SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION

e- TENDER NOTICE NO.24 FOR 2022-23

-

NAME OF WORK : **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli**

TENDER DOCUMENT I

SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION

SAVE WATER EVERY DROP COUNTS

Contractor No of Correction Executive Engineer SMKC

PRESS TENDER NOTICE

सांगली मिरज कुपवाड शहर महानगरपालिका

ई निविदा सुचना क्र. २४ सन २०२२-२३

केंद्र पुरुस्कृत अमृत २.० अंतर्गत कुपवाड भुयारी गटार योजना ता. मिरज, जि. सांगली या कामाची निविदा सांगली मिरज कुपवाड शहर महानगरपालिका यांचे कडुन मागविणेत येत आहे. कामाची अंदाजित किंमत रु. २०६.४७ कोटी (जीएसटी शिवाय) इतकी असुन. या कामासंबधीचा सविस्तर तपशिल www.mahatenders.gov.in या संकेतस्थळावर दि.१६/०१/२०२३ पासुन उपलब्ध करुन देणेत येत आहे.

निविदा कार्यक्रमाविषयक सर्व तारखा www.mahatenders.gov.in या संकेतस्थळावर प्रसिद्ध करण्यात आलेल्या निविदा सुचना नुसार राहतील.

-सही-

आयुक्त

दि.१०/०१/२०२३ सांगली मिरज कुपवाड शहर महानगरपालिका

Sangli Miraj Kupwad City Muncipal Corporation

E-TENDER NOTICE NO 24 FOR 2022-23

SMKC invites e-Tender for the work of Kupwad Under Ground Drainage Scheme Under Central Govt. program Amrut 2.0 **Tal. Miraj, Dist. Sangli** in the state of Maharashtra Valued (Without GST) Rs. 206.47 Cr. The E-Tender details are available on **www.mahatenders.gov.in** from dated 16/01/2023.

All relevant dates will be as per the tender published in web portal **www.mahatenders.gov.in**

Date :-10 /01/2023

- sd-
(Commissioner)
Sangli Miraj Kupwad Munciapl Corporation

SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION

Name of work : Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli

TENDER NOTICE NO.24 FOR 2022-23

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DETAILED TENDER NOTICE

Sangli Miraj and Kupwad City Muncipal corporation

DETAILED TENDER NOTICE NO. 24 OF 2022-23

Online percentage rate basis Tender in B-1 Form in two envelopes system are invited for the following works from the contractors registered with MJP in in class I(unlimited) (civil) or registered in CIDCO/MIDC OR ANY GOVERNMENT DEPARTMENT IN INDIA in equivalent class of MJP on the Government of Maharashtra e-Tendering Portal www.mahatenders.gov.in

Note : *In order to participate in e-tendering process, it is mandatory for new contractors (first time users of this website) to complete the Online Registration Process for the e-Tendering website. For guidelines, kindly refer to Bidders Manual Kit documents provided on the website*

a) **NAME OF WORK** : **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2**

b) **ESTIMATED TNDER COST** : 206,46,72,610/-

c) **EARNEST MONEY DEPOSIT** : **1,03,23,363/- (0.5% of the cost put to tender)**

d) **DOWNLOADING COST OF TENDER DOCUMENTS:-** Rs. 59,000/- (Including GST) **(Non-refundable).**

e) **CLASS OF CONTRACTOR :** the contractors registered with MJP in in class I(unlimited)(civil) or registered in CIDCO/MIDC OR ANY GOVERNMENT DEPARTMENT IN INDIA in equivalent class of MJP

1. EARNEST MONEY DEPOSIT/TENDER FEES :

Tender fee and EMD shall be paid by

1. SBI Net Banking or

2. Other Bank Internet Bank MOPS.

3. In shape of Bank Guarantee for 8 month period in any Nationatized Bank in favour of Commissioner Sangli Miraj Kupwad Muncipal Corporation, Sangli

For any assistance please contact help desk. Details are available online.

The online payment procedure can be seen on
https://mahatenders.gov.in→ Announcement → online payment procedure.
Online payment requires 48 hours in Bank working days for clearance and hence, payment should have been made accordingly.

The EMD will be retained in the pooling account and will be refunded to the unqualified / unsuccessful bidders after award of tender to the successful lowest bidder. The EMD of successful bidder will be ultimately refunded or will be adjusted against the security deposit after selection of the successful bidder at the time of execution of the contract. In case, Commissioner decided to forfeit / adjust the EMD amount of the bidder, the EMD amount in such cases shall be credited to the bank account of the SMKM Corporation. The mandate for EMD refunds / forfeit / adjustment against security deposit shall trigger from e-tender application of NIC portal."

NOTE - The bidder should make the payment well in advance so as to ensure that the payment reaches to Bank 4 (four) days before date and time for submission of tender.

2. SECURITY DEPOSIT

- 4% of the Estimated cost or Accepted Tender cost whichever is higher
- **Initial Security Deposit.**

  2% of estimated cost or accepted tender cost whichever is higher in the form of Fixed Receipt OR Bank Guarantee from Nationalized / Scheduled Bank in the name of The Commissioner Sangli Miraj and Kupwad City Muncipal Corporation for 24 months (time limit) and shall be extended suitably if the work is not completed within the time limit.

- **Deductions through R.A. Bills.**

Balance 2% amount will be recovered through each running bill at 5% of the gross

amount of R.A. Bill to the extent that total required security deposit is to be recovered.

2.1 Additional Security Deposit. (Performance security)

- If the tenderer has quoted the offer below than the estimated rates put to the tender, the tenderer shall have to submit Additional Security Deposit(ASD) (Performance security) in the form of bank guarantee of any nationalize or scheduled Bank in favor of the "The Commissioner Sangli Miraj and Kupwad City Corporation

- The tenderer shall submit the Bank Guarantee of Additional Security Deposit (ASD) within 8 days from opening of Financial Bid to the office of "The Commissioner Sangli Miraj and Kupwad City Corporation.".

- If the first lowest (L-1) tenderer failed to submit the Additional Performance Security Deposit within eight days then his tender shall be liable for rejection and his EMD will be forfeited. In such case, if the second lowest (L-2) tenderer agree to execute the work at less than the rates of first lowest tenderer, then his tender will be accepted. The 2nd lowest tenderer will have to submit the Additional Performance Security Deposit in form of Bank Guarantee / Demand Draft.

- The amount of the (ASD) Bank Guarantee shall be calculated by the tenderer in accordance with this following manner.

- If the tenderer has quoted below the estimated rates, the ASD (Performance security) shall be paid additionally as mentioned below.

Rate quoted to Estimated Rate	Additional Security Deposite (Performance security)
Below 0 % to below 1 %	1) NIL
Lower than below 1% to below 10%	2) 1 % of estimated cost put to tender
Lower than below 10% to below 15%.	3) 1% + (% rate quoted -10%) For example : If 15% below is quoted the amount of performance security (Additional Security Deposit) shall be 1+ (15-10) = 6% Performance Security of estimated cost put to tender. If the amount is less than Rs. 1000/-, then minimum to be Rs. 1000/-

Lower than 15 % below	4) % as per Sr. No. 3 + (% rate quoted -15%) x 2 For example : If 19% below is quoted the amount of performance security (Additional Security Deposit) shall be 6+(19-15)x2 = 6%+8% = 14% Performance Security of estimated cost put to tender. If the amount is less than Rs. 1000/-, then minimum to be

- The bank Guarantee shall be valid upto defect liability period of the tender. It should bear MICR and IFS code.
- In case it is found that documents / Bank Guarantees submitted by the tenderer are faluse or misleading his earnest money shall be suspended for the period of 1 year. Additionally legal action may be initiated against the tenderer .
- The work order shall be given to the concerned tenderer after the clearance of the Bank Guarantee submitted by him.

REFUND OF PERFORMANCE SECURITY

- The amount of the performance security in the form of Bank Guarantee shall be released after completion of defect liability period of the tender.
- Non submission of additional security deposit in the form of Bank Guarantee shall be liable to summarily rejection of his tender.

The initial Security Deposit and additional security deposit may be in the form of Fixed deposit receipt OR Bank Guarantee by a Nationalized/Scheduled Bank in the name of "The Commissioner Sangli Miraj and Kupwad City Muncipal Corporation and shall be for a minimum period of 24 months (time limit) and shall be extended suitably if the work is not completed within the time limit. The tenderer shall have to furnish this security deposit with initial security deposit.

3. STAMP DUTY

The contractor shall bear the revenue stamp duty as per State Govrnment Registration and Stamps Departmrent Ltr. No. 3837/2021 Dt. 16/09/2021 Article No. 63 Applicable for work contracts as below and Director of finance MJP fa-2/audit/191/243 Dt. 11.18.2021.

Work Conttract, that is to say, a contractact for works and labour or services involving transfer of property in goods (Whether as goods or in some other for) in its execution and includes a sub contract.

टीप:- वित्त विभाग यांचे पत्र क्र. संकिर्ण -२०१८/प्र.क्र.१२/सा.स/ दि. ७/०२/२०१८ अन्वये मुंद्राक शुल्क शासनाच्या Government Receipt Accounting System (GRAS) प्रणालीद्वारे भरणे बंधनकारक आहे.

a.	Where the amount or value set forth in such contract does not exceed Rs. 10 Lakh	One Hunderd
b.	Where it exceed Rs. 10 Lakh	Five Hundered rupees plus 0.1 percent of the amount above ten lakh subject maximum of rupees twenty five lakh.

4. TIME OF COMPLETION

24 (21+3) months (Twenty Four Months) calendar months, including Monsoon and 3 months of trial Run. This will be counted from the date of issue of the work order.

5. DETAILED TENDER SCHEDULE

Sr. No.	Activities	Date & Time
1	Tender publishing date	16/01/2023 11.00 Hrs
2	Documents download start date	16/01/2023 11.00 Hrs
3	Documents download end date	07/02/2023 15.00 Hrs
4	Pre-bid meeting date	24/01/2023 12.30 Hrs
5	Bid submission start date	01/02/2023 11.00 Hrs
6	Bid submission closing date	07/02/2023 15.00 Hrs
7	Bid opening date (Techinical)	09/02/2023 11.00 Hrs
8	Bid opening date (Financial) (If Possible)	10/02/2023 11.00 Hrs

6. PRE QUALIFICATION CRITERIA

The bidder will have to fulfil the criteria mentioned below in order to qualify for opening of envelope (II) i.e. Commercial bid.

I)The firm / contractor should registered with MJP in in class I (unlimited) (civil) or registered in CIDCO/MIDC OR ANY GOVERNMENT DEPARTMENT IN INDIA in equivalent class of MJP. The validity of registration should be at least upto the last date for submission of tender, then only pre-qualification will be considered. It is necessary to renew the registration before issue of work order. Bidder need to submit online copy of registration.

II)The agency shall have experience successful completion and commissioning of

the works listed below with any Govt/Semi Govt./ corporation or equivalent organization. The experience of each work should be under single agreement.

Sr. No	Components in project	Experience required for
1	Rising mains pipeline(350 mm Dia 4750 m Length,700 mm dia.1580 m Length & 1000 mm dia. 150 m Length DI K9 Pipes)	Contractor should have experience of successful completion of Providing,supplying,lowering, laying, jointing hydraulic testing and commissioning satisfactorily minimum **250 mm Dia. DI** Pipes of Length **1620 m** in a single contract.
2	Non clog sewage submersible Pump of Individual Capacity – 215 HP – 3 Nos.& , 120 HP – 2 Nos, , Total Installed Capacity – 885 HP. Trasformer Capacity-630 KVA	(a) Contractor should have experience of successful completion of Providing, erecting & testing commissioning of Non clog sewage submersible Pump of **Individual Capacity – 110 HP & Installed Capacity – 445 HP.** in a single contract. (b) Contractor should have experience of successful completion of Providing, erecting & testing commissioning of Compact Substation with min capacity of Transformer 315 KVA in a single contract.
3	Sewer Collection system	
	A) DWC HDPE Pipe (150 mm dia. 238097 m length,170 mm dia. 6729 m length,200 mm dia.5971 m length & 250 mm dia.2221 m length)	Contractor should have experience of successful completion of Providing,supplying,lowering, laying, jointing hydraulic testing and commissioning satisfactorily minimum **170 mm Dia. HDPE DWC** Pipes of Length **63255 m** in a single contract.
	B)RCC Pipe (300 mm dia. 1447 m length,350 mm dia. 753 m length,400 mm dia.1670m length , 450 mm dia.2469 m length, 500 mm dia. 2544 m length,600 mm dia. 1045 m length,700 mm dia.1210 m length, 800 mm dia.1133 m length ,1000 mm dia.4184 m length &1200 mm dia.100 m length)	Contractor should have experience of successful completion of Providing,supplying,lowering, laying, jointing hydraulic testing and commissioning satisfactorily minimum **700 mm Dia. RCC** Pipes of Length **4139 m** in a single contract.
4	Wet well sump and Pumping stations a)Ahilyanagar Wet Well Pumping station (266000 lit.) b)Tulajainagar Wet Well Pumping station (730000 lit.) c) Kumbhar mala Wet Well Pumping station (1570000 lit.)	Contractor should have experience of Providing, Constructing, commissioning and Testing successfully atleast 1 wet well sump and Pumping station having **Min 1570000 liter** gross capacity in single contract.

5	Sewage Treatment Plant (27 MLD Capacity) of SBR 6.Technology	Contractor should have experience of successfully completed designing , constructing and completing satisfactory water tightness test of **Sewage Treatment Plant STP of** Sequential Batch Reactor (SBR) technology of Minimum Capacity 13.50 **MLD** & above in single tender. This STP should be in operation for minimum one year, giving satisfactory results (Quality of effluent shall be as required in Tender as per NTPC norms.)
6	Technology Tie up	Bidder should tie-up with a Technology provider for Sequential Batch Reactor and shall submit Technology Tie-up/ Consent Agreement as part of their bid. The technology provider shall have experience of providing SBR for at least three STPs each of 13.50 MLD in India for any State/ Central Government Departments/ Organizations/ MHADAs which are working satisfactorily for at least three years as on date of calling of Tender and achieving the outlet parameters as mentioned in the Tender. Performance Certificate for each work should be issued by the end user, duly certified by a officer not below the rank of Executive Engineer should be enclosed.
7	Automation/SCADA	a) Bidder shall be Contractor or manufacturer or authorized dealer or system integrater for all types of sensors required for automation or SCADA, like Pressure transmitters, level transmitter, PLC integration, Energy monitoring systems, PLC based control monitoring and communication systems, flow meters and water quality parameters etc. b) Experience of successful installation and commissioning of automation in minimum one sewarage scheme with automation at pumping machinery operations, STP, water quality monitoring and Pumping station operations. c) 50 % of required annual maintenance period i.e.2.5 years. d) If bidder is not a manufacturer or dealer of Sensor /PLC, he shall have Joint Venture with manufacturer/dealers.

III)The bidder shall submit online, required experience certificate. The certificate of experience shall have to be issued by the officer not below the rank of Executive Engineer and counter signed by the Executive/Hydraulic/Superintending Engineer or equivalent officer or head of Govt/Semi Govt./, Corporation or councils. Except Automation work, the certificate issued by Private Individuals/ Private Organization will not be considered.

IV)Incase LT installation The certificate of experience shall have to be issued by the officer not below the rank of Executive Engineer or equivalent officer or Head of Govt/Semi Govt./, Corporation or councils.

V)For the work of Automation experience certificate issued by private organization can be considered if supported by company registration certificate, TAN, VAT, PAN and contact details.

VI)The firm shall have valid GST registration No or TIN No.

VII)The firm shall have valid PAN No.

All the documents pertaining to pre-qualification criteria shall be submitted separately online in Envelop No.1 (Technical Bid)

VIII) BID CAPACITY (For the tender costing above Rs.50 cr)

The bidder shall have a bid capacity more than the value of this bid. Bidding capacity of contractor for completion of work will be decided by following formula.

BIDDING CAPACITY =(1.25 x N x A) – B

Where ..

A =	Average of engineering works of maximum value executed by the contractor in any three years of last five years, upgraded to the present year (i.e. tender accepted year) by the formula given below $\left\{1+ \frac{(\text{WPI Present} - \text{WPI Max Value years})}{\text{WPI Max. value years}} \times\right\}$ Maximum value of engineering works executed in a year **WPI Present :-** Wholesale price index of the month and year in which tender is invited. **WPI Max. value years :-** Average wholesale price index of the year in which the max. value of engineering works executed

N = Number of years prescribed for completion of the work for which present bid is invited.

