

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

e-mail ID : sewestcircle1@gmail.com



Memo No. :- MED/SE(W)/574/W-268/2022

Dated:-21.02.2024

NOTICE INVITING e-TENDER

Notice Inviting e-Tender No: 30 of SE (WC)/MED/2023-24

The Superintending Engineer, West Circle, Municipal Engineering Directorate, Patal Bazar, 3rd Floor, Tinkonia, Purba Bardhaman, Pin 713101 on behalf of the Governor of West Bengal invites sealed competitive Bid on Turnkey Basis (Two part System) from reliable, bonafied and resourceful Companies / Firms / Contractors having experience and acumen in construction work in Govt. / Board / Semi Govt. / Municipality/ Corporation / Statutory Authority /Govt. undertaking etc. as noted below the eligibility and depicted hereunder for participating in the e-Bid.

1) Name of the Work:-

General Nomenclature of work: Planning, Design, Construction, and Commissioning of different capacity of Clear Water Reservoir , Pump House with Electrical Sub Station building & Extension of existing Pump House, CWR (if any) with Interconnection of pipe around Pump House, sub soil investigation along with all other allied works (Civil & Electro-mechanical works & others, if any) including 3(three) months trial run and necessary training of maintenance staff and thereafter 5 (FIVE) years operation and maintenance of the whole system with security and guarding arrangement at mentioned Pump House and extension of Clear water pump house for requisite nos. pumps including pipe connection around existing mentioned pump house for Water Supply Scheme under AMRUT 2.0 within Asansol Municipal Corporation on Turnkey Basis.

(Please refer Table No-1 for List of Works)

2) Table No: 1

Sl. No.	Name of the work	Department al Tentative Cost including O&M (Rs. In Crore)	Earnest Money (Rs.)	Period of Completion of the work	Annual Turnover	Bank Solvency
1	Planning, Design, Construction, and Commissioning of 3050 cu. m capacity Clear Water Reservoir , Pump House with Electrical Sub Station building & Extension of existing Pump House, CWR (if any) with Interconnection of pipe around Pump House, sub soil investigation along with all other allied works (Civil & Electro-mechanical works & others, if any) including 3(three) months trial run and necessary training of maintenance staff and thereafter 5 (FIVE) years operation and maintenance of the whole system with security and guarding arrangement at Kendulia Pump House and extension of Clear water pump house for required nos. of pumps including pipe connection around existing Sirishdanga pump house at Jamuria area for Water Supply Scheme under AMRUT 2.0 within Asansol Municipal Corporation. on Turnkey Basis .	16.90	Initial Earnest money of ₹ 5.00 Lakh & Balance Earnest Money Deposit i.e. @2% of bid amount beyond ₹5.00lakh (if any) shall have to be deposited after acceptance of Bid Proposal by the L1 bidder.	400 days	Rs. 5.00 Crore	Rs. 4.00 Crore
2	Planning, Design, Construction, and Commissioning of 1900 cu. m capacity Clear Water Reservoir , Pump House with Electrical Sub Station building & Extension of existing Pump House, CWR (if any) with Interconnection of pipe around Pump House, sub soil investigation , along with all other allied works (Civil & Electro-mechanical works & others, if any) including 3(three) months trial run and necessary training of maintenance staff and thereafter 5 (FIVE) years operation and maintenance of the whole system with security and guarding arrangement at Gangutia Pump House and Extension of CWR and pump house for required nos. of pump including pipe connection at existing CWR at existing Neamatpur Pump House at Kulti area for Water Supply Scheme under AMRUT 2.0 within Asansol Municipal Corporation on Turnkey Basis .	17.90	Initial Earnest money of ₹ 5.00 Lakh & Balance Earnest Money Deposit i.e. @2% of bid amount beyond ₹5.00lakh (if any) shall have to be deposited after acceptance of Bid Proposal by the L1 bidder.	365 days	Rs. 6.00 Crore	Rs. 5.00 Crore
3	Planning, Design, Construction, and Commissioning of 700 cu. m capacity Clear Water Reservoir , Pump House with Electrical Sub Station building & Extension of existing Pump House , CWR (if any) with Interconnection of pipe around Pump House, sub soil investigation, Boundary wall, Guard Room , along with all other allied works (Civil & Electro-mechanical works & others, if any) including 3(three) months trial run and necessary training of	10.50	Initial Earnest money of ₹ 5.00 Lakh & Balance Earnest Money Deposit i.e. @2% of bid amount	300 days	Rs. 3.00 Crore	Rs. 2.00 Crore

	maintenance staff and thereafter 5 (FIVE) years operation and maintenance of the whole system with security and guarding arrangement at Dumping Ground Pump House and Extension of CWR and pump house for required nos. of pump including pipe connection at existing CWR at existing Rabinsen Pump House for Water Supply Scheme under AMRUT 2.0 within Asansol Municipal Corporation on Turnkey Basis .		beyond □5.00lakh (if any) shall have to be deposited after acceptance of Bid Proposal by the L1 bidder.			
4	Augmentation/ Modification of Electro-mechanical works related to Clear Water Pump House and existing pumps including 3(three) months trial run and necessary training of maintenance staff and thereafter 5 (FIVE) years operation and maintenance of the whole system for Water Supply Scheme under AMRUT 2.0 within Asansol Municipal Corporation on Turnkey Basis at following locations: (i) Bhutaburi Existing GLR, (ii) Polo Ground Existing GLR, (iii) Ismile Existing GLR, (iv) Barachak Existing GLR, (v) Dihika Existing GLR, (vi) KSTP Existing GLR, (vii) Barakar Existing GLR (viii) Ramnagar Existing GLR.	36.00	Initial Earnest money of □ 5.00 Lakh & Balance Earnest Money Deposit i.e. @2% of bid amount beyond □5.00lakh (if any) shall have to be deposited after acceptance of Bid Proposal by the L1 bidder.	300 days	Rs. 12.00 Crore	Rs. 8.00 Crore

3) Eligibility criteria and other details:

- N.B. If any Bidder participates in more than one work, required credential should also be cumulative in nature

1.	Scope of Work in Brief	<ul style="list-style-type: none"> • Planning, Design, Construction, and Commissioning of different capacity of Clear Water Reservoir , Pump House with Electrical Sub Station building & Extension of existing Pump House, CWR (if any) with Interconnection of pipe around Pump House, • Sub soil investigation • Boundary Wall & Guard Room • Other allied works viz. Civil & Electro-mechanical works • Extension of Clear water pump house for requisite nos. pumps • Pipe connection around proposed/existing pump house • 3(three) months trial run and necessary training of maintenance staff • 5 (FIVE) years operation and maintenance of the whole system with security and guarding arrangement. <p>N.B. The Contractor shall have cube testing machine at the site for Sl. No. 1 to 3</p>
2.	Location of Works: (As per Table No. – 1)	(i)Kendulia, Sirishdanga at Jamuria, (ii) Gangutia, Neamatpur at Kulti (iii) Dumping Ground, Rabinsen at Raniganj iv) Bhutaburi Existing GLR, Polo Ground Existing GLR, Ismile Existing GLR, Barachak Existing GLR, Dihika Existing GLR, KSTP Existing GLR, Barakar Existing GLR & Ramnagar Existing GLR within Asansol Municipal Corporation.

3.	Eligibility to participate in the Bid	<p>(i) Intending tenderers should produce credentials of a similar nature of work of the minimum 40% of the Value in a single tender above, during 5(five) years prior to the date of issue of this tender notice; (N.B. for Sl. No.-4: The Bidders having credential of Electro-mechanical works along with Civil works viz. WTP,IG with Intake well, Sub station or similar shall also be eligible for the bid.) OR</p> <p>(ii) Intending tenderers should produce credentials of 2(two) similar nature of work, each of the minimum 30% of the Value during 5(five) years prior to the date of issue of the tender notice; (N.B. for Sl. No.-4: The Bidders having credential of Electro-mechanical works along with Civil works viz. WTP,IG with Intake well, Sub station or similar shall also be eligible for the bid.)</p>												
		<p style="text-align: center;">OR</p> <p>(iii) Intending tenderers should produce credentials of one single running work of similar nature which has been completed to the extent of 80% or more and value of which is not less than the desired capacity at (i) above; In case of running works; only those tenderers who will submit the certificate of satisfactory running work from the concerned Executive Engineer or equivalent competent authority will be eligible for the tender. In the required certificate it should be clearly stated that the work is in progress satisfactorily and also that no penal action has been initiated against the executed agency, i.e., the tenderer. (N.B. for Sl. No.-4: The Bidders having credential of Electro-mechanical works along with Civil works viz. WTP,IG with Intake well, Sub station or similar shall also be eligible for the bid.)</p> <p style="text-align: center;">AND</p> <p>(v) Having annual turnover (in 3CB format or similar), of at least as per Table No -1 or above in any one year of last three Financial years from the issue of this NIT. AND</p> <p>(vi) Bank solvency as per Table No.-1 from any Indian scheduled / nationalized bank issued maximum 1 year prior from the last date of submission of the tender. AND</p> <p>(vii) Having valid Electrical License for 11 kV installation , Electrical Supervisory License AND</p> <p>(viii) GST, P. Tax Clearance Certificates and receipts (current), Income Tax Acknowledgement Receipt (Last 3 years), PAN Card, , Trade license, ESI and EPF registration etc. AND</p> <p>(ix) 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.</p>												
4.	Documents to be produced in support of Credential for Bid Part-I (Prequalification Documents)	<p>Valid documents in support of credibility in terms with eligibility criteria depicted in this Notice (Ref:Sl. No. 3 : Eligibility criteria and other details). Besides, the following documents shall have to be furnished:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">a.</td> <td>Particulars of ownership/partnership or Board of Directors pertaining to the Organization/Company/Firm</td> </tr> <tr> <td style="text-align: center;">b.</td> <td>Valid Electrical License(Both HT & LT), GST, P. Tax Clearance Certificates and receipts (current), PAN Card, Electrical Supervisory License, Trade license, ESI and EPF registration etc.</td> </tr> <tr> <td style="text-align: center;">c.</td> <td>Bank solvency Certificate</td> </tr> <tr> <td style="text-align: center;">d.</td> <td>Valid documents in support of annual Turnover.</td> </tr> <tr> <td style="text-align: center;">e.</td> <td>List of machines and equipment's necessary</td> </tr> <tr> <td style="text-align: center;">f.</td> <td>Experience and address, fax & telephone nos., mobile no., & E-mail, ID nos. of the firm.</td> </tr> </table> <p>All documents in original to be produced in due course of time as & when asked by the Bid inviting authority.</p>	a.	Particulars of ownership/partnership or Board of Directors pertaining to the Organization/Company/Firm	b.	Valid Electrical License(Both HT & LT), GST , P. Tax Clearance Certificates and receipts (current), PAN Card, Electrical Supervisory License, Trade license, ESI and EPF registration etc.	c.	Bank solvency Certificate	d.	Valid documents in support of annual Turnover.	e.	List of machines and equipment's necessary	f.	Experience and address, fax & telephone nos., mobile no., & E-mail, ID nos. of the firm.
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5.	Earnest Money (on line)	2% of the Quoted Bid price in two parts , viz																																	
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	b.	Earnest Money Deposit i.e. 2% of bid amount beyond Rs .5, 00,000.00 (if any) shall have to be deposited after acceptance of Bid Proposal as per WB Govt. norms. Additional security deposit @10% of the accepted amount is to be deposited in due course as per GoWB norms if the accepted amount is found to be @80% or less than the departmental estimated amount against the entire work of this NIT. All sorts of security and/ or retention money shall be released only after satisfactory and successful completion of 5-year Defect Liability Period of the entire work including O&M or as mentioned otherwise in this NIT, without any interest.																																	
		Note: The Earnest Money, as specified in this NleB shall be paid by online internet bank transfer or NEFT or RTGS (as per GO No. 3975-F(Y) dt. 28.07.2016 of Finance Deptt., 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.																																	
6.	Cost price of Bid documents	NIL																																	
7.	Date and Time Schedule :-	<table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Particulars</th> <th>Date and Time</th> </tr> </thead> <tbody> <tr> <td>a)</td> <td>Date of uploading of NleB. and Bid Documents online) (Publishing Date)</td> <td>21/02/2024 at 06.00 p.m</td> </tr> <tr> <td>b)</td> <td>Documents download/sell start date (Online)</td> <td>21/02/2024 at 06.30 p.m</td> </tr> <tr> <td>c)</td> <td>Date of Pre Bid Meeting with the intending bidders In the office of the Superintending Engineer, West Circle, Municipal Engineering Directorate, Bardhaman.</td> <td>05/03/2024 at 01.00 p.m</td> </tr> <tr> <td>d)</td> <td>Bid submission start date (On line)</td> <td>22/02/2024 at 10.00 a.m</td> </tr> <tr> <td>e)</td> <td>Bid Submission closing (On line)</td> <td>22/03/2024 at 06.00 p.m</td> </tr> <tr> <td>f)</td> <td>Bid opening date for Technical Proposals (Online)</td> <td>27/03/2024 at 11.00 a.m</td> </tr> <tr> <td>g)</td> <td>Date of uploading list for Technically Qualified Bidders (online)</td> <td>To be notified later</td> </tr> <tr> <td>h)</td> <td>Date and Place for opening of Financial Proposal (Online)</td> <td>To be notified during uploading of Technical Evaluation Sheet of Bidders</td> </tr> <tr> <td>i)</td> <td>Date of uploading of list of qualified bidders along with the offer rates through (on line),</td> <td>To be notified later.</td> </tr> <tr> <td>j)</td> <td>Also if necessary for further negotiation Through offline for final rate.</td> <td>To be notified later.</td> </tr> </tbody> </table>	Sl. No.	Particulars	Date and Time	a)	Date of uploading of NleB. and Bid Documents online) (Publishing Date)	21/02/2024 at 06.00 p.m	b)	Documents download/sell start date (Online)	21/02/2024 at 06.30 p.m	c)	Date of Pre Bid Meeting with the intending bidders In the office of the Superintending Engineer, West Circle, Municipal Engineering Directorate, Bardhaman.	05/03/2024 at 01.00 p.m	d)	Bid submission start date (On line)	22/02/2024 at 10.00 a.m	e)	Bid Submission closing (On line)	22/03/2024 at 06.00 p.m	f)	Bid opening date for Technical Proposals (Online)	27/03/2024 at 11.00 a.m	g)	Date of uploading list for Technically Qualified Bidders (online)	To be notified later	h)	Date and Place for opening of Financial Proposal (Online)	To be notified during uploading of Technical Evaluation Sheet of Bidders	i)	Date of uploading of list of qualified bidders along with the offer rates through (on line),	To be notified later.	j)	Also if necessary for further negotiation Through offline for final rate.	To be notified later.
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8.	Time of completion	Time of completion i.e. commissioning of all components of the above mentioned work in all respect (before the start of the trial run) of the Contract is mentioned in Table No- 1 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 infrastructural 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. They are also acquainted with relevant IS specifications, with latest amendments, IE Rules, 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, labours, water supply, existing & proposed site levels, Highest Flood Level (HFL), Finished Ground Level(FGL) position and diversion of transportation and barricading , if required, electricity and any other general information including topological condition & existing level and level pertaining to and needed for the work to be completed in time properly.
10.	Bid documents	<p>A full set of Bid documents consists of 2 Parts. These are</p> <p>PART I :-Containing all documents in relation to the name of the firm applied for and credential possessed along with all documents as depicted in SI. No. 3 along with this NleB and its all corrigenda's.</p> <p style="text-align: center;">And</p> <p>Section A: Description of the Project and scope of work (Civil) Section B: Conditions & requirements for-Bidding. Section C: General conditions of the Contract. Section D: General Specification of workmanship and material for civil works Section E: Electro mechanical works- Technical Specification, Vendor List, Scope of work- SI. No. 1(Kendulia & Sirishdanga) Section F: Electro mechanical works- Technical Specification, Vendor List, Scope of work- SI. No. 2(Gangutia & Neamatpur) Section G: Electro mechanical works- Technical Specification, Vendor List, Scope of work- SI. No. 3(Dumping Ground & Rabinsen)</p> <p>Section H: Electro mechanical works- Technical Specification, Vendor List, Scope of work- SI. No. 4 (Bhutaburi,PoloGround,Ismile,Barachak,Dihika,KSTP)+ Kulti(Barakar+Ramnagar)</p> <p>Section I: ANNEXURES:</p> <p style="padding-left: 40px;">i. WB Form No. 2911</p> <p>PART II :-Containing the Following Document.</p> <p>Bid Price / Price Schedule.(.xls format)</p>
11.	Validity of Bid	The Bid submitted shall remain valid at least for a period of 180 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 even a legal action may be taken by Directorate.
13.	Acceptance of Bid	The " The Superintending Engineer, West Circle, Municipal engineering Directorate. " will accept the Bid. He /She does not bind himself/herself 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	<p>The successful Bidder will be notified in writing of the acceptance of his Bid. The Bidder then (after coming in contract executing a formal agreement as per norms) becomes the "Contractor" and he shall forthwith take steps to execute Formal Contract Agreement in appropriate "WB Form No. 2911 with the "The Superintending Engineer, West Circle, Municipal Engineering Directorate." and fulfil all his obligations as required by the Contract.</p> <p>After the Bid is provisionally accepted, the Bidder shall submit Detailed Design & Drawing of all Civil & Electro- Mech components, 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. Directorate and KMDA as the case may be, provisional approval of the submitted drawings will be accorded phase wise for execution. Even after approval from the competent authority, if it is necessary to rectify anything at site, it is the sole responsibility of the contractor to reconstruct the same at his own cost at site after necessary approval from competent authority.</p>

		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 O&M of the contract , and other obligation, if any.
16.	Name & address of Engineer-In-Charge (EIC) of the Work	The Executive Engineer, Municipal Engineering Directorate, Asansol Division, Ismile, Barafkal, PHE Office Complex, Paschim Bardhaman, PIN- 713301 E-mail ID – medasansoldiv@gmail.com
17.	Execution of the Work	The Contractor is liable to execute the whole work as per direction and instruction of the Executive Engineer , Asansol Division of Municipal Engineering Directorate who is the " Engineer in Charge " of the work after due approval of drawings & design of the " Superintending Engineer, West Circle, M.E. Directorate. "
18.	Payment	Payment will be made to the successful Bidder by the "Executive Engineer, Asansol Division, Municipal Engineering Directorate on availability of fund given by the UD&MA Department of Govt. of W.B.
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.
Following clauses are to be adhering to by the concerned Bidder during the process of Bidding.		
20.	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 "The Superintending Engineer, West Circle, Municipal engineering Directorate.", feels it to be necessary and exigent.	
21.	Persons having authenticated and having registered Power of Attorney may be considered lawfully becoming to be acting on and for behalf of the Bidder.	
22.	Sufficient care has been taken to avoid variance in between the contents of the listed. Documents in the Bid document. 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.	
23.	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.	
24.	Bid Acceptance Authority is the "The Superintending Engineer, West Circle, Municipal engineering Directorate."	
25.	In case of any dispute arising from any clauses of similar nature between bid documents and WB Form No 2911 & IS Specifications, the decision of the Superintending Engineer, West Circle, M.E. Directorate, will be final and binding.	
26.	All usual deductions for taxes as applicable i.e. GST, IT, and Labour welfare cess etc. as applicable will be made from the bills from time to time (please refer cl.57 of section C).	
27.	No conditional Bid shall be entertained.	
28.	In reference of Clause 57 of Section C , in case of any dispute arising in the breakup and analysis thereof, decision of Superintending Engineer, West Circle, M.E. Dte. will be binding and final.	
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 participating in the Bid and entering into a contract for the work as mentioned in the Notice inviting Bid, 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.	Prospective applicants are advised to note carefully the minimum qualification criteria as Mentioned in 'Instructions to Bidders' before bidding.	
31.	During scrutiny, if it is come to the notice to Bid inviting authority that the credential or any other papers found incorrect/manufactured/fabricated, then Bidder will not be allowed to participate in the Bid and that application will be out rightly rejected without any prejudice.	
32.	Before issuance of the work order, the Bid 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.	
33.	If any discrepancy arises between two similar clauses of Bid document or on different notifications, the decision of "the Superintending Engineer, West Circle, M.E.Dte." is final & binding.	
34.	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.	
35.	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 Bid 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 Bid. The power of attorney shall have to be registered in accordance with the provisions of the Registration Act, 1908.
36.	Any legal matter will be settled within the jurisdiction of Hon'ble District Judges Court at Bardhaman, Dist.-Purba Bardhaman, West Bengal.
37.	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.
38.	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.
39.	Security Deposit @ 8% (eight percent) excluding @2% deposited initially as EMD, will be deducted from each and every running bill. The entire amount i.e., @10% (ten percent) of Security Deposit (Initial @2% EM + subsequent @8%) excluding for operation and maintenance will be refunded as per prevailing Govt. norms without any interest only after successful completion of operation and maintenance of the whole work in all respect as per clause 57 of section C after full satisfaction of E.I.C.
40.	The successful bidder has to provide detailed documents for all civil and electro mechanical works including planning and drawings as per the clause 57 of Section C in due course which will be treated as part of the bid document.
41.	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. If any item the contractor feels as major item but not reflected in the clause will be pointed out during pre-bid meeting. All the items 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.
42.	The requisite cost of Earnest Money, as specified in this NleB shall be paid by online internet bank transfer or NEFT or RTGS (as per GO No. 3975-F(Y) dt. 28.07.2016 of Finance Deptt., 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
43.	The Bidders quoting rate in the item-wise BOQ will be treated as the "Quoted rate inclusive of all type of taxes for Central Govt., State Govt., and any other Statutory body as admissible by rules and regulation of the Government (Central/State) time to time. Therefore All usual deductions for taxes as applicable i.e., GST, IT, Labour welfare cess etc. will be deducted from the bills submitted by contractor time to time for their works. No extra claim in any circumstances beyond the quoted rate in uploaded BOQ will be entertained by the TIA.



Superintending Engineer,

West Circle,

Municipal Engineering Directorate

INSTRUCTION TO BIDDERS/BIDDERS
SECTION – A-I

1. General guidance for e-Bidding

Instructions/ Guidelines for bidders for electronic submission of the Bids have been annexed for assisting them to participate in e-Bidding.

2. Registration of Bidder

Any Bidder willing to take part in the process of e-Bidding will have to be enrolled and registered with the Government e-procurement system, through logging on to <https://wb.tender.gov.in> The Bidder is to click on the link for e-Bidding 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 Bids, 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 NIE-B and Bid 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 Bid Documents.

5. Submission of Bids.

General process of submission, Bids 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. As per Sl. No. 4
- ii. Prequalification Application (Sec-B, Form – I)
- iii. Scanned Copy of earnest money (EMD) payment as prescribed in the NIE-B in favour of –The Superintending Engineer, West Circle, Municipal engineering Directorate.” ", payable at Bardhaman.

2. NIE-B (download 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: -Declaration Of The Bidder)
- iii. Bank Solvency Certificate.
- iv. Form III & IV of Section B.

- v. Declaration by the Bidder.
- vi. Annexure V & Annexure X

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

- i. Professional Tax (PT) deposit receipt challan (up to date), IT PAN Card, IT Return for the Current Assessment year, GSTN (up to date)
- ii. Power of Attorney (For Partnership Firm/ Private Limited Company, if any)
- iii. Tax Audit Report (3CB Format or similar) along with Balance Sheet and Profit and Loss A/c for the last three years (year just preceding the current Financial Year will be considered as year – D)
- iv. List of technical staff along with structure and organization (Section – B, Form – III).

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			
Sl. No.	Category Name	Sub Category Name	Sub Category Description
A	CERTIFICATES		
		A1. CERTIFICATES	1. GSTN/ P.F/PAN / P. Tax Clearance Certificate 2. Income Tax Acknowledgement Receipt (Latest) 3. Valid Electrical License 4. E.S.I Registration Certificate. 5. Valid Trade License
B	COMPANY DETAILS		
		B1. COMPANY DETAILS 1	1. Proprietorship Firm (Trade License). 2. Power of Attorney (For Partnership Firm/ Private Limited Company, if any)
C	CREDENTIAL		

		C1. CREDENTIAL1	Similar nature Work & Completion Certificates along with work order and payment certificate issued by competent authority (as per SI No. 4 of Nle-B)
E	FINANCIAL INFO		
		E1. P/L & BALANCE SHEET 2020-2021 to 2022-2023	P/L & BALANCE SHEET (As per Nle- B)
		E2. PAYMENT CERTIFICATE 1	Payment Certificate in support of valid credential only to be submitted(as per Nle- B)
		E3 PAYMENT CERTIFICATE 2	
F	MANPOWER		
		F1. TECHNICAL PERSONNEL	1. List of sufficiently qualified technical person (as per SI No 4 of NleB)
		F2. TECHNICAL PERSONNEL ON CONTRACT	1. List of technical personnel employed under the organisation (or on contact basis) in details with name, qualification, experience and, address with contact number.
G	DECLARATION	DECLARATION 1	1. Bank Solvency Certificate (As per Nle-B)
		DECLARATION 2	2. Valid Document in support of annual turn-over (As per Nle-B)
		DECLARATION 3	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 Deptt. of Municipal Affairs, Govt. of West Bengal. Comparative Statement may be forwarded to appropriate authority for approval.
- 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. 11, Bid Price / Price Schedule has 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 Nle-B 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 Bid 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 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 (Bid 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 (Bid accepting authority) action.

The Bidder whose Bid has been accepted will be notified by the Bid 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 Bid Form will incorporate all necessary documents, e.g. Nle-B., all addenda-corrigendum, different filled-up forms (Section –B), Price Schedule and the same will be executed between the Bid Accepting Authority and the successful Bidder.

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

SECTION- B-1

FORM –I

PRE-QUALIFICATION APPLICATION

**To
The Superintending
Engineer, West Circle,
Municipal Engineering
Directorate.”
Bardhaman.**

Ref: - Bid

for _____

_____ (Name of work) _____

____ **NIEB No.:**

Dear Sir,

Having examined the Statutory, Non statutory and NIE-B documents, I /we hereby submit all the necessary information and relevant documents for evaluation. The application is made by me / us 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) Bid Inviting and Accepting Authority can amend the scope and value of the contract bid under this project.

(b) Bid Inviting and Accepting Authority reserves the right to reject any application without assigning any reason.

Encl:- e-Filling:-

1. Statutory Documents
2. Non-Statutory Documents

Date: -

Signature of applicant including title

and capacity in which application is made.

**SECTION – B1
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)
a) Current Assets : (It should not include investment in any other firm)					
b) Current liabilities : (It should include bank overdraft)					
c) Working capital : (a) – (b)					
d) Net worth : (Proprietors Capital or Partners Capital or Paid up Capital + Reserve and surplus)					
e) Bank loan/ Guarantee : (As per clause G.2. with all sub clauses)					

B.3 Annual value of construction works undertaken :

Work in hand i.e. Work order issued	As on 31.03.2023	As on 31.03.2022	As on 31.03.201	As on 31.03.2020	As on 31.3.2019	As on 31.03.2018

Signed by an authorized officer of the firm
Title of the officer

Name of the Firm with Seal

Date _____

Declaration of the Bidder

(Affidavit to be affirmed on a Non Judicial Stamp Paper of Rs. 10/- and enclosed with the Bid documents which is required to be submitted in time duly)

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 NIE-B (NIE-B 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, West Bengal Sales Tax Act, VAT Act, Income Tax 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 –B1

FORM- III

STRUCTURE AND ORGANISATION

A.1 Name of applicant:

A.2 Office Address:

Telephone No and Cell Phone No. :

Fax No. :

E mail:

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 – B1

FORM – IV

C. 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.

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

1. The Hon'ble Mayor, Asansol Municipal Corporation.
2. The State Mission Director AMRUT, ILGUS Bhawan, HC Block, Sector-III, Saltlake, Kol-106.
3. The Chief Engineer (South), M.E.Dte., Bikash Bhawan, Saltlake, Kol-106.
4. The Joint Secretary, UD&MA for wide circulation in a day by National News Paper in Bengali, English and Hindi News Paper.
5. The District Magistrate, Paschim Bardhaman.
6. The Executive Engineer, M.E.Dte., Asansol Division.
7. The Office Notice Board of Superintending Engineer, West Circle, for wide circulation



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

SECTION – A

DESCRIPTION OF THE PROJECT AND SCOPE OF WORK

1.0 GENERAL

The work involves Planning, Design, Construction, Supply, Delivery, Installation & Commissioning of required capacity of Clear Water Reservoir as mentioned in Table No 1 (**top of the water level of the CWR at 0.50 metre above H.F.L. excluding 500 mm freeboard**) cum Pumping Station, all sorts of cables, panels, trays, switches etc, all sorts of pipes, valves, short pieces, suction-delivery line, common delivery manifold, **Sub-Station building (FFL shall be 1.5 m above HFL or 0.6 m above EGL which ever is higher)**, illumination, earthing, metering, protection, fire extinguisher along with all other allied works (Civil & Electromechanical work & others, if any required to complete the project) at the above mentioned locations as per Table No 1 and necessary training of maintenance staff & thereafter 5 (five) years operation and maintenance (including necessary spare parts, repairing cost, security and guarding) of the whole system on Turnkey Basis as per NIT and/or BOQ and/or site condition and/ or direction of the EIC. The scope of work vis-à-vis the specifications mentioned somewhere in this NIT is brief, indicative and not exhaustive. This is a turnkey type project and the scope and/or the specifications shall be as per site-requirement, direction of the EIC and overall as per intension expressed in the NIT and or EIC.

2.0 LOCATION

The site of the pumping station at Jamuria, Kulti , Asansol & Raniganj area as mentioned in Table-1 within Asansol Municipal Corporation.

3.0. SCHEME PROCEDURE TO BE ADOPTED

- (a) The water to be pumped to OHRs from CWRs using required nos. of pumping units as per the Rising main route for each route. The specifications of the pumps, motors & other E&M equipments in respect of discharge, head etc. are given in the respective '**Sections**' on tentative basis, however, the contractor shall submit his design capacities of the pumps motors & other E&M equipments after studying the site condition.
- (b) Drawings shall be submitted for common delivery manifold, individual suction and delivery lines from bell mouth to delivery rising-mains (up to the specified length) with non-return valve (NRV), Butter-fly and/ or Sluice valve actuator operated Rising type., dismantling joint, enlarger, and reducer and connected to the separate dia as applicable.
- (c) All Electro-Mechanical works related to water supply shall strictly conform relevant and latest IS Code, IE rules, CPHEEO manual etc. as and where applicable.

4.0 DETAILED SCOPE OF WORK

4.1 : Major scopes/components of CIVIL work:

- (A) Sub Soil Investigation
- (B) Design, Drawing, & construction of Civil -`components

{Ref. vide Table-1 of Clause -2}

4.1.1: Jamuraia:

Name of work : Sl. No – 1 vide Table No -1

- | | |
|-------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| (i) Construction of a NEW Clear Water Reservoir at Kendulia Pump House | -3050 cu.m |
| (ii) Construction of Clear Water Pump House at Kendulia CWR - | } As per requirement and approval of competent authority |
| (iii) Construction of Electrical Sub-station building at Kendulia - | |
| (iv) Extension of Clear Water Pump House for 2 Nos. of Pump at Existing Sirishdanga Pump House- | |
| (v) Pipe Connection around Existing Sirishdanga Pump House. | |
| (vii) Sub-soil investigation at Kendulia | -2 no. |

4.1.2: **KULTI:**

Name of work : Sl. No – 2 vide Table No -1

- | | |
|------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| (i) Construction of a NEW Clear Water Reservoir at Gangutia Pump House | 1900 cu. m |
| (ii) Augmentation of existing CWR at Neamatpur - | 200 cu. m |
| (iii) Construction of Clear Water Pump House at Gangutia CWR | } As per requirement and approval of competent authority |
| (iv) Construction of Electrical Sub-station building at Gangutia | |
| (v) Extension of Clear Water Pump House for 2 Nos. of Pump at Existing Pump House at Neamatpur | |
| (vi) Pipe Connection around Existing Neamatpur Pump House. | |
| (vii) Sub-soil investigation at Gangutia | -2 nos. |

4.1.3 : **RANIGANJ:**

Name of work : Sl. No – 3 vide Table No -1

- | | |
|------------------------------------------------------------------------------|-----------|
| (i) Construction of a NEW Clear Water Reservoir at Dumping Ground Pump House | -700 cu.m |
| (ii) Augmentation of existing CWR at Rabinsen Pump House - | 200 cu. m |

- | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------|
| <ul style="list-style-type: none"> (iii) Construction of Clear Water Pump House at Dumping Ground CWR (iv) Construction of Electrical Sub-station building at Dumping Ground (v) Extension of Clear Water Pump House for 2 Nos. of Pump at Existing Rabinsen Pump House. | } | As per requirement and approval of competent authority |
| <ul style="list-style-type: none"> (vi) Pipe Connection around Existing Rabinsen Pump House. (vii) Sub-soil investigation at Dumping Ground (viii) Construction of a Guard Room at Dumping Ground | <ul style="list-style-type: none"> - L.S. -2 nos. - 24 sq. m | |

4.1.4: Salient Specifications of common CIVIL Components:

(A) CWR with pump house

Sl. No.	Items	Brief Specification
1	Raft foundation and other R.C.C.works	Concrete-M-30 Design Mix, Steel- SAIL/TATA/RINL, Below RCC foundation- sand, BFS, Polythene Sheet, Shuttering- Steel/Ply, 'Z' type M. S. Sheet piles, if required.
2	Plaster-Outside and Inside	CM (1:3) (with NCP -Inside)
3	Ceiling	Non-Toxic Epoxy Paint (2 coats)
4	Floor	ASF
5	Painting	Exterior grade Acrylic primer & Acrylic Emulsion (min. 2 coats)
6	Water Proofing Treatment on roof	as per specification laid down in I.S. 1346 -1991 and application of hot bitumen (grade 85/25 or 90/15) as per I.S.702 - 1988 @ 12Kg/10Sq.m on each layer .
7	Piping Arrangement (D.I. D.F. /C.I.D.F.) with Sluice valves	Inlet Pipe (500 mm/600 mm dia K9) ,Overflow Pipe (600 mm dia K9) Washout Pipe (150 mm K9) (Diameter may vary as per Site condition)
8	Miscellaneous works	As per direction of E-I-C conforming to PWD & Other Departmental Schedules and relevant I. S. Codes

(B) GUARD ROOM with toilet room

Sl. No.	Items	Brief Specification
1	Isolated footing foundation and other R.C.C. works	Concrete-M-20 (Nominal Mix), Steel- Other than SAIL/TATA/RINL <i>except Septic Tank where only SAIL/TATA/RINL shall be used</i> , Below RCC foundation- sand, BFS, Polythene Sheet,

2	Dam Proof Course	25 mm in C.C. 1:1.5: 3
3	Brick work	1 st Class bricks, 250 mm thick in C.M. (1:6) and 125 mm in C.M.(1:4)
4	Plaster	On masonry surface 15 mm & 20 mm thick in C.M.(1:6) On RCC surface 10 mm thick in C.M. (1:4)
5	Flooring	Main Room- ASF, Toilet floor-Ceramic tiles
6	Inside Wall of Toilet	Ceramic tiles
7	Painting	On plastered surfaces-Exterior grade Acrylic primer & Acrylic Emulsion (min. 2 coats) On wooden and steel surfaces- Oil paints with primer
8	Septic Tank	For 10 users along with soak pit and Inspection pit as per PWD schedule
9	PVC storage Tank	500 litre capacity
10	Wall Selves	RCC
11	Door s& Windows	Wooden for Main room- Panel shutter- Frame- Sal-local, Shutter with- Sishu/Gamar/Champ/Badam/Bhola/Mogra/Hallak PVC for toilet Steel grill work in windows (with all necessary fixtures)
12	Plumbing & Sanitary works	Pipes- PVC - dia. as per direction of E-I-C All necessary Items as per DPR provision and direction of EIC
13	Miscellaneous works	As per direction of E-I-C conforming to PWD & Other Departmental Schedules and relevant I. S. Codes

C. New Construction/Repairing of Boundary Wall with Fencing

Sl. No.	Items	Brief Specification
1	Isolated footing foundation and other R.C.C. works	Height of Boundary wall shall be minimum 2m then fencing of 600 mm, Concrete-M-20 (Nominal Mix), Steel- Other than SAIL/TATA/RINL Below RCC foundation- sand, BFS, Polythene Sheet,
2	Brick work	1 st Class bricks, 125 mm thick in C.M. (1:4) 250 mm thick in C.M. (1:6)
3	Plaster	On masonry surface 15 mm & 20 mm thick in C.M.(1:6) On RCC surface 10 mm thick in C.M. (1:4)
4	Painting	On plastered surfaces-Exterior grade Acrylic primer & Acrylic Emulsion (min. 2 coats) On steel surfaces- synthetic enamel paint 2 coats with primer
5	Fencing	Supplying fitting and fixing 600 mm diameter R.B.T Concertina fencing on wall top using concertina coils
6	Miscellaneous works	As per direction of E-I-C conforming to PWD & Other Departmental Schedules and relevant I. S. Codes

4.2 : New and Augmentation of Electro-Mechanical works:

{Ref. vide Table-1 of Clause -2}

4.2.1 Ref. Section E to H

4.2.2 : Note:

(i) In general all the modified/augmented electro-mechanical shall be done in the existing pump houses with minor additional and alteration civil works but at some locations, additional space can be required to accommodate for installation of higher capacity of pumping machineries. In such cases, the expenditure on the civil works shall be borne by the contractor. The direction of the EIC shall be followed.

(ii) The scope of work of Electro-mechanical works given in this section are on the overall basis. The internal / detailed specification of the components of the each items shall be gathered by the contractor from the concern Division Office for further technical guidance as per provision of DPR.

(iii) Any other specification or item missed in this bid documents inadvertently, shall be included as per I.E rule, Departmental Schedules, IS. Code and approval of Competent Authority and shall be abided by the contractor.

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

SECTION - B
CONDITIONS & REQUIREMENTS FOR BIDDING

1. Submission of e-Bid document will not be allowed beyond the schedule time indicated in the e-Bidding.
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 e-Bid.
3. Each page of the e-Bid documents, drawing etc. has to be digitally signed / initiated by the authorized signatory.
4. No e-Bid proposal will be entertained without the earnest money being submitted as indicated in the NIB. No interest will be allowed for the said earnest money and the Bid issuing authority will hold the same till finalization of the e-Bid.
5. Any conditional e-Bid will be liable for rejection.
6. The Bid inviting Authority reserves the right to reserve or amend the e-Bid documents prior to the date notified for submission of the e-Bid or also to extend the time mentioned in the NIB under intimation to the Bidders.
7. e-Bid once offered cannot be withdrawn within a period of 180 calendar days from the date set for opening of e-Bid. Any extension of this validity period if required will be subject to concurrence of the Bidders.
8. 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 e-Bid documents before the Bid Inviting Authority by uploading his/her doubt within a period of Forty eight hours before the date of Pre bid meeting as per schedule.
9. 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 e-Bid documents. Bid Inviting Authority however, reserves the right to have pre-Bid conference with the intending Bidders if deemed necessary. Any point or irregularities or questions could not be raised after expiry of pre-bid meeting.
10. 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. The Bidders must be acquainted with existing ground level (EGL), Highest flood level (HFL), Finished ground level (FGL)/Proposed ground level (PGL), and other required levels.
11. If expenses incurred for site inspection and all activities in the preparation and uploading of the e-Bid shall be borne by the Bidders.

12. 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.
13. e-Bid, 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 e-Bid, which may be found to be defective during the detail scrutiny.

