarization Index i.e ratio of Megger values at 600 sec. to 60 sec for HV to earth, L.V to earth and HV to LV		:	Shall be greater than 1.50	
33	Core Assembly		:	Boltless	
34.	Temperature Indicator				
	a)	Oil	:	One number	
	b)	Winding	:	One number	
35	Maximum permissible no load loss at rated voltage and rated frequency.		:	Vendor to provide	
36	Maximum permissible load loss at rated current at normal tape and at 75 <sup>0</sup> C		:	Vendor to provide	

## 2.6 TAPS

2.6.1 Transformers with off circuit tap changing gear shall have taps ranging from (+) 5 % to (-) 10% in equal steps of 2.5% each on HV side with 7 tap position. Tap 3 will be the principal tap position. The tap changing switch shall be located in the convenient position so that it can be operated from ground level. The switch handle will be provided with a locking arrangement along with tap position indication thus enabling the switch to be locked in position.



## **2.7 LOADING OF TRANSFORMER**

The transformers shall be capable of operation continuously in accordance with IS: 2026 and latest revision thereof at their continuous maximum rating and overload at any ratio as per IS 6600.

### **2.7.1 PARALLEL OPERATION**

The transformers shall operate satisfactorily in parallel among themselves and with similar units to be installed.

### **2.7.2 DUTY UNDER FAULT CONDITIONS**

Transformer shall be designed and constructed to withstand/without damage the thermal and dynamic effects of external short circuit under the conditions laid down in IS:2026 (Part-I).The thermal & dynamic ability to withstand short circuit shall be demonstrated by tests thermal and carried out on the transformer of same design.

### **2.7.3 NO LOAD CURRENT**

The no load current at 110% and 112.5% of rated voltage shall not exceed 1% and 2% respectively. The variation shall be as per IS: 2026(Part-I).

### **2.7.4 MAXIMUM CURRENT DENSITY:**

Maximum current density for HV and LV winding for rated current at normal tap in any case shall not exceed 3.0 Amp /mm<sup>2</sup>.

## **2.8 TRANSFORMER OIL:**

The transformer oil shall be EHV grade & comply with IS: 335 and latest amendments thereof. No inhibitors shall be used in the oil. 10% extra oil shall be provided. The extra quantity of oil shall be supplied in non-returnable drums along with the oil required for the radiator banks.

## **2.9 CONTINUOUS MAXIMUM RATING AND TEMPERATURE RISE:**

Each transformer shall be capable of operating continuously at their normal rating without exceeding temperature rise limits with maximum daily average ambient temperature of 50°C as specified below:

- i) Hot Spot: The maximum spot temperature shall be limited to 54<sup>0</sup> C-over ambient temperature.
- ii) Winding: Temperatures raise 45<sup>0</sup> C by resistance measurement.
- iii) Oil: 40<sup>0</sup> C by thermometer measurement.

**2.10 IMPEDANCE VALUE:**

The percentage impedance shall be as above or as per required specification above & guided by IS: 2026 (part-5)/2011.

Measurement of losses shall form part of type test/routine/ acceptance test. The losses of first and subsequent transformers supplied shall also be guaranteed at the time of pre commissioning test and the losses exceeding guaranteed figures shall stand rejected. The vendor shall replace the transformer without any financial liability to the purchaser.

The supplier shall supply two copies of the type test/routine test certificate to each consignee with each transformer on receipt of dispatch instructions.

All windings of transformers shall have uniform class insulation when tested in Accordance with relevant IS: 2026/1981. The maximum hot spot temperature rise shall be limited to 54 Deg. C. over ambient temperature. The highest system voltage and the minimum basic impulse with stand level of winding for 1.2/50  $\mu$ s full wave shall be as given below:

Rated voltage (KV)	Highest system voltage (KV)	Minimum basic impulse with Stand level (KVp)
LV Side (6.6 kV)	7.2	60
HV Side(33 kV)	36	170

Temperature gradient between winding and oil should not exceed the permissible limits.

**2.11 HV / LV TERMINAL ARRANGEMENT:**

2.11.1 HV terminal shall be brought out into suitable solid porcelain type weather proof type bushing fit for rated cable termination. HV and LV Cable box shall be provided on the side wall of the tank including neutral bushing for earthing. 2 lengths of 11 KV ( E ) grade 300 mm<sup>2</sup> ( Al.) conductor XLPE cable shall be provided from the LV Cable Box of the Transformer to each Incomer of 6.6 KV VCB Switchboard. The neutral terminal brought on to a separate

neutral bushing shall be suitable for 2 Nos of 50X6mm GS Flat. The separate neutral terminal shall be provided with NCT 300 / 1+1 Class PS & 5P10, 15 VA burden

2.11.2 Dimensions of the LV side bushing (6.6 KV side) shall conform to IS 3347/Part-III) and those of 36KV bushing (33KV Side) shall conform to IS 3347/ (Part-V). The creepage distance for 33KV shall be 900mm and for 6.6 KV shall be 437.5 mm.

2.11.3 The transformer shall be supplied with first filling of fresh insulation oil. The oil shall conform to

IS / 335 / 1983 and its latest amendment, if any.

2.11.4 All insulating materials used in the manufacturer of the transformers shall be of the best quality of their respective kind, containable in the market and shall conform to relevant IS.

2.11.5 The design and all materials including insulating materials used in construction of transformers shall be such as to reduce to maximum the risk of development of acidity in oil during the course of service.

## **2.12 FITTINGS AND ACCESSORIES TO BE PROVIDED ON EACH TRANSFORMER:**

- i) Inspection covers
- ii) Diagram and rating plate
- iii) Terminal marking plate
- iv) Two earthing terminals
- v) Lifting lugs
- vi) Jacking lugs
- vii) Flanged wheels
- viii) Thermometer pocket
- ix) Oil filling hole with plug
- x) Air release device
- xi) Drain valve with plug with locking arrangements
  
- xii) Filter valves, one suitable valve located at the top of the tank and one of similar size at the bottom of the tank mounted diagonally opposite to each other.
- xiii) Two nos. oil sampling valve for taking out sample from top, middle and bottom of tank
- xiv) Conservator
- xv) Dehydrating breather
- xvi) Radiators
- xvii) Pressure relief Valve
- xviii) Gas and oil actuated relay
- xix) Magnetic type oil gauge
- xx) Dial type oil temperature indicator

- xxi) Dial type winding temperature indicator
- xxii) Marshalling Box with contacts of Buchholz Relay, OTI, WTI, PRV & MOG duly wired
- xxiii) Any other parts if necessary.
- xxiv) NCT 300 / 1+1 Class PS & 5P10, 15 VA burden

Any fittings, accessories of apparatus which might not have been mentioned in the specification, but which are usual and necessary in the equipment of similar nature and are recommended by the manufacturer for satisfactory operation are to be provided by the vendor during offer stage. All apparatus must be complete in all details whether mentioned in the specification or not.

### 2.13 RATING PLATE:

Each transformer shall be provided with a non-detachable rating and terminal Marking plate(s) of weather proof material, fitted in visible position, mentioning complete information as given in clause-15.1 and 15.2 of latest version of IS: 2026 (Part-I) and clause-20 of IS: 1180 part-I-1989.

In place of serial number of transformer/ unique no. shall be punched on rating plate. Unique number has been allotted indicating the name of firm, capacity, specification and serial number of the transformers. No-load/Load losses must also be engraved on the diagram plate. The entries on the rating plate as per Clause-15.1 and 15.2 of latest version of IS: 2026 (Part-I) shall be invariable marked (by etching engraving or stamping) Plate should be firmly riveted with tank so that it may not be detached afterwards.

In addition to above plate, the following details shall be punched on a mild steel plate of size 150x150x3 mm. And this plate shall be welded firmly on the transformer tank just above the rating plate in a visible position.

- i) Unique number
- ii) Name of firm
- iii) Warranty period/Date of manufacture

2.13.1 The transformer tank and cover shall be fabricated from good commercial grade low carbon steel of tested quality, suitable for welding. The minimum thickness of which shall be 6mm. for the side and 10mm for the bottom & cover for transformers with longer sides having a horizontal length up to but not exceeding 1800mm. For horizontal length above 1800 mm, the minimum side plate thickness shall be 10mm. and the thickness of bottom and cover plate shall be 12mm. The tank and the cover shall be welded construction. All seams shall be welded and wherever practicable, they shall be double welded. Tanks stiffeners shall be continuously welded to the tank and designed to prevent retention of water.

2.13.2 The main body of the tank shall have sufficient strength to withstand and without permanent distortion.

- i) A vacuum of 760mm. of mercury.

- ii) Continuous internal gas pressure of 0.7 atmosphere above atmosphere pressure with oil at Operating level i.e. the transformer tank should be able to withstand 100% vacuum and also one atmosphere pressure above atmosphere internal pressure.

2.13.3 The detachable tank cover shall be bolted to the tank and the transformer design shall be such that the tank will not split between the lower and upper cooler connections.

2.13.4 Each tank shall be provided with the following:

- i) Lifting lugs suitable for lifting the transformer complete with all accessories filled with oil by cranks. A minimum of four jacking lugs in accessible position to enable the transformers complete with oil to be raised or Lowered using hydraulic or screw jacks. The minimum height of jacking lugs above base shall be:
  - a) Transformers above 10 tones weight: 500 mm
  - b) Transformer up to and including 10 tones weight: 300 mm
- ii) Horizontal plates with 50 mm dia draw holes drilled the rein should be fitted adjacent to each corner of the rectangular tank at more than 750 mm from the base to permit haulage in any direction. On the rounded tanks the draw holes shall be located on the diagonals of the rectangular formed by the overall boundaries of the tank,

2.13.5 Each tank cover shall be of adequate strength and shall not distort when lifted. Inspection opening shall be provided to give easy access to lower ends of bushing terminals etc. for changing ratio or winding connection or testing to each connection. These shall be of adequate size not less than 450mmx350mm. Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

2.13.6 All bolted connections to the tank shall be fitted with suitable oil tight gaskets of nitrile rubber or equivalent, which shall give satisfactory service under the operating conditions. Special attentions shall be given to the methods of making the hot oil tight joints between the tank and cover as also between the cover and the bushing and all other outlets to ensure that the joints can be remade satisfactorily and with ease, with the help of semi-skilled labor. Gaskets of neoprene and / or any kind of impregnated / bonded core or cork only which can easily be damaged by over pressing is not acceptable. Use of hemp as gasket material is also not acceptable.

2.13.7 Suitable guide shall be provided for positioning the various parts during assembly or dismantling. Adequate space should be provided between the cores and winding and the bottom of tank for collection of any sediment.

2.13.8 Lifting eyes or lugs shall be provided on all parts of the transformers requiring independent handling assembly or dismantling.

2.12.9 External surface shall be given a priming coat and two finishing coats of durable oil and weather resisting paint or enamel. The colour of the finishing coat shall be dark admirable, gray conforming to no. 632 of ISS colour for ready mixed paints (second revision).

The requirement for the dry film thickness (DFT) of paint and the material to be used shall be as given below.

Sl	Paint type	Area to be painted	No of coats	DFT (Min)
1	Liquid Paint			
	a) Zinc Chromate (Primer)	Out side	02	45 micron
	b) Polyurethane (Finished coat)	Out side	02	35 micron

#### 2.14 COOLING OF TRANSFORMERS:

- a. The transformer shall have 'ON-AN' cooling only. The cooling arrangement shall consist of detachable radiators, which may be directly mounted on the transformers. Connections between the radiators and tank shall be made with flanges provided with gaskets and an indicating short valve provided at both connection ends, which can be fastened in either open or closed position.
- b. The radiators shall be so arranged that these can be detached from the tank or bank without disturbing the oil in transformer. These shall be designed to withstand the vacuum and pressure specified for the tank.
- c. Radiators shall be so designed as to be accessible for cleaning and painting to prevent accumulation of water on the outer surface, to completely drain oil from the tank or bank and to ensure against formation of gas pockets when the tank is being filled. All connections between the radiators and tank or bank and between the bank and tank shall be provided with blank Flanges when the particular item is detached.
- d. Each radiator shall have a lifting eye, an oil drain and Vent at top.

#### A. CONSERVATOR:

- A conservator complete with sump and drain valve shall be provided in such a position so as not to obstruct the electrical connection to the transformer, having a capacity between highest and lowest visible levels to meet the requirement of the expansion of the total cold

oil volume in the transformer and cooling equipment from the minimum ambient temperature of 0Deg. C to 90Deg. C. The minimum indicated oil level shall be with the food pipe from the tank covered with not less than 15mm. Depth of oil and the indicated range of oil level shall be minimum to max.

- If the sump is formed by extending the food pipe inside the conservator this extension shall be for at least 25mm.
- The conservator shall be provided with two filter valves, one at the bottom and the other at the top at opposite and for filtration purpose.
- One oil gauge magnetic type with provision for low level shall be mounted on conservator to indicate the minimum normal and maximum level as below: -

Minimum	-5Deg.C
Normal	+30Deg.C
Maximum	+90Deg.C
- One end of the conservator shall be bolted into position so that it can be removed for clearing/ repairing purpose.
- The oil connection from transformer tank to the conservator vessel shall be arranged at a rising angle of 3 to 9 Deg. C to the horizontal up to gas oil actuated relay and shall consist of 50mm. inside diameter pipe.
  - i) The passage of air is through silica gel.
  - ii) The external atmosphere is continuously in contact with silica gel.
  - iii) The moisture absorption indicated by a change in colour of the tinted crystals can be observed from distance.
  - iv) The silica gel Breathers shall have minimum quantity of silica gel as 1 Kg for every 3500Ltrs of oil in the tank. The container for the dehydrating agent shall be of transparent plastic of best quality, to be approved by DoWR. The breather is mounted at approx. 1400mm. above ground level.

#### **B. PRESSURE RELIEF DEVICE:**

- A safety valve of the chimney type with an equalizer pipe inter connecting the top of the conservator and upper most part of the safety valve should be provided to prevent rise of oil in the safety valve pipe. A stopcock should also be provided in the inter connecting pipe. An air release cock shall also be fitted in convenient position.
- The safety valve pipe shall preferably take off from the side of the transformer tank near to the tank covers and not from the top of tank cover. This is with a view to prevent the gases forming in the tank, from rising into the safety valve pipe and there by passing the gas and oil actuator Relay (defeating its purpose) and for avoiding the necessity for providing, a bottom

diaphragm for the safety valve pipe, which would be necessary in case, it takes off from the tank cover.

**C. GAS AND OIL ACTUATED RELAY:**

- A double float type gas and oil actuated relay (Buchholz Relay) shall be provided with alarm and tripping contacts to detect accumulation of gas and sudden change in oil pressure, complete with shut off valves on both sides and flange couplings and to permit easy removal without conservator, a bleed valve for gas venting and test valve. The device shall be provided with two electrically independent potential free contacts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

**D. TEMPERATURE INDICATING DEVICE:**

- Minimum 150mm dia suitable dial type thermometer with maximum pointer and resetting device with alarm and trip contacts to read the temperature in the hottest of oil shall be provided.
- A dial type winding temperature indicator shall be provided to indicate the hottest spot winding temperature with contacts for alarm and tripping to be set at will.

**E. MARSHALLING BOX:**

- The transformer shall be provided with marshalling box made of sheet steel, in which all the leads for gas and oil-actuated relays, oil winding temperature indication and alarm, low oil level alarm shall be brought out to suitable terminals. This Marshalling Box shall be perfectly mounted on transformers. Temperature indicators shall be housed in the Marshalling Box so that these are clearly visible.
- The box shall have slopping roof and the interior and exterior painting shall be in accordance with the specification. Padlock along with duplicate keys shall be supplied for marshalling box. The degree of protection shall be IP-55 or better.
- All incoming cables shall enter the Marshalling Box from the bottom and the gland plate shall not be less than 450 mm from the base of the box. The gland plate and associated compartment shall be sealed in suitable manner to prevent the ingress of moisture from the cable trench.
- The schematic diagram of the circuitry inside the marshalling box be prepared and fixed inside the door under a suitable sheet.

**F. WINDING CONNECTION AND VECTORS:**

- a) The primary winding shall be connected in delta and secondary winding in star as per vector symbol DY-11 (IS: 2026). So as to produce a positive displacement of 30 deg. From the primary to the secondary vectors of the same phase (Vector rotation assumed counter clock wise).  
The neutral point of the secondary (LV) winding shall be solidly earthed and should be brought out to a separate insulated terminal, enabling a current transformer for an earth leakage relay to be connected wherever required.
- b) The winding shall be so designed that all coil assemblies of identical voltage ratings shall be inter changeable and field repairs to the windings can be made ready without special equipment's. The coil shall be supported between adjacent sections by insulating spacers



and the barriers bracing's and other insulations used in the assembling at the winding shall be arranged to ensure free circulation of the oil and to reduce hot spots in the windings.

- c) The coil shall be dried under vacuum and submerged in dried insulating oil to develop the full electrical strength of the winding. All material used in the insulation and assembly of the winding shall be insoluble, non-catalytic and chemically inactive in hot transformer oil and shall not soften, ooze out, shrink, collapse or otherwise be adversely effected under the operating conditions.
- d) All threaded connections shall be provided with locking facilities. All loads from the winding to the terminal board and bushing shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.
- e) The windings shall be clamped securely in place, so that they will not be displaced or deformed, during short circuits. The assembled core and windings shall be vacuum dried and suitably impregnated before removal from the trending tank. The copper conductors used in the coil structure shall be best suited to the requirement and all permanent current carrying joints in the windings and the leads shall be welded or brazed.

## **2.15 TESTS:**

### **2.15.1 ROUTINE TESTS**

Transformer routine tests shall include tests stated in latest issue of IS: 2026 (Part –1). These tests shall also include but shall not be limited to the following:

- i. Measurement of winding DC resistance.
- ii. Measurement of voltage rating on each tapping.
- iii. Check for polarity and voltage vector relationship.
- iv. Measurement of No Load loss and current at 90%, 100% and 110% of rated voltage.
- v. Measurement of percentage impedance on principal tap and extreme taps.
- vi. Load loss at principal tap measured at rated frequency by applying an approximately Sinusoidal supply to one winding sufficient to flow rated current in the winding with the other winding short-circuited.
- vii. Measurement of insulation resistance.
- viii. Polarization index i.e Insulation Resistance for 10 minutes and one minute (R10 mt / R 1 mt).
- ix. Induced over voltage withstand test.
- x. Separate source voltage with stand test.
- xi. Dielectric test on transformer oil shall also include testing of oil sample drawn from transformer out of the offered at the suppliers work for BDV of oil (fresh from storage of tank as well as from transformer).
- xii. Oil leakage test.

All tanks and oil filled compartments shall be tested for oil tightness by being completely filled with air/ oil of a viscosity not greater than that of insulating oil conforming to IS: 335 at an ambient temperature and subject to pressure equal to 0.7 atmosphere above atmospheric pressure measured at the base of tank. This pressure shall be sustain for a

period of not less than 12 Hours for oil and one Hours for air during which time no leakage shall be occur.

### 2.15.2 TYPE TEST:

The offered equipment must be of proven design through successful type testing particularly Temperature rise Test/ Short circuit Test/ Lightning impulse withstand Test, as per IS:2026 or latest amendment thereof at CPRI, Bangalore/Bhopal or NTH, Ghaziabad or ERDA, Vadodara or any other approved source and certification shall be produced during detail engineering. The manufacturer shall carry out temperature rise tests in accordance with IS: 2026 on one piece of one rating. Before conducting the Temperature rise Test, the firm will offer for both stage inspections and final inspection of the transformer at the manufacturer's works. The type tests shall include:

### 2.15.3 Vacuum Test:

Transformer tank at an internal vacuum limiting to one atmosphere but not more than the pressure of 3.33 KN./Sq.m. (25 mm of Hg.) for one Hour. The permanent deflection of flat plates after vacuum has been released shall not exceed the value specified below without affecting the performance of the transformer:

Horizontal Length of flat plate (mm)	Permanent deflection
Up to & including 750	05
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.0
2001 to 2250	11

2251 to 2500	12.5
2501 to 3000	16
Above 3000	19

#### **2.16 TOLERANCE:**

However, no negative tolerance on all the parameters including physical of dimensions tank certificated by test house/ laboratories as mentioned in respect of the equipment which has been successfully type tested shall be allowed.

### GUARANTEED TECHNICAL PARTICULARS OF THE 33 / 6.6 KV TRANSFORMER

The guaranteed technical particulars shall be subject to tolerance as per relevant ISS. However no negative tolerance shall be allowed on ways and dimensions that of quoted and further no negative tolerance shall be allowed in weights and dimensions then that of short circuit tested transformers. The tolerance of guaranteed performance figures shall be specified in ISS: 2026/1985 (Part-I) amended from time to time except where specified otherwise.

The successful Tenderers will have to submit the quality assurance plan for Purchaser's approval.