B = Value of existing commitment & ongoing works to be completed during the period completion of the work (i.e. work in hand)

Contractor No of Correction Executive Engineer SMKC

ठेकेदाराने Self Declaration सादर करणे आवश्यक राहील. (Annexure 15)

Bid capacity calculation ठेकेदाराने सादर करताना

1. प्रगतीप्रथावरील तसेच ठेकेदाराने न्यूनतम देकार भरलेल्या निविदा व निविदा स्वीकृत झालेल्या तथापि कार्यादेश देने बाकी निविदा इ. कामांची माहिती दर्शविणारा Annexure-1 मधील सर्व विवरणपत्रांमध्ये किमान कार्यकारी अभियंता पेक्षा कमी नसलेल्या पदावरील अधिकाऱ्यांची स्वाक्षरी असणे आवश्यक आहे किंवा सनदी लेखापालामार्फत प्रमाणित करणे आवश्यक आहे . या सर्व विवरणपत्रांमध्ये ठेकेदारांची साक्षरी अनिवार्य राहील तसेच नगरपालिका/ महानगरपालिका इ. स्थानिक स्वराज्य संस्थांच्या कामाच्या बाबतीत संस्थेतील प्रशासकीय प्रमुखांची स्वाक्षरी असणे आवश्यक आहे किंवा सनदी लेखापाला मार्फत प्रमाणित करणे आवश्यक आहे. या सर्व विवरण पत्रांमध्ये ठेकेदारांची स्वाक्षरी अनिवार्य राहील.
2. वर्ष निहाय Turnover त्याच प्रमाणे Bid Capacity Calculations चार्टर्ड अकाउंटंटचे कडून तपासून घेऊन CA आणि ठेकेदारांच्या स्वाक्षरीसह ठेकेदारांच्या लेटर हेड वर असणे आवश्यक आहे.
3. Bid Capacity Calculations सोबत ठेकेदाराने द्यावयाच्या प्रगतीपथावरील कामे व त्याचप्रमाणे न्यूनतम देकार भरण्यात येऊन Letter of Indent प्राप्त झालेल्या कामांच्या बाबतीतील विवरण पत्राचा नमुना Annexure-**14** नुसार संलग्न केला आहे.
4. ठेकेदाराने त्यांच्याकडील प्रगतीपथावरील कमे व त्याच प्रमाणे न्यूनतम देकार भरण्यात आलेल्या निविदांच्या बाबतीत Letter of Indent मिळालेल्या कामाचा समावेश करावा मात्र, निविदा प्रक्रियेत भाग घेऊन, केवळ न्यूनतम देकार भरलेल्या कामांचा समावेश करण्यात येऊ नये.
5. Contractor should submit Bid Capacity calculations with works in hand also lowest Bid and letter of indent in Annexure-14
6. Contractor should submit Statement of work in hand or incomplete work duly signed by not less than Executive Engineer, in case of municipal council or municipal corporation statement should be signed by Chief Officer Hydraulic Engineer respectively.
7. Contractor should submit year wise turnover and Bid capacity calculation on his/her letterhead duly signed by Chartered accountant.
8. With Bid capacity calculation contractor should submit aaffidivate as per (Annexure-14).
9. Contractor should submit list of works in hand and list of tenders with lowest also letter of for which he is L1 (lowest 1) and also submit list of tenders for which letter od Indent or letter of acceptance issue to him.

IX) **Networth** = PRE-QUALIFICATIONS CRITERIA (FINANTIAL)

1. The networth is applicable to tenders costing more than 25 crores.
2. The networth calculatios should be certified by chartered accountants.
3. The Bidder should have networth 8% of tender cost of continues 3 years from the finantial year. In which he desires to take work.

X) **Geo Tagging** - It shall be binding for all contractors to inspect the work site , quarry area and other important site area before filling their offer for this tender. The con-

tractor shall submit geotagging declaration letter that they are visited the site and offer is submitted after consideration of site conditions in Envelope no. 1. Without geotagging declaration the tender will not considered.

- COLLABORATION & JOINT VENTURE

Collaboration :-

The contractor who is willing to participate in tender process, and if he is not having experience of particular sub-work, then he is allowed to have collaboration with other agency or contractor registered with Maharashtra Jeevan Pradhikaran or any government department in India or any contractor (in case of automation) in appropriate class and having experience of the particular sub-work as specified in pre-qualification criteria. Contractor with whom above collaboration is done shall be responsible for successful completion of the works. However it will be the responsibility of the principal contractor to get the work done.

In no case value of work to be done by collaborator, with whom collaboration is made, should exceed the value of work to be done by the principal contractor.

a) In no case the value of work done by the Principal Contractor shall be less than 51 percent.
b) Collaborating firm can have collaboration with multiple principal contractor.
c) One principal contractor can not be collaborator to another principal contractor in the same Bid.
d) The principal contractor shall be ultimately responsible for completion of entire work.

e) Moreover with whom collaboration is made will only be binding to carry out the work to the effect of principal contractor & should submit an agreement on Rs. 100/- stamp paper as per prescribed form (Annexure 6A) duly Notarized at the time of pre-qualification of bidder.

f) The Principal Contractor can have maximum two collabora- tions,i.e. one for Civil works & one for Mechanical & Ellectrical works.

g) Collaborator shall be a registered contractor in a appropriate class required to get him eligible to quote the tender amounting to the cost of sub work for which collaboration is being done.

Joint Venture :-

The contractor who is interested to have blank tender form and if he do not have necessary experience of similar type of work then he is allowed to have joint venture with another agency having the experience of similar type of civil work.

If there is joint venture, same shall be in appropriate format as per Annexure 6B and it shall be clearly mentioned in the agreement that both the contractor will be

jointly and severally responsible for the successful completion of works included in the tender with all test and trials for full tender period. It is necessary to enclose the registra- tion certificates of joint venture firm with the Registrar of the Part- nership Firm or the receipt of payment made to Registrar of the Part- nership Firm on account of fees toward joint venture firm with condition of submitting registration certificate before issue of work order. Then only pre qualification application will be considered. In the case of joint venture, the contractor having higher class of registration will only be considered.

In Joint Venture, the contractor having major share shall have registration in class mentioned in tender i.e. the class required to execute the entire work for which the Joint Venture is done. The contractor having minor share shall have registration in appropriate class, required to get him eligible to execute the proportionate cost of work, derived on the basis of his share in Joint Venture.

In case of equal share in Joint Venture (i.e. 50% each), both the contractor shall have registration of required class mentioned in the tender.

Incase of work of erection of High Tension Installations, main contractor shall have joint venture with the registered Mechanical/Pumping Machinery contractor. Manufacturer representative shall be present during the erection.

8. COST OF BLANK TENDER FORM

- Rs. 59,000/- per set Blank Tender documents will not be sold by this office. Interested contractors have to download tender documents from the website.
- Cost of blank tender form shall not be accepted in the form of cash or cheque. The cost of the tender documents will not be refunded under any circumstances.

9. ISSUE OF BLANK TENDER FORM

The blank tender forms will have to be downloaded, from the website **http://mahatenders.gov.in** as per online schedule.

10. PRE-TENDER CONFERENCE

Pre-Tender conference is open to all prospective tenderers and will be held on 24/01/2023 **at** 12.30 hours in the office **of The Commissioner Sangli Miraj and kupwad City Muncipal Corporation** wherein the prospective tenderers will have opportunity to obtain clarifications regarding the work and the tender conditions.

The prospective tenderers are free to ask for any additional information or clarification either in writing or orally and the reply to the same will be given in writing and this clarification referred to as common set of conditions, shall also be common and applicable to all tenderers. The minutes of this meeting along with the letters of tenderers will form the part and parcel of the tender documents. Bidder need to submit online signed copy of pre bid minutes in a technical bid.

11. VALIDITY OF THE OFFER

120 days from the date opening of the financial bid of tender.

12. LAST DATE & TIME OF ONLINE SUBMISSION OF TENDER FORM

AS per Schedule.

13. DATE & TIME OF ONLINE OPENING OF TENDER

AS per Schedule in the office of The Commissioner Sangli Miraj and kupwad City Muncipal Corporation

14. SUBMISSION OF TENDER

Bids must be accompanied with:

a. The firm shall have valid CGST & SGST registration No. or TIN No.

b. The firm shall have valid PAN No.

c. Copy of online payment receipt of EMD

d. Scanned copy of all documents, certificates specified in Pre-qualification Criteria in Point No.6.

e. Scanned copy of duly signed declaration of contractor in prescribed format filled in agency's letter head attached with the tender. (Annexure- 5)

f. Scanned copy of duly signed undertaking for guarantee in prescribed format filled in agency's letter head attached with the tender. (Annexure-4)

g. Scanned copy of minutes of Pre-bid meeting duly signed by Contractor.

h. Scanned copy of Joint Venture (Annexure 6 B) / Collaboration in prescribed format. (Annexure 6A)

i. Scanned copy of the registration certificate in appropriate class for Individual contractor and registration certificates of both the contractors in case of collaboration and Joint Venture.

j. The Contractor should submit declaration of his firm that the name of his firm is not black listed by Govt. or semi Govt. department. The scanned copy of the declaration should be submitted in envelope no. 1. (Annexure 13)

k. The affidavit on Rs. 500/- stamp stating that, the contractor is liable for action under penal code if any papers are found false / fraudulent during contract period and even after the completion of contract should be appended as per Para 2.1 of Maharashrta Govt. Resolution No.CAT-2018 / prakra-127/Ima-2/ Dt.28/11/2018 (Annexture 9)

l. Following documents for Bid Capapcity Calculation should be submitted

(i) Calculations of Bid Capacity (Certified by Chartered Accountant). Details of audited

turnover executed by the contractor in last five years and existing commitment of ongoing work.(Annexure 7).

(ii) Annual Turn Over (Certified by Chartered Accountant for last five years)

(iii) Annexure 14 (Certified by Chartered Accountant).

(iv) Annexure 15- Self declaration which includes litigation.

(v) Work in Hand - existing commitments of ongoing works counter signed by Engineer-in-charge not below the rank of Executive Engineer or equivalent officer or head of any other Govt./semi Govt. organization.

(vi) Net worth document as per criteria mentioned in 6 (IX)

m. Scan copy of Bar Chart duly signed by the contractor. (Annexure-8)

n. The firm shall have EPF Registration certificate.

o. Declaration/authority letter for site visit and geo tagging (Annexure 16).

Bid shall be treated as invalid if scanned copies as mentioned above are not submitted online along with the bid.

The guidelines, "to download the tender document and online submission of bids procedure of tender opening" can be downloaded from website "**http://mahatenders.gov.in**".

14.1 The two envelopes No. 1 & 2 shall be digitally sealed and signed and submitted online as per the online tender schedule.

14.2 The date and time for online submission of envelopes shall strictly apply in all cases. The tenderers should ensure that their tender is prepared online before the expiry of the scheduled date and time and then submitted online before the expiry of the scheduled date and time. Offers not submitted online will not be entertained.

14.3 If for any reason, any interested bidder fails to complete any of online stages during the complete tender cycle, department shall not be responsible and any grievance regarding that shall not be entertained.

15. OPENING OF TENDER

The tenders will be opened on the date specified in the tender notice or on the date intimated to prospective bidders, in the presence of the intending bidders or their authorized representative to whom they may choose to remain present along with the copy of the original documents submitted for Pre Qualification. Following procedure will be adopted for opening of the tender.

Envelope No. I (Technical Bid)

First of all, Envelope No. 1 of the tenderer will be opened online through e-Tendering procedure to verify its contents as per requirements. Scanned copies of following documents shall be in Envelope No. 1.

a. The firm shall have valid CGST & SGST registration No. or TIN No.

b. The firm shall have valid PAN No.

c. Copy of online payment receipt of EMD

d. Scanned copy of all documents, certificates specified in Pre-qualification Criteria in Point No.6.

e. Scanned copy of duly signed declaration of contractor in prescribed format filled in agency's letter head attached with the tender. (Annexure- 5)

f. Scanned copy of duly signed undertaking for guarantee in prescribed format filled in agency's letter head attached with the tender. (Annexure-4)

g. Scanned copy of minutes of Pre-bid meeting duly signed by Contractor.

h. Scanned copy of Joint Venture (Annexure 6 B) / Collaboration in prescribed format. (Annexure 6A)

i. Scanned copy of the registration certificate in appropriate class for Individual contractor and registration certificates of both the contractors in case of collaboration and Joint Venture.

j. The Contractor should submit declaration of his firm that the name of his firm is not black listed by Govt. or semi Govt. department. The scanned copy of the declaration should be submitted in envelope no. 1. (Annexure 13)

k. The affidavit on Rs. 500/- stamp stating that, the contractor is liable for action under penal code if any papers are found false / fraudulent during contract period and even after the completion of contract should be appended as per Para 2.1 of Maharashrta Govt. Resolution No.CAT-2018 / prakra-127/Ima-2/ Dt.28/11/2018 (Annexture 9)

l. Following documents for Bid Capapcity Calculation should be submitted

(i) Calculations of Bid Capacity (Certified by Chartered Accountant). Details of audited turnover executed by the contractor in last five years and existing commitment of ongoing work.(Annexure 7).

(ii) Annual Turn Over (Certified by Chartered Accountant for last five years)

(iii) Annexure 14 (Certified by Chartered Accountant).

(iv) Annexure 15- Self declaration which includes litigation.

(v) Work in Hand - existing commitments of ongoing works counter signed by Engineer-in-charge not below the rank of Executive Engineer or equivalent officer or head of any other Govt./semi Govt. organization.

(vi) Net worth document as per criteria mentioned in 6 (IX)

m. Scan copy of Bar Chart duly signed by the contractor. (Annexure-8)

n. The firm shall have EPF Registration certificate.

o. Declaration/authority letter for site visit and geo tagging (Annexure 16).

If the various documents contained in this Envelope do not meet the requirements as stated above, a note will be recorded accordingly by the tender opening authority and the envelope No. II of such tenderers will not be considered for further action and the same will be rejected. Also tender will be liable for rejection if bidder mention his commercial offer anywhere in envelop No.1

Envelope No. II (Commercial Bid)

This envelope shall be opened online through e-Tendering procedure after opening of envelope No. 1 only, if the contents of Envelope No. 1 are found to be acceptable to the SMKC/Corporation/council. The tendered rate shall then be read out by the tender opening authority.

16. INSURANCE

Contractor shall take out necessary Insurance policy/policies so as to provide adequate Insurance cover of execution of awarded contract work from the Director of Insurance, Maharashtra State Mumbai-51 only. Its postal address for correspondence is 264, I st Floor MHADA, opposite Kala Nagar, Bandra East, Mumbai-400051 (Tel.No.6438403/Fax6438461). Insurance policy/policies taken out from other company will not be accepted. However, if the same should be under the co-insurance cum-servicing arrangements approved by the Director of Insurance. If the policy taken out by the contractor is not on coinsurance basis

(G.I.F.60% and Insurance company 40%) the same will not be accepted and the amount of Premium calculated by the Director of Insurance will be recovered directly from the amount Payable to the contractor for the executed contracted work which may be noted.

17. GST/GST TDS

The rates quoted by the contractor must be inclusive of all relevant taxes except GST.No extra payment of this account will be made to the Contractor.

a) Bidder shall quotes his rate excluding G.S.T.
b) GST shall be paid on the amount of bill of the work done as per prevailing guidelines rate of GST during the period of work done as applicable
c) The rates quoted by the contractor shall be deemed to inclusive of the labour

welfare cess and other taxes (Other than GST) that the contractor will have to pay for the performance of his contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

d) The bidder shall quote his rate considering the provisions counted under GST Act 2017

e) Amount of GST 2% i.e. CGST & SGST each 1% will be deducted at source (T.D.S.) from 01.10.2018.

18. GEO TAGGING

1) It shall be binding for all contractors to inspect the work site, quarry area and othr important site location before filling the tender.

2) The officers calling for the tender have to fix 3 (three) site location for geo tagging for effective site visit. (Details of location visit will be made available at the time of site visit)

3) The officers calling for the tender or representative will be available during office hours at S MKC Drainage dept. office Hirabag Sangli. During the period 5 working days before tender closing date .the site visit to carry out procedure of geo tagging effectively.