14. Bidders before uploading the e-Bid documents shall have to ensure that –Declaration by the e-Bidder in the pro-forma set out in the e-Bid documents is to be filed separately with the e-Bid documents in the form of Affidavit to be affirmed by the same person signing the Bid documents.
15. The Bid inviting authority reserves the right to accept or reject any or all of the e-Bid received or to split up the work in groups or to relax any clause without assigning any reason thereof.
16. This set of Bid documents consists of:
 - a. Detail Notice inviting Bid.
 - b. Declaration by the e-Bidder.
 - c. Main Bid Documents consists of PART I & PART II (Technical) & financial (.xls format)
 - d. Municipal Tender Form.

Superintending Engineer, West Circle,
Municipal Engineering Directorate

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 approved in writing, including subsequent written confirmation of previous verbal approval and "approval" means 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 –The The Superintending Engineer, West Circle, Municipal engineering Directorate.” ll or his Authorized representative.
- (c) "Bank" means the "State Bank of India" or any other Nationalized 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 there to or deductions therefore 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 Bardhaman 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 —Superintending Engineer, West Circle, M.E.Dte. or his representatives of Municipal Engineering Directorate from time to time.
- (k) "Employer" means –The The Superintending Engineer, West Circle, Municipal engineering Directorate.”
- (l)"Engineer-in-Charge” means the Executive Engineer, Asansol Division of Municipal Engineering Directorate.
- (m)"Engineer's Representatives" means any Assistant Engineer or Junior Engineer or any Technical Personnel 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 (EGL)" means the level of the referred point of the exposed surface of the ground, road or pavement free from extraneous materials and High Flood Level (HFL) or Finished Ground Level (FGL) is the referred top most point of the nearby road shown in site plan.
- (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 (ULB) or other authority legally entitled to the control or manage local funds but also includes the West Bengal State Electricity Distribution Company Ltd.
- (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 –Superintendent Engineer, West Circle Municipal Engineering Directorate,. Further specification laid down in the P.W.D Schedule of Govt. Of West Bengal & all relevant IS codes with latest amendments will be implied after due approval from S.E (SC). In case of any ambiguity or completion of different schedule the decision of S.E (SC), will be final and bindings.
- (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, Company 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, 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.

(5) Period of completion: The period of completion shall be 300 (Three hundred days) after issuing the work order.

2.0. ENGINEER 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.

(a) Failure of the Engineer's Representative to disapprove any work of materials shall not prejudice the power of the Superintendent Engineer, West Circle Municipal Engineering Directorate, 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 Superintendent Engineer, West Circle, Municipal Engineering Directorate, , who shall there upon confirm, reverse or vary such decision.

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 EIC.

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 Superintendent Engineer, West Circle, Municipal Engineering Directorate, 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 labours 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 Superintendent Engineer, West Circle Municipal Engineering Directorate, in terms of the provisions in Clause B-2.3 of the Conditions and Requirements for Bidding (omitted portion) 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 shall pay such additional sum as may be reasonable to cover such costs with recommendation of the Superintendent Engineer, West Circle Municipal Engineering Directorate.

6.0 DRAWINGS

(1) Custody of drawing: All the approved Drawings shall remain in the safe custody of the Executive Engineer, Asansol Division, Municipal Engineering Directorate, 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, Municipal Engineering Directorate, Govt. of West Bengal all drawings as provided under the Contract.

(2) One copy of approved drawing is 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 Representatives and by any other persons authorized by the Engineer in writing.

(3) Disruption of progress: The Contractor shall give written notice to EIC 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 Superintendent Engineer, West Circle Municipal Engineering Directorate, on recommendation of Executive Engineer, Asansol Division, Municipal Engineering Directorate 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.

(4) The contractors should submit required design calculations along with drawing. If required by Superintendent Engineer, West Circle, Municipal Engineering Directorate, / E.I.C the design shall be submitted in latest version of civil, Mechanical, & Electrical software's with their hard copies and soft copies (in CD).

7.0 ADDITIONAL COPIES OF DRAWINGS

The EIC 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 EIC shall be final and binding on the Contractor.

8.0 GENERAL OBLIGATION

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, safety & security or all Site operations and methods of construction, erection etc. During trial run and annual maintenance period the contractor has to assured safety and security of the whole plant by providing necessary guard/watchmen at his own cost.

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.

10.0. GUARANTEE/WARRANTEE:

The contractor shall stand guarantee for successful operation of the plant for 5 years 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 risk and cost. During the guarantee period (after the trial run period) the firm's representative shall visit the site once in a month and advice in writing the Superintendent Engineer, West Circle Municipal Engineering Directorate, 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 EIC 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 EIC 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.

10.1 START-UP GUARANTEES

Until such time as the equipment or material installed and erected under the contract is finally accepted by the Department in keeping with the terms and condition of this contract and associated specifications the responsibility for proper storage, testing, maintenance and efficient of the same shall be that of the contractor. Prior to start-up contractor shall be required to service of the equipment and during start-up render such assistance as may be necessary or request for by the Employer.

When the equipment has not been manufactured by the bidder, Back to Back Guarantee shall be provided and the manufacturer recommendations for installation of the same shall be strictly adhered to and any defects developing due to faulty installation transportation and / or erection during start-up or during a period of one year from the date of commissioning shall be rectified, remedied or made good by the contractor through manufacturer, if considered by the Department, at his own cost. When the equipment has manufactured by the bidder himself, rectification within similar period is compulsory.

11.0. INSPECTION OF SITE

The EIC 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, topography together in the level, 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 Bidding 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 EIC shall pay the additional cost to which the Contractor shall have been put by reason of such conditions, including the proper and reasonable cost with due recommendation of Superintendent Engineer, West Circle Municipal Engineering Directorate.

- 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 EIC on recommendation of Superintendent Engineer West Circle Municipal Engineering Directorate, which the Contractor may take in the absence of specific instructions from the EIC 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 EIC and shall comply with and adhere strictly to the EIC'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 EIC 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 EIC, 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 EIC 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 EIC, 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 EIC 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 Superintendent Engineer, West Circle Municipal Engineering Directorate, 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 Chairperson, 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 Superintendent Engineer, Circle Municipal Engineering Directorate, 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 Superintendent Engineer, West Circle Municipal Engineering Directorate,. Such authorized agent or representative shall receive, on behalf of the Contractor, direction and instruction from the Superintendent Engineer, West Circle Municipal Engineering Directorate, 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 Superintendent Engineer, West Circle, Municipal Engineering Directorate, or the EIC.

16.0. EMPLOYEES

(1) Contractor's Employees - The Contractor shall provide and employ on the Site in connection with the execution and maintenance of the Works with minimum 3 nos. HT operator with 3 nos. electrician shall be provided at the time of operation of the plant and guarding arrangement should be provided at night.

a) Such technical assistants as are skilled and experienced in their respective calling and such sub-agents, foreman and leading hands as arc 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 EIC.

(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 Executive Engineer, Asansol Division, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose employment is otherwise considered by the Executive Engineer to be undesirable and such person shall not be again employed upon the Works without the written permission of the Executive Engineer. Any person so removed from the Works shall be replaced as soon as possible by a competent substitute approved by the Executive Engineer.

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 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, sight 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 EIC or the

Engineer's Representative, for the protection of the works, contractor's employees, and employee's 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 EIC 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 EIC 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 EIC 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 EIC 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 EIC 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 EIC 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 EIC or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums.

21.0. DAMAGES

(1) Damage to persons and property: The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the EIC 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 EIC 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 EIC, his servant or agents or other contractors for the damage or injury.
- (2) Indemnity of EIC: The Contractor shall indemnify the EIC 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 EIC, or to any person, including any employee of the EIC, 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) hereof.
- (2) Minimum Amount of third party insurance: Such insurance shall be affected with an insurer and in terms approved by the EIC, 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 EIC 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 It identify under the policy being brought or made against the The Superintending Engineer, West Circle, Municipal engineering Directorate.” 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 EIC 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 EIC, his agents, or servants. The Contractor shall indemnify and keep indemnified the EIC 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 EIC, 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 EIC 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 EIC is indemnified under the policy, but the Contractor shall require such sub-contractor to produce to the EIC 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 EIC 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 EIC 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.

25.0. (1) 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 in 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.

(2) 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 EIC 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, TREASURE TROVE ETC.

All fossils, Any treasure trove, coins articles of value or object with 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 and shall be handed over to the owner.

27.0. PATENT RIGHTS AND ROYALTIES

The Contractor shall save harmless and indemnify the EIC 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 EIC 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 EIC 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 EIC or the local authority as the case may be. **No labour, Supervisor or Engineer of the contractor shall enter inside the premises of project or any other existing installations without prior permission of concerned officers/ EIC.**

(b) Opportunities for other contractors: The Contractor shall in accordance with the requirements of the EIC, 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 EIC 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, East Circle, Municipal Engineering Directorate.

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 EIC 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 workers 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 LABOUR ETC.

The Contractor shall, if required by the EIC, deliver to the EIC, or at his office a return in detail in such form and at such intervals as the EIC 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, East Circle, Municipal Engineering Directorate or 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 EIC, 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 EIC.

(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 to Contractor to price or allow for the same in his Bid.

(4) Cost of Tests not provided for, etc.: If the EIC 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, but otherwise the cost shall be borne by the Employer.

36.0. INSPECTION OF OPERATIONS

The Departmental Engineers and/or 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 at the cost of the bidder.

37.0. EXAMINATION

(1) Examination of work before covering up: No work shall be covered up or put out of view without the approval of the Superintending Engineer, East Circle, Municipal Engineer Directorate or the his authorized Representative and the Contractor shall afford full opportunity for the EIC 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 Superintending Engineer, West Circle, Municipal Engineer Directorate or the his authorized Representative. If any such part or parts have been recovered up or put out of view

after compliance with the requirement of sub- clause (I) 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 EIC 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 EIC 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 EIC and if permission to resume Work is not given by the EIC 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 Contractor's Control. The successful contractor shall within four weeks from the date of issue of Letter of Intent furnish one or more drawings stating and showing the following:

1.0 Layout of cable trenches, cable trays showing the locations and levels together with position of hooks at the under site of the operating platform stating the maximum load required to be withstood.

2.0 Any other data that the Bid considers relevant for construction of civil structure.

3.0 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.

(2) Way leaves etc.: The Contractor shall bear all costs and charges for special or temporary way leaves required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional accommodation outside the site required by him for the purpose of the works.

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 to 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, M.E.Dte 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 EIC 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 EIC 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 EIC under this Clause, the Contractor shall seek the EIC 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 EIC 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 or 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.

47.0. 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, 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 is 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 equipment as per specification and to the satisfaction of Engineer-in-Charge.

48. MAINTENANCE

(1) Maintenance Period: Maintenance period shall be for a period of one year counted from the date of certified commissioning i.e. after successful trial runs of 3 months. The Contractor shall provide spare parts at his cost required during the maintenance period.

(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 EIC 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 days, confirm the same from his end in writing to the Employer, and If such confirmation is not contradicted in writing within fourteen 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 Applicable Circle, Public Works Department schedule of rates as was in vogue on the date of submission of the Bid. The same 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-analyzed 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%: - 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.

(3) Claims: The Contractor shall send to the EIC 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. 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, Work Contract Tax 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 TERMS

Part- A for the works from Sl. No. 1 to 3 vide Table No-1- Clause-2

**Terms of Payment: Item wise break up
(payment may be released on prorata-basis)**

1	Planning, Design, Construction of the required capacity of CWR as mentioned in Table No 1 with pumping station and all other allied works including Plastering, Painting, Roof Treatment, inlet pipes, delivery pipes & support, valves support, pump foundation, common delivery line support as per tentative drawing attached with bid document complete in all respect as per approved drawing and direction of EIC.(30% of Quoted Amount)		
	Break up :		
A	All structural work upto EGL	40%	
B	All structural work upto Roof Level of CWR	20%	
C	All structural work upto Roof Level of Pump house	20%	
D	All work including finishing Complete in all respect	10%	
E	After successful trial run of the plant.	10%	
	Total =	100%	
2	Planning, Design & Construction of Sub-station building (RCC Framed) for load along with brick work, Plastering, Painting, Roof treatment, flooring, door & windows, ramp complete in all respect as per tentative drawing in Annexure and Approved design as per direction of E.I.C.(10% of Quoted Amount)		
	Break up :		
A	Construction of all Structural work complete in all respect	50%	
B	All finishing work completion in all respect.	40%	
C	After successful trial run of the plant.	10%	
	Total =	100%	
3	Supply, delivery and installation of Electromechanical equipment of Bid Document complete in all respect as per approved drawing and direction of EIC.(50% of Quoted Amount)		
	Break up:		
A	Supply of all Electro-Mechanical equipment required to complete the item.	60%	
B	Installation of Electro-mechanical equipment and any other work required to complete the item in all respect.	30%	
C	Testing, Commissioning and after successful trial run of the plant.	10%	
	Total =	100%	
4	Operation and maintenance of the plant for 5 (FIVE) years. The work includes supplying adequate number of operator personnel and skilled labour with a provision for necessary training to the personnel appointed by the ULB including supplying all sundry materials, and replacement of all types of damaged component etc. as per Bid document and complete in all respect and as per Bid document and as per direction of EIC. N.B:- This item will be executed after three (3) months trial run. The electricity charges shall be borne by the ULB since the start of trial run. (10% of Quoted Amount)		
	Break up :		

A	After successful completion of 1 year	20%	
B	After successful completion of 2 years	20%	
C	After successful completion of 3 years	20%	
D	After successful completion of 4 years	20%	
E	After successful completion of 5 years	20%	
		Total =	100%

Part- B for work of Sl. No. 4 vide Table No-1- Clause-2

Terms of Payment: Item wise break up (payment may be released on prorata-basis)			
1	Supply, delivery and installation of Electromechanical equipment of Bid Document complete in all respect as per approved drawing and direction of EIC. (60% of Quoted Amount)		
	Break up:		
i)	Supply of all Electro-Mechanical equipment required to 25% complete the item.	25%	
ii)	Supply of all Electro-Mechanical equipment required to 50% complete the item.	25%	
iii)	Supply of all Electro-Mechanical equipment required to 75% complete the item.	25%	
iv)	Supply of all Electro-Mechanical equipment required to 100% complete the item.	25%	
		Total	100%
2	Installation of Electro-mechanical equipment and any other work required to complete the item in all respect. (25% of Quoted Amount)		
i)	Installation of Electro-mechanical equipment and any other work required to 25% complete the item in all respect	25%	
ii)	Installation of Electro-mechanical equipment and any other work required to 50% complete the item in all respect	25%	
iii)	Installation of Electro-mechanical equipment and any other work required to 75% complete the item in all respect	25%	
iv)	Installation of Electro-mechanical equipment and any other work required to 100% complete the item in all respect	25%	
		Total	100%
3	Testing, Commissioning and after successful trial run of the plant. (5% of Quoted Amount)		
i)	Testing, Commissioning and after successful trial run of the plant upto 25%	25%	
ii)	Testing, Commissioning and after successful trial run of the plant upto 50%	25%	
iii)	Testing, Commissioning and after successful trial run of the plant upto 75%	25%	
iv)	Testing, Commissioning and after successful trial run of the plant upto 100%	25%	
		Total	100%

4	<p>Operation and maintenance of the plant for 5 (FIVE)) years. The work includes supplying adequate number of operator personnel and skilled labour with a provision for necessary training to the personnel appointed by the ULB including supplying all sundry materials, and replacement of all types of damaged component etc. as per Bid document and complete in all respect and as per Bid document and as per direction of EIC. N.B:- This item will be executed after three (3) months trial run. The electricity charges shall be borne by the ULB since the start of trial run. (10% of Quoted Amount)</p>		
	Break up :		
A	After successful completion of 1 year	20%	
B	After successful completion of 2 years	20%	
C	After successful completion of 3 years	20%	
D	After successful completion of 4 years	20%	
E	After successful completion of 5 years	20%	
	Total =	100%	

d) If any item not included in this clause or missing but required for successful completion & O/M of the scheme have to consider by the bidder while quoting their rate and submit the same with details along with cost analysis if desired by competent authority before acceptance of the bid.

Note:

a) 2% (of the accepted amount) of Earnest money deposited earlier will be converted into Security deposit after awarding the Contract and 8% of security deposit will be recovered from each running account bill for Sl No. 1 to 4.

Additional security deposit @10% of the accepted amount is to be deposited in due course as per GoWB norms if the accepted amount is found to be @80% or less than the departmental estimated amount against the entire work of this NIT

b) The Defect Liability Period is 5 years.

There shall be 30 % of Security Deposit or Retention money will be returned after successful completion of 4 years and the balance 70% shall be returned after successful completion 5 years i.e. successful completion of operation & maintenance work without any interest. No part security before completion of O & M will be entertained.

c) The total amount to be quoted & uploaded by the bidder in .xls format of BOQ under Financial document will be as per the clause 57 of Section-C .

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 fulfillment 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 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 in 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. 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, East Circle, Municipal Engineering Directorate 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 proceeding 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 (I), (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 Clause C-62(8) (a) to (d).

63.0. FRUSTRATION

Payment in event of Frustration: A war, or other circumstances outside the control of both parties, arises after the Contract is made so that either party is prevented 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 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 be 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:

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

- (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. 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.

68.0. 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.

69.0. CONTRACTOR TO PROVIDE FACILITIES

The Contractor shall provide such labours, 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.

70.0. 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.

71.0. 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.

72.0. 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.

73.0. 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.

74.0. 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).

75.0. BIDDER SHALL VISIT THE SITE

Intending Bidder shall visit the site and make him thoroughly acquainted with the local site condition, nature and requirements of the works, facilities of transport condition effective labour and materials, access, delivery, loading, unloading and storage for materials and removal of unsuitable materials. The Bidder shall deemed to be incorporate in their Bidder quotation for cost of procurement, carriage, freight and other charges as also for any special difficulties and including incorporation any or all inconveniences, police restriction for transport etc for proper execution of work as indicated in the drawing. The successful Bidder will not be entitled to any claim of compensation for difficulties faced or for losses incurred on account of any condition which existed before the commencement of the work or which in the opinion of the owner might be deemed to have reasonably been inferred to be so existing before commencement of work.

76.0 GOVERNMENT AND LOCAL RULES / LAW OF STATE

The contractor shall conform to the provisions of all local Bye-laws and Acts relating to the work and to the work and to the Regulations etc. of the Government and Local Authorities and of any company with whose system the structure is proposed to be connected. The contractor shall give all notices required by said Act, Rules, Regulations and Bye-laws etc. and pay all fees payable to such authority/authorities for execution of the work involved. The cost, if any, shall be deemed to have been included in his quoted rates, taking into account all liabilities for licenses, fees for footpath encroachment and restorations etc. and shall indemnify the owner against such liabilities and shall defend all actions arising from such claims or liabilities.

77.0 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. Any modifications to the store shed in suggested by the Superintending Engineer of East Circle of Municipal Engineering Directorate recommendation for better storing of materials that shall have to be carried out by the Contractor at his own cost.

78.0 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 of East Circle of Municipal Engineering Directorate may deem fit.

79.0 WATER AND ELECTRICITY FOR CONSTRUCTION

1. The Contractor shall have to make his own arrangement at his own risk and cost for supply of water and 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. However, from the start of Trial Run and subsequent O & M for next 12 months, the electricity charges shall be borne by the Asansol Municipal Corporation.

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 Bidders shall investigate this matter during site inspection before submission of Bidders: No payment will be entertained on this account.

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.

80.0 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 of West Circle of Municipal Engineering Directorate.

81.0 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. This equipment shall be provided at suitable prominent and easily accessible places and shall be properly maintained.

82.0 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 of West Circle of Municipal Engineering Directorate, 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 of East Circle of Municipal Engineering Directorate may direct.

83.0 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 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.

84.0 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 of West Circle of Municipal

Engineering Directorate 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.

85.0 LAYOUT AND CHECKING

The contractor shall provide all labours, 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.

85. Reference Points

After the joint survey has been plotted and approved by the E.I.C. recommendation or his authorized representative, 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.

86.0 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 of East Circle of Municipal Engineering Directorate 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 Bidder Drawing.

87.0 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 E.I.C. Municipal Engineering Directorate 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.

88.0 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.

89.0 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 of West Circle of Municipal Engineering Directorate 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 9.0 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

90.0 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 of West Circle of Municipal Engineering Directorate. 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.

91.0 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.

92.0 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.

93.0 SITE ORDER BOOKS

1. For the purpose of quick communication between the Engineer or his Representative and the Contractor or his Agent or Representative, Site order 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.

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.

94.0 TECHNICAL ASSISTANCE

Training of Technical Personnel:- The Contractor shall undertake to train three 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.

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

SECTION – D

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 binding.
- 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, shall, if so directed by him, 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 EIC 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, labours, 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 specifications contained herein are 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.

<u>I.S. Code No.</u>	<u>Description</u>
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 for Differed steel bar & wires for concrete reinforcement.
IS: 1077	Common Burnt Clay Buildlllg 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: 1893	Workability of Concrete

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.

- 2.2.1 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.
- 2.2.2 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.
- 2.2.3 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.
- 2.2.4 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.
- 2.2.5 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.
- 2.2.6 For the work of excavation the Tenderer 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 Tenderer 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 property moistened and well rammed. Excavated materials which is surplus or which is consolidated unsuitable for back filling shall have 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.

3.2 CEMENT

The Cement shall be Portland Pozzolona Cement conforming to IS 1489-1991 Part-I & II and/or Portland Slag Cement conforming to IS 455-1989

3.3 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.

3.3.1 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	:	20 mm
Thin R. C. C. Members		
With very narrow space	:	12 mm.
Mat/Lean Concrete		20/40 mm.

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.

3.3.2 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.

3.4 REINFORCEMENT

3.4.1 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.

3.4.2 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.

3.4.3 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.

3.4.4 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.

3.4.5 Steel bars conforming to IS: 1786; 1985 (Reaffirmed 1990) specifications.

- (i) For CWR, Pump House, Sub-station building - Brand/manufacturer as TATA/SAIL/RINL
- (ii) For other works - Brand/manufacturer as other than TATA/SAIL/RINL

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: 10262. It should be sampled and analysed 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.
- 3.6.3 The workability shall be measured by slump. Slump for different grades of concrete and for specified structure shall be as per the I.S. code
- 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: 456. 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.D., 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 Labours, 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 M3 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 and shall not be less than Grade of M25 for works other than water retaining structure & for water retaining structure (RCC) Grade will be M30 and higher as per 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 i.e., IS: 10262 with latest amendments 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. Proper admixtures of reputed brand should be used to maintain workability and in making concrete for water retaining structures with prior approval of E.I.C.

The mix design by the Contractor shall be used for works only after obtaining approval of mix design and written order thereafter 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 FORM WORK

3.9.1 The Form Work shall conform to IS: 456-2000 . Whenever necessary, shuttering must be provided. The work shall also include providing all necessary staging, centering, shuttering & formwork 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: 456-2000 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 smoothening 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 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. Any important operation such as concreting or stripping of form work adequate notice shall be given in advance.

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.

4.0 BRICK WORK

- 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

- 5.1.1 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. All internal angles shall be rounded off as per drawing or as directed by the Engineer-in-Charge without any extra charges- if required.
- 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 White Washing

- 6.2.1 White washing shall be done with 5(five) parts of stone lime and I (one) part of shell lime with necessary gum (about 2 Kg per M3 of lime) using a small quantity of blue as per direction of Engineer-in-Charge. The lime shall be brought to the site unslaked and shall be slaked at site with an excess of water and allowed to remain under water for (two) days. To the mixture fresh water may be added to bring the consistency to that of a thin cream. When thoroughly mixed, the mix is to be strained through coarse cloth. The surface of the wall is to be brushed thoroughly cleaned before the white washing is applied. Each coat

of white wash has to be laid on with brushes. Each coat of White Wash 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 white wash 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.

6.3 Weather Guard / Weather Shield / Weather Coat with Primer

6.3.1 Where specified, external surface shall be finished with two coats of 'Weather Guard / Weather Shield / Weather Coat with Primer' of approved colour, shade and manufacture. The surface shall have to be finished it to 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 'Weather Guard / Weather Shield / Weather Coat with Primer' or equivalent to be mixed will be strictly as per manufacturer's specification. The mixed 'Weather Guard / Weather Shield / Weather Coat with Primer' or equivalent shall have to be applied to the surface with a brush of a good quality. 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 'Weather Guard / Weather Shield / Weather Coat with Primer' or equivalent application shall be wetted at the end of the day with a fine water spray. Necessary primer has to be applied before coating of Weather Guard / Weather Shield / Weather Coat with primer.

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.

6.4.3 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 provide 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.

8.3 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 is 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 West 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.

8.5 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.

8.6 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: 5 years

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9.0 FLOORING

- 9.1 Patent Stone Floorings shall be 25mm. thick in M25 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 'Ironite' 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 M25 grade concrete and allowed to dry. Then the second layer of 25mm.thick flooring of M25 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 center to center 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 center, 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 have to 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 'Follow operator' for opening to any position and closing. Additional intermediate

members be 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 Steel Gate

The M.S gates (6.0X3.0 m), architecturally designed will be obtained from manufacturer as approved by the Engineer-in-Charge. These shall include M.S gate of jail type as per approved design made of strong M.S form work, intermediate stiffeners, and round/square bars or angles of M.S Sheet(not less than 14 gauge), gusset cleat, etc. including necessary reworking, bolting, welding, locking & hanging, arrangement, fitting, fixing etc. complete in all respect as per direction of E.I.C. The both the shutters will have rolling arrangement with a single openable gate in one shutter. 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 M.S. 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 ready mixed paint over a coat of approved anticorrosive primer.

11.0 CABLE TRENCHES

11.1 The cable trenches should normally be of dimension 760mm x 460 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 th) are to be provided on the wall side of the cable trench 600 mm apart all along with cable tray.

11.2 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/m² 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.

11.3 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.

12.0 POCKETS & HOLDING DOWN BOLTS

Provision has also to be kept for pockets and holding down bolts as per requirement of the electrical and mechanical equipments 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.

13.0 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.

14.0 DOORS & WINDOWS

Usually aluminum framed and partially glazed door of single shutter and double shutter of relevant I.S. code shall be provided as per site condition and direction of E.I.C.

The sliding glazed windows with fully / semi transparent shall be provided,

15.0 IMPORTANT GUIDELINES AND SPECIFICATIONS

15.1 Unless otherwise specified elsewhere, the work shall be carried out as per the following specifications.

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

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

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

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

15.5 Roofs shall be provided with polyurethane paint.

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

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

16.0 SPECIAL NOTES

16.1 The layout of the plant as shown on the drawing attached is not binding on the Bidder but is only indicative.

16.2 The Bidder shall not quote for works differing from the specifications of the Bid unless specifically

permitted elsewhere in the Bid documents.

16.3 The suitability of the plant 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.

16.4 There shall not be any ambiguity in the offer. Bid containing any ambiguity may be interpreted in a manner advantageous to the Employer.

17.0 ITEMS OF WORKS

The items of works have already been detailed in these documents. However, it is repeated below:

- a. Retaining cum boundary wall & Illumination of the Substation path way - the scope is to be finalized after given view consideration of the actual site condition and soil report.
- b. 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 Bidder.

18.0 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.

19.0 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.

Superintending Engineer, West Circle,
Municipal Engineering Directorate

SECTION – E

Electro mechanical works- Technical Specification, Vendor List, Scope of work- (Kendulia & Sirishdanga)

A. Technical Specification of Major Electro-Mechanical Equipments for CWR at Jamuria(Kendulia Prop.+Sirisdanga Exis.) under AMC

This is indicative not exhaustive, will be finalized in detail engineering.

1.0. (A) VERTICAL TURBINE (VT) PUMP (FOR KENDULIA GLR)

1.0 Vertical Wet Pit Pumps

The pumps shall be of vertical wet pit type with mixed flow impeller. Pumps shall be placed vertically submerged in the wet pit and mounted on CWR Floor pumping station. 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 1.5M(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. The specific gravity of Clear Water shall be considered as 1.00 M (Max.).

1.2 The pump battery shall contain suitable no pump sets out of which each pump shall deliver 100 % 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-pullout type. The individual pump discharge lines shall run over the main operating floor and shall be connected with the common delivery manifold. The pump discharge head/motors tool /soleplate 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 shutoff 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 curves shall be stable all throughout. There shall be a margin of at-least 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-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 mm 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.

1.11 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 level, the required bottom clearance at the indicated level etc. The total suspension length, as has been considered in the offer backed by technical justification shall be placed with the technical offer.

1.12 The pump assembly shall be provided with suitable anti-friction roller thrust bearing, 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.

1.13 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.

1.14 The pump motor shall be considered as a single unit and the vibration limit should be within the limit specified in above IS.

1.15 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.

- 1.16 The pump shall also withstand the condition of any back flow on it.
- 1.17 The static and dynamic loading of the pump motor assembly with other allied components shall be clearly indicated.
- 1.18 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.
- 1.19 The impeller of the offered pump shall not be either on the lowest trim or the highest trim of the same pump family offered.
- 1.20 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.
- 1.21 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.
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 | : | Material shaving 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 |

1.29 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 for at least one pump as per by the manufacturer choice of the department at various discharge conditions including duty point shall be conducted by the manufacturer and test report shall be submitted. The duration of the performance tests of all pumps shall be not less than 2 / 3 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.

1.30 The tenderer shall fill-up the guaranteed performance figure / data given in the separate section and submit with the technical offer

1.31 Hydraulic test at shop

- 1.31.1 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.
- 1.31.2 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.
- 1.31.3 Tests shall be conducted with actual drive motors at full load and full speed.
- 1.31.4 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.
- 1.31.5 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

1.36 Performance test at shop

- 1.36.1 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.
- 1.36.2 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.
- 1.36.3 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.

1.37 PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES

1.37.1 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.

1.38 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.

1.39 **CLEANING, PROTECTION AND PAINTING**

1.39.1 **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.

1.39.2 **Painting**

All surfaces shall thoroughly be cleaned in a manner approved by the manufacturer for necessary paint (Epoxy) 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.

1.39.3 **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.

1.40 **TESTS AND INSPECTION**

1.40.1 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 EIC representatives. All relevant cost of such inspection by two representatives of EIC has to be borne by the manufacturer / contractor.

1.50 **SPARE PARTS**

1.50.1 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

1.50.2 The spare parts as mentioned are to be supplied within the completion period of the contract alongwith the main equipment.

1.50.3 Cost of spare parts as above are to be mentioned separately.

- 1.50.4 Replacement of spare parts during contract period would be borne by the Tenderer at their own cost.

List of spare parts

- i) Rotating Unit: 06nos
- ii) TNC switch: 06nos
- iii) Tr. Feeder relay: 02nos
- iv) Bearing: 10 sets
- v) Indicating lamp "50" nos.
- vi) Contactor: 06 nos.

1.60 **DRAWINGS, CURVES & INFORMATION REQUIRED**

- 1.60.1 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 along with a tentative General Arrangement Drawing showing relevant details shall be submitted with the offer.
- 1.60.2 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.
- 1.60.3 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.
- 1.60.4 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

1.51 **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.

13.00.00 **PROPOSAL DATA**

13.01.00 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 - M³/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 **PUMP NPSHR**
- 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 **FLEXIBLE JOINTS AND SHAFT**
- 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 **THRUST BEARING**

- 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 **EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE**
- 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 **GENERAL**
- 7.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering 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	:

01.00 (B) HORIZONTAL SPLIT CASE PUMP **(FOR SIRISDANGA GLR)**

There will be adequate number of pumps which are to be located at the Pump House. The Clear Water pumping station shall be as under:

The horizontal axially split centrifugal pumps are to be installed in a dry pit for horizontal execution. The prime mover would be squirrel cage induction motor. Connection of pump & motor shall be with flexible coupling. The vibration level shall be 50 microns both in horizontal & vertical direction, sound level of maximum 85 db during running condition of pump & motor at a distance of 1.50 mtr. The pump shall be supplied with base plate, grounding pad, lifting lug, eyebolts, foundation bolts, and nuts, flexible coupling, coupling guard etc. The pump shall have provision for fixing pressure gauge, vent pipe, etc.

- The Pump models shall be selected in such a manner that apart from the present duty condition mentioned above, the future duty condition of 10% increase in flow and corresponding increase in Head could be achieved by changing only the impeller assembly. The price is to be quoted for pumps with present duty condition. Necessary Data from the pump manufacturer is required to be submitted including family curve of the offered model by the successful tenderer. Further during detail engineering, the pump head may undergo a change upto a maximum of (+) 10%. Pump rotational speed shall not exceed 1000 rpm (syn).

2.00.00 SPECIFIC REQUIREMENTS

Design

The design, manufacturing, performance of the horizontal centrifugal axially pumps as specified hereinafter, shall comply with the requirements of applicable codes, the latest applicable Indian/British/American/DIN standards, in particular and in that order of application, the following.

2.01.01	IS	1520	Horizontal centrifugal pump for clean, cold, fresh water.
2.01.02	IS	5120	Technical requirements, rotodynamic special purpose pumps.
2.01.03	IS	9137	Code for acceptance test for centrifugal, mixed flow and axial pumps - Class C.
2.01.04			Hydraulic Institute Standards.
2.01.05	BS	599	Methods for Testing Pumps.
2.01.06	BS	5316	Acceptance tests for centrifugal, mixed flow and axial pumps.
2.01.07	PTC	8.2	Centrifugal pumps-Power test codes.
2.01.08			The materials of the various components shall be as per data sheet or equivalent material conforming to applicable IS/BS/ASTM/DIN Standards in that order of application.

2.01.09 In case of any contradiction between the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail. In case of contradiction between this specification and the pump data specification sheets enclosed, stipulations of the data specification sheets' shall prevail.

3.00.00 **GENERAL PERFORMANCE REQUIREMENTS**

3.01.00 The pump shall be designed to have best efficiency at the specified duty point. The Pump set shall be suitable for continuous operation at any point within the — 'Range of Operation', so as to match with the system resistance curve.

3.02.00 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

3.03.00 Pumps shall be suitable for parallel operation. The characteristics curves such as head vs. capacity, KW vs. capacity EFFICIENCY vs. capacity etc., shall match to ensure equal load sharing and trouble free parallel operation throughout the range. In the event of tripping of one of the operating pumps, the other operating pumps shall be capable of passing the maximum flow through it as dictated by the system resistance corresponding to both maximum and minimum water level in the pump suction sump.

3.04.00 The pump motor set shall be designed in such a way that there is no damage on account of any reverse flow through the pump which may occur due to any abnormal operation of the system.

3.05.00 Where reverse flow through the pump is specified in data specification sheets, the drive motor shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed without injurious heating, when power to the motor is restored with a minimum voltage of 90% at the motor terminal.

External head that may be imposed on the pump under reverse flow condition is to be decided by the Bidder after analyzing the complete system and the particular abnormal condition of run. However, any specific requirement as mentioned in the Pump Data Sheet shall be adhered to Torque-speed curve for pump and motor for such reverse flow condition shall have to be submitted along with the offer.

4.00.00 **DESIGN & CONSTRUCTION**

4.01.00 **Pump type**

Pump shall be axially split case, single volute, double suction, mixed flow type and shall be constructed in a manner that they can be placed on their foundation with their shaft in horizontal axis.

4.02.00 **Casing**

The casing shall be a single volute, double suction design and shall be so constructed that when it will be placed on its existing foundation the integrally cast with one half of the casing so that the other half of the casing can be removed without having to disturb the suction and discharge pipelines. A suitable fixture shall be provided with each pump for easy removal of one half of casing, which will have no connection with the pipelines, for inspection and / or replacement of the Rotating Elements.

4.03.00 **Impeller**

The impeller shall be double entry type and dynamically balanced.

4.04.00 **Wearing Rings**

Casing wearing rings shall be provided with torque and groove arrangement to prevent rotation and shall be easily removable.

4.05.00 **Impeller Shaft**

The impeller shaft shall be ground finished on its entire length and shall be protected with sleeves so that the shaft itself cannot come into contact with the actual liquid pumped.

4.06.00 **Sleeves**

Sleeves shall be keyed onto the shaft and located by grub screws to prevent relative rotation between the sleeve and the shaft. The impeller shall be kept in position on the shaft by means of two sleeves, which in turn shall be locked by means of suitably designed sleeve nuts.

4.07.00 **Stuffing Box**

The Stuffing box shall be an integral part of the casing and shall be fitted with lantern rings. The lantern rings shall be sandwiched between gland packings. The packings inside the stuffing box shall be held in position by glands.

4.08.00 **Glands**

The glands shall be designed to facilitate easy removal for inspection and replacement of packing.

4.09.00 **Bearings**

Adequate capacity thrust bearings ball/roller shall be provided to take the full axial thrust of the pump as well as the weight of the pump-rotating element. Thrust bearing shall be placed in the non-driving end of the pump and shall be grease lubricated anti friction type and ball bearing shall be placed in the driving end of the pump and shall be grease lubricated anti-friction type. Suitable Temperature detectors shall be provided for both DE & NDE side and the signal from the same shall be hooked upto the Control Desk & Instrument Panel

4.10.00 **Discharge Branch**

4.10.01 Discharge branch pipe upto the battery limit under this specification shall be flanged and bolted and shall be complete with gaskets, nuts and bolts of shall screwed as specified in data specification sheets. A dismantling joint in to be provided in each delivery pipeline along with valves.

4.11.00 **Suction Branch**

4.11.01 A dismantling joint will be provided at the pump individual suction side pipeline along with valves to avoid the pipe assembly from any additional thrust. Any thrust loading is to be transmitted to the foundation bolts of the pump assembly.

4.12.00 **Pump Motor Supports, Base Plate etc.**

The pumps and motors shall have common base plate supporting arrangements. The pumps & motors base frame shall be fixed on the foundation through foundation bolts.

5.00.00 **Hydraulic test at shop**

5.01.00 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.

5.02.00 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.

5.03.00 Tests shall be conducted with job motors at full load and full speed.

5.04.00 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.

5.05.00 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

6.00.00 **Performance test at shop**

6.01.00 Each pump shall have to be tested to determine the characteristic 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.

6.02.00 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.

6.03.00 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.

7.00.00 **PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES**

7.01.00 **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, which shall not be more than those specified under clause 2.01.03.

7.02.00 **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 to 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.

8.00.00 **CLEANING, PROTECTION AND PAINTING**

8.01.00 **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.

8.02.00 **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.

8.03.00 **Packing for shipment**

All parts shall be properly boxed, created or otherwise protected for transportation to suit the mode of transportation. Exposed finished surfaces shall be thoroughly greased before transportation.

9.00.00 **TESTS AND INSPECTION**

9.01.00 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.

9.02.00 Where stage inspection is to be witnessed by Employer in addition to above, the bidder shall submit to the Employer at the initiation of the contract, the deadline of PERT-CHART showing the manufacturing progress and indicating the periods where inspection of the Employer or his authorized inspection agency is required at the manufacturers premises.

9.03.00 Where stage inspection is to be witnessed by Employer, the various stages of inspection, together with the program shall be submitted to the Employer. The inspection and test procedures shall also be submitted for Employer's approval.

10.00.00 **SPECIAL TOOLS AND TACKLE**

10.01.00 The Tenderer shall quote separately for a complete and unused set of all special tools, tackles etc., if any, including tool boxes, specifying the quantum of requirement, for erection, maintenance, overhaul or

complete replacement of equipment under this specification. A complete list of tools necessary shall be enclosed with the Proposal.

10.02.00 The Price quoted for tools, shall not be considered for evaluation of Tender.

11.00.00 **SPARE PARTS**

11.01.00 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

12.00.00 **DELIVERY**

12.01.00 The schedule of the project demands early delivery of the equipments.

12.02.00 The delivery date shall be indicated by the Successful Tenderer in the Progress Schedule showing the time required for different phases of the work under the scope of this specification taking the date of issue of Letter of Intent as datum.