1.	Name of Manufacturer	
2.	Type of Transformer	
3.	Rating	
	a)	Rated output (MVA)
	b)	Rated Voltage of HV&LV (KV)
	c)	Rated Current of HV&LV (A)
	d)	No load Voltage ratio
	e)	No. of Phases
	f)	Rated frequency

4.	Connections		
	a)	High Voltage	
	b)	Low Voltage	
	c)	Vector Group Symbol	
5.	Cooling Arrangement		
a.	a)	Type of cooling	
	b)	Number of Cooling tubes / fins per radiator and number of radiators	
	c)	Size of radiator fins	
	d)	Thickness of sheet	
	e)	Horizontal distance between radiators	
	f)	Vertical distance between Core center line and radiator center line	
6.	Dimension of inside of tank (mm)		
	a)	Length	
	b)	Breadth	
	c)	Height	
	d)	Weight of tank without fitting	
7.	Thickness of transformer tank Plate (mm)		
	a)	Sides	
	b)	Bottom	
	c)	Cover	
8.	Overall Dimension of Tank with Fittings (mm)		
	a)	Length	
	b)	Breadth	
	c)	Height	
9.	Details of Oil		
	a)	Standards of Oil	
	b)	Quantity of Oil (Ltr. and Kg.)	

	c)	Quantity of extra oil ( Ltr and Kg)	
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10.	Details of Core		
	a)	Material of core lamination & Grade	
	b)	Thickness of core plates	
	c)	Insulation of Core lamination	
	d)	Window Height	
	e)	Leg Center	
	f)	Core Diameter (approx.) (mm)	
	g)	Core cross sectional area (gross) (mm <sup>2</sup> )	
	h)	Core cross sectional area (net) (mm <sup>2</sup> )	
	i)	Maximum flux density in core at normal voltage, frequency and ratio	
	j)	Weight of stamping in core and yoke separately in Kgs.	
		i) Core	
		ii) Yoke	
	k)	Size and No. of clamping channels	
	l)	Weight of clamping channels with stiffeners	
	m)	Size & number of tie rod (if used)	
	n)	Size & number of core bolt	
(Note: Please enclose details of core-steps, its drawing and flux density, weight of core, fittings, copper, oil, Off Load Tap Changer separately).			
11.	Weight of transformer		
	a)	Weight of core only	

	b)	Weight of core assembly excluding HV & LV coils	
	c)	Weight of complete core coil assembly	
	d)	Value of Transformer Oil	
	e)	Weight of Transformer oil	
	f)	Weight of insulated conductor in HV	
	g)	Weight of insulated conductor in LV	
	h)	Weight of Tank and fittings (Kgs.) including tap changer.	
	i)	Total weight of transformer with oil	
12.	Details of Winding		HV LV
	a)	Type of winding and material	
	b)	Conductor Size (bare)	
	c)	Cross sectional area (mm <sup>2</sup> )	
	i)	Gross	
	ii)	Net	
	d)	Type of insulation of conductor	
	e)	Size of insulated conductor	
	f)	Number of disc / coil per limb	
	g)	No. of coils per disc	
	h)	Internal dia of coil	
	i)	Outer dia of coil	
	j)	Axial length	
	k)	Mean length of turns (mm)	
	l)	No. of turns	
	m)	Inter turn insulation	
	n)	End turn insulation	
	o)	Type of axial coil supports	
	p)	Details of end clamping rings	

	q)	Whether windings are inter leaved	
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	r)	Size of cooling ducts	
	s)	Weight of bare conductor used in one leg (kg.)	
	t)	Weight of insulated conductor used in one leg (kg.) (dry)	
	u)	$I^2R$ loss at 75°C (per phase)	
	v)	Maximum current density in winding at CMR – Amp./Sq cm.	
	w)	Polarization index ( ratio of Megger values at 600 sec to 60 sec for HV to earth and HV to LV)	Shall be greater than or equal to 1.5
	x)	Resistance of winding (with 5% tolerance):	
	a)	At 20° C ( Ohm )	
	b)	At 75° C ( Ohm )	
13.		Thermal time constants – Hrs.	
14.		Terminal arrangement HV side	
15.		Terminal arrangement LV side	
16.		Regulation at full load at 75°C	
	a)	At unity power factor	
	b)	At 0.8 power factor (lagging)	
17.		Percentage efficiently at normal ratio, rated voltage and at 75°C average winding temperature	
			UPF      0.8PF
	a)	Full Load	
	b)	3/4 Full Load	
	c)	1/2 Full Load	
	d)	1/4 Full Load	
18.		No load current as percentage of full load current at rated	



		volt. and frequency in %	
19.		Power factor and no load current at normal volt. and frequency in %	
20.		RMS value of symmetrical short time current rating as per ISS which the transformer can withstand and its duration	
	a)	H.V. Winding	
	b)	L.V. Winding	
21.		Maximum out of balance force in winding on short circuit at the terminals	
22.		Clearance between phases in Air (mm)	
	a)	H.V. Side	
	b)	L.V. Side	
	c)	L.V. to Earth	
23.		Clearance in oil (mm)	
	a)	Internal clearance between inner walls of Tank & Core Coil assembly unit	
	b)	On length side	
	c)	On Breadth Side	
	d)	Radial clearance between H.V. & L.V. Winding	
	e)	Phase of phase clearance between H.V. Limb	
	f)	Radial clearance of L.V. coil from core	
	g)	Minimum clearance between LV Pole to earth	
	h)	Horizontal duct between H.T. disc	
	i)	End clearance of H.T. coil from Yoke (with angle shaped windings)	
	j)	Minimum clearance between core & tank bottom	
	k)	Angular ducts between LT & HT winding	

24.	Insulation Details		
	a)	End spacing of L.V.	
	b)	End spacing of H.V.	
	c)	L.V. winding to core	
	d)	Between HV & LV winding	
	e)	Inter phase barrier	
	f)	End phase barrier	
25.	Insulation Level		HV      LV
	a)	Separate source power frequency Volt. Withstand – KV.	
	b)	Induced over voltage withstand – KV	
	c)	1.2/50 $\mu$ s full wave lighting impulse withstand voltage-KV	
	i)	Impulse	
	ii)	Power frequency (Dry & Wet)	
	d)	Voltage to earth for which the star point will be insulated – KV	
	i)	Impulse	
	ii)	Power frequency (Dry & Wet)	
26.	Performance reference Temp. (Deg. C)		
27.	Volts per coil of HV winding (Volts)		
28.	Approx. Volts per layer of HV winding (Volts)		
29.	Impedance voltage at rated full load and transformation		
30.	Percentage reactance Ratio at rated voltage & frequency at 75 <sup>o</sup> C.		
31.	Percentage resistance at 75 <sup>o</sup> C		
32.	Impedence voltage at principal tapping and at 75 <sup>o</sup> C		

	average winding temperature expressed as percentage of rated voltage between HV & LV winding - %	
33.	Permissible duration of over load following continuous running at normal rated load in an ambient Temp. of 50 <sup>0</sup> C	
	a) 10% overload	
	b) 20% overload	
	c) 30% overload	
34.	Maximum temperature rise at full load (above max. average ambient Temp. of 50 <sup>0</sup> C.)	
	a) Of top oil by thermometer Deg. C.	
	b) Of winding by resistance method Deg. C.	
	c) By hot spot temperature indicator Deg. C.	
35.	Limit of hot spot temperature for which designed – Deg. C.	
36.	Temperature Gradient between winding and oil – Deg. C.	
37.	Maximum No. load loss at rated voltage on principal tapping at rated frequency (Guaranteed without any plus tolerance) (including 25% stray no load loss for considering inconsistencies of B-H characteristics of core material and workmanship).	
38.	Maximum load loss at rated current on principal tapping at 75 <sup>0</sup> C. (Guaranteed without any plus tolerance) including 10% stray load loss)	
39.	Resistance voltage drop at rated current for principal tapping at 75 <sup>0</sup> C average winding temperature as percent of rated voltage - %	
40.	Reactance voltage drop expressed as percent for rated voltage - %	

41.	Temperature indicators	OTI	WTI
	a) Make and Type		
	b) Permissible setting ranges for alarm & trip.		

	c)	No. of contacts	
	d)	Current rating of each contact.	
42.	Gas and oil actuated relay description data & range of settings, schematic diagram etc.		
43.	Type of pressure relief device & pressure at which it operates.		
44.	Details of magnetic oil gauge		
45.	Weight of silica gel (Grm.)		
46.	Particular of Bushings		HVLV
	a)	Name of manufacturer	
	b)	Type	
	c)	Voltage rating – KV	
	d)	Visible power frequency voltage discharge test – KV	
	e)	Dry power frequency withstand voltage for one minute	
	f)	Wet power frequency withstand voltage for 30 minutes	
	g)	Dry standard lightning impulse with stand volt-KV	
	h)	Creepage distance in air (mm) (protected and total)	
	i)	Recommended Gap setting – mm	
	j)	Weight of assembled bushing KG	
47.	Free space required at the top for removal of bushing – mm		
48.	Minimum clearance height for lifting core & windings from tank		
Note: Type tests Reports of bushings shall be submitted			
49.	Details of Off load tap changer		
	a)	Make	
	b)	Type	
	c)	Rating	
	i)	Rated voltage	
	ii)	Rated current	

		iii)	step voltage	
		iv)	No. of steps.	
50.	Shipping details			
a.	a)	Parts detached for transport		
b.	b)	Approx. Weight of heaviest package – kg.		
c.	c)	Approx. dimension of larges package-mm		
		i)	Length	
		ii)	Breadth	
		iii)	Height	
51.	Type Testing			
a.	a)	Whether the transformer of the offered design has been type tested during last 5 years from the date of opening of tender?		
b.	b)	If yes, when and where was it type tested?		
c.	c)	Is there any deviation in the technical specification of offered for 33 / 6.6 KV, power transformer?		
52.	Details of test reports			

Sl. No.	Name of Test	Date of Test	Whether test reports enclosed or not (Yes / No)	If yes no. of sheets.
1.	Temperature Rise Test			
2.	Vacuum Test			
3.	Pressure Test			
4.	Impulse Voltage with stand			

	test (lightning Impulse Test)			
5.	Short Circuit Test			
6.	Thermal ability Test			
7.	Zero sequence Impedance Test			

To be filled by vendor

**Note: Vendor shall furnish filled data sheet for each transformer rating separately.**

### 3.0 HT PDB

3.1 The HT PDB shall be multi panel switch board suitable for indoor installation and shall operate at 6.6 KV  $\pm 10\%$ , 3 $\phi$ , 50 Hz  $\pm 5\%$  AC earthed system. The Switchboard shall comprise of the following

- I) Incomer panel – 2 Nos.
- II) Bus Coupler with Trunking Panel – 1 No.
- III) Capacitor – Reactor Feeder panel – As per total number of working pump offered + 1 Spare Feeder
- IV) Transformer Feeder Panel – 2 Nos.
- V) Outgoing Feeder Panel to Pump House (IG) – 2 Nos.
- VI) Bus PT Panel – 2 Nos.
- VII) Earthing Truck – 1 No.

3.2 The switch gear shall be indoor, metal clad, floor mounted, horizontal isolation and horizontal draw out type and shall be suitable for trouble free and continuous operation at 6.6 KV $\pm 10\%$ , 3 phases, 3 wire, 50 Hz  $\pm 5\%$ , grounded system. The switch gear will be located in a hot, humid and tropical atmosphere.

Design and construction shall be such so as to allow extension at either ends. The base channel frame of the switch gear along with all hardware shall be within the scope of the contract.

The switch gear enclosure shall conform to the degree of protection IP-4X. The minimum thickness of sheet used shall be 2 mm except the gland plate where the sheet thickness shall be 3 mm.

The switch gear assembly shall comprise a continuous dead front, line up of free standing, vertical cubicles. Each cubical shall have front hinged door with latches and a removable back cover. All covers and doors shall be provided with neoprene gaskets.

Circuit breakers, instrument transformer, bus bars, cable chamber etc. shall be housed in separate compartments.

3.3 The Switch gear shall be fully wired at the factory to ensure proper functioning of indications, control, protection, transfer and inter-locking scheme.

Fuse & links shall be provided to permit individual circuit isolation without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired up-to terminal blocks.

Wiring shall be done with flexible, 1.1KV grade PVC insulated switchboard wires with stranded copper conductors of 2.5 sq. mm for control and current circuits and 1.5 sq. mm for voltage circuits.

Each wire shall be identified with both ends with permanent marker bearing wire number as per contractor's wiring diagram.

Wire termination shall be made with crimping type connectors with insulating sleeves.

Not more than two wires shall be connected to any terminal. At least 25% spare terminal shall be furnished in the terminal block.

3.4 Switch gear shall be designed for cable entry from bottom. Sufficient space shall be provided for ease of termination and connection.

Power cables shall be XLPE insulated, armoured, overall PVC sheathed with stranded aluminum conductors.

Control cables shall be XLPE insulated, armoured, overall PVC sheathed with 2.5 sq. mm stranded copper conductors.

All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates (3 mm thick), cable supports, crimping type tinned copper / aluminum lugs, brass compression glands with washers and terminal blocks.

3.5 The main buses and connections shall be of high conductivity electrolyte grade copper, sized for specific current rating with maximum temperature rise limited to 90°C. Bus-bars and connection shall be fully insulated for working voltage with adequate phase / ground clearance. Insulating sleeves for bus bars and cast resin shrouds for joints shall be provided.

All buses and connections shall be supported and braced to withstand stress due to maximum short circuit current and also to take care of any thermal expansion.

Bus-bars shall be color coded for easy identification and the bus-bar chamber shall be provided with inter panel barrier with epoxy cast seal-off bushings through which the buses will pass through so as to prevent fire from one panel to other.

3.6 A copper ground bus, rated to carry maximum fault current for 3 secs., shall extend for full length of the switchgear. The ground bus shall be provided with two bolt drilling with GI bolts, nuts and washers at each end to receive GI flat of adequate sizes to withstand earth fault current.

CT & VT secondary neutrals shall be earthed through removable links so that earth of the one circuit may be removed without disturbing the others.

Each stationery unit shall be directly connected to the ground bus.

3.7 The circuit breaker shall be vacuum type triple pole 800 Amps, 25 KA for 3 secs., horizontal draw out, horizontal isolation having Service / Test / Isolated position with positive indication for each position. The V.C.B. shall have 220 V AC / 110 V DC ( to be freezed during detail engineering) motorized spring charged trip free mechanism and mounted on a carriage complete with self contained manually operated fully interlocked, raising and lowering mechanism with earthing truck. The operating mechanism shall normally be operated from remote electrical control but arrangement should also be made for local electrical control. Mechanical device shall also be provided on the breaker for manually tripping and closing. Each set of the circuit breaker shall have the following features:

- a) 1 set mechanical ON & OFF indicator.
- b) 1 rear entry cable box with glands suitable for 11 KV grade XLPE cable.
- c) 1 set of indicating lamp ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY / Service & Test Position Indications for each breaker & in addition DC FAIL / R-Y-B Phase Indications ( for Incomer only ).
- d) 3 double core current transformers of suitable ratio and accuracy class 5P10 & 1.0 shall be provided for protection & metering
- e) Shunt trip coil rated for 110 V DC.
- f) 1 space heater with ON & OFF switch
- g) 15A / 5A 3 Pin Plug Socket
- h) In – panel lighting with control switch
- i) Space heater for each individual motor shall be fed from the individual motor feeder and provision for such distribution as well as interlocks shall be provided in HT PDB cum MCC.
- j) 240 V AC Alarm Bell & Buzzar for non – trip fault & trip with provision for alarm cancellation ( common )
- k) Auxiliary switches with required contact.
- l) 1 suitable label

In addition, 1 no resin cast and draw out type PT shall be provided in the Incoming Panel, suitable for 3 phase, 3 wire 3 limb 50 Hz system with a ratio of 6.6 KV /110 /  $\sqrt{3}$  / 110 /  $\sqrt{3}$  volts, 100 VA, class 1.0 / 3 P. Symmetrical breaking capacity of the circuit breaker shall be 25 KA and making capacity shall be 62.5KA. The short time rating of the circuit breaker shall be 25 KA for 3 secs.

The circuit breaker shall be capable of carrying rated current at 45°C ambient temperature without derating.

3.8 The feeder details of the Multi panel HT PDB shall be as under:

A) Incoming feeder Panel : 2 Nos. (800 A ) each equipped with the following:

- |      |  |   |       |
|------|--|---|-------|
| i)   | 96 sq mm ( 0 – 8 KV ) Voltmeter with Selector Switch | - | 1 Set |
| ii)  | 96 sq mm ( Dual scale ) Ammeter with Selector Switch | - | 1 Set |
| iii) | Local/ Remote selector switch                        | - | 1 No. |
| iv)  | TNC Breaker Control switch                           | - | 1 No. |



- v) Double core Dual Ratio Cast Resin CT of appropriate rating with 5 A secondary, Class 5 P10 & 1.0, 10VA burden - 1 Set  
( 3 Nos. )
- vi) Microprocessor based draw out directional combined IDMTL over current & earth fault relay type P127 or equivalent - 1 No.
- vii) Master trip relay type VAJH – 13 - 1 No.
- viii) Trip Circuit Supervision Relay type VAX - 31 - 1 No.
- ix) Multifunction meter (For Amp. Voltage, frequency, power factor etc. ) type ELITE445 or equivalent - 1 No.
- x) Power Factor Meter - 1 No.
- xii) 8 Channel alarm annunciator - 1 Set
- xiii) ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY / SERVICE / TEST POSITION / DC FAIL / R – Y – B Phase Indication Lamp - 11 Nos.

B) Bus Coupler Panel : 1 No. equipped with the following

- i) Local / Remote selector switch - 1 No.
- ii) TNC Breaker Control switch - 1 No.
- iii) ON / OFF / SPRING CHARGED / SERVICE / TEST POSITION / TRIP CIRCUIT HEALTHY Indication Lamp with Push Button - 6 Nos.

C) Outgoing Feeder Panels for Transformer : 2 Nos. each equipped with the following

- i) Local / Remote selector switch - 1 No.
- ii) TNC Breaker Control switch - 1 No.
- iii) ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY / SERVICE / TEST POSITION Indication Lamp - 7 Nos.

iv)	Suitable scaled Ammeter with Selector Switch	-	1 No.
v)	Double core Cast Resin CT of appropriate rating with 5A Secondary, Class 5 P10 & 1.0, 10VA burden	-	1 Set ( 3 Nos. )
vi)	Microprocessor based draw out combined IDMTL over current & earth fault relay type P122 / 7SR11 or equivalent	-	1 No.
vii)	Auxiliary Relay type VAA – 33	-	1 No.
viii)	Master trip relay type VAJH-13	-	1 No.
ix)	Trip Circuit Supervision Relay type VAX 31	-	1 No.
x)	8 Channel alarm annunciator & Indicating Lamps	-	1 Set.
D)	Out going feeder panels for Capacitor - Reactor Each Capacitor - Reactor feeder panel shall be equipped with the following:		
i)	Suitably scaled Ammeter with Selector Switch	-	1 Set
ii)	Local / Remote selector switch	-	1 No.
iii)	TNC Breaker Control switch	-	1 No.
iv)	Double core Cast Resin CT of appropriate rating with 5A Secondary, Class 5 P10 & 1.0, 10VA burden	-	1 Set ( 3 Nos. )
v)	Microprocessor based draw out Non directional combined IDMTL over current & earth fault relay type P127 or equivalent	-	1 No.
vi)	Neutral Displacement Relay type VDG-14	-	1 No.
vii)	Master trip relay type VAJH-13	-	1 No.
viii)	Trip Circuit Supervision relay type VAX – 31	-	1 No.
ix)	8 Channel alarm annunciator & Indicating Lamps	-	1 Set

x) ON / OFF / TRIP / SPRING CHARGED / SERVICE / TEST POSITION / TRIP - 7 Nos.  
Circuit Healthy Indication Lamp

xi) Surge Arrestor - 1 Set

E) Common for all above feeders:

i) Anti – pumping relay

F) Bus PT Panel: 2 Nos. – each equipped with the following

The Bus PT Panel shall be complete with 6600 /110/ 110 volts, 100 VA, Class 1.0 / 3P,

$\sqrt{3}$   $\sqrt{3}$   $\sqrt{3}$

Cast Resin PT suitable for operation on 3 phase, 3 wire, 50 Hz AC system. The bus PT shall be complete with indicating lamps, Voltmeter with Selector Switch and all other accessories as required.

3.9 Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MV Switchboard to the switch-gear panels

DC Supply: 110V DC supply in each panel by duplicate feeders shall be made available from the station battery bank / Battery Charger / DCDB stated elsewhere. Hooking up with the station switchgear and other equipments is within the scope of the contractor and shall be done through cables.

3.10 All equipment, accessories and wiring shall have fungus protection.  
Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease and rust.

After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stove after each coat.

The switch gear shall be finished in RAL 7032 with two coats of epoxy paints

- 3.11 Notwithstanding whatever mentioned elsewhere in the document, following tests shall include but not necessarily limited to the following:
- (a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.
  - (b) All wiring and current carrying part shall be given appropriate high voltage test.
  - (c) Primary current and voltage shall be applied to all instrument transformers.
  - (d) Routine test shall be carried out on all equipment such as circuit breakers, instruments, transformers, relays and meters.

All tests shall be performed in presence of owner's representative.

Certified copies of all the tests carried out at the manufacturer's premises shall be furnished in three copies.

#### **4.0 POWER FACTOR IMPROVEMENT CAPACITORS AND REACTORS**

- 4.1 There shall be such number of sets of Capacitor-Reactor-RVT Panel units corresponding to the number of running motors connected through the HT PDB cum MCC for the total scheme.
- 4.2 7.2 KV capacitors along with 02% Series reactors shall be provided so as to improve the power factor to at least 0.98. The capacitors shall be suitable for operation in 6.6 KV  $\pm$  10%, 50HZ  $\pm$  5%, 3-phase, AC earthed system. It shall be indoor type, free standing, floor mounted, sheet steel enclosed complete with all base channels, anchor bolts and hard wares.
- 4.3 The capacitors shall conform to IS 13925 and shall be suitable for stringent applications and low loss. The capacitor shall be natural cooled type manufactured with non-PCB fluid, having bio degradable and non inflammable and non-deteriorating chemical properties. The same shall be equipped with self discharging devices. Suitable rated HT external HRC fuses with striker pin arrangement, in addition to the internal fuses, if any, shall be used. The final ratings of the capacitors shall be determined from the load current of the motor at pump duty point loading.
- 4.4 The capacitor shall be hermetically sealed and fully protected from atmospheric ingress and hazards. The capacitor shall withstand abnormal system hazards like switching transients and surges, inrush currents, over voltages and over currents.

- 4.5 The capacitors shall have suitable cable termination boxes for terminating 11 KV ( E ) grade 3-Core, up-to 300 Sq. mm XLPE cable with glands & clamps. The successful tenderer shall have to submit the detail calculation for selection of capacitors & reactors during detailed engineering for approval of the department prior to ordering on the sub-vendor.
- 4.6 The suitable rating Reactors shall be in series with the capacitor for inrush current limiting service and shall be indoor dry type, 6.6 KV, 3-phase, 50 HZ. It shall conform to IS: 5553.
- 4.7 The interconnection of the capacitors and the series reactors shall be made through suitable bus ducting. Copper bars having high conductivity and electrolytic grade shall be of adequate size. Suitable insulators, supports as required shall be provided.
- 4.8 The termination arrangement shall be such that there shall be no possibility of impregnant leakage with internal lug crimping to an assembly of epoxy moulded insulator bushings with terminal studs being inserted moulded.
- 4.9 Three numbers single phase indoor, resin impregnate dry type, air cooled RVT in 5 limb construction having ratio  $\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{\sqrt{3}}$  with Star / Star / Open – Delta connection, 100 VA burden and accuracy class 1.0 / 3P shall be provided in conjunction with the Capacitor – Reactor for unbalance protection. The RVT shall have bushing as terminal arrangement and fuses on LV side. The RVT shall conform to IS: 3156.
- 4.10 The Capacitor – reactor unit along with the RVT shall be housed in a common sheet steel with wire mesh enclosure.
- 4.11 Since the major load is inductive type, major VAR shall be introduced in the system on Energisation and acceleration of main motor.

#### CHECK LIST OF CAPACITORS & REACTORS

<b>1.00</b>	<b>Capacitor</b>		
1.01	Manufacturer name with contact address, telephone, Fax, E-Mail etc	:	
1.02	Overall dimension (L x B x W)	:	
1.03	Approximate Weight	:	

1.04	System Voltage	:	
1.05	Capacitor Rating	:	
1.06	No. of units	:	

1.07	Capacitor Rated Voltage	:	
1.07	Capacitor Type	:	
1.08	Type of internal connection	:	
1.09	Whether the capacitor is capable to improve the power factor of the motor at pump duty point load condition to 0.98	:	Yes/No
1.10	Type of connection with motor	:	
1.11	Rated current	:	
1.12	Cooling system	:	
1.13	Dielectric	:	
1.14	Whether external HRC fuses provided and ratings	:	
1.15	Type of installation	:	
1.16	Whether discharging resistance have been provided	:	
1.17	Standard to which conform	:	

<b>2.00</b>	<b>REACTORS</b>		
2.01	Make	:	
2.02	Rating	:	
2.03	Type of installation	:	
2.04	Cooling system	:	
2.05	Type of connection with capacitor:	:	
2.05	Type of connection with capacitor:	:	

## 5.0 TRANSFORMER:

- 5.1 Two nos. 200 KVA, 6.6 KV / 0.433 KV, DYn 11, air natural cooling, Dry Type Distribution Transformer to be manufactured, shop tested, supplied, erected, tested & commissioned generally in conformity with latest revision of IS.
- 5.2 The transformers shall be of the latest design, cast resin air natural cooling type. The transformers shall be suitable for indoor installation. The transformer shall be suitable for operation at full rated power on all tapings without exceeding the following temperature rise.