4) The contractor himself or his authorized representative shall carry out Geo-tagging and shall submit authority letter to the department. The declaration / Authority letter dully attested ith date and time of the site visit. The contractor himself or his authorized representative shall satisfied the representative officers calling for the tender present at the site by giving his identity or showing authentic identity card and shall keep the procedure confidential (Annexure)

5) The contractor shall submit Geo Tagging with Declaration / Authority (form attached with tender) letter in Envelope No. 1. Without Geo tagging the tender will not be considered.

6) The Contractor shall submit the geo tagging of location / spots as specified below –
   1. Ahilyanagar Wet well and pumping Station.
   2. Tuljai Nagar Wet well and pumping Station.
   3. Jagruti Wet well
   4. Kumbhar Mala Wet Well Pumping station and STP.

19. RIGHT RESERVED

a) Right to reject any or all tenders without assigning any reason thereof is reserved by the competent authority, whose decision will be final and legally binding on all the tenderer.

b) Tender with stipulations for settlement of a dispute by reference to Arbitration will not be entertained.

Sd/-
The Commissioner
Sangli Miraj Kupwad City
Muncipal Corporation

Contractor No of Correction Executive Engineer SMKC

ANNEXURE-1

INFORMATION ABOUT WORK IN HAND

(To be supported with certificate signed by concerned Superintending Engineer/City Engineer) in case Col. 8 shows the cost of completed work as more than 80%)

Sr. No.	Name of Works	Name of Division /MC	Accepted Tender Cost.	Cost of supply of pipes	Balance cost (4-5)	Cost of work completed as on _____ (Excluding supply of pipe)	Proportion of Col.7 to Col.6 %	Reason for delay (if any) for completion of balance work.
1	2	3	4	5	6	7	8	9

Contractor No of Correction Executive Engineer SMKC

ANNEXURE-2

DETAILS OF MACHINERY AVAILABLE WITH THE TENDERER

FOR THE USE ON THIS WORK

Sr.No	Name of Equipment	No. of unit	Name of Make	Capacity	Age and Condition	Remark

ANNEXURE-3

FORM OF BANK GUARANTEE
BANK GUARANTEE
(***Security for Performance***)

In consideration of the Commissioner/Chief Officer (hereinafter called "…….. Municipal Corporation" (..MC) having agreed to exempt hereafter called "The said contractor") from the demand, under the terms and conditions of an Agreement dated (hereafter called "the said Agreement") made between the Commissioner/Chief Officer …MC and the said contractor for the Security Deposit for the due fulfillment by the said contractor of the terms and conditions contained in the said Agreement, on production of the Bank Guarantee for Rs_____(In words Rs_____) we, (hereinafter referred to as "the Bank" at the request of the said contractor do hereby undertake to pay to the MC an amount not exceeding the above said amount of Guarantee against any loss or damage caused to or would be caused to or suffered by the …MC by reason of any breach by the said contractor or any of the terms or conditions.

2. We, _____ do hereby undertake to pay the amounts due and payable under this Guarantee without any demur, in hereby on a demand from the …MC stating that the amount claimed is due by way of loss or damage caused to or would be to or suffered by the …MC by reason of breach of the said contractor of any of the terms or condition contained in the said agreement or any reason of the contractor's failure to perform the said Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding the above said amount Guarantee.

3. WE undertake to pay to the …MC any money so demanded not withstanding any dispute or disputes raised by the Contractor in any suit or proceeding pending before any court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the contractor shall have no claim against us for making such payment

4. We _____ further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continued to be enforceable till all the dues of the ….MC under or by virtue of the said Agreement have

been fully paid and its claims satisfied or discharged till …MC certified that the terms and conditions of the said Agreement have been duly and properly carried out by the said contractor and accordingly discharges this guarantee unless a demand or claim under this guarantee is made on us in writing on or before we shall be discharged from all liability under this guarantee thereafter.

5. We _____ further agree with the …MC that the ….MC shall have the fullest liberty without our consent and without affecting in any manner our obligations here under to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the …MC against the said contractor and to forbear or enforce any of the terms and conditions relating to the said Agreement, and we shall not be relieved from any liability by reason of any such variation, or extension being granted to the said contractor, or for any forbearance act or omission on the part of the …MC any indulgence by the ….MC to the said contractor or by any such matter or thing whatsoever which under the law to sureties would, but for this provisions, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or of the Contractor.

7. We, lastly undertake not revoke this guarantee during its currency except with the previous consent of the ….MC in writing.

Dated the day of 2022-23

For _____

(Indicate the name of the Bank)

<u>Note: However, these forms will be as per the current practices of ….MC and Banks</u>.

ANNEXURE-4

UNDERTAKING FOR GUARANTEE

I/We Guarantee that :

1 I/We will replace repair and adjust free of all charges to the employer any part of the work which fails to comply with the Specifications or amendment to such specifications as refereed to in our specifications attached to tender, fair were and tear except until the completion and for a period mentioned under clause 20 from the date or completion of contract.

2 All the work will be reliable.

3 All the work will be of a type which has been proved in service to be suitable for the duty required by the specifications and will be manufactured and tested in accordance with the appropriate standard specifications approved by the Engineer-in-charge.

4 I/We accept the abide by the clause relating to quality and guarantee of work.

DATE : CONTRACTOR

ANNEXURE-5

DECLARATION BY CONTRACTOR

…… Muncipal Corporation/Council
WATER SUPPLY DEPARTMENT

Name of work :- ----------Ta.--------- - ---------- Dist.----------,----------

DECLARATION

I hereby declare that I have made myself thoroughly conversant with the local conditions regarding all materials such as stones, murum, sand, availability of water etc. and labour on which I have based my rates for this work. The specifications and requirements of lead for this work have been carefully studied and understood by me before submitting the tender. I undertake to use only the best materials, to be approved by the Chief Engineer/Commissioner/Chief Officer/Engineer in charge of the work or his duly authorized representative, before starting the work and also to abide by his decision.

I hereby undertake to pay the labours engaged on the work as per Minimum Wages Act 1984 applicable to the zone concerned.

Contractor's Signature

ANNEXURE-6A

COLLABORATION AGREEMENT

COLLABORATION AGREEMENT

This agreement made at (Place) _____ this day (date, month and year) between M/s. _____ (Name of the bidder, who intends to collaborate and its registered office address) here-in-after referred as (Principal contractor) which expression shall unless it be repugnant to the context or contrary to the meaning there of be deemed to mean and includes its successors in business and permitted assigns of the ONE PART and M/s ----------(name of the collaborator and its registered address) here-in-after referred as (Collaborator) which expression shall unless it be repugnant to the context or contrary to the meaning there of be deemed to mean and includes its successors in business and permitted assigns of the OTHER PART.

WHERE AS

1) …… Municipal Corporation/Council has floated a tender for the work ---------- ---------- Ta.---------- ---------- Dist

(Principal contractor) ----------registered with Maharashtra Jeevan Pradhikaran/MCGM/MIDC/CIDCOANY GOVT ORGANIZATION in Class -------- is a well established contractor engaged in the activities of execution of water supply projects.

1. (Collaborator) ----------Registered with Maharashtra Jeevan Pradhikran/MIDC/MCGM/CIDCO/ANY GOVT in Civil/Mechnical Class--------- is well established contractor having the experience of work mentioned in para 4.

1. The principal contractor desires to collaborate with the collaborator for execution of following works, as he don't have sufficient experience of this particular work included in tender as mentioned in para 1 above.

Sr.No.	Name of work	Amount
	Total :-	

(Note *:- It is obligatory to furnish above information otherwise collaboration agreement will not be considered).*

1. The Parties hereto have come together to set up a collaboration in order to quote for the tender mention in para 1 above and on award of the tender to jointly execute the work as mentioned in para 4 above as well as to guarantee it's perfect execution utilizing the technical experience. The principal contractor involved in this collaboration, directly or indirectly will hold fully responsible towards …… Municipal Corporation to look after the execution of the said work as per the terms and conditions and specifications mentioned in tender.

NOW IT IS HEREBY AGREED BY AND BETWEEN THE PARTIES HERETO AS UNDER :-

1) In consideration of the mutual understanding, trust and confidence each of the parties in other, they have mutually agreed to form a collaboration to submit the tender and if the tender is accepted by the …….. Municipal Corporation/Council then carry on the business as a collaboration in respect of development and execution of the said work in accordance with the terms and conditions that may be imposed or agreed by and between the …….. Municipal Corporation/Council and the Principal contractor hereto.

2) The collaborator shall be responsible for completion of works for which the collaboration is made, however the principal contractor shall be ultimately responsible and liable for completion of entire works in accordance with the terms and conditions on which the award to execute the work is made by …….. Municipal Corporation/Council under the said tender.

3) In the event of any dispute or difference or misunderstanding arises between both of them in course of execution of the work after the award of the work to the Principal contractor by …… Municipal Corporation, the same shall be referred to Commissioner SMKC and his decision in this respect shall be final and binding on both the parties.

IN WITNESS WHERE OF the parties hereunto have set and subscribed there respective hands and seals the day, month and year first above written.

SIGNED, SEALED AND DELIVERED
BY THE WITH NAME

(Name of First Party) **(Name of Second Party)**

WITNESS :-

1.

2.

JOINT VENTURE AGREEMENT

ANNEXURE –6B

JOINT VENTURE AGREEMENT

JOINT VENTURE AGREEMENT

This agreement of joint venture made and entered into at _ on this _____ day of …… by and between.

1. PARTY NO.1:- _____
   _____
   _____
2. PARTY NO.2:- _____
   _____

1. Name of joint venture firm _____
   _____

1. Period of Joint Venture is valid upto _____.

DEFINITION

In this deed the following words and expressions shall have the meaning set out below

The joint venture (J.V.) shall mean _____ *(Party No.1)* _____ and _____ *(Party No.2)* _____ Collectivity acting in collaboration for the purpose of this agreement.

"Appex Co-ordination Body (ACB) shall mean the body comprising the managing director of _____ *(Party No.1)* _____ and managing director of _____ *(Party No.2)* _____ - as the two partners of the Joint Venture. New firm will be _____ *(Name of joint venture firm)* _____".

"The Employer" shall mean the COMMISSIONER/CHIEF OFFICER

The 'work' shall mean .....
.....
.....
.....

.....
.....

"The contract" shall mean the contract emerged into or to be entered into between the joint venture and the employer for the work.

JOINT VENTURE

Whereas Parties hereto declare that they agree and undertake to form a joint venture for the purpose of applying for pre-qualification for tender and if pre-qualified to execute the work, as an integrated joint venture. The J.V. shall be called as "*Name of joint venture firm*".

The parties are not, under this agreement entering into any permanent partnership or joint venture to tender for undertake any contract other than the subject work.

WITNESS

Whereas the COMMISSIONER/CHIEF OFFICER. hereinafter referred as the Executive Engineer/COMMISSIONER/CHIEF OFFICER, have invited pre-qualification for the work of.....
.....
.....
.....
.....

Whereas "as *Name of joint venture firm* wish to apply for pre-qualification for tender and if pre-qualified to execute the work if awarded as per the terms for the bid documents contract.

Now Therefore This Deed of Partnership Witnesses As Follow :-

1. That these recitals are and shall be deemed to have been part and parcel of the present Agreement of joint venture.

1. That this Agreement shall come into force from the date of this Agreement i.e. ___ day of ……..

1. That the operation of this agreement for joint venture firm concerns and is confined to this work only.

1. That the name of the joint venture firm shall be "*Name of joint venture firm*

_____.

2. That "*Name of joint venture firm*" shall jointly execute the work according to all terms and conditions as stated in the relevant instruction contained in the bid document contract as integrated joint venture styled.

1. That this agreement for J.V. shall regulate the relations between the parties and shall include without being limited to them the following condition.

a. "*Name of joint venture firm*" shall be the lead company in charge of the joint venture, for all intents and purpose.

a. The parties here to shall be jointly and severally liable to employer for all act, deeds and things pertaining to the contract.

a. That the managing director of the lead partner of the joint venture shall be the manager of the joint venture firm and shall have the power to control and manage the affairs of the joint venture.
b. That on behalf of the "*Name of joint venture firm, the manager*" shall have the authority to incur liabilities, receive instructions and payments, sign and execute the contract for and on the joint venture. All payment and under the contract shall be made into the joint venture's bank account.

a. One bank account shall be opened in the name of J.V. to be operated by the individual signatory as mutually decided by the representatives of joint venture partners.
b. That each partners of the J.V. agrees and undertakes to place at the disposal of the joint venture the benefit of its individual experience, technical knowledge and skill and shall in all respects bear its share of the responsibilities including the provision of information, advice and other assistance required in connection with the work. The share and the participation of the all the partner in the joint venture shall broadly be as follows.

Name of partner	Percentage of shares
1. *Party No.1*	
2. *Party No.2*	

a. And all rights, interests, liabilities, obligations, work experience and risks (and all net profit or net losses) arising out of the contract shall be shared or born by the parties in

proportion to these share. Each of the parties shall furnish its proportionate share in any bounds, guarantees, sureties required for the work as well as its proportionate share in any working capital and other financial requirements, all in accordance with the decisions of the ACB.

b. Any loan/advances shall be shared by the _____ *Party No.1 and Party No.2* _____ at the ratio of _____ & _____ respectively.
c. All funds, finance or working capital required for carrying out and executing the works or contract shall be procured and utilized by the parties as mutually agreed by them.

a. **Site management :-**

A project manager appointed by ACB will manage the execution of the work on the site. The project manager shall be authorized to represent the joint venture on site, in respect of matters arising out of or under the contract.

a. The _____ *Name of joint venture firm* _____ shall be jointly and severally responsible and liable towards the employer for the execution of the contract condition.
b. The joint venture deed shall be registered with the Registrar of partnership firms, Govt. of Maharashtra.
c. This joint venture agreement shall not be dissolved till the completion of defect liability period as stipulated in the tender document condition of works.
d. This joint venture agreement is deemed to be null and void in case the joint venture firm is not qualified by the employer or unsuccessful in the award of work.
e. That question relating to validity and interpretation on this deed shall be governed by the laws of India. Any disputes in interpretation of any conditions mentioned herein shall be referred to Comissioner, Sangli MIraj Kupwad City MC and his decision in this respect shall be final and binding to both the parties. Neither the obligation of each party hereto performs the contract nor the execution of the work shall stop during the course of this arbitration processing or as a result there of.
f. That no party to the J.V. has the right to assign any benefits, obligations or liability under the agreement to any third party without obtaining the written consent of the other partner and employer.
g. Bank account in the name of the joint venture firm may be opened with any scheduled or nationalized bank and the representatives of the J.V. partner are authorized to operate upon individually.
h. That both the parties to the J.V. shall be responsible to maintain or cause to maintain proper books of accounts in respect of the business of the joint venture firm and the same shall be closed as at the end of the every financial year.
i. That the financial year of the firm shall be the year ended on the 31st March of every year.

j. That upon closure of the books of account balance sheet and profit and loss account as to that state of affairs of the firms as the end of the financial year and as to the profit or loss made or incurred by the firm of the year ended of that day, respectively shall be prepared and the same shall be subject to audit by a chartered accountant.

LEGAL JURISDICTION

All matters pertaining or to commencing from this joint venture agreement involving the employer shall be subject to jurisdiction of high court of judicature at Mumbai.

NOTICES AND CORRESPONDENCE

All correspondence and notice to the joint venture shall be sent to the following address.

(Address)

SIGNED, SEALED AND DELIVERED
BY THE WITH NAME

(Name of First Party) **(Name of Second Party)**

WITNESS :-

1.

2.

Annexure-7

Details of audited turnover exected by the contractor in last five years and existing commitment of ongoing work.

(in Rs. Cr.)

Abstract for BID Capacity Calculation

Details of audited turnover exected by the contractor in last five years and existing commitment of ongoing work.