12.03.00 The Successful Tenderer shall guarantee the delivery date subject to penalty.

13.00.00 **DRAWINGS, CURVES & INFORMATION REQUIRED**

13.01.00 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.

13.02.00 Speed Vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed Vs. torque curves of the motor, corresponding to 85%, 90%, 100% rated voltage and also extending over Quadrant I & Quadrant II covering reverse flow conditions, if applicable.

13.03.00 Diagram showing the type of lubrication system, etc.

13.04.00 Complete descriptive and illustrated literature on the equipment and accessories being offered.

13.05.00 Experience list for the similar type of equipment supplied, which should indicate name of customer, date of ordering, value of order date of commissioning, pump parameters and number.

13.06.00 A comprehensive write up or brochure on the details of manufacturing and test rig facilities in the shop of the manufacturer.

13.07.00 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.

13.08.00 All data furnished during bidding stage including details furnished under Clause 13.00.00 above 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.

13.09.00 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

14.00.00 **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.
 - 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.

- b) The information shall be organised 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.
- g) The Instruction Manual shall include the list of spare parts that are required for 2 years normal operation and maintenance for equipment. It shall also include list of all special tools and tackle furnished with complete drawings and instructions for use of such tools and tackles.

15.00.00 **DEVIATIONS**

The Tenderer is required to submit with his proposal a detailed list of any and all exceptions taken to this specification by filling up the Deviations Sheet. In absence of such a list it will be understood and agreed that Tenderer's proposal is based on strict conformance to the specification in all respects. These requirements, however, are not intended to prohibit Tenderers from offering alternate quotation for equipment which they consider to be equal or superior to that specified for the intended service and for which he believes he can show economic and/or technical advantages, provided that he is not allowed to add to the Vendors list and is confined to items not appearing therein. However acceptance of the same is at the sole discretionary power of the T.I.A.

16.00.00 **PROPOSAL DATA**

16.01.00 To complete the proposal, the Tenderer must fill up the following DATA SHEET / CHECK LIST furnished hereinafter.

16.02.00 Each Tenderer shall supply the data requested in Proposal Data paragraph as above by typing in appropriate places on each page. These filled in data sheets must be properly signed by authorised representative of the Tenderer or Manufacturer as verification of the data submitted. These signed pages, in their entirety, shall be returned with and shall be part of the Tenderer's formal proposal. The Tenderer shall completely fill in the above information required for each of the above mentioned sheets. Failure to comply with this requirement may result in the rejection of the tender.

17.00.00 **FOREIGN EXCHANGE AVAILABILITY**

No foreign exchange license will be available for this specification, if any foreign exchange is required by any Tenderer, it will have to be arranged from his own quota, through his own arrangement.

DATA SHEET / CHECK LIST OF THE PUMPS BEING OFFERED

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

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 present duty condition for solo operation	:	
1.08.00	Efficiency of Pump at future duty condition for Solo operation	:	
1.09.00	Efficiency of Pump at present & future duty condition in parallel operation	:	
2.00.00	PERFORMANCES		
2.01.01	Guaranteed capacity - M ³ /hr in peak flow without tolerance in single operation & parallel operation.	:	
2.01.02	Guaranteed head - MWC at peak flow discharge, without tolerance in single operation & parallel operation.	:	
2.01.03	Input to the Pump (KW) at present & future 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 at present & future duty condition	:	
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 present and future duty condition	:	
2.01.10	Pump shut off head for present and future duty condition	:	
2.01.11	Minimum submergence required in MWC at worst flow condition	:	
2.02.01	PUMP NPSHR		
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	:	
2.02.06	Pump shut off head		
3.00.00	FLEXIBLE JOINTS AND SHAFT		
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 **THRUST BEARING**
- 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 :

The following data are obligatory for all the pumps

- 5.00 **MATERIAL OF CONSTRUCTION**
- 5.00.01 *Impeller* : *ASTMA-743, Gr- CF8M*
- 5.00.02 *Casing* : *CI, IS- 210, FG-260*
- 5.00.03 *Casing ring* : *SS, Type- 304*
- 5.00.04 *Pump shaft* : *SS410*
- 5.00.05 *Coupling for pump Motor* : *Flexible pin and Bush type, C.I.*
- 5.00.04 *Shaft sleeve* : *SS, ASTMA-276, Type- 410*
- 5.00.06 *Base Plate* : *M.S*

The following data are to be filled up by the tenderer

- 6.00.01 Are the pumps suitable for parallel operation :
- 6.00.02 Whether non-Reserve Rutchet is provided in pump or not :
- 6.00.03 Type of lubrication for pump :
- 6.00.04 Whether pre lubrication arrangement provided
- 7.00.00 **EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE**
- 7.00.01 Impellers :
- 7.00.02 Pump Bowl Casing :

- 7.00.03 Shaft :
- 7.00.04 Thrust Bearing :
- 7.00.05 Whether pump performance curve (H-Q, Q-P, Q-n, Q-NPSHR) authenticated by the pump manufacturer provided with the offer resistance curve :
- 7.00.06 Whether the copy of the pump family curve, authenticated by the pump manufacturer provided with the offer :
- 7.00.07 Whether the system head curve superimposed with pump performance curve & modified performance curve provided with the offer :
- 8.00.00 **GENERAL**
- 8.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering devices provided :
- 8.00.02 Whether lifting lugs, eye bolts etc. provided :

- 8.00.03 load data
- 8.00.04 Weight of total pump assembly (empty) :
- 8.00.05 Weight of total water column :
- 8.00.06 Total Static Load :
- 8.00.07 Total dynamic Load :
- 8.00.08 Maximum horizontal back thrust at maximum water level condition :

**HORIZONTAL PUMP AXIALLY SPLIT CASE
DATA SPECIFICATION SHEET**

GENERAL INFORMATION

Service	Clear Water	Pump Type axially split case	Horizontal pump
Designation			
No of pumps Reqd.: (To be filled in by the tenderer)		Duty	Continuous
Pumps working condition	Solo / Parallel	Location	Indoor

ELECTRICAL DOCUMENT

Electrical Motors Technical Specification Enclosed : Yes/No

SUPPLY OF ACCESSORIES AND SERVICE

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

Base Plate	Yes/No	Eye bolts, Lifting tackle etc.	Yes/No
Sole Plate	Yes/No	Vent and drain with isolation valves	Yes/No
Foundation bolts, nuts, sleeves nut	Yes/No		
Companion flanges at Pump		Universal Joint	Yes/No
Suction & Discharge reducers along with nuts, bolts & gaskets	Yes/No	Thrust block reqd. Non reverse ratchet	Yes/No Yes/No
External cooling/sealing/lubrication	Yes/No	Special Tools & Tackle	Yes/No
		Spare parts (for 4 years operation)	Yes/No
Cooling/sealing/lubrication system	Yes/No	Painting & Protective coating	Yes/No
Discharge pressure gauge	Yes/No	Suction side low level switch with annunciation hooter complete with accessories.	Yes/No
Suction pressure/VAC Gauge	Yes/No		
Pump Motor Coupling & Guard	Yes/No		

DATA SPECIFICATION SHEET

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

PUMP PARAMETERS

Design Capacity	Individual Pump of required capacity	Permissible tolerance in design	(±) 2.5%
Effective head (excluding loss in pump discharge branch pipe)	Discharge at duty point with parallel operation in all the cases	Permissible tolerance in efficiency :	(-) 3%
Available at design capacity :	Tenderer to indicate from the data supplied	Minimum submergence : required	Tenderer to indicate.
Discharge pressure :	In MLC	Static head of pumping system	
Pump shut off head :	In MLC	Frictional head of system : at design capacity	
Range of operation : (Tenderer to indicate)	% to % of design capacity	Reverse flow through pump to be considered for motor selection	Yes/No

Maximum speed :
(Tenderer to indicate)

Only rising stable HQ characteristics throughout the 'Range of Operation' is acceptable

Yes/No

LIQUID DATA

Liquid handled	Clear Water	Chloride	39 ppm
Specific Gravity	Nearly 1.0	Total hardness as CaCO ₃ max	144 ppm
Temperature	10- 40 ⁰ C	Chlorine	2 ppm
pH Value	7.3 to 8.6	Total dissolved solids max	500 ppm
Turbidity	5 NTU/ JTU (Max)		

**DATA SPECIFICATION SHEET
INSPECTION AND TESTING**

Item
Stage inspection by owner :
(details of Stage Inspection by Owner to be added in due course)

Specification
Yes/No

Material testing and Identification

Required/not required

RADIOGRAPHY

Parts to be tested:
Testing Std:
Acceptance Std:

ULTRASONIC Test

Parts to be tested
Testing Std.
Acceptance Std

DYE PENETRATION

Parts to be checked
Testing Std.
Acceptance Std.

Hydrostatic test

Testing Std.
Acceptance Std.

Dynamic balancing pump impeller shop to be witnessed

Yes/No

Performance test at shop reqd. at full speed & full load

Yes/No

MAGNETIC PARTICLES

Parts to be checked
Testing Std.
Acceptance Std.

NOTES

1. Pump motor set to be designed for starting with discharge valve partly open/closed condition.
2. Motor cooling arrangement shall be self-circulation type having fans mounted on motor shafts.
3. For sealing/cooling water shall be tapped from the pump discharge.
4. Range of operation of the pumps shall be selected by the Tenderer shall also indicate the minimum water level at which pumps can be satisfactorily operated on continuous basis. Tenderer shall furnish with his offer NPSH Vs capacity curve for the entire range of operation based on the above conditions and considering single pump operation & all installed pump operation.

As per technical specification and instruction manual of the manufacturer.

01.01 SUMP PUMP

Provision of two numbers sump pumps have made considering one unit will operate other would remain as standby. All seepage water from glands would be accumulated in a sump of dimension approximate 1.5-meter x 1.0-meter x 0.6 meters. The capacity of each pump would be 30M³/Hr at a head 15 Meter. The drive motors would be of adequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. The delivery pipes of individual pumps will be connected to a common manifold would be such that the water can be drained in a nearby location, outside the pump house within a distance of 10 meter maximum. The NRV and pit valve shall be placed in each pump delivery line and one no pit valve shall be placed in delivery line which generates from the common header. All GI pipes and specials within the bidder's scope. The bidder has to provide suitable capacity DOL starter for individual pump motor set and placed in the suitable place for easy operation. The power will be taken from the control panel through switch fuse unit.

OR

The portable submersible dewatering pump motor set will be suitable for dewatering gland leakage muddy water withadequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. Submersible motor will be oil filled. The pump will be fitted with suitable mechanical seals, ball bearing etc. and shall be capable of performance details bellow when running in 2900. The pump will be fitted with cast iron / bronze impeller fitted in cast iron casing.

Pumps and motor shall be closed coupled and motor will be placed on top of the pump. This arrangement will ensure that in the sump can be drained to the maximum extent possible, so that the level of water in the sump is only a few cm above the pump inlet.

The motor winding will be insulated with oil and water resistance materials. The pump and motor unit shall be capable of running dry even when the motor oil seals fail draining out the oil from the motor and running which vertically no water sump.

Installation: -

As per technical specification and instruction manual of the manufacturer.

02.00 MOTORS (VERTICAL AXIS FOR KENDULIA GLR& HORIZONTAL AXIS FOR SIRISDANGA GLR)

2.01.00 SCOPE

- 2.01.01 This specification covers the general requirements of the drive motors.
- 2.01.02 Motor shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 2.01.03 In case of any discrepancy, the driven equipment specification shall govern.

2.02.00 STANDARDS

All motors shall confirm to the latest applicable IS/BS/DIN Publications.

2.03.00 TECHNICAL SPECIFICATION FOR DRIVE MOTORS

- 2.03.01 The drive electrical motors shall be of squirrel cage induction type vertical /Horizontal axis to suit the size of the pump and shall be able to drive the pump. The rating of the motors shall be minimum 45KW, 110KW, & 200KW (FOR KENDULIA GLR) and 45KW, (FOR SIRISDANGA GLR) & 1500 RPM (Syn.), 415V \pm 10%, 3 Phase, 50 Hz \pm 5%.
- 2.03.02 The motor shall be designed for Star / Delta starting arrangements. The motor starting current shall be guided by IS 12615.
- 2.03.03 All the motors shall be rated for continuous duty operation (duty: S1) IE2. However, due to the operational schedule of the pumping station, the pump motor unit may demand for 8/10 start and stop in a day with a minimum time gap of 20 minutes for one stop after prolong operation and restart the same. The motor shall also be capable of one immediate hot restart and three equi spaced starts per hour.
- 2.03.04 The motor KW rating shall have 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 operation whichever is higher. The overload capacity of the such selected motor rating shall be 10% continuous by allowing temperature rise upto Class-F limits. If the tenderer feel that the above rated motor is not satisfying stated loading, they may offer their rating of motor.
- 2.03.05 The motor characteristics shall match the requirements of the driven equipment.
- 2.03.06 The motor should deliver rated output and accelerate the full speed with 85% of the rated voltage at motor terminal. The accelerating time of the motor should not be more than 3 sec.
- 2.03.07 With 85% rated voltage at motor terminal, the motor shall be capable of working satisfactorily at full load at least 5 minutes without injurious heating or stalling. For 3% voltage imbalance in power supply, the motor shall not be de-rated by more than 10%.
- 2.03.08 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 sec. 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.
- 2.03.09 The motor shall be TEFC type having protection group of IPs 55. Motor shall be suitable for rotation in both the direction.
- 2.03.10 The insulation of the stator winding of the motor shall be of Class-F but the heat exchanging arrangement shall be such that the temperature rise is limited to that of Class-B as IS:325 over the ambient temperature. The ambient temperature may be considered as 45°C and the relative humidity may vary from 80% to 100%.
- 2.03.11 The rotor of the motor should be sturdy in construction so as to ensure trouble free operation as indicated in relevant clause without any rotor bar fracture inside or outside the rotor slots or rotor bar end brazing failure or development of cracks in the brazed joint of the rotor bar with shorting ring. The rotor bar of the rotor shall be 99.99% electrolyte grade Cu and shall be well machined, insulated tightly placed and evenly press fitted inside the rotor slots, the later being broached to have smooth finish. The rotor shall be slotted end ring design. The rotor bars in the form of temple bars shall be used. Proper brazing materials shall be used.

The rotor shall be dynamically balanced with all the fans and with key in the shaft extension.

The rotor must carry a guarantee of at least 20,000 starts as per the operations schedule mentioned in relevant clause without any rotor bar failure or any other type of rotor failure.

- 2.03.12 The motor shall be provided with anti-friction bearing, 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 on-service positive lubrication with drains and grease collectors to guard against over lubrication.

The type and number of bearing the lubricant details (limited to normally available types of IOC or, any standard make). Quantity and frequency of bearing lubrication should be clearly indicated in the offer as well as to be displayed in the rating plate of the motor.

- 2.03.13 The motor should be smooth in operation and the noise level should not exceed 85 db. at 1.5M from the motor. The vibration level of the pump and motor should be within the specified the limit of IS:11724 and must be within 75 microns.

The motor should have adequate number of terminal boxes for main power cable, control cable & signal cable. The motor main terminal box shall be

rotatable in steps of 90°. The main terminal box should be suitable for minimum 2 run 3 core, 1.1 KV grade, 35/50/70/150/185/240/300 sq.mm. Aluminium conductor, armoured, XLPE Cable as deemed fit to the system. The terminal boxes shall be with removable cover with access to connection. No compound shall be used in the terminal box for easy handling. The motor terminal boxes shall be furnished with suitable cable lugs and double compression brass glands to match with the cable size. The terminals shall be clearly identified by phase markings and termination indication corresponding to direction of rotation.

The maximum system fault current for a duration of 1.0 sec. shall be considered.

The motor shall be equipped with built-in anti-condensation space heater of adequate rating suitable for operation at 240V AC supply. Separate terminal box for the space heater connection are to be provided.

The frame of each motor shall be provided with two separate and distinct grounding pads suitable for accommodation of grounding conductors of suitable size GI flat. The main cable terminal boxes shall have separate grounding pads.

- 2.03.14 The rating plate of the motor should contain, the minimum information as indicated in the relevant IS. Apart from the same, the information as indicated in relevant clause as well as the temperature rise in °C under rated condition, method of measurement, degree of protection shall be furnished.

- 2.03.15 The successful tenderer should 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.

- 2.03.16 The dimensional drawing of the offered motor, terminal box drawings, load data, GD2 value of the drive unit and the driven unit shall be furnished to the EIC for approval.
- 2.03.17 Apart from the standard accessories provided by the motor manufacturer and those accessories mentioned in preceding paras, one local lock switch is to be provided with each motor having proper connection with the motor connecting switchgear so that the motor breaker cannot be closed when the lock switch is in operation. The motor shall also be provided with suitable lifting lugs eye bolts having adequate provision for lifting installation.
- 2.03.18 The motor shall be provided with RTD's and BTD's for alarm and trip (for rating 75 KW and above). The leads shall be brought out to a separate terminal box.
- 2.03.19 The routine tests as per IS:325 shall be conducted to each motor. Temperature rise test are to be conducted on at least one motor (75KW & above) of each rating. The motor vibration tests shall be conducted mounting the motor on the shop motor stool. All the above tests are to be conducted at the manufacturer's shop in presence of the departmental representatives. Apart from the shop testing, normal field testing are to be carried out during installation, pre-commissioning and commissioning. All necessary arrangements for the tests are to be made by the contractor.
- 2.03.20 Motors up to 5 KW shall be of DOL starting and beyond 5 KW shall be Star-Delta Starting

CHECK LIST OF THE MOTORS BEING OFFERED

- 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 (Rating 75KW & above)
- 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 M²)
- 1.41.00 GD2 value of load to motor shaft (kg M²)
- 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 75 KW & above) of at least 1 no. motors as per choice of the customer, shall be performed. Further any special tests called for in the driven equipment specification shall be performed. The manufacturer/tenderer has to bear all expenses for such testing to witness the tests for max. two representatives of EIC to the manufacturer's 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 manufacture's factory.

3.00.00 SPARES

Spare parts are to be supplied as specified separately. Recommended spares for five (5) years operation shall be quoted along with the bid clearly identifying the part nos. with recommended quantities.

I) DE & NDE Bearing :1 set.

4.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

- 4.01.00 Along with the bid:
 - Individual motor data as per Check List
- 4.02.00 After Award of the Contract for Approval:
 - a) Dimensional General Arrangement Drawing
 - b) Foundation Plan & Loading
 - c) Cable end box details
 - d) Load Vs Efficiency & power factor, Current Vs Time / Speed curves
 - e) Thermal withstand curves hot & cold

- f) Speed torque characteristics at 80% & 100% voltage
- g) Complete motor data

VALVES AND SPECIALS

03.01.01 Delivery side of pumps

The delivery side of each pump shall be provided with 1 no. Electrical Actuator operated butterfly valve and 1 no. non-return valve, 1 no. Dismantling joint & short pieces wherever required. The diameter of the valves and joints shall selected based on velocity of 2.0 m/sec(approx.) with nearest sizes as per IS.

03.01.02 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 water and to maintain unidirectional flow. The valve shall be maintenance free, leak proof and shall have low life cycle cost. The PN rating of valves shall be PN 1.0. /1.6

The non-return valve shall be single door, Ductile Iron, double flanged, conventional non-slam design. The body, door, cover shall be of ductile iron (Gr. GGG 40). The seat and body shall withstand fluid pressure of 10-16kg / cm² and 16-24 kg / cm² 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/ mm².

The valves are subject to satisfactory hydrostatic test at manufacture's works and in presence of the department's representative for acceptance.

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.

03.02.01 Butterfly Valve

The butterfly valves shall be DIDF, PN 1.0. /1.6, conforming to IS 13095 of 1996 / BS 5155. The seat pressure shall be 10-16 kg/cm² and body pressure shall be 16-24 kg/cm². The valve shall operate smoothly & steadily in both directions, 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, IP68 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

03.02.02 ELECTRICAL ACTUATOR

1. The actuator motor for the BFV 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 for continuous submergence.
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 switchesAll 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 10% 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.

03 .00.01 SLUICE VALVE

The sluice valves shall be manufactured from ductile iron (Gr. GGG 40). conforming to IS-14846 / 2000. Flange ends as per IS 1538 or as per other standards to match with other flanges. The body seat shall be of S.S. AISI-410 stem shall be of S.S. AISI-410 & the stem nut shall be Gun metal conforming to I.S. 305:1981/BS 2874. Other details are to be submitted for approval.

The seat pressure shall be 10 kg/cm² and body pressure shall be 15 kg/cm². The valves should pass through hydrostatics test for duration of 5 minutes.

Body, Cover, Wedge	:	Ductile Iron GGG 40
Shaft	:	S.S. to AISI-410
Body Seat	:	S.S. to AISI-304
Bearing	:	G.M./Teflon
Wedge Sit	:	S.S. to AISI-304
Packing	:	Rubber "O" ring
Internal Fasteners & Clamping Ring	:	S.S. to AISI-304
External Fasteners	:	Carbon Steel to IS:1367 Cl. 4.6 & 4.0.
Hand wheel	:	Fabricated Steel
Worm Gear Unit	:	Mfg. Std.
Actuator	:	No

Testing (as per IS : 13095 / 91)				Inspection		
Hydro Body	:	15 Kg / Sq.cm for 5 minutes		Hydro Test	:	Witness & Test Report
Hydro Seat	:	10 Kg / Sq.cm for 2 minutes		Visual	:	Witness & Test Report
Disc. Test	:	10 Kg / Sq.cm for 5 minutes		Material Test	:	Test Report
Quantity				Note:		
Size (NB)	Qty (Nos.)	Location	Service / Application	1. Valves shall be tight shut-off closures for frequent operation 2. Valve should closed with clock wise rotation of Hand wheel. In case of hand wheel operation) 3. Valves shall be painted with one coat of Red oxide primer & two coats of Black bituminous paints before dispatch. 4. Marking : Brand / Size / PN – Rating / Heat No. & Sl. No.		

Materials of construction test certificates shall be provided during supplies. The sluice valves shall be rising spindle type with gearing arrangement / hand wheel for easy manual operation.

03.04 **M.S. DISMANTLING JOINT ASSEMBLY AT INDIVIDUAL DELIVERY LINE AND MANIFOLD**

One M. S. dismantling joint of suitable diameter is to be fixed in each of the individual delivery and one no along with the Flow meter & BFV on the water delivery 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 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 10 -16kg/cm². One leak proof concrete chamber if required as per site condition is to be constructed. The Dimension of the Chamber would however depend on the final alignment and level of the site condition

03.05 **PUMP DELIVERY SIDE PIPING AND COMMON DELIVERY MANIFOLD**

The pump individual delivery side piping, valves and joints and Common Delivery Manifold shall be shall selected based on velocity of 2.0 m/sec(approx.) and 1.55 m/sec (Approx.) respectively with nearest sizes as per IS.

The pipes shall be made up of M.S. 8/12 mm thick plates for individual delivery line and Common Delivery manifold, 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 common delivery manifold shall of such diameter as per the Technical offer. The manifold shall be fabricated from 8/12mm thick MS plates. The common manifold shall have blank flange / Dish end on one side with adequate stiffening (as applicable) and the other side would be extended from the centre line of the last pump to install one each Dismantling Joint, Butterfly valve, Air Release Valve and further as required to install one Full bore Electromagnetic flow meter. The length of the manifold must be extended at least one meter on one side after the interconnections with the delivery pipe lines from the pumps at the one extreme end and in the other end it will be extended up to the specified length.

The common delivery manifold shall be provided with one no. 100 mm dia air release valve (double throat) 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).

03.06 Pressure Gauge/Compound Gauge (Dial Type):

The individual discharge line and common delivery manifold shall be provided with pressure gauge (6" dial) 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 -10 Kg / Sq.cm. The pressure gauge shall have 3-way cock and fitting.

03.07 Tamper proof Kinetic air release valve

Air valve for clean, cold potable water up to 50°C

PN 10 / 16

DN 80 – 200

Double chamber valve with twin float (Rubber / Vulcanite coated timber core / SS 304) - automatic operation with water.

Two-orifice venting system with 3 functions (supply and release of air as well as automatic venting during operation)

Flange connection dimensions to IS 1538 Table 4 & 6

Body and Cover made of CAST IRON IS 210 Gr. FG 260

Seal made of EPDM

Corrosion protection:

Inside and outside with liquid epoxy coating; thickness >250 μm , colour: RAL 5005 blue

Accessories:

Must have a metal seated gate valves (description as above for Sluice Valves up to 800 mm) of same diameter for isolation purpose, complete with gasket and fasteners (steel galvanized)

04.00 HTPDB (FOR KENDULIA GLR)

4.1. The HT PDB shall be multi panel switch board suitable for indoor installation and shall operate at 11 KV $\pm 10\%$, 3 ϕ , 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.

4.2. 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 11 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.

- 4.3 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.

- 4.4 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.

- 4.5 copper, sized for specific current rating with maximum temperature rise limited to 90⁰C. 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.

- 4.6 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.

- 4.7 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 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 11 KV grade XLPE cable.
- c) 1 set of indicating lamp ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUITHEALTHY / 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 and closing coil rated for 110 V DC.
- f) 1 space heater with ON & OFF switch
- g) 15A / 15A 3 Pin Plug Socket
- h) In – panel lighting with control switch
- i) Space heater for each Switchgear panel
- 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 suitable for 3 phase, 3 wire 5 limb 50 Hz system with a ratio of 11 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 62KA. 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.

4.8 The feeder details of the Multi panel HT PDB shall be as under:

A) Incoming feeder Panel: 1 No. (800 A)

- | | | | |
|-------|-------------------------------------------------------------------------------------------------------------------|---|-------------------|
| i) | 96 sq mm (0 – 12 KV) Voltmeter with Selector Switch | - | 1 Set |
| ii) | 96 sqmm Ammeter suitably dual scaled 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 ratio and 5A 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. |
| viii) | Trip Circuit Supervision Relay type VAX 31 or equivalent | - | 1 No. |
| ix) | Master Trip Relay type VAJH 13 or equivalent | - | 1 No. |
| x) | Multifunction meter (For Amp. Voltage, frequency, power factor etc.) type ELITE 445 or equivalent | - | 1 No. |
| xi) | Power Factor Meter | - | 1 No. |
| xii) | KW Meter | - | 1 No. |
| xiii) | 12 Channel alarm annunciator & Indicating Lamps | | 1 Set |

B) Out going feeder panels for transformers: 2 Nos. (800 A)
Each Transformer feeder panel shall be equipped with the following:

- | | | | |
|------|--------------------------------------------------------|---|-------|
| i) | 96 sq. mm Ammeter suitably scaled 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 ratio and 5A Secondary, Class 5 P10 & 1.0, 10VA burden - 1 Set (3 Nos.)
 - v) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P122 or equivalent - 1 No.
 - vi) Master trip relay type VAJH-13 - 1 No.
 - vii) Trip Circuit Supervision Relay type VAX 31 or equivalent - 1 No.
 - viii) Auxiliary relay type VAA -33 or equivalent - 3 Nos.
 - ix) 12 Channel alarm annunciator & Indicating Lamps - 1 Set
- C) Common for all above feeders:

- i) Anti – pumping relay

4.9. Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MCC cum PDB 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.

4.10. 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

4.11 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.

05.00 TRANSFORMER (FOR KENDULIA GLR)

There will be total two (2) number of transformers, each having a capacity of 1000 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

- i) Conservator with drain valves and oil gauge.
- ii) Silica gel breather
- iii) Bidirectional rollers
- iv) PRV with contact.
- v) Oil filter valve
- vi) Transformer tank drain valve, one upper and one lower.

- vii) Earthing terminals – 2 nos.
- viii) Air relieve plugs
- ix) Rating and diagram plate
- x) Bucholz's relay with Alarm and Trip
- xi) OTI with Alarm and Trip contacts
- xii) WTI with Alarm and Trip contacts
- xiii) MOG with contact
- xiv) Marshalling box with contacts of Bucholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 5.1 Two nos. 1000 KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45° C.
- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.
- 5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.
- 5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	: 3 (three)
Winding connection & vector group	:	: DYn-11
Rated frequency	:	: 50 cycles/sec.
Rated KVA	:	: 1000 KVA
Rated primary voltage	:	: 11 KV
Rated secondary voltage	:	: 0.433 KV
Method of system earthing	:	: Secondary solidly grounded
Tap-Changer	:	: Off-circuit Tap-changer (OCTC) (+) 5% to (-) 10%
Tapings	:	: in steps of 2.5%
HV side terminal arrangements	:	: Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus Coupler PDB at Substation. (KENDULIAGLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 1600 A for phases and 800 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 1600A incoming feeders 2 nos. each comprising of following components:

- i) 415 V, 4 pole, 1600A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release 1 No
- ii) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1
No.
- iii) 96 sq. mm, 0 – 500 V Voltmeter with selector switch 1
No.
- iv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- v) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- vi) Red, Yellow, Blue phase indicating lamp as required
- vii) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- viii) TNC Breaker Control Switch 1 No.
- ix) Local / Remote Selector Switch 1 No.
- x) Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13
1 No.

6.12 1600 A Bus coupler feeder one (1) number comprising of following components:

- i) 415 V, 4 Pole, 1600 A, 50 KA electrically operated draw out
ACB without release. 1 No.

- ii) TNC Breaker Control Switch 1 No.
- iii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for KENDULIAGLR (each equipped with following:)

- I) 415 V, 3 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.
- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.
- VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 4 Nos.
- b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
- (Adjustable O/L) rated upto 50⁰ C without duration
- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility

for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB at KENDULIA GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1250A for phases and 630A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- | | | |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| i) | 415 V, 4 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. | 1 No |
| ii) | 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch | 1 No. |
| iii) | 96 sq mm, 0 – 500 V Voltmeter with selector switch | 1 No. |
| iv) | Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA | 3 Nos. |
| v) | Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA | 3
Nos. |
| vi) | Red, Yellow, Blue phase indicating lamp | as required |
| vii) | MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp | 4
Nos. |
| viii) | TNC Breaker Control Switch | 1 No. |
| ix) | Local / Remote Selector Switch | 1 No. |
| x) | Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13 | |

1 No.

7.11 1250 A Bus coupler feeder one (1) number comprising of following components:

- i) 415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type

ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.

- ii) TNC Breaker Control Switch 1 No.
- iii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 200KW Star – Delta Starter Motor feeders, each comprising of following components:
Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 110KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| d) | Start / Stop Push Button | - | 1 Set |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.12 45KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / | - | 4 |

	OFF / TRIP / EARTH FAULT TRIP	Nos.
	Start / Stop Push Button	- 1 Set
d)		
e)	96 Sq mm suitably scaled including cramped scale Ammeter with selector switch	- 1 No.
f)	True Digital Microprocessor based 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 (BOCR/EOCR or equivalent)	- 1 No.
g)	High speed master trip relay type VAJH 13 or equivalent	- 1 No.
h)	CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA	- 3 Nos.
i)	CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA	- 3 Nos.

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

a)	Motor protection circuit breaker	1 no
b)	Power contractor	3 no
c)	Aux. contractor	5 no
d)	Current transformer	3 no
e)	Analog ammeter	1 no
f)	Ammeter selector switch	1 no
g)	Indicating lamp	3 no
h)	On/off push button	2 no.
i)	Star delta timer	1 no
j)	Thermal overload relay	1 no
k)	Power terminal,	2 no

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

- b) 63 A TPN MCCB with Microprocessor based O/C & E/F releases (Adjustable O/L) rated upto 50⁰ C without deration4 Nos
- C) Not less than #A TPN MPCB for actuator feeder15 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

- e) 16 A DP MCB 8 Nos

08.00 LT DB at WBSEDCL Room For Receiving Power AT SIRISDANGA GLR

08.01 The LTIC/OG is required to Receiving Power from WBSEDCL Andprovide power to the Pump Houses MCC cum PDB and auxiliary loads for desired locations.

08.02 The LTDB shall be suitable for 415 V ± 10%, 50 Hz ± 5%, 3 phase, 4 wire supply system. Theincoming power shall be provided from the WBSEDCL supply.

08.03 Incoming feeder termination shall be done with XLPE insulated armoured aluminium cable as required.

The LTIC/OG panel details are as under:

Incomer &Outgoing :415 V, 3 phase 4 wire , 50 HZ, 400A MCCB for receiving & delivering power

The panel shall be side entry and rear out type single panel MCCB feeder with micro-processor base adjustable O/L, E/F and Short Circuit.

09.00 415 V Multi panel MCC cum PDB atSIRISDANGA GLR LOCATION

9.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

9.2 The MCC cum 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 outgoing feeder & PDB at at substation

9.3 The MCC cum 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.

9.4 The MCC cum 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.

9.5 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.

9.6 The bus bar for the MCC cum PDB shall be TPN, 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 400A for phases and 200 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 50 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.

9.7 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 ACB shall receive 2X 185 sq.mm., 1.1 KV grade 3.5 core 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.

9.8 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.

9.9 Feeder details with mounted components

The feeder details are as under:

9.10 400A incoming feeder 1 no. comprising of following components:

- i) 415 V, 4 pole, 400A, 50 KA MCCB with adjustable O/L, S/C, E/F 1 No
- ii) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- iii) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- iv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- v) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- vi) Red, Yellow, Blue phase indicating lamp 3 Nos.
- vii) ACB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp 4 Nos.
- viii) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13

1 No.

9.11 45KW Star – Delta Starter Motor feeders, each comprising of following components:
(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Adequate rating (Min one size higher than the selection as per Type-II Coordination), 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Adequate rating (Min one size higher than the selection as per Type-II Coordination Air Breaker Contactor with 240 V - 3

	AC Coil arrangement		Nos.
c)	Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP	-	4 Nos.
d)	Start / Stop Push Button	-	1 Set
e)	96 Sq mm suitably scaled including cramped scale Ammeter with selector switch	-	1 No.
f)	True Digital Microprocessor based 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 (BOCR/EOCR or equivalent)	-	1 No.
g)	High speed master trip relay type VAJH 13 or equivalent	-	1 No.
h)	CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA	-	3 Nos.
i)	CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA	-	3 Nos.
j)	Local /Remote selector switch		1 No.

9.13 MCCB / MCB feeder of following rating

- a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases (Adjustable O/L) rated upto 50⁰ C without duration 6Nos.
- b) Not less than # A TPN MPCB for Actuator. 5 Nos
- c) 63 A TPN MCCB with Microprocessor based O/C & E/F releases (Adjustable O/L) rated upto 50⁰ C without deration 3 Nos.

d) ON / OFF / Trip Indicating Lamp (For each feeder) As per requirement

- e) 16 A DP MCB 6 Nos.

15.00 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

15.1 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

15.2 Float and Boost Battery Charger

15.2.1 Charger – I (Float Charger – SCR Control)

- a) Output Voltage : 110 – 125 V DC [steplesslyadjustable]
- 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

15.2.2 Charger – II (Boost cum Float Charger – SCR Control)

- a) Output Voltage Boost : 110 – 127 V DC [steplessly adjustable]
Em. Float: 110 V – 125 V DC [steplessly 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

15.3 Protection

- a) Snubber across each device
- b) Phase failure / sequence reversal

c) Soft start with current limiting (intrinsic feature of trigger PCB)

15.4 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

15.5 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.

15.6 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

15.7 DCDB Outgoing Feeder

- a) 2 P, 16 A DC MCB - 6 Nos.

15.8 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

16.00 CABLE:

All HT and M.V. power cables shall be with XLPE insulation, stranded aluminium / copper conductor and armoured

16.01 HT &M.V. Cables and Jointing

All HT and M.V. Cables shall be 11 KV (E) / 1.1 KV grade XLPE insulated and armoured of Al / Cu. conductor 3 core / 3½ core / 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 1000 mm width x 1200mm 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.

16.02 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.

17.00 FLOW SENSOR

There shall be one number of Full bore Electromagnetic flow meter on the common delivery manifold. The flow meters 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 m³/hr & total flow in cubic meter. The flow sensor shall be suitable to measure Raw 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 50 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 ± 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 Raw Water.

Type:- Pulsed DC electromagnetic.

Accuracy:- ± 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.

Weather protection class:- IP68 NEMA 6 P or as per the specified by EIC.

Minimum conductivity:- 20 $\mu\text{S}/\text{cm}$

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 single Length as required as per site condition between sensor and transmitter.

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.

Output: - 4-20 mA DC

Power supply: - 240 V AC 50 Hz and shall be supplied from the MCC cum PDB at a approximate 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.

18.00 Flow meter/ Flow sensor or Flow Tube fixing chamber

For fixing of Flow Tube at the delivery manifold, leak proof chamber of adequate dimension is to be constructed if required as per site condition with a rung-ladder of suitable length for getting down if necessary.

19.00 EARTHING

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 75mm wide and 8 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 Earth Pits should not be less than 3 meters.

20.00 LIGHTING SYSTEM

20.01 Luminaries

The scope includes indoor lighting of pump house, substation building, Annex area and reasonable area lighting around the Pump House and Substation Building. Industrial Medium bay luminaries with 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 Substation Room lighting should be provided with LED T/L 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.

Area illumination/access bridge level 100 LUX with suitable LED fittings.

All the entrance/exists of pump house shall be provided with LED down lighter or bracket mounted fittings with LED lamps of minimum 45 Was per site condition (minimum 90W for unloading bay entrance).

20.02 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.

20.03 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.

20.04. 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.

20.05 The above stated distribution board shall be fed from independent switch fuse unit / MCB / MCCB located in the PDB.

20.06 440 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.

20.07 The minimum required size of the conductor for internal distribution point wiring shall be as follows:

Sl.	Type of fitting	Minimum size of wire
-----	-----------------	----------------------

No /wiring

1. LED Fluorescent 2 nos. 1 core -1.5 mm² copper & 1 no. Earth wire of 1.0 mm² copper
2. LED Flood light fitting 2 nos. 1 core -2.5 mm² copper & 1 no. Earth wire of 1.0 mm² copper
3. Receptacle- 5A 2 nos. 1 core -2.5 mm² copper & 1 no. Earth wire of 1.0 mm² copper
4. Receptacle- 15A 2 nos – 1 core-4 mm² copper & 1 no Earth wire of 1.0 mm² copper

21.00 Ventilation & Firefighting System:

21.01 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 / armoured cable including all other accessories as required.

- a) 3 - phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for the Pump House to ensure 10 Air changes/Hr..
- b) Single phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for all the rooms of Sub Station as per the direction of EIC.
- c) Wall mounting type control panel for exhaust fan and others ----- 2 Sets, one each for pump House and substation.
- e) 18" Pedestal fan with regulator and all other accessories --- 3 Nos.

21.02 Fire Extinguisher

- a) ABC type Portable type fire extinguisher 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.

20.00 OVERHEAD CRANE

20.1 EOT Crane.

The EOT. Crane will be minimum 5 M.T. capacity Electrically Operated Travelling Crane (E.O.T.) with a lift from the operating floor level and up to the level above the installed motors. The long travel & the Cross Travel along with height of lift of the crane shall be finalised after freezing of the Pump House 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 shall be manually operated. The buffers must be spring loaded operation.

The EOT Crane should be tested at manufacturer's works / site as per relevant IS. The same may be witnessed by the EIC. The Contractor has to arrange for such testing at his own cost.

21.00 Chlorination System

- 1) Chlorination System should be 2X 5k.g/Hr.
- 2) Pre- & Post Chlorination by gases chlorine arrangement capable of producing with 25% overloading.

22.00 MECHANICAL TYPE LEVEL INDICATOR

The Mechanical level Indicator shall be equipped with for continuous monitoring of sump level.

The level indicator 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 05Mtr.