Winding temperature rise - 90° C over ambient of 50° C

- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'F' insulation, designed and constructed with particular reference to tropical conditions.
- 5.4 The transformer shall be designed to be capable of withstanding, without injury, the thermal and mechanical stress of short-circuits between phases or between phase and earth at the terminals of any winding with full voltage applied across the other winding. The transformers shall be capable of withstanding specified through fault currents for 2 seconds.
- 5.5 The transformers shall operate with minimum noise and vibration. The cores, enclosure / protective housings and other structural parts shall be properly constructed and windings properly braced so that the mechanical vibration is kept to the minimum, thus reducing the noise. The core-coil assembly shall be fixed in such a manner that no shifting or deformation occur during shipment or installation.
- 5.6 The transformer shall be designed for losses as per ECBC guidelines. All mechanism shall be of stainless steel, brass, gunmetal or other suitable material to prevent sticking due to rust or corrosion. If any temporary fitting is fixed to the enclosure / protective housing of a transformer for transporting / handling purposes, these shall be identified as well as instructions and illustrated drawings shall be furnished to facilitate their removal at site after erection.
- 5.7 The enclosure of the transformer shall be such that the H.T. cable termination can be done inside the enclosure and the L.T. cable inside a cable box assembly.
- 5.8 The transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range – 5% to + 5%.
- 5.9 Neutral terminal of star connected winding of each transformer shall be designed for the highest over current that can flow through the terminal. The neutral terminal shall in the LV cable terminal box. The transformer also shall have one additional brought out neutral which is intended to be directly connected to earth permanently.
- 5.10 The transformer shall be generally conformity with latest revision of IS: 11171- 1985 (reaffirmed-2001) and IEC: 726 (1982). Ref standard IS 2026 (Part-I to Part II) IS 10028 (PII) etc. shall be applicable only in so far as they are applicable.

5.11 Transformer Fittings

The transformer shall be fitted with all standard and special fittings and accessories as per IS and CBIP Standard and shall include but not being limited to the following:

- a) Rating, diagram and tap connection plates
- b) Terminal marking plate
- c) Earthing terminal - 2 nos.

- d) Lifting lugs, jacking pads and haulage lugs / holes
- e) Winding temperature indicator with Alarm & Trip contacts.
- f) Externally operated link board with position indicator
- g) Cable terminal (both HV & LV side)
- h) Under carriage with flanged bi-directional wheels with locking and bolting devices

5.12 Each transformer shall be provided with a stainless steel rating plate fitted in a visible position showing the followings.

- a. Kind of transformer
- b. Ref to IS standard
- c. Manufacturer's name
- d. Manufacturer's serial number
- e. Year of manufacture
- f. Number of phases
- g. Rated KVA
- h. Rated frequency
- i. Rated voltage
- j. Rated current
- k. Connection symbol
- l. Percentage impedance voltage at rated current
- m. Type of cooling
- n. Total mass in Kg.

5.13 Transformer losses

Transformer losses shall be guided by the ECBC guideline.



5.14 Following shop tests shall be carried out on the transformer in presence of departmental representative -

- a) Measurement of winding resistance.
- b) Measurement of voltage ratio and check on voltage vector relationship.
- c) Measurement of impedance voltage/ short circuit impedance on principal tapping and load loss.
- d) Measurement of no load loss and current.
- e) Measurement of insulation resistance.

5.15 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	: Indoor
Nature of cooling	: Natural Air Cooling
No. of phases	: 3 (three)
Winding connection & vector group	: DYn-11
Rated frequency	: 50 cycles/sec.
Rated KVA	: 200 KVA
Rated primary voltage	: 6.6 KV
Rated secondary voltage	: 0.433 KV
Method of system earthing	: Secondary solidly grounded
Tap-Changer	: Off-circuit Tap-changer (OCTC)
Tapings	: - 5% to + 5% in steps of 2.5%
HV side terminal arrangements 300	: Suitable for terminating 11 KV grade 3 core sq. mm. XLPE cable
LV side terminal arrangements	: Suitable for terminating 1.1 KV grade 3½ core 1 x 400 sq. mm. XLPE cable

## **6.0 415 V 2 Incomer & 1 Bus Coupler Multi panel PDB**

6.1 The PDB is required to provide power to the auxiliary load and Main Lighting Distribution Board at the Sub-station and Pump House.

6.2 The PDB shall be suitable for 415 V  $\pm$  10%, 50 Hz  $\pm$  5%, 3 phase, 4 wire supply system. The incoming power shall be provided from the secondary side of the transformer through suitable size of cables.

6.3 The PDB shall be 2 mm CRCA sheet steel enclosed, floor mounted type, self supporting, fully compartmentalised, dust & vermin proof, cubicle pattern, non-draw out and modular in construction. It shall be finished painted with powder coated paint after necessary chemical treatment for rust free surfaces and application of anti rust chemical coating. The base frame of the panel shall be made of ISMC – 75 channel.

6.4 The PDB shall be dead front type with concealed type hinged doors at front and bolted covers at the rear. All hinged doors shall be interlocked with the respective switchgears such that the same cannot be opened while the feeder is ON.

6.5 It shall have rear access and the cable termination arrangement shall be provided at the rear of the respective feeder modules. For incomers, extended bus bars shall be installed preferably from the top of the panel as per respective specifications. The vertical dropper bus bars shall be placed in between two vertical aligned feeder modules.

6.6 The bus bar of PDB shall be spitted into two sections with one bus coupler in between. Each section will receive power through an incoming MCCB connected with the secondary side of the transformer

6.7 The bus bar for the PDB shall be TPN type, made of E91E grade Aluminium alloy insulated with 1.1KV grade heat shrink type PVC colour coded sleeve. The rating of the bus bar shall be 630 A for phases and 300 A for neutral. The current density of the bus bar shall not exceed 1Amp / sq mm. The bus bars shall be supported on non hygroscopic type resin moulded insulators and the distance between insulators shall be so designed to make the bus bar system capable of withstanding a short circuit fault current of 35 KA ( r.m.s. ) for 1 sec. The front bus bar chamber shall be fully shrouded to avoid accidental contact with the live bus bars.

The minimum clearance between bus bars and bus bar to earth shall be as per IS.

6.8 Incoming & Outgoing feeder termination shall be done with extended bus bar arrangement if required. The cable termination chamber shall be provided with cable supporting clamps. Each incoming MCCB shall receive 1 No. 1.1 KV grade 3½ core 300 sq mm XLPE insulated armoured aluminium cable. The control wiring of the panel shall be done with 1100 V grade PVC insulated 2.5 sq mm flexible copper wire with copper lugs and ferrule marking at each end.

All hinged door shall be earthed with flexible copper wire.

6.9 A continuous earth bus of size 50 x 8 mm and made of aluminium shall run throughout the length of the panel with drilled holes at the end for connecting the same with the station earth bus bar.

6.10 Feeder details with mounted components

The feeder details are as under:

6.11 400A incoming feeders 2 nos. each comprising of following components:

	i) 415 V, 4 pole, 400 A, 35 KA MCCB fitted with microprocessor based O/L, short circuit, earth fault (Adjustable) and Shunt Trip Release.	1 no
No.	ii) 96 sq mm, 0 – 300 A Ammeter with selector switch	1
No.	iii) 96 sq mm, 0 – 500 V Voltmeter with selector switch	1
Nos.	iv) Current Transformer of ratio 300 / 5A, Class: 1.0, 10 VA	3
Nos.	v) Red, Yellow, Blue phase indicating lamp	3

Nos.	vi) MCCB ON / OFF / TRIP Indicating Lamp	3
6.12	400A Bus coupler feeder one ( 1 ) number comprising of following components:	
No.	i) 415 V, 4 pole, 400 A, 35 KA MCCB without release	1
Nos.	ii) Bus Coupler ON / OFF Indicating Lamp	2
6.13	250A Outgoing feeders 2 nos. each comprising of following components:	
	i) 415 V, 3 pole, 250 A, 35 KA MCCB fitted with microprocessor based O/L, short circuit, earth fault (Adjustable) and Shunt Trip Release.	1 no
No.	ii) 96 sq mm, 0 – 250 A Ammeter with selector switch	1
Nos.	iii) Current Transformer of ratio 250 / 5A, Class: 1.0, 10 VA	3
Nos.	iv) Red, Yellow, Blue phase indicating lamp	3
Nos.	v) MCCB ON / OFF / TRIP Indicating Lamp	3
6.14	MCCB / MCB feeder 14 Nos. of following rating	
Nos.	i) a) 63 A TPN MCCB with Microprocessor based O/C & E/F releases	3

(Adjustable O/L)

Nos.	b) ON / OFF / Trip Indicating Lamp (For each feeder )	9
Nos.	ii) a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases (Adjustable O/L)	5
Nos.	b) ON / OFF / Trip Indicating Lamp (For each feeder )	15
Nos.	ii) 32 A DP MCB	6

**CHECK LIST FOR THE 415 V PDB ( FOR SUBSTATION & PUMPING STATION )**

- i) Make :
- ii) Rating ( Rated Voltage / Rated Current ) :
- iii) Type of construction / mounting :
- iv) Short circuit current ( r.m.s. ) withstand  
Capacity ( in KA ) :
- v) Sheet steel thickness :
- vi) Type of sheet steel treatment :
- vii) Finish paint shade :
- viii) Type of finish paint :
- ix) Degree of protection :
- x) Bus bar materials :
- xi) Bus bar rating ( continuous ) :
- xii) Temperature rise of bus bars over ambient (45°C) :
- xiii) Size of base frame :

- xiv) Whether Bus bar are provided with colour coded sleeves :
- xv) Breaking Capacity of MCCB :
- xvi) Breaking capacity of fuse switch unit :
- xvii) Duty category of fuse switch unit :
- xviii) Rupturing capacity of HRC fuse link :
- xix) Reference standard followed :

## 7.0 Battery & Battery Charging Equipment

There shall be one battery bank along with float and boost charger. The battery bank shall be Exide make 110 V Sealed Maintenance free VRLA battery with UPST type 55 nos. 2 volt 100Ah cells.

Inter row connectors / inter tier connectors shall be provided where necessary. Suitable battery stand complete with cell number plate shall be provided.

The three phase float and boost battery charger with integral DCDB shall be housed in a floor mounting type steel enclosure with adequate ventilation for natural air cooling. The broad specification of the float and boost charger with DCDB is as under:

Battery: 110 V, 100 AH SMF VRLA ( 2 V x 55 Nos. )

Load : 10 A DC, Boost: 15 A DC

### 7.1 A.C. Input

- a) Voltage : 415 V,  $\pm$  10%
- b) Phase : 3 Phase, 4 Wire
- c) Frequency : 50 Hz  $\pm$  6%
- d) Combined voltage & frequency variation within :  $\pm$  10%

e) System earthing : Solidly earthed

## 7.2 Float and Boost Battery Charger

### 7.2.1 Charger – I ( Float Charger – SCR Control )

a) Output Voltage : 110 – 125 V DC [ sleeplessly adjustable ]  
b) Output current : 10 A D.C. + trickle charging current  
c) Rectifier Configuration : Full wave fully controlled SCR bridge  
  
d) Control mode : Constant voltage current limiting  
e) Regulation :  $\pm 1\%$   
f) Ripple voltage : 1% RMS

### 7.2.2 Charger – II ( Boost cum Float Charger – SCR Control )

a) Output Voltage Boost : 110 – 127 V DC [ sleeplessly adjustable ]  
Em. Float: 110 V – 125 V DC [ sleeplessly adjustable]  
b) Output current Boost: 15 A D.C.  
Em. Float: 10 A DC + Trickle charging current  
c) Rectifier Configuration Full wave fully controlled SCR bridge  
d) Control mode Constant voltage current limiting  
e) Regulation  $\pm 1\%$   
f) Ripple voltage 1% RMS  
g) Commencement & termination Automatic / Manual  
of boost charging

### 7.3 Protection

- a) Snubber across each device
- b) Phase failure / sequence reversal
- c) Soft start with current limiting (intrinsic feature of trigger PCB)

### 7.4 Annunciation

- a) Mains fail
- b) Phase fail & sequence reversal
- c) Float under voltage
- d) Float over voltage
- e) Battery fuse blown
- f) Battery under voltage

### 7.5 Indicating LEDs / Lamps

- a) AC supply healthy - 3 Nos.
- b) Float Charger ON - 1 No.
- c) Boost charger ON in Auto mode - 1 No.
  
- d) Boost charger ON in Manual mode - 1 No.
- e) Boost charger ON in Em. Float mode - 1 No.

### 7.6 Metering

- a) AC Voltmeter with Selector Switch at input



- b) DC Voltmeter with Selector Switch at output
- c) DC Ammeter at output
- d) Centre zero Ammeter at battery path

7.7 DCDB Outgoing Feeder

- a) 2 P, 16 A DC MCB - 8 Nos.

7.8 Enclosure

- a) Material - Mild Steel Sheet (2 mm thick)
- b) Painting - Powder coated (Shade RAL7032)
- c) Doors - Front – 1, Rear – 2
- d) Cable entry - From Bottom
- e) Ventilation - Air natural through louvers backed by fine wire mesh

## **B. PUMPING STATION**

### **1.0) Vertical Wet Pit Pumps**

- 1.1 The pumps shall be of vertical wet pit type with mixed flow impeller. Pumps shall be placed vertically submerged within the Sump of the wet pit pump house.. The pump shall be self service water lubricated type. Self lubricated type guide bearings are to be provided at suitable positions of the shafts and shall not be more than 1.5 M (approximately) apart. Since the service water may carry minor solid particles, the guide bearings shall have suitable passages within them to expel / pass these minor solid particles by self working pressure, and the same will not stuck inside the bearings deteriorating them.
- 1.2 The pump battery shall contain suitable no pump sets out of which each pump shall deliver 50 % of the demand and also the system shall have minimum 50% stand-by Pumps.
- 1.3 Pumps shall be vertically driven with shaft directly & flexibly coupled with adequate rating, V1, SCIM. The pump rotational speed shall not be more than 1500 rpm (syn).
- 1.4 The pumps shall be of non-pull out type. The individual pump discharge line shall run over the main operating floor and shall be connected with the common delivery manifold. The pump discharge head/ motor stool / sole plate shall be rigidly grouted on the Pump floor. The foundation plan and foundation pockets required to be kept with the civil construction, and the successful bidder on receipt of the order shall furnish the pump-motor foundation plan authenticated by the OEM. The said foundation will take care and encounter the horizontal back thrust as may be generated during start/stop of the same (at shut off condition may be considered).
- 1.5 The pump impeller shall be securely held on the pump shaft as per provision of the pump manufacturer's design so as to prevent sliding of the impeller along the shaft during operation.
- 1.6 The pumps shall be of having a fairly steep H-Q curve. The tenderer shall furnish the evaluated specific speed of the pump at the specific trim at duty point. The pump H-Q characteristics curve shall be stable all throughout. There shall be a margin of at-leas 25% in between the run-out flow and the duty point flow.

- 1.7 The pump efficiency shall be reasonably high. The head-discharge-efficiency-KW absorbed-NPSHR shall be guaranteed without any tolerances at the duty point working at river water level condition mentioned in the Obligatory Data.
- The tenderer shall have to confirm the maximum power absorbed by the pump on the entire range starting from the shut-off to run-out without any positive tolerance
- 1.8 The suspension length of the pump assembly shall be such that it can safely work at the lowest low IG level condition considering worst of (i) the NPSHR of the offered pump at the maximum water discharge condition on the entire operating range & (ii) minimum submergence requirement. It shall have one suitable basket type strainer preventing entry of foreign particle and of any solid in the pump.
- 1.9 The vertical column pipe assembly shall be of suitable dia fabricated from adequately thick MS plate, flanged type, and anti-corrosive epoxy painted both inside and outside. The column piping shall be of individual length not more than 1.5 M each for effective and easy handling.
- 1.10 The total suspension length including the bottom basket strainer if any, shall be fixed by the tenderer considering the minimum submergence requirement working at the lowest low sump level, the required bottom clearance at the indicated Sump level etc. The total suspension length, as has been considered in the offer backed by technical justification shall be placed with the Part-I offer.
- 1.11 The pump assembly shall be provided with suitable anti-friction roller thrust bearing with a **PT-100 probe so as to measure the pump bearing temperature**, non-reverse ratchet assembly, bowl bearing, suction bell bearing, shafts sleeves including sleeve at gland packing point, seal ring / wearing ring, provision for impeller adjustment nut, double throat air-valve at column vent point and other important features as provided by the manufacturer. Suitable motor stool, motor sole plate with facility of pulling out the column and bowl assembly through it, anchoring bolts, nuts, washers, fixing bolts all complete are to be provided..
- 1.12 The pump rotating assembly shall be statically and dynamically accurately balanced. The impeller balancing shall be within the grade G- 6.4 as per IS: 11723. No hole or any piece

being welded / bolted on the pump impeller for balancing shall be allowed. The shaft should be ground all over and perfectly aligned. Special care should be taken that the entire pump assembly do not experience vibration beyond the permissible limit as per IS:11724, of such class roto-dynamic unit while in operating even in worst operating condition at any combination.

- 1.13 The pump motor shall be considered as a single unit and the vibration limit should be within the limit specified in above IS.
- 1.14 The noise level shall be within the permissible limit of IS: 12065. The thrust bearing shall be designed in such a manner to be worked safely on any working condition even at the respective shut off.
- 1.15 The pump shall also withstand the condition of any back flow on it.
- 1.16 The static and dynamic loading of the pump motor assembly with other allied components shall be clearly indicated.
- 1.17 The pump shall be capable of continuous operation. The pump shaft, line shaft shall be accurately sized. Replaceable sleeves are to be provided at desired point. The Stuffing box shall be self sealed design provided with packing ring and preferably with Split type gland.
- 1.18 The impeller of the offered pump shall not be either on the lowest trim or the highest trim of the same pump family offered.
- 1.19 The wetted portion of the pump shall have a proper finish. The pump shall have a minimum efficiency of 80% at duty point. Pumps offered with lesser efficiency at duty point shall not be accepted.
- 1.20 The pump shaft shall be accurately machined and ground all over. The portion of the pump that will come under the contact with pumped liquid shall be protected by replaceable sleeves.
- 1.21 Suitable pump casing wearing ring and/or impeller neck ring as per the manufacturer's design shall be provided. Each pump shaft shall be adequately supported, both at driving and non-driving ends, on anti-friction type ball/roller bearings capable to withstand the worst thrust loading for the pump operation from shut-off to run-out.

- 1.22 The pump shall be suitable for valve open starting and also to take care of the condition of back water flow in it, if any. Grease injection nipples and grease collector at each bearing points shall be provided.
- 1.23 The overall noise level of the pump-motor unit shall be within the stipulations of the relevant BIS limit all round measured from a distance of 1.5 M.
- 1.24 The identical parts of the pumps shall be inter- changeable type.
- 1.25 The supply of the pump shall be completed by the pump manufacturer with the following components and accessories: -

Suitable motor stool, pump motor sole plate with facility of pulling out the column and bowl assembly through it, anchoring bolts, nuts, washers, fixing bolts all complete are to be provided. Sole Plate of the total pump-motor assembly, motor stool with all foundation bolts, nuts, washers, wedges, leveling shims and other erection materials as required. It may be noted that there shall be no other thrust encountering device on the pump discharge pipe branch and the common delivery header excepting the pump foundation bolts. The pump foundation bolts shall be adequate enough to withstand all the thrust that may occur during pump operation including start/stop. Additionally one MSDF short-piece with adequate stiffeners shall be provided just after the pump delivery flange and the same shall be anchored with pump / intermediate floor to minimize the back – thrust.

Suitable flexible coupling with bolts, nuts, pins, keys etc. for coupling the drive and driven unit.

Air-vent cock, priming cock suitably placed.

Self sealed packing box provided with packing rings, lantern rings, split type glands, gland cooling water connection with cock, valves etc., all service pipes, valves, fittings, drain plug, lifting lugs etc. as required for safe operation of pumps.

Any other accessories & component considered by the manufacturer for safe, efficient operation of pumps

1.26 The pumps shall be capable for continuous operation at any stated level condition.

1.27 The material of construction of the pump is given below. If the tenderer feels that the MOC other than what have been stated will give better service and performance, he may offer the pumps with the MOC as per his choice, backed by technical justifications, but the same shall only be made as an alternative offer.

- a) Pump casing : CI as per IS 210 Grade FG 260
- b) Impeller : SS, CF8M
- c) Pump Shaft & Intermediate shaft : SS 410
- d) Sleeves : SS 410 hardened
- e) Shaft Pins, Keys : SS 410
- f) Shaft Coupling : SS 410
- g) Bearing ( Except thrust bearing ) : Self lubricated type with cut-less nitrile rubber in SS shell (straight grooves preferred)
- h) Wearing ring / seal ring : Materials having at least 50 BHN hardness difference to the nearest component
- i) Impeller Nut : CI IS 210 GR. FG 260
- i) All hardware used in total pump Assembly (nuts/bolts/fasteners etc.) : SS-410
- k) Column pipes : MS, fabricated from adequately thick steel plate with anti- corrosive epoxy painted both inside and outside after proper surface finish

1.28 All materials, casting used for manufacture of the pumps with allied components & accessories shall be of best tested quality and the contractor has to submit the test certificate for the MOC at the time of shop test as well as with the supplies.

Ultrasonic test to the shafts are to be conducted and test certificate to be furnished.

The dynamic balancing of the rotating unit with coupling, key etc. is to be conducted and test certificate is to be submitted on shop test.

Dye-penetration test to the impeller are to be conducted and the test certificate are to be furnished with the supply.

Hydrostatic tests at a pressure not less than 1.5 times of the shut-off pressure for duration of 30 minutes are to be performed and test certificates to be furnished.

The pump performance test of all the pumps for head, efficiency, power consumed etc. versus discharge shall be conducted as per IS: 9137 in presence of the departmental representatives and in full load, full speed with the job motor and preferably with full column setting.

The duration of the performance test at shop shall be not less than 8 hours continuous operation and the temperature monitoring of both pump and motor shall be conducted.

The tenderer should indicate the maximum column setting, they can accommodate in their factory test bed.

The NPSHR test as per IS: 9137 to at least one pump as per choice of the department at various discharge conditions including duty point shall be conducted during the joint shop tests of pumps. The duration of the performance tests of all pumps shall be not less than 8 hours each, during which the temperature, noise, vibration shall be monitored and tested.

The minimum submergence test as per IS: 9137 shall be conducted to at least one pump as per choice of the department at various discharge conditions including at duty point during the joint shop test of the pumps.

Vibration analysis to all pump motor sets are to be made in all load conditions both during the shop-testing as well as at site after the pump sets have been fully commissioned.

After the performance tests, one pump as per choice of the department shall be stripped off and the internal components shall be checked

Apart from the stated shop tests all field tests including noise, temperature rise, and vibration analysis shall be conducted by the contractor.

1.29 The tenderer shall fill-up the guaranteed performance figure / data given in the separate section and submit with the part-I offer

**1.30 Hydraulic test at shop**

1.30.1 All pressure parts shall be subject to hydraulic testing at a pressure of 150% of shut off head or 200% of rated head (effective head) whichever is higher, for a period not less than 30 minutes.

1.30.2 Performance test are to be conducted to cover the entire range of operation of the pumps. These shall be carried out to a span of at least 125% of rated capacity up to pump shut off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves including the design capacity points and the two extremities of the Range of operation specified. For range of operation, stipulation in relevant Clause may be followed.

1.30.3 Tests shall be conducted with actual drive motors at full load and full speed.

1.30.4 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.

1.30.5 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

**1.31 Performance test at shop**

1.31.1 Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted, in presence of Employer or his representative, as per the



requirements of the Hydraulic Institute Standard/ASME Power Test Code PTE 8.2/BS-599/I.S.S., latest edition/ relevant universally accepted codes.