Sr. No	Name of Works	Name of Division /MC	Accepted Tender Cost.	Amount of work completed					Amount of balance work	Remark
				2017-18	2018-19	2019-20	2020-21	2021-22		

Year	Max. value of engineering works executed in the year	Maximum value of engineering works executed by the the contractor in any one year, during the last five years		Remarks
		Value	**Year**	
1	**2**	**3**	**4**	**5**
2017-18		Write the max value here	Write concerned year here	
2018-19				
2019-20				
2020-21				
2021-22				

(Rs. In Crore)

Contractor No of Correction Executive Engineer SMKC

Year	Value of existing commitment of ongoing work to be completed during next **N** years	Total value of existing commitment of ongoing work to be completed during next **N** years. (B)
1	**2**	**3**
2022-23		
2023-24		
2024-25		

Average of engineering works of a maximum value executed in any three years during last five years upgrade to present year (i.e. Tender submission year) by increasing the cost as per rise in wholesale price index between the year of maximum value and month and year of tender submission (A) =……

No. of year prescribed for completion of work for which present tender are invited (N) =

Total value of existing commitment of ongoing work to be completed during next **N** years (B) =

Note :-

- Since all the data is pertaining to the contractors own performance, the contractors are requested to provide its bidding capacity for this work by furnishing the calculations and supporting documents duly certified by chartered accountant to prove its contentions
- Ongoing works and works were contractor is lowest and for which letter intent has been issue to the contractor shall be considered in the calculation of value of existing commitement and ongoing works. (B)
- The statement showing the value of existing commitments of ongoing works during next N years for each of works in the list should be counter signed by Engineer-in-charge not below the rank of Executive Engineer or equivalent officer or head of any other Govt/semi Govt. organization.
- Submission of false information results in blacklisting of the contracting agency.
- Bidder shall submit the affidavit as per the format provided in the Annexure 14.
- Bidder shall submit the self declaration as per the format provided in Annexure 15.
- Annual turnovers and Bid capacity calculations shall submitted in contractors letter head with signature of contractor. Same shall be submitted due verified certification of the Chartered Accountant.
- If support documents are not found uploaded, bid capacity will not be taken into account which will result in disqualification for this tender .

ANNEXURE-8

BAR CHART

Sr. No.	Name Of Subwork	Month up to 24 Months																					

Contractor No of Correction Executive Engineer SMKC

ANNEXURE-9

AFFIDAVIT (on Rs. 500/- Stamp Paper)

I…….age…… ……..address…… (Authorized signatory to sign the contract), hereby submit, vide this affidavit in truth, that I am the owner of the contracting firm……../ authorized signatory and I am submitting the documents in envelope no. 1 for the purpose of scrutiny of the contract. I hereby agree to the conditions mentioned below :

I am liable for action under Indian penal code for submission of any false / fraudulent paper / information submitted in envelope no. 1.

I am liable for action under Indian penal code if during contract period and defect liability period, any false information, false bill of purchases supporting proof or purchase, proof of testing submitted by my staff, subletting company or by myself, I will be liable for action under Indian Penal Code.

I am liable for action under Indian penal code if any paper are found false / fraudulent during contract period and even after the completion of contract (finalization of final bill).

(Signature of Contractor)
(Seal of Company)

Annexure 10

विषयः स्वीकृत निविदेतील कलम-2 नुसार, कंत्राटदारास दंडाची आकारणी, दंड कमी करणे, दंड स्थगित करणे, दंडाची रक्कम परत करणे याविषयी सूचना खालीलप्रमाणे.

निधी, उपांगासाठीची जागा इत्यादि सर्व बाबी उपलब्ध असून ठेकेदारास काम करण्यास कोणतीही अडचण नसतानाही स्वीकृत निविदेंतर्गत कामांची बारचार्टनुसार प्रगती न राखणे, काम पूर्णत्वास नेण्यास टाळाटाळ करणे, सूचना देवूनही कामे संथ गतीने करणे इत्यादि बाबतीत बी/1 निविदेतील कलम-2 च्या अनुषंगाने ठेकेदारावर आकारावयाच्या दंडाबाबत सविस्तर सूचना देण्यात आल्या आहेत. त्याचप्रमाणे ठेकेदाराने विहीत मुदतीत काम पूर्ण केल्यास आकारण्यात आलेल्या दंडाचा परतावा करण्याविषयीच्या सूचना निर्गमित करण्यात आल्या आहेत.
दंडाची आकारणी व परतावा याबाबतीत खालीलप्रमाणे कार्यवाही करण्यात येईल.

निविदेनुसार प्रकल्प पूर्ण करण्याचा कालावधी विचारात घेऊन, निविदेत समाविष्ट सर्व उपांगांचे काम पूर्ण करण्यासंबंधीचे नियोजित कार्यक्रम दर्शविणारा बारचार्ट निविदा संचामध्ये अंतर्भूत केलेला आहे. ठेकेदाराने निविदा सादर करताना, सदर बारचार्टवर संमतीदर्शक स्वाक्षरीसह किंवा योजना पूर्ण करण्याच्या कालावधीमध्ये बदल न करता, सुधारित बारचार्ट तयार करुन स्वाक्षरीसह निविदेसोबत सादर करावा.

2. अ) मजीप्रा ने प्रत्येक महिन्यात कामाचा आढावा घेऊन खालील विवरणपत्रानुसार नियोजित व प्रत्यक्ष प्रगतीचा तपशील चालू देयकासोबत मनपा कार्यालयास सादर करेल.
ब) मनपा कार्यालयाने आढाव्या बाबतचे विवरणपत्र तपासून ज्या-ज्या उपांगांच्या बाबतीत प्रत्यक्षात प्रगती कमी आहे, अशा कामांच्या उल्लेखासह ठेकेदारास नोटीस देईल.

Sr. No.	Date of review	Name of Subwork	A/T Cod or cost put to tender of subwork whichever is more	Amount of works not handed over / line out not given to contractor	Net amount of works handed over / line out given to contractor (४-५)	Expected physical progress as per barchart in %	Expected cost of work as per barchart in rupees	Achived physical progress in %	Cost of work as per achieved physical progress in rupees	Difference in physical progress in % (७-९)	Difference in cost of work (८-१०)
१	२	३	४	५	६	७	८	९	१०	११	१२

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३. अ) संबंधीत कार्यकारी अभियंता मनपा सांगली निविदेंतर्गत कामांच्या प्रगतीचा आढावा दरवर्षाच्या जानेवारी व जुलै महिन्याच्या दुसऱ्या आठवड्यात घेण्यात येईल. आढाव्याचा तपशील पुढील विवरणपत्रानुसार अभिलेखी ठेवण्यात येईल.

Sr. No.	Date of review	Name of Subwork	A/T Cod or cost put to tender of subwork whichever is more	Amount of works not handed over / line out not given to contractor	Net amount of works handed over / line out given to contractor (4-5)	Expected physical progress as per barchart in %	Expected cost of work as per barchart in rupees	Achived physical progress in %	Cost of work as per achieved physical progress in rupees	Difference in physical progress in % (7-9)	Difference in cost of work (8-10)
1	2	3	4	5	6	7	8	9	10	11	12

ब) दंड आकारणी करताना भूसंपादन, वन जमीन संपादन, खात्यामार्फत पाईप पुरवठा वेळेवर न होणे, पुढील टप्प्यामधील कामांना मंजूरी प्राप्त नसणे, रोड/रेल्वेक्रॉसिंग इत्यादि कारणांमुळे बंद असलेल्या / क्लीअर लाईन आऊट न दिलेल्या म्हणजेच कामाच्या विलंबास ठेकेदार जबाबदार नाही अशा कामांसाठी दंडाची आकारणी करण्यात येणार नाही. विलंबास ठेकेदार जबाबदार नाही अशा कामांची किंमत वजा करुन दंडाची आकारणी करण्यात येईल. आढाव्या अंतीवरीलप्रमाणे अभिलेखी ठेवलेल्या विवरणपत्रानुसार ठेकेदाराने मान्य केलेल्या बारचार्टमधील नियोजित प्रगती आणि ठेकेदाराने प्रत्यक्षात साध्य केलेली प्रगती यांच्यामध्ये कमी प्रगती दिसून आल्यास वरील विवरण पत्रातील स्तंभ क्र.12 मधील फरकाच्या किंमतीवर कंत्राटदारावर दंड आकारणी करण्याचा प्रस्ताव तयार करुन दंड मंजूर करण्यास अधीक्षक अभियंता यांच्याकडे 7 दिवसामध्ये सादर करण्यात येईल.

ड) दंड आकारणीच्या प्रस्तावासोबत बारचार्टनुसार पूर्ण करावयाच्या कामांचा तपशील, विलंबास ठेकेदार जबाबदार नाही अशा कामांचा तपशील, ठेकेदाराने पूर्ण केलेल्या कामांचा तपशील, निविदेनुसार काम पूर्ण करण्याचा कालावधी, बारचार्ट इत्यादि सर्व माहिती सादर करावी.

४. अ) Formula for calculation of fine to be imposed is as below :

$$\text{Minimum fine to be imposed per day} = \frac{\text{Difference in cost of work lagging according to barchart (as per column No १२ as per review)}}{\text{१८० days or Work completion period whichever is less.}} \times \frac{५}{१००}$$

ब) दंडाची परिगणना करताना, स्वीकृत निविदेची किंमत व निविदेतील कामांची अंदाजित किंमत यापैकी जी किंमत जास्त असेल ती किंमत विचारात घेण्यात येईल.

क) कामाच्या दरवर्षाच्या जानेवारी व जुलै महिन्याच्या आढाव्यानंतर कामाची प्रगती बारचार्टनुसार समाधानकारक नसल्यास फेब्रुवारी तसेच ऑगस्ट महिन्यामध्ये दंडाची आकारणी करण्यात येईल.

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ड) प्रत्येक आढाव्यानंतर प्रगतीनुरुप उर्वरित प्रलंबित कामांच्या किंमतीवर आधारित नव्याने दंडाची आकारणी करण्यात येईल. उदा.- फेब्रुवारी महिन्यामध्ये दंडाची आकारणी केली असल्यास आणि जुलै महिन्याच्या आढाव्यानंतरही कामाची प्रगती बारचार्टनुसार समाधानकारक नसल्यास व पुन्हा दंडाची आकारणी करणे क्रम प्राप्त ठरल्यास, फेब्रुवारी महिन्यातील दंडाची आकारणी संपुष्टात आणून आढाव्यानुसार ऑगस्टमध्ये नव्याने दंडाची आकारणी करण्यात येईल.

इ) ठेकेदाराने विहीत वेळेत काम पूर्ण केल्यास, आकारणी करण्यात आलेल्या दंडाची अंशतः/ पूर्ण रक्कम परत करण्याविषयीचा प्रस्ताव असल्यास, तो प्रस्ताव प्रत्येक वर्षाच्या मार्च व सप्टेंबर महिन्यामध्ये सादर करण्यात येईल.

ई) उदाहरणादाखल दंड आकारणी करण्याविषयीचा नमुना परिगणनेचा तपशील सहपत्र क्र.3 नुसार मार्गदर्शनार्थ संलग्न केले आहे.

५. अ) दंडाची आकारणी, दंड कमी करणे, दंड स्थगित करणे, दंडाची रक्कम परत करणे याविषयीचा अधिकार **सांमिकु मनपा ची** राहील.

ब) वरील अधिकारानुसार, दंड आकारणीचा अधिकार निश्चित करण्यात आला असला तरी योजनेच्या आढाव्या दरम्यान किंवा योजनेच्या क्षेत्रिय पाहणीच्या वेळी कंत्राटदार विलंबाने काम करीत असल्याचे वरिष्ठ अधिकाऱ्यांच्या निदर्शनास आले तर, अशाप्रकरणी दंड लावण्याचा अधिकार संबंधीत वरिष्ठ अधिकाऱ्यास सुध्दा राहील.

६. भूसंपादन, वनजमीन संपादन, खात्यामार्फत पाईप पुरवठा वेळेवर न होणे, पुढील टप्प्यामधील कामांना मंजूरी प्राप्त नसणे, रोड / रेल्वेक्रॉसिंग इ. परवानग्या प्राप्त करुन घेण्यासाठी युध्दपातळीवर पाठपुरावा करण्यात येईल. केलेल्या पाठपुराव्यासंबंधीचा तपशील अभिलेखी ठेवण्यात येईल.

७. वरील मुद्दा क्र.6 नमूद केल्यानुसार- भूसंपादन, वन जमीन संपादन, खात्यामार्फत पाईप पुरवठा वेळेवर न होणे, पुढील टप्प्यामधील कामांना मंजूरी प्राप्त नसणे, रोड रेल्वेक्रॉसिंग इ. बाबींची पूर्तता/ परवानग्या प्राप्त झाल्यानंतर, त्या तारखेपासून संबंधीत उपांगे पूर्ण करण्याचा कालावधी परिगणित करुन सुधारित बारचार्ट मंजूर करण्यात येईल. अशा उपांगांसाठी सुधारित बारचार्टनुसारच दंडाची परिगणना करणे अनिवार्य राहील.

८. बारचार्टनुसार काम पूर्ण करण्याचा कालावधी, काम करताना येणाऱ्या अडचणी यांचा विचार करुन, काम पूर्ण करण्यासाठीचा सुधारित कालावधी विचारात घेऊन, वेळोवेळी मुदतवाढ देण्याविषयीची कार्यवाही निविदेतील अटी व शर्तीनुसार करण्यात येईल.

९. दंडाची आकारणी बाबतचा सविस्तर तपशील, योजनेच्या मासिक प्रगती अहवालामध्ये न चुकता दर्शविण्यात येईल.

१०. दंडाची आकारणी करण्यात आल्यानंतर, दंड वसूल करण्यात यावा आणि वसूल केलेला दंड मजीप्राच्या डिपॉझिट खात्यात न ठेवता कलेक्शन खात्यामध्ये जमा करण्यात येईल.

११. अ) ठेकेदाराने केलेल्या कामाची किंमत दंडाची रक्कम वसूल करण्या इतपत पुरेशी नसल्यास निविदेतील अटी व शर्तीनुसार, ठेकेदारावर कलम-3(क) नुसार कार्यवाही करण्यात येईल. त्याचप्रमाणे योजनेंतर्गत उर्वरित काम पूर्ण करण्यास ठेकेदार टाळाटाळ करत असल्यास, निविदेतील अटी व शर्तीनुसार, ठेकेदारावर कलम-3(क) नुसार कार्यवाही करण्यात येईल.

ब) अशा प्रकरणी उर्वरित कामे करण्यासाठी जास्त रक्कमेची आवश्यकता लागल्यास सदर वाढीव रक्कम दंडाच्या रक्कमेतून व सुरक्षा अनामत रक्कमेतून वसूल करण्यात येईल. त्यानंतरही वसूलीची रक्कम शिल्लक राहिल्यास, त्याच ठेकेदाराच्या इतर निविदेंतर्गत कामांच्या देयकातून वसूल करण्याची कार्यवाही करण्यात येईल.

१२. यापूर्वी स्वीकृत निविदेच्या 10 टक्के इतकी रक्कम दंड म्हणून वसूल करण्याची तरतूद होती, आता उपांगवार प्रगतीच्या आधारे दंड आकारणीची प्रणाली लागू करण्यात आली असल्याने स्वीकृत निविदा किंमतीच्या जास्तीत जास्त 5 टक्के इतकी रक्कम वसूल करण्यात येईल.

ANNEXURE-13

SELF DECLARATION

I ----------age----------years occupation business residing at ---------- ---------- do hereby state on oath as under :-

That I am proprietor / Director / Partner / Power of Attorney Holder of the company name and style as M/s ----------having its address at ---------- ----------

That I further say that M/s ---------- is **not black listed** by any Government / Semi Government Organization / any Local Bodies and any other Private Bodies.

Whatever information of documents submitted for registration are true and correct as per my knowledge. I take full responsibility regarding genuineness of documents submitted by me.

Date :-

Place :- Signature of Contractor

Contractor No of Correction Executive Engineer SMKC

Annexure - 14

Name of work :- Date :-

Draft Affidavit Regarding

The work in hand & work where bids have been submitted

I / We hereby declare that, I / We have bidded for for the work of _____ and at the date of bided in the below given Table – I (A). The following works amounting to Rs. _____ Crores are the balance works. Which are yet to be executed by my / our firm.

Table I (A) During th next _____ Years

Sr. No.	Description of works	Place & State	Contract No. & Date of W.O.	Name & Address of Department	Accepted Tender Cost Rs. (In Lakhs)	Sanction date of Completion
1	2	3	4	5	6	7
Ongoing works						

Details of ongoing works			Value of works remaining to be completed (Rs. In Lakhs)	Reasons for delay
Expenditure	Expected progress in % & Amount	Actual progress % & Amount		
8	9	10	11	12
To be certified by CA.				

Similarly in the works mentioned in the table 1 (b) , my / our firm is lowest and the tender Iis approved and work order is yet to issued. The cost of such work in is Rs. _____ cr.