B. List of Vendors

Sl. No.	Equipment	Make
01.00	Pump	Kirloskar / Mather & Platt / WPIL Ltd.
02.00	Motor	Siemens / ABB / Marathon/ Crompton
03.00	Control Desk/ MV Switchboard / MCC cum PDB	Sellwin. / PCE Projects / RNR / Roycco.Engg.

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) / BCH
08.00	Contactors	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 / Micro System
12.00	Digital Indicators	Micro System /Meco
13.00	Temperature Scanner	Pecon/ Micro System /Laxon / Chino / Masuka Instruments Pvt. Ltd.
14.00	Radar type Level Monitoring System\	Siemens / Khrone / Rosemount
14.01	Mechanical Type Level Indicator	NGM/Joydev. Engg./Star Enterprise.
15.00	Flow meter, Indicator, Totaliser	Krohne / Endress Hauser/ABB/Siemens
16.00	Control Fuses	GE/Siemens
17.00	Current Transformer	Kappa /JAWS / Schneider
18.00	Capacitor	Unistar / L&T / Epcos
19.00	Butterfly Valves, Non-Return Valve & Sluice Valve	VAG/ IVC / Kirloskar / Fluidtech/IVI
20.00	Valve Actuators	Rotork / Auma
21.00	Gauges	Bell / Taylors / H. Guru /Bell/Baumer
22.00	Fire Extinguishers	Surex / Minimax / Cease Fire / Fire Shield
23.00	Submersible Sump Pump	KSB / Calama / Kirloskar
24.00	Air Conditioner	Carrier / LG / Voltas

25.00	Lighting system	
26.01	Light Fitting	Philips / Bajaj/C.G/KLITE
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 Implements Co.	Surekha / Plycare / India Engineering &
30.00	H.T. Switchgear	Siemens / Schneider / ABB
31.00	Power Transformer	Schneider / KEC/ Voltamp. (Vadodara) /AEG/CG
32.00	Battery	Exide/Aamron
33.00	Battery Charger	Caldyne / Electro Service/Dekem/Live Line

C. Scope of Work for Major E/M Equipments.(AT KENDULIA GLR)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 670 cu.m/hr & Head not less than 35 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	3	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 700 cu.m/hr & Head not less than 60 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	3	Nos.
3	Supply, Delivery, Installation, Testing & Commissioning of 345 cu.m/hr & Head not less than 30 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
4	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8/10 mm thickness sheet.)	1	Lot

5	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
6	Providing, Installation, Testing and Commissioning of Pressure gauges.	1	Lot
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 500 mm dia.	1	Nos.
8	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 500 mm dia.	1	Nos.
9	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
10	Supply, delivery, Installation, Testing & Commissioning of Mechanical Level Indicator for CWR/Sump/Well.	1	Nos.
11	Providing, installation, testing and commissioning of submersible Mono block pump set 7.5 KW with starter	1	Nos.
12	Supply, delivery, Installation and commissioning of 5 M.Ton capacity EOT Crane complete in all respect including testing , certification and as per NIT and tender specifications	1	Job
13	Supplying, Installation, testing & Commissioning of Chlorination for Automatic/Manual Gaseous chlorination unit by 2x5 kg/hr. auto cum manual with chlorinator accessories chlorine analyser, tonner (900 kg), safety kit and allied accessories all complete with EOT crane arrangement.	1	Job
14	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
15	Supply, Installation, Testing & Commissioning of 1000 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
16	Supply , installation , testing & commissioning of Float cum boost charger suitable for 415V with variation 10% , 50 HZ , single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
17	Supply, installation, testing & commissioning of 415 V PDB Panel at Substation Building.	1	No
18	Supply, installation, testing & commissioning of 415 V PMCC Panel at Substation Building.	1	No
20	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
21	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
22	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job

23	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job
24	Supply, delivery and Installation of safety equipment.	1	Job
25	Supply, delivery and Installation of Perforated and Ladder type Cable tray, Panel base support, with all accessories & cable tray supports.	1	Job
26	Providing and fixing in position lightening arrester set	1	Job
27	SITC of Ventilation System for Pump House & Panel Room	1	Job
28	Illumination of Pump room & Panel room incl. supplying fitting, fixing all complete.	1	Job
29	Outdoor illumination for Access bridge & Compound lighting, including supplying, fixing all complete.	1	Job
30	Dehydration & Filtration of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
31	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
32	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
33	Operation and maintenance for 5 years (Includes Manpower & spares)	1	Job

D. Scope of Work for Major E/M Equipments.(AT SIRISDANGA)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 265 cu.m/hr & Head not less than 36 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	3	Nos.
2	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
3	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot

4	Providing, Installation, Testing and Commissioning of Compound gauges & Pressure gauges	1	Lot
5	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 300 mm dia.	1	Nos.
6	Supply, delivery, Installation, Testing & Commissioning of Mechanical Level Indicator for CWR/Sump/Well.	1	Nos.
7	415 V, 3 phase 4 wire, 50 HZ, LT DB Panel for receiving power as per specification	1	No
8	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No
9	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
10	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
11	Supply, delivery and Installation of Perforated and Ladder type Cable tray, Panel base support, with all accessories & cable tray supports.	1	Job
12	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
13	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
15	Dismantling Charge	1	Job

Superintending Engineer,
West Circle, M.E.Dte

SECTION – F

Electro mechanical works- Technical Specification, Vendor List, Scope of work- Sl. No. 2 (Gangutia & Neamatpur)

A. Technical Specification of Major Electro-Mechanical Equipments for CWR at KULTI (GANGUTIA Prop.+ NEAMATPUR Exis.) under AMC

This is indicative not exhaustive, will be finalized in detail engineering.

2.0. (A) VERTICAL TURBINE (VT) PUMP

2.0 Vertical Wet Pit Pumps

- 1.1 The pump shall be of vertical wet pit type with mixed flow impeller. Pump shall be placed vertically submerged in the wet pit and mounted on CWR Floor pumping station. 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 1.5M (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 stick inside the bearings deteriorating them. The specific gravity of Clear Water shall be considered as 1.00 M (Max.).

- 1.2 The pump battery shall contain suitable no pump sets out of which each pump shall deliver 100 % 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 lines 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 orders shall furnish the pump-motor foundation plan authenticated by the OEM. The said foundation will take care and encounter the horizontal back thrusts may be generated during start/stop of the same (at shutoff condition may be considered).
- 1.5 The pump impellers 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 tenderers shall furnish the evaluated specific speed of the pump at the specific trim at duty point. The pump H-Q characteristics curves shall be stable all throughout. There shall be a margin of at least 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 tenderers 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-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 mm 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.
- 1.11 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 level, the required bottom clearance at the indicated level etc. The total suspension length,

as has been considered in the offer backed by technical justification shall be placed with the technical offer.

- 1.12 The pump assembly shall be provided with suitable anti-friction roller thrust bearing, 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.
- 1.13 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.
- 1.14 The pump motor shall be considered as a single unit and the vibration limit should be within the limit specified in above IS.
- 1.15 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.
- 1.16 The pump shall also withstand the condition of any back flow on it.
- 1.17 The static and dynamic loading of the pump motor assembly with other allied components shall be clearly indicated.
- 1.18 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.
- 1.19 The impeller of the offered pump shall not be either on the lowest trim or the highest trim of the same pump family offered.
- 1.20 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.

- 1.21 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.
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 pump 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 pump 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 without cut-less nitrile rubber in SS shell (straight grooves preferred) |
| h) Wearing ring / seal ring | : | Material 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 |

1.29 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 for at least one pump as per by the manufacturer choice of the department at various discharge conditions including duty point shall be conducted by the manufacturer and test report shall be submitted. The duration of the performance tests of all pumps shall be not less than 2 / 3 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.

1.30 The tenderer shall fill-up the guaranteed performance figure / data given in the separate section and submit with the technical offer

1.31 **Hydraulic test at shop**

1.31.1 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.

1.31.2 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.

1.31.3 Tests shall be conducted with actual drive motors at full load and full speed.

1.31.4 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.

1.31.5 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

1.36 **Performance test at shop**

1.36.1 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.

1.36.2 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.

1.36.3 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.

1.37 **PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES**

1.37.1 **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.

1.38 **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.

1.39 **CLEANING, PROTECTION AND PAINTING**

1.39.1 **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.

1.39.2 **Painting**

All surfaces shall thoroughly be cleaned in a manner approved by the manufacturer for necessary paint (Epoxy) 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.

1.39.3 **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.

1.40 **TESTS AND INSPECTION**

1.40.1 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 EIC representatives. All relevant cost of such inspection by two representatives of EIC has to be borne by the manufacturer / contractor.

1.50 **SPARE PARTS**

1.50.1 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

1.50.2 The spare parts as mentioned are to be supplied within the completion period of the contract alongwith the main equipment.

1.50.3 Cost of spare parts as above are to be mentioned separately.

1.50.4 Replacement of spare parts during contract period would be borne by the Tenderer at their own cost.

List of spare parts

- vii) Rotating Unit: 06nos
- viii) TNC switch: 06nos
- ix) Tr. Feeder relay: 02nos
- x) Bearing: 10 sets
- xi) Indicating lamp "50" nos.
- xii) Contactor: 06 nos.

1.60 **DRAWINGS, CURVES & INFORMATION REQUIRED**

1.60.1 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 along with a tentative General Arrangement Drawing showing relevant details shall be submitted with the offer.

- 1.60.2 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.
- 1.60.3 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.
- 1.60.4 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

1.51 **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.

13.00.00 **PROPOSAL DATA**

13.01.00 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 - M³/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	PUMP NPSHR	
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	FLEXIBLE JOINTS AND SHAFT	
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	THRUST BEARING	
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 **EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE**
- 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 **GENERAL**
- 7.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering 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 :

01.01 SUMP PUMP

Provision of two numbers sump pumps have made considering one unit will operate other would remain as standby. All seepage water from glands would be accumulated in a sump of dimension approximate 1.5-meter x 1.0-meter x 0.6 meters. The capacity of each pump would be 30M³/Hr at a head 15 Meter. The drive motors would be of adequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. The delivery pipes of individual pumps will be connected to a common manifold would be such that the water can be drained in a nearby location, outside the pump house within a distance of 10 meter maximum. The NRV and pit valve shall be placed in each pump delivery line

and one no pit valve shall be placed in delivery line which generates from the common header. All GI pipes and specials within the bidder's scope. The bidder has to provide suitable capacity DOL starter for individual pump motor set and placed in the suitable place for easy operation. The power will be taken from the control panel through switch fuse unit.

OR

The portable submersible dewatering pump motor set will be suitable for dewatering gland leakage muddy water with adequate rating of $415 \pm 10\%$ volt, $50\text{Hz} \pm 3\%$ and 2900 rpm to cater the load of the above pumps. Submersible motor will be oil filled. The pump will be fitted with suitable mechanical seals, ball bearing etc. and shall be capable of performance details below when running in 2900. The pump will be fitted with cast iron / bronze impeller fitted in cast iron casing.

Pumps and motor shall be closed coupled and motor will be placed on top of the pump. This arrangement will ensure that in the sump can be drained to the maximum extent possible, so that the level of water in the sump is only a few cm above the pump inlet.

The motor winding will be insulated with oil and water resistance materials. The pump and motor unit shall be capable of running dry even when the motor oil seals fail draining out the oil from the motor and running which vertically no water sump.

Installation: -

As per technical specification and instruction manual of the manufacturer.

02.00 MOTORS

2.01.00 SCOPE

- 2.01.01 This specification covers the general requirements of the drive motors.
- 2.01.02 Motor shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 2.01.03 In case of any discrepancy, the driven equipment specification shall govern.

2.02.00 STANDARDS

All motors shall conform to the latest applicable IS/BS/DIN Publications.

2.03.00 TECHNICAL SPECIFICATION FOR DRIVE MOTORS

- 2.03.01 The drive electrical motors shall be of squirrel cage induction type vertical axis to suit the size of the pump and shall be able to drive the pump. The rating of the motors shall be minimum 30KW,160KW (FOR GANGUTIA GLR) and 132KW,160KW, (FOR NEAMATPUR GLR)& 1500 RPM (Syn.), $415\text{V} \pm 10\%$, 3 Phase, $50\text{ Hz} \pm 5\%$,
- 2.03.02 The motor shall be designed for Star / Delta starting arrangements. The motor starting current shall be guided by IS 12615.
- 2.03.03 All the motors shall be rated for continuous duty operation (duty: S1) IE2. However, due to the operational schedule of the pumping station, the pump motor unit may demand for 8/10 start and stop in a day with a minimum time gap of 20 minutes for one stop after prolong operation and restart the same. The motor shall also be capable of one immediate hot restart and three equi spaced starts per hour.
- 2.03.04 The motor KW rating shall have 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 operation whichever is higher. The overload capacity of the such selected motor rating shall be 10% continuous by allowing temperature rise upto Class-F limits. If the tenderer feel that the above rated motor is not satisfying stated loading, they may offer their rating of motor.

- 2.03.05 The motor characteristics shall match the requirements of the driven equipment.
- 2.03.06 The motor should deliver rated output and accelerate the full speed with 85% of the rated voltage at motor terminal. The accelerating time of the motor should not be more than 3 sec.
- 2.03.07 With 85% rated voltage at motor terminal, the motor shall be capable of working satisfactorily at full load at least 5 minutes without injurious heating or stalling. For 3% voltage imbalance in power supply, the motor shall not be de-rated by more than 10%.
- 2.03.08 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 sec. 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.
- 2.03.09 The motor shall be TEFC type having protection group of IPs 55. Motor shall be suitable for rotation in both the direction.
- 2.03.10 The insulation of the stator winding of the motor shall be of Class-F but the heat exchanging arrangement shall be such that the temperature rise is limited to that of Class-B as IS:325 over the ambient temperature. The ambient temperature may be considered as 45°C and the relative humidity may vary from 80% to 100%.
- 2.03.11 The rotor of the motor should be sturdy in construction so as to ensure trouble free operation as indicated in relevant clause without any rotor bar fracture inside or outside the rotor slots or rotor bar end brazing failure or development of cracks in the brazed joint of the rotor bar with shorting ring. The rotor bar of the rotor shall be 99.99% electrolyte grade Cu and shall be well machined, insulated tightly placed and evenly press fitted inside the rotor slots, the later being broached to have smooth finish. The rotor shall be slotted end ring design. The rotor bars in the form of temple bars shall be used. Proper brazing materials shall be used.
- The rotor shall be dynamically balanced with all the fans and with key in the shaft extension.
- The rotor must carry a guarantee of at least 20,000 starts as per the operations schedule mentioned in relevant clause without any rotor bar failure or any other type of rotor failure.
- 2.03.12 The motor shall be provided with anti-friction bearing, 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 on-service positive lubrication with drains and grease collectors to guard against over lubrication.
- The type and number of bearing the lubricant details (limited to normally available types of IOC or, any standard make). Quantity and frequency of bearing lubrication should be clearly indicated in the offer as well as to be displayed in the rating plate of the motor.
- 2.03.13 The motor should be smooth in operation and the noise level should not exceed 85 db. at 1.5M from the motor. The vibration level of the pump and motor should be within the specified the limit of IS:11724 and must be within 75 microns.

The motor should have adequate number of terminal boxes for main power cable, control cable & signal cable. The motor main terminal box shall be

rotatable in steps of 90°. The main terminal box should be suitable for minimum 2 run 3 core, 1.1 KV grade, 35/50/70/95/150/185/240/300 sq.mm. Aluminium conductor, armoured, XLPE Cable as deemed fit to the system. The terminal boxes shall be with removable cover with access to connection. No compound shall be used in the terminal box for easy handling. The motor terminal boxes shall be furnished with suitable cable lugs and double compression brass glands to match with the cable size. The terminals shall be clearly identified by phase markings and termination indication corresponding to direction of rotation.

The maximum system fault current for a duration of 1.0 sec. shall be considered.

The motor shall be equipped with built-in anti-condensation space heater of adequate rating suitable for operation at 240V AC supply. Separate terminal box for the space heater connection are to be provided.

The frame of each motor shall be provided with two separate and distinct grounding pads suitable for accommodation of grounding conductors of suitable size GI flat. The main cable terminal boxes shall have separate grounding pads.

- 2.03.14 The rating plate of the motor should contain, the minimum information as indicated in the relevant IS. Apart from the same, the information as indicated in relevant clause as well as the temperature rise in °C under rated condition, method of measurement, degree of protection shall be furnished.
- 2.03.15 The successful tenderer should 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.
- 2.03.16 The dimensional drawing of the offered motor, terminal box drawings, load data, GD2 value of the drive unit and the driven unit shall be furnished to the EIC for approval.
- 2.03.17 Apart from the standard accessories provided by the motor manufacturer and those accessories mentioned in preceding paras, one local lock switch is to be provided with each motor having proper connection with the motor connecting switchgear so that the motor breaker cannot be closed when the lock switch is in operation. The motor shall also be provided with suitable lifting lugs eye bolts having adequate provision for lifting installation.
- 2.03.18 The motor shall be provided with RTD's and BTD's for alarm and trip (for rating 75 KW and above). The leads shall be brought out to a separate terminal box.
- 2.03.19 The routine tests as per IS:325 shall be conducted to each motor. Temperature rise test are to be conducted on at least one motor (75KW & above) of each rating. The motor vibration tests shall be conducted mounting the motor on the shop motor stool. All the above tests are to be conducted at the manufacturer's shop in presence of the departmental representatives. Apart from the shop testing, normal field testing are to be carried out during installation, pre-commissioning and commissioning. All necessary arrangements for the tests are to be made by the contractor.
- 2.03.20 Motors up to 5 KW shall be of DOL starting and beyond 5 KW shall be Star-Delta Starting

CHECK LIST OF THE MOTORS BEING OFFERED

- 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 equipage 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 (Rating 75KW & above)
- 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 M²)
- 1.41.00 GD2 value of load to motor shaft (kg M²)
- 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 75 KW & above) of at least 1 no. motors as per choice of the customer, shall be performed. Further any special tests called for in the driven equipment specification shall be performed. The manufacturer/tenderer has to bear all expenses for such testing to witness the tests for max. two representatives of EIC to the manufacturer's 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 manufacture's factory.

3.00.00 SPARES

Spare parts are to be supplied as specified separately. Recommended spares for five (5) years operation shall be quoted along with the bid clearly identifying the part nos. with recommended quantities.

l) DE & NDE Bearing :1 set.

4.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

4.01.00 Along with the bid:

Individual motor data as per Check List

4.02.00 After Award of the Contract for Approval:

- a) Dimensional General Arrangement Drawing
- b) Foundation Plan & Loading
- c) Cable end box details
- d) Load Vs Efficiency & power factor, Current Vs Time / Speed curves
- e) Thermal withstand curves hot & cold
- f) Speed torque characteristics at 80% & 100% voltage
- g) Complete motor data

VALVES AND SPECIALS

03.01.01 Delivery side of pumps

The delivery side of each pump shall be provided with 1 no. Electrical Actuator operated butterfly valve and 1 no. non-return valve, 1 no. Dismantling joint & short pieces wherever required. The diameter of the valves and joints shall select based on velocity of 2.0 m/sec(approx.) with nearest sizes as per IS.

03.01.02 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 water and to maintain unidirectional flow. The valve shall be maintenance free, leak proof and shall have low life cycle cost. The PN rating of valves shall be PN 1.0. /1.6

The non-return valve shall be single door, Ductile Iron, double flanged, conventional non-slam design. The body, door, cover shall be of ductile iron (Gr. GGG 40). The seat and body shall withstand fluid pressure of 10-16kg / cm² and 16-24 kg / cm² 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/ mm².

The valves are subject to satisfactory hydrostatic test at manufacture's works and in presence of the department's representative for acceptance.

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.

03.02.01 **Butterfly Valve**

The butterfly valves shall be D1D1, PN 1.0. /1.6, conforming to IS 13095 of 1996 / BS 5155. The seat pressure shall be 10-16 kg/cm² and body pressure shall be 16-24 kg/cm². The valve shall operate smoothly & steadily in both directions, 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.

- b) 415V ± 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, IP68 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

03.02.02 ELECTRICAL ACTUATOR

2. The actuator motor for the BFV 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 for continuous submergence.
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
 - iii. torque limit switches for 'open' and 'close'
 - iv. 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.

- i) 415V \pm 10% 3 phase, 50 Hz, AC motor.
- j) Reduction gearing arrangement.
- k) Torque & limit switch mechanism.
- l) Valve position indicator.
- m) Arrangements for pick up signals for displaying the % opening of the valves in the suitable meters to be placed on control desk.
- n) Remote operation facility with selector switch and local control console.
- o) The hand wheel with clutch mechanism for manual operation. The manual operation shall be automatically declutched when actuator motors in operation.
- p) 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.

03 .00.01 SLUICE VALVE

The sluice valves shall be manufactured from ductile iron (Gr. GGG 40). conforming to IS-14846 / 2000. Flange ends as per IS 1538 or as per other standards to match with other flanges. The body seat shall be of S.S. AISI-410 stem shall be of S.S. AISI-410 & the stem nut shall be Gun metal conforming to I.S. 305:1981/BS 2874. Other details are to be submitted for approval.

The seat pressure shall be 10 kg/cm² and body pressure shall be 15 kg/cm². The valves should pass through hydrostatics test for duration of 5 minutes.

Body, Cover, Wedge	:	Ductile Iron GGG 40
Shaft	:	S.S. to AISI-410
Body Seat	:	S.S. to AISI-304
Bearing	:	G.M./Teflon
Wedge Sit	:	S.S. to AISI-304
Packing	:	Rubber "O" ring
Internal Fasteners & Clamping Ring	:	S.S. to AISI-304
External Fasteners	:	Carbon Steel to IS:1367 Cl. 4.6 & 4.0.
Hand wheel	:	Fabricated Steel

Worm Gear Unit : Mfg. Std.
Actuator : No

Testing (as per IS : 13095 / 91)				Inspection
Hydro Body : 15 Kg / Sq.cm for 5 minutes				Hydro Test : Witness & Test Report
Hydro Seat : 10 Kg / Sq.cm for 2 minutes				Visual : Witness & Test Report
Disc. Test : 10 Kg / Sq.cm for 5 minutes				Material Test : Test Report
Quantity				Note:
Size (NB)	Qty (Nos.)	Location	Service / Application	1. Valves shall be tight shut-off closures for frequent operation 2. Valve should closed with clock wise rotation of Hand wheel. In case of hand wheel operation) 3. Valves shall be painted with one coat of Red oxide primer & two coats of Black bituminous paints before dispatch. 4. Marking : Brand / Size / PN – Rating / Heat No. & Sl. No.

Materials of construction test certificates shall be provided during supplies. The sluice valves shall be rising spindle type with gearing arrangement / hand wheel for easy manual operation.

03.04 **M.S. DISMANTLING JOINT ASSEMBLY AT INDIVIDUAL DELIVERY LINE AND MANIFOLD**

One M. S. dismantling joint of suitable diameter is to be fixed in each of the individual delivery and one no along with the Flow meter & BFV on the water delivery 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 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 10 -16kg/cm². One leak proof concrete chamber if required as per site condition is to be constructed. The Dimension of the Chamber would however depend on the final alignment and level of the site condition

03.05 **PUMP DELIVERY SIDE PIPING AND COMMON DELIVERY MANIFOLD**

The pump individual delivery side piping, valves and joints and Common Delivery Manifold shall be shall selected based on velocity of 2.0 m/sec(approx.) and 1.55 m/sec (Approx.) respectively with nearest sizes as per IS.

The pipes shall be made up of M.S. 8/12 mm thick plates for individual delivery line and Common Delivery manifold, 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 common delivery manifold shall of such diameter as per the Technical offer. The manifold shall be fabricated from 8/12mm thick MS plates. The common manifold shall have blank flange / Dish end on one side with adequate stiffening (as applicable) and the other side would be extended from the centre line of the last pump to install one each Dismantling Joint, Butterfly valve, Air Release Valve and further as required to install one Full bore Electromagnetic flow meter. The length of the manifold must be extended at least one meter on one side after the interconnections with the delivery pipe lines from the pumps at the one extreme end and in the other end it will be extended up to the specified length.

The common delivery manifold shall be provided with one no. 100 mm dia air release valve (double throat) 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).

03.06 Pressure Gauge/Compound Gauge (Dial Type):

The individual discharge line and common delivery manifold shall be provided with pressure gauge (6" dial) 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 -10 Kg / Sq.cm. The pressure gauge shall have 3-way cock and fitting.

03.07 Tamper proof Kinetic air release valve

Air valve for clean, cold potable water up to 50°C

PN 10 / 16

DN 80 – 200

Double chamber valve with twin float (Rubber / Vulcanite coated timber core / SS 304) - automatic operation with water. Two-orifice venting system with 3 functions (supply and release of air as well as automatic venting during operation)

Flange connection dimensions to IS 1538 Table 4 & 6

Body and Cover made of CAST IRON IS 210 Gr. FG 260

Seal made of EPDM

Corrosion protection:

Inside and outside with liquid epoxy coating; thickness >250 μm , colour: RAL 5005 blue

Accessories:

Must have a metal seated gate valves (description as above for Sluice Valves up to 800 mm) of same diameter for isolation purpose, complete with gasket and fasteners (steel galvanized)

04.00 HTPDB (FOR GANGUTIA GLR& NEAMATPUR GLR)

4.1. The HT PDB shall be multi panel switch board suitable for indoor installation and shall operate at 11 KV $\pm 10\%$, 3 ϕ , 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.

4.2. 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 11 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.

4.3 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.

- 4.4 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.

- 4.5 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.

- 4.6 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.

- 4.7 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 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:

- 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 CIRCUITHEALTHY / 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 and closing coil rated for 110 V DC.
- f) 1 space heater with ON & OFF switch
- g) 15A / 15A 3 Pin Plug Socket
- h) In – panel lighting with control switch
- i) Space heater for each Switchgear panel
- 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 suitable for 3 phase, 3 wire 5 limb 50 Hz system with a ratio of 11 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 62KA. 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.

4.8 The feeder details of the Multi panel HT PDB shall be as under:

- A) Incoming feeder Panel: 1 No. (800 A)
 - i) 96 sq mm (0 – 12 KV) Voltmeter with Selector Switch - 1 Set
 - ii) 96 sqmm Ammeter suitably dual scaled 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 ratio and 5A 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.

viii)	Trip Circuit Supervision Relay type VAX 31 or equivalent	-	1 No.
ix)	Master Trip Relay type VAJH 13 or equivalent	-	1 No.
x)	Multifunction meter (For Amp. Voltage, frequency, power factor etc.) type ELITE 445 or equivalent	-	1 No.
xi)	Power Factor Meter	-	1 No.
xii)	KW Meter	-	1 No.
xiii)	12 Channel alarm annunciator & Indicating Lamps		1 Set
B) Out going feeder panels for transformers: 2 Nos. (800 A) Each Transformer feeder panel shall be equipped with the following:			
i)	96 sq. mm Ammeter suitably scaled 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 ratio and 5A Secondary, Class 5 P10 & 1.0, 10VA burden	-	1 Set (3 Nos.)
v)	Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P122 or equivalent	-	1 No.
vi)	Master trip relay type VAJH-13	-	1 No.
vii)	Trip Circuit Supervision Relay type VAX 31 or equivalent	-	1 No.
viii)	Auxiliary relay type VAA -33 or equivalent	-	3 Nos.
ix)	12 Channel alarm annunciator & Indicating Lamps	-	1 Set
C) Common for all above feeders:			
i)	Anti – pumping relay		

4.9. Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MCC cum PDB 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.

4.10. 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

4.11 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.

05.00 TRANSFORMER (FOR GANGUTIA GLR)

There will be total two (2) number of transformers, each having a capacity of 1000 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

- iv) Conservator with drain valves and oil gauge.

- v) Silica gel breather
- vi) Bidirectional rollers
- iv) PRV with contact.
- v) Oil filter valve
- vi) Transformer tank drain valve, one upper and one lower.

- vii) Earthing terminals – 2 nos.
- viii) Air relieve plugs
- ix) Rating and diagram plate
- x) Buchholz's relay with Alarm and Trip
- xi) OTI with Alarm and Trip contacts
- xv) WTI with Alarm and Trip contacts
- xvi) MOG with contact
- xvii) Marshalling box with contacts of Buchholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 5.1 Two nos. 1000 KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45⁰ C.

- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.
- 5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.

5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Buchholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	: 3 (three)
Winding connection & vector group	:	: DYn-11
Rated frequency	:	: 50 cycles/sec.
Rated KVA	:	: 1000 KVA
Rated primary voltage	:	: 11 KV
Rated secondary voltage	:	: 0.433 KV
Method of system earthing	:	: Secondary solidly grounded
Tap-Changer	:	: Off-circuit Tap-changer (OCTC) (+) 5% to (-)
10%		
Tapings	:	: in steps of 2.5%
HV side terminal arrangements	:	: Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus Coupler PDB at Substation. (GANGUTIA GLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 1600 A for phases and 800 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 1600A incoming feeders 2 nos. each comprising of following components:

- | | | |
|-------|----------------------------------------------------------------------------------------------------------------------------------|--------|
| xi) | 415 V, 4 pole, 1600A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release | 1 No |
| xii) | 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch
No. | 1 |
| xiii) | 96 sq. mm, 0 – 500 V Voltmeter with selector switch
No. | 1 |
| xiv) | Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA | 3 Nos. |

- xv) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- xvi) Red, Yellow, Blue phase indicating lamp as required
- xvii) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- xviii) TNC Breaker Control Switch 1 No.
- xix) Local / Remote Selector Switch 1 No.
- xx) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13
1 No.

6.12 1600 A Bus coupler feeder one (1) number comprising of following components:

- v) 415 V, 4 Pole, 1600 A, 50 KA electrically operated draw out ACB without release. 1 No.
- vi) TNC Breaker Control Switch 1 No.
- vii) Local / Remote Selector Switch 1 No.
- viii) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for GANGUTIAGLR (each equipped with following:)

- I) 415 V, 3 pole, 1250A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.
- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.

VI) Local / Remote Selector Switch

1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 4 Nos.
b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
(Adjustable O/L) rated upto 50⁰ C without duration

- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB at GANGUTIA GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1250A for phases and 630A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- xi) 415 V, 4 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- xii) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- xiii) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- xiv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- xv) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3
Nos.
- xvi) Red, Yellow, Blue phase indicating lamp as required
- xvii) MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp 4
Nos.
- xviii) TNC Breaker Control Switch 1 No.
- xix) Local / Remote Selector Switch 1 No.
- xx) Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13
1 No.

7.11 1250 A Bus coupler feeder one (1) number comprising of following components:

- iv) 415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.
- v) TNC Breaker Control Switch 1 No.
- vi) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders, each comprising of following components:
Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor- - 1 No.
based trip unit with adjustable overload, short circuit &
earth fault rated upto 50⁰ C without deration

- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 30KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

- | | | |
|-------------------------------------|------|-------|
| l) Motor protection circuit breaker | 1 no | |
| m) Power contractor | | 3 no |
| n) Aux. contractor | | 5 no |
| o) Current transformer | | 3 no |
| p) Analog ammeter | | 1no |
| q) Ammeter selector switch | | 1 no |
| r) Indicating lamp | 3 no | |
| s) On/off push button | | 2 no. |
| t) Star delta timer | 1 no | |
| u) Thermal overload relay | | 1 no |
| v) Power terminal, | | 2 no |

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 4 Nos

D) Not less than #A TPN MPCB for actuator feeder 9 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 8 Nos

04.00 TRANSFORMER (FOR NEAMATPUR)

There will be total two (2) number of transformers, each having a capacity of 1250 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

- vii) Conservator with drain valves and oil gauge.
- viii) Silica gel breather
- ix) Bidirectional rollers
- iv) PRV with contact.
- v) Oil filter valve
- vi) Transformer tank drain valve, one upper and one lower.

- vii) Earthing terminals – 2 nos.
- viii) Air relieve plugs
- ix) Rating and diagram plate
- x) Bucholz's relay with Alarm and Trip
- xi) OTI with Alarm and Trip contacts
- xviii) WTI with Alarm and Trip contacts
- xix) MOG with contact
- xx) Marshalling box with contacts of Bucholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 4.1 Two nos. 1250 KVA 11 KV / 0.433 KV, DYN 11, ONAN, Distribution Transformer to be manufactured, shop tested, supplied, erected, tested & commissioned generally in conformity with latest revision of IS.
- 4.2 The transformers shall be of the latest design & 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 - 75 ° C over ambient of 45° C.
- 4.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' insulation, designed and constructed with particular reference to tropical conditions.
- 4.4 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.
- 4.5 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.
- 4.6 The transformer shall be designed for minimum losses as per I.S.1180 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.
- 4.7 The transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 4.8 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.
- 4.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.

4.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

4.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

4.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

4.13 Following shop tests shall be carried out on the transformer along with the other tests 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

4.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	: 3 (three)
Winding connection & vector group	:	: DYn-11
Rated frequency	:	: 50 cycles/sec.
Rated KVA	:	: 1250 KVA
Rated primary voltage	:	: 11 KV
Rated secondary voltage	:	: 0.433 KV
Method of system earthing	:	: Secondary solidly grounded
Tap-Changer	:	: Off-circuit Tap-changer (OCTC) (+) 5% to (-)
10%		
Tapings	:	: in steps of 2.5%
HV side terminal arrangements	:	: Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus Coupler PDB at Substation (FOR NEAMATPUR GLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.

- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 2000 A for phases and 1000 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 2000A incoming feeders 2 nos. each comprising of following components:

415 V, 4 pole, 2000A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release	1 No
-------------------------------------------------------------------------------------------------------------------------------------	------

- xxi) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1
No.
- xxii) 96 sq. mm, 0 – 500 V Voltmeter with selector switch 1
No.
- xxiii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- xxiv) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- xxv) Red, Yellow, Blue phase indicating lamp as required
- xxvi) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- xxvii) TNC Breaker Control Switch 1 No.
- xxviii) Local / Remote Selector Switch 1 No.
- xxi) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13
1 No.

6.12 2000 A Bus coupler feeder one (1) number comprising of following components:

- ix) 415 V, 4 Pole, 2000 A, 50 KA electrically operated draw out
ACB without release. 1 No.
- x) TNC Breaker Control Switch 1 No.
- xi) Local / Remote Selector Switch 1 No.
- xii) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. each equipped with following:(For MCC cum PDB) for NEAMATPUR GLR.

- q) 415 V, 3 pole, 1600A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No

ii) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.

iii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.

iv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp 4 Nos.

v) TNC Breaker Control Switch 1 No.

vi) Local / Remote Selector Switch 1 No.

x) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13

1 No.

6.15 MCCB / MCB feeder of following rating

a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.

d) 16 A DP MCB 6 Nos.

6.16 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50 KA for 1 Sec. The ACB shall be electrically operated draw out type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)

- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

7.0 415 V Multi panel MCC cum PDB(A) at NEAMATPUR GLR.

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1600A for phases and 800A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- i) 415 V, 4 pole, 1600A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- xi) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- xii) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- xiii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3
Nos.
- xiv) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA
3 Nos.
- xv) Red, Yellow, Blue phase indicating lamp as required
- xvi) MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp
4 Nos.
- xvii) TNC Breaker Control Switch 1 No.
- xviii) Local / Remote Selector Switch 1 No.
- xix) Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element
type P111 or equivalent with VAJH 13
1 No.

7.11 1600 A Bus coupler feeder one (1) number comprising of following components:

- i) 415 V, 4 Pole, 1600 A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No.
- ii) TNC Breaker Control Switch 1 No.

- iii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders, each comprising of following components:
Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 132KW Star – Delta Starter Motor feeders, each comprising of following components:
Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC - 3

	Coil arrangement		Nos.
c)	Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP	-	4 Nos.
d)	Start / Stop Push Button	-	1 Set
e)	96 Sq mm suitably scaled including cramped scale Ammeter with selector switch	-	1 No.
f)	True Digital Microprocessor based 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.
g)	High speed master trip relay type VAJH 13 or equivalent	-	1 No.
h)	CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA	-	3 Nos.
i)	CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA	-	3 Nos.

7.12 75KW Star – Delta Starter Motor feeders,(3W+2S) each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

a)	Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration	-	1 No.
b)	Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement	-	3 Nos.
c)	Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP	-	4 Nos.
d)	Start / Stop Push Button	-	1 Set
e)	96 Sq mm suitably scaled including cramped scale Ammeter with selector switch	-	1 No.
f)	True Digital Microprocessor based 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-211 or equivalent) | - 1 No. |
| g) High speed master trip relay type VAJH 13 or equivalent | - 1 No. |
| h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - 3 Nos. |
| i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - 3 Nos. |

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

- | | |
|-------------------------------------|-------|
| a) Motor protection circuit breaker | 1 no |
| b) Power contractor | 3 no |
| c) Aux. contractor | 5 no |
| d) Current transformer | 3 no |
| e) Analog ammeter | 1 no |
| f) Ammeter selector switch | 1 no |
| g) Indicating lamp | 3 no |
| h) On/off push button | 2 no. |
| i) Star delta timer | 1 no |
| j) Thermal overload relay | 1 no |
| k) Power terminal, | 2 no |

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB/MPCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

c) Not less than #A TPN MCCB for actuator feeder 15 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

- e) 16 A DP MCB 6 Nos.

15.00 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

15.1 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

15.2 Float and Boost Battery Charger

15.2.1 Charger – I (Float Charger – SCR Control)

- a) Output Voltage : 110 – 125 V DC [steplesslyadjustable]
- 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

15.2.2 Charger – II (Boost cum Float Charger – SCR Control)

- a) Output Voltage Boost : 110 – 127 V DC [steplessly adjustable]
Em. Float: 110 V – 125 V DC [steplessly 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) Cable entry - From Bottom
- e) Ventilation - Air natural through louvers backed by fine wire mesh

16.00 CABLE:

All HT and M.V. power cables shall be with XLPE insulation, stranded aluminium / copper conductor and armoured

16.01 HT &M.V. Cables and Jointing

All HT and M.V. Cables shall be 11 KV (E) / 1.1 KV grade XLPE insulated and armoured of Al / Cu. conductor 3 core / 3½ core / 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 1000 mm width x 1200mm 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.

16.02 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.

17.00 FLOW SENSOR

There shall be one number of Full bore Electromagnetic flow meter on the common delivery manifold. The flow meters 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 m³/hr & total flow in cubic meter. The flow sensor shall be suitable to measure Raw 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 50 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 ± 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 Raw Water.

Type:- Pulsed DC electromagnetic.

Accuracy:- ± 0.5 % of measure value.

Repeatability:- ± 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.

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 single Length as required as per site condition between sensor and transmitter.

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.

Output: - 4-20 mA DC

Power supply: - 240 V AC 50 Hz and shall be supplied from the MCC cum PDB at a approximate 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.

18.00 Flow meter/ Flow sensor or Flow Tube fixing chamber

For fixing of Flow Tube at the delivery manifold, leak proof chamber of adequate dimension is to be constructed if required as per site condition with a rung-ladder of suitable length for getting down if necessary.

19.00 EARTHING

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 be such that after installation the earth resistance of the system must be well below one ohm.

One GI bus bar 75mm wide and 8 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 amendment 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 Earth Pits should not be less than 3 meters.

20.00 LIGHTING SYSTEM

20.01 Luminaries

The scope includes indoor lighting of pump house, substation building, Annex area and reasonable area lighting around the Pump House and Substation Building. Industrial Medium bay luminaries with 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 Substation Room lighting should be provided with LED T/L 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.

Area illumination/access bridge level 100 LUX with suitable LED fittings.

All the entrance/exists of pump house shall be provided with LED down lighter or bracket mounted fittings with LED lamps of minimum 45 Was per site condition (minimum 90W for unloading bay entrance).

20.02 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.

- 20.03 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.

- 20.04. 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.