1.31.2 The Contractor shall conduct necessary arrangements for establishing such test with adequate size of sump, to establish the suitability of suction conditions , flow correcting devices for measurement of flow.

1.31.3 The Employer or his authorized representative shall be given full access to all tests. Prior to performance tests, the Contractor shall intimate the Owner allowing adequate time so that if the Employer so desires, his representatives can witness the test.

## **1.32 PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES**

### **1.32.1 Performance Guarantee and Tolerance**

The Bidder shall guarantee the effective head at the specified designed capacity and also the corresponding pump efficiency, pump input power. Unless otherwise mentioned, the Bidder shall specify the allowable tolerance considered by him on the guaranteed performance on other operating points, which shall not be more than those specified in IS9137.

### **1.33 Rectification of Deficient Performance**

The tenderer shall indicate the guaranteed efficiency of the pumps offered by him. While carrying out shop performance tests, the permissible limits of errors in measurement shall be in conformity with Class-B of BS:599 without any penalty whatsoever. Apart from that a negative tolerance of maximum (-) 3% on quoted efficiency shall be acceptable only with penalty. Variation more than (-) 3% will render the pump liable for rejection.

If the shop performance tests indicate any failure of the pump to achieve the guaranteed efficiency, the Contractor will be given a time, to be decided by the Owner, to make up the deficiency at his cost by incorporating necessary modification, alteration and replacement.

## **1.34 CLEANING, PROTECTION AND PAINTING**

### **1.34.1 Cleaning before shipment**

Surface of all parts shall be cleaned to remove scale, dirt, oil, water, grease and other foreign objects prior to final assembly of the equipment. All openings shall be covered to guard against damage and entry of foreign objects.

### **1.34.2 Painting**

All surfaces shall thoroughly be cleaned in a manner approved by the manufacturer for necessary paint coating to be applied on the surface. In case of any prevalent Standard/Codes on selection and application of painting/coating, the same shall be strictly adhered to.

The colour code for finished painting on the external surface shall be subject to Employer's approval. Necessary finish paintings including touch up paints, if not applied at shop, shall be done by the Contractor from sealed containers for site application.

### **1.34.3 Packing for shipment**

All parts shall be properly boxed, crated or otherwise protected for transportation to suit the mode of transportation. Exposed finished surfaces shall be thoroughly greased before transportation.

## **1.35 TESTS AND INSPECTION**

1.35.1 The manufacturers shall conduct all tests required to ensure that the equipment furnished shall conform the requirements of this specification and in compliance with requirements of applicable Codes and Standards. The particulars of the proposed tests and the procedures for the tests shall be submitted to the Employer for approval before conducting the tests. The pump is to be tested on the test bed of manufacturers' works in presence of the MED's representatives. All relevant cost of such inspection by two representatives of MED has to be borne by the manufacturer / contractor.

## **1.36 SPARE PARTS**

1.36.1 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

1.36.2 The spare parts as mentioned are to be supplied within the completion period of the contract alongwith the main equipment.

1.36.3 Cost of spare parts as above are to be mentioned separately.

1.36.4 Replacement of spare parts during Guarantee period would be borne by the Tenderer at their own cost.

## **1.37 DRAWINGS, CURVES & INFORMATION REQUIRED**

1.37.1 Characteristic curves of pumps showing effective head, pump input power, efficiency, submergence/NPSH, against capacity ranging from shut off condition to at least 125% of rated capacity alongwith a tentative General Arrangement Drawing showing relevant details shall be submitted with the offer.

1.37.2 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.

1.37.3 All data furnished during bidding stage shall be treated as final and binding on the Contractor if, however, any, minor change is essential during detail design stage for any improvement in the system, such changes shall be carried out only after obtaining approval of the Employer.

1.37.4 The  $G.D^2$  values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

### **1.38 INSTRUCTION MANUALS**

- a) The instruction manual shall present the following basic categories of information in a comprehensive manner prepared for use by operating and/or maintenance personnel :
  - i) Instruction of Erection
  - ii) Instruction for pre-commissioning check up, operation, abnormal conditions, maintenance and repair.
  - iii) Write up on Controls and interlocks provided, if any
  - iv) Recommended inspection points and periods of inspections.
  - v) Schedule of preventive maintenance.
  - vi) Ordering information for all replacement parts.
  - vii) Recommendation for type of lubricants, lubricating points, frequency of lubrication and lubricant changing schedule.
  - viii) Trouble Shooting Procedure.
- b) The information shall be organized in a logical and orderly sequence. A general description of the equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment.
- c) Necessary drawings and/or other illustrations shall be included or copies of appropriate final drawings shall be bound in the manual. Test, adjustment and calibration information as appropriate shall be included and shall be identified to the specific equipment. Safety and other warning notices and installations, maintenance and operating cautions shall be emphasized.
- d) A parts list shall be included showing part nomenclature, manufacture's part number and/or other information necessary for accurate identification and ordering of replacement parts.
- e) Instruction manual shall be securely bound in durable folder.
- f) If a standard manual is furnished covering more than the specific equipment purchased, the applicable model (or other identification) number, parts number and other information for the specific equipment purchased shall be clearly identified and highlighted. Sectional drawing to suitable scale and characteristic curves for the particular equipment supplied must be included in the Instruction manual.

### **1.39 PROPOSAL DATA**

- 1.39.1 To complete the proposal, the Tenderer must fill up the following DATA SHEET / CHECK LIST furnished hereinafter.

## DATA SHEET / CHECK LIST OF THE PUMPS BEING OFFERED

( FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS IF THERE BE ANY)

**1.00.00 GENERAL**

- 1.01.00 Manufacturer :
- 1.02.00 Model No. :
- 1.03.00 Type of Pump :
- 1.04.00 Non Pullout : Yes/No
- 1.05.00 Impeller Type : Closed/Semi open/Open
- 1.06.00 No. of Pumps offered :
- 1.07.00 Efficiency of Pump at duty condition :  
for solo operation

- 1.08.00 Efficiency of Pump at duty condition :  
in parallel operation  
:

**2.00.00 PERFORMANCES**

- 2.01.01 Guaranteed capacity - M<sup>3</sup>/hr without tolerance :  
in single operation & parallel operation
- 2.01.02 Guaranteed head - MWC at rated discharge :  
discharge, without tolerance in single operation  
parallel operation.
- 2.01.03 Input to the Pump (KW) at duty condition in :  
single operation & parallel operation  
without tolerance
- 2.01.04 Pump input power at worst operating condition  
on the range of operation (without positive  
tolerance)
- 2.01.05 Pump input power at shut off :

2.01.06	Range of operation of Pump	:
2.01.07	Recommended Motor KW	:
2.02.08	Pump rated speed (RPM)	:
2.01.09	Pump specific speed for duty condition	:
2.01.10	Pump shut off head for duty condition	:
2.01.11	Minimum submergence required in MWC at worst flow condition	:
2.02.01	<b>PUMP NPSHR</b>	
2.02.02	-do- at highest water level condition	:
2.02.03	-do- at lowest water level condition	:
2.02.04	-do- in the operating range, without positive tolerance	:
2.02.05	Pump duty : continuous/intermittent	:
3.00.00	<b>FLEXIBLE JOINTS AND SHAFT</b>	
3.00.01	Flexible Coupling	
3.00.02	Type	:
3.00.03	Make	:
3.00.04	Factor of Safety adopted	:
3.00.05	Degree of Flexibility	:
3.00.06	Extent of Play allowed	:
3.00.07	Shaft diameter	:
3.00.08	Material	:
3.00.09	Factor of Safety adopted	:
4.00.00	<b>THRUST BEARING</b>	
4.00.01	Type	:
4.00.02	Whether separate thrust bearing for pump motor provided or not	:
4.00.03	Method of lubrication	
4.00.04	Whether the thrust bearing is capable for worst loading of both phases	:
4.00.05	Axial thrust at duty point (kg) approx	:

4.00.06	Whether thrust bearing temperature detector provided	:
5.00.01	Are the pumps suitable for parallel operation	:
5.00.02	Whether non-Reserve Ratchet is provided in pump or not	:
5.00.03	Type of lubrication for pump	:
5.00.04	Whether pre lubrication arrangement provided	:
6.00.00	<b>EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE</b>	
6.00.01	Impellers	:
6.00.02	Pump Bowl Casing	:
6.00.03	Shaft	:
6.00.04	Thrust Bearing	:
6.00.05	Whether pump performance curve (H-Q, Q-P, Q-n, Q-NPSHR) authenticated by the pump manufacturer provided with the offer along with system resistance curve	:
6.00.06	Whether the copy of the pump family curve, authenticated by the pump manufacturer provided with the offer	:
6.00.07	Whether the Pump H-Q curve superimposed on the system head curve submitted with the offer	:
7.00.00	<b>GENERAL</b>	
7.00.01	Are companion flanges, air release valves, sole plate, arrangement for thrust encounging devices provided	:
7.00.02	Whether lifting lugs, eye bolts etc. provided	:
7.00.03	load data	:
7.00.04	Weight of total pump assembly (empty)	:
7.00.05	Weight of total water column	:
7.00.06	Total Static Load	:
7.00.07	Total dynamic Load	:

7.00.08 Maximum horizontal back thrust at maximum water level condition :

## 2.0) Motors

- 2.1 The main drive motors shall be of squirrel cage TEFC / CACA induction motor, vertical axis, V1 (as per IS: 2253), continuous duty to suit the offered pumps and shall be capable to drive the pump in all declared working conditions. The motor shall be of high starting torque type suitable for 6.6 KV  $\pm 10\%$ ; 50 C/S  $\pm 5\%$ ; combined variation  $\pm 10\%$  AC; 3-phase supply and not greater than 1500R.P.M.(Syn).
- 2.2 All the motors shall be rated for continuous duty (S1) and shall have IP 55 degree of protection in accordance with IS: 4691.

However, due to operational need, the pump-motor set may demand for frequent start or stop operation, with a maximum time gap of 5-10 minutes from one stop after prolonged operation in rated load and may demand restarting of the same. The pump motor set shall be capable to take care of the stated situation.

- 2.3 All the motors shall have high efficiency and power factor. It shall have unchanged efficiency during rated output utilization.
- 2.4 All the motor ratings shall be of minimum 530 KW considering at least 20% margin over the maximum pump input at duty point or 10% margin over the maximum pump input in the worst case of the pump operation in the total range (from shut-off to run out), whichever is higher. The overall capacity of the motor shall be selected for continuous operation at the rated output for the voltage and frequency condition mentioned above in the worst case by allowing the temperature rise limited to that of class-B over the ambient temperature of 45° centigrade. But the class of insulation of the motors shall be Class F.
- 2.5 The motor characteristics shall match the requirements of the driven unit (pump) so that adequate starting torque, acceleration, pull up, break down and full load torque are available for the intended service. The motor shall be suitable to start the pumps in valve open condition. It shall also not be overloaded in case of back water flow occurs occasionally.
- 2.6 The motor shall have rotating rotational speed not greater than 1500 RPM (syn). The percentage slip of the motor at different load conditions shall match the pump speeds

required then at the different load conditions. The tenderer shall clearly indicate the motor speed and slip at different load conditions.

2.7 The stator windings design shall be such that it shall have superior electrical, mechanical and thermal properties and shall achieve better heat transfer and higher dielectric strength.

2.8 The rotor of the motor should be sturdy in construction so as to ensure trouble free operation. Special care shall be taken to ensure better torque characteristics.

9.9 All the motors shall be provided with a very efficient cooling system so that the temperature of the stator winding does not rise abnormally. The method of cooling shall be at least IC 411 / IC 611 as per IS: 6362:1995. All the motors shall be provided with bi directional specially designed external cooling fan for low noise operation. Noise level shall be within the values as stipulated in IS: 12065.

2.10 The motor shall be suitable for DOL starting.

2.11 The motor shall deliver rated output and accelerate at full speed with 85% of rated voltage at the motor terminal. With 85% rated voltage at motor terminal, it shall be capable of working satisfactorily at full load for at least 10 minutes without injurious heating or stalling.

2.12 The motor locked rotor current shall be limited within 720% of the motor rated current without any positive tolerance.

2.13 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds. Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting using motor rated capacity.

2.14 The motor shall be provided with 12 Nos. simplex type RTD's and BTD's for alarm and trip. In addition 2 Nos. dia type thermometers with 1 NO + 1 NC potential free contacts shall be provided. The leads shall be brought out to a separate terminal box.

Suitable wiring by signal cable shall be made to receive the signal from the field to the



control desk and the circuitry for alarm and trip shall be arranged so as to give alarm and or trip the motor, as the case may be.

2.15 The rotor shall be dynamically balanced with all the fans and with half key in the shaft extension and to vibration severity grade as per IS: 12075. But the noise level of the pump and motor in combine shall not exceed the stipulations as mentioned in IS: 12065.

2.16 The motor shall be provided with anti-friction bearings, grease lubricated both at driving and non-driving ends.

The bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matter like dirt, water etc. into the bearing area. Grease lubricated bearings shall be pre-lubricated and shall have provision for in-service positive lubrication with drains and grease collectors to guard against over lubrication.

2.17 The motor terminal box shall be of detachable type and rotate-able by 360° in steps of 90° in each position. The terminal box shall have IP 55 degree of protection. It shall be suitable for terminating one number 3-core, 11 KV ( E ) grade, 300 sq. mm XLPE aluminum conductor armoured cables for main motor feeding. Mounting of the terminal box shall match with the site requirement.

The terminal boxes shall be with removable cover /adaptor pieces with access to connection. The motor terminal boxes shall be furnished with suitable cable lugs and double compression brass glands to match with the cable size.

2.18 The motor shall be equipped with built-in anti-condensation thermostatically controlled space heater of adequate rating suitable for operation in 230 V AC supply. Separate terminal box ( s ) for the space heater connection is to be provided.

2.19 The frame of each motor shall be provided with two separate and distinct grounding pads suitable for accommodation of suitably sized grounding conductors. The main cable terminal boxes shall have separate grounding pads.

2.20 The rating plate of the motor should contain the minimum information as indicated in the relevant BIS standard and shall be made of stainless steel.

2.21 The successful tenderer shall furnish the motor load-efficiency curve, torque-speed curve, load-power factor curve, thermal withstand curve (hot and cold), current-speed curve and current-time curve for approval of the Department.

The dimensional drawing of the offered motor, terminal box drawings, load data, GD<sup>2</sup> value of the drive unit and the driven unit alongwith final Data Sheet shall also be furnished by the successful tenderer for approval of the Department.

2.22 The motor shall also be provided with suitable lifting lugs/eye bolts having adequate provision for lifting/ installation. Common base frame for the pump & motor as indicated earlier shall be used with suitable foundation bolts, Dowelling pin etc. shall also be provided.

2.23 The routine tests as per IS: 325 shall be conducted on each motor at Shop i.e. at manufacturer's works. Similarly, the type test (Heat Run Test) shall be conducted on at least one motor randomly selected during the tests. All necessary arrangements and costs thereof for the tests are to be made by the contractor and shall be included in the offered cost.

2.24 Apart from the technical offer, the tenderer should furnish the Check List duly filled-in in the Part-I offer.

#### **CHECK LIST OF THE MOTORS**

- 1.01.00 Manufacturer of the Motor
- 1.02.00 Rates output in KW
- 1.03.00 No of Poles
- 1.04.00 Speed
- 1.05.00 Nos. offered
- 1.06.00 Type of duty & duty designation (as per IS 325)
- 1.07.00 Whether the motor is capable for operation after one hot restart and/or three equispace hourly restarts.

- 1.08.00 Supply conditions
  - 1.08.01 Rated voltage (Volts)
  - 1.08.02 Allowable variation in voltage (%)
  - 1.08.03 Frequency (Hz)
  - 1.08.04 Allowable variation in frequency considered
- 1.09.00 No. of phase
- 1.10.00 Stator connection
- 1.11.00 Currents
  - 1.11.01 Full load current
  - 1.11.02 No load current
  - 1.11.03 Starting current % of full load current
- 1.12.00 Efficiency at 100% & 75% load
- 1.13.00 Power factor at 100% & 75% load
- 1.14.02 No load power factor
- 1.15.00 Method of starting
- 1.16.00 Starting torque (% of full load torque)
- 1.17.00 Maximum torque (% of full load torque)
- 1.18.00 Acceleration time (sec.) from dead stop to full load speed
  - 1.19.00 With 100% terminal voltage
  - 1.20.00 With 85% terminal voltage
- 1.21.00 Safe stall time - cold/hot
- 1.22.00 Class of insulation
- 1.23.00 Ref Ambient (temperature EC)
- 1.24.00 Temperature rise in (EC) by resistance method & class which limited
- 1.25.00 Type of enclosure

- 1.26.00 Degree of protection
- 1.27.00 Installation
- 1.28.00 Shaft orientation & mounting
- 1.29.00 Space heaters - No proposed
  - 1.29.01 Number
  - 1.29.02 Rating (Watts)
  - 1.29.03 Voltage, Phase, Frequency
- 1.30.00 Whether separate terminal box provided for
- 1.31.00 Bearings
  - 1.31.01 Driving end
  - 1.32.02 Non-driving end
  - 1.32.03 Anticipated life (hours)
- 1.33.00 Recommended lubricant
- 1.34.00 Whether separate lubricant nipple provided
- 1.35.00 Interval of lubrication (hours)
- 1.36.00 Whether winding temperature detectors & bearing temperature detector provided
- 1.37.00 Whether separate terminal box for BTDS & RTD's provided
- 1.38.00 Approx. weight of the motor (kgs)
- 1.39.00 Dynamic load (kgs)
  - 1.39.01 Normal running condition
  - 1.39.02 Starting condition
  - 1.39.03 Short current condition
- 1.40.00 GD2 value of motor (kg M<sup>2</sup>)
- 1.41.00 GD2 value of load to motor shaft (kg M<sup>2</sup>)

- 1.42.00 Painting
- 1.43.00 Earth terminal & lifting lug provided (Y/N)
- 1.44.00 Technical leaflets/literatures provided or not

**2.00.00 TESTS**

- 2.01.00 Upon completion, each motor shall be subjected to standard routine tests as per I.S. In addition, type test ( Temperature rise ) of at least 1 no. motor as per choice of the customer, shall be performed. Further any special tests called for in the driven equipment specification shall be performed. The tenderer has to bear all expenses for such testing to witness the tests for max. two representatives of MED at the manufacturers premises.
- 2.02.00 3 ( Three ) copies of routine test certificates and type test certificate shall be submitted for approval prior to the despatch of the motors from the manufactures premises.

**3.00.00 SPARE PARTS**

Spare parts are to be supplied as specified separately.

**3) HT PDB CUM MCC AT PUMP HOUSE ( IG )**

- 3.1. The HT PDB cum MCC shall be multi panel switch board suitable for indoor installation and shall operate at 6.6 KV  $\pm 10\%$ , 3 $\phi$ , 50 Hz  $\pm 5\%$  AC earthed system. The Switchboard shall comprise of the following

- Feeder
- I) Incomer panel – 2 Nos.
  - II) Bus Coupler with Trunking Panel – 1 No.
  - III) Motor Feeder panel – As per total number of pump sets offered + 1 Spare
  - IV) Bus PT – 2 Nos.
  - V) Earthing Truck – 1 No.

- 3.2. The switch gear shall be indoor, metal clad, floor mounted, horizontal isolation and horizontal draw out type and shall be suitable for trouble free and continuous operation at 6.6 KV $\pm 10\%$ , 3 phases, 3 wire, 50 Hz  $\pm 5\%$ , grounded system. The switch gear will be located in a hot, humid and tropical atmosphere.

Design and construction shall be such so as to allow extension at either ends. The base channel frame of the switch gear along with all hardware shall be within the scope of the contract.

The switch gear enclosure shall conform to the degree of protection IP-4X. The minimum thickness of sheet used shall be 2 mm except the gland plate where the sheet thickness shall be 3 mm.

The switch gear assembly shall comprise a continuous dead front, line up of free standing, vertical cubicles. Each cubical shall have front hinged door with latches and a removable back cover. All covers and doors shall be provided with neoprene gaskets.

Circuit breakers, instrument transformer, bus bars, cable chamber etc. shall be housed in separate compartments.

- 3.3 The Switch gear shall be fully wired at the factory to ensure proper functioning of indications, control, protection, transfer and inter-locking scheme.

Fuse & links shall be provided to permit individual circuit isolation without disturbing other circuits. All spare contacts of relays, switches and other devices shall be wired up-to terminal blocks.

Wiring shall be done with flexible, 1.1KV grade PVC insulated switchboard wires with stranded copper conductors of 2.5 sq. mm for control and current circuits and 1.5 sq. mm for voltage circuits.

Each wire shall be identified with both ends with permanent marker bearing wire number as per contractor's wiring diagram.

Wire termination shall be made with crimping type connectors with insulating sleeves.

Not more than two wires shall be connected to any terminal. At least 25% spare terminal shall be furnished in the terminal block.

- 3.4 Switch gear shall be designed for cable entry from bottom. Sufficient space shall be provided for ease of termination and connection.

Power cables shall be XLPE insulated, armoured, overall PVC sheathed with stranded aluminum conductors.

Control cables shall be XLPE insulated, armoured, overall PVC sheathed with 2.5 sq. mm stranded copper conductors.

All provisions and accessories shall be furnished for termination and connection of cables, including removable gland plates (3 mm thick), cable supports, crimping type tinned copper / aluminum lugs, brass compression glands with washers and terminal blocks.

- 3.5 The main buses and connections shall be of high conductivity electrolyte grade copper, sized for specific current rating with maximum temperature rise limited to 90°C. Bus-bars and connection shall be fully insulated for working voltage with adequate phase / ground clearance. Insulating sleeves for bus bars and cast resin shrouds for joints shall be provided.

All buses and connections shall be supported and braced to withstand stress due to maximum short circuit current and also to take care of any thermal expansion.

Bus-bars shall be color coded for easy identification and the bus-bar chamber shall be provided with inter panel barrier with epoxy cast seal-off bushings through which the buses will pass through so as to prevent fire from one panel to other.

- 3.6 A copper ground bus, rated to carry maximum fault current for 3 secs., shall extend for full length of the switchgear. The ground bus shall be provided with two bolt drilling with GI bolts, nuts and washers at each end to receive GI flat of adequate sizes to withstand earth fault current.

CT & VT secondary neutrals shall be earthed through removable links so that earth of the one circuit may be removed without disturbing the others.

Each stationery unit shall be directly connected to the ground bus.

3.7 The circuit breaker shall be vacuum type triple pole 800 Amps, 25 KA for 3 secs., horizontal draw out, horizontal isolation having Service / Test / Isolated position with positive indication for each position. The V.C.B. shall have 220 V AC / 110 V DC ( to be freezed during detail engineering) motorized spring charged trip free mechanism and mounted on a carriage complete with self contained manually operated fully interlocked, raising and lowering mechanism with earthing truck. The operating mechanism shall normally be operated from remote electrical control but arrangement should also be made for local electrical control. Mechanical device shall also be provided on the breaker for manually tripping and closing. Each set of the circuit breaker shall have the following features:

- d) 1 set mechanical ON & OFF indicator.
- e) 1 rear entry cable box with glands suitable for 11 KV grade XLPE cable.
- f) 1 set of indicating lamp ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY / Service & Test Position Indications for each breaker & in addition DC FAIL / R-Y-B Phase Indications ( for Incomer only ).
- d) 3 double core current transformers of suitable ratio and accuracy class 5P10 & 1.0 shall be provided for protection & metering
- e) Shunt trip coil rated for 110 V DC.
- f) 1 space heater with ON & OFF switch
- g) 15A / 5A 3 Pin Plug Socket
- h) In – panel lighting with control switch
- i) Space heater for each individual motor shall be fed from the individual motor feeder and provision for such distribution as well as interlocks shall be provided in HT PDB cum MCC.
- j) 240 V AC Alarm Bell & Buzzar for non – trip fault & trip with provision for alarm cancellation ( common )
- k) Auxiliary switches with required contact.
- l) 1 suitable label

In addition, 1 no resin cast and draw out type PT shall be provided in the Incoming Panel, suitable for 3 phase, 3 wire 3 limb 50 Hz system with a ratio of 6.6 KV /110 /  $\sqrt{3}$  / 110 /  $\sqrt{3}$  volts, 100 VA, class 1.0 / 3 P. Symmetrical breaking capacity of the circuit breaker shall be 25 KA and making capacity shall be 62.5KA. The short time rating of the circuit breaker shall be 25 KA for 3 secs.