Table 1 (B)

Sr. No.	Description of works	Place & State	Contract No. & Date of W.O.	Name & Address of Department	Accepted Tender Cost Rs. (In Lakhs)	Sanction date of Completion
1	2	3	4	5	6	7
Tender where bidder is lowest and tender is approved, work order to be issued.						

Contractor No of Correction Executive Engineer SMKC

Details of ongoing works			Value of works remaining to be completed (Rs. In Lakhs)	Reasons for delay
Expenditure	Expected progress in % & Amount	Actual progress % & Amount		
8	9	10	11	12
				To be certified by CA.

I / We here by declare that, the above given information is true as on _____ the day of _____ month ____ year ____. No any information is false and misleading, I have not abandond any work or action under clause 3 (c) is not executed against me / our firm. I am not black listed for any of the work.

If information is above table is found to be false or in complete or the department finds that any information is hidden by me / our firm, the department will have all the liability to debar my firm from this binding or any further binding and department can black listed my / our firm for the period as it may find suitable for such action.

Date : - Place :-	Signature Name of the firm

Contractor No of Correction Executive Engineer SMKC

Annexure - 15

Self Declaration

- All the information provide in the forms, statements and attachments submitted in proof of the qualification requirements are correct. No any misleading or false information provided.
- I have not abandoned the works and I have properly completed all the contractor in time.
- I have / have not participated in the previous biddings for the same work and had/ had not quoted unreasonably high bid prices and could not furnish rational justification
- The details of litigation history is as below.

Name of Other party(s)	Cause of dispute	Litigation where (Court/arbitration)	Amount involved

- I am not financially failured.

Contractor No of Correction Executive Engineer SMKC

ANNEXURE - 16

DECLARATION/AUTHORITY LETTER FOR SITE VISIT AND GEO TAGGING

Name of Work : **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli**

Name of contractor / Agency :-

I Myself ---------- hereby declare / authorize my authorized representative ---------- to carry site visit and inspect / visit other important location on site of above mentioned work.

Date :

Place :

Time :

Signature with stamp ot the
Contractor / Agency

I Myself / authorized representative have personally inspected the work site on the date ---------- time ---------- PM/AM and have made myself / our self-acquainted. Satisfied with the site Conditaion. The details of Geo-Tagging as mentioned in the tender will be uploaded in envelope No.1 of the tender.

Date :

Place :

Time :

Signature with stamp ot the
Contractor / Agency

Certified by
Executive Engineer,
SMKC

Note : Locations – As Specified By Engineer In Charge.

GENERAL CONDITIONS OF CONTRACT

Sangli Miraj And Kupwad City Muncipal Corporation

Name of work : Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli

GENERAL CONDITIONS OF CONTRACT

1. DEFINITIONS

1.1 In the contract, the following terms shall be interpreted as indicated.

a) “UDD “means Urban development department

b) “AMRUT” means Atal mission for rejuvenation and urban transformation

c) "The Contract" means the agreement entered into between the owner and the contractor as recorded in the contract form signed by the parties, includes all attachments and appendices there to and all documents incorporated by references therein. Contract is the deed of contract together with all its original accompaniments and those later incorporated in it by internal consent.

d) "The Contract Price" means the price payable to the contractor under the contract for the full and proper performance of its contractual obligations.

e) "The Goods" means all of the equipments, machinery and/or other materials which the contractor is required to supply to the owner under the contract.

f) "Services" means services ancillary to the contract such as transportation and insurance and any other incidental services, such as Provision of Technical Assistance, Trial Runs, Commissioning, Training to staff and other such obligations of the contractor covered under the contract.

g) "The Owner" means, the Commissioner Sangli Miraj and Kupwad City Muncipal corporation the person, for the time being holding that Office and also his successors and shall include any Engineer authorized by him.

h) The "Contractor" means successful tenderer, that is the tenderer, who’s tender has been accepted and who has been authorized to proceed with the work.

i) "The SMKC” shall mean the Sangli Miraj and Kupwad city Muncipal Corporation, a SMKC constituted under the SMKC Ordinance issued on 10.03.1997.

j) “ M.C” means ……Municipal Corporation

k) "SMKC" means, Sangli Miraj and Kupwad city Muncipal Corporation.

l) “Executive Engineer “ i.e "The Executive Engineer water Supply and Drainage SMKC. " shall mean Commissioner SMKC the person, for the time being holding that Office and also his successors and shall include any

Engineer authorized by him.

m) "The City Engineer means the Engineer, so designated by the SMKC or any other Engineer who is for the time being entrusted with his functions, duties and powers and so notified.

n) "Tender" means the proposal of the contractor submitted in prescribed form setting-forth the prices for the goods to be supplied and other related services to be rendered and setting forth his acceptance of the terms and obligations of the conditions of contract and specifications.

o) "Contract Time" means period specified in the document for the entire execution of contracted works and other services to be rendered commencing from the date of notification of award including monsoon period.

p) "Month" means calendar month.

q) "Site" means location at which the contractor will have to execute the contracted work.

r) "The Engineer or Engineer-in-charge" shall mean the Executive Engineer /Hydraulic Engineer / water supply Engineer authorized by the Municipal Corporation/Council .

s) PMC means Project Management consultant appointed by the Sangli Municipal Corporation/Municipal Council.

2. The contractor shall erect temporary sheds for storage for material supplied by Corporation/Council and brought by him on site. Also at each construction site contractor shall have separate storage space for cement and other material.

3. All the water retaining structures shall be designed in M25 and constructed in M30.

4. Contractor shall take trial pits and trial bores at site at his own cost to ascertain the bearing capacity of the strata and accordingly submit the designs.

5. Contractor shall submit designs and drawings for all structures such as Balancing Tank, Intake well, Jack well, Pump House, Water Treatment Plant. (Hydraulic and structural),Sump, ESR, GSR, Thrust blocks/anchor blocks, Pumping machinery and its layout, all allied electrical and mechanical equipments as directed by Executive Engineer/Engineer in charge/Chief officer .This designs and drawings shall be got checked from Government Engineering College or IIT at contractors own cost.

6. The contractor shall maintain the record of these materials in the prescribed proforma and registers as directed by the Executive Engineer/Engineer in charge/Chief officer. The sample of prescribed proforma is attached herewith. These registers shall be signed by both contractors and representative of Engineer-in-Charge. These registers shall be made available for inspection, verification for the department as and when required. These registers shall be in the custody of department and shall be

maintained by the department.

7. Contractor shall take photographs and videos of all sub-works during construction and submit two copies in hard and soft along with final bill.

8. Contractor shall prepare record drawings of all sub-works as per execution in details by using Auto Cad programme; as directed by Executive Engineer/Engineer in charge/Chief officer. He should submit 3 Nos. C.D. (R.W) along with three hard copies during the submission of final bill. Final bill will not be passed unless and until this is submitted. No extra payment will be made for submission of CDs.

9. Contractor shall maintain register for dewatering having details such as BHP of pumps, start and stop of dewatering pumps, Fuel consumed etc.

10. The material i.e. cement, steel, sand, metal, bricks, alum pipes valves etc. brought on the work site shall be accompanied with the necessary company/manufacturing firm's test certificate. In addition these materials shall be tested as per frequency prescribed by the department and the cost of such testing shall be borne by the contractor. If the test results are satisfactory, then and then only the material shall be allowed to be used on the work. If the test results are not as per standards, these materials shall be immediately removed from the work site at contractor's cost. In case of cement, if so requested by the contractor in writing, material will be allowed to be used before receipt of test results but this will be entirely at the risk and cost of the contractor.

11. All the formwork used for construction shall be of steel or with lining of steel. Wooden shutters may be allowed at the discretion of the Executive Engineer/Engineer in charge/Chief officer for minor works.

12. Contractor shall have Cube Testing machine on site. Test cubes shall be tested in front of Executive Engineer/Engineer in charge/Chief officer or his representative and a register for it shall also be maintained.

13. RCC designer appointed by the Contractor shall visit and inspect the work at various stages of construction and comply with the query of the department without any extra cost.

14. SCOPE AND MEANING OF CONTRACT:

The term contract hereinafter used means and includes the notice for invitation of tender, schedule 'A' i.e. schedule for departmental supply of materials, schedule 'B'

i.e. schedule of items to be executed under this contract, general conditions, schedule of obligatory requirements, general and detailed specifications all appendices drawing and any other documents attached to the blank tender form issued to the contractor firm. These are subject to any alterations and modifications carried out and agreed to before the contract is finally decided and accepted by the Executive Engineer The term contract and firms means the agency entering into contract with the Executive Engineer

The SMKC, an urban local body of Government of Maharashtra, has proposed to execute the following work under sanctioned scheme "Amrut-2"

This Tender includes,

S.N	Name of Subwork
1	**Working Survey**
2	**Collection System**
	A) For Zone 1
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 500 mm Total Length- 30.44 Kms.
	ii)Household Service Connection for Zone 1
	iii)Road Reinstating for zone 1
	B) For Zone 3B
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 1000 mm Total Length- 26.97 Kms.
	ii)Household Service Connection for Zone 3B
	iii)Road Reinstating for zone 3B
	C) For Zone 2A
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 450 mm Total Length- 31.61 Kms.
	ii)Household Service Connection for Zone 2A
	iii)Road Reinstating for zone 2A
	D) For Zone 2B
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 800 mm Total Length- 100.2 Kms.
	ii)Household Service Connection for Zone 2B
	iii)Road Reinstating for zone 2B
	E) For Zone 3A
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 1200 mm Total Length- 80.9 Kms.
	ii)Household Service Connection for Zone 3A
	iii)Road Reinstating for zone 3A
3	**Wet well and Panel rooms**
	A)RCC Wet well and Panel room at Ahilyanagar 5.00 M Dia, Cap.78.5 cum Net and 266 cum Gross
	B) RCC Wet well and Panel room at Tuljainagar 9.1 m Dia, Cap. 260 Cum Net and 730 Cum Gross
	C) RCC Wet well and Panel room at Kumbhar Mala 11.5 M Dia, cap. 571 Cum Net and 1570

	Cum Gross
	D) RCC Wet well near Jagruti 5.2 m Dia Cap. 56 Cum
4	**Pumping Machinery and allied works**
	a)Ahilyanagar Pumping station PS 1
	b)Tuljainagar Pumping station PS 2
	c)Kumbhar Mala Pumping station PS 3
	d) Jetting cum suction Machine
5	**Pumping main**
	A) Ahilyanagar
	i) Rising Main from Ahilyanagar wet well to Wet well near Jagruti, 350 mm Dia D.I. K-9, Length- 4750 M
	ii) Road Reinstating for Rising main
	B) Tuljainagar
	i) Rising Main from Tuljaeenagar Wet well to Wet well near Jagruti. (700 mm ø D.I. K-9, L=1580 m)
	ii) Road Reinstating for Rising Main
	C) Kumbhar Mala
	Rising Main fromKumbhar Mala wet well to STP, 1000 mm Dia D.I. K-9, Length- 150 M
6	**S.T.P. Type S.B.R. 27.00 MLD**
7	A) RCC Wet Well Storage tank for Treated Water Cap 1.125 ML
	B) Disposal arrangement 1200 mm R.C.C. Pipe Length 960 M
8	**Miscellaneous**
	A) Compound wall for Ahilyanagar Wet well
	B) Compound wall for Tulajainagar and Jagruti Wet wells and Compound wall with CLF for S.T.P.
	C) i) Repairs to House connection & Water supply pipelines in zone1 & 3B
	ii) Repairs to House connection and Water supply pipelines for zones 2A,2B,3A
9	**Remaining works of Sangli UGD and Miraj UGD**
	A) Sangli UGD
	B) Miraj UGD

15. IMPORT LICENSE AND FOREIGN EXCHANGE :

In respect of the work on contractors own design, the contractor shall quote for the indigenous equipment only. Foreign exchange and import license required by the contractor if any shall have to be arranged by the contractor independently. Department shall not take any responsibility in this regards. Delay in getting any materials shall not be entertained for extension of time limit of the contract.

16. ACQUITANCE WITH WORKS AND SITE CONDITIONS:

The contractor shall be deemed to have carefully examined the scope of work, location and alignment of various components under this tender, site conditions, the general conditions, the specifications, drawing availability of material required etc.

and has fully acquainted himself regarding all aspects of works, if he shall have any doubt as to the meaning of any portion of the tender papers. He shall set forth the particulars of the tender to the notice of Executive Engineer, M.J.P/ Chief Officer/Commissioner, before submission of tender and get the doubts cleared. Once the tender is submitted duly filled, he shall be supposed to have accepted the conditions and specifications full and interpretation of the conditions be entirely at the discretion of the competent authority of the department.

17. OBSTRUCTIONS IN THE WORK :

All obstructions such as electric cables, telephone line, water and sewer mains, manholes, natural drainage, culverts, storm water drains etc. corning in the way shall be carefully looked after against any damages which otherwise will have to be made good by the contractor at his own cost. Any work of removing, repairing or remaking etc will be carried out by the contractor without any extra claims for the same in contractor with the respective departments.

18. LAND FOR THE USE BY THE CONTRACTOR FOR STORING MATERIALS ETC. :

As far as possible the contractor shall be allowed to use the Municipal Land without any charge, in possession of concern SMKC for stacking his materials, stores, erection of temporary structures, sheds etc with prior written permission of Executive Engineer Sangli Miraj and Kupwad City Muncipal corporation.. The location of the temporary structures to be erected shall be got approved from the Executive Engineer SMKC and all the products obtained after cutting the same shall be stacked at suitable place as directed by Engineer in charge. All concern SMKC land occupied by the contractor for temporary use shall be handed over back in good conditions to the entire satisfactions of the concern SMKC. as and when demanded by him. Any damage or alterations made in the area shall be made good by the contractor. If the departmental land is not available the contractor has to make his own arrangements of land on hire or otherwise at his own cost.

19. LABOUR CAMPS :

The contractor shall at his own expenses make all necessary provisions for land, housing grains, water supply and sanitary arrangements etc for employees and shall pay direct to the authorized concerned all rents, taxes and other charges. The contractor shall also comply with all requirements of health department in regard to maintenance of anti-epidemic conditions.

20. WORK THROUGH OTHER AGENCY IN THE SAME AREA :

The City Engineer SMKC. shall have the right to execute the works, not included in this

contract, but within the premises occupied by the contractor for the purpose of this contract, through any other agency.

21. SPECIFICATIONS

The wording of items in Schedule 'B' shall be taken as guidelines for general provisions and coverage under the item. The detailed specifications for relevant items shall be as per detailed specifications enclosed and as per P.W.D. Hand Book, Standard Specifications, Relevant and latest editions of IS.Code. The other standard, wherever quoted, shall be applicable. If the standard specifications fall short for the items quoted in the Schedule of this contract, reference shall be made to the latest Indian Standard Specifications, IRC codes. If any of the items of the contract do not fall in reference quoted above, the decision and specification as directed by the Executive Engineer/Engineer in charge/Chief officer shall be final.

It is presumed that the Contractor has gone carefully through the standard specification (Vol. I & II, 1981 edition) and the Schedule of rate of the Division, and has also studied site conditions before arriving at rates quoted by him. The special provisions and detailed specification of wording of any item shall gain precedence over the corresponding contrary provisions (if any) in the standard specification given without reproduction the details in contract. Decision of Executive Engineer/Engineer in charge/Chief officer shall be final in case of interpretation of specifications.

22. WATER AND ELECTRICITY

The contractor shall make his own arrangements at his own cost for water required for construction and hydraulic testing as well as for labor camp. The SMKC does not take any responsibility for supply of water to contractor for construction or testing purposes during the entire work. If water is supplied by SMKC, Contractor shall take connection at his cost and provide water meter on it. Water charges shall be paid by contractor as per prevailing water rates to SMKC regularly every month. Power supply from MSEDCL if required for construction of work as well as for labour camp will have to be arranged by the contractor at his cost. SMKC does not take guarantee for continuous power supply at site.

23. LINE OUT

The contractor shall himself carry out the line out of works in the presence of the representative of the SMKC and the contractor shall be responsible for accuracy of it. He shall employ a qualified Engineer for this purpose as well as for supervision of works.