- 20.05 The above stated distribution board shall be fed from independent switch fuse unit / MCB / MCCB located in the PDB.
- 20.06 440 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.
- 20.07 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.	LED Fluorescent	2 nos. 1 core -1.5 mm ² copper & 1 no. Earth wire of 1.0 mm ² copper
2.	LED Flood light fitting	2 nos. 1 core -2.5 mm ² copper & 1 no. Earth wire of 1.0 mm ² copper
3.	Receptacle- 5A	2 nos. 1 core -2.5 mm ² copper & 1 no. Earth wire of 1.0 mm ² copper
4.	Receptacle- 15A	2 nos – 1 core-4 mm ² copper & 1 no Earth wire of 1.0 mm ² copper

21.00 Ventilation & Firefighting System:

- 21.01 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 / armoured cable including all other accessories as required.
- d) 3 - phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for the Pump House to ensure 10 Air changes/Hr..
 - e) Single phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for all the rooms of Sub Station as per the direction of EIC.
 - f) Wall mounting type control panel for exhaust fan and others ----- 2 Sets, one each for pump House and substation.
 - e) 18" Pedestal fan with regulator and all other accessories --- 3 Nos.
- 21.03 Fire Extinguisher
- a) ABC type Portable type fire extinguisher 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.

20.00 OVERHEAD CRANE

20.1 EOT Crane.

The EOT. Crane will be minimum 5 M.T. capacity Electrically Operated Travelling Crane (E.O.T.) with a lift from the operating floor level and up to the level above the installed motors. The long travel & the Cross Travel along with height of lift of the crane shall be finalised after freezing of the Pump House 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 shall be manually operated. The buffers must be spring loaded operation.

The EOT Crane should be tested at manufacturer's works / site as per relevant IS. The same may be witnessed by the EIC. The Contractor has to arrange for such testing at his own cost.

21.00 Chlorination System

- 3) Chlorination System should be 2X 5k. g/Hr.
- 4) Pre-& Post Chlorination by gases chlorine arrangement capable of producing with 25% overloading.

22.00 MECHANICAL TYPE LEVEL INDICATOR

The Mechanical level Indicator shall be equipped with for continuous monitoring of sump level.

The level indicator 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 05Mtr.

B. List of Vendors

Sl. No.	Equipment	Make
01.00	Pump	Kirloskar / Mather & Platt / WPIL Ltd.
02.00	Motor	Siemens / ABB / Marathon/ Crompton
03.00	Control Desk/ MV Switchboard / MCC cum PDB	Sellwin. / PCE Projects / RNR / Roycco.Engg.
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) / BCH
08.00	Contactors	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 / Micro System
12.00	Digital Indicators	Micro System /Meco
13.00	Temperature Scanner	Pecon/ Micro System /Laxon / Chino / Masuka Instruments Pvt. Ltd.
14.00	Radar type Level Monitoring System\	Siemens / Khrono / Rosemount
14.01	Mechanical Type Level Indicator	NGM/Joydev. Engg./Star Enterprise.
15.00	Flow meter, Indicator, Totaliser	Krohne / Endress Hauser/ABB/Siemens
16.00	Control Fuses	GE/Siemens
17.00	Current Transformer	Kappa /JAWS / Schneider
18.00	Capacitor	Unistar / L&T / Epcos

19.00	Butterfly Valves, Non-Return Valve & Sluice Valve	VAG/ IVC / Kirloskar / Fluidtech/IVI
20.00	Valve Actuators	Rotork / Auma
21.00	Gauges	Bell / Taylors / H. Guru /Bell/Baumer
22.00	Fire Extinguishers	Surex / Minimax / Cease Fire / Fire Shield
23.00	Submersible Sump Pump	KSB / Calama / Kirloskar
24.00	Air Conditioner	Carrier / LG / Voltas
25.00	Lighting system	
26.01	Light Fitting	Philips / Bajaj/C.G/KLITE
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 Implements Co.	Surekha / Plycare / India Engineering &
30.00	H.T. Switchgear	Siemens / Schneider / ABB
31.00	Power Transformer	Schneider / KEC/ Voltamp. (Vadodara) /AEG/CG
32.00	Battery	Exide/Aamron
33.00	Battery Charger	Caldyne / Electro Service/Dekem/Live Line

C. Scope of Work for Major E/M Equipments.(AT GANGUTIA GLR)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 135 cu.m/hr & Head not less than 45 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 660 cu.m/hr & Head not less than 56 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	3	Nos.

3	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
4	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
5	Providing, Installation, Testing and Commissioning of Pressure gauges.	1	Lot
6	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 150 mm dia.	1	Nos.
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 500 mm dia.	1	Nos.
8	Supply, delivery, Installation, Testing & Commissioning of Mechanical Level Indicator for CWR/Sump/Well.	1	Nos.
9	Providing, installation, testing and commissioning of submersible Monoblock pump set 7.5 KW with starter	1	Nos.
10	Supply, delivery, Installation and commissioning of 5 M.Ton capacity EOT Crane complete in all respect including testing, certification and as per NIT and tender specifications	1	Job
11	Supplying, Installation, testing & Commissioning of Chlorination for Automatic/Manual Gaseous chlorination unit by 2x5 kg/hr. auto cum manual with chlorinator accessories chlorine analyser, safety kit and allied accessories all complete along with Tonner & EOT crane	1	Job
12	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
13	Supply, Installation, Testing & Commissioning of 1000 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
14	Supply, installation, testing & commissioning of Float cum boost charger suitable for 415V with variation 10%, 50 HZ, single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
15	Supply, installation, testing & commissioning of 415 V PDB Panel.	1	Set
16	Supply, installation, testing & commissioning of 415 V PMCC Panel.	1	No
17	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
18	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job

19	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
20	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job
21	Supply , delivery and Installation of safety equipment.	1	Job
22	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support,with all accessories & cable tray supports.	1	Job
23	Providing and fixing in position lightening arrester set	1	Job
24	SITC of Ventilation System for Pump House & Panel Room	1	Job
25	Illumination of Pump room & Panel room incl. supplying fitting, fixing all complete.	1	Job
26	Outdoor illumination for Access bridge & Compound lighting , including supplying , fixing all complete.	1	Job
27	Dehydration&Filtraion of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
28	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
29	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
30	Operation and maintenance for 5 years (Includes Manpower & spares)	1	Job

E. Scope of Work for Major E/M Equipments.(AT NEAMATPUR)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 525 cu.m/hr & Head not less than 66 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	3	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 502 cu.m/hr & Head not less than 60 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
3	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
4	Supply, delivery, Installtion, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot

5	Providing, Installation, Testing and Commissioning of Pressure gauges.	1	Lot
6	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 450 mm dia.	1	Nos.
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 200 mm dia.	1	Nos.
8	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 300 mm dia.	1	Nos.
9	Supply, delivery , Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
10	Supply, Installation, Testing & Commissioning of 1250 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
11	Supply , installation , testing & commissioning of Float cum boost charger suitable for 415V with variation 10% , 50 HZ , single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Nos
12	Supply, delivery, Installation, Testing and Commissioning of suitable LT PDB Panel as per specification.	1	Set
13	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No
14	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
15	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
16	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
17	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job
18	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support,with all accessories & cable tray supports.	1	Job
19	Dehdration&Filtraion of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
20	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
21	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
22	Dimantling Charges	1	Job

SECTION – G

A. Technical Specification of Major Electro-Mechanical Equipments for CWR at Raniganj(Dumping Ground Prop.+Rabinsen Exis.) under AMC

This is indicative not exhaustive, will be finalized in detail engineering.

3.0. (A) VERTICAL TURBINE (VT) PUMP

3.0 Vertical Wet Pit Pumps

- 1.2 The pumps shall be of vertical wet pit type with mixed flow impeller. Pumps shall be placed vertically submerged in the wet pit and mounted on CWR Floor pumping station. 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 1.5M (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. The specific gravity of Clear Water shall be considered as 1.00 M (Max.).
- 1.2 The pump battery shall contain suitable no pump sets out of which each pump shall deliver 100 % 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/motors tool /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 shutoff condition may be considered).
- 1.5 The pump impellers 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 curves shall be stable all throughout. There shall be a margin of at-least 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 tenderers 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-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 mm 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.

1.11 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 level, the required bottom clearance at the indicated level etc. The total suspension length, as has been considered in the offer backed by technical justification shall be placed with the technical offer.

1.12 The pump assembly shall be provided with suitable anti-friction roller thrust bearing, 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.

1.13 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.

1.14 The pump motor shall be considered as a single unit and the vibration limit should be within the limit specified in above IS.

1.15 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.

- 1.16 The pump shall also withstand the condition of any back flow on it.
- 1.17 The static and dynamic loading of the pump motor assembly with other allied components shall be clearly indicated.
- 1.18 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.
- 1.19 The impeller of the offered pump shall not be either on the lowest trim or the highest trim of the same pump family offered.
- 1.20 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.
- 1.21 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.
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 without 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 |

1.29 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 for at least one pump as per by the manufacturer choice of the department at various discharge conditions including duty point shall be conducted by the manufacturer and test report shall be submitted. The duration of the performance tests of all pumps shall be not less than 2 / 3 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.

1.30 The tenderer shall fill-up the guaranteed performance figure / data given in the separate section and submit with the technical offer

1.31 Hydraulic test at shop

- 1.31.1 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.
- 1.31.2 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.
- 1.31.3 Tests shall be conducted with actual drive motors at full load and full speed.
- 1.31.4 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.
- 1.31.5 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

1.36 Performance test at shop

- 1.36.1 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.
- 1.36.2 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.
- 1.36.3 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.

1.37 PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES

1.37.1 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.

1.38 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.

1.39 **CLEANING, PROTECTION AND PAINTING**

1.39.1 **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.

1.39.2 **Painting**

All surfaces shall thoroughly be cleaned in a manner approved by the manufacturer for necessary paint (Epoxy) 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.

1.39.3 **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.

1.40 **TESTS AND INSPECTION**

1.40.1 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 EIC representatives. All relevant cost of such inspection by two representatives of EIC has to be borne by the manufacturer / contractor.

1.50 **SPARE PARTS**

1.50.1 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

1.50.2 The spare parts as mentioned are to be supplied within the completion period of the contract alongwith the main equipment.

1.50.3 Cost of spare parts as above are to be mentioned separately.

- 1.50.4 Replacement of spare parts during contract period would be borne by the Tenderer at their own cost.

List of spare parts

- xiii) Rotating Unit: 06nos
- xiv) TNC switch: 06nos
- xv) Tr. Feeder relay: 02nos
- xvi) Bearing: 10 sets
- xvii) Indicating lamp "50" nos.
- xviii) Contactor: 06 nos.

1.60 **DRAWINGS, CURVES & INFORMATION REQUIRED**

- 1.60.1 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 along with a tentative General Arrangement Drawing showing relevant details shall be submitted with the offer.
- 1.60.2 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.
- 1.60.3 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.
- 1.60.4 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

1.51 **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.

13.00.00 **PROPOSAL DATA**

13.01.00 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 - M³/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 **PUMP NPSHR**
- 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 **FLEXIBLE JOINTS AND SHAFT**
- 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 **THRUST BEARING**

- 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 **EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE**
- 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 **GENERAL**
- 7.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering 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	:

01.00 (B)HORIZONTAL SPLIT CASE PUMP

There will be adequate number of pumps which are to be located at the Pump House. The Clear Water pumping station shall be as under:

The horizontal axially split centrifugal pumps are to be installed in a dry pit for horizontal execution. The prime mover would be squirrel cage induction motor. Connection of pump & motor shall be with flexible coupling. The vibration level shall be 50 microns both in horizontal & vertical direction, sound level of maximum 85 db during running condition of pump & motor at a distance of 1.50 mtr. The pump shall be supplied with base plate, grounding pad, lifting lug, eyebolts, foundation bolts, and nuts, flexible coupling, coupling guard etc. The pump shall have provision for fixing pressure gauge, vent pipe, etc.

- The Pump models shall be selected in such a manner that apart from the present duty condition mentioned above, the future duty condition of 10% increase in flow and corresponding increase in Head could be achieved by changing only the impeller assembly. The price is to be quoted for pumps with present duty condition. Necessary Data from the pump manufacturer is required to be submitted including family curve of the offered model by the successful tenderer. Further during detail engineering, the pump head may undergo a change upto a maximum of (+) 10%. Pump rotational speed shall not exceed 1000 rpm (syn).

2.00.00 SPECIFIC REQUIREMENTS

Design

The design, manufacturing, performance of the horizontal centrifugal axially pumps as specified hereinafter, shall comply with the requirements of applicable codes, the latest applicable Indian/British/American/DIN standards, in particular and in that order of application, the following.

2.01.01	IS	1520	Horizontal centrifugal pump for clean, cold, fresh water.
2.01.02	IS	5120	Technical requirements, rotodynamic special purpose pumps.
2.01.03	IS	9137	Code for acceptance test for centrifugal, mixed flow and axial pumps - Class C.
2.01.04			Hydraulic Institute Standards.
2.01.05	BS	599	Methods for Testing Pumps.
2.01.06	BS	5316	Acceptance tests for centrifugal, mixed flow and axial pumps.
2.01.07	PTC	8.2	Centrifugal pumps-Power test codes.
2.01.08			The materials of the various components shall be as per data sheet or equivalent material conforming to applicable IS/BS/ASTM/DIN Standards in that order of application.

2.01.09 In case of any contradiction between the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail. In case of contradiction between this specification and the pump data specification sheets enclosed, stipulations of the data specification sheets' shall prevail.

3.00.00 **GENERAL PERFORMANCE REQUIREMENTS**

3.01.00 The pump shall be designed to have best efficiency at the specified duty point. The Pump set shall be suitable for continuous operation at any point within the — 'Range of Operation', so as to match with the system resistance curve.

3.02.00 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

3.03.00 Pumps shall be suitable for parallel operation. The characteristics curves such as head vs. capacity, KW vs. capacity EFFICIENCY vs. capacity etc., shall match to ensure equal load sharing and trouble free parallel operation throughout the range. In the event of tripping of one of the operating pumps, the other operating pumps shall be capable of passing the maximum flow through it as dictated by the system resistance corresponding to both maximum and minimum water level in the pump suction sump.

3.04.00 The pump motor set shall be designed in such a way that there is no damage on account of any reverse flow through the pump which may occur due to any abnormal operation of the system.

3.05.00 Where reverse flow through the pump is specified in data specification sheets, the drive motor shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed without injurious heating, when power to the motor is restored with a minimum voltage of 90% at the motor terminal.

External head that may be imposed on the pump under reverse flow condition is to be decided by the Bidder after analyzing the complete system and the particular abnormal condition of run. However, any specific requirement as mentioned in the Pump Data Sheet shall be adhered to Torque-speed curve for pump and motor for such reverse flow condition shall have to be submitted along with the offer.

4.00.00 **DESIGN & CONSTRUCTION**

4.01.00 **Pump type**

Pump shall be axially split case, single volute, double suction, mixed flow type and shall be constructed in a manner that they can be placed on their foundation with their shaft in horizontal axis.

4.02.00 **Casing**

The casing shall be a single volute, double suction design and shall be so constructed that when it will be placed on its existing foundation the integrally cast with one half of the casing so that the other half of the casing can be removed without having to disturb the suction and discharge pipelines. A suitable fixture shall be provided with each pump for easy removal of one half of casing, which will have no connection with the pipelines, for inspection and / or replacement of the Rotating Elements.

4.03.00 **Impeller**

The impeller shall be double entry type and dynamically balanced.

4.04.00 **Wearing Rings**

Casing wearing rings shall be provided with torque and groove arrangement to prevent rotation and shall be easily removable.

4.05.00 **Impeller Shaft**

The impeller shaft shall be ground finished on its entire length and shall be protected with sleeves so that the shaft itself cannot come into contact with the actual liquid pumped.

4.06.00 **Sleeves**

Sleeves shall be keyed onto the shaft and located by grub screws to prevent relative rotation between the sleeve and the shaft. The impeller shall be kept in position on the shaft by means of two sleeves, which in turn shall be locked by means of suitably designed sleeve nuts.

4.07.00 **Stuffing Box**

The Stuffing box shall be an integral part of the casing and shall be fitted with lantern rings. The lantern rings shall be sandwiched between gland packings. The packings inside the stuffing box shall be held in position by glands.

4.08.00 **Glands**

The glands shall be designed to facilitate easy removal for inspection and replacement of packing.

4.09.00 **Bearings**

Adequate capacity thrust bearings ball/roller shall be provided to take the full axial thrust of the pump as well as the weight of the pump-rotating element. Thrust bearing shall be placed in the non-driving end of the pump and shall be grease lubricated anti friction type and ball bearing shall be placed in the driving end of the pump and shall be grease lubricated anti-friction type. Suitable Temperature detectors shall be provided for both DE & NDE side and the signal from the same shall be hooked upto the Control Desk & Instrument Panel

4.10.00 **Discharge Branch**

4.10.01 Discharge branch pipe upto the battery limit under this specification shall be flanged and bolted and shall be complete with gaskets, nuts and bolts of shall screwed as specified in data specification sheets. A dismantling joint in to be provided in each delivery pipeline along with valves.

4.11.00 **Suction Branch**

4.11.01 A dismantling joint will be provided at the pump individual suction side pipeline along with valves to avoid the pipe assembly from any additional thrust. Any thrust loading is to be transmitted to the foundation bolts of the pump assembly.

4.12.00 **Pump Motor Supports, Base Plate etc.**

The pumps and motors shall have common base plate supporting arrangements. The pumps & motors base frame shall be fixed on the foundation through foundation bolts.

5.00.00 **Hydraulic test at shop**

5.01.00 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.

5.02.00 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.

5.03.00 Tests shall be conducted with job motors at full load and full speed.

5.04.00 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.

5.05.00 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

6.00.00 **Performance test at shop**

6.01.00 Each pump shall have to be tested to determine the characteristic 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.

6.02.00 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.

6.03.00 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.

7.00.00 **PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES**

7.01.00 **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, which shall not be more than those specified under clause 2.01.03.

7.02.00 **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 to 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.

8.00.00 **CLEANING, PROTECTION AND PAINTING**

8.01.00 **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.

8.02.00 **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.

8.03.00 **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.

9.00.00 **TESTS AND INSPECTION**

9.01.00 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.

9.02.00 Where stage inspection is to be witnessed by Employer in addition to above, the bidder shall submit to the Employer at the initiation of the contract, the deadline of PERT-CHART showing the manufacturing progress and indicating the periods where inspection of the Employer or his authorized inspection agency is required at the manufacturers premises.

9.03.00 Where stage inspection is to be witnessed by Employer, the various stages of inspection, together with the program shall be submitted to the Employer. The inspection and test procedures shall also be submitted for Employer's approval.

10.00.00 **SPECIAL TOOLS AND TACKLE**

10.01.00 The Tenderer shall quote separately for a complete and unused set of all special tools, tackles etc., if any, including tool boxes, specifying the quantum of requirement, for erection, maintenance, overhaul or

complete replacement of equipment under this specification. A complete list of tools necessary shall be enclosed with the Proposal.

10.02.00 The Price quoted for tools, shall not be considered for evaluation of Tender.

11.00.00 **SPARE PARTS**

11.01.00 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

12.00.00 **DELIVERY**

12.01.00 The schedule of the project demands early delivery of the equipments.

12.02.00 The delivery date shall be indicated by the Successful Tenderer in the Progress Schedule showing the time required for different phases of the work under the scope of this specification taking the date of issue of Letter of Intent as datum.

12.03.00 The Successful Tenderer shall guarantee the delivery date subject to penalty.

13.00.00 **DRAWINGS, CURVES & INFORMATION REQUIRED**

13.01.00 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.

13.02.00 Speed Vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed Vs. torque curves of the motor, corresponding to 85%, 90%, 100% rated voltage and also extending over Quadrant I & Quadrant II covering reverse flow conditions, if applicable.

13.03.00 Diagram showing the type of lubrication system, etc.

13.04.00 Complete descriptive and illustrated literature on the equipment and accessories being offered.

13.05.00 Experience list for the similar type of equipment supplied, which should indicate name of customer, date of ordering, value of order date of commissioning, pump parameters and number.

13.06.00 A comprehensive write up or brochure on the details of manufacturing and test rig facilities in the shop of the manufacturer.

13.07.00 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.

13.08.00 All data furnished during bidding stage including details furnished under Clause 13.00.00 above 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.

13.09.00 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

14.00.00 **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.
 - 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.

- b) The information shall be organised 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.
- g) The Instruction Manual shall include the list of spare parts that are required for 2 years normal operation and maintenance for equipment. It shall also include list of all special tools and tackle furnished with complete drawings and instructions for use of such tools and tackles.

15.00.00 **DEVIATIONS**

The Tenderer is required to submit with his proposal a detailed list of any and all exceptions taken to this specification by filling up the Deviations Sheet. In absence of such a list it will be understood and agreed that Tenderer's proposal is based on strict conformance to the specification in all respects. These requirements, however, are not intended to prohibit Tenderers from offering alternate quotation for equipment which they consider to be equal or superior to that specified for the intended service and for which he believes he can show economic and/or technical advantages, provided that he is not allowed to add to the Vendors list and is confined to items not appearing therein. However acceptance of the same is at the sole discretionary power of the T.I.A.

16.00.00 **PROPOSAL DATA**

16.01.00 To complete the proposal, the Tenderer must fill up the following DATA SHEET / CHECK LIST furnished hereinafter.

16.02.00 Each Tenderer shall supply the data requested in Proposal Data paragraph as above by typing in appropriate places on each page. These filled in data sheets must be properly signed by authorised representative of the Tenderer or Manufacturer as verification of the data submitted. These signed pages, in their entirety, shall be returned with and shall be part of the Tenderer's formal proposal. The Tenderer shall completely fill in the above information required for each of the above mentioned sheets. Failure to comply with this requirement may result in the rejection of the tender.

17.00.00 **FOREIGN EXCHANGE AVAILABILITY**

No foreign exchange license will be available for this specification, if any foreign exchange is required by any Tenderer, it will have to be arranged from his own quota, through his own arrangement.

DATA SHEET / CHECK LIST OF THE PUMPS BEING OFFERED

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

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 present duty condition for solo operation	:	
1.08.00	Efficiency of Pump at future duty condition for Solo operation	:	
1.09.00	Efficiency of Pump at present & future duty condition in parallel operation	:	
2.00.00	PERFORMANCES		
2.01.01	Guaranteed capacity - M ³ /hr in peak flow without tolerance in single operation & parallel operation.	:	
2.01.02	Guaranteed head - MWC at peak flow discharge, without tolerance in single operation & parallel operation.	:	
2.01.03	Input to the Pump (KW) at present & future 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 at present & future duty condition	:	
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 present and future duty condition	:	
2.01.10	Pump shut off head for present and future duty condition	:	
2.01.11	Minimum submergence required in MWC at worst flow condition	:	
2.02.01	PUMP NPSHR		
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	:	
2.02.06	Pump shut off head		
3.00.00	FLEXIBLE JOINTS AND SHAFT		
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	THRUST BEARING	
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	:

The following data are obligatory for all the pumps

5.00	MATERIAL OF CONSTRUCTION	
5.00.01	Impeller	: ASTMA-743, Gr- CF8M
5.00.02	Casing	: CI, IS- 210, FG-260
5.00.03	Casing ring	: SS, Type- 304
5.00.04	Pump shaft	: SS410
5.00.05	Coupling for pump Motor	: Flexible pin and Bush type, C.I.
5.00.04	Shaft sleeve	: SS, ASTMA-276, Type- 410
5.00.06	Base Plate	: M.S

The following data are to be filled up by the tenderer

6.00.01	Are the pumps suitable for parallel operation	:
6.00.02	Whether non-Reserve Rutchet is provided in pump or not	:
6.00.03	Type of lubrication for pump	:
6.00.04	Whether pre lubrication arrangement provided	:
7.00.00	EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE	
7.00.01	Impellers	:
7.00.02	Pump Bowl Casing	:

- 7.00.03 Shaft :
- 7.00.04 Thrust Bearing :
- 7.00.05 Whether pump performance curve (H-Q, Q-P, Q-n, Q-NPSHR) authenticated by the pump manufacturer provided with the offer resistance curve :
- 7.00.06 Whether the copy of the pump family curve, authenticated by the pump manufacturer provided with the offer :
- 7.00.07 Whether the system head curve superimposed with pump performance curve & modified performance curve provided with the offer :
- 8.00.00 **GENERAL**
- 8.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering devices provided :
- 8.00.02 Whether lifting lugs, eye bolts etc. provided :

- 8.00.03 load data
- 8.00.04 Weight of total pump assembly (empty) :
- 8.00.05 Weight of total water column :
- 8.00.06 Total Static Load :
- 8.00.07 Total dynamic Load :
- 8.00.08 Maximum horizontal back thrust at maximum water level condition :

**HORIZONTAL PUMP AXIALLY SPLIT CASE
DATA SPECIFICATION SHEET**

GENERAL INFORMATION

Service	Clear Water	Pump Type axially split case	Horizontal pump
Designation			
No of pumps Reqd.: (To be filled in by the tenderer)		Duty	Continuous
Pumps working condition	Solo / Parallel	Location	Indoor

ELECTRICAL DOCUMENT

Electrical Motors Technical Specification Enclosed : Yes/No

SUPPLY OF ACCESSORIES AND SERVICE

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

Base Plate	Yes/No	Eye bolts, Lifting tackle etc.	Yes/No
Sole Plate	Yes/No	Vent and drain with isolation valves	Yes/No
Foundation bolts, nuts, sleeves nut	Yes/No		
Companion flanges at Pump		Universal Joint	Yes/No
Suction & Discharge reducers along with nuts, bolts & gaskets	Yes/No	Thrust block reqd. Non reverse ratchet	Yes/No Yes/No
External cooling/sealing/lubrication	Yes/No	Special Tools & Tackle	Yes/No
		Spare parts (for 4 years operation)	Yes/No
Cooling/sealing/lubrication system	Yes/No	Painting & Protective coating	Yes/No
Discharge pressure gauge	Yes/No	Suction side low level switch with annunciation hooter complete with accessories.	Yes/No
Suction pressure/VAC Gauge	Yes/No		
Pump Motor Coupling & Guard	Yes/No		

DATA SPECIFICATION SHEET

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

PUMP PARAMETERS

Design Capacity	Individual Pump of required capacity	Permissible tolerance in design	(±) 2.5%
Effective head (excluding loss in pump discharge branch pipe)	Discharge at duty point with parallel operation in all the cases	Permissible tolerance in efficiency :	(-) 3%
Available at design capacity :	Tenderer to indicate from the data supplied	Minimum submergence : required	Tenderer to indicate.
Discharge pressure :	In MLC	Static head of pumping system	
Pump shut off head :	In MLC	Frictional head of system : at design capacity	
Range of operation : (Tenderer to indicate)	% to % of design capacity	Reverse flow through pump to be considered for motor selection	Yes/No

Maximum speed :
(Tenderer to indicate)

Only rising stable HQ characteristics throughout the 'Range of Operation' is acceptable

Yes/No

LIQUID DATA

Liquid handled	Clear Water	Chloride	39 ppm
Specific Gravity	Nearly 1.0	Total hardness as CaCO ₃ max	144 ppm
Temperature	10- 40 ⁰ C	Chlorine	2 ppm
pH Value	7.3 to 8.6	Total dissolved solids max	500 ppm
Turbidity	5 NTU/ JTU (Max)		

**DATA SPECIFICATION SHEET
INSPECTION AND TESTING**

Item
Stage inspection by owner :
(details of Stage Inspection by Owner to be added in due course)

Specification
Yes/No

Material testing and Identification

Required/not required

RADIOGRAPHY

Parts to be tested:
Testing Std:
Acceptance Std:

ULTRASONIC Test

Parts to be tested
Testing Std.
Acceptance Std

DYE PENETRATION

Parts to be checked
Testing Std.
Acceptance Std.

Hydrostatic test

Testing Std.
Acceptance Std.

Dynamic balancing pump impeller shop to be witnessed

Yes/No

Performance test at shop reqd. at full speed & full load

Yes/No

MAGNETIC PARTICLES

Parts to be checked
Testing Std.
Acceptance Std.

NOTES

1. Pump motor set to be designed for starting with discharge valve partly open/closed condition.
2. Motor cooling arrangement shall be self-circulation type having fans mounted on motor shafts.
3. For sealing/cooling water shall be tapped from the pump discharge.
4. Range of operation of the pumps shall be selected by the Tenderer shall also indicate the minimum water level at which pumps can be satisfactorily operated on continuous basis. Tenderer shall furnish with his offer NPSH Vs capacity curve for the entire range of operation based on the above conditions and considering single pump operation & all installed pump operation.

As per technical specification and instruction manual of the manufacturer.

01.01 SUMP PUMP

Provision of two numbers sump pumps have made considering one unit will operate other would remain as standby. All seepage water from glands would be accumulated in a sump of dimension approximate 1.5-meter x 1.0-meter x 0.6 meters. The capacity of each pump would be 30M³/Hr at a head 15 Meter. The drive motors would be of adequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. The delivery pipes of individual pumps will be connected to a common manifold would be such that the water can be drained in a nearby location, outside the pump house within a distance of 10 meter maximum. The NRV and pit valve shall be placed in each pump delivery line and one no pit valve shall be placed in delivery line which generates from the common header. All GI pipes and specials within the bidder's scope. The bidder has to provide suitable capacity DOL starter for individual pump motor set and placed in the suitable place for easy operation. The power will be taken from the control panel through switch fuse unit.

OR

The portable submersible dewatering pump motor set will be suitable for dewatering gland leakage muddy water with adequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. Submersible motor will be oil filled. The pump will be fitted with suitable mechanical seals, ball bearing etc. and shall be capable of performance details below when running in 2900. The pump will be fitted with cast iron / bronze impeller fitted in cast iron casing.

Pumps and motor shall be closed coupled and motor will be placed on top of the pump. This arrangement will ensure that in the sump can be drained to the maximum extent possible, so that the level of water in the sump is only a few cm above the pump inlet.

The motor winding will be insulated with oil and water resistance materials. The pump and motor unit shall be capable of running dry even when the motor oil seals fail draining out the oil from the motor and running which vertically no water sump.

Installation: -

As per technical specification and instruction manual of the manufacturer.

02.00 MOTORS (VERTICAL AXIS FOR DUMPING GROUND GLR & HORIZONTAL AXIS RABINSEN FOR SIRISDANGA GLR)

2.01.00 SCOPE

- 2.01.01 This specification covers the general requirements of the drive motors.
- 2.01.02 Motor shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 2.01.03 In case of any discrepancy, the driven equipment specification shall govern.

2.02.00 STANDARDS

All motors shall confirm to the latest applicable IS/BS/DIN Publications.

2.03.00 TECHNICAL SPECIFICATION FOR DRIVE MOTORS

- 2.03.01 The drive electrical motors shall be of squirrel cage induction type vertical /Horizontal axis to suit the size of the pump and shall be able to drive the pump. The rating of the motors shall be minimum 45KW,55KW (FOR DUMPING GROUND GLR) and 55KW, (FOR RABINSEN GLR)& 1500 RPM (Syn.), 415V \pm 10%, 3 Phase, 50 Hz \pm 5%,
- 2.03.02 The motor shall be designed for Star / Delta starting arrangements. The motor starting current shall be guided by IS 12615.
- 2.03.03 All the motors shall be rated for continuous duty operation (duty: S1) IE2. However, due to the operational schedule of the pumping station, the pump motor unit may demand for 8/10 start and stop in a day with a minimum time gap of 20 minutes for one stop after prolong operation and restart the same. The motor shall also be capable of one immediate hot restart and three equi spaced starts per hour.
- 2.03.04 The motor KW rating shall have 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 operation whichever is higher. The overload capacity of the such selected motor rating shall be 10% continuous by allowing temperature rise upto Class-F limits. If the tenderer feel that the above rated motor is not satisfying stated loading, they may offer their rating of motor.
- 2.03.05 The motor characteristics shall match the requirements of the driven equipment.
- 2.03.06 The motor should deliver rated output and accelerate the full speed with 85% of the rated voltage at motor terminal. The accelerating time of the motor should not be more than 3 sec.
- 2.03.07 With 85% rated voltage at motor terminal, the motor shall be capable of working satisfactorily at full load at least 5 minutes without injurious heating or stalling. For 3% voltage imbalance in power supply, the motor shall not be de-rated by more than 10%.
- 2.03.08 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 sec. 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.
- 2.03.09 The motor shall be TEFC type having protection group of IPs 55. Motor shall be suitable for rotation in both the direction.
- 2.03.10 The insulation of the stator winding of the motor shall be of Class-F but the heat exchanging arrangement shall be such that the temperature rise is limited to that of Class-B as IS:325 over the ambient temperature. The ambient temperature may be considered as 45°C and the relative humidity may vary from 80% to 100%.
- 2.03.11 The rotor of the motor should be sturdy in construction so as at ensure trouble free operation as indicated in relevant clause without any rotor bar fracture inside or outside the rotor slots or rotor bar end brazing failure or development of cracks in the brazed joint of the rotor bar with shorting ring. The rotor bar of the rotor shall be 99.99% electrolyte grade Cu and shall be well machined, insulated tightly placed and evenly press fitted inside the rotor slots, the later being broached to have smooth finish. The rotor shall be slotted end ring design. The rotor bars in the form of temple bars shall be used. Proper brazing materials shall be used.

The rotor shall be dynamically balanced with all the fans and with key in the shaft extension.

The rotor must carry a guarantee of at least 20,000 starts as per the operations schedule mentioned in relevant clause without any rotor bar failure or any other type of rotor failure.

- 2.03.12 The motor shall be provided with anti-friction bearing, 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 on-service positive lubrication with drains and grease collectors to guard against over lubrication.

The type and number of bearing the lubricant details (limited to normally available types of IOC or, any standard make). Quantity and frequency of bearing lubrication should be clearly indicated in the offer as well as to be displayed in the rating plate of the motor.

- 2.03.13 The motor should be smooth in operation and the noise level should not exceed 85 db. at 1.5M from the motor. The vibration level of the pump and motor should be within the specified the limit of IS:11724 and must be within 75 microns.

The motor should have adequate number of terminal boxes for main power cable, control cable & signal cable. The motor main terminal box shall be

rotatable in steps of 90°. The main terminal box should be suitable for minimum 2 run 3 core, 1.1 KV grade, 35/50/70/95/150/185/240/300 sq.mm. Aluminium conductor, armoured, XLPE Cable as deemed fit to the system. The terminal boxes shall be with removable cover with access to connection. No compound shall be used in the terminal box for easy handling. The motor terminal boxes shall be furnished with suitable cable lugs and double compression brass glands to match with the cable size. The terminals shall be clearly identified by phase markings and termination indication corresponding to direction of rotation.

The maximum system fault current for a duration of 1.0 sec. shall be considered.

The motor shall be equipped with built-in anti-condensation space heater of adequate rating suitable for operation at 240V AC supply. Separate terminal box for the space heater connection are to be provided.

The frame of each motor shall be provided with two separate and distinct grounding pads suitable for accommodation of grounding conductors of suitable size GI flat. The main cable terminal boxes shall have separate grounding pads.

- 2.03.14 The rating plate of the motor should contain, the minimum information as indicated in the relevant IS. Apart from the same, the information as indicated in relevant clause as well as the temperature rise in °C under rated condition, method of measurement, degree of protection shall be furnished.

- 2.03.15 The successful tenderer should 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.

- 2.03.16 The dimensional drawing of the offered motor, terminal box drawings, load data, GD2 value of the drive unit and the driven unit shall be furnished to the EIC for approval.
- 2.03.17 Apart from the standard accessories provided by the motor manufacturer and those accessories mentioned in preceding paras, one local lock switch is to be provided with each motor having proper connection with the motor connecting switchgear so that the motor breaker cannot be closed when the lock switch is in operation. The motor shall also be provided with suitable lifting lugs eye bolts having adequate provision for lifting installation.
- 2.03.18 The motor shall be provided with RTD's and BTD's for alarm and trip (for rating 75 KW and above). The leads shall be brought out to a separate terminal box.
- 2.03.19 The routine tests as per IS:325 shall be conducted to each motor. Temperature rise test are to be conducted on at least one motor (75KW & above) of each rating. The motor vibration tests shall be conducted mounting the motor on the shop motor stool. All the above tests are to be conducted at the manufacturer's shop in presence of the departmental representatives. Apart from the shop testing, normal field testing are to be carried out during installation, pre-commissioning and commissioning. All necessary arrangements for the tests are to be made by the contractor.
- 2.03.20 Motors up to 5 KW shall be of DOL starting and beyond 5 KW shall be Star-Delta Starting

CHECK LIST OF THE MOTORS BEING OFFERED

- 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 (Rating 75KW & above)
- 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 M²)
- 1.41.00 GD2 value of load to motor shaft (kg M²)
- 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 75 KW & above) of at least 1 no. motors as per choice of the customer, shall be performed. Further any special tests called for in the driven equipment specification shall be performed. The manufacturer/tenderer has to bear all expenses for such testing to witness the tests for max. two representatives of EIC to the manufacturer's 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 manufacture's factory.

3.00.00 SPARES

Spare parts are to be supplied as specified separately. Recommended spares for five (5) years operation shall be quoted along with the bid clearly identifying the part nos. with recommended quantities.

I) DE & NDE Bearing :1 set.

4.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

- 4.01.00 Along with the bid:
 - Individual motor data as per Check List
- 4.02.00 After Award of the Contract for Approval:
 - a) Dimensional General Arrangement Drawing
 - b) Foundation Plan & Loading
 - c) Cable end box details
 - d) Load Vs Efficiency & power factor, Current Vs Time / Speed curves
 - e) Thermal withstand curves hot & cold

- f) Speed torque characteristics at 80% & 100% voltage
- g) Complete motor data

VALVES AND SPECIALS

03.01.01 Delivery side of pumps

The delivery side of each pump shall be provided with 1 no. Electrical Actuator operated butterfly valve and 1 no. non-return valve, 1 no. Dismantling joint & short pieces wherever required. The diameter of the valves and joints shall selected based on velocity of 2.0 m/sec(approx.) with nearest sizes as per IS.

03.01.02 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 water and to maintain unidirectional flow. The valve shall be maintenance free, leak proof and shall have low life cycle cost. The PN rating of valves shall be PN 1.0. /1.6

The non-return valve shall be single door, Ductile Iron, double flanged, conventional non-slam design. The body, door, cover shall be of ductile iron (Gr. GGG 40). The seat and body shall withstand fluid pressure of 10-16kg / cm² and 16-24 kg / cm² 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/ mm².

The valves are subject to satisfactory hydrostatic test at manufacture's works and in presence of the department's representative for acceptance.

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.

03.02.01 Butterfly Valve

The butterfly valves shall be DIDF, PN 1.0. /1.6, conforming to IS 13095 of 1996 / BS 5155. The seat pressure shall be 10-16 kg/cm² and body pressure shall be 16-24 kg/cm². The valve shall operate smoothly & steadily in both directions, 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.

- c) 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, IP68 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

03.02.02 ELECTRICAL ACTUATOR

- 3. The actuator motor for the BFV 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 for continuous submergence.
- 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
 - v. torque limit switches for 'open' and 'close'
 - vi. Position limit switchesAll 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.

- r) 415V \pm 10% 3 phase, 50 Hz, AC motor.
- s) Reduction gearing arrangement.
- t) Torque & limit switch mechanism.
- u) Valve position indicator.
- v) Arrangements for pick up signals for displaying the % opening of the valves in the suitable meters to be placed on control desk.
- w) Remote operation facility with selector switch and local control console.
- x) The hand wheel with clutch mechanism for manual operation. The manual operation shall be automatically declutched when actuator motors in operation.
- y) 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.