The circuit breaker shall be capable of carrying rated current at 45°C ambient temperature without derating.

3.8 The feeder details of the Multi panel HT PDB cum MCC shall be as under:

A) Incoming feeder Panel : 2 Nos. (800 A ) each equipped with the following:

- i) 96 sq mm ( 0 – 8 KV ) Voltmeter with Selector Switch - 1 Set
- ii) 96 sq mm ( Dual scale ) Ammeter with Selector Switch - 1 Set

iii)	Local/ Remote selector switch	-	1 No.
iv)	TNC Breaker Control switch	-	1 No.
v)	Double core Dual Ratio Cast Resin CT of appropriate rating with 5 A secondary, Class 5 P10 & 1.0, 10VA burden	-	1 Set ( 3 Nos. )
vi)	Microprocessor based draw out directional combined IDMTL over current & earth fault relay type P127 or equivalent	-	1 No.
vii)	Master trip relay type VAJH – 13	-	1 No.
viii)	Trip Circuit Supervision Relay type VAX - 31	-	1 No.
ix)	Multifunction meter (For Amp. Voltage, frequency, power factor etc. ) type ELITE445 or equivalent	-	1 No.
x)	Power Factor Meter	-	1 No.
xi)	KW Meter	-	1 No
xii)	8 Channel alarm annunciator	-	1 Set
xiii)	ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY / SERVICE / TEST POSITION / DC FAIL / R – Y – B Phase Indication Lamp	-	11 Nos.
B)	Bus Coupler Panel : 1 No. equipped with the following		
i)	Local / Remote selector switch	-	1 No.
ii)	TNC Breaker Control switch	-	1 No.
iii)	ON / OFF / SPRING CHARGED / SERVICE / TEST POSITION / TRIP CIRCUIT	-	6 Nos.



HEALTHY Indication Lamp with Push Button

- C) Out going feeder panels for Motors  
Each Motor feeder panel shall be equipped with the following :
- i) Dual Scale Ammeter with Selector Switch - 1 Set
  - ii) Local / Remote selector switch - 1 No.
  - iii) TNC Breaker Control switch - 1 No.
  - iv) Double core Cast Resin CT of appropriate rating with 5A Secondary, Class 5 P10 & 1.0, 10VA burden - 1 Set  
( 3 Nos. )
  - v) True Digital Microprocessor based draw out Motor Protection relay suitable for 5A CT Secondary and having thermal overload protection, instantaneous short circuit protection, inverse and definite time negative sequence current protection, instantaneous and definite time earth fault protection, locked rotor protection, loss of load protection and reverse phase sequence protection type P225 or equivalent - 1 No.
  - vi) Master trip relay type VAJH-13 - 1 No.
  - vii) Trip Circuit Supervision Relay type VAX 31 - 1 No.
  - viii) 8 Channel alarm annunciator - 1 Set
  - ix) ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUIT HEALTHY / SERVICE / TEST POSITION Indication Lamp - 7 Nos.
  - x) Surge Arrestor - 1 Set
- D) Common for all above feeders:
- i) Anti – pumping relay

E) Bus PT : 2 Nos. – each equipped with the following

The Bus PT shall be complete with  $\frac{6600}{\sqrt{3}}$  /  $\frac{110}{\sqrt{3}}$  /  $\frac{110}{\sqrt{3}}$  volts, 100 VA, Class 1.0 / 3P,

Cast Resin PT suitable for operation on 3 phase, 3 wire, 50 Hz AC system. The bus PT shall be complete with indicating lamps, Voltmeter with Selector Switch and all other accessories as required.

3.9 Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MV Switchboard to the switch-gear panels

DC Supply: 110V DC supply in each panel by duplicate feeders shall be made available from the station battery bank / Battery Charger / DCDB stated elsewhere. Hooking up with the station switchgear and other equipments is within the scope of the contractor and shall be done through cables.

3.10 All equipment, accessories and wiring shall have fungus protection. Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent the entrance of insects.

All surfaces shall be sand blasted, pickled and grounded as required to produce a smooth, clean surface free of scale, grease and rust.

After cleaning, the surfaces shall be given a phosphate coating followed by two coats of high quality primer and stove after each coat.

The switch gear shall be finished in RAL 7032 with two coats of epoxy paints

3.11 Notwithstanding whatever mentioned elsewhere in the document, following tests shall include but not necessarily limited to the following:

- (a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment.
- (b) All wiring and current carrying part shall be given appropriate high voltage test.
- (c) Primary current and voltage shall be applied to all instrument transformers.
- (d) Routine test shall be carried out on all equipment such as circuit breakers, instruments, transformers, relays and meters.

All tests shall be performed in presence of owner's representative.

Certified copies of all the tests carried out at the manufacturer's premises shall be furnished in three copies.

## CHECK LIST OF THE HT PDB CUM MCC

### **1.0 Buses:**

- 1.01 Bus-bar material :
  - 1.02 Bus-bar size :
  - 1.03 Minimum Clearance of bare bus and connections
    - (a) phase to phase - mm :
    - (b) phase to ground - mm :
  - 1.04 Bus-bar provided with
    - (a) Insulated Sleeve :
    - (b) Insulating barriers :
  - 1.05 Current Ratings
    - (a) Continuous (Amp) :
    - (b) 3-Second (KA rms) :
  - 1.06 Temperature rise over 45°C Ambient (°C) :
  - 1.07 Standard to which buses conform :
- ### **2.0 Vacuum Circuit Breakers:**
- 2.01 Make :
  - 2.02 Type & Service :
  - 2.03 Execution :
  - 2.04 Rated Voltage:
    - (a) Nominal :
    - (b) Highest :
  - 2.05 No of Poles :
  - 2.06 Frequency :

2.07	Current Ratings	:	
	(a) Rated current at Standard ambient	:	
	(b) 3-second thermal rating (KA rms)	:	
	(c) Momentary (KA rms)	:	
2.08	Temperature rise over 45°C ambient	:	°C
2.09	Interrupting Capacity	:	
	(a) Symmetrical- KA (rms) at rated voltage	:	
	(b) Asymmetrical (if any)- KA (rms)	:	
2.10	Making Capacity	:	
	(a) Peak KA	:	
	(b) RMS symmetrical	:	
2.11	Closing time	:	Cycle/mille-sec
2.12	Opening time	:	Cycle/mille-sec
2.13	No of breaks per phase	:	
2.14	Insulation level	:	
	(a) 1-Minute dry withstand (KV rms)	:	
	(b) Impulse withstand (KV Peak)	:	
2.15	Standard to which conforms	:	
2.16	No load mechanical operation	:	
2.17	Number of operation at rated current	:	
<b>3.00</b>	<b>Operating Mechanism</b>		
3.01	Type	:	
3.02	Trip free or fixed	:	
3.03	Charging Time	:	
3.04	Closing :	:	
	(a) Closing voltage	:	
	(b) Tripping voltage	:	
3.05	Allowable variation in Control Voltage	:	
	(a) Closing	:	

- (b) Tripping
- 3.06 Current required for Tripping :
- 3.07 No of auxiliary switch furnished :
- (a) Normally open
- (b) Normally close
- (c) Breaking Capacity :
- (d) Type
- (e) No of spare contacts furnished :
- (f) Are the auxiliary contacts convertible type :
- 3.08 Operation counter furnished or not :
- 3.09 Mechanical trip furnished or not :
- 3.10 Mechanical safety interlocks provided or not :
- 3.11 Breaker provided with service/test and isolated position :
- 3.12 Type of indication provided with above position :
- 3.13 Can cubicle door be closed when Breaker in service or not in test Position :
- 3.14 Impact for foundation design to include dead load plus impact values on opening at maximum interrupting rating :
- 3.15 Standard to which conforms :
- 4.0. Panel Assembly**
- 4.1 Dimensions (LXBXH) :

- 4.2 Approximate weight :
- 4.3 Material of construction and thickness :
- 4.4 Degree of protection of external enclosure :
- 4.5 Space for power cable termination :
- 4.6 Space for multicore cable termination :
- 4.7. Space Heater Yes/No
- (a) Thermostat controlled space heater furnished for each cubicle :
- (b) Rating :
- (i) Voltage :
- (ii) Watts :
- 4.8 Ground Bus
- (a) Material :
- (b) Size :
- 4.9 Wiring
- (a) Size of wire :
- (b) Insulation :
- (c) Voltage class :
- 4.10 Minimum space required for installation
- (a) Minimum rear space :
- (b) Minimum front space :

- 4.11 Current Transformer details :
- (a) Type :
- (b) Make :
- (c) Frequency & voltage :
- (d) Pole :
- (e) Protection Class :
- (f) Metering Class :
- (g) Rated burden :
- (h) Class of insulation :
- (i) Short time thermal rating :
- (j) Dynamic current rating :
- (k) Mounting :
- (l) IS .Standard to which conform :
- (m) CT ratio :
- (i) Incoming feeder :
- (ii) Transformer feeder :
- iii) Motor Feeder :
- iv) Capacitor Feeder :

- 4.12 Voltage Transformer :
- (a) Type :
- (b) Make :

- (c) Frequency & voltage :
- (d) Pole :
- (e) Accuracy class :
- (f) Rated burden :

- (g) Connection :
- (h) Class of insulation :
- (i) Mounting whether withdrawal type :
- (j) Standard to which conform :

- 4.13 Indicating lamp :
- Type :
- Make :
- Voltage :
- Wattage :



- 4.15 Fuses :
- Type :
- Make :
- Voltage :
- Rupturing Capacity :
- IS standard to which conforms :

**5.0. Tests**

- 5.1. Indicate the tests to be performed :
- (a) :
- (b) :
- (c) :
- (d) :
- (e) :
- :
- :

**6.0. General :**

- 6.1 Whether GA drawing submitted or not :
- 6.2 Technical literature submitted or not :

**4.0 415 V 2 Incomer & 1 Bus Coupler Multi panel PDB at Pump House**

4.1 The PDB is required to provide power to the auxiliary load and Main Lighting Distribution Board at the Sub-station and Pump House.

4.2 The PDB shall be suitable for 415 V ± 10%, 50 Hz ± 5%, 3 phase, 4 wire supply system. The incoming power shall be provided from the secondary side of the transformer through suitable size of cables.

4.3 The PDB shall be 2 mm CRCA sheet steel enclosed, floor mounted type, self supporting, fully compartmentalised, dust & vermin proof, cubicle pattern, non-draw out and modular in construction. It shall be finished painted with powder coated paint after necessary chemical treatment for rust free surfaces and application of anti rust chemical coating. The base frame of the panel shall be made of ISMC – 75 channel.

4.4 The PDB shall be dead front type with concealed type hinged doors at front and bolted covers at the rear. All hinged doors shall be interlocked with the respective switchgears such that the same cannot be opened while the feeder is ON.

4.5 It shall have rear access and the cable termination arrangement shall be provided at the rear of the respective feeder modules. For incomers, extended bus bars shall be installed preferably from the top of the panel as per respective specifications. The vertical dropper bus bars shall be placed in between two vertical aligned feeder modules.

4.6 The bus bar of PDB shall be spitted into two sections with one bus coupler in between. Each section will receive power through an incoming MCCB connected with the secondary side of the transformer

4.7 The bus bar for the PDB shall be TPN type, made of E91E grade Aluminium alloy insulated with 1.1KV grade heat shrink type PVC colour coded sleeve. The rating of the bus bar shall be 500 A for phases and 250 A for neutral. The current density of the bus bar shall not exceed 1Amp / sq mm. The bus bars shall be supported on non hygroscopic type resin moulded insulators and the distance between insulators shall be so designed to make the bus bar system capable of withstanding a short circuit fault current of 35 KA ( r.m.s. ) for 1 sec. The front bus bar chamber shall be fully shrouded to avoid accidental contact with the live bus bars.

The minimum clearance between bus bars and bus bar to earth shall be as per IS.

4.8 Incoming & Outgoing feeder termination shall be done with extended bus bar arrangement if required. The cable termination chamber shall be provided with cable supporting clamps. Each incoming MCCB shall receive 1 No. 1.1 KV grade 3½ core 300 sq mm XLPE insulated armoured aluminium cable. The control wiring of the panel shall be done with 1100 V grade PVC insulated 2.5 sq mm flexible copper wire with copper lugs and ferrule marking at each end.

All hinged door shall be earthed with flexible copper wire.

4.9 A continuous earth bus of size 50 x 8 mm and made of aluminium shall run throughout the length of the panel with drilled holes at the end for connecting the same with the station earth bus bar.

4.10 Feeder details with mounted components

The feeder details are as under:

4.11 250A incoming feeders 2 nos. each comprising of following components:

i)	415 V, 3 pole, 250 A, 35 KA MCCB fitted with microprocessor based O/L, short circuit, earth fault (Adjustable) and Shunt Trip Release.	1 no
No.		
ii)	96 sq mm, 0 – 250 A Ammeter with selector switch	1
No.		
iii)	96 sq mm, 0 – 500 V Voltmeter with selector switch	1
No.		
iv)	Current Transformer of ratio 250 / 5A, Class: 1.0, 10 VA	3
Nos.		
v)	Red, Yellow, Blue phase indicating lamp	3
Nos.		
vi)	MCCB ON / OFF / TRIP Indicating Lamp	3
Nos.		

.12 250A Bus coupler feeder one ( 1 ) number comprising of following components:

i)	415 V, 3 pole, 250 A, 35 KA MCCB without release	1
No.		
ii)	Bus Coupler ON / OFF Indicating Lamp	2
Nos.		

4.13 MCCB / MCB feeder 17 Nos. of following rating

i) a)	63 A TPN MCCB with Microprocessor based O/C & E/F releases (Adjustable O/L)	2
Nos.		

Nos.	b) ON / OFF / Trip Indicating Lamp (For each feeder )	6
Nos.	ii) a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases (Adjustable O/L)	9
Nos.	b) ON / OFF / Trip Indicating Lamp (For each feeder )	27
Nos.	ii) 32 A DP MCB	6

## 5.0 CONTROL DESK AND INSTRUMENT PANEL

### 5.1 General

For remote operation of motors and other feeders with all controls, indication and annunciation, one Control Desk and Instrument Panel shall be provided. The Control Desk shall be installed at the control room of pump house.

The control desk shall be made of 2mm thick CRCA sheet steel floor mounted, dust and vermin proof and suitable for indoor installation in tropicalised climate. The degree of protection for the control desk shall be IP-54. The Control Desk surfaces shall be degreased, derusted, pickled and phosphated to remove all grease, dust and dust particles and provide flawless smooth surface. After sheet treatment the Control Desk surface shall be applied with Powder coating finish paint of shade RAL 7032.

The Control Desk shall have two distinct surface, one vertical and one inclined horizontal. The vertical surface shall be provided with Annunciator, Meters, Instruments, mimic diagram etc. while the horizontal surface shall be fitted with control / selector switches, push button for actuators, indicating lamps etc. The horizontal surface shall be designed such that operating/control devices are placed suitably and within the easy operational reach of the operator.

The Control Desk shall generally comprise but not limited to the following:

#### ON VERTICAL FACE

- |    |  |   |                 |
|----|--|---|-----------------|
| a) | Digital Pressure Indicator ( for pump individual delivery & manifold ) | - | <b>As reqd.</b> |
| b) | <b>Digital Valve Position Indicator ( for Butterfly Valves )</b>       | - | <b>As reqd.</b> |
| c) | <b>Digital Water Level Indicator ( for IG water level )</b>            | - | <b>1 No.</b>    |

- d) **Digital Flow rate indicator, totaliser and recorder** - 1 Set
- e) **Multifunction meters type ELITE 445 or equivalent ( for HT PDB Incomers, HT PDB cum MCC incomers & 33 KV Incomers)** - 5 Nos.
- f) **96 sq mm ( 0 – 36 KV ), ( 0 – 8000 V ) & ( 0 – 500 V ) Voltmeter for Incomer of 33 KV Panel, HT PDB, HT PDB cum MCC, Bus PT Panels and Incomers of 415V PDB** - As reqd.
- g) **96 sq mm Ammeter ( for all feeders of HT PDB, HT PDB cum MCC except Bus Coupler & Bus PT ), 33 KV Feeders and Incomers of 415 V PDB** - As reqd.

- h) **Centrally located Microprocessor based Alarm Annunciator (adequate number of window ) with LED illuminated annunciator, solid state hooter for audio alarm, test, accept, reset push buttons etc.** - As reqd.

The annunciator shall be complete with all accessories as required to detect the fault signal of different parameters of the system

- i) **Glass Fibre illuminated Mimic Panel by LED depicting all P & I and electrical scheme as per system requirement** - 1 Set
- j) **Digital Clock** - 1 No.

All fault indication shall be on translucent plastic windows and these shall be clearly visible when the indicating LEDs are lighted.

The annunciator shall be provided with the following engraved facia :

- i) **HT Feeder Trip for over current & earth fault ( for all feeders ) / (over voltage / voltage unbalance for capacitor feeder & Incomer / under voltage for Motor feeders ) of HT PDB cum MCC and 33 KV Panels**
- ii) **PDB Feeder Trip for over current & earth fault ( for incomers )**
- iii) **Motor winding temperature high alarm & trip for all motors**
- iv) **Motor Bearing temperature ( DE & NDE ) high alarm & trip for all motors**
- v) **Pump Bearing temperature ( DE & NDE ) high alarm & trip for all pumps**
- vi) **IG water Level low ( alarm )**
- vii) **IG water Level low Low ( trip )**
- viii) **IG water Level high ( alarm )**
- ix) **AC failure**
- x) **Bell for alarm signals**

**xi) Hooter for trip signals**

**Apart from above annunciation windows all other annunciation as are required and developed during detail engineering stage are to be provided with at least 6 nos. spare windows.**

**ON HORIZONTAL FACE**

- a) **Trip – Neutral – Close spring return type heavy duty breaker control switch (for all feeders of HT PDB, HT PDB cum MCC, 33 KG Feeders and other feeders )** - **As reqd.**
- b) **Open – Close – Off Push Button for valve actuators** - **As reqd.**
- c) **Clustered type indicating lamps for the following indication**
  - i) **AC Supply ON** - **1 No.**
  - ii) **DC Fail** - **1 No.**
  - iii) **ON – OFF – Trip ( for all feeders of HT PDB cum MCC and other feeders if applicable )** - **As reqd.**
  - iv) **ON – OFF for capacitor** - **As reqd.**
  - v) **Valve Full Open – Valve Full Close – Valve Running – Feeder OFF** - **As reqd.**
- d) **Test – Accept – Reset Push Button** - **3 Nos.**
- e) **Voltmeter Selector Switch** - **As reqd.**
- f) **Ammeter Selector Switch** - **As reqd.**

**6) CABLE ( SUBSTATION AND PUMPING STATION ) :**

**All HT and M.V. power cables shall be with XLPE insulation, stranded aluminium / copper conductor and armoured**

**6.01 HT & M.V. Cables and Jointing**

All HT and M.V. Cables shall be 33 KV ( E ) / 11 KV ( E ) / 1.1 KV grade XLPE insulated and armoured of Al / Cu. conductor 3 core / 3½ / 4 core as required. The core shall be stranded and the installation shall be suitable for the working condition. The cable wherever laid in underground trenches shall be of minimum 750 mm width x 750 mm average depth or with cable tray arrangement where necessary and in suitable size cable tray in the pump floor / Sub-station building / between Pump House & Substation Building. Where cable is laid in masonry trench, the cable trenches (where applicable) shall be filled up with sand or covered with chequered plate/RCC slab according to the direction of Engineer-in-Charge. Where necessary cables shall be supported on clamps of approved type and shall be properly protected with G.I. conduit or other protective covering as per direction of Engineer-in-Charge.

All Jointings should be of 'dry type' to be done with hydraulic crimping machine where applicable & done in accordance with the provision of I.E. rules. All jointing materials and other accessories shall be included in the quoted price.

6.02 Control cable and jointing

All Control cables shall be XLPE insulated of 1100 volts grade multi strand copper conductor and armoured of suitable size. The control cable should be terminated with proper sockets, glands etc. At least 2 cores shall be kept as spare in all control circuits.

6.03 Signal Cable

The signal cable shall be PVC insulated 650 / 1100 V grade screened and with stranded copper conductor of appropriate no. of cores as per scheme requirement. Minimum 2 cores shall be kept as spare in all circuits.

6.04 Data Sheet for Cables

HT & M.V. Cables

- i) Make
- ii) Voltage grade & type
- iii) Size

Control cable

- i) Make
- ii) Voltage grade & type
- iii) Size

Screened signal cable

- i) Make
- ii) Voltage grade & type
- iii) Size

**7) VALVES AND SPECIALS**

7.01 **Delivery side of pumps**

The delivery side of each pump shall be provided with 1 no. Electrical Actuator operated butterfly valve, 1 no. non-return valve with external damping arrangement, 1 no.

Dismantling joint & short pieces wherever required. The diameter of the valves and joints shall as per technical offer.

7.02

### **Non Return Valve**

The non return valve as mentioned here in before shall be manufactured conforming to IS: 5312 (Part-I) / equivalent international standard. The valves will be used for handling clear potable water to maintain the flow unidirectional. The valve shall be maintenance free, leak proof and shall have low life cycle cost. The PN rating of valves shall be 1.6.

The non return valve shall be single door and double flanged, conventional non slam design with external dashpot arrangement ( as per decision of EIC ) . The body, door, cover shall be of ductile iron (Gr. GGG 40). The seat and body shall withstand fluid pressure of 16kg / cm<sup>2</sup> and 24 kg / cm<sup>2</sup> respectively. The body seat, door face rings, bearing block, disc shaft, hinge pin, plug and fasteners shall be of SS 316. The bearings shall be suitable for maximum thrust imposed by the shaft during testing and in service.

The end connection shall be drilled flanged type as per IS or BS or equivalent standard. The non return valve shall have features for quick closing (up to 85%) and slow closing from 85 to 100%. It shall have by pass valve with cock. The valve shall be marked to indicate the direction of flow.

The design and construction of the non return valve shall be non slam type and the disc shall be so balanced that the it will not bump against the valve body while the pump is in operation.

The surface protection of the valve shall be done by either epoxy powder coating or epoxy painting (min. paint thickness - 250 micron) for both inside and outside.

All bolts and nuts for flange connection(s) of entire pipe line ( delivery & common manifold ) where applicable shall be of carbon steel having tensile strength 300 N/ mm<sup>2</sup>.

The valves are subject to satisfactory hydrostatic test at manufacture's works and in presence of the department's representative for acceptance.