24. PROGRAMME AND PROGRESS SCHEDULE

The contractor shall furnish within 15 days from the date of work order a progress schedule indicating the date of starting, quarterly progress expected to be achieved and anticipated date of completion of each major item of the work. The schedule should be capable of achievement towards completion of whole work in the stipulated time.

i. The Contractor shall submit his own programme as per time limit stipulated in the tender, in the form of Bar Chart which should give details of milestones of physical stages of each sub work. Simultaneously with the execution of the Contract Agreement, the Contractor shall submit to The Engineer his item-wise monthly programme, which shall be nothing but detailing of the programme,

ii. The programme shall also state the milestones of part commissioning and part completion of the sub-work included in the tender. The programme shall also provide the information as to required approvals to drawings, samples, materials, equipments and their time of submissions to the SMKC. The progress shall be submitted by the Contractor visa-a-vis programme every month. The works team of the Contractor shall be so motivated to know the balance work at the end of each week and the rate required in the balance period to complete the work and therefore, shall endeavor to complete the task assigned for each week timely. In case, where the updated and revised schedule is required, the same shall be submitted to the owner for approval.

If deviation exceeds 10% in scheduled programme, competent authority has right to reject the tender of successful tenderer.

In the event of contractor failing to execute the work as per scheduled programme submitted by him or in the event of unreasonable delay in the part of contractor, he shall be liable to as compensation an amount at the fixed rate subject to maximum amounting to 10% of the tender cost.

25. CHECKING QUALITY OF THE WORK :

The Engineer in charge should consider it necessary to satisfy himself to the quality of work, the contractor shall at any time during continuance of the contract period produce sample of work done or if necessary pull down a responsible part of the work enough for such inspection and testing as the Engineer in charge may direct. The contractor shall make good the same at his cost and to the satisfaction of the Engineer in charge without extra cost.

26. CHANGES :

Any marginal and minor changes as may be found necessary by the Engineer in charge during execution shall have to be carried out by the contractor without extra cost.

27. INSURANCE OF WORKERS :

The successful tenderer should get the labour insurance done, on account of risk involved within a month from the date of work order, failing which Rs. 20646726- will be withheld from the R. A. bills of the work and it will not be refunded till labour insurance is done and a documentary evidence to this effect is produced by the contractor. The successful contractor tenderer should purchase insurance policy identifying the Commissioner SMKC therein.

28. ARBITRATION

In case any dispute arises out during execution of works, no arbitrator shall be appointed for redressal of the dispute. In case of disputes, between a Contractor and SMKC, the decision of the Commissioner SMKC Sangli shall be final and binding. In case of any further dispute, the decision of Secretary UDD-2 / any other person appointed by the Secretary UDD-2 will be final.

29. INTENT AND INTERPRETATION OF CONTRACT DOCUMENTS

29.1 The contract documents are complementary and what is called for by one is as binding as if called for by all. Any work that may be reasonably inferred from the drawings or specifications as being required to produce the intended result shall be provided by the contractor whether or not it is specifically called for, in Schedule- 'B'.

The contractor shall furnish and pay for all labour, supervision, materials, equipment, transportation, construction, equipment and machinery tools, appliances, water, fuel, power, energy, light, heat, utilities, telephone, storage, protections, safety provisions, and all other facilities like service, incidentals, approaches to site etc any nature whatsoever necessary for the satisfactory and acceptable execution, testing and completion of the work in accordance with the contract documents, ready for use and operation by the owner. The cost of all these arrangements shall be deemed to be included in the contract offer and no separate payment shall be admissible thereof.

29.2 Interpretations

Written clarifications or interpretations necessary for the proper execution or progress of the work, in the form of drawings or otherwise, will be issued with reasonable

promptness by the Engineer and in accordance with any schedule agreed upon.

29.3 Drawings

Figured dimensions on drawings shall govern over scaled dimensions and detailed drawings shall govern over general drawings. The Contractor shall submit six sets of drawings according to the design.

29.4 *Signed Drawings*

Signed drawings alone shall not be deemed to be in order for work unless it is entered in the agreement or schedule or drawings under proper attestation of the Contractor and the Engineer or unless it has been sent to the contractor by the Engineer with a covering letter confirming that the drawing is an authority for work in the contract.

29.5 *Technical Words*

Work, materials or equipment described in words which so applied have a well-known trade or technical meaning shall be deemed to refer to such recognized meanings.

30. LANDS, CONDITION AND LAYOUT

30.1 Line out of the Work

30.2 Surveys and Measurements

The contractor shall carefully preserve all surveys as also setting out stakes, reference points, bench marks and monuments. If any stakes, points or benches be removed or destroyed by any act of the contractor or his employees, they may be reset at the contractor's expense. The contractor shall supply without charge the requisite number of persons with the means and materials necessary for the purpose of working survey, setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or materials.

30.3 Contractor's Verification

The Contractor will establish at the work site a substantial B.M. and connect it to a permanent B.M. available in the area with known value. The contractor will then carry out necessary surveys and leveling, covering his work, in verification of the survey data on the working drawings furnished by the Engineer and he will be

responsible for establishing the correct lines and levels and verification of the lines and level furnished on the working drawings. If any error has occurred in the work due to non-observance of this clause, the contractor will be responsible for the error and bear the cost of corrective work.

30.4 Site Office

The Contractor shall construct at his cost a semi-permanent nature site office with minimum of 20 Sq.m area and shall be provided with minimum two tables, two almaries, six Nos of chairs. The office and the furniture shall be provided and maintained by the contractor throughout the contract period at his cost. The use of the site offices shall be adequate size to accommodate the inspecting Engineers of SMKC/IRMA/any other inspection committee/agency appointed by the Government of India/Maharashtra/Collector/Municipal Administration to discuss and review progress of work. No extra payment will be made on this account.

The site office shall be provided at all the conspicuous structures to be constructed/components to be executed.

31 SECURITY DEPOSIT AND INDEMNITY BOND

31.1 *Security Deposit*

The security deposit shall be returned to the contractor without any interest when the contractor ceases to be under any obligation under the contract. This shall be read with Clause No.1 and 20 of B-1 Form for Security Deposit and Defect Liability Clause respectively.

31.2 *Loss or Damage Indemnity Bond*

The contractor shall be responsible during the progress as well as maintenance for any liability imposed by law for any damage to the work or any part thereof or to any of the materials or other things used in performing the work or for injury to any person or persons or for any property damaged in or outside the work limit. The contractor shall indemnify and hold the owner and the Engineer harmless against any and all liability, claims, loss or injury, including costs, expenses, and attorney's fees incurred in the defense of same, arising from any allegation, whether groundless or not, of damage or injury to any person or property resulting from the performance of the work or from any material used in the work or from any condition of the work or work site, or from any cause whatsoever during the progress and maintenance of the work.

32. SUPERVISION AND SUPERINTENDENCE

32.1 SUPERVISORY STAFF :

The contractor shall have experienced technical qualified general supervisor for the work, who is capable of managing and guiding the work and also capable of understanding the instructions given to him by the Engineer in charge from time to time and shall be responsible to carry them out promptly. The contractor shall have during working hours, supervisor of sufficient training and experience to supervise the various items and operations of the work. Further, the Engineer in charge may notice, desire contractor high ranking member to be present on any specified date, the contractor shall comply with such directions Contractor's Supervision

The contractor shall supervise and direct the works efficiently and with his best skill and attention. He shall be solely responsible for means, methods, techniques, procedures and sequences of construction. The contractor shall co-ordinate all parts of the work and shall be responsible to see that the finished work complies fully with the contract documents, and such instructions and variation orders as the Engineer may issue during the progress of the works.

32.2 Agent

The Contractor shall keep on the work at all times during its progress a competent resident agent preferably a qualified and experienced Engineer, capable of managing and guiding the work and understanding the specifications and contract conditions. For this purpose the contractor shall communicate to the Department, name, qualification and experience of such Engineer to be appointed for execution of this work. The agent appointed by the contractor shall not be replaced without ten (10) days written notice to the Engineer except under extra-ordinary circumstances. The agent shall be the Contractor's representative at the site and shall have authority to act on behalf of the contractor. All communications, instructions and directions given to the agent shall be binding as if given to the Contractor by the Engineer not otherwise required to be in writing will be given or confirmed in writing upon request of the Contractor. or in work-order book

33. CARE AND USE OF SITE

The Contractor shall not commence operations on land allotted for work without prior approval of the Engineer. If these lands are not adequate the Contractor may have to make his own arrangements for additional lands required for his use. The contractor shall not demolish, remove or alter any of the structures, trees or other facilities on the site without prior approval of the Engineer. All the area of Contractor's operations shall be cleared before returning them to the Engineer.

34. OVERLOADING

No part of the work or new and existing structures, scaffolding, shoring, sheeting, construction machinery and equipment, or other permanent and temporary facilities shall be loaded more than its capacity. The Contractor shall bear the cost of correcting damage caused by loading or abnormal stresses or pressures.

35. USE OF EXPLOSIVES

The Contractor shall comply with the laws, ordinances, regulations, codes, orders, other governing the transportation, storage and use of explosives, shall exercise extreme care not to endanger life or property and shall be responsible for all injury or damage resulting from the use of explosives for or on the work.

36. MANUFACTURER'S INSTRUCTIONS

The Contractor shall compare the requirements of the various manufacturer's instructions with requirements of the contract documents, shall promptly notify to the Engineer in writing of any difference between such requirements and shall not proceed with any of the works affected by such difference shall until an interpretation or clarification is issued pursuant to article.

The contractor shall bear all costs for any error in the work resulting from his failure to the various requirements and notify the owner of any such difference.

37. PROTECTION

The contractor shall take all precautions and furnish and maintain protection to prevent damage, injury or loss to other persons who may be affected thereby. All the works and all materials and equipment to be incorporated therein whether in storage or on the site, under the care, custody or control of the contractor or any of his sub-contractors and other improvements and property at the site or where work is to be performed including building, tools and plants, pole lines, fences, guard rails, guide posts, culvert and works markers, sign structures, conduits, pipelines and improvements within or adjacent to streets, right-of-way, or easements, except those items required to be removed by the Contractor in the contract documents. The Contractors protection shall include all the safety precautions and other necessary forms of protection, and the notification of the owners of utilities and adjacent property.

The contractor shall protect adjoining site against structural, decorative and other

damages that could be caused by the execution of works and make good at his cost any such damages that could be caused by the execution of works and make good at his cost any such damages.

38. UTILITIES AND SUB-STRUCTURES

Before commencing any excavations, the Contractor shall investigate, determine the actual locations, and protect the indicated utilities and structures, shall determine the existence, position and ownership of other utilities and substructures in the site or before the work is performed by communication with such property owners, search of records, or otherwise and shall protect all such utilities and substructures.

38.1 Restoration and Repair

Except for those improvements and facilities required to be permanently removed by the contractor, the contractor shall make satisfactory and acceptable arrangements with the appropriate owners, and shall repair, restore all improvements, structures, private and public roads, property, utilities and facilities disturbed, disconnected, or damaged as a result or consequence of his work or the operations of those for whom he is responsible or liable, including that caused by trespass of any of them, with or without his knowledge or consent, or by the transporting of workmen, material or equipment to or from the site.

39. WORKMEN

The contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the works any unfit person or anyone not skilled and experienced in the assigned task. The Contractor shall in respect of labour employed by him comply with or cause to be complied with the provisions of various labour law and rules and regulations as applicable to them in regard to all matters provided therein and shall indemnify the owner in respect of all claims that may be made against the owner for non-compliance thereof by the Contractor.

In the event of the contractor committing a default or breach of any provisions of labour laws and rules and regulations, the Contractor shall without prejudice to any other liability under the acts pay the owner a sum as decided by the engineer.

39.1 Work during Night or On Sundays and Holidays

Unless otherwise provided, none of the permanent works shall be carried out during night, Sunday or authorized holidays without permission in writing. However, when

work is unavoidable or necessary for the safety of life, priority of works, the Contractor shall take necessary action immediately and intimate the Engineer accordingly.

39.2 Workmanship

The quality of workmanship produced by skilled knowledgeable and experienced workmen, machines and artisans shall be excellent. Particular attention shall be given to the strength appearance and finish of exposed work.

40. MATERIALS AND EQUIPMENT

All materials and equipment incorporated in the work shall be new. Materials and equipment not covered by detailed requirements in the contract documents shall be of the best commercial quality suitable for the purpose intended and approved by the owner prior to use in the work.

40.1 *Optional Materials*

Only one brand, kind or make of material or equipment shall be used for each specific purpose through-out the works, notwithstanding that similar material or equipment of two or more manufacturers or proprietary items may be specified for the same purpose

41. USE OF APPROVED SUBSTITUTIONS OR EQUALS

The contractor shall bear all extra expenses resulting from providing or using approved substitutions or equals where they affect the adjoining or related work, including the expenses of required engineering, redesigning, drafting and permits where necessary, whether the Engineer's approval is given after receipt of tenders.

42. LAWS AND REGULATIONS

43. Governing Law

The contract documents shall be governed by the laws and by-laws of India, the State of Maharashtra and the local bodies in this region.

44. Resolving the disputes:

In case of disputes, between a Contractor and SMKC, the decision of the Commissioner SMKC Sangli shall be final and binding. In case of any further dispute, the decision of Secretary UDD-2 / any other person appointed by the Secretary UDD-2 will be final.

45. BURRIED AND CONCEALED WORK

The contractor shall help in recording the precise location of all piping, conduits, ducts cables and like work that is buried, embedded in concrete or masonry, or concealed in wood or metal frame walls and structures at the time such work is installed and prior to concealment. Should the contractor cover such buried or work before such recording takes place, he shall uncover the unrecorded work to the extent required by the Engineer and shall satisfactorily restore and reconstruct the removed work with no change in the contract price or the contract time.

46. SAFETY PRECAUTIONS AND EMERGENCIES

Contractor's Responsibility for Safety

The contractor shall be solely responsible notwithstanding any stipulations by owner or Engineer for initiating, maintaining and supervising all safety precautions and programmes, in connection with the work and shall comply with all laws, ordinance, code rules regulations and lawful orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damages, injury or loss during the entire contract period including non-working hours.

On the occurrence of an accident arising out of the works which result in death or which is so serious as to be likely to result in death, the contractor shall within one hour of such accident intimate in writing to the Engineer the facts stating clearly and with sufficient details the circumstances of such accidents and subsequent action taken by him. All other accidents on the works involving injuries to the persons or property other than that of the contractor shall be promptly reported to the Engineer clearly and with sufficient details the facts of such accidents and the action taken by the contractor. In all cases, the contractor shall indemnify the Engineer against all losses or damages, resulting directly from the contractor's failure to report in the manner aforesaid.

This includes the penalties or fines, if any payable by the owner as a consequence of failure to give notice under Workmen's Compensation Act or otherwise to conform to the provisions of the said Act in regard to such accidents. In the event of an accident in respect of which compensation may become payable by the contractor, such sum of money as may, in the opinion of the Engineer, be sufficient to meet such liability will be kept in deposit. On the receipt of award from the Labour Commissioner in regard to the quantum of compensation, the difference in the amount will be adjusted.

It is obligatory that the contractor shall take an all Risk Insurance Policy for the works

and keep it in force throughout the work period.

47. WARNINGS AND BARRICADES

The contractor shall provide and maintain barricades, guards, guard rails, temporary bridges and walkways, watchmen, headlights and danger signals illuminated from sunset to sunrise and all other necessary appliances and safeguards to protect the work, life, property, the public, excavations, equipment and materials. Barricades shall be substantial construction and shall be painted such as to increase their visibility at night. For any accident arising out of the neglect of above instructions, the contractor shall be bound to bear the expenses of defense of every suit, action or other legal proceedings, at law, that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay all damages and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid in compromising any claim by any such person.

48. ENGINEER'S STATUS DURING CONSTRUCTION, AUTHORITY OF THE ENGINEER

The Engineer shall have the authority to enforce compliance with the contract documents. On all questions relating to quantities, the acceptability of materials, equipment, or works, the adequacy of the performance of the work and the interpretation of the drawings and specifications, the decision of the Engineer shall be final and binding and shall be precedent to any payment under the contract agreement unless otherwise provided in the contract documents. The Engineer shall have the authority to stop the work or any part thereof as may be necessary to ensure the proper execution of the work, disapprove or reject the works which is defective, to require the uncovering and inspection or testing of the works to require re-examination of the works, to issue interpretations and clarifications, to order changes or alterations in the works, and other authority as provided elsewhere in the contract documents.

The Engineer shall not be liable for the results of any ruling, interpretation or decision rendered, or request, demand, instruction, or order issued by him in good faith. The contractor shall promptly comply with requests, demands, instructions and order from the Engineer.