03 .00.01 SLUICE VALVE

The sluice valves shall be manufactured from ductile iron (Gr. GGG 40). conforming to IS-14846 / 2000. Flange ends as per IS 1538 or as per other standards to match with other flanges. The body seat shall be of S.S. AISI-410 stem shall be of S.S. AISI-410 & the stem nut shall be Gun metal conforming to I.S. 305:1981/BS 2874. Other details are to be submitted for approval.

The seat pressure shall be 10 kg/cm² and body pressure shall be 15 kg/cm². The valves should pass through hydrostatics test for duration of 5 minutes.

Body, Cover, Wedge	:	Ductile Iron GGG 40
Shaft	:	S.S. to AISI-410
Body Seat	:	S.S. to AISI-304
Bearing	:	G.M./Teflon
Wedge Sit	:	S.S. to AISI-304
Packing	:	Rubber "O" ring
Internal Fasteners & Clamping Ring	:	S.S. to AISI-304
External Fasteners	:	Carbon Steel to IS:1367 Cl. 4.6 & 4.0.
Hand wheel	:	Fabricated Steel
Worm Gear Unit	:	Mfg. Std.
Actuator	:	No

Testing (as per IS : 13095 / 91)				Inspection		
Hydro Body	:	15 Kg / Sq.cm for 5 minutes		Hydro Test	:	Witness & Test Report
Hydro Seat	:	10 Kg / Sq.cm for 2 minutes		Visual	:	Witness & Test Report
Disc. Test	:	10 Kg / Sq.cm for 5 minutes		Material Test	:	Test Report
Quantity				Note:		
Size (NB)	Qty (Nos.)	Location	Service / Application	1. Valves shall be tight shut-off closures for frequent operation 2. Valve should closed with clock wise rotation of Hand wheel. In case of hand wheel operation) 3. Valves shall be painted with one coat of Red oxide primer & two coats of Black bituminous paints before dispatch. 4. Marking : Brand / Size / PN – Rating / Heat No. & Sl. No.		

Materials of construction test certificates shall be provided during supplies. The sluice valves shall be rising spindle type with gearing arrangement / hand wheel for easy manual operation.

03.04 **M.S. DISMANTLING JOINT ASSEMBLY AT INDIVIDUAL DELIVERY LINE AND MANIFOLD**

One M. S. dismantling joint of suitable diameter is to be fixed in each of the individual delivery and one no along with the Flow meter & BFV on the water delivery 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 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 10 -16kg/cm². One leak proof concrete chamber if required as per site condition is to be constructed. The Dimension of the Chamber would however depend on the final alignment and level of the site condition

03.05 **PUMP DELIVERY SIDE PIPING AND COMMON DELIVERY MANIFOLD**

The pump individual delivery side piping, valves and joints and Common Delivery Manifold shall be shall selected based on velocity of 2.0 m/sec(approx.) and 1.55 m/sec (Approx.) respectively with nearest sizes as per IS.

The pipes shall be made up of M.S. 8/12 mm thick plates for individual delivery line and Common Delivery manifold, 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 common delivery manifold shall of such diameter as per the Technical offer. The manifold shall be fabricated from 8/12mm thick MS plates. The common manifold shall have blank flange / Dish end on one side with adequate stiffening (as applicable) and the other side would be extended from the centre line of the last pump to install one each Dismantling Joint, Butterfly valve, Air Release Valve and further as required to install one Full bore Electromagnetic flow meter. The length of the manifold must be extended at least one meter on one side after the interconnections with the delivery pipe lines from the pumps at the one extreme end and in the other end it will be extended up to the specified length.

The common delivery manifold shall be provided with one no. 100 mm dia air release valve (double throat) 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).

03.06 Pressure Gauge/Compound Gauge (Dial Type):

The individual discharge line and common delivery manifold shall be provided with pressure gauge (6" dial) 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 -10 Kg / Sq.cm. The pressure gauge shall have 3-way cock and fitting.

03.07 Tamper proof Kinetic air release valve

Air valve for clean, cold potable water up to 50°C

PN 10 / 16

DN 80 – 200

Double chamber valve with twin float (Rubber / Vulcanite coated timber core / SS 304) - automatic operation with water.

Two-orifice venting system with 3 functions (supply and release of air as well as automatic venting during operation)

Flange connection dimensions to IS 1538 Table 4 & 6

Body and Cover made of CAST IRON IS 210 Gr. FG 260

Seal made of EPDM

Corrosion protection:

Inside and outside with liquid epoxy coating; thickness >250 μm , colour: RAL 5005 blue

Accessories:

Must have a metal seated gate valves (description as above for Sluice Valves up to 800 mm) of same diameter for isolation purpose, complete with gasket and fasteners (steel galvanized)

04.00 HTPDB (FOR DUMPING GROUND GLR)

4.1. The HT PDB shall be multi panel switch board suitable for indoor installation and shall operate at 11 KV $\pm 10\%$, 3 ϕ , 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.

4.2. 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 11 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.

- 4.3 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.

- 4.4 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.

- 4.5 copper, sized for specific current rating with maximum temperature rise limited to 90⁰C. 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.

- 4.6 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.

- 4.7 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 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:

- g) 1 set mechanical ON & OFF indicator.
- h) 1 rear entry cable box with glands suitable for 11 KV grade XLPE cable.
- i) 1 set of indicating lamp ON / OFF / TRIP / SPRING CHARGED / TRIP CIRCUITHEALTHY / 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 and closing coil rated for 110 V DC.
- f) 1 space heater with ON & OFF switch
- g) 15A / 15A 3 Pin Plug Socket
- h) In – panel lighting with control switch
- i) Space heater for each Switchgear panel
- 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 suitable for 3 phase, 3 wire 5 limb 50 Hz system with a ratio of 11 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 62KA. 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.

4.8 The feeder details of the Multi panel HT PDB shall be as under:

A) Incoming feeder Panel: 1 No. (800 A)

- | | | | |
|-------|-------------------------------------------------------------------------------------------------------------------|---|-------------------|
| i) | 96 sq mm (0 – 12 KV) Voltmeter with Selector Switch | - | 1 Set |
| ii) | 96 sqmm Ammeter suitably dual scaled 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 ratio and 5A 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. |
| viii) | Trip Circuit Supervision Relay type VAX 31 or equivalent | - | 1 No. |
| ix) | Master Trip Relay type VAJH 13 or equivalent | - | 1 No. |
| x) | Multifunction meter (For Amp. Voltage, frequency, power factor etc.) type ELITE 445 or equivalent | - | 1 No. |
| xi) | Power Factor Meter | - | 1 No. |
| xii) | KW Meter | - | 1 No. |
| xiii) | 12 Channel alarm annunciator & Indicating Lamps | | 1 Set |

B) Out going feeder panels for transformers: 2 Nos. (800 A)
Each Transformer feeder panel shall be equipped with the following:

- | | | | |
|------|--------------------------------------------------------|---|-------|
| i) | 96 sq. mm Ammeter suitably scaled 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 ratio and 5A Secondary, Class 5 P10 & 1.0, 10VA burden - 1 Set (3 Nos.)
 - v) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P122 or equivalent - 1 No.
 - vi) Master trip relay type VAJH-13 - 1 No.
 - vii) Trip Circuit Supervision Relay type VAX 31 or equivalent - 1 No.
 - viii) Auxiliary relay type VAA -33 or equivalent - 3 Nos.
 - ix) 12 Channel alarm annunciator & Indicating Lamps - 1 Set
- C) Common for all above feeders:

- i) Anti – pumping relay

4.9. Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MCC cum PDB 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.

4.10. 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

4.11 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.

05.00 TRANSFORMER (FOR DUMPING GROUND GLR)

There will be total two (2) number of transformers, each having a capacity of 315 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

- xx) Conservator with drain valves and oil gauge.
- xxi) Silica gel breather
- xxii) Bidirectional rollers
- iv) PRV with contact.
- v) Oil filter valve
- vi) Transformer tank drain valve, one upper and one lower.

- vii) Earthing terminals – 2 nos.
- viii) Air relieve plugs
- ix) Rating and diagram plate
- x) Bucholz's relay with Alarm and Trip
- xi) OTI with Alarm and Trip contacts
- xxi) WTI with Alarm and Trip contacts
- xxii) MOG with contact
- xxiii) Marshalling box with contacts of Bucholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 240 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 5.1 Two nos. 315KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45° C.
- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.
- 5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.
- 5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	: 3 (three)
Winding connection & vector group	:	: DYn-11
Rated frequency	:	: 50 cycles/sec.
Rated KVA	:	: 315 KVA
Rated primary voltage	:	: 11 KV
Rated secondary voltage	:	: 0.433 KV
Method of system earthing	:	: Secondary solidly grounded
Tap-Changer	:	: Off-circuit Tap-changer (OCTC) (+) 5% to (-) 10%
Tapings	:	: in steps of 2.5%
HV side terminal arrangements	:	: Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 240 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus Coupler PDB at Substation. (DUMPING GROUND GLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 630A incoming feeders 2 nos. each comprising of following components:

- xxix) 415 V, 4 pole, 630A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release 1 No
- xxx) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1
No.
- xxxi) 96 sq. mm, 0 – 500 V Voltmeter with selector switch 1
No.
- xxxii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- xxxiii) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- xxxiv) Red, Yellow, Blue phase indicating lamp as required
- xxxv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- xxxvi) TNC Breaker Control Switch 1 No.
- xxxvii) Local / Remote Selector Switch 1 No.
- xxxviii) Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13
1 No.

6.12 630 A Bus coupler feeder one (1) number comprising of following components:

- xiii) 415 V, 4 Pole, 630 A, 50 KA electrically operated draw out
ACB without release. 1 No.

- xiv) TNC Breaker Control Switch 1 No.
- xv) Local / Remote Selector Switch 1 No.
- xvi) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for DUMPING GROUNDGLR (each equipped with following:)

- I) 415 V, 3 pole, 630A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.
- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.
- VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 4 Nos.
- b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility

for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB at DUMPING GROUND GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 630A for phases and 300A 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 50 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.

7.7 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 1.1 KV grade 3.5 core 240 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

xxii)	415 V, 4 pole, 630A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No
xxiii)	96 sq mm, suitably scaled Ammeter with cramped scale & selector switch	1 No.
xxiv)	96 sq mm, 0 – 500 V Voltmeter with selector switch	1 No.
xxv)	Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA	3 Nos.
xxvi)	Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA	3 Nos.
xxvii)	Red, Yellow, Blue phase indicating lamp	as required
xxviii)	MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp	4 Nos.
xxix)	TNC Breaker Control Switch	1 No.
xxx)	Local / Remote Selector Switch	1 No.
xxxi)	Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13	1 No.

7.11 630 A Bus coupler feeder one (1) number comprising of following components:

vii) 415 V, 4 Pole, 630 A, 50 KA electrically operated draw out type

ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.

- | | | |
|-------|-------------------------------------------------------|--------|
| viii) | TNC Breaker Control Switch | 1 No. |
| ix) | Local / Remote Selector Switch | 1 No. |
| iv) | Bus Coupler ON / OFF / Spring Charged Indicating Lamp | 3 Nos. |

7.12 55KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| d) | Start / Stop Push Button | - | 1 Set |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) | - | 1 No. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.12 45KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| d) | Start / Stop Push Button | - | 1 Set |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) | - | 1 No. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

- | | | |
|-----|----------------------------------|-------|
| w) | Motor protection circuit breaker | 1 no |
| x) | Power contractor | 3 no |
| y) | Aux. contractor | 5 no |
| z) | Current transformer | 3 no |
| aa) | Analog ammeter | 1no |
| bb) | Ammeter selector switch | 1 no |
| cc) | Indicating lamp | 3 no |
| dd) | On/off push button | 2 no. |
| ee) | Star delta timer | 1 no |
| ff) | Thermal overload relay | 1 no |
| gg) | Power terminal, | 2 no |

7.14 MCCB / MCB feeder of following rating

- a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.
(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos
- b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration3 Nos
- E) Not less than #A TPN MPCB for actuator feeder8 Nos
- d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.
- e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 1 Incomer & Bus Bar PDB at Substation. (RABINSEN GLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 1250 A for phases and 600 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 1250A incoming feeders 1 nos. each comprising of following components:

- | | | |
|--------|----------------------------------------------------------------------------------------------------------------------------------|--------|
| xxxix) | 415 V, 4 pole, 1250A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release | 1 No |
| xl) | 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch | 1 No. |
| xli) | 96 sq. mm, 0 – 500 V Voltmeter with selector switch | 1 No. |
| xlii) | Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA | 3 Nos. |
| xliii) | Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA | 3 Nos. |

- xliv) Red, Yellow, Blue phase indicating lamp as required
- xliv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- xlvi) TNC Breaker Control Switch 1 No.
- xlvii) Local / Remote Selector Switch 1 No.
- xlviii) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13
1 No.

6.12 1250 A Busbar shall be 1250 A for phases and 600 A for neutral.

6.13 Outgoing feeders --- 2 Nos. for RABINSEGLR (each equipped with following:)

I) 415 V, 3 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No

II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.

III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.

IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.

V) TNC Breaker Control Switch 1 No.

VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB at RABINSEN GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1250A for phases and 630A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- xxxii) 415 V, 4 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- xxxiii) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- xxxiv) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- xxxv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.

- xxxvi) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA Nos. 3
- xxxvii) Red, Yellow, Blue phase indicating lamp as required
- xxxviii) MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp Nos. 4
- xxxix) TNC Breaker Control Switch 1 No.
- xl) Local / Remote Selector Switch 1 No.
- xli) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13 1 No.

7.11 1250 A Bus coupler feeder one (1) number comprising of following components:

- x) 415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No.
- xi) TNC Breaker Control Switch 1 No.
- xii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 110KW Star – Delta Starter Motor feeders (2W+1S), each comprising of following components: Type 2 coordination should have to be followed.

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| f) | True Digital Microprocessor based 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. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.12 55KW Star – Delta Starter Motor feeders (5 nos. feeders), each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| | Start / Stop Push Button | - | 1 Set |
| d) | | | |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) | - | 1 No. |
| g) | High speed master trip relay type VAJH 13 or | - | 1 No. |

equivalent

- h) CT of appropriate rating and 5A Secondary, - 3
Class 1.0, 10 VA Nos.
- i) CT of appropriate rating and 5A Secondary, - 3
Class 5 P 10, 15 VA Nos.

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

hh)	Motor protection circuit breaker	1 no
ii)	Power contractor	3 no
jj)	Aux. contractor	5 no
kk)	Current transformer	3 no
ll)	Analog ammeter	1 no
mm)	Ammeter selector switch	1 no
nn)	Indicating lamp	3 no
oo)	On/off push button	2 no.
pp)	Star delta timer	1 no
qq)	Thermal overload relay	1 no
rr)	Power terminal,	2 no

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

F) Not less than #A TPN MPCB for actuator feeder 15 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

15.00 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

15.1 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

15.2 Float and Boost Battery Charger

15.2.1 Charger – I (Float Charger – SCR Control)

- a) Output Voltage : 110 – 125 V DC [steplesslyadjustable]
- 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

15.2.2 Charger – II (Boost cum Float Charger – SCR Control)

- a) Output Voltage Boost : 110 – 127 V DC [steplessly adjustable]
Em. Float: 110 V – 125 V DC [steplessly 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

15.3 Protection

- a) Snubber across each device

- b) Phase failure / sequence reversal
- c) Soft start with current limiting (intrinsic feature of trigger PCB)

15.4 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

15.5 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.

15.6 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

15.7 DCDB Outgoing Feeder

- a) 2 P, 16 A DC MCB - 6 Nos.

15.8 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

16.00 CABLE:

All HT and M.V. power cables shall be with XLPE insulation, stranded aluminium / copper conductor and armoured

16.01 HT &M.V. Cables and Jointing

All HT and M.V. Cables shall be 11 KV (E) / 1.1 KV grade XLPE insulated and armoured of Al / Cu. conductor 3 core / 3½ core / 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 1000 mm width x 1200mm 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.

16.02 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.

17.00 FLOW SENSOR

There shall be one number of Full bore Electromagnetic flow meter on the common delivery manifold. The flow meters 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 m³/hr & total flow in cubic meter. The flow sensor shall be suitable to measure Raw 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 50 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 ± 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 Raw Water.

Type:- Pulsed DC electromagnetic.

Accuracy:- ± 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.

Weather protection class:- IP68 NEMA 6 P or as per the specified by EIC.

Minimum conductivity:- 20 $\mu\text{S}/\text{cm}$

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 single Length as required as per site condition between sensor and transmitter.

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.

Output: - 4-20 mA DC

Power supply: - 240 V AC 50 Hz and shall be supplied from the MCC cum PDB at a approximate 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.

18.00 Flow meter/ Flow sensor or Flow Tube fixing chamber

For fixing of Flow Tube at the delivery manifold, leak proof chamber of adequate dimension is to be constructed if required as per site condition with a rung-ladder of suitable length for getting down if necessary.

19.00 EARTHING

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 75mm wide and 8 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 Earth Pits should not be less than 3 meters.

20.00 LIGHTING SYSTEM

20.01 Luminaries

The scope includes indoor lighting of pump house, substation building, Annex area and reasonable area lighting around the Pump House and Substation Building. Industrial Medium bay luminaries with 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 Substation Room lighting should be provided with LED T/L 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.

Area illumination/access bridge level 100 LUX with suitable LED fittings.

All the entrance/exists of pump house shall be provided with LED down lighter or bracket mounted fittings with LED lamps of minimum 45 Was per site condition (minimum 90W for unloading bay entrance).

20.02 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.

20.03 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.

20.04. 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.

20.05 The above stated distribution board shall be fed from independent switch fuse unit / MCB / MCCB located in the PDB.

20.06 440 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.

20.07 The minimum required size of the conductor for internal distribution point wiring shall be as follows:

Sl.	Type of fitting	Minimum size of wire
-----	-----------------	----------------------

No /wiring

1. LED Fluorescent 2 nos. 1 core -1.5 mm² copper & 1 no. Earth wire of 1.0 mm² copper
2. LED Flood light fitting 2 nos. 1 core -2.5 mm² copper & 1 no. Earth wire of 1.0 mm² copper
3. Receptacle- 5A 2 nos. 1 core -2.5 mm² copper & 1 no. Earth wire of 1.0 mm² copper
4. Receptacle- 15A 2 nos – 1 core-4 mm² copper & 1 no Earth wire of 1.0 mm² copper

21.00 Ventilation & Firefighting System:

21.01 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 / armoured cable including all other accessories as required.

- g) 3 - phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for the Pump House to ensure 10 Air changes/Hr..
- h) Single phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for all the rooms of Sub Station as per the direction of EIC.
- i) Wall mounting type control panel for exhaust fan and others ----- 2 Sets, one each for pump House and substation.
- e) 18" Pedestal fan with regulator and all other accessories --- 3 Nos.

21.04 Fire Extinguisher

- a) ABC type Portable type fire extinguisher 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.

20.00 OVERHEAD CRANE

20.1 EOT Crane.

The EOT. Crane will be minimum 3 M.T. capacity Electrically Operated Travelling Crane (E.O.T.) with a lift from the operating floor level and up to the level above the installed motors. The long travel & the Cross Travel along with height of lift of the crane shall be finalised after freezing of the Pump House 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 shall be manually operated. The buffers must be spring loaded operation.

The EOT Crane should be tested at manufacturer's works / site as per relevant IS. The same may be witnessed by the EIC. The Contractor has to arrange for such testing at his own cost.

21.00 Chlorination System

- 5) Chlorination System should be 2X 5k. g/Hr.
- 6) Pre- & Post Chlorination by gases chlorine arrangement capable of producing with 25% overloading.

22.00 MECHANICAL TYPE LEVEL INDICATOR

The Mechanical level Indicator shall be equipped with for continuous monitoring of sump level.

The level indicator 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 05Mtr.

B.List of Vendors

Sl. No.	Equipment	Make
01.00	Pump	Kirloskar / Mather & Platt / WPIL Ltd.
02.00	Motor	Siemens / ABB / Marathon/ Crompton

03.00	Control Desk/ MV Switchboard / MCC cum PDB	Sellwin. / PCE Projects / RNR / Roycco.Engg.
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) / BCH
08.00	Contactors	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 / Micro System
12.00	Digital Indicators	Micro System /Meco
13.00	Temperature Scanner	Pecon/ Micro System /Laxon / Chino / Masuka Instruments Pvt. Ltd.
14.00	Radar type Level Monitoring System\	Siemens / Khrono / Rosemount
14.01	Mechanical Type Level Indicator	NGM/Joydev. Engg./Star Enterprise.
15.00	Flow meter, Indicator, Totaliser	Krohne / Endress Hauser/ABB/Siemens
16.00	Control Fuses	GE/Siemens
17.00	Current Transformer	Kappa /JAWS / Schneider
18.00	Capacitor	Unistar / L&T / Epcos
19.00	Butterfly Valves, Non-Return Valve & Sluice Valve	VAG/ IVC / Kirloskar / Fluidtech/IVI
20.00	Valve Actuators	Rotork / Auma
21.00	Gauges	Bell / Taylors / H. Guru /Bell/Baumer
22.00	Fire Extinguishers	Surex / Minimax / Cease Fire / Fire Shield

23.00	Submersible Sump Pump	KSB / Calama / Kirloskar
24.00	Air Conditioner	Carrier / LG / Voltas
25.00	Lighting system	
26.01	Light Fitting	Philips / Bajaj/C.G/KLITE
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 Implements Co.	Surekha / Plycare / India Engineering &
30.00	H.T. Switchgear	Siemens / Schneider / ABB
31.00	Power Transformer	Schneider / KEC/ Voltamp. (Vadodara) /AEG/CG
32.00	Battery	Exide/Aamron
33.00	Battery Charger	Caldyne / Electro Service/Dekem/Live Line

C.Scope of Work for Major E/M Equipments.(AT DUMPING GROUND GLR)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 300 cu.m/hr & Head not less than 40 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 210 cu.m/hr & Head not less than 49 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
3	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8/12 mm thickness sheet.)	1	Lot

4	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
5	Providing, Installation, Testing and Commissioning of Compound gauges, Pressure gauges & Pressure Transmitter	1	Lot
6	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 200 mm dia.	1	Nos.
8	Supply, delivery, Installation, Testing & Commissioning of Mechanical Level Indicator for CWR/Sump/Well.	1	Nos.
9	Providing, installation, testing and commissioning of submersible Monoblock pump set 7.5 KW with starter	1	Nos.
10	Supply, delivery, Installation and commissioning of 3 M.Ton capacity EOT Crane complete in all respect including testing, certification and as per NIT and tender specifications	1	Job
11	Supplying, Installation, testing & Commissioning of Chlorination for Automatic/Manual Gaseous chlorination unit by 2x5 kg/hr. auto cum manual with chlorinator accessories chlorine analyser, safety kit and allied accessories all complete along with Tonner & EOT crane	1	Job
12	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
13	Supply, Installation, Testing & Commissioning of 315 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
14	Supply, installation, testing & commissioning of Float cum boost charger suitable for 415V with variation 10%, 50 HZ, single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
15	Supply, delivery, Installation, Testing and Commissioning of suitable LT PDB Panel as per specification.	1	No
16	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No
17	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
18	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
19	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
20	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job

21	Supply, delivery and Installation of safety equipment.	1	Job
22	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support,with all accessories & cable tray supports.	1	Job
23	Providing and fixing in position lightening arrester set	1	Job
24	SITC of Ventilation System for Pump House & Panel Room	1	Job
25	Illumination of Pump room & Panel room incl. supplying fitting, fixing all complete.	1	Job
26	Outdoor illumination for Access bridge & Compound lighting, including supplying , fixing all complete.	1	Job
27	Dehydration&Filtration of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
28	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
29	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
30	Operation and maintenance for 5 years (Includes Manpower & spares)	1	Job

D.Scope of Work for Major E/M Equipments.(AT RABINSEN)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty
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1	Supply, Delivery, Installation, Testing & Commissioning of 300 cu.m/hr & Head not less than 40 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2
2	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines	1
3	Supply, delivery, Installtion, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1
4	Providing, Installation, Testing and Commissioning of Pressure gauges & Pressure Transmitter	1
5	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1
6	Supply, delivery, Installation and commissioning of 3 M.Ton capacity EOT Crane complete in all respect including testing , certification and as per NIT and tender specifications	1
7	415 V, 3 phase 4 wire, 50 HZ, LT PDB Panel as per specification	1
8	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1
9	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1
10	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1
11	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support, with all accessories & cable tray supports.	1
12	Dehydration & Filtraion of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1
13	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1
14	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1

Superintending Engineer,
West Circle, M.E.Dte

SECTION – H

A. Technical Specification of Major Electro-Mechanical Equipments for CWR

at

**Asansol (Bhutaburi, Polo Ground, Ismile, Barachak, Dihika, KSTP)+ Kulti (Barakar+Ramnagar)
under AMC**

This is indicative not exhaustive, will be finalized in detail engineering.

4.0. (A) VERTICAL TURBINE (VT) PUMP (FOR BHUTABURI, POLO GROUND, BARACHAK, BARAKAR, RAMNAGAR GLR)

4.0 Vertical Wet Pit Pumps

- 1.3 The pump shall be of vertical wet pit type with mixed flow impeller. Pump shall be placed vertically submerged in the wet pit and mounted on CWR Floor pumping station. The pump shall be self-service water lubricated type. Self-lubricated type guide bearings are to be provided at suitable position of the shafts and shall not be more than 1.5M (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 stick inside the bearings deteriorating them. The specific gravity of Clear Water shall be considered as 1.00 M (Max.).
- 1.2 The pump battery shall contain suitable no. of pumps set out of which each pump shall deliver 100 % of the demand and also the system shall have minimum 50% stand-by Pumps.
- 1.3 Pump 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 pump shall be of non-pull out type. The individual pump discharge lines 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 orders shall furnish the pump-motor foundation plan authenticated by the OEM. The said foundation will take care and counter the horizontal back thrusts may be generated during start/stop of the same (at shutoff condition may be considered).
- 1.5 The pump impellers 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 pump 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 curves shall be stable all throughout. There shall be a margin of at least 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-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 mm 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.
- 1.11 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 level, the required bottom clearance at the indicated level etc. The total suspension length, as has been considered in the offer backed by technical justification shall be placed with the technical offer.
- 1.12 The pump assembly shall be provided with suitable anti-friction roller thrust bearing, 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.
- 1.13 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.
- 1.14 The pump motor shall be considered as a single unit and the vibration limit should be within the limit specified in above IS.
- 1.15 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.
- 1.16 The pump shall also withstand the condition of any back flow on it.
- 1.17 The static and dynamic loading of the pump motor assembly with other allied components shall be clearly indicated.

- 1.18 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.
- 1.19 The impeller of the offered pump shall not be either on the lowest trim or the highest trim of the same pump family offered.
- 1.20 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.
- 1.21 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.
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 pump 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 pump 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 without less nitrile rubber in SS shell (straight grooves preferred) |
| h) Wearing ring / seal ring | : | Material 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 |

1.29 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 for at least one pump as per by the manufacturer choice of the department at various discharge conditions including duty point shall be conducted by the manufacturer and test report shall be submitted. The duration of the performance tests of all pumps shall be not less than 2 / 3 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.

1.30 The tenderer shall fill-up the guaranteed performance figure / data given in the separate section and submit with the technical offer

1.31 **Hydraulic test at shop**

- 1.31.1 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.
- 1.31.2 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.
- 1.31.3 Tests shall be conducted with actual drive motors at full load and full speed.
- 1.31.4 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.
- 1.31.5 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

1.36 **Performance test at shop**

- 1.36.1 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.
- 1.36.2 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.
- 1.36.3 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.

1.37 **PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES**

1.37.1 **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.

1.38 **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.

1.39 **CLEANING, PROTECTION AND PAINTING**

1.39.1 **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.

1.39.2 **Painting**

All surfaces shall thoroughly be cleaned in a manner approved by the manufacturer for necessary paint (Epoxy) 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.

1.39.3 **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.

1.40 **TESTS AND INSPECTION**

1.40.1 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 EIC representatives. All relevant cost of such inspection by two representatives of EIC has to be borne by the manufacturer / contractor.

1.50 **SPARE PARTS**

1.50.1 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

1.50.2 The spare parts as mentioned are to be supplied within the completion period of the contract alongwith the main equipment.

1.50.3 Cost of spare parts as above are to be mentioned separately.

1.50.4 Replacement of spare parts during contract period would be borne by the Tenderer at their own cost.

List of spare parts

- xix) Rotating Unit: 06nos
- xx) TNC switch: 06nos
- xxi) Tr. Feeder relay: 02nos
- xxii) Bearing: 10 sets
- xxiii) Indicating lamp "50" nos.
- xxiv) Contactor: 06 nos.

1.60 **DRAWINGS, CURVES & INFORMATION REQUIRED**

- 1.60.1 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 along with a tentative General Arrangement Drawing showing relevant details shall be submitted with the offer.
- 1.60.2 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.
- 1.60.3 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.
- 1.60.4 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

1.51 **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.

13.00.00 **PROPOSAL DATA**

13.01.00 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 - M³/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 **PUMP NPSHR**

- 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 **FLEXIBLE JOINTS AND SHAFT**

- 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 **THRUST BEARING**

- 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 **EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE**
- 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 **GENERAL**
- 7.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering 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	:

01.00 (B)HORIZONTAL SPLIT CASE PUMP **(FOR ISMILE, DIHIKA, KSTP GLR)**

There will be adequate number of pumps which are to be located at the Pump House. The Clear Water pumping station shall be as under:

The horizontal axially split centrifugal pumps are to be installed in a dry pit for horizontal execution. The prime mover would be squirrel cage induction motor. Connection of pump & motor shall be with flexible coupling. The vibration level shall be 50 microns both in horizontal & vertical direction, sound level of maximum 85 db during running condition of pump & motor at a distance of 1.50 mtr. The pump shall be supplied with base plate, grounding pad, lifting lug, eyebolts, foundation bolts, and nuts, flexible coupling, coupling guard etc. The pump shall have provision for fixing pressure gauge, vent pipe, etc.

- The Pump models shall be selected in such a manner that apart from the present duty condition mentioned above, the future duty condition of 10% increase in flow and corresponding increase in Head could be achieved by changing only the impeller assembly. The price is to be quoted for pumps with present duty condition. Necessary Data from the pump manufacturer is required to be submitted including family curve of the offered model by the successful tenderer. Further during detail engineering, the pump head may undergo a change upto a maximum of (+) 10%. Pump rotational speed shall not exceed 1000 rpm (syn).

2.00.00 **SPECIFIC REQUIREMENTS**

Design

The design, manufacturing, performance of the horizontal centrifugal axially pumps as specified hereinafter, shall comply with the requirements of applicable codes, the latest applicable Indian/British/American/DIN standards, in particular and in that order of application, the following.

2.01.01	IS	1520	Horizontal centrifugal pump for clean, cold, fresh water.
2.01.02	IS	5120	Technical requirements, rotodynamic special purpose pumps.
2.01.03	IS	9137	Code for acceptance test for centrifugal, mixed flow and axial pumps - Class C.
2.01.04			Hydraulic Institute Standards.
2.01.05	BS	599	Methods for Testing Pumps.
2.01.06	BS	5316	Acceptance tests for centrifugal, mixed flow and axial pumps.
2.01.07	PTC	8.2	Centrifugal pumps-Power test codes.
2.01.08			The materials of the various components shall be as per data sheet or equivalent material conforming to applicable IS/BS/ASTM/DIN Standards in that order of application.

2.01.09 In case of any contradiction between the aforesaid standards and the stipulations as per the technical specification as specified hereinafter, the stipulations of the technical specification shall prevail. In case of contradiction between this specification and the pump data specification sheets enclosed, stipulations of the data specification sheets' shall prevail.

3.00.00 **GENERAL PERFORMANCE REQUIREMENTS**

3.01.00 The pump shall be designed to have best efficiency at the specified duty point. The Pump set shall be suitable for continuous operation at any point within the — 'Range of Operation', so as to match with the system resistance curve.

3.02.00 Pumps shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off.

3.03.00 Pumps shall be suitable for parallel operation. The characteristics curves such as head vs. capacity, KW vs. capacity EFFICIENCY vs. capacity etc., shall match to ensure equal load sharing and trouble free parallel operation throughout the range. In the event of tripping of one of the operating pumps, the other operating pumps shall be capable of passing the maximum flow through it as dictated by the system resistance corresponding to both maximum and minimum water level in the pump suction sump.

3.04.00 The pump motor set shall be designed in such a way that there is no damage on account of any reverse flow through the pump which may occur due to any abnormal operation of the system.

3.05.00 Where reverse flow through the pump is specified in data specification sheets, the drive motor shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed without injurious heating, when power to the motor is restored with a minimum voltage of 90% at the motor terminal.

External head that may be imposed on the pump under reverse flow condition is to be decided by the Bidder after analyzing the complete system and the particular abnormal condition of run. However, any specific requirement as mentioned in the Pump Data Sheet shall be adhered to Torque-speed curve for pump and motor for such reverse flow condition shall have to be submitted along with the offer.

4.00.00 **DESIGN & CONSTRUCTION**

4.01.00 **Pump type**

Pump shall be axially split case, single volute, double suction, mixed flow type and shall be constructed in a manner that they can be placed on their foundation with their shaft in horizontal axis.

4.02.00 **Casing**

The casing shall be a single volute, double suction design and shall be so constructed that when it will be placed on its existing foundation the integrally cast with one half of the casing so that the other half of the casing can be removed without having to disturb the suction and discharge pipelines. A suitable fixture shall be provided with each pump for easy removal of one half of casing, which will have no connection with the pipelines, for inspection and / or replacement of the Rotating Elements.

4.03.00 **Impeller**

The impeller shall be double entry type and dynamically balanced.

4.04.00 **Wearing Rings**

Casing wearing rings shall be provided with torque and groove arrangement to prevent rotation and shall be easily removable.

4.05.00 **Impeller Shaft**

The impeller shaft shall be ground finished on its entire length and shall be protected with sleeves so that the shaft itself cannot come into contact with the actual liquid pumped.

4.06.00 **Sleeves**

Sleeves shall be keyed onto the shaft and located by grub screws to prevent relative rotation between the sleeve and the shaft. The impeller shall be kept in position on the shaft by means of two sleeves, which in turn shall be locked by means of suitably designed sleeve nuts.

4.07.00 **Stuffing Box**

The Stuffing box shall be an integral part of the casing and shall be fitted with lantern rings. The lantern rings shall be sandwiched between gland packings. The packings inside the stuffing box shall be held in position by glands.

4.08.00 **Glands**

The glands shall be designed to facilitate easy removal for inspection and replacement of packing.

4.09.00 **Bearings**

Adequate capacity thrust bearings ball/roller shall be provided to take the full axial thrust of the pump as well as the weight of the pump-rotating element. Thrust bearing shall be placed in the non-driving end of the pump and shall be grease lubricated anti friction type and ball bearing shall be placed in the driving end of the pump and shall be grease lubricated anti-friction type. Suitable Temperature detectors shall be provided for both DE & NDE side and the signal from the same shall be hooked upto the Control Desk & Instrument Panel

4.10.00 **Discharge Branch**

4.10.01 Discharge branch pipe upto the battery limit under this specification shall be flanged and bolted and shall be complete with gaskets, nuts and bolts of shall screwed as specified in data specification sheets. A dismantling joint in to be provided in each delivery pipeline along with valves.

4.11.00 **Suction Branch**

4.11.01 A dismantling joint will be provided at the pump individual suction side pipeline along with valves to avoid the pipe assembly from any additional thrust. Any thrust loading is to be transmitted to the foundation bolts of the pump assembly.

4.12.00 **Pump Motor Supports, Base Plate etc.**

The pumps and motors shall have common base plate supporting arrangements. The pumps & motors base frame shall be fixed on the foundation through foundation bolts.

5.00.00 **Hydraulic test at shop**

5.01.00 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.

5.02.00 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.

5.03.00 Tests shall be conducted with job motors at full load and full speed.

5.04.00 Reports and test certificates of the above tests shall be submitted to the Engineer-in-charge for approval of the employer.

5.05.00 All rotating components of the pumps shall be subjected to dynamic balancing tests, & to be specified in Data Sheets.

6.00.00 **Performance test at shop**

6.01.00 Each pump shall have to be tested to determine the characteristic 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.

6.02.00 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.

6.03.00 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.

7.00.00 **PERFORMANCE GUARANTEE, TOLERANCE AND PENALTIES**

7.01.00 **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, which shall not be more than those specified under clause 2.01.03.

7.02.00 **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 to 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.

8.00.00 **CLEANING, PROTECTION AND PAINTING**

8.01.00 **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.

8.02.00 **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.

8.03.00 **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.

9.00.00 **TESTS AND INSPECTION**

9.01.00 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.

9.02.00 Where stage inspection is to be witnessed by Employer in addition to above, the bidder shall submit to the Employer at the initiation of the contract, the deadline of PERT-CHART showing the manufacturing progress and indicating the periods where inspection of the Employer or his authorized inspection agency is required at the manufacturers premises.

9.03.00 Where stage inspection is to be witnessed by Employer, the various stages of inspection, together with the program shall be submitted to the Employer. The inspection and test procedures shall also be submitted for Employer's approval.

10.00.00 **SPECIAL TOOLS AND TACKLE**

10.01.00 The Tenderer shall quote separately for a complete and unused set of all special tools, tackles etc., if any, including tool boxes, specifying the quantum of requirement, for erection, maintenance, overhaul or

complete replacement of equipment under this specification. A complete list of tools necessary shall be enclosed with the Proposal.

10.02.00 The Price quoted for tools, shall not be considered for evaluation of Tender.

11.00.00 **SPARE PARTS**

11.01.00 The tenderer is to supply spare parts as per list enclosed vide list of spare parts as per tender specification.

12.00.00 **DELIVERY**

12.01.00 The schedule of the project demands early delivery of the equipments.

12.02.00 The delivery date shall be indicated by the Successful Tenderer in the Progress Schedule showing the time required for different phases of the work under the scope of this specification taking the date of issue of Letter of Intent as datum.

12.03.00 The Successful Tenderer shall guarantee the delivery date subject to penalty.

13.00.00 **DRAWINGS, CURVES & INFORMATION REQUIRED**

13.01.00 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.

13.02.00 Speed Vs. torque curve of the pump corresponding to recommended mode of pump starting, super-imposed on speed Vs. torque curves of the motor, corresponding to 85%, 90%, 100% rated voltage and also extending over Quadrant I & Quadrant II covering reverse flow conditions, if applicable.

13.03.00 Diagram showing the type of lubrication system, etc.

13.04.00 Complete descriptive and illustrated literature on the equipment and accessories being offered.

13.05.00 Experience list for the similar type of equipment supplied, which should indicate name of customer, date of ordering, value of order date of commissioning, pump parameters and number.

13.06.00 A comprehensive write up or brochure on the details of manufacturing and test rig facilities in the shop of the manufacturer.

13.07.00 The successful bidder shall furnish the following drawings/data for Employer's approval after award of the contract.

13.08.00 All data furnished during bidding stage including details furnished under Clause 13.00.00 above 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.

13.09.00 The G.D2 values of the impeller of the pump and Rotor of the motor at 1500 R.P.M. (syn.) are to be furnished.

14.00.00 **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.
 - 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.

- b) The information shall be organised 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.
- g) The Instruction Manual shall include the list of spare parts that are required for 2 years normal operation and maintenance for equipment. It shall also include list of all special tools and tackle furnished with complete drawings and instructions for use of such tools and tackles.