7.02 1      Material or construction & other specifications of Non Return Valve shall preferably be  
as            follows:



Fluid to be Handled	:	Clear Water
Pressure Rating	:	PN 1.6
Design Temperature	:	45 Deg. C
Design Standard	:	IS 5312 ( Part – I ) / 84
Type of Disc	:	Single Disc ( Swing Type )
Closure Characteristic	:	Non – Slamming
Seating Faces	:	Metal to Metal
End Connection	:	IS 1538 / 93 ( Table – 4 & 6 ), Flat Face
Operation	:	Self
Installation	:	Horizontal
By Pass arrangement	:	Yes
Dashpot	:	External

#### Material of Construction

Body, Cover	:	Ductile Iron GGG 40
Disc with Hinge	:	Ductile Iron GGG 40
Body Seat Ring	:	L.T.B. to IS 318 Gr.2
Disc Face Ring	:	L.T.B. to IS 318 Gr.2
Hinge Pin	:	H.T.B. to IS 320 Gr. HT 2
Air Release Plug	:	Carbon Steel
Plug / Retainer	:	Carbon Steel
Gasket	:	Rubber, IS 638, Type: B
Bolts / Studs & Nuts	:	Carbon Steel, IS 1367/67 CI 4.6 & 4.0
Shaft	:	SS 410

<b>Testing</b>	<b>Inspection</b>
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Testing Standard : IS 5312(Part-I)/84		Hydro Test : Witness & Test Report	
Hydro Body : 24 Kg / Sq. Cm		Visual : Witness & Test Report	
Hydro Seat : 16 Kg / Sq. Cm		Material Test : Test Report	
<b>Quantity</b>		<b>Note</b>	
Size ( NB)	Qty.	Location	
As per BOQ	As per BOQ		<ol style="list-style-type: none"> <li>1. Valves shall have free acting, quick opening non-slam closure characteristic</li> <li>2. Reinforcing ribs are provided on body, cover &amp; disc.</li> <li>3. Flow direction mark shall be Cast Integrally on the body to indicate the Direction of flow</li> <li>4. Valves shall be painted with one coat of Red oxide primer &amp; Two coats of Epoxy Paint</li> <li>5. Marking: Brand / Size / PN – Rating / Heat No. &amp; Arrow Mark SI. No.</li> </ol>

The MOC of other accessories to complete the individual delivery piping like Y or T bends, flanged end short piece, flanged end enlarger/ reducer or any other components required to complete the job in all respect shall be MS as per IS 226.

#### NON – RETURN VALVE DATA SHEET

1.01 Make :

1.02 Size :

1.03 Quantity offered :

1.04	Type	:
1.05	Test standard, test pressure & duration of test	:
1.05.1	Body	:
1.05.2	Seat	:
1.06	Surface protection	:
1.07	Whether damping arrangement provided or not	:
1.08	Whether by pass arrangement provided or not	:
1.09	Face to face distance	:
2.00	Material of Construction	:
2.01	Body	:
2.02	Seat	:
2.03	Disc	:
2.04	Door Face Ring	:
2.05	Bearing Block	:
2.06	Disk shaft	:
2.07	Disk Seat	:
2.08	Hinge pin, plug, fasteners	:

### 7.03 Butterfly Valve

The butterfly valves shall be DIDF, PN 1.60, conforming to IS 13095 of 1996 / BS 5155. The seat pressure shall be 16 kg/cm<sup>2</sup> and body pressure shall be 24 kg/cm<sup>2</sup>. The valve shall operate smoothly & steadily in both direction, free from flow induced vibrations. The butterfly valve shall be double flanged, double eccentric design. The body, disc materials shall be of ductile iron (Gr. GGG 40). It should provide tight shut off closures & shall be suitable for frequent operation as well as from throttled duty conditions. The valve disk should rotate 90° from full open to full close. The valve disk shall be solid streamlined slab design, and to have minimum head loss. The seat ring shall be of stainless steel (SS) with micro finished nickel / Monel overlay. The seating shall preferably be integral. The disc seal shall be of elastomeric EPDM. The EPDM seal on the disc must be of easy replaceable type with the facility of replacement at site. The shaft bearings shall be medium free, steel backed PTFE / bronze and suitable for maximum axial thrust imposed by the shaft during testing and in service. The fasteners shall be of SS 304.. The valve shall have suitable and adequate capacity of gear box actuator with hand wheel and

indicating pointer. The gear box actuator unit shall be of so sealed type with necessary attachments such that external water do not enter the gear box housing to spoil the mechanism. The gear box shall be directly coupled to electrical actuators. The electrical actuators shall be complete with motor starter with reversing control gear, mechanical indication showing the amount of valve opening and shall have the following components.

- a) 415V  $\pm$  12.5% 3 phase, 50 Hz, AC motor.
- b) Reduction gearing arrangement.
- c) Torque & limit switch mechanism.
- d) Valve position indicator.
  
- e) Arrangements for pick up signals for displaying the % opening of the valves in the suitable meters to be placed on control desk
- f) The hand wheel with clutch mechanism for manual operation. The manual operation shall be automatically declutched when actuator motors in operation
- g) Motors shall be of outdoor construction, IP 68 protection group

The motors and gearing arrangement shall be of adequate to open and close the valve under full unbalance pressure and to overcome the seating torque. The torque switch should function as a full proof design by tripping the motor in case of over torque condition.

Material of construction & other specifications of Butterfly Valve shall preferably be as follows:

Fluid to be Handled	:	Clear Potable Water
Pressure Rating	:	PN 1.6
Design Temperature	:	(-) 10 <sup>0</sup> C to 65 <sup>0</sup> C
Design Standard	:	IS 13095 / 91
Service application	:	Tight shut-off
Type	:	Double Flanged Quarter Turn
Disc Type	:	Double eccentric
Seal ( Nitrile rubber )	:	Mounted on disc
End Connection	:	Flanged ends to IS 1538/93 ( Table-4 & 6 ), Flat Face
Operation	:	Actuator operated
Installation	:	Horizontal

### Material of Construction

Body, End Cover & Gland Plate	:	Ductile Iron GGG 40
Disc	:	Ductile Iron GGG 40
Shaft	:	SS to AISI 410
Body Seat	:	Nickel weld overlay micro finished
Bearing	:	G.M. / Teflon
Disc Seal	:	Nitrile Rubber ( Shore Hardness 55' – 65'A)
Packing	:	Rubber "O" Ring
Internal Fasteners & Clamping Ring	:	SS to AISI 304
External Fasteners	:	Carbon Steel, IS 1367 CI 4.6 & 4.0
Hand Wheel	:	Fabricated Steel
Worm Gear Unit	:	Manufacturer standard
Actuator	:	Yes

Testing ( as per IS 13095 /91 )			Inspection	
Hydro Body : 24 Kg / Sq. Cm for 5 min			Hydro Test	: Witness & Test Report
Hydro Seat : 16 Kg / Sq. Cm for 2 min			Visual	: Witness & Test Report
Disc Test : 16 Kg / Sq. Cm for 5 min			Material Test	: Test Report
Quantity			Note	
Size ( NB)	Qty.	Location		
As per BOQ	As per BOQ			

--	--	--	--

**MOTORISED BUTTERFLY VALVE DATA SHEET**

- 1.1 Make :
- 1.2 Size :
- 1.3 Quantity offered :
- 1.4 Type :
- 1.5 Test pressure & duration of test :
- 1.6 Material of Construction
  - 1.6.1 Body :
  - 1.6.2 Body seat :
  - 1.6.3 Seat Ring :
  - 1.6.4 Disk :
  - 1.6.5 Bonnet :
  - 1.6.6 Spindle :
  - 1.6.7 Disc nut :
  - 1.6.8 Gasket :
  - 1.6.9 Bolts & Nuts :
  - 1.6.10 Gland packing :
  - 1.6.11 Gland :

1.6.12 Spindle Nut	:
1.6.13 Handle wheel	:
1.6.14 Thrust plate	:
1.6.15 Cover	:
1.6.16 Face Rings	:
1.6.17 Yoke	:
1.7 Face to Face Distance	:

### **ELECTRICAL ACTUATOR**

1. The actuator motor for the Butterfly valves shall be suitable for use on  $415 \pm 10\%$  Volts, 3 phase, 50 HZ power supply and shall have high torque and low inertia squirrel cage motor having minimum class F insulated, 15 minutes rated and shall be with temperature sensing protection by a thermostat / thermistor directly embedded in all phases of the stator winding.
2. The actuator motor shall be provided with complete environmental protection during prolonged period of inactivity to prevent condensation and must have IP 68 degree of protection.
3. The actuator motor must have high starting torque and it shall be suitable for 60 Starts / hour. The actuator gear box assembly shall be of the totally enclosed oil bath lubricated type and shall be suitable for operation at any angle.
4. The actuator assembly shall have a mechanically independent hand wheel drive for emergency manual operation of the valve by declutching the actuator motor drive by integral lever or otherwise. The drive shall be restored to power drive mechanism automatically on starting of the actuator motor.
5. The actuator assembly shall be provided with following limit switches
  - i. torque limit switches for 'open' and 'close'
  - ii. Position limit switches

All switches shall have contact ratings of 10 amps at 250 volts AC inductive.
6. The actuator assembly shall have integral reversing contactor starter, local control facilities and terminals for remote control and indication circuit at remote end. The starter shall be both mechanically and electrically interlocked and shall have adequately rated contactors to suit the

actuator motor rating. The motor shall positively be protected from any earth leakage and single phasing. All electrical shall be mounted on a readily accessible printed circuit board to facilitate withdrawal of starter assembly without any electrical disconnection. Local control shall comprise of one pad lockable three position L/R selector switch and push button switches for open, close and stop. All external wire connections shall be within the scope of the contractor.

- 7 The actuator assembly shall have facilities to indicate the position of the valve in remote control desk (percentage opening of the valve). The actuator assembly shall have one mechanical dial indicator to indicate the position of the valve. In addition, end of travel indication shall be illuminated with red indicating valve open and green indicating valve closed. The valves and actuators are subject to satisfactory shop test at manufacture's works and PG test at site in presence of the department's representative for acceptance.

The electrical actuators shall have the following components.

- a) 415V  $\pm$  12.5% 3 phase, 50 Hz, AC motor.
- b) Reduction gearing arrangement.
- c) Torque & limit switch mechanism.
- d) Valve position indicator.
- e) Arrangements for pick up signals for displaying the % opening of the valves in the suitable meters to be placed on control desk.
- f) Remote operation facility with selector switch and local control console.
- g) The hand wheel with clutch mechanism for manual operation. The manual operation shall be automatically declutched when actuator motors in operation.
- h) Motors shall be of outdoor construction, IP 68 protection group suitable for continuous submergence.

The motors and gearing arrangement shall be of adequate to open and close the valve under full unbalance pressure and to overcome the seating torque. The torque switch should function as a full proof design by tripping the motor in case of over torque condition.

#### **DATA SHEET**

- 1.1 Make
- 1.2 Type
- 1.3 Rating of Motors
- 1.4 Whether provided with limit & Torque Switches, if so, torque limit
- 1.5 Protection Group (IP)



- 1.6 Whether suitable for outdoor & temporary submergence duty/indoor type
- 1.7 Whether equipped with suitable component & termination arrangement for transmitting signals for displaying valve opening % indicating in the valve opening indication meters.
- 1.8 I.S. Standard to which it conforms

### **8.0) M.S. DISMANTLING JOINT ASSEMBLY AT DELIVERY RISING MAIN**

One M. S. dismantling joint of suitable diameter is to be fixed along with the Flow meter & BFV on the delivery rising main for the ease of dismantling and fitting of Flow meter during maintenance and to relieve the pipe line stresses. The expansion range for each of the dismantling joint shall be minimum 40 – 50 mm. The M. S. dismantling joint shall be complete with long stud (SS 304) holding arrangements with split flange matching with the site requirement. The hydrostatic test pressure of the DJ shall be 16 kg/cm<sup>2</sup>.

The datasheet for the same is as follows-

#### **DATA SHEET**

- I. Joint Size
- II. Pipe thickness
- III. Maximum length
- IV. Minimum length
- V. O.D.
- VI. P.C.D.
- VII. Thickness
- VIII. Flange size
- IX. Flange thickness
- X. Stud Nos.
- XI. Stud dia.

XII. Rubber Gasket

### **M.S. PUDDLE COLLAR / PLATE**

- 1.1 Collar size
- 1.2 O.D.
- 1.3 I.D.
- 1.4 Thickness of the Collar
- 1.5 Number of Hooks

### **9.0) PUMP DELIVERY SIDE PIPING AND COMMON DELIVERY MANIFOLD**

The pump individual delivery side piping, valves and dismantling joints shall be of such diameter as per Technical offer.

One dismantling joint of respective diameter is to be fixed along with the Butterfly Valve & NRV on the individual delivery pipe line of each pump within a suitable distance on individual pump delivery pipe line..

The pipes shall be made up of M.S. 10 mm thick plates for individual delivery line & 12 mm thick plate for Common Delivery manifolds, painted both inside and outside by anticorrosive epoxy paints. The pipes shall be of welded joints and shall consist of necessary companion flanges so as to connect the piping with the DJ, NRV, BFV's of the individual pump delivery branch. The pump individual delivery side piping shall be connected to be common delivery manifold as per the layout. Necessary gaskets of suitable thickness shall have to be provided to all flange joints complete with all necessary nuts, bolts, washers etc. The length shall be ascertained from the layout and from the dimensions of the valves/specials. The tenderer should also provide the necessary arrangements to encounter the horizontal back thrust if any and the details as per the pump manufacture's recommendation shall be clearly indicated in the layout drawing.

The common delivery manifold shall of such diameter as per the Technical offer. The manifold shall be fabricated from 12 mm thick MS plates. The common manifolds within the Pump House and on the River Bank shall have blank flange / Dish end on both sides with adequate stiffening (as applicable). The length of the manifold shall be extended upto a suitable length. There shall be two nos. identical delivery mains ( MS 10 mm thickness ) from the Common Delivery Manifold in the Pump House and the same shall run over the Gangway over the river and upto the Common Delivery Manifold on the River Bank. This manifold shall be of identical diameter as inside Pump House ( MS 10 mm thickness ) of suitable length. From this CDM the rising main shall deliver the required water as per Sketch attached.

Each Delivery Man over the Gangway shall be provided with one no. 100 mm dia air release valve (double throat) one no. 100 mm dia. Sluice Valve ( wash-out ) and one no. NRV suitably placed. The pipe where ever laid underground shall be painted with anticorrosive paints at the inside and outside shall be wrapped and coated with anti corrosive tape of not less than 4mm thick so as to prevent the pipes from corrosion.

(Necessary surface finish for proper painting and wrapping coating shall be made by the contractor and careful laying shall be done so as to prevent damages during laying).

## **10.0) FLOW SENSOR**

There shall be one number of Full bore Electromagnetic flow meter on the rising main as per sketch attached. The flow meter is to be installed and commissioned for measuring the instant flow rates as well as the total flow for a period of time of the station passing throughout the common manifold. The flow rates shall be indicated in m<sup>3</sup>/hr & total flow in cubic meter. The flow sensor shall be suitable to measure Clear water. The flow meter shall be electromagnetic inline type to provide indication, totalization and signal transmission of the liquid. The display is

required at the Control Desk around 400 mtr. away from the transmitter installation point on the pipe line. Amplification of signals, if necessary, are to be incorporated. The flow meter must be capable of measuring velocity of water upto 3 m / sec with accuracy of  $\pm 0.5\%$ . Flow sensitivity must be  $\pm 0.3$  m/s at any flow rate. The linearity of the instrument shall be 0.1% of scale. The sensor must have enclosure of class IP-68. The tenderer shall clearly indicate the position of flow sensor. The data sheet for flow sensor is as follows.

The flow meter will be full bore electromagnetic type should be capable to handle flow of Clear Potable Water.

Type:- Pulsed DC electromagnetic.

Accuracy:-  $\pm 0.5$  % of measure value.

Repeatability:-  $\pm 0.2$  %

Size of flow meter:- As per designed diameter of the common delivery manifold.

Sensor type:- In line full bore electromagnetic.

Process connection:- Flanged type to IS 1538

Weather protection class:- IP68 NEMA 6 P or as per the specified by EIC.

Minimum conductivity:- 20 us/cm

Full scale velocity:- 1 to 5 m/sec.

Process temperature:- 50 °C max.

Process pressure:- 10 Bar max.

Electrodes:- SS 316 L/ SS 316.

Coil housing :- SS304

Flange MOC:- Carbon steel .

Flow sensor tube:- SS304

Cable between sensor and transmitter:- Copper cable of Length as per site condition

Flow transmitter:- Microprocessor based, wall mounted.

Type of display of transmitter:- Display should be LCD or LED type and the size should be suitable for making it visible from at least 6m distance.

Out put:- 4-20 mA DC

Power supply :- 240 V AC 50 Hz and shall be supplied from the PDB at a maximum distance of 50 m.

Input:- From flow tube

Web server:- The flow meter should be compatible for connection with web server for remote facility display facility.

Protection class :- IP 68.

Calibration shall be accredited according to ISO/IEC 17025.

#### **Data Sheet of Flow Sensor**

- 1.1 Make
- 1.2 Type
- 1.3 Model No.
- 1.4 Flow range
- 1.5 Accuracy
- 1.6 Display system
- 1.7 Relays
- 1.8 Power supply
- 1.9 Sensitivity
- 1.10 Details of cabling
- 1.11 Physical specification
- 1.12 Details of transmitter including installations details
- 1.13 Working temperature
- 1.14 Details of microprocessor if any

**11.0) Flow meter/ Flow sensor or Flow Tube fixing chamber**

For fixing of Flow Tube at the rising main , leak proof chamber with rung - ladder of dimension 2.5M x 1.5M x 2.5M ( approx )is to be constructed if required as per site condition.

**12.0) RADAR TYPE LEVEL MONITORING SYSTEM**

- 12.01 The radar level transmitter shall be equipped with K- band ( 25 GHZ ) pulse radar level transmitter for continuous monitoring of sump level and a hand held programmer. The 25 GHZ frequency shall create a narrow focused beam allowing for a smaller horn antenna and decreasing sensitivity to obstruction.
- 12.02 The transmitter shall be securely mounted on the pump floor platform. It shall be capable to monitor the sump level continuously. Range of measurement from LWL to HWL shall be around 10 Mtr. with provision of ALARM function of the operating pumps at HWL & LWL and Trip function at LLWL.
- 12.03 The transmitter shall have ingress protection of IP 67 / 68. Mounting arrangement shall be included in the scope of work.
- 12.04 The cable connection between transmitter and the controller ( to be mounted on the Control Desk ) shall be carried out by PVC wire 0.5sq mm copper conductor shielded screened cable and the same shall preferably run in a grounded metal conduit. The controller shall have communication ports with Modbus protocol so as to communicate the field data for interfacing with SCADA in future.
- 12.05 The signal output shall be 4 – 20 mA and accuracy level shall be  $\pm 0.25\%$ .
- 12.06 The field ( hand held ) programmer shall be compatible with the transmitter. The transmitter / controller shall have memory backed up by in-built battery. All displays shall be back-lit LED type.
- 12.07 Auxiliary AC / DC power supply, if required, shall be provided with the system.

**13.0) DISMANTLING JOINT FOR INDIVIDUAL DELIVERY**

One dismantling joint of respective diameter is to be fixed along with the Butterfly Valve & NRV on the individual delivery pipe line of each pump within a suitable distance on individual pump delivery pipe line..

**14.0) EARTHING ( FOR SUBSTATION & PUMPING STATION )**

The total installation shall be effectively earthed by providing a ring main earthing. Each earthing set shall consist of one G.I. pipe of not less than 2" dia and 10' length. The electrode shall be buried below the ground upto the depth of moist earth which shall not be less than 8'-0" from ground level and must be 6'-0" away from any building structure. The bottom portion of the electrodes shall be properly perforated and one cast iron cap properly screwed of approved type and design and shall be fitted on the top of the

electrode, connection leads to the earth bus inside the station. After fixing and drawing out of the earth leads, the top portion of the earth, electrode upto 1 ft. shall be properly brick pitched and shall be fitted with water proof bituminous compound. The connecting lead shall be GI strip 75 x 8 mm and shall be laid at a depth of not less than 600 mm from ground level. The leads shall be connected to GI earth bus bar inside the pumping station by means of proper welds. The nos. of individual earthing connected to the Earth bus should such that after installation the earth resistance of the system must be well below one ohm.

One GI bus bar 100 mm wide and 10 mm thick shall be provided so that the frames of all electric motors, switch gears, transformers and other electrical accessories and installation shall be connected to this station earth bus by two separate GI strip of adequate dimension. All metallic cover frames, equipments, installation etc. shall be earthed to the full satisfaction of Engineer-in-charge and the Govt. Electrical Inspector.

The earthing and bonding shall be according to the I.E. Rules 1956 with ammendment of 1990. All non current carrying metal parts associated with H.V. installation shall be effectively earthed to the grounding system to achieve:

- a) Limit the touch and step potential to tolerable values;
- b) Limit the ground potential rise to tolerable values so as to prevent danger due to transfer of potential through ground, earth wires, cable sheath etc.
- c) Maintain the resistance of the earth connection to such a value as to make operation of the protective device effective.

The same must be approved by the Govt. Electrical Inspector and shall pass the statutory tests.

The successful tenderer shall have to submit the detailed and fully dimensioned drawing of the whole electrical system showing the proper earthing duly approved by the Govt. Electrical Inspector before commencement of the actual installation work.

The distance between each individual Earthing should not be less than 3 meters.

## **15.0) LIGHTING SYSTEM ( SUBSTATION AND PUMPING STATION )**

### **15.01 Luminaries**

The scope includes indoor lighting of pump house and substation building. Industrial Medium bay luminaries with Metal 250W / LED 150W lamps are to be provided in a row alternatively in the beams at each of the pump house ceiling. Motor/ Operating floor lighting should be provided with LED T/L industrial type fixtures and to be fixed on the wall at a level above the lintel. The positions are to be finalized as per requirement and direction of the E.I.C. The illumination level would be 150 Lux.

The Control Room, lighting should be provided with LED T/L with decorative type fixtures with reflectors tentatively 2X18W with watt cool day light type (Brilliant White). Illumination level would be 200-250 Lux.

In the corridors, toilet, LED T/L with are to be provided to generate an illumination level of 150 Lux.

All the entrance/exists of pump house shall be provided with LED down lighter or bracket mounted fittings with LED lamps of minimum 45 W as per site condition ( minimum 90W for unloading bay entrance).

**15.02 WIRING**

All wiring installation work must be as per relevant I.S. with proper distribution network, M.C.B. are to be used in distribution boxes and there must be colour segregation for power/netural/ground wires.

15.03 In strategic locations of the substation building / pump house, adequate number of 415 / 240 volt TPN / SPN MCB Distribution board shall be placed with multiple ways of different current rating (MCB ) along with a incoming switch from where power to be fed to different switch board.

15.04 Individual switch board shall comprise of multiple number of switch (6/10 Amps rated) as the case may be, which shall be used for switching 'ON' and "OFF' operation of the lights / fans / receptacles etc. The individual switch board shall be double door design so as to cover up the switch / regulator etc i.e. switches / regulator etc shall be accessible on opening the door cover.

15.05 The above stated distribution board shall be fed from independent switch fuse unit / MCB located in the PDB.

15.06 440 volt, 15 Amps and 240 volts/15 Amps socket outlet shall be provided where ever required and power shall be taken from the individual way of the distribution board.