The whole of the works shall be under the directions of the Engineer, whose decision shall be final, conclusive and binding on all parties to the contract, on all questions relating to the construction and meaning of plans, working drawings, sections and

specifications connected with the work. The Engineer shall have the power and authority from time to time and at all times make an issue such further instructions and directions as may appear to him necessary or proper for the guidance of the contractor and the good and sufficient execution of the works according to the terms of specifications and the contractor shall receive, execute, obey and be bound by the same according to the true intent and meaning thereof; fully and effectually. Engineer may order any of the works contemplated thereby to be omitted, with or without the substitution of any other works in lieu thereof, or may order any works or any portion of works executed or partially executed, to be removed, changed or altered and if needful, may order that other works shall be substituted instead thereof and the difference of expenses occasioned by any such diminution or alteration so ordered and directed shall be deducted from or added to the amount of this contract.

49. DUTIES OF ENGINEER'S REPRESENTATIVE

The duties of the representative of the Engineer are to check, inspect and continuously supervise the work and to test any materials to be used or workmanship employed in connection with the works. He shall furnish the drawings and information to the contractor, approve the contractor's drawings subject to post-facto approval and signature of the Engineer-in-Charge, recommend and approve the interim certificates and taking over certificates after thorough checking and inspection and recommend extra work required and extension of time.
Approval for or acceptance of any work or material or failure to disapprove any work or material by the representative of the Engineer shall not prejudice the power of the Engineer thereafter to disapprove such work of material and to order removal or modification thereof. If the contractor shall be dissatisfied with any decision of the representative of the Engineer, he shall be entitled to refer the matter to the Engineer, who shall thereupon confirm, reserve or vary such decision only in genuine cases.

The representative of the Engineer shall be liable to inform the Engineer about the daily progress and compare it with the programme. He shall also inform the contractor immediately about the log or lead in the progress than the programme.

50. DEFECTS AND RECTIFICATION

For period specified in the Clause 20 of B.1 form for the defect liability period for the individual type of work from the date of issuance of the completion certificate in accordance with Condition "Final Inspection and Acceptance" mentioned herein after, contractor shall remain liable for any of the works or parts thereof or equipment and fittings supplied which in the opinion of the Engineer fail to comply with the

requirements of the contract or are in any way unsatisfactory or defective except fair wear and tear. The process of the assembly commissioning of all sections of pipe lines, tested hydraulically in patches, will involve some additional measures such as shaft of suitable height, fixing of air valves at more number of places on the alignment and all such measures shall be done by the contractor.

To the intent that the works and each part thereof shall at or as soon practicable after the expiry of the above period be taken over by the Engineer in the condition required by the contract to the satisfaction of the Engineer, the contractor shall finish the work (if any) outstanding at the date of completion as soon as may be practicable after such date and shall execute all such work of repair, amendment, reconstruction, rectification and making good of defects imperfections, shrinkages or other faults as may during the period of maintenance or after its expiry be required of the contractor in writing by the Engineer as a result of an inspection made by or on behalf of the Engineer prior to the expiry of the period. The contractor at his own expenses shall carry out all such work if the necessity thereof shall in the opinion of the Engineer and due to the use of materials or to neglect or failure on the part of the contractor to comply with any obligation expressed or implied on the contractors pat under the contract. If the contractor fails to do any such work as entitled to carry out such work in which the contractor should have carried out at the contractor's own cost, the Engineer shall be entitled to recover from the contractor the cost thereof or may deduct the same from the moneys that become due to the contractor. Notwithstanding the aforesaid, if the contractor remains in default, one calendar month after the Engineer has given written instructions in writing, the Security Deposit shall become payable to the SMKC/Corporation/Chief Officer who will deduct the cost plus overhead expenses of such works as have been necessary to rectify the contractor's default and the balance, if any, shall be disbursed. The Contractor shall submit the operation and maintenance manual for the fruitful operation of the works. The Contractor will have a liberty to visit the operating works during the defect liability period and satisfy himself about the on-going operations in case he do not visit and a defect is observed then the Engineer's opinion shall be final and binding as to the application of defect liability.

51. RIGHT TO WITHHOLD

The Engineer may refuse to approve to any payment, or because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously approved and paid to such extent as may be necessary in the opinion of the Engineer to protect him from loss because (a). The work is defective, (b) Third party claims have been filed or there is reasonable evidence indicating probable filing of such claims, (c) of the Contractor's failure to make

payment properly to sub-contractors or for labour, materials or equipment, (d) of damage to another Contractor, or to the property of other caused by the Contractor, (e) of reasonable doubt that the work cannot be completed for the unpaid balance of the contract price, (f) of reasonable indication that the work will not be completed within the contract time, (g) of the Contractor's neglect or unsatisfactory prosecution of the work including failure to clean up. Once the provisions of law that enables or require the Engineer to withhold such payments are removed, payment will be made for amounts withheld because of them to the extent the contractor is entitled to payment.

52. FINAL INSPECTION AND ACCEPTANCE

Upon written notice from the contractor, that the entire work required by the contract documents is complete and that all submittals required by him are made, and after the Contractor has delivered the bonds, certificates of inspection, guarantees, warranties, releases and other documents, as required by the contract documents or by law, the Engineer will make a final inspection, and he will notify the Contractor in writing of any particulars in which this inspection reveals that the work is defective, and will also notify the Contractor in writing of any deficiencies in the submittals and the document required from him.
The Contractor shall promptly make such corrections as are necessary to remedy all defects or deficiencies. After the Contractor has completed any such corrections to the satisfaction of the owner, the Engineer will issue a written completion certificate of the work and file any notice and completion required by law or otherwise.

53. CONTINUING OBLIGATION OF THE CONTRACTOR

The Contractor's obligation to perform and complete the work in accordance with the contract documents is and shall be absolute. Neither the observation during construction and final inspection of the work by the Engineer, nor any payment to the Contractor under the Contract documents, nor any use or occupancy of the work or any part thereof by the Engineer, nor any act of acceptance by the defective work by the Engineer shall constitute acceptance of work not in accordance with the contract documents.

54. TAXES TO BE DEDUCTED AT SOURCE

During the course of contract period the deduction of Income Tax/GST(TDS) or any other Central/State or local tax required to be deducted at source, will be made as per prevailing rules from the contractors bills and will be remitted to the concerned Departments. Certificate for such deductions will be issued by the Executive Engineer/Chief Officer.

55. RECORDS AND MEASUREMENTS

The Engineer shall except or otherwise stated therein, determine by measurement the value in accordance with the contract of works done in accordance therewith.
All items having a financial value shall be entered in a measurement book, level book etc. as prescribed by the Engineer so that a complete record is obtained of all work performed under the contract.

The Engineer ORhis authorized representative shall take measurements jointly with the Contractor or his authorized representative. Before taking measurement of any work the Engineer or the person deputed by him for the purpose shall give reasonable notice to the contractor. If the contractor fails to attend or send an authorized representative for measurement after such notice or fails to countersign or record the objection within a week from the date of measurement, then in any such event measurements will be taken by the Engineer, or by the person deputed by him shall be taken to be correct measurements of the works and shall be binding on the contractor. There shall be absolutely no doubt regarding the measurements and hence the contractor shall first arrange the exact branding of the alignment length on site, and mark distinctly. All hidden measurements shall be measured by steel tape, on the exact section as marked previously and depth by the regular staff generally at an average interval of 30 m or suitable interval decided by Engineer-in-Charge.

In case of difference of opinion in the measured quantity and the payable quantity of any particular measurements, the contractor must know the departmental practices developed as per the manuals and standard specifications.

Normally only excavation will not be measured. When the pipes and specials are laid in position, then only the excavation and other items will be measured.

The Contractor shall, without any extra charge, provide assistance with every appliance and other things necessary for measurements, such as leveling instruments (Auto setting), tapes, staffs, camera, paints, brushes and required labour.

Measurements shall be signed and dated by both the parties each day (for taking measurement) on the site on completion of measurements. The Contractor shall take up still colour photographs at intervals during the execution of works so that a history of development of the works is maintained.

The dated photographs, in two copies, shall be submitted to the Engineer-in-charge every time. No extra cost will be paid for this. This generation of record shall provide the used methodology of working and highlight the quality of material and workmanship. The cost of the said work shall be borne by the Contractor. It shall be

the property of the SMKC/Municipal Council/Corporation. and shall not be used for campaigning, advertising without permission of the SMKC/ Council/Corporation.

56. WRITTEN NOTICE

Written notice shall be deemed to have been duly served or delivered in person to the individual or member of the firm or to an Engineer of the contractor for whom it was intended, or if delivered at or sent by registered or certified mail to the last business address known to him who gives the notice. The notice on the Fax Message/ E-Mail shall be deemed to have been duly served. The address given in the contractor's tender on which all notices, letters and other communications to the contractor shall be mailed or delivered, except that said address may be changed by the Contractor by notifying the owner in writing. This shall not preclude the service of any notice, letter or other communication upon the Contractor personally.

57. USE OF COMPLETED PORTIONS

The owner shall have the right, upon written notice to the Contractor, to take possession or occupancy of, and use any completed or partially completed portions of the work, notwithstanding that the time for completing the entire work or such portions may not have expired but such taking possession or occupancy and use shall not deemed to waive of any requirement of the contract documents or a waiver or acceptance of any work not completed in accordance with the contract documents.

58. CLEANING UP

The contractor shall at all times during the work keep the site and premises, adjoining property and public property free from accumulations of waste materials, rubbish, and other debris resulting from the works, and at the completion of the work shall remove all waste materials, rubbish and debris from and about the site and premises as well as all tools, construction equipment and machinery and surplus materials, and shall leave the site and premises, clean, tidy and ready for occupancy by the owner. The Contractor shall restore to their original condition those portions of the site not designated for alteration by the contract documents paved ways, parking areas and roadways disturbed by the construction shall be redone by filing the excavation, if any, by sand compacted material and bringing it to its original shape as directed and approved by the Engineer. No waste material shall be buried or disposed off on the owner's property unless so approved in writing by the Engineer-in-Charge. Before the Contractor applies for final inspection and acceptance of the work, all items of work shall be complete, ready to operate, and in a clean condition as determined by the Engineer.

59. OWNER'S RIGHT TO CLEAN UP

If the Contractor fails to satisfactorily clean up or if a dispute arises between the Contractor or in several Contractors as to their responsibility for cleaning up, the Engineer may clean up and charge the cost thereof to the Contractor for his failure, or to the several contractors as the Engineer shall determine to be just.

60. FOSSILS ETC.

All fossils, coins, articles of value of antiquity and structures or other remains or things of geological or archaeological interest discovered on the site shall be deemed to be the property of the owner and the Contractor shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing and shall immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out at the expenses of the Engineer's order as to the disposal of the same.

61. LABOUR RULES

If demanded by Municipal Authorities, the contractor will have to produce to the satisfaction of the accepting authority a valid and current license issued in his favor under the provision of Contract Labour (Regulation and Abolition) Act 1970, before starting the work, otherwise the Contractor shall have to face the further consequences. The contractor shall have to comply with the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure will be breach of contract and the Superintending Engineer, may in his discretion, cancel the contract, the Contractor shall also be liable, for any pecuniary liability arising on account of any violation of the provisions of this act, by him.

Salient features of some major labour laws/ Acts applicable to establishment engaged will be as below.

a. Workman compensation Act 1923.
b. Payment of Gratuity Act 1972.
c. Employees PF and miscellaneous provisions Act 1952.
d. Maternity Benefit Act 1951.
e. Contract Labour (Regulations and Abolition) Act 1970.
f. Minimum Wages Act 1948.
g. Payment of Wages Act 1936.
h. Equal Remuneration Act 1979.
i. Payment of Bonus Act 1965.
j. Industrial Disputes Act 1947.
k. Industrial Employment (Standing orders) Act 1946.
l. Trade Union Act 1926.

m. Child labour act 1926.
n. Inter state Migrant Workmen's (Regulation of Employment and Conditioned of Services) Act 1979.
o. The Building and other construction works (Regulation of employment and conditions of Services Act 1946 and the cess Act of 1996).
p. Factories Act 1948.

All the relevant law and act will be applicable for this work.

62. STATUTORY INCREASE IN DUTIES, TAXES ETC.

All the taxes excluding GST and duties levied by the Central Govt., State Govt and by Local Bodies at the prevailing rates applicable on the date of receipt of tender, considering this contractor should quote his offer. Any increase in tax rates till completion of work shall be fully borne by the Contractor and shall not be reimbursed to him on any account.

63. INSPECTION, TESTING & FEES.

All material & equipment, irrespective whether specified or not, shall be tested at manufacturer's works laboratory and the Test Certificate thereof shall be furnished. The test shall be witnessed by the Engineer-in-charge as well as the third party designated by the SMKC.

64. MACHINERY REQUIRED

All machinery required for erection/execution purposes such as cranes, trucks, etc. shall be arranged by the Contractor. Department shall not take any responsibility for providing such machinery even on rental basis. No concreting shall be permitted unless centering and reinforcement is approved by the Engineer-in-Charge.

65. WORK ORDER BOOK

A well bound work order book shall be maintained on site and it shall be the property of SMKC/Corporation/Council and the Contractor/ his agent shall promptly sign orders given therein by the Engineer in charge of SMKC /Chief Officer/Commissioner. officials or his superior officer, in token of having received them and comply them.This will be a permanent record The compliance shall be reported by the contractor to the Engineer in good time so that it can be checked. The blank work order book with machine numbered pages will be provided by the SMKC/Corporation/Council free of charge for this purpose. The Contractor will be allowed to copy out the instruction therein from time to time. He will not record any remarks in the order book but may take up the matter recorded therein.

66. DISCREPANCIES AND OMISSIONS

The tender drawings and specifications, shall be considered as explanatory, of each other and together shall form the technical requirements and stipulations of tender documents. Detailed drawings shall have preference over small scale drawings. Similarly, detailed specifications shall have preference over general specifications. Should any discrepancy arise as to the meaning, intent or interpretation of any specification or drawing the decision of the Engineer- in-charge shall be final and binding on the Contractor.

67. PRICE VARIATION - AUTHORITY

Price variation is (as per clause 59) applicable to this tender.

68. NO INTEREST ON DUES

No interest shall be payable by the SMKC on amounts, due to contractors pending final settlement of claim. Further, no interest shall be payable by SMKC on any amount/payment.

69. Any recovery advised by the SMKC shall be recovered from any bill or money retained from this contract. All the recoveries either outstanding or dues under the contract or incidental there to as determined may be, stand recoverable.
Secured Advance will be granted as per provisions made in MPW Manual and MPW Account Code.

70. Mobilization Advance will not be granted.

71. The tenderer is entitled to avail exemption from central excise tax, to all items of machinery, including instruments, apparatus and appliances, auxiliary equipment and their components/parts required for setting up a water treatment plants intended to treat water to make it fit for consumption of humans or animals. Central excise duty will also be exempted on pipes of sizes 100 mm and above required for obtaining untreated (raw) water from its source to the plant and for supplying the treated (potable drinking) water to the storage place from which it would be further supplied for consumption of humans or animals. The concession would be subject to the certification by the Collector/District Magistrate/Deputy Commissioner of the District in which the water treatment plant is to be set-up. To avail exemption on duty the tenderer himself shall pursue the matter with different Government Departments. Any co-operation in this regard will be extended to the tenderer. The tenderer shall quote his offer taking into account above exemption which he may avail.

SPECIAL CONDITIONS

Sangli Miraj And Kupwad City Muncipal Corporation

Name of work : Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli

SPECIAL CONDITIONS

1) Payment against Excess quantities of various items.

Before making payment of excess quantities as per rules, the concerned Executive Engineer/ Engineer in charge of SMKC shall get himself satisfied regarding genuineness of the claim and he should also exercise a compulsory check of minimum 10 % of measurements for a particular item. Responsibility of informing the excess quantities as per Schedule 'B' of the tender for approval of Competent authority of SMKC and also for correctness of claim to be submitted in future shall rest with Junior Engineer, a auditor and divisional Accountant also. While submitting the proposal for approval, concerned authorities should consider the exact position of the revised estimates, if necessary due to this excess.

For executing any quantity, the excess over the quantity specified in the tender, the contractor should be authorized by the Executive Engineer/Engineer in charge of SMKCin writing.

While asking the contractor to execute such excess quantity, the concerned Executive Engineer/Engineer in charge of SMKC should inform the Contractor in writing specifically that the payment in excess of quantities specified in the tender will be made after following concerned prescribed rules.