15.00.00 **DEVIATIONS**

The Tenderer is required to submit with his proposal a detailed list of any and all exceptions taken to this specification by filling up the Deviations Sheet. In absence of such a list it will be understood and agreed that Tenderer's proposal is based on strict conformance to the specification in all respects. These requirements, however, are not intended to prohibit Tenderers from offering alternate quotation for equipment which they consider to be equal or superior to that specified for the intended service and for which he believes he can show economic and/or technical advantages, provided that he is not allowed to add to the Vendors list and is confined to items not appearing therein. However acceptance of the same is at the sole discretionary power of the T.I.A.

16.00.00 **PROPOSAL DATA**

16.01.00 To complete the proposal, the Tenderer must fill up the following DATA SHEET / CHECK LIST furnished hereinafter.

16.02.00 Each Tenderer shall supply the data requested in Proposal Data paragraph as above by typing in appropriate places on each page. These filled in data sheets must be properly signed by authorised representative of the Tenderer or Manufacturer as verification of the data submitted. These signed pages, in their entirety, shall be returned with and shall be part of the Tenderer's formal proposal. The Tenderer shall completely fill in the above information required for each of the above mentioned sheets. Failure to comply with this requirement may result in the rejection of the tender.

17.00.00 **FOREIGN EXCHANGE AVAILABILITY**

No foreign exchange license will be available for this specification, if any foreign exchange is required by any Tenderer, it will have to be arranged from his own quota, through his own arrangement.

DATA SHEET / CHECK LIST OF THE PUMPS BEING OFFERED

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

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 present duty condition for solo operation	:	
1.08.00	Efficiency of Pump at future duty condition for Solo operation	:	
1.09.00	Efficiency of Pump at present & future duty condition in parallel operation	:	
2.00.00	PERFORMANCES		
2.01.01	Guaranteed capacity - M ³ /hr in peak flow without tolerance in single operation & parallel operation.	:	
2.01.02	Guaranteed head - MWC at peak flow discharge, without tolerance in single operation & parallel operation.	:	
2.01.03	Input to the Pump (KW) at present & future 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 at present & future duty condition	:	
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 present and future duty condition	:	
2.01.10	Pump shut off head for present and future duty condition	:	
2.01.11	Minimum submergence required in MWC at worst flow condition	:	
2.02.01	PUMP NPSHR		
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	:	
2.02.06	Pump shut off head		
3.00.00	FLEXIBLE JOINTS AND SHAFT		
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	THRUST BEARING	
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	:

The following data are obligatory for all the pumps

5.00	MATERIAL OF CONSTRUCTION	
5.00.01	Impeller	: ASTMA-743, Gr- CF8M
5.00.02	Casing	: CI, IS- 210, FG-260
5.00.03	Casing ring	: SS, Type- 304
5.00.04	Pump shaft	: SS410
5.00.05	Coupling for pump Motor	: Flexible pin and Bush type, C.I.
5.00.04	Shaft sleeve	: SS, ASTMA-276, Type- 410
5.00.06	Base Plate	: M.S

The following data are to be filled up by the tenderer

6.00.01	Are the pumps suitable for parallel operation	:
6.00.02	Whether non-Reserve Rutchet is provided in pump or not	:
6.00.03	Type of lubrication for pump	:
6.00.04	Whether pre lubrication arrangement provided	:
7.00.00	EXPECTED LIVES UNDER NORMAL OPERATION AND MAINTENANCE	
7.00.01	Impellers	:
7.00.02	Pump Bowl Casing	:

- 7.00.03 Shaft :
- 7.00.04 Thrust Bearing :
- 7.00.05 Whether pump performance curve (H-Q, Q-P, Q-n, Q-NPSHR) authenticated by the pump manufacturer provided with the offer resistance curve :
- 7.00.06 Whether the copy of the pump family curve, authenticated by the pump manufacturer provided with the offer :
- 7.00.07 Whether the system head curve superimposed with pump performance curve & modified performance curve provided with the offer :
- 8.00.00 **GENERAL**
- 8.00.01 Are companion flanges, air release valves, sole plate, arrangement for thrust encountering devices provided :
- 8.00.02 Whether lifting lugs, eye bolts etc. provided :

- 8.00.03 load data
- 8.00.04 Weight of total pump assembly (empty) :
- 8.00.05 Weight of total water column :
- 8.00.06 Total Static Load :
- 8.00.07 Total dynamic Load :
- 8.00.08 Maximum horizontal back thrust at maximum water level condition :

**HORIZONTAL PUMP AXIALLY SPLIT CASE
DATA SPECIFICATION SHEET**

GENERAL INFORMATION

Service	Clear Water	Pump Type axially split case	Horizontal pump
Designation			
No of pumps Reqd.: (To be filled in by the tenderer)		Duty	Continuous
Pumps working condition	Solo / Parallel	Location	Indoor

ELECTRICAL DOCUMENT

Electrical Motors Technical Specification Enclosed : Yes/No

SUPPLY OF ACCESSORIES AND SERVICE

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

Base Plate	Yes/No	Eye bolts, Lifting tackle etc.	Yes/No
Sole Plate	Yes/No	Vent and drain with isolation valves	Yes/No
Foundation bolts, nuts, sleeves nut	Yes/No		
Companion flanges at Pump		Universal Joint	Yes/No
Suction & Discharge reducers along with nuts, bolts & gaskets	Yes/No	Thrust block reqd. Non reverse ratchet	Yes/No Yes/No
External cooling/sealing/lubrication	Yes/No	Special Tools & Tackle	Yes/No
		Spare parts (for 4 years operation)	Yes/No
Cooling/sealing/lubrication system	Yes/No	Painting & Protective coating	Yes/No
Discharge pressure gauge	Yes/No	Suction side low level switch with annunciation hooter complete with accessories.	Yes/No
Suction pressure/VAC Gauge	Yes/No		
Pump Motor Coupling & Guard	Yes/No		

DATA SPECIFICATION SHEET

(FOLLOWING DATA SHEET ARE TO BE FILLED UP SEPARATELY FOR EACH CATEGORY OF PUMPS)

PUMP PARAMETERS

Design Capacity	Individual Pump of required capacity	Permissible tolerance in design	(±) 2.5%
Effective head (excluding loss in pump discharge branch pipe)	Discharge at duty point with parallel operation in all the cases	Permissible tolerance in efficiency :	(-) 3%
Available at design capacity :	Tenderer to indicate from the data supplied	Minimum submergence : required	Tenderer to indicate.
Discharge pressure :	In MLC	Static head of pumping system	
Pump shut off head :	In MLC	Frictional head of system : at design capacity	
Range of operation : (Tenderer to indicate)	% to % of design capacity	Reverse flow through pump to be considered for motor selection	Yes/No

Maximum speed :
(Tenderer to indicate)

Only rising stable HQ characteristics throughout the 'Range of Operation' is acceptable

Yes/No

LIQUID DATA

Liquid handled	Clear Water	Chloride	39 ppm
Specific Gravity	Nearly 1.0	Total hardness as CaCO ₃ max	144 ppm
Temperature	10- 40 ⁰ C	Chlorine	2 ppm
pH Value	7.3 to 8.6	Total dissolved solids max	500 ppm
Turbidity	5 NTU/ JTU (Max)		

**DATA SPECIFICATION SHEET
INSPECTION AND TESTING**

Item
Stage inspection by owner :
(details of Stage Inspection by Owner to be added in due course)

Specification
Yes/No

Material testing and Identification

Required/not required

RADIOGRAPHY
Parts to be tested:
Testing Std:
Acceptance Std:

ULTRASONIC Test
Parts to be tested
Testing Std.
Acceptance Std

DYE PENETRATION
Parts to be checked
Testing Std.
Acceptance Std.

MAGNETIC PARTICLES
Parts to be checked
Testing Std.
Acceptance Std.

Hydrostatic test
Testing Std.
Acceptance Std.

Dynamic balancing pump impeller shop to be witnessed

Yes/No

Performance test at shop reqd. at full speed & full load

Yes/No

NOTES

1. Pump motor set to be designed for starting with discharge valve partly open/closed condition.
2. Motor cooling arrangement shall be self-circulation type having fans mounted on motor shafts.
3. For sealing/cooling water shall be tapped from the pump discharge.
4. Range of operation of the pumps shall be selected by the Tenderer shall also indicate the minimum water level at which pumps can be satisfactorily operated on continuous basis. Tenderer shall furnish with his offer NPSH Vs capacity curve for the entire range of operation based on the above conditions and considering single pump operation & all installed pump operation.

As per technical specification and instruction manual of the manufacturer.

01.01 SUMP PUMP

Provision of two numbers sump pumps have made considering one unit will operate other would remain as standby. All seepage water from glands would be accumulated in a sump of dimension approximate 1.5-meter x 1.0-meter x 0.6 meters. The capacity of each pump would be 30M³/Hr at a head 15 Meter. The drive motors would be of adequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. The delivery pipes of individual pumps will be connected to a common manifold would be such that the water can be drained in a nearby location, outside the pump house within a distance of 10 meter maximum. The NRV and pit valve shall be placed in each pump delivery line and one no pit valve shall be placed in delivery line which generates from the common header. All GI pipes and specials within the bidder's scope. The bidder has to provide suitable capacity DOL starter for individual pump motor set and placed in the suitable place for easy operation. The power will be taken from the control panel through switch fuse unit.

OR

The portable submersible dewatering pump motor set will be suitable for dewatering gland leakage muddy water withadequate rating of 415± 10% volt, 50Hz ±3% and 2900 rpm to cater the load of the above pumps. Submersible motor will be oil filled. The pump will be fitted with suitable mechanical seals, ball bearing etc. and shall be capable of performance details bellow when running in 2900. The pump will be fitted with cast iron / bronze impeller fitted in cast iron casing.

Pumps and motor shall be closed coupled and motor will be placed on top of the pump. This arrangement will ensure that in the sump can be drained to the maximum extent possible, so that the level of water in the sump is only a few cm above the pump inlet.

The motor winding will be insulated with oil and water resistance materials. The pump and motor unit shall be capable of running dry even when the motor oil seals fail draining out the oil from the motor and running which vertically no water sump.

Installation: -

As per technical specification and instruction manual of the manufacturer.

02.00 MOTORS (VERTICAL AXIS FOR BHUTABURI, POLO GROUND, BARACHAK, BARAKAR, RAMNAGAR GLR & HORIZONTAL AXIS RABINSEN FOR ISMILE, DIHIKA, KSTP GLR)

2.01.00 SCOPE

- 2.01.01 This specification covers the general requirements of the drive motors.
- 2.01.02 Motor shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 2.01.03 In case of any discrepancy, the driven equipment specification shall govern.

2.02.00 STANDARDS

All motors shall conform to the latest applicable IS/BS/DIN Publications.

2.03.00 TECHNICAL SPECIFICATION FOR DRIVE MOTORS

- 2.03.01 The drive electrical motors shall be of squirrel cage induction type vertical /Horizontal axis to suit the size of the pump and shall be able to drive the pump. The rating of the motors shall be minimum 200KW, (FOR BHUTABURI GLR) and 90KW,132KW,160KW (FOR POLO GROUND GLR) and 30KW,45KW,55KW,132KW,160KW (For ISMILE GLR) and 132KW (FOR BARACHAK GLR) and 160 KW (For DIHIKA) and 90KW,160KW(for KSTP) and 90KW (For BARAKAR GLR) and 160KW (For RAMNAGAR LOCATION) & 1500 RPM (Syn.), 415V \pm 10%, 3 Phase, 50 Hz \pm 5%,
- 2.03.02 The motor shall be designed for Star / Delta starting arrangements. The motor starting current shall be guided by IS 12615.
- 2.03.03 All the motors shall be rated for continuous duty operation (duty: S1) IE2. However, due to the operational schedule of the pumping station, the pump motor unit may demand for 8/10 start and stop in a day with a minimum time gap of 20 minutes for one stop after prolong operation and restart the same. The motor shall also be capable of one immediate hot restart and three equi spaced starts per hour.
- 2.03.04 The motor KW rating shall have 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 operation whichever is higher. The overload capacity of the such selected motor rating shall be 10% continuous by allowing temperature rise upto Class-F limits. If the tenderer feel that the above rated motor is not satisfying stated loading, they may offer their rating of motor.
- 2.03.05 The motor characteristics shall match the requirements of the driven equipment.
- 2.03.06 The motor should deliver rated output and accelerate the full speed with 85% of the rated voltage at motor terminal. The accelerating time of the motor should not be more than 3 sec.
- 2.03.07 With 85% rated voltage at motor terminal, the motor shall be capable of working satisfactorily at full load at least 5 minutes without injurious heating or stalling. For 3% voltage imbalance in power supply, the motor shall not be de-rated by more than 10%.
- 2.03.08 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 sec. 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.
- 2.03.09 The motor shall be TEFC type having protection group of IPs 55. Motor shall be suitable for rotation in both the direction.
- 2.03.10 The insulation of the stator winding of the motor shall be of Class-F but the heat exchanging arrangement shall be such that the temperature rise is limited to that of Class-B as IS:325 over the ambient temperature. The ambient temperature may be considered as 45°C and the relative humidity may vary from 80% to 100%.
- 2.03.11 The rotor of the motor should be sturdy in construction so as to ensure trouble free operation as indicated in relevant clause without any rotor bar fracture inside or outside the rotor slots or rotor bar end brazing failure or development of cracks in the brazed joint of the rotor bar with shorting ring. The rotor bar of the rotor shall be 99.99% electrolyte grade Cu and shall be well machined, insulated tightly placed and evenly press fitted

inside the rotor slots, the later being broached to have smooth finish. The rotor shall be slotted end ring design. The rotor bars in the form of temple bars shall be used. Proper brazing materials shall be used.

The rotor shall be dynamically balanced with all the fans and with key in the shaft extension.

The rotor must carry a guarantee of at least 20,000 starts as per the operations schedule mentioned in relevant clause without any rotor bar failure or any other type of rotor failure.

- 2.03.12 The motor shall be provided with anti-friction bearing, 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 on-service positive lubrication with drains and grease collectors to guard against over lubrication.

The type and number of bearing the lubricant details (limited to normally available types of IOC or, any standard make). Quantity and frequency of bearing lubrication should be clearly indicated in the offer as well as to be displayed in the rating plate of the motor.

- 2.03.13 The motor should be smooth in operation and the noise level should not exceed 85 db. at 1.5M from the motor. The vibration level of the pump and motor should be within the specified the limit of IS:11724 and must be within 75 microns.

The motor should have adequate number of terminal boxes for main power cable, control cable & signal cable. The motor main terminal box shall be

rotatable in steps of 90°. The main terminal box should be suitable for minimum 2 run 3 core, 1.1 KV grade, 35/50/70/95/150/185/240/300 sq.mm. Aluminium conductor, armoured, XLPE Cable as deemed fit to the system. The terminal boxes shall be with removable cover with access to connection. No compound shall be used in the terminal box for easy handling. The motor terminal boxes shall be furnished with suitable cable lugs and double compression brass glands to match with the cable size. The terminals shall be clearly identified by phase markings and termination indication corresponding to direction of rotation.

The maximum system fault current for a duration of 1.0 sec. shall be considered.

The motor shall be equipped with built-in anti-condensation space heater of adequate rating suitable for operation at 240V AC supply. Separate terminal box for the space heater connection are to be provided.

The frame of each motor shall be provided with two separate and distinct grounding pads suitable for accommodation of grounding conductors of suitable size GI flat. The main cable terminal boxes shall have separate grounding pads.

- 2.03.14 The rating plate of the motor should contain, the minimum information as indicated in the relevant IS. Apart from the same, the information as indicated in relevant clause as well as the temperature rise in °C under rated condition, method of measurement, degree of protection shall be furnished.

- 2.03.15 The successful tenderer should 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.
- 2.03.16 The dimensional drawing of the offered motor, terminal box drawings, load data, GD2 value of the drive unit and the driven unit shall be furnished to the EIC for approval.
- 2.03.17 Apart from the standard accessories provided by the motor manufacturer and those accessories mentioned in preceding paras, one local lock switch is to be provided with each motor having proper connection with the motor connecting switchgear so that the motor breaker cannot be closed when the lock switch is in operation. The motor shall also be provided with suitable lifting lugs eye bolts having adequate provision for lifting installation.
- 2.03.18 The motor shall be provided with RTD's and BTD's for alarm and trip (for rating 75 KW and above). The leads shall be brought out to a separate terminal box.
- 2.03.19 The routine tests as per IS:325 shall be conducted to each motor. Temperature rise test are to be conducted on at least one motor (75KW & above) of each rating. The motor vibration tests shall be conducted mounting the motor on the shop motor stool. All the above tests are to be conducted at the manufacturer's shop in presence of the departmental representatives. Apart from the shop testing, normal field testing are to be carried out during installation, pre-commissioning and commissioning. All necessary arrangements for the tests are to be made by the contractor.
- 2.03.20 Motors up to 5 KW shall be of DOL starting and beyond 5 KW shall be Star-Delta Starting

CHECK LIST OF THE MOTORS BEING OFFERED

- 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 (Rating 75KW & above)
- 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 M²)
- 1.41.00 GD2 value of load to motor shaft (kg M²)
- 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 75 KW & above) of at least 1 no. motors as per choice of the customer, shall be performed. Further any special tests called for in the driven equipment specification shall be performed. The manufacturer/tenderer has to bear all expenses for such testing to witness the tests for max. two representatives of EIC to the manufacturer's 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 manufacture's factory.

3.00.00 SPARES

Spare parts are to be supplied as specified separately. Recommended spares for five (5) years operation shall be quoted along with the bid clearly identifying the part nos. with recommended quantities.

I) DE & NDE Bearing :1 set.

4.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

- 4.01.00 Along with the bid:
 - Individual motor data as per Check List
- 4.02.00 After Award of the Contract for Approval:
 - a) Dimensional General Arrangement Drawing

- b) Foundation Plan & Loading
- c) Cable end box details
- d) Load Vs Efficiency & power factor, Current Vs Time / Speed curves
- e) Thermal withstand curves hot & cold
- f) Speed torque characteristics at 80% & 100% voltage
- g) Complete motor data

VALVES AND SPECIALS

03.01.01 Delivery side of pumps

The delivery side of each pump shall be provided with 1 no. Electrical Actuator operated butterfly valve and 1 no. non-return valve, 1 no. Dismantling joint & short pieces wherever required. The diameter of the valves and joints shall selected based on velocity of 2.0 m/sec(approx.) with nearest sizes as per IS.

03.01.02 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 water and to maintain unidirectional flow. The valve shall be maintenance free, leak proof and shall have low life cycle cost. The PN rating of valves shall be PN 1.0. /1.6

The non-return valve shall be single door, Ductile Iron, double flanged, conventional non-slam design. The body, door, cover shall be of ductile iron (Gr. GGG 40). The seat and body shall withstand fluid pressure of 10-16kg / cm² and 16-24 kg / cm² 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/ mm².

The valves are subject to satisfactory hydrostatic test at manufacture's works and in presence of the department's representative for acceptance.

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.

03.02.01 Butterfly Valve

The butterfly valves shall be D1DF, PN 1.0. /1.6, conforming to IS 13095 of 1996 / BS 5155. The seat pressure shall be 10-16 kg/cm² and body pressure shall be 16-24 kg/cm². The valve shall operate smoothly & steadily in both directions, 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.

- d) 415V ± 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, IP68 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

03.02.02 ELECTRICAL ACTUATOR

- 4. The actuator motor for the BFV shall be suitable for use on 415 ± 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 for continuous submergence.

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
 - vii. torque limit switches for 'open' and 'close'
 - viii. Position limit switchesAll 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.

- z) 415V \pm 10% 3 phase, 50 Hz, AC motor.
- aa) Reduction gearing arrangement.
- bb) Torque & limit switch mechanism.
- cc) Valve position indicator.
- dd) Arrangements for pick up signals for displaying the % opening of the valves in the suitable meters to be placed on control desk.
- ee) Remote operation facility with selector switch and local control console.
- ff) The hand wheel with clutch mechanism for manual operation. The manual operation shall be automatically declutched when actuator motors in operation.
- gg) 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.

03 .00.01 SLUICE VALVE

The sluice valves shall be manufactured from ductile iron (Gr. GGG 40). conforming to IS-14846 / 2000. Flange ends as per IS 1538 or as per other standards to match with other flanges. The body seat shall be of S.S. AISI-410 stem shall be of S.S. AISI-410 & the stem nut shall be Gun metal conforming to I.S. 305:1981/BS 2874. Other details are to be submitted for approval.

The seat pressure shall be 10 kg/cm² and body pressure shall be 15 kg/cm². The valves should pass through hydrostatics test for duration of 5 minutes.

Body, Cover, Wedge	:	Ductile Iron GGG 40
Shaft	:	S.S. to AISI-410
Body Seat	:	S.S. to AISI-304
Bearing	:	G.M./Teflon
Wedge Sit	:	S.S. to AISI-304
Packing	:	Rubber "O" ring
Internal Fasteners & Clamping Ring	:	S.S. to AISI-304
External Fasteners	:	Carbon Steel to IS:1367 Cl. 4.6 & 4.0.
Hand wheel	:	Fabricated Steel
Worm Gear Unit	:	Mfg. Std.
Actuator	:	No

Testing (as per IS : 13095 / 91)				Inspection	
Hydro Body	:	15 Kg / Sq.cm for 5 minutes	Hydro Test	:	Witness & Test Report
Hydro Seat	:	10 Kg / Sq.cm for 2 minutes	Visual	:	Witness & Test Report
Disc. Test	:	10 Kg / Sq.cm for 5 minutes	Material Test	:	Test Report
Quantity				Note:	
Size (NB)	Qty (Nos.)	Location	Service / Application	1. Valves shall be tight shut-off closures for frequent operation 2. Valve should closed with clock wise rotation of Hand wheel. In case of hand wheel operation) 3. Valves shall be painted with one coat of Red oxide primer & two coats of Black bituminous paints before dispatch. 4. Marking : Brand / Size / PN – Rating / Heat No. & Sl. No.	

Materials of construction test certificates shall be provided during supplies. The sluice valves shall be rising spindle type with gearing arrangement / hand wheel for easy manual operation.

03.04 **M.S. DISMANTLING JOINT ASSEMBLY AT INDIVIDUAL DELIVERY LINE AND MANIFOLD**

One M. S. dismantling joint of suitable diameter is to be fixed in each of the individual delivery and one no along with the Flow meter & BFV on the water delivery 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 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 10 -16kg/cm². One leak proof concrete chamber if required as per site condition is to be constructed. The Dimension of the Chamber would however depend on the final alignment and level of the site condition

03.05 **PUMP DELIVERY SIDE PIPING AND COMMON DELIVERY MANIFOLD**

The pump individual delivery side piping, valves and joints and Common Delivery Manifold shall be shall selected based on velocity of 2.0 m/sec(approx.) and 1.55 m/sec (Approx.) respectively with nearest sizes as per IS.

The pipes shall be made up of M.S. 8/12 mm thick plates for individual delivery line and Common Delivery manifold, 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 common delivery manifold shall of such diameter as per the Technical offer. The manifold shall be fabricated from 8/12mm thick MS plates. The common manifold shall have blank flange / Dish end on one side with adequate stiffening (as applicable) and the other side would be extended from the centre line of the last pump to install one each Dismantling Joint, Butterfly valve, Air Release Valve and further as required to install one Full bore Electromagnetic flow meter. The length of the manifold must be extended at least one meter on one side after the interconnections with the delivery pipe lines from the pumps at the one extreme end and in the other end it will be extended up to the specified length.

The common delivery manifold shall be provided with one no. 100 mm dia air release valve (double throat) 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).

03.06 Pressure Gauge/Compound Gauge (Dial Type):

The individual discharge line and common delivery manifold shall be provided with pressure gauge (6" dial) 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 -10 Kg / Sq.cm. The pressure gauge shall have 3-way cock and fitting.

03.07 Tamper proof Kinetic air release valve

Air valve for clean, cold potable water up to 50°C

PN 10 / 16

DN 80 – 200

Double chamber valve with twin float (Rubber / Vulcanite coated timber core / SS 304) - automatic operation with water. Two-orifice venting system with 3 functions (supply and release of air as well as automatic venting during operation)

Flange connection dimensions to IS 1538 Table 4 & 6

Body and Cover made of CAST IRON IS 210 Gr. FG 260

Seal made of EPDM

Corrosion protection:

Inside and outside with liquid epoxy coating; thickness >250 μm , colour: RAL 5005 blue

Accessories:

Must have a metal seated gate valves (description as above for Sluice Valves up to 800 mm) of same diameter for isolation purpose, complete with gasket and fasteners (steel galvanized)

04.00 HTPDB (FOR BHUTABURI, POLO GROUND, ISMILE, BARACHAK, KSTP, AND RAMNAGARGLR)

4.1. The HT PDB shall be multi panel switch board suitable for indoor installation and shall operate at 11 KV $\pm 10\%$, 3 ϕ , 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.

4.2. 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 11 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.

- 4.3 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.

- 4.4 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.

- 4.5 copper, sized for specific current rating with maximum temperature rise limited to 90⁰C. 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.

- 4.6 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.

- 4.7 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 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:

- j) 1 set mechanical ON & OFF indicator.
- k) 1 rear entry cable box with glands suitable for 11 KV grade XLPE cable.
- l) 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 and closing coil rated for 110 V DC.
- f) 1 space heater with ON & OFF switch
- g) 15A / 15A 3 Pin Plug Socket
- h) In – panel lighting with control switch
- i) Space heater for each Switchgear panel
- 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 suitable for 3 phase, 3 wire 5 limb 50 Hz system with a ratio of 11 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 62KA. 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.

4.8 The feeder details of the Multi panel HT PDB shall be as under:

A) Incoming feeder Panel: 1 No. (800 A)

- | | | | |
|-------|-------------------------------------------------------------------------------------------------------------------|---|-------------------|
| i) | 96 sq mm (0 – 12 KV) Voltmeter with Selector Switch | - | 1 Set |
| ii) | 96 sqmm Ammeter suitably dual scaled 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 ratio and 5A 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. |
| viii) | Trip Circuit Supervision Relay type VAX 31 or equivalent | - | 1 No. |
| ix) | Master Trip Relay type VAJH 13 or equivalent | - | 1 No. |
| x) | Multifunction meter (For Amp. Voltage, frequency, power factor etc.) type ELITE 445 or equivalent | - | 1 No. |
| xi) | Power Factor Meter | - | 1 No. |
| xii) | KW Meter | - | 1 No. |
| xiii) | 12 Channel alarm annunciator & Indicating Lamps | | 1 Set |

B) Out going feeder panels for transformers: 2 Nos. (800 A)
Each Transformer feeder panel shall be equipped with the following:

- | | | | |
|-----|--------------------------------------------------------|---|-------|
| i) | 96 sq. mm Ammeter suitably scaled 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 ratio and 5A Secondary, Class 5 P10 & 1.0, 10VA burden - 1 Set (3 Nos.)
- v) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P122 or equivalent - 1 No.
- vi) Master trip relay type VAJH-13 - 1 No.
- vii) Trip Circuit Supervision Relay type VAX 31 or equivalent - 1 No.
- viii) Auxiliary relay type VAA -33 or equivalent - 3 Nos.
- ix) 12 Channel alarm annunciator & Indicating Lamps - 1 Set

C) Common for all above feeders:

- i) Anti – pumping relay

4.9. Following power supplies shall be arranged to switch-gear.

AC Supply: 220V AC from MCC cum PDB 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.

- 4.10. 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

- 4.11 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.

05.00 TRANSFORMER (FOR BHUTABURI GLR)

There will be total two (2) number of transformers, each having a capacity of 1600 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

- xxiii) Conservator with drain valves and oil gauge.
- xxiv) Silica gel breather
- xxv) Bidirectional rollers
- iv) PRV with contact.
- v) Oil filter valve
- vi) Transformer tank drain valve, one upper and one lower.

- vii) Earthing terminals – 2 nos.
- viii) Air relieve plugs
- ix) Rating and diagram plate
- x) Bucholz's relay with Alarm and Trip
- xi) OTI with Alarm and Trip contacts
- xxiv) WTI with Alarm and Trip contacts
- xxv) MOG with contact
- xxvi) Marshalling box with contacts of Bucholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 5.1 Two nos. 1600KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45° C.
- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.
- 5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.

5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	: 3 (three)
Winding connection & vector group	:	: DYn-11
Rated frequency	:	: 50 cycles/sec.
Rated KVA	:	: 1600 KVA
Rated primary voltage	:	: 11 KV
Rated secondary voltage	:	: 0.433 KV
Method of system earthing	:	: Secondary solidly grounded
Tap-Changer	:	: Off-circuit Tap-changer (OCTC) (+) 5% to (-)
10%		
Tapings	:	: in steps of 2.5%
HV side terminal arrangements	:	: Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

05.00 TRANSFORMER (FOR POLO GROUND & ISMILE GLR)

There will be total two (2) number of transformers, each having a capacity of 1250 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

xxvi) Conservator with drain valves and oil gauge.

xxvii) Silica gel breather

xxviii) Bidirectional rollers

iv) PRV with contact.

v) Oil filter valve

vi) Transformer tank drain valve, one upper and one lower.

vii) Earthing terminals – 2 nos.

viii) Air relieve plugs

ix) Rating and diagram plate

x) Bucholz's relay with Alarm and Trip

xi) OTI with Alarm and Trip contacts

xxvii) WTI with Alarm and Trip contacts

xxviii) MOG with contact

xxix) Marshalling box with contacts of Bucholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

5.1 Two nos. 1250KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45⁰ C.
- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.
- 5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.
- 5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	3 (three)
Winding connection & vector group	:	DYn-11
Rated frequency	:	50 cycles/sec.
Rated KVA	:	1250 KVA
Rated primary voltage	:	11 KV
Rated secondary voltage	:	0.433 KV
Method of system earthing	:	Secondary solidly grounded
Tap-Changer	:	Off-circuit Tap-changer (OCTC) (+) 5% to (-)
10% Tapings	:	in steps of 2.5%
HV side terminal arrangements	:	Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

05.00 TRANSFORMER (FOR BARACHAK & RAMNAGAR GLR)

There will be total two (2) number of transformers, each having a capacity of 800 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

- xxix) Conservator with drain valves and oil gauge.
- xxx) Silica gel breather
- xxxi) Bidirectional rollers
- iv) PRV with contact.
- v) Oil filter valve
- vi) Transformer tank drain valve, one upper and one lower.

- vii) Earthing terminals – 2 nos.
- viii) Air relieve plugs
- ix) Rating and diagram plate
- x) Bucholz's relay with Alarm and Trip

- xi) OTI with Alarm and Trip contacts
- xxx) WTI with Alarm and Trip contacts
- xxxii) Marshalling box with contacts of Buchholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 240/300/400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C over oil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 5.1 Two nos. 800KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45° C.
- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.
- 5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.

5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	3 (three)
Winding connection & vector group	:	DYn-11
Rated frequency	:	50 cycles/sec.
Rated KVA	:	800 KVA
Rated primary voltage	:	11 KV
Rated secondary voltage	:	0.433 KV
Method of system earthing	:	Secondary solidly grounded
Tap-Changer	:	Off-circuit Tap-changer (OCTC) (+) 5% to (-)
10%		
Tapings	:	in steps of 2.5%
HV side terminal arrangements	:	Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.

LV side terminal arrangements

:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 240/300/400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

05.00 TRANSFORMER (FOR KSTP GLR)

There will be total two (2) number of transformers, each having a capacity of 1000 KVA.

The voltage rating of the Transformer shall be 11 KV / 433 V

Normally the specification of all the transformers are, 11 / 0.433 KV with neutral brought out, 3 ph, 50 c/s, Dyn. 11 vector group, shall be supplied and installed by the contractor. Each of the transformers should be equipped with:

xxxii) Conservator with drain valves and oil gauge.

xxxiii) Silica gel breather

xxxiv) Bidirectional rollers

iv) PRV with contact.

v) Oil filter valve

vi) Transformer tank drain valve, one upper and one lower.

vii) Earthing terminals – 2 nos.

viii) Air relieve plugs

ix) Rating and diagram plate

x) Bucholz's relay with Alarm and Trip

xi) OTI with Alarm and Trip contacts

xxxiii) WTI with Alarm and Trip contacts

xxxiv) MOG with contact

xxxv) Marshalling box with contacts of Bucholz, OTI, WTI, MOG & PRV duly wired up to the terminal block

Transformers will be wound with 99.99% electrolytic grade copper wires / flat and the H.T. sides of the transformer will be fitted with OFF circuit tap changing device with a range of +5% to -10% in step of 2½%.

Primary side (H.T.) terminal box shall be suitable for terminating one no. 11 KV grade, 300 sq. mm, Al. conductor 3 core XLPE insulated cable complete with sealing and armour clamping gland.

Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. Mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

Transformers shall be supplied in fully oil filled condition. Transformers should be manufactured according to latest I.S.S. Manufacturers' test shall be carried out in presence of the representative of M.E.Dte. and a test certificate to be submitted. Temperature rise of the transformer shall not exceed 50 / 75°C overoil / winding and also comply with IS 1180 & IS 2026 Latest version, as applicable only in so far as they are applicable.

- 5.1 Two nos. 1000KVA 11 KV / 0.433 KV, DYN 11, ONAN, 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 & 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 - 75 ° C over ambient of 45⁰ C.
- 5.3 The transformer shall be double copper wound and having CRGO silicon steel made core built up with class 'A' 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 minimum losses as per I.S.1180 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 transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range (+) 5% to (-) 10 %.
- 5.8 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.

5.9 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) IS 1180 etc. shall be applicable only in so far as they are applicable.

5.10 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) Oil temperature indicator with Alarm & Trip contacts.
- g) Bucholz's relay with Alarm and Trip contacts.
- h) PRV with Trip contact.
- i) MOG with contact
- j) Externally operated Off-circuit tap switch with position indicator
- k) Cable terminal boxes (both HV & LV side)
- l) Bi-directional wheels with locking and bolting devices

5.11 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.
- o. Quantity of Oil.
- p. Percentage Impedance.

5.12 Transformer losses

Transformer losses shall be guided by the I.S.1180 guideline.

5.13 Following shop tests shall be carried out on the transformer along with the other tests 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

5.14 TECHNICAL PARTICULARS OF THE TRANSFORMER

Type	:	Indoor
Nature of cooling	:	ONAN
No. of phases	:	: 3 (three)
Winding connection & vector group	:	: DYn-11
Rated frequency	:	: 50 cycles/sec.
Rated KVA	:	: 1000 KVA
Rated primary voltage	:	: 11 KV
Rated secondary voltage	:	: 0.433 KV
Method of system earthing	:	: Secondary solidly grounded
Tap-Changer	:	: Off-circuit Tap-changer (OCTC) (+) 5% to (-) 10%
Tapings	:	: in steps of 2.5%
HV side terminal arrangements	:	: Cable end box on HV side suitable for terminating 11 KV grade 3 core 300 sq.mm. XLPE cable.
LV side terminal arrangements	:	:Secondary (L.T.) terminal box shall be suitable for terminating 1.1 KV grade, 300/400 sq. mm as required, Al. conductor 3.5 core XLPE insulated cable complete with sealing and armour clamping gland.

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus Coupler PDB at Substation. (BHUTABURI GLR LOCATION)

6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station

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 transformers.

- 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 channels.
- 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 ACB connected from the secondary side of transformers.

6.7 The bus bar for the PDB shall be TPN, 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 2500 A for phases and 1250 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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:

6.112500A incoming feeders 2 nos. each comprising of following components:

- | | | |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| xlix) | 415 V, 4 pole, 2500A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release | 1 No |
| l) | 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch
No. | 1 |
| li) | 96 sq. mm, 0 – 500 V Voltmeter with selector switch
No. | 1 |
| lii) | Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA | 3 Nos. |
| liii) | Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA | 3 Nos. |
| liv) | Red, Yellow, Blue phase indicating lamp | as required |
| lv) | CB ON / OFF / TRIP / Spring Charged Indicating Lamp | As required. |
| lvi) | TNC Breaker Control Switch | 1 No. |
| lvii) | Local / Remote Selector Switch | 1 No. |
| lviii) | Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13 | 1 No. |

6.12 2500 A Bus coupler feeder one (1) number comprising of following components:

- | | | |
|--------|-------------------------------------------------------------------------------------|--------|
| xvii) | 415 V, 4 Pole, 2500 A, 65 KA electrically operated draw out
ACB without release. | 1 No. |
| xviii) | TNC Breaker Control Switch | 1 No. |
| xix) | Local / Remote Selector Switch | 1 No. |
| xx) | Bus Coupler ON / OFF / Spring Charged Indicating Lamp | 3 Nos. |

6.13 Outgoing feeders --- 2 Nos. for BHUTABURI GLR (each equipped with following:)

- I) 415 V, 3 pole, 2500A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No

- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.

- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.
- VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 4 Nos.
- b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
(Adjustable O/L) rated upto 50⁰ C without duration
- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 65 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB atBHUTABURI GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 2000A for phases and 1000A 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 50 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.

7.7 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 1.1 KV grade 3.5 core 240 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- | | | |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| xliii) | 415 V, 4 pole, 2000A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. | 1 No |
| xliiii) | 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch | 1 No. |
| xliv) | 96 sq mm, 0 – 500 V Voltmeter with selector switch | 1 No. |
| xliv) | Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA | 3 Nos. |
| xlvi) | Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA | 3
Nos. |
| xlvii) | Red, Yellow, Blue phase indicating lamp | as required |
| xlviiii) | MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp | 4
Nos. |
| xliv) | TNC Breaker Control Switch | 1 No. |
| l) | Local / Remote Selector Switch | 1 No. |
| li) | Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13 | 1 No. |

7.11 2000A Bus coupler feeder one (1) number comprising of following components:

- | | | |
|--------|---------------------------------------------------------------------------------------------------------------------------------------|-------|
| xliii) | 415 V, 4 Pole, 2000 A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. | 1 No. |
| xliv) | TNC Breaker Control Switch | 1 No. |
| xv) | Local / Remote Selector Switch | 1 No. |

- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 200KW Star – Delta Starter Motor feeders,(with capacitor Unit) each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| d) | Start / Stop Push Button | - | 1 Set |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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 (<i>Type 225</i> or equivalent) | - | 1 No. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

- | | | |
|-----|----------------------------------|------|
| ss) | Motor protection circuit breaker | 1 no |
| tt) | Power contractor | 3 no |

uu)	Aux. contractor	5 no
vv)	Current transformer	3 no
ww)	Analog ammeter	1 no
xx)	Ammeter selector switch	1 no
yy)	Indicating lamp	3 no
zz)	On/off push button	2 no.
aaa)	Star delta timer	1 no
bbb)	Thermal overload relay	1 no
ccc)	Power terminal,	2 no

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.
(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

G) Not less than #A TPN MPCB for actuator feeder 11 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 2 Incomer &1 Bus coupler PDB at Substation. (POLO GROUNDGLR LOCATION)

6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station

6.2 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 transformers.

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 channels.

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 ACB connected from the secondary side of transformers.

6.7 The bus bar for the PDB shall be TPN, 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 2000 A for phases and 1000 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 65 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 2000A incoming feeders 2 nos. each comprising of following components:

- | | | |
|------|----------------------------------------------------------------------------------------------------------------------------------|-------|
| lix) | 415 V, 4 pole, 2000A, 65 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release | 1 No |
| lx) | 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch | 1 No. |

- lxi) 96 sq. mm, 0 – 500 V Voltmeter with selector switch No. 1
- lxii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- lxiii) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- lxiv) Red, Yellow, Blue phase indicating lamp as required
- lxv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- lxvi) TNC Breaker Control Switch 1 No.
- lxvii) Local / Remote Selector Switch 1 No.
- lxviii) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13 1 No.