15.07 The minimum required size of the conductor for internal distribution point wiring shall be as follows:

Sl. No	Type of fitting /wiring	Minimum size of wire
1.	Fluorescent fitting	2 nos. 1 core -1.5 mm <sup>2</sup> copper & 1 no. Earth wire of 1.0 mm <sup>2</sup> copper
2.	HPSV fitting	2 nos. 1 core -1.5 mm <sup>2</sup> copper & 1 no. Earth wire of 1.0 mm <sup>2</sup> copper
3.	Flood light fitting	2 nos. 1 core -2.5 mm <sup>2</sup> copper & 1 no. Earth wire of 1.0 mm <sup>2</sup> copper
4.	Receptacle-5A	2 nos. 1 core -2.5 mm <sup>2</sup> copper & 1 no. Earth wire of 1.0 mm <sup>2</sup> copper
5.	Receptacle-15A	2 nos – 1 core-4 mm <sup>2</sup> copper & 1 no Earth wire of 1.0 mm <sup>2</sup> copper

**16.0) Ventilation and Fire fighting :**

- 16.01 Ventilation: The entire pump house including all electrical rooms and the Sub Station Rooms shall have proper ventilation arrangement. The scope shall include the supply and fixing of following equipments complete with GI conduit wiring including all other accessories as required.
- a) 3 - phase 450 dia, 1000 / 1500 r.p.m. (Syn) or as applicable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for the Pump House .
  - b) 300 dia, 1000 / 1500 r.p.m. (Syn), Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for the Sub-station
  - c) Wall mounting type control panel for ventilation system ----- 2 Sets
  - e) 18" Pedestal fan with regulator and all other accessories --- 4 Nos.
- 16.02 Fire fighting: The pump house and substation building shall be provided with the following:
- a) ABC type Portable type fire extinguisher (2 Kg Capacity) consisting of welded cylinder, squeeze lever discharge valve, internal discharge tube, discharge nozzle suspension bracket, duly charged and pressurized with ISI marked.
  - b) ABC stored pressure type fire extinguisher 5 Kg capacity with discharge hose and nozzle and consisting of welded cylinder, squeeze lever discharge valve, internal discharge tube, discharge nozzle suspension bracket, duly charged and pressurized with ISI marked.
  - c) Dry type fire extinguisher 5 Kg capacity with discharge hose and nozzle and consisting of welded cylinder, squeeze lever discharge valve, internal discharge tube, discharge nozzle suspension bracket, duly charged and pressurized with ISI marked.
  - d) Fire buckets (9 litre capacity) made from 24 SWG GI Sheet including wall mounting bracket and filling of sand.

### 17.0) Pressure transducer / Pressure Sensor with Local Display

- i. The pressure transducer / pressure sensor shall be used to indicate, record the
  - a. individual pump discharge line water pressure, manifold line pressure. The recording instrument unit (indicator unit) shall be mounted in the control desk cum instrument panel.
- ii. The transducer / sensor shall be field mounting type **with local display** and most reliable. It shall have protection for surge and over voltage in both positive and reverse polarity. The pressure port shall be from stainless steel and shall be 100% leak proof.
- iii. The accuracy of the sensors/ transducers shall be  $\pm 0.25\%$  full scale



- iv. It shall have output signal option of 4 -20 mA and shall have requisite power supply.
  - a. The enclosure shall be with required length of interconnecting cable so that the same can be fed to a recorder/ indicator unit located in central control desk. If for transmission of such signal, any signal conditioner and or any signal booster is necessary, the same shall be incorporated within the offered cost.
- v. The entire process connection is the responsibility of the contractor and the offered
  - a. Rate shall include all such field requirements like watertight joint box, additional cable length etc to complete the job in all respect.
- vi. The scope of this itemized job is all inclusive of SITC of complete transducer/ sensor Sets (field mountable) including recorder units (desk mountable) with all associated signal transmission cabling (specified elsewhere) works in one length including all other accessories within the offered cost for the specific item.

## **18.0) Pressure Gauge (Dial Type)**

18.01 The individual discharge line pressure gauge (6" dial) shall be of bourdon type.

The bourdon tube shall be of SS 316. The gauge shall have cast aluminium weather proof case and casing shall be black stove enameled. The accuracy shall be of  $\pm 1\%$ . The full scale range shall be from 0 -16 Kg / Sq.cm. The pressure gauge shall have 3 way cock and fitting.

## **9) OVERHEAD CRANE ( PUMP HOUSE )**

19.01 Electrically Operated Travelling Crane

The E.O.T. Crane will be 10.0 M.T. capacity Electrically Operated Travelling Crane (E.O.T.) with 1T auxiliary hoist, suitable for inching operation with a lift from the operating floor level and up to the level above the installed motors. The long travel & the Cross Travel of the crane would be as per attached layout drawing. Suitable type of Crain rails, girders and all other accessories as necessary for Installation and operation of the crane are to be designed & provided by the contractor within the lump sum quoted amount. The two travels of the main hoists i.e Long, Cross and the hoisting operation must be electrically operated. Limit switches for long, cross travel & hoisting are to be provided for protection. The braking arrangement should be Electro Hydro-Thrustor Brake for the hoisting operation & may be disc type for the travels. The buffers must be spring loaded operation. The speed and other parameters are as follows :-

Speed of Hoisting : 4 to 5 m/min.

Speed of Cross Travel : 10 to 12 m /min.

Speed of long travel : 12 to 15 m/min.

Type of brake : Electro Hydro- Thrustor Brake for hoist  
& disc type for the Travel.

Motor : Crane Duty, SQ. Cage, Duty Category- S4, Class-F.

The EOT Crane should be tested at manufacturer's works / site as per relevant IS. The same will be witnessed by the EIC. The Contractor has to arrange for such testing at his own cost. Test Certificate issued from the approved authority is to be submitted.

## **SECTION - J**

### **List of Vendors**

<b>Sl. No.</b>	<b>Equipment</b>	<b>Make</b>
01.00	Pump	Kirloskar / Mather & Platt / WPIL Ltd.
02.00	Motor	Siemens / ABB / Marathon
03.00	Control Desk / PDB	Siemens / Sellwin / ABB/Schneider / PCE Projects/ Bhartiya Cutler Hammer / System & Control (I) Pvt. Ltd.
04.00	ACB/MCCB	L&T / Siemens / ABB / Schneider
05.00	Fuse Switch Unit	L&T / Siemens / ABB / Schneider
06.00	Breaker control switch	Kaycee / Recom / Alstom
07.00	Relays	Schneider / ABB / ER/ Siemens(Reyrolle)
08.00	Contactator	L&T/ Siemens / ABB / Schneider
09.00	Meters	AE / IMP / Enercon/ Secure
10.00	Cable :	
10.01	HT & LT Cable	Gloster / Polycab / Havells / UCL
10.02	Control / Signal Cable	Gloster / Polycab / Havells / UCL

11.00	Pressure Transmitters	Siemens / ABB / Honeywell
12.00	Digital Indicators	Micro System / Mecos
13.00	Temperature Scanner	Pecon/ Micro System / Laxon / Chino / Masuka Instruments Pvt. Ltd.
14.00	Radar type Level Monitoring System	Siemens / Khrono / Rosemount
15.00	Flow meter & Recorder Indicator, Totaliser	Krohne / Endress Hauser/ ABB / Siemens
16.00	Control Fuses	GE/Siemens / L & T
17.00	Current Transformer	Kappa /JAWS / Schneider
18.00	Capacitor	Universal / L&T / Epcos
19.00	Butterfly Valves, Non-Return Valve & Sluice Valve	VAG / IVC / Kirloskar / Fluidtech
20.00	Valve Actuators	Rotork / Auma
21.00	Pressure Gauges	Bell / Taylors / H. Guru
22.00	Fire Extinguishers	Surex / Minimax / Cease Fire / Fire Shield
23.00	Submersible Pump	KSB / Calama / Kirloskar
24.00	Air Conditioner	Carrier / LG / Voltas / Hitachi
25.00	Lighting system	
26.01	Light Fitting	Philips / Bajaj
26.02	Wire	Finolex / KDK / Havells
26.03	Switches	Anchor / Havells / Cab
27.00	Ventilation System	P.N. Chakraborty & Co. / Universal Air System / PASCO
28.00	Exhaust Fan / Ventilation Fan	Alstom / EPC / Pasco / Marathon
29.00	Crane	Surekha / Pilcare / India Engineering & Implements Co.
30.00	H.T. Switchgear	Siemens / Schneider / ABB

31.00	Power Transformer	Schneider / KEC/ Voltamp (Vadodara) / CGL
32.00	Battery	Exide
33.00	Battery Charger	Caldyne / Electro Service

**Superintending Engineer**

**NAME OF WORK: DESIGN, ENGINEERING, SUPPLY, STORAGE, INSTALLATION, COMMISSIONING, TRIAL RUN & FIVE YEARS OPERATION & MAINTENANCE OF CLEAR WATER PUMPING STATION OF CAPACITY 51200 M<sup>3</sup> / DAY AND POWER DISTRIBUTION SYSTEM LOCATED AT DAMRA ( JAMURIA ), DISTRICT – BURDWAN UNDER ASANSOL MUNICIPAL CORPORATION**

**SCOPE OF WORK AND PRICE SCHEDULE**

Sl. No.	Description of Items	Qty	Unit	Rate (Rs.)	Amount (Rs.)
	<b><u>PART-A1 (SUPPLY PART FOR SUBSTATION )</u></b>				
)	Supply, delivery at site and storage of 3 panel,26.2 KA 33KV indoor type H.T. Vacuum Circuit Breaker as per specification with all inter connection	1	Set		
)	Supply, delivery at site and storage of 3150 KVA, 33 KV / 6.6 KV ONAN indoor type Transformers with neutral brought out as per technical specification and				

	all accessories complete.	2	No.		
)	Supply, delivery at site and storage of 6.6 KV HT PDB as per specification with all inter connection				
)	Supply, delivery at site and storage of 7.20 KV Capacitor – Reactor – RVT Panel for improvement of power factor of adequate rating as per specification and Technical Offer	1	Lot		
)	Supply, delivery at site and storage of 200 KVA, 6.6 / 0.433 KV, AN, indoor, Dry type Transformers with neutral brought out as per technical specification and all accessories complete.	2	Nos.		
)	Supply, delivery at site and storage of multi panel 400A, 415V PDB connected with the secondary side of 200 KVA transformers suitable for operation at 415 volt, 3 phase, 50 Hz AC system with all interconnection complete as per specification	1	Set		
)	Supply, delivery at site and storage of 110 V, 100Ah, sealed maintenance free battery comprising of 55 nos., 2 Volts cells with float and boost charger cum DCDB	1	Set		
00	Supply, delivery at site and storage of H.T., M.V. and Control Cable as per specification & as follows :				
<b>8.01</b>	<b>HT Cable</b>				
a)	From WBSEDCL's Summation Panel to incoming panel of 33 KV HT Switchgear, 33 KV (E ) grade, 300 sq mm dia AL conductor, XLPE				
<b>286</b>	<b>INFILTRATION GALLERY &amp; WELL ALONG WITH OTHER ALLIED WORKS AT DAMRA FOR JAMURIA AREA UNDER AMRUT 2.0 SCHEME WITHIN ASANSOL MUNICIPAL CORPORATION</b>				

		insulated, armoured cable as per Specification	1	Lot		
	b)	From 33 KV HT Switchgear to two number of 3150 KVA Transformer HV side terminal of 33 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		
	c)	From two numbers of 3150 KVA transformer secondary side to the two numbers of Incomers of 6.6 KV HT PDB Panel, 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		
	d)	From 6.6 KV HT PDB to two numbers of 200 KVA HV side Terminal of 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		
	e)	From outgoing feeder of 6.6 KV HT PDB to Capacitor – Reactor – RVT Panel, 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	1	Lot		
	f)	From two nos. of outgoing feeders to the two nos. of 6.6 KV HT PDB cum MCC at Pump House (IG), 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		
<b>8.02</b>	<b>MV Cable</b>					
	a)	From two nos. of 200 KVA transformer secondary side to the two number of 400A incomers of 415 V PDB 1.1 KV grade, 3.5 C, 300 sq mm, Al. conductor, XLPE insulated armoured cable as per specification & direction of EIC	2	Lot		
	b)	From each of the 250 A outgoing MCCB of 415 V PDB to respective incoming MCCB of PDB at Pump House ( IG ) , 1.1 KV grade, 3.5 C, 300 sq mm, Al. conductor, XLPE insulated armoured cable as per specification & direction of EIC	2	Lot		
	c)	From 400 A PDB at Substation to Battery Charger, 1.1 KV grade, 4C 2.5 sq mm stranded copper conductor XLPE insulated armoured cable	1	Lot		
	d)	From Battery Charger / DCDB to 33 KV Panel at substation, 1.1 KV 3C, 2.5 sq mm stranded				

		Copper conductor XLPE insulated armoured cable	2	Lot		
	e)	From Battery Charger / DCDB to 6.6 KV PDB at substation, 1.1 KV 3C, 2.5 sq mm stranded Copper conductor XLPE insulated armoured cable	2	Lot		
	f)	From 400 A PDB at Substation to Exhaust Fan Control Panel , 1.1 KV grade, 4C 6 sq mm stranded copper conductor XLPE insulated armoured cable	1	Lot		
	g)	From 400 A PDB at Substation to Lighting DB , 1.1 KV grade, 4C 6 sq mm stranded copper conductor XLPE insulated armoured cable	2	Lot		
	h)	From 400 A PDB at Substation to 33 KV Panel , 1.1 KV grade, 3C 2.5 sq mm stranded copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
	i)	From 400 A PDB at Substation to 6.6 KV PDB , 1.1 KV grade, 3C 2.5 sq mm stranded copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
	k)	From 400 A PDB at Substation to 250 A PDB at Pump House , 1.1 KV grade, 3.5C 300 sq mm Al. conductor XLPE insulated armoured cable for AC supply	2	Lot		
	l)	From DCDB at Substation to DCDB at Pump House , 1.1 KV grade, 3C 6 sq mm stranded copper conductor XLPE insulated armoured cable for AC supply	2	Lot		
<b>8.03</b>	<b>Control Cable</b>					
	a)	Stranded copper conductor of various ratings and of suitable sizes as per specification for all control, indication and interlocking circuit at Substation including Control Desk at Pump House ( IG )	1	Lot		



9.0	Supply, delivery at site and storage of Jointing materials as per specification & as follows					
	a)	All H.T. Cable jointing materials ( dry type, Heat Shrink joint )	1	Lot		
	b)	All M.V. Cable jointing materials of different cross sections ( dry type)	1	Lot		
	c)	All Control & Screen Cable jointing materials for different cross sections ( dry type)	1	Lot		
10.0	Supply, delivery at site and storage of earthing equipment as per specification and all other equipments required to comply with latest IE Rules		1	Lot		
11.0	Supply, delivery at site and storage of Lightning Arrestor along with earth strip and earth electrodes all complete as per specification and all other equipment required to comply with latest I.E. Rules		1	Lot		
12.0.	Supply, delivery at site & storage of fire extinguishers and fire buckets as follows:					
	a)	A-B-C Type ( 5 Kg. each )	5	No.		
	b)	CO <sub>2</sub> Type ( 4.5Kg. each )	5	No.		

3.0.	Supply, delivery at site and storage of Misc. Item such as rubber mats, Shock Treatment Chart ,Danger Boards, sand buckets, Glow Sign Board etc. as per specification		1	Lot		
4.0	Supply, delivery at site and storage of spare parts as per specification		1	Lot		
	<b><u>PART-A2 (SUPPLY PART FOR PUMPING STATION)</u></b>					
)	Supply, delivery at site & storage of vertical turbine pumps with column assembly, discharge head, sole plate, motor stool and all other accessories all complete of suitable capacity and TDH as per specification and Technical offer. Maximum allowable speed of pump shall be 1500 R.P.M.		1	Lot		

)	Supply, delivery at site & storage of MS pipes, specials, joints, flanges & common delivery manifold ( CDM) with extended pipe line as per specification and Technical offer.	1	Lot		
)	Supply, delivery at site & storage of valves complete with fixture as per specification and Technical offer & as follows.				
i)	Butterfly valve for delivery side of pumps fitted with electrical actuator suitable for local and control desk operation and display system for the individual pump delivery pipe line	1	Lot		
ii)	Non-Return Valve for individual pump delivery pipe line	1	Lot		
iii)	Butterfly valve fitted with electrical actuator suitable for local and control desk operation and display system for delivery rising main	1	No.		
iv)	Double throat air valve with Isolating Valve at delivery rising main as per specification	2	No.		
v)	Non-rising Sluice valve for wash-out ( on each delivery line between Common Manifold at Pump House and Common Delivery Manifold at River Bank)	2	No.		
vi)	Non-Return valve (on each delivery line between Common Manifold at Pump House and Common Delivery Manifold at River Bank)	2	No.		
)	Supply, delivery at site and storage of M.S. dismantling joint assembly for delivery rising main as per specification and Technical offer	1	No.		
)	Supply, delivery at site and storage of M.S. dismantling joint assembly for the individual pump delivery pipe line as per specification and Technical offer.	1	Lot		

	Supply, delivery at site and storage of M.S. puddle collar / plate for each delivery line between CDM at Pump House to CDM at River Bank as per specification	2	No.		
	Supply, delivery at site and storage of Full bore electromagnetic type Flow meter, Recorder, Totaliser as per specification and Technical offer.	1	Item		
	Supply, delivery at site and storage of Pressure gauges complete with fittings and fixture as per specification and Technical offer & as follows.				
	a) Pressure gauge for Delivery side on each pump (0– 16 Kg / cm <sup>2</sup> )	1	Lot		
	b) Pressure gauge for each delivery main from CDM and rising main (0 – 16 Kg / cm <sup>2</sup> )	3	No.		
	Supply, delivery at site and storage of pressure transmitter and level indicator complete with fitting and fixture as per specification and Technical offer & as follows.				
	a) Pressure transmitter for delivery side on each pump ( 0 – 16 Kg / cm <sup>2</sup> )				
	b) Pressure transmitter for each delivery main from CDM and rising main (0 – 16 Kg / cm <sup>2</sup> )	3	No.		
	c) Radar type Level Monitoring system for Pump House (IG ) Water Level complete with all accessories	1	No.		
0.	Supply, delivery at site and storage of Vertical squirrel-cage TEFC / CACA motor rated at 6600V ±10%, 50Hz ±5%, 3Ph, 1500 R.P.M.(syn.) of adequate capacity to match the pump at sl. no. 1) complete with coupling hub and all other accessories as per specification & Technical offer ( Rating not less than 530 KW )	1	Lot		
1.	Supply, delivery at site and storage of multi panel HT PDB cum MCC of 800 A capacity suitable for operation at 6600 Volt, ± 10%, 3 phase, 50Hz, ± 5%, A.C. system as per specification and Technical offer	1	Set		
2.	Supply, delivery at site and storage of 415 V PDB of 250A capacity at Pump House, suitable for operation at 415 Volts, ±10%, 3 Phase, 50 Hz, ±5% AC system as	1	Set		

	per specification				
3.	Supply, delivery at site & storage of Remote Control Desk & Instrument panel for the motor control, Power Distribution & other system as per specification and Technical offer	1	Set		
4.	Supply, delivery at site & storage of DCDB at Pump House as per specification	1	Set		
5.	Supply, delivery at site and storage of Control Panel for exhaust fans	1	Set		
6.	Supply, delivery at site and storage of HT, M.V. and Control Cable as per specification & as follows :				
	a) From HT PDB cum MCC to respective Motor Terminals, 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable, complete for all the motors.	1	Lot		
	b) From DCDB at Pump House to HT PDB cum MCC, 1.1 KV grade, 2 x 3 C, 2.5 sq mm stranded copper conductor XLPE insulated armoured cable for DC supply ( Duplicate feeder )	1	Lot		
	c) From DCDB at Pump House to Control Desk, 1.1 KV grade, 3C 2.5 sq mm Multi strand copper conductor XLPE insulated armoured cable for DC supply	1	Lot		
	d) From 415 V PDB to. LDB at pump House, 1.1 KV 4C, 6 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		
	e) From 415V PDB to all Valve Actuators, 1.1 KV, 4C, 2.5 / 4 sq mm Multi strand copper conductor XLPE insulated armoured cable	1	Lot		
	f) From 415 V PDB to all motor Space Heaters, 1.1 KV 3C, 2.5 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		

	g)	From 415 V PDB to E.O.T. Crane, 1.1 KV 4C, 6 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		
	h)	From 415 V PDB to Control Desk, 1.1 KV, 3C, 2.5 sq mm Multi strand copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
	i)	From 415 V PDB to H.T. PDB cum MCC, 1.1 KV 3C, 2.5 sq mm Multi strand Copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
	j)	From 415 V PDB to Control Panel for Exhaust Fans, 1.1 KV 4C, 6 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		
	k)	From 415 V PDB to Pressure Transmitter & Flow Transmitter / Indicator, 650 / 1100 V 4C 0.75 sq mm Screen Cable	1	Lot		
	l)	From Control Desk to each Motor RTD / BTD Terminal Box, 650 / 1100V grade 1.5mm PVC insulated stranded copper screened armoured cable, complete for all the motors	1	Lot		
	m)	Control Cable for AC & DC supply of stranded copper conductor of various sizes & grade and of suitable length as per specification for all remote control, indication and interlocking circuits	1	Lot		
17.	Supply, delivery at site and storage of Jointing materials as per specification & as follows					
	a)	All H.T. Cable jointing materials ( dry type )	1	Lot		
	b)	All M.V. Cable jointing materials ( dry type)	1	Lot		
	c)	All Control & Screen Cable jointing materials (dry type)	1	Lot		
18.	Supply, delivery at site and storage of materials for Earthing system as per current I.E. Rule & specification for all equipment		1	Lot		

19.	Supply, delivery at site and storage of Lightning Arrestor along with earth strip and earth electrodes all complete as per specification and all other equipment required to comply with latest I.E. Rule	1	Lot		
20.	Supply, delivery at site & storage of fire extinguishers and fire buckets as follows:				
	a) Dry Powder ( 5Kg. each )	3	No.		
	b) ABC Type ( 5 Kg. each )	3	No.		
	c) ABC Type ( 2 Kg. each ) portable	2	No.		
	d) Fire Bucket ( 9 Litres )	6	No.		
21	Supply, delivery at site and storage of Ventilation System comprising of Exhaust fans complete with cowl etc. at the pump house all complete as per specification.	1	Set		
22.	Supply, delivery at site and storage of M.S. Structural materials for cable tray / rack, panel installation supports, Pipes & valves supports, fabricated stairs & all other fabrication work.	1	Item		
23.	Supply, delivery at site and storage of all luminaries, fittings, fixtures complete with necessary cables with wires and all other accessories for inside lighting of pump house including Lighting Distribution Boards as per specification.	1	Item		
24.	Supply, delivery at site and storage of Misc. Item such as rubber mats, Shock Treatment Chart ,Safety Signage, Glow Sign Board etc. as per specification	1	Item		
25.	Supply, delivery at site and storage of 10 T capacity E.O.T. Crane with 1 T capacity auxiliary hoist suitable for inching operation with other allied equipment all complete as per specification	1	Item		
26.	Supply and delivery at site and storage of spare parts as per specification	1	Item		