2) General

The quoted rate shall be total rate for the completed item of work as per the specification, and shall be inclusive of all incidental charges such as lifts, leads for materials, water for construction etc. The rates for excavation are inclusive of the edge of the excavation pit beyond foundation.

The tenderer must obtain on his own responsibility and his own expenses all the information which may be necessary for the purpose of making a tender and entering into a contract and must consider and satisfy himself with all local conditions, sites and quarries means of accesses, the nature of rock, material to be met with in all execution and all materials pertaining to work.

Specifications of item stipulated for other sub works shall be made applicable, where

relevant.

3) Outline of works

The work will be on the lines of plans attached to the tender documents. The plans are however, liable to change and strata as shown there is approximate.

The item of work and their approximate quantities are given in schedule 'B' of the tender. The quantities are approximate and are liable to vary on plus or minus side.

4) Unit

The rates quoted for each item are for units mentioned in Schedule 'B' against each item.

5) Site conditions

1. It shall be presumed that the Contractor has satisfied himself as to the nature of the works, general and local conditions, particularly on those bearings on transport handling, storage of materials, availability of labour, weather conditions and has estimated the cost and quoted his rates accordingly City Engineer SMKC will bear no responsibility for lack of such acquaintance with site conditions and consequences thereof.
2. Set of tender documents and conditions (up to a maximum of three sets) at the discretion of the City Engineer SMKC will be supplied to the contractor after acceptance of tender.

6) Extras, Omissions and Discrepancies.

1. In all the cases of the omissions, doubts or discrepancies in the dimension in the drawing and items of works, reference shall be made to the City Engineer SMKC , whose elucidation and elaboration shall be considered final.

7) Supply of material by the contractor.

7.1 The contractor should supply all the material mentioned in Schedule "B". This shall be conforming to relevant IS & approved SMKC vendors.. All types of pipes, valve and specials will be accepted only after due third party inspection and satisfactory inspection by the third party inspection agencies appointed by the SMKC. (List of third party inspection agencies appointed is periodically circulated by the SMKC central office). The charges for the same shall be borne by the contractor.

7.2 Other material such as cement, tor steel etc. shall be conforming to relevant ISS testing charges for cement, steel shall be borne by the contractor. Ultra Tech cement (Ultra tech) shall be preferably be used for water retaining structures.

7.3 1) In case of item of supply of pipes, valves, specials etc, 80% amount of supplied item

will be paid to the contractor on receipt of material (after satisfactory third party inspection), 10% amount will be released after lowering, laying, jointing and remaining 10 % amount will be released after satisfactory hydraulic testing.

2) 10% cost of item included in pipeline sub work excluding supply items (pipes, all types of valves and Specials) shall be retained till satisfactory hydraulic testing is give as per tender specification.

7.4 The contractor shall provide, at the site of work, satisfactory storage for not less than one month's average consumption of works and shall keep the cement of storage and utilization of cement in the order of its arrival at the stores and the contractor shall maintain satisfactory records, which would at any time show the dates of receipt and proposed utilization of cement lying in the storage.

7.5 The City Engineer SMKC shall at all the times have access to the stores and sites, method of storage, records and securities provided by the contractor. The contractor shall comply with instruction that will be given by City Engineer SMKC , in this behalf.

7.6 The contractor shall further at all times satisfy the City Engineer SMKC on demand any production of books, of submissions of returns in Performa as directed, other proofs, that, the cement supplied is being used for the purpose for which it is supplied and available to the City Engineer SMKC .

8 TIME OF COMPLETION OF WORK:-

If at any stage of work, it is found that the execution of work is not as per the programme given in the Bar Chart, a fine shall be imposed on the contractor as mentioned in the agreement form.

9. APPOINTMENT OF ARBITRATOR:-

In case of any disputes raised between contractor and Executive Engineer/Engineer in charge during the course of contract regarding work, there shall be no provision for the appointment of an Arbitrator. In case of disputes, between a Contractor and SMKC, the decision of the Commissioner SMKC Sangli shall be final and binding. In case of any further dispute, the decision of Secretary UDD-2 / any other person appointed by the Secretary UDD-2 will be final. f the contractor files a case in appropriate court, the action of withdrawing the work and allotting it to any other agency shall be deemed to be continued as per the practice in vogue in the larger interest of implementation of work in time and as per original time schedule.

10. STRATA :

Strata for excavation are shown approximate based on trial pits and the Contractor shall have no right to claim extra if there is variations in the strata. The contractor will also have no claim if extra excavation is required to be done due to boulders and the

Contractor will have to make such extra excavation good by filling the same by C.C. 1:3:6 (M-100) or by plum concrete with 60% plum in C.C.1:3:6 maximum

11. CHANGE IN SITE:

No claims shall be paid on account of reasonable change in site, alignment or orientation of the proposed work, within the work site marked on plan attached to the tender as the circumstances may call for.

12. TOOLS AND PLANT:

All tools, instruments and machinery and all other materials (not included in the Material Schedule 'A') shall be acquired by the Contractor. It is, however, open to the Engineer to lend or supply to the Contractor implements, machinery or other service not covered by the tender document which he can be and may consider desirable. For such tools, instruments, machinery and service provided, the Contractor will have to sign an agreement and pay Security Deposit and rental charges as may be fixed by the Engineer.

13. EXCAVATED MATERIALS:

All excavated stuff shall be SMKC/CORPORATION/Council s property and shall be disposed off at lead and lift by the Contractor in a manner as directed by the Engineer.

14. DAMAGES TO UNDER/ABOVE GROUND UTILITY

During the course of excavation and laying of the pipe line utmost care of existing main, electrical and telephone cables and private water connections/sewage connections shall be taken. Any damage to existing main electrical and telephone cable and private water/ sewage connection, etc, occurs during the course of execution, same shall be restored at the cost of the contractor. In case the repairs are done by owner, the cost of such repair will be recovered from the contractor.

Rates for all type of materials are exclusive of GST and all taxes levied by Central Government, State Government or local bodies.

Rates for supply of specials and valves are exclusive of excise duty (Central), GST & inclusive of Third party inspection charges, storage charges, overhead charges and transportation of materials up to site and stacking. Rates mentioned in the tender are exclusive of all Central Govt, State Govt. and Local taxes, duties and cess etc.

15. Though the contractor is required to do refilling before hydraulic testing to avoid traffic hurdle, no payment for refilling of the trenches of pipe line shall be payable till

satisfactory hydraulic testing is given. Re-excavation required if any during testing shall be done by contractor at his own cost.

16. The works of cross connections to existing lines are to be arranged in such a way as no major shutdowns are required to be taken and work should be completed within minimum period of time, without interrupting the major water supply in the area.

17. Activity in Bar chart and network diagram (CPM / PERT) shall be modified regularly in case any activity could not be done in time due to some extra ordinary reason. The same modified Bar Chart/Network diagram should be submitted for approval of Engineer-in-Charge or competent authority of Corporation, who will give approval after consultation with SMKC.

18. Work shall be executed in stages as mentioned Government Resolution issued by the Urban Development department.

19. INCENTIVE BONUS

As an encouragement to the early completion of the project an incentive bonus will be payable to the contractor.

If contractor completes the work before scheduled time limit, he will be paid incentive bonus at the rate of 0.5% of the initial contract value or revised contract value whichever is less for every one month of early completion ahead of the original completion period or revised completion period whichever is less.

Maximum incentive payable shall not be more than 3% of the original value or revised value whichever is less.

This incentive scheme shall not apply if extension to the original completion period is required irrespective of on whose account (Owner or Contractor's account). Period less than a month will not reckoned for the incentive bonus calculations.

20. All the bills in R A bill format shall be submitted to the MJP by the contractor. The bills will be checked and scrutinized by MJP and will be submitted to the ULB/SMKC/SMKC for Recording, Passing and Payment by the ULB/SMKC/SMKC.

21. The bills vetted and submitted by the PMC will be normally cleared and payment will be released within a period of 15 days from the receipt of such vetted bills by the ULB/SMKC or executing agency as the case may be. Such payment will be subject to availability of funds with the ULB/SMKC or executing agency.

22. Extension of time limit will be granted by Executive Engineer Water Suppply and Drainage SMKC after obtaining approval/consent of competent authority of SMKC

INSTRUCTIONS TO TENDERER

Sangli Miraj And Kupwad City Muncipal Corporation

Name of work : Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli

INSTRUCTIONS TO TENDERER

1. **AWARD CRITERIA**

The Owner will award the contract to the successful bidder whose bid has been determined to be substantially responsive and has been determined as the lowest evaluated bid, provided further that the Bidder is determined to be qualified to perform the contract satisfactorily. The tender will be awarded after bid evaluation report approved by the appropriate competent authority.

2. **ACCEPTANCE OF THE TENDER**

2.1 The acceptance of the tender rests with the appropriate competent authority. The right to reject any or all the tenders without assigning any reason thereof is reserved by appropriate competent authority. The tenderer whose tender is accepted will have to enter into regular agreement in the type and form prescribed in the tender and abides by all the rules embodied therein, cost of agreement etc. should also be borne by the tenderer.

2.2 No corrections, additions or alterations in the tender document shall be made. No special stipulations in the tender document shall be permitted.

2.3 The tender shall be liable to be rejected outright if while submitting the same.

i) The Tender is not submitted on E-tendering portal specified in the Tender Notice.
ii) The Tenderer proposes any conditions and alterations in the obligatory conditions of the tender.
iii) Any of the pages of the tender is removed/replaced or spoiled badly.
iv) If the offer in words and in figures is not filled in appropriate place of B.1 Form.
v) If the specified Earnest Money in specified form is not paid.
vi) Any erasures are made in the tender documents.
vii) The tenderer or in case of firm or company authorized person does not sign the tender documents in the place provided for the purpose, in B.1 Tender form.

2.4 If the tendering contractors are a firm or company, they shall in their forwarding letter should mention the names of all the partners of the firm or the company as the case may be and the names of the partners who hold the power of attorney authorizing him to conduct transactions on behalf of the Company/Firm.

2.5 Rules and conditions of the contract are subject to amendment till the time of

acceptance of tender.

2.6 The notes and conditions stipulated in this notice will form a part of the agreement.

3.0 SIGNING OF CONTRACT

At the same time as the Owner notifies the successful Bidder that the bid has been accepted, the Owner will send the Bidder an acceptance letter informing the Bidder, the further necessary line of action including signing of contract etc.

4.0 FOR SPECIAL ATTENTION OF TENDERER

The tenderer is expected to visit the site before quoting the tender and get himself acquainted with the site conditions and site requirements.
The contracting firm shall study the site and general conditions in respect of approaches, labour, water supply, climate, quarries and the data included in the tender papers and get verified from the actual inspection of site etc. before submitting the tender. In case of any doubt about any item or data included in the tender or otherwise, it shall be got clarified by applying in writing to the tender inviting authority at least 3 days before the date of pre-tender conference. Once the tender is submitted, it shall be concluded with all the details required for completing the work as per tender conditions and specifications.
Responsibility of Departmental staff will be nominal and limited to extending all possible help in solving local problems for obtaining permission, obtaining power supply etc.

5.0 LOCAL ROADS

The existing public roads that are near the site of work are shown in Drawing accompanying the Tender documents. The contactor may contract and maintains additional roads as required at his own expenses.

6.0 MEDICAL AND SANITARY ARRANGEMENT TO BE PROVIDED FOR LABOUR EMPLOTED IN THE CONSTRUCTION BY THE CONTRACTOR

a) The contractor shall provide an adequate supply of pure and wholesome water for the use of laborers on works and in camps.

b) The contractor shall construct trenches, semi permanent latrines for the use of labourers , Separate latrine shall be provided for men and women.

c) The contractor shall construct sufficient number of huts on a suitable plot of land for use of the labourers according to the following specifications.

i) Hut of Bomboobs and Grass may be constructed.

ii) A good site not liable to submergence shall be selected on high ground remote from jungle but well provided with trees shall be chosen wherever it is available. The neighborhood of land, jungle s trees or woods should be particularly avoided . Camp should not be established close to large cutting of earth work.

iii) The lines of huts shall have open space of at least 10 meters between rows. When a good natural site is not available in this case. Particular attention should be given to the drainage.

iv) There should be no overcrowding , floor space at the rate of 3 sqm. (30 sq.ft) per head shall be provided . Care should be taken to see that the huts are kept clean and in good order.

v) The contractor must find his own land and if he wants Govt. land he should apply for it. Assessment for it if demanded will be payable by contractor. However the department does not bind itself for making available the required land.

d) The contractor shall construct a sufficient number of bathing places. Washing places should also be provided for the purpose of washing clothes.

e) The contractor shall make sufficient arrangement for draining away the surface and sullage water as well as water from the bathing and washing places and shall dispose off this waste water in such a way as not to cause any nuisance.

f) The contractor shall engage a medical officer with a traveling dispensary for a camp containing 500 or more persons, If there is no Govt. Or other private dispensary situated within 8 kilometers from the camp. In case of emergency the contractor shall arrange at his cost free transport for quick medical help to his sick workers.

g) The contractor shall provide the necessary staff for erecting the satisfactory conservancy and cleanliness of the camp to the satisfaction of the Engineer-In-Charge. At least one sweeper per 200 persons should be engaged.

h) The Assistant Director of Public Health shall be consulted before opening a labour camp and his instructions on matters such as Water Supply, sanitary, convenience for the camp site accommodation and food supply be followed by the contractor etc.

i) The contractor shall make arrangement for all antimalarial measures to be provided for the labours employed on the work. The anti measures shall be as directed by Assistant Director of public health.

j) In addition to above all provisions of the relevant labour Act pertaining to basic amenities to be provided to the labourer shall be applicable which will be arranged by the contractor.

7. MISCELLANEOUS

7.1 For providing electric wiring or water ling etc. Recesses shall be provided if necessary

through walls, slabs, beams, etc. and later-on refilled it who out any extra cost.

7.2 In case it becomes necessary for the due fulfillment of contractor for the contractor to occupy land outside the department, limits the contractor will have to make his own arrangements with the land owners and pay such rents if any, which are payable as mutually/agreed between them.

7.3 The contractor shall duly comply with provisions of the Apprentices Act 1961 (III of 1961) and the rules and order made there under from time to time under the said rules and on this failure or neglect to do so he shall subject to all the liabilities and penalties provided by the said Act and Said Rules.

7.4 It is presumed that the contractor has gone carefully through the standard specification (Vol I and II 1981 edition) and the schedule of rates of the Division, and studies of site condition before arriving at rates quoted by him. The special provisions and detailed specification of wording of any item shall gain precedence over the corresponding contrary provisions (if any) in the standard specification given without reproducing the details in contract. Decision of Engineer in charge shall be final in case of interpretation of specification.

7.5 If the standard specifications fall short for the items quoted in the schedule of this contract, reference shall be made to the latest Indian standard specifications, I.R.C. code, if any of the item of this contract do not fill in reference quoted above the decision and specification as directed by the Engineer-In –Charge. Shall be final.

7.6 The stacking and storage of building materials at site shall be in such a manner as to prevent deterioration or inclusion of foreign material and to ensure the preservation of the quality. Properties and fitness of the work. Suitable precautions shall be taken by contractor to protect the materials against atmospheric action, fire and other hazards. The materials likely to be carried away by wind shall be stored, in suitable stores or with suitable barricades and where there is likelihood of subsidence of soil, heavy ,materials shall be stored on paved platforms. Suitable separation barricades and enclosure as directed shall be provided to separate materials brought by contractor and material issued by Govt. To contractor under Schedule- A. Same applies for the materials obtained from different source of supply.

8. HANDING OVER OF WORK

All work and material before taken over by Sangli Miraj And Kupwad City Muncipal Corporation will be entire responsibility of the contractor for guarding, maintaining and making good, any damage of any magnitude. Interim payments made for suck work will not alter this position. The handing over by the contractor and taking over by the Executive Engineer/Engineer in charge or chief Officer or his authorized agent will be always in writing, copies of which will go to the Executive Engineer, signed by authorized representative of SMKC and the contractor. It is however understood that

before taking over of such work SMKC will not put the system into its regular use, casual or incidental one, except as specifically mentioned elsewhere in this contract or mutually agreed to.

ACQUAINTANCE WITH SITE CONDITIONS AND WORK CONDITIONS

Sangli Miraj and Kupwad City Muncipal Corporation

NAME OF WORK : Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