6.12 2000A Bus coupler feeder one (1) number comprising of following components:

- i) 415 V, 4 Pole, 2000 A, 65 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No.
- ii) TNC Breaker Control Switch 1 No.
- iii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for POLO GROUNDGLR (each equipped with following:)

- i) 415 V, 3 pole, 1600A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No

- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.
- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.
- VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
- b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50/65 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB at POLO GROUND GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1600A for phases and 800A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- lii) 415 V, 4 pole, 1600A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- liii) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- liv) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- lv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- lvi) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3
Nos.
- lvii) Red, Yellow, Blue phase indicating lamp as required
- lviii) MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp 4
Nos.
- lix) TNC Breaker Control Switch 1 No.
- lx) Local / Remote Selector Switch 1 No.
- lxi) Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13
1 No.

7.11 1600 A Bus coupler feeder one (1) number comprising of following components:

- iv) 415 V, 4 Pole, 1600 A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.
- v) TNC Breaker Control Switch 1 No.
- vi) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 90KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| d) | Start / Stop Push Button | - | 1 Set |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.12 132KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |

- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 225 or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- Start / Stop Push Button - 1 Set
- d)
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based Motor Protection relay suitable for 5A CT secondary and having thermal overload protection, instantaneous short circuit protection, inverse - 1 No.

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 225 or equivalent)

- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

ddd) Motor protection circuit breaker	1 no
eee) Power contractor	3 no
fff) Aux. contractor	5 no
ggg) Current transformer	3 no
hhh) Analog ammeter	1 no
iii) Ammeter selector switch	1 no
jjj) Indicating lamp	3 no
kkk) On/off push button	2 no.
lll) Star delta timer	1 no
mmm) Thermal overload relay	1 no
nnn) Power terminal,	2 no

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

H) Not less than #A TPN MPCB for actuator feeder 10 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 2 Incomer &1 Bus coupling PDB at Substation.(BARACHAKGLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 1250 A for phases and 630 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 1250A incoming feeders 2 nos. each comprising of following components:

- | | | |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| lxxix) | 415 V, 4 pole, 1250A, 50KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release | 1 No |
| lxxx) | 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch
No. | 1 |
| lxxxi) | 96 sq. mm, 0 – 500 V Voltmeter with selector switch
No. | 1 |
| lxxxii) | Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA | 3 Nos. |
| lxxxiii) | Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA | 3 Nos. |
| lxxxiv) | Red, Yellow, Blue phase indicating lamp | as required |
| lxxxv) | CB ON / OFF / TRIP / Spring Charged Indicating Lamp | As required. |
| lxxxvi) | TNC Breaker Control Switch | 1 No. |
| lxxxvii) | Local / Remote Selector Switch | 1 No. |
| lxxxviii) | Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13 | 1 No. |

6.12 1250A Bus coupler feeder one (1) number comprising of following components:

- vii) 415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.
- viii) TNC Breaker Control Switch 1 No.
- ix) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for BARACHAKGLR (each equipped with following:)

- I) 415 V, 3 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No
- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.
- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.
- VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
- b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
- (Adjustable O/L) rated upto 50⁰ C without duration
- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

.7.0 415 V Multi panel MCC cum PDB atBARACHAK GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1250A for phases and 630A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

lxii)	415 V, 4 pole, 1250A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No	
lxiii)	96 sq mm, suitably scaled Ammeter with cramped scale & selector switch	1 No.	
lxiv)	96 sq mm, 0 – 500 V Voltmeter with selector switch	1 No.	
lxv)	Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA	3 Nos.	
lxvi)	Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA	3	
	Nos.		
lxvii)	Red, Yellow, Blue phase indicating lamp	as required	
lxviii)	MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp		4
	Nos.		
lxix)	TNC Breaker Control Switch	1 No.	
lxx)	Local / Remote Selector Switch	1 No.	
lxxi)	Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13		
			1 No.

7.11 1250 A Bus coupler feeder one (1) number comprising of following components:

x)	415 V, 4 Pole, 1250 A, 65 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No.	
xi)	TNC Breaker Control Switch	1 No.	
xii)	Local / Remote Selector Switch	1 No.	
iv)	Bus Coupler ON / OFF / Spring Charged Indicating Lamp	3 Nos.	

7.12 45KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.
(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 75KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.
(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.

- f) True Digital Microprocessor based 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 225 or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 132KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- Start / Stop Push Button - 1 Set
- d)
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 - 1 No.

- protection (Type 225 or equivalent)
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
 - h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
 - i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

ooo) Motor protection circuit breaker	1 no
ppp) Power contractor	3 no
qqq) Aux. contractor	5 no
rrr) Current transformer	3 no
sss) Analog ammeter	1no
ttt) Ammeter selector switch	1 no
uuu) Indicating lamp	3 no
vvv) On/off push button	2 no.
www) Star delta timer	1 no
xxx) Thermal overload relay	1 no
yyy) Power terminal,	2 no

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

l) Not less than #A TPN MPCB for actuator feeder 13 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 2 Incomer &1 Bus coupling PDB at Substation. (ISMILE GLR LOCATION)

6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station

- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 2000 A for phases and 1000 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 65 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 2000A incoming feeders 2 nos. each comprising of following components:

- lxxix) 415 V, 4 pole, 2000A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release 1 No
- lxxx) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1
No.
- lxxxi) 96 sq. mm, 0 – 500 V Voltmeter with selector switch 1
No.
- lxxxii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- lxxxiii) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- lxxxiv) Red, Yellow, Blue phase indicating lamp as required
- lxxxv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- lxxxvi) TNC Breaker Control Switch 1 No.
- lxxxvii) Local / Remote Selector Switch 1 No.
- lxxxviii) Microprocessor based draw out type non-directional combined IDMTL over
current relay with high set instantaneous element and instantaneous earth fault
element type P111 or equivalent with VAJH 13
1 No.

6.12 2000A Bus coupler feeder one (1) number comprising of following components:

- xiii) 415 V, 4 Pole, 2000 A, 65 KA electrically operated draw out type

ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.

- xiv) TNC Breaker Control Switch 1 No.
- xv) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for ISMILEGLR (each equipped with following:)

I) 415 V, 3 pole, 2000A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No

II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.

III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.

IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.

V) TNC Breaker Control Switch 1 No.

VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.

d) 16 A DP MCB 6 Nos.

6.15 Technical Specification of Air Circuit Breaker (ACB)

The ACB shall be rated as specified elsewhere at 50⁰ C without duration and 50/65 KA for 1 Sec. The ACB shall be electrically operated drawout type with shunt trip release. The neutral conductor shall be 100% of the phase conductor. The ACB shall be provided with built-in

LCD display. Over current releases, if specified, shall have on-line functional testing facility and trip indicators shall be provided to display the nature of fault without any external power supply. Earth fault protection shall have adjustable settings upto 10% of Nominal current. The CTs provided shall be air-core. The ACB shall have position indication with padlocking facility for all positions including door interlock and padlocking facility of the shutters in closed position. The ACB shall be provided with the following features in the front panel.

- Contact position indicator (ON / OFF)
- Stored energy status indicator
- Connected / Test / Disconnected position
- Trip indication on fault
- OK indicator (Mechanical) on the front panel when the trip or OFF conditions are cleared and the circuit breaker can be closed on "ON" command (Manual or Electrical)
- All the accessories viz. shunt, motor and under voltage coils shall be accessible from the front without removing the breaker from its panel for replacement any

.7.0 415 V Multi panel MCC cum PDB at ISMILE GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 2000A for phases and 1000A 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 50 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.

7.7 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 1.1 KV grade 3.5 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

lxxii)	415 V, 4 pole, 2000A, 65 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No
lxxiii)	96 sq mm, suitably scaled Ammeter with cramped scale & selector switch	1 No.
lxxiv)	96 sq mm, 0 – 500 V Voltmeter with selector switch	1 No.
lxxv)	Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA	3 Nos.
lxxvi)	Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA	3 Nos.
lxxvii)	Red, Yellow, Blue phase indicating lamp	as required
lxxviii)	MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp	4 Nos.
lxxix)	TNC Breaker Control Switch	1 No.
lxxx)	Local / Remote Selector Switch	1 No.
lxxxi)	Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13	1 No.

7.11 2000 A Bus coupler feeder one (1) number comprising of following components:

- xvi) 415 V, 4 Pole, 2000 A, 65 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.
- xvii) TNC Breaker Control Switch 1 No.
- xviii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 30KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, - 3

7.12 45KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50 ⁰ C without deration | - | 1 No. |
| b) | Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement | - | 3 Nos. |
| c) | Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP | - | 4 Nos. |
| d) | Start / Stop Push Button | - | 1 Set |
| e) | 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch | - | 1 No. |
| f) | True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) | - | 1 No. |
| g) | High speed master trip relay type VAJH 13 or equivalent | - | 1 No. |
| h) | CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA | - | 3 Nos. |
| i) | CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA | - | 3 Nos. |

7.12 55KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- | | | | |
|----|-----------------------------------------------------------------------------------------------------------------|---|-------|
| a) | Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & | - | 1 No. |
|----|-----------------------------------------------------------------------------------------------------------------|---|-------|

- earth fault rated upto 50⁰ C without deration
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
 - c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
 - d) Start / Stop Push Button - 1 Set
 - e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
 - f) True Digital Microprocessor based 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 211 or equivalent) - 1 No.
 - g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
 - h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
 - i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 132KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set

- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 225 or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 - 1 No.

fault protection, locked rotor protection, loss of load protection and reverse phase sequence protection (Type 225 or equivalent)

- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.13 7.5 KW Star – Delta Starter Motor feeders, each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed.)

zzz)	Motor protection circuit breaker	1 no
aaaa)	Power contractor	3 no
bbbb)	Aux. contractor	5 no
cccc)	Current transformer	3 no
dddd)	Analog ammeter	1no
eeee)	Ammeter selector switch	1 no
ffff)	Indicating lamp	3 no
gggg)	On/off push button	2 no.
hhhh)	Star delta timer	1 no
iiii)	Thermal overload relay	1 no
jjjj)	Power terminal,	2 no

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

J) Not less than #A TPN MPCB for actuator feeder 22 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 2 no Out going feeders from existing panel.at sub station(DIHIKAGLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 minimum 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 50 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 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 ACB lead to MCC panel shall receive power through 1.1 KV grade 3.5core 240/300 sq. mm XLPE insulated armoured aluminium cable as required. 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.

6.13 Outgoing feeders --- 2 Nos. for DIHIKAGLR (each equipped with following:)

I) 415 V, 3 pole, 630A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No

II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.

III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.

IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.

V) TNC Breaker Control Switch 1 No.

VI) Local / Remote Selector Switch 1 No.

.7.0 415 V Multi panel MCC cum PDB atDIHIKA GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 630A for phases and 300A 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 50 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.

7.7 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 1.1 KV grade 3.5 core 240/300 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

- lxxxii) 415 V, 4 pole, 630A, 50 KA electrically operated draw out type
ACB/MCCB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No
- lxxxiii) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- lxxxiv) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- lxxxv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- lxxxvi) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3
Nos.
- lxxxvii) Red, Yellow, Blue phase indicating lamp as required
- lxxxviii) MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp
4 Nos.

- lxxxix) TNC Breaker Control Switch 1 No.
- xc) Local / Remote Selector Switch 1 No.
- xc) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13 1 No.

7.11 630 A Bus coupler feeder one (1) number comprising of following components:

- xix) 415 V, 4 Pole, 630 A, 50 KA electrically operated draw out type ACB/MCCB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No.
- xx) TNC Breaker Control Switch 1 No.
- xxi) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- Start / Stop Push Button - 1 Set
- d)
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 225 or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.14 MCCB / MCB feeder of following rating

- a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.
(Adjustable O/L) rated upto 50⁰ C without duration 3 Nos
- b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos
- K) Not less than #A TPN MPCB for actuator feeder 4Nos
- d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.
- e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus coupling PDB at Substation.(KSTPGLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.

- 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 channels.
- 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 ACB connected from the secondary side of transformers.
- 6.7 The bus bar for the PDB shall be TPN, 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 1600 A for phases and 800 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 1600A incoming feeders 2 nos. each comprising of following components:

- lxxxix) 415 V, 4 pole, 1600A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release 1 No
- xc) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1
No.
- xcj) 96 sq. mm, 0 – 500 V Voltmeter with selector switch 1
No.
- xcii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- xciii) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- xciv) Red, Yellow, Blue phase indicating lamp as required
- xcv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- xcvi) TNC Breaker Control Switch 1 No.
- xcvii) Local / Remote Selector Switch 1 No.
- xcviii) Microprocessor based draw out type non-directional combined IDMTL over current
relay with high set instantaneous element and instantaneous earth fault element type
P111 or equivalent with VAJH 13
1 No.

6.12 1600A Bus coupler feeder one (1) number comprising of following components:

- xxii) 415 V, 4 Pole, 1600 A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.
- xxiii) TNC Breaker Control Switch 1 No.
- xxiv) Local / Remote Selector Switch 1 No.

iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for KSTPGLR (each equipped with following:)

I) 415 V, 3 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No

II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.

III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.

IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.

V) TNC Breaker Control Switch 1 No.

VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.

d) 16 A DP MCB 6 Nos.

.7.0 415 V Multi panel MCC cum PDB at BARAKARGLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 400A for phases and 200A 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 50 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.

7.7 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 1.1 KV grade 3.5 core 240/300 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

xcii)	415 V, 4 pole, 400A, 50 KA electrically operated draw out type ACB /MCCB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No
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- xciii) 96 sq mm, suitably scaled Ammeter with cramped scale & selector switch 1 No.
- xciv) 96 sq mm, 0 – 500 V Voltmeter with selector switch 1 No.
- xcv) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- xcvi) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- xcvii) Red, Yellow, Blue phase indicating lamp as required
- xcviii) MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp 4 Nos.
- xcix) TNC Breaker Control Switch 1 No.
- c) Local / Remote Selector Switch 1 No.
- ci) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13 1 No.

7.11 400 A Bus coupler feeder one (1) number comprising of following components:

- xxv) 415 V, 4 Pole, 400 A, 50 KA electrically operated draw out type ACB/MCCB with microprocessor-based O/L, S/C, E/F & shunt trip release. 1 No.
- xxvi) TNC Breaker Control Switch 1 No.
- xxvii) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 90KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor - 3

	with 240 V AC Coil arrangement	Nos.
c)	Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP	- 4 Nos.
	Start / Stop Push Button	- 1 Set
d)		
e)	96 Sq mm suitably scaled including cramped scale Ammeter with selector switch	- 1 No.
f)	True Digital Microprocessor based 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 225 or equivalent)	- 1 No.
g)	High speed master trip relay type VAJH 13 or equivalent	- 1 No.
h)	CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA	- 3 Nos.
i)	CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA	- 3 Nos.

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.

(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

L) Not less than #A TPN MPCB for actuator feeder4Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

.7.0 415 V Multi panel MCC cum PDB at KSTP GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1250A for phases and 630A 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 50 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.

7.7 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 1.1 KV grade 3.5 core 300/400 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

cii)	415 V, 4 pole, 1250A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No
ciii)	96 sq mm, suitably scaled Ammeter with cramped scale & selector switch	1 No.
civ)	96 sq mm, 0 – 500 V Voltmeter with selector switch	1 No.
cv)	Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA	3 Nos.
cvi)	Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA	3 Nos.
cvii)	Red, Yellow, Blue phase indicating lamp	as required
cviii)	MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp	4 Nos.
cix)	TNC Breaker Control Switch	1 No.
cx)	Local / Remote Selector Switch	1 No.
cxi)	Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13	1 No.

7.11 1250 A Bus coupler feeder one (1) number comprising of following components:

xxviii)	415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No.
xxix)	TNC Breaker Control Switch	1 No.
xxx)	Local / Remote Selector Switch	1 No.
iv)	Bus Coupler ON / OFF / Spring Charged Indicating Lamp	3 Nos.

7.12 45KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.
(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 (BOCR/EOCR or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 75KW Star – Delta Starter Motor feeders,with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.
(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- d) Start / Stop Push Button - 1 Set
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.

- f) True Digital Microprocessor based 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 225 or equivalent) - 1 No.
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.

(Number of feeders shall be no. of Pump sets installed plus one spare)

- a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.
- b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.
- c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.
- Start / Stop Push Button - 1 Set
- d)
- e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.
- f) True Digital Microprocessor based 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 - 1 No.

- protection (Type 225 or equivalent)
- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
 - h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
 - i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.14 MCCB / MCB feeder of following rating

- a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.
(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos
- b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos
- M) Not less than #A TPN MPCB for actuator feeder 12Nos
- d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.
- e) 16 A DP MCB 6 Nos

06.00 Technical Specification OF 415 V, 2 Incomer & 1 Bus coupling PDB at Substation.(RAMNAGARGLR LOCATION)

- 6.1 The PDB is required to provide power to the Pump House MCC cum PDB and auxiliary load at the Sub-station
- 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 transformers.
- 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 channels.
- 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 ACB connected from the secondary side of transformers.

6.7 The bus bar for the PDB shall be TPN, 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 1250 A for phases and 630 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 50 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 ACB shall receive power through 1.1 KV grade 3.5core 300/400 sq. mm XLPE insulated armoured aluminium cable as required. 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 1250A incoming feeders 2 nos. each comprising of following components:

- | | | |
|-------|---------------------------------------------------------------------------------------------------------------------------------|-------|
| xcix) | 415 V, 4 pole, 1250A, 50KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release | 1 No |
| c) | 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch | 1 No. |

- ci) 96 sq. mm, 0 – 500 V Voltmeter with selector switch 1
No.
- cii) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- ciii) Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA 3 Nos.
- civ) Red, Yellow, Blue phase indicating lamp as required
- cv) CB ON / OFF / TRIP / Spring Charged Indicating Lamp As required.
- cvi) TNC Breaker Control Switch 1 No.
- cvii) Local / Remote Selector Switch 1 No.
- cviii) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13
1 No.

6.12 1250A Bus coupler feeder one (1) number comprising of following components:

- xxxix) 415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.
- xxxix) TNC Breaker Control Switch 1 No.
- xxxix) Local / Remote Selector Switch 1 No.
- iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

6.13 Outgoing feeders --- 2 Nos. for RAMNAGARGLR (each equipped with following:)

- i) 415 V, 3 pole, 1250A, 50 KA electrically operated draw out type
ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No

- II) 96 sq. mm, suitably scaled Ammeter with cramped scale and selector switch 1 No.
- III) Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA 3 Nos.
- IV) CB ON / OFF / TRIP / Spring Charged Indicating Lampas required.
- V) TNC Breaker Control Switch 1 No.
- VI) Local / Remote Selector Switch 1 No.

6.14 MCCB / MCB feeder of following rating

- a) 32A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.
- b) 63A TPN MCCB with Microprocessor based O/C & E/F releases 3 Nos.

(Adjustable O/L) rated upto 50⁰ C without duration

- c) ON / OFF / Trip Indicating Lamp (For each feeder) As required.
- d) 16 A DP MCB 6 Nos.

.7.0 415 V Multi panel MCC cum PDB at RAMNAGAR GLR LOCATION

7.1 The MCC cum PDB is required to provide power to the Pump Motors, auxiliary load and Main Lighting Distribution Board at Pump House.

7.2 The MCC cum 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 outgoing feeder & PDB at at substation

7.3 The MCC cum 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.

7.4 The MCC cum 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.

7.5 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.

7.6 The bus bar for the MCC cum PDB shall be TPN, 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 1250A for phases and 630A 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 50 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.

7.7 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 1.1 KV grade 3.5 core 300/400 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.

7.8 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.

7.9 Feeder details with mounted components

The feeder details are as under:

7.10 A incoming feeder 2 nos. comprising of following components:

cxii)	415 V, 4 pole, 1250A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.	1 No
cxiii)	96 sq mm, suitably scaled Ammeter with cramped scale & selector switch	1 No.
cxiv)	96 sq mm, 0 – 500 V Voltmeter with selector switch	1 No.
cxv)	Current Transformer of suitable ratio & 5A secondary, Class: 1.0, 15 VA	3 Nos.
cxvi)	Current Transformer of suitable ratio & 5A secondary, Class: 5P10, 10 VA	3 Nos.
cxvii)	Red, Yellow, Blue phase indicating lamp	as required
cxviii)	MCCB ON / OFF / TRIP / Earth Fault Trip Indicating Lamp	4 Nos.
cxix)	TNC Breaker Control Switch	1 No.
cxx)	Local / Remote Selector Switch	1 No.

cxxi) Microprocessor based draw out type non-directional combined IDMTL over current relay with high set instantaneous element and instantaneous earth fault element type P111 or equivalent with VAJH 13

1 No.

7.11 1250 A Bus coupler feeder one (1) number comprising of following components:

xxxiv) 415 V, 4 Pole, 1250 A, 50 KA electrically operated draw out type ACB with microprocessor-based O/L, S/C, E/F & shunt trip release.
1 No.

xxxv) TNC Breaker Control Switch 1 No.

xxxvi) Local / Remote Selector Switch 1 No.

iv) Bus Coupler ON / OFF / Spring Charged Indicating Lamp 3 Nos.

7.12 160KW Star – Delta Starter Motor feeders with capacitor bank each comprising of following components: Type 2 coordination should have to be followed.
(Number of feeders shall be no. of Pump sets installed plus one spare)

a) Not less than reqd. A, 50 KA MCCB with microprocessor-based trip unit with adjustable overload, short circuit & earth fault rated upto 50⁰ C without deration - 1 No.

b) Not less than reqd. A Air Breaker Contactor with 240 V AC Coil arrangement - 3 Nos.

c) Clustered LED type indicating lamp for ON / OFF / TRIP / EARTH FAULT TRIP - 4 Nos.

Start / Stop Push Button - 1 Set

d)

e) 96 Sq mm suitably scaled including cramped scale Ammeter with selector switch - 1 No.

f) True Digital Microprocessor based Motor Protection relay suitable for 5A CT secondary and having thermal overload protection, instantaneous short circuit protection, inverse and definite time negative sequence current - 1 No.

protection, instantaneous and definite time earth fault protection, locked rotor protection, loss of load protection and reverse phase sequence protection (Type 225 or equivalent)

- g) High speed master trip relay type VAJH 13 or equivalent - 1 No.
- h) CT of appropriate rating and 5A Secondary, Class 1.0, 10 VA - 3 Nos.
- i) CT of appropriate rating and 5A Secondary, Class 5 P 10, 15 VA - 3 Nos.

7.14 MCCB / MCB feeder of following rating

a) 32 A TPN MCCB with Microprocessor based O/C & E/F releases for delivery valves, common delivery and annex load. with rated amp HRC Fuse.
(Adjustable O/L) rated upto 50⁰ C without duration 8 Nos

b) 63/100 A TPN MCCB with Microprocessor based O/C & E/F releases
(Adjustable O/L) rated upto 50⁰ C without deration 3 Nos

N) Not less than #A TPN MPCB for actuator feeder 13 Nos

d) ON / OFF / Trip Indicating Lamp (For each feeder) as required.

e) 16 A DP MCB 6 Nos

15.00 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

15.1 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

15.2 Float and Boost Battery Charger

15.2.1 Charger – I (Float Charger – SCR Control)

- a) Output Voltage : 110 – 125 V DC [steplesslyadjustable]
- 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

15.2.2 Charger – II (Boost cum Float Charger – SCR Control)

- a) Output Voltage Boost : 110 – 127 V DC [steplessly adjustable]
Em. Float: 110 V – 125 V DC [steplessly 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

15.3 Protection

- a) Snubber across each device
- b) Phase failure / sequence reversal
- c) Soft start with current limiting (intrinsic feature of trigger PCB)

15.4 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

15.5 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.

15.6 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

15.7 DCDB Outgoing Feeder

- a) 2 P, 16 A DC MCB - 6 Nos.

15.8 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

16.00 CABLE:

All HT and M.V. power cables shall be with XLPE insulation, stranded aluminium / copper conductor and armoured

16.01 HT &M.V. Cables and Jointing

All HT and M.V. Cables shall be 11 KV (E) / 1.1 KV grade XLPE insulated and armoured of Al / Cu. conductor 3 core / 3½ core / 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 1000 mm width x 1200mm 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.

16.02 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.

17.00 FLOW SENSOR

There shall be one number of Full bore Electromagnetic flow meter on the common delivery manifold. The flow meters 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 m³/hr & total flow in cubic meter. The flow sensor shall be suitable to measure Raw 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 50 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 ± 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 Raw 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.

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 single Length as required as per site condition between sensor and transmitter.

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.

Output: - 4-20 mA DC

Power supply: - 240 V AC 50 Hz and shall be supplied from the MCC cum PDB at a approximate 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.

18.00 Flow meter/ Flow sensor or Flow Tube fixing chamber

For fixing of Flow Tube at the delivery manifold, leak proof chamber of adequate dimension is to be constructed if required as per site condition with a rung-ladder of suitable length for getting down if necessary.

19.00 EARTHING

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 75mm wide and 8 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 Earth Pits should not be less than 3 meters.

20.00 LIGHTING SYSTEM

20.01 Luminaries

The scope includes indoor lighting of pump house, substation building, Annex area and reasonable area lighting around the Pump House and Substation Building. Industrial Medium bay luminaries with 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 Substation Room lighting should be provided with LED T/L 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.

Area illumination/access bridge level 100 LUX with suitable LED fittings.

All the entrance/exists of pump house shall be provided with LED down lighter or bracket mounted fittings with LED lamps of minimum 45 Was per site condition (minimum 90W for unloading bay entrance).

20.02 **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/natural/ground wires.

20.03 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.

20.04. 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.

20.05 The above stated distribution board shall be fed from independent switch fuse unit / MCB / MCCB located in the PDB.

20.06 440 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.

20.07 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.	LED Fluorescent	2 nos. 1 core -1.5 mm ² copper & 1 no. Earth wire of 1.0 mm ² copper
2.	LED Flood light fitting	2 nos. 1 core -2.5 mm ² copper & 1 no. Earth wire of 1.0 mm ² copper
3.	Receptacle-5A	2 nos. 1 core -2.5 mm ² copper & 1 no. Earth wire of 1.0 mm ² copper
4.	Receptacle-	2 nos – 1 core-4 mm ² copper & 1 no Earth wire of

21.00 Ventilation & Firefighting System:

21.01 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 / armoured cable including all other accessories as required.

- j) 3 - phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for the Pump House to ensure 10 Air changes/Hr..
- k) Single phase suitable Exhaust fans including proper louvers, duct work, rain cowl and bird protection screen ----- As required for all the rooms of Sub Station as per the direction of EIC.
- l) Wall mounting type control panel for exhaust fan and others ----- 2 Sets, one each for pump House and substation.
- e) 18" Pedestal fan with regulator and all other accessories --- 3 Nos.

21.05 Fire Extinguisher

- a) ABC type Portable type fire extinguisher 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.

20.00 OVERHEAD CRANE

20.1 EOT Crane.

The EOT. Crane will be minimum 3/5 M.T. capacity Electrically Operated Travelling Crane (E.O.T.) with a lift from the operating floor level and up to the level above the installed motors. The long travel & the Cross Travel along with height of lift of the crane shall be finalised after freezing of the Pump House 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 shall be manually operated. The buffers must be spring loaded operation.

The EOT Crane should be tested at manufacturer's works / site as per relevant IS. The same may be witnessed by the EIC. The Contractor has to arrange for such testing at his own cost.

21.00 Chlorination System

- 7) Chlorination System should be 2X 5k. g/Hr.
- 8) Pre- & Post Chlorination by gases chlorine arrangement capable of producing with 25% overloading.

22.00 MECHANICAL TYPE LEVEL INDICATOR

The Mechanical level Indicator shall be equipped with for continuous monitoring of sump level.

The level indicator 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 05Mtr.

B.List of Vendors

Sl. No.	Equipment	Make
01.00	Pump	Kirloskar / Mather & Platt / WPIL Ltd.
02.00	Motor	Siemens / ABB / Marathon/ Crompton
03.00	Control Desk/ MV Switchboard / MCC cum PDB	Sellwin. / PCE Projects / RNR / Roycco.Engg.
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) / BCH
08.00	Contactors	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 / Micro System
12.00	Digital Indicators	Micro System /Meco
13.00	Temperature Scanner	Pecon/ Micro System /Laxon / Chino / Masuka Instruments Pvt. Ltd.
14.00	Radar type Level Monitoring System\	Siemens / Khrone / Rosemount
14.01	Mechanical Type Level Indicator	NGM/Joydev. Engg./Star Enterprise.
15.00	Flow meter, Indicator, Totaliser	Krohne / Endress Hauser/ABB/Siemens
16.00	Control Fuses	GE/Siemens
17.00	Current Transformer	Kappa /JAWS / Schneider
18.00	Capacitor	Unistar / L&T / Epcos
19.00	Butterfly Valves, Non-Return Valve & Sluice Valve	VAG/ IVC / Kirloskar / Fluidtech/IVI
20.00	Valve Actuators	Rotork / Auma
21.00	Gauges	Bell / Taylors / H. Guru /Bell/Baumer
22.00	Fire Extinguishers	Surex / Minimax / Cease Fire / Fire Shield
23.00	Submersible Sump Pump	KSB / Calama / Kirloskar
24.00	Air Conditioner	Carrier / LG / Voltas
25.00	Lighting system	
26.01	Light Fitting	Philips / Bajaj/C.G/KLITE
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 Implements Co.	Surekha / Plycare / India Engineering &
30.00	H.T. Switchgear	Siemens / Schneider / ABB
31.00	Power Transformer	Schneider / KEC/ Voltamp. (Vadodara) /AEG/CG
32.00	Battery	Exide/Aamron
33.00	Battery Charger	Caldyne / Electro Service/Dekem/Live Line

C.Scope of Work for Major E/M Equipments.(AT BHUTABURI)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 615 cu.m/hr & Head not less than 78 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 440 cu.m/hr & Head not less than 88 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	6	Nos.
3	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
4	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
5	Providing, Installation, Testing and Commissioning of Compound gauges, Pressure gauges & Pressure Transmitter	1	Lot
6	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1	Nos.
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 600 mm dia.	1	Nos.
8	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
9	Supply, Installation, Testing & Commissioning of 1600 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos

10	Supply , installation , testing & commissioning of Float cum boost charger suitable for 415V with variation 10% , 50 HZ , single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
11	Supply, delivery, Installation, Testing and Commissioning of suitable LT PDB Panel as per specification.	1	No
12	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel with Capacitor bank as per specification.	1	No
13	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
14	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
15	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
16	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support,with all accessories & cable tray supports.	1	Job
17	Dehdryation&Filtraion of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
18	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
19	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
20	Dismantling Chargres	1	Job

D.Scope of Work for Major E/M Equipments.(ATPOLO GROUND)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 724 cu.m/hr & Head not less than 38 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 352 cu.m/hr & Head not less than 57 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
3	Supply, Delivery, Installation, Testing & Commissioning of 1155 cu.m/hr & Head not less than 30 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	3	Nos.

4	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
5	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
6	Providing, Installation, Testing and Commissioning of Compound gauges, Pressure gauges & Pressure Transmitter	1	Lot
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1	Nos.
8	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
9	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 700 mm dia.	1	Nos.
10	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
11	Supply, Installation, Testing & Commissioning of 1250 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
12	Supply, installation, testing & commissioning of Float cum boost charger suitable for 415V with variation 10%, 50 HZ, single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
13	Supply, delivery, Installation, Testing and Commissioning of suitable LT PDB Panel as per specification.	1	No
14	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel with Capacitor bank as per specification.	1	No
15	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
16	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
17	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
18	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job
19	Supply, delivery and Installation of Perforated and Ladder type Cable tray, Panel base support, with all accessories & cable tray supports.	1	Job
20	Dehydration & Filtration of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
21	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job

22	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
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E.Scope of Work for Major E/M Equipments.(AT ISMILE)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 190 cu.m/hr & Head not less than 38 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 218 cu.m/hr & Head not less than 32 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
3	Supply, Delivery, Installation, Testing & Commissioning of 712 cu.m/hr & Head not less than 45 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
4	Supply, Delivery, Installation, Testing & Commissioning of 280 cu.m/hr & Head not less than 42 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
5	Supply, Delivery, Installation, Testing & Commissioning of 730 cu.m/hr & Head not less than 53 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
6	Supply, Delivery, Installation, Testing & Commissioning of 265 cu.m/hr & Head not less than 40 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
7	Supply, Delivery, Installation, Testing & Commissioning of 485 cu.m/hr & Head not less than 25 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
8	Supply, Fabrication, installation, testing & Commissioning of flanged/plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
9	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
10	Providing, Installation, Testing and Commissioning of Compound gauges, Pressure gauges.	1	Lot
11	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 200 mm dia.	1	Nos.
12	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 200 mm dia.	1	Nos.

13	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1	Nos.
14	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
15	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1	Nos.
16	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
17	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 300 mm dia.	1	Nos.
18	Supply, delivery , Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
19	Supply, Installation, Testing & Commissioning of 1250 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
20	Supply , installation , testing & commissioning of Float cum boost charger suitable for 415V with variation 10% , 50 HZ , single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
21	415 V, 3 phase 4 wire, 50 HZ, LT PDB Panel as per specification	1	No
22	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel with Capacitor bank as per specification.	1	No
23	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
24	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
25	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
26	Supply, delivery and Installation of safety equipment.	1	Job
27	Supply, delivery and Installtion of Perforated and Ladder type Cable tray, Panel base support,with all accessories & cable tray supports.	1	Job
28	Dehydration&Filtration of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
29	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
30	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
31	Dismantling Charges	1	Job

F.Scope of Work for Major E/M Equipments.(AT BARACHAK)

This is indicative not exhaustive, will be finalized in detail engineering.

Sl No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 322 cu.m/hr & Head not less than 85 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
3	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
4	Providing, Installation, Testing and Commissioning of Pressure gauges.	1	Lot
5	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
6	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
7	Supply, Installation, Testing & Commissioning of 800 KVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
8	Supply, installation, testing & commissioning of Float cum boost charger suitable for 415V with variation 10%, 50 HZ, single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
9	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No
10	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
11	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
12	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
13	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job

14	Supply, delivery and Installtion of Perforated and Ladder type Cable tray, Panel base support,with all accessories & cable tray supports.	1	Job
15	Dehdryation&Filtraion of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
16	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
17	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
18	Dimantling Charges	1	Job

G.Scope of Work for Major E/M Equipments.(AT DIHIKA)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 635 cu.m/hr & Head not less than 52 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges,bolts, nuts, gaskets,etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
3	Supply, delivery, Installtion, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve,etc.) for Delivery & Common Manifold.	1	Lot
4	Providing, Installation, Testing and Commissioning of Compound gauges, Pressure gauges.	1	Lot
5	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1	Nos.
6	Supply, delivery, Installation, Testing and Commissioning of suitable Extension LT PDB Panel as per specification.	1	Nos.
7	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No
8	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
9	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
10	Supply, delivery and Installtion of Perforated and Ladder type Cable tray, Panel base support,with all accessories & cable tray supports.	1	Job

11	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
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H.Scope of Work for Major E/M Equipments.(AT KSTP)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 810 cu.m/hr & Head not less than 28 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Delivery, Installation, Testing & Commissioning of 750 cu.m/hr & Head not less than 45 m, Horizontal Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
3	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
4	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
5	Providing, Installation, Testing and Commissioning of Compound gauges, Pressure gauges & Pressure Transmitter	1	Lot
6	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 400 mm dia.	1	Nos.
7	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 350 mm dia.	1	Nos.
8	Supply, delivery, Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
9	Supply, Installation, Testing & Commissioning of 1000 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos
10	Supply, installation, testing & commissioning of Float cum boost charger suitable for 415V with variation 10%, 50 HZ, single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
11	Supply, delivery, Installation, Testing and Commissioning of suitable LT PDB Panel	1	Set
12	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No

13	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
14	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
15	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
16	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control Cables).	1	Job
17	Supply, delivery and Installation of Perforated and Ladder type Cable tray , Panel base support, with all accessories & cable tray supports.	1	Job
18	Dehydration & Filtration of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
19	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
20	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
21	Dismantling Chargers	1	Job

I.Scope of Work for Major E/M Equipments.(AT BARAKAR)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 325 cu.m/hr & Head not less than 60 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges, bolts, nuts, gaskets, etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
3	Supply, delivery, Installation, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve, etc.) for Delivery & Common Manifold.	1	Lot
4	Providing, Installation, Testing and Commissioning of Pressure gauges.	1	Lot
5	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
6	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel as per specification.	1	No
7	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job

8	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
9	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support,with all accessories & cable tray supports.	1	Job
10	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
11	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
12	Dismantling Charges	1	Job

J.Scope of Work for Major E/M Equipments.(AT RAMNAGAR)

This is indicative not exhaustive, will be finalized in detail engineering.

SI No.	Brief Description of Item	Qty	Unit
1	Supply, Delivery, Installation, Testing & Commissioning of 370 cu.m/hr & Head not less than 100 m, Vertical Turbine Pump - Motor set with all req. accessories with suitable motor, 415 V, 50 Hz.	2	Nos.
2	Supply, Fabrication, installation, testing & Commissioning of flanged/ plain ended MS pipe made from MS sheet of relevant IS specification (bends, Enlarger, reducers, fittings, specials, flanges,bolts, nuts, gaskets,etc as required to complete the installation) for Delivery & Common Manifold and Jointing the MS to DI Lines (Minimum 8 mm thickness sheet.)	1	Lot
3	Supply, delivery, Installtion, Testing and Commissioning of suitable DI Valves & Joints (i.e Sluice Valve, Butterfly Valve, NRV, DJ, EJ, MJ, Air Valve,etc.) for Delivery & Common Manifold.	1	Lot
4	Providing, Installation, Testing and Commissioning of Pressure gauges.	1	Lot
5	Providing, Installation, Testing and Commissioning of Electromagnetic Flow Meter of 250 mm dia.	1	Nos.
6	Supply, delivery, Installation and commissioning of 5 M.Ton capacity EOT Crane complete in all respect including testing , certification and as per NIT and tender specifications	1	Job
7	Supply, delivery , Installation, Testing and Commissioning of suitable 11 kV, 800 Amp, 26.3 KA for 3 sec, 3 Panel VCB Switchboard with following: I/C Feeder - 1 No, O/G Transformer Feeder - 2 Nos.	1	Set
8	Supply, Installation, Testing & Commissioning of 800 kVA, 11 kV/0.433 kV, 3 phase, 50 Hz, ONAN type transformer as per specifications and NIT.	2	Nos

9	Supply , installation , testing & commissioning of Float cum boost charger suitable for 415V with variation 10% , 50 HZ , single phase/3-phase input & 24/48/110 Volt DC. and Battery Bank of minimum 100 AH capacity comprising SMF/VRLA batteries, MS stand, interconnect wiring etc as required complete in all respect	1	Set
10	415 V, 3 phase 4 wire, 50 HZ, LT PDB Panel with Capacitor bank as per spécification	1	No
11	Supply, delivery, Installation, Testing and Commissioning of suitable LT PMCC Panel with Capacitor bank as per specification.	1	No
13	Supply, delivery, Installation, Testing & Commissioning of suitable Earthing Systems, etc	1	Job
14	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (H.T Cables).	1	Job
15	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (L.T Cables).	1	Job
16	Supply, delivery, Laying, Testing & Commissioning of suitable Cable (Control & Instruments Cables).	1	Job
17	Supply, delivery and Installtion of Perforated and Ladder type Cable tray , Panel base support,with all accessories & cable tray supports.	1	Job
18	Dehydration&Filtraion of Transformer Oil to raise the dielectric strength to the value specified in IS including submission of test result	1	Job
19	Commissioning of whole system & Performance test for (72 hours) including DOE clearance.	1	Job
20	Trial Run for (three) months after successful commissioning of the whole installation as per specification and direction of the EIC.	1	Job
21	Dismantling Charges	1	Job



**SUPER INTENDING ENGINEER
WEST CIRLE,M.E.Dte.**