<b><u>PART-B1 ( INSTALLATION PART FOR SUBSTATION )</u></b>					
)	Installation at site of 3 panel, 26.2 KA 33KV indoor type H.T. Vacuum Circuit Breaker as per specification with all inter connection	1	Set		
)	Installation at site of 3150 KVA, 33 KV / 6.6 KV ONAN indoor type Transformers with neutral brought out as per technical specification and all accessories complete.	2	No.		
)	Installation at site of 6.6 KV HT PDB as per specification with all inter connection	1	Set		
)	Installation at site of 7.20 KV Capacitor – Reactor – RVT Panel for improvement of power factor of adequate rating as per specification and Technical Offer	1	Lot		
)	Installation at site of 200 KVA, 6.6 / 0.433 KV, AN, indoor, Dry type Transformers with neutral brought out as per technical specification and all accessories complete.	2	No.		
)	Installation at site of multi panel 400A 415 V PDB connected with the secondary side of 200 KVA transformers suitable for operation at 415 volt, 3 phase, 50 Hz AC system with all interconnection complete as per specification	1	Set		
)	Installation at site of 110 V, 100Ah, sealed maintenance free battery comprising of 55 nos., 2 Volts cells with float and boost charger cum DCDB	1	Set		
.00	Installation / Laying at site of H.T., M.V. and Control Cable as per specification & as follows :				
<b>.01</b>	<b>HT Cable</b>				
a)	From WBSEDCL's Summation Panel to incoming panel of 33 KV HT Switchgear, 33 KV (E ) grade, 300 sq mm dia AL conductor, XLPE insulated, armoured cable as per Specification	1	Lot		
b)	From 33 KV HT Switchgear to two number of 3150 KVA Transformer HV side terminal of 33 KV(E) grade 3C 300 sq mm Al. conductor, XLPE				

		insulated armoured cable as per specification	2	Lot		
c)		From two numbers of 3150 KVA transformer secondary side to the two numbers of Incomers of 6.6 KV HT PDB Panel, 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		
d)		From 6.6 KV HT PDB to two numbers of 200 KVA HV side Terminal of 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		

e)		From outgoing feeder of 6.6 KV HT PDB to Capacitor – Reactor – RVT Panel, 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	1	Lot		
f)		From two nos. of outgoing feeders to the two nos. of 6.6 KV HT PDB cum MCC at Pump House (IG), 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable as per specification	2	Lot		
<b>8.02</b>	<b>MV Cable</b>					
a)		From two nos. of 200 KVA transformer secondary side to the two number of 400A incomers of 415 V PDB 1.1 KV grade, 3.5 C, 300 sq mm, Al. conductor, XLPE insulated armoured cable as per specification & direction of EIC	2	Lot		
b)		From each of the 250 A outgoing MCCB of 415 V PDB to respective incoming MCCB of PDB at Pump House ( IG) , 1.1 KV grade, 3.5 C, 300 sq mm, Al. conductor, XLPE insulated armoured cable as per specification & direction of EIC	2	Lot		
c)		From 400 A PDB at Substation to Battery Charger, 1.1 KV grade, 4C 2.5 sq mm stranded copper conductor XLPE insulated armoured cable	1	Lot		
d)		From Battery Charger / DCDB to 33 KV Panel at substation, 1.1 KV 3C, 2.5 sq mm stranded Copper conductor XLPE insulated armoured cable	2	Lot		



e)	From Battery Charger / DCDB to 6.6 KV PDB at substation, 1.1 KV 3C, 2.5 sq mm stranded Copper conductor XLPE insulated armoured cable	2	Lot		
f)	From 400 A PDB at Substation to Exhaust Fan Control Panel , 1.1 KV grade, 4C 6 sq mm stranded copper conductor XLPE insulated armoured cable	1	Lot		
g)	From 400 A PDB at Substation to Lighting DB , 1.1 KV grade, 4C 6 sq mm stranded copper conductor XLPE insulated armoured cable	2	Lot		
h)	From 400 A PDB at Substation to 33 KV Panel , 1.1 KV grade, 3C 2.5 sq mm stranded copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
i)	From 400 A PDB at Substation to 6.6 KV PDB , 1.1 KV grade, 3C 2.5 sq mm stranded copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
k)	From 400 A PDB at Substation to 250 A PDB at Pump House , 1.1 KV grade, 3.5C 300 sq mm Al. conductor XLPE insulated armoured cable for AC supply	2	Lot		
l)	From DCDB at Substation to DCDB at Pump House , 1.1 KV grade, 3C 6 sq mm stranded copper conductor XLPE insulated armoured cable for AC supply	2	Lot		

<b>8.03</b>	<b>Control Cable</b>				
a)	Stranded copper conductor of various ratings and of suitable sizes as per specification for al control, indication and interlocking circuit at Substation including Control Desk at Pump House ( IG )	1	Lot		
9.0	Installation at site of Jointing materials as per specification & as follows				

	a)	All H.T. Cable jointing materials ( dry type, Heat Shrink joint )	1	Lot		
	b)	All M.V. Cable jointing materials of different cross sections ( dry type)	1	Lot		
	c)	All Control & Screen Cable jointing materials for different cross sections ( dry type)	1	Lot		
10.0		Installation at site of earthing equipment as per specification and all other equipments required to comply with latest IE Rules	1	Lot		
11.0		Installation at site of Lightning Arrestor along with earth strip and earth electrodes all complete as per specification and all other equipment required to comply with latest I.E. Rules	1	Lot		
12.0.		Supply, delivery at site & storage of fire extinguishers and fire buckets as follows:				
	a)	A-B-C Type ( 5 Kg. each )	5	No.		
	b)	CO <sub>2</sub> Type ( 4.5Kg. each )	5	No.		
13.0.		Installation at site of Misc. Item such as rubber mats, Shock Treatment Chart ,Danger Boards, sand buckets, Glow Sign Board etc. as per specification	1	Lot		
14.0		Carrying out heat run of HT & MV equipments, dehydration of Transformer oil and making ready all HT / MV equipment for High / Medium pressure testing as per rule	1	Job		
15.0		Carrying out statutory high pressure testing on all HT equipment & medium pressure testing on MV equipments as per specification including charges of Govt. Inspector	1	Job		
16.0		Charges for Diesel Generator set / Temporary power connection from WBSEDCL / CESC for construction purposes	1	Job		
17.0		Testing the whole installation & submission of test reports as per specification & direction of EIC	1	Job		
18.0		Commissioning the whole installation including trial run for 30 days on load operation as per specification	1	Job		

	& direction of EIC				
19.0	Operation & maintenance of all electrical appliances installed in the substation for a period of five year with adequate number of working personnel for round the clock operation as per requirement and as per specification & direction of EIC	60	Month		

	<b><u>PART-B2 ( INSTALLATION PART FOR PUMPING STATION )</u></b>				
1)	Installation at site of vertical turbine pumps with column assembly, discharge head, sole plate, motor stool and all other accessories all complete of suitable capacity and TDH as per specification and Technical offer. Maximum allowable speed of pump shall be 1500 R.P.M.	1	Lot		
2)	Installation at site of MS pipes, specials, joints, flanges & common delivery manifold ( CDM ) with extended pipe line as per specification and Technical offer.	1	Lot		

	Installation at site of valves complete with fixture as per specification and Technical offer & as follows.				
i)	Butterfly valve for delivery side of pumps fitted with electrical actuator suitable for local and control desk operation and display system for the individual pump delivery pipe line	1	Lot		
ii)	Non-Return Valve for individual pump delivery pipe line	1	Lot		
iii)	Butterfly valve fitted with electrical actuator suitable for local and control desk operation and display system for delivery rising main	1	No.		
iv)	Double throat air valve with Isolating Valve at delivery rising main as per specification	2	No.		
v)	Non-rising Sluice valve for wash-out ( on each delivery line between Common Manifold at	2	No.		

		Pump House and Common Delivery Manifold at River Bank)				
	vi)	Non-Return valve (on each delivery line between Common Manifold at Pump House and Common Delivery Manifold at River Bank)	2	No.		
		Installation at site of M.S. dismantling joint assembly for delivery rising main as per specification and Technical offer	1	No.		
		Installation at site of M.S. dismantling joint assembly for the individual pump delivery pipe line as per specification and Technical offer.	1	Lot		
		Installation at site of M.S. puddle collar / plate for each delivery line between CDM at Pump House to CDM at River Bank as per specification .	2	No.		
		Installation at site of Full bore electromagnetic type Flow meter, Recorder, Totaliser as per specification and Technical offer.	1	Item		
		Installation at site of Pressure gauges complete with fittings and fixture as per specification and Technical offer & as follows.				
	a)	Pressure gauge for Delivery side on each pump (0– 16 Kg / cm <sup>2</sup> )	1	Lot		
	b)	Pressure gauge for each delivery main from CDM and rising main (0 – 16 Kg / cm <sup>2</sup> )	3	No.		
		Installation at site of pressure transmitter and level indicator complete with fitting and fixture as per specification and Technical offer & as follows.				
	a)	Pressure transmitter for delivery side on each pump ( 0 – 16 Kg / cm <sup>2</sup> )	1	Lot		
	b)	Pressure transmitter for each delivery main from CDM and rising main (0 – 16 Kg / cm <sup>2</sup> )	3	No.		
	c)	Radar type Level Monitoring system for Pump House (IG ) Water Level complete with all accessories	1	No.		
0.		Installation at site of Vertical squirrel-cage TEFC / CACA motor rated at 6600V ±10%, 50Hz ±5%, 3Ph, 1500				

	R.P.M.(syn.) of adequate capacity to match the pump at sl. no. 1) complete with coupling hub and all other accessories as per specification & Technical offer (Rating not less than 530 KW )	1	Lot		
1.	Installation at site of multi panel HT PDB cum MCC of 800 A capacity suitable for operation at 6600 Volt, $\pm 10\%$ , 3 phase, 50Hz, $\pm 5\%$ , A.C. system as per specification and Technical offer	1	Set		
2.	Installation at site of 415V PDB of 250A capacity at Pump House, suitable for operation at 415 Volts, $\pm 10\%$ , 3 Phase, 50 Hz, $\pm 5\%$ AC system as per specification	1	Set		
3.	Installation at site of Remote Control Desk & Instrument panel for the motor control, Power Distribution & other system as per specification and Technical offer	1	Set		
4.	Installation at site of DCDB at Pump House as per specification	1	Set		
5.	Installation at site of Control Panel for exhaust fans	1	Set		
6.	Installation / laying at site of HT, M.V. and Control Cable as per specification & as follows :				
	a) From HT PDB cum MCC to respective Motor Terminals, 11 KV(E) grade 3C 300 sq mm Al. conductor, XLPE insulated armoured cable, complete for all the motors.	1	Lot		
	b) From DCDB at Pump House to HT PDB cum MCC, 1.1 KV grade, 2 x 3 C, 2.5 sq mm stranded copper conductor XLPE insulated armoured cable for DC supply ( Duplicate feeder )	1	Lot		
	c) From DCDB at Pump House to Control Desk, 1.1 KV grade, 3C 2.5 sq mm Multi strand copper conductor XLPE insulated armoured cable for DC supply	1	Lot		
	d) From 415V PDB to. LDB at pump House, 1.1 KV 4C, 6 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		

	e)	From 415V PDB to all Valve Actuators, 1.1 KV, 4C, 2.5 / 4 sq mm Multi strand copper conductor XLPE insulated armoured cable	1	Lot		
	f)	From 415V PDB to all motor Space Heaters, 1.1 KV 3C, 2.5 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		
	g)	From 415V PDB to E.O.T. Crane, 1.1 KV 4C, 6 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		
	h)	From 415V PDB to Control Desk, 1.1 KV, 3C, 2.5 sq mm Multi strand copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
	i)	From 415V PDB to H.T. PDB cum MCC, 1.1 KV 3C, 2.5 sq mm Multi strand Copper conductor XLPE insulated armoured cable for AC supply	1	Lot		
	j)	From 415V PDB to Control Panel for Exhaust Fans, 1.1 KV 4C, 6 sq mm Multi strand Copper conductor XLPE insulated armoured cable	1	Lot		
	k)	From 415V PDB to Pressure Transmitter & Flow Transmitter / Indicator, 650 / 1100 V 4C 0.75 sq mm Screen Cable	1	Lot		
	l)	From Control Desk to each Motor RTD / BTD Terminal Box, 650 / 1100V grade 1.5mm PVC insulated stranded copper screened armoured cable, complete for all the motors	1	Lot		
	m)	Control Cable for AC & DC supply of stranded copper conductor of various sizes & grade and of suitable length as per specification for all remote control, indication and interlocking circuits	1	Lot		
17.	Installation at site of Jointing materials as per specification & as follows					
	a)	All H.T. Cable jointing materials ( dry type )	1	Lot		
	b)	All M.V. Cable jointing materials ( dry type)	1	Lot		

	c)	All Control & Screen Cable jointing materials (dry type)	1	Lot	
18.		Installation at site of materials for Earthing system as per current I.E. Rule & specification for all equipment	1	Lot	
19.		Installation at site of Lightning Arrestor along with earth strip and earth electrodes all complete as per specification and all other equipment required to comply with latest I.E. Rule	1	Lot	

20.		Installation at site of fire extinguishers and fire buckets as follows:			
	a)	Dry Powder ( 5Kg. each )	3	No.	
	b)	ABC Type ( 5 Kg. each )	3	No.	
	c)	ABC Type ( 2 Kg. each ) portable	2	No.	
	d)	Fire Bucket ( 9 Litres )	6	No.	
21.		Installation at site of Ventilation System comprising of Exhaust fans complete with cowl etc. at the pump house all complete as per specification.	1	Set	
22.		Installation at site of M.S. Structural materials for cable tray / rack, panel installation supports, Pipes & valves supports, fabricated stairs & all other fabrication work.	1	Item	
23.		Installation at site of all luminaries, fittings, fixtures complete with necessary cables with wires and all other accessories for inside lighting of pump house including Lighting Distribution Boards as per specification.	1	Item	
24.		Installation at site of Misc. Item such as rubber mats, Shock Treatment Chart ,Safety Signage, Glow Sign Board etc. as per specification	1	Item	
25.		Installation at site of 10 T capacity E.O.T. Crane with 1 T capacity auxiliary hoist suitable for inching operation			

	with other allied equipment all complete as per specification	1	Item		
28..	Painting the whole installation as per specification & direction of E.I.C.	1	Job		
29.	Carrying out pre-commissioning test on H.T & M.V equipments and making ready all H.T. & M.V. equipment for High/Medium pressure tests and submission of test reports	1	Job		
30	Carrying out Statutory High pressure tests on all H.T. equipment & medium pressure testing on M.V. Equipments as per specification including charges of Govt. Electrical Inspector.	1	Job		
31.	Charges for Diesel Generator set/Temporary power connection from CESC for construction purpose.	1	Job		
32.	Commissioning the whole installation including Trial Run of Pumps for one month with 8 hrs. at a stretch operation as per specification & direction of E.I.C.	1	Job		
33.	Operation & Maintenance of the whole installation for a period of five years ( after trial run ) deploying adequate number of working personnel for round the clock operation as per requirement, specification & direction of E.I.C.	60	Months		
				<b>TOTAL</b>	



## APPENDIX - I

### Data / Documents to be Furnished

#### LIST OF DATA / DOCUMENTS TO BE FURNISHED WITH THE OFFER (TECHNICAL BID)

- 1.0 Flow and Head calculation for Pump selection
- 2.0 Calculation for selection of size of valves and pipes
  
- 3.00 PUMP**
  - 1.01 Characteristic curve of the pump H-Q, Q-N, Q-P, Q-NPSHR, containing the logo of the pump manufacturer & signature of the authorised Signatory of the pump manufacturer and seal.
  - 1.02 Copy of the printed family curve of the pump manufacturer, with multiplication factor, if any, for the pump offered.
  - 1.03 Pump H – Q curve duly superimposed on the system curve
  - 1.04 Pump G.A. drawing with load datas.
  - 1.05 Pump foundation details with due consideration of dynamic loading and vibration.
  - 1.06 Arrangement details for pump pre lubrication, if required.
  - 1.07 Pump Data Sheet / Check list
  - 1.08 Authorisation letter from Pump Manufacturer addressed to TIA authorising the tenderer to submit Bid with their pump.
  
- 4.00 MOTOR**
  - 2.01 Motor Data Sheet / Check List
  - 2.02 GA Drawing
  
- 5.00 Check List for HT PDB cum MCC, PDB, Capacitor – Reactor
  
- 6.00 Check list for Butterfly Valve, Non – Return Valve, DMJ, Puddle Collar / Plate

## APPENDIX - II

### Data / Documents / Drawings to be Furnished

#### LIST OF DATA / DOCUMENT / DRAWINGS ETC. TO BE FURNISHED BY THE SUCCESSFUL TENDERER

- 1.01 Pump – Motor GA and sectional drawing with part no., Data Sheets
- 1.02 Pump house layout drawing with load data.
- 1.03 Single line diagram of the electrical system and earthing.
- 1.04 Cable schedule and termination chart.
- 1.05 GA details of H.T. PDB cum MCC, 415 Volt MV Switchboard & PDB, Control Desk & instrumentation panel.
- 1.06 GA & Sectional drawing with part nos. for Butterfly valves & Non – Return valve
- 1.07 Schematic power wiring drawings (both H.V. & M.V.), panel wise.
- 1.08 Schematic Control Wiring drawings panel wise.
- 1.09 Purchase order references of individual equipments.
- 1.10 List of authorised service centres of individual equipment.
- 1.11 List of special tools & tackles required for effective installation & maintenance, if any
- 1.12 As – Built drawing with Installation, operation, maintenance manuals for major equipments.
- 1.13 Design calculation for earthing system and Earthing layout
- 1.14 Completion drawings ( As built ) for all electrical circuit diagrams, layout drawing.
- 1.15 Details/type of bearings of pump & motor.
  
- 1.16 P&I diagram of the system.
- 1.17 Calculations for selecting the final ratings of capacitors from approved Motor drawing

**APPENDIX - III**  
**List of Spare Parts**

**PUMPING STATION**

- 1      **Pump**
  - i)    One set complete rotating assembly.
  - ii)   Driving and Non-driving end bearing for one pump.
  
- 2      **Motor**
  - i)    Driving & Non-driving end Bearings for one motor - 1 set.
  
- 3      **Vacuum Circuit Breaker**
  - i)    Trip coil                    - 2 Nos.
  - ii)   Closing coil                - 2 nos.
  - iii)  TNC Breaker Control Switch – 2 Nos.
  - iv)  Indication Lamps – 12 Nos.
  
- 4      **PDB and Control Desk**
  - i)    63 A MCCB – 1 No.
  - i)    32 A MCCB – 3 Nos.
  - ii)  Indication lamps – 12 nos.
  
- 5      **Relays**

Type P225 or equivalent - 1 no.  
Type P127 or equivalent - 1 No.  
Type VAJH-13                    - 1 no.  
Type VAX –31                    - 1 no.
  
- 6      **Instruments**

Volt meter - 2 nos.  
Ammeter - 2 nos.

**7. Miscellaneous Items**

- i) One Steel Almira of adequate size as directed by EIC
- ii) One steel Table with 4 ( four ) numbers of steel chairs

**SUB-STATION**

**1. Vacuum Circuit Breaker**

- i) Trip coil - 5 Nos. ( 33 KV – 2 Nos., 6.6 KV – 3 Nos. )
- ii) Closing coil - 5 nos. ( 33 KV – 2 Nos., 6.6 KV – 3 Nos. )
- iii) TNC Breaker Control Switch – 5 Nos. ( 33 KV – 2 Nos., 6.6 KV – 3 Nos. )
- iv) Indication Lamps – 12 Nos. ( 33 KV – 4 Nos., 6.6 KV – 8 Nos. )

**2. MV Switchboard and Control Desk**

- i) 63 & 32 A TP MCCB - 1 No. each
- ii) Indication lamps – 12 nos.

**3. Relays**

- Type P127 or equivalent - 1 No.
- Type P122 or equivalent - 1 No.
- Type VAJH-13 - 1 no.
- Type VAX –31 - 1 no.
- Type CDG – 11 - 1 No.

**4. Instruments**

- Volt meter - 2 nos.
- Ammeter - 2 nos.

5. **Miscellaneous Items**

- i) One Steel Almira of adequate size as directed by EIC
- ii) One steel Table with 4 ( four ) numbers of steel chairs

Chairman

**TYPICAL LAYOUT OF 33KV SUBSTATION**



**Section – K**

**ANNEXURES**

**ANNEXURE – I**

**SOIL / SAND INVESTIGATION REPORT FOR COLLECTOR WELL STRUCTURE**

Soil / sand investigation report will be prepared by agency after receiving of work order. Bidder will take his own survey at the site. The safer values to be taken while designing the foundation. All the survey and design shall be duly approved from IIT Kharagpur / Jadavpur University / IEST Shibpur.

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## **ANNEXURE - II**

### **LIST OF DOCUMENTS TO BE FURNISHED**

List of instruments supplied by bidders have to be furnish by bidders and will be uploaded in Technical Document 2 folder with digital signature.

1. Pump thrust bearing housing details.
2. Pump non-reverse ratchet details.
3. Finally approved pump house layout with load data.
4. Finally approved single line diagram of the electrical system and earthing.
5. Cable schedule and termination chart.
6. GA details of L.T. Board at pumping and substation.
7. Schematic power wiring drawings (M.V), panel wise.
8. Schematic Control Wiring drawings panel wise.
9. List of authorized service centres of individual equipment.
10. List of special tools & tackles required for effective installation & maintenance.
11. Installation, operation, maintenance manuals for all equipment.
12. Completion drawings for all electrical circuit diagrams, layout Terms & Conditions. (The drawings etc. shall be furnished on transparency along with the copies mentioned).



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ANNEXURE – III

LIST OF TOOLS OF ELECTRICAL EQUIPMENT

Supplied by the bidder

Sl. No.	Description of Item	Quantity & Make
<b>A</b>	<b>Mechanical instrument</b>	
01.	Double Ended Spanner (6 mm to 25 mm)	3 Sets
02.	Screw Driver (6 mm to 25 mm)	3 Sets
<b>B</b>	<b>Sliding Pipe Wrench</b>	
03.	150 mm	3 Nos.
04.	250 mm	3 Nos.
05.	350 mm	3 Nos.
06.	Hand Drill (6 mm to 19 mm)	3 Nos.
07.	H.S. Drills (1.5 mm to 10 mm)	3 Nos.
08.	Round Rough File 350 mm	3 Nos.
09.	Flat Rough File 350 mm	3 Nos.
10.	Steel Tape 2 Meter	3 Nos.
11.	Hacksaw 300 mm	3 Nos.
<b>C</b>	<b>Hammer with handle</b>	
12.	1 kg	3 Nos.
13	2.5 kg	3 Nos.
14.	Cold Chisel 200 mm x 20 mm	3 Nos.
15.	Centre Punch	3 Nos.
16.	Engineering Square 200 mm	3 Nos.
17.	Spirit Level	3 Nos.
<b>D</b>	<b>Electrical Equipment</b>	
18	Multi Range Tong Tester	1 No.
19	500V Meggar	1 No.

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**ANNEXURE - V**

**LIST OF DEVIATIONS**

The Bidders are advised to fill up the list of deviations, they indicate/sought for in their offer, showing the specifications & the deviations wanted backed by all clarifications & justifications.

If there is no deviation sought, the Bidder must indicate NIL in the list.

Sl. No.	Items	Details as per Bid specification	Details of the offer	Reason for which such deviation sought for with technical backup


**Signature of Bidder**

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**ANNEXURE – VI**

**HYDRAULIC SURVEY REPORT BY BIDDER**

Hydraulic Investigation to be done by the bidder by any reputed Govt. organisation.

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**ANNEXURE – VIII**

**TENTATIVE SITE PLAN AND LAY-OUT PLAN OF COLLECTOR WELL**

Lay out plane of proposed Collector well, foot way bridge, Pumping station & L.T. Sub Station located at Damra for Jamuria, within Asansol Municipal Corporation, Paschim Bardhaman District, will be submitted by agency within one month from the date of receiving of work order.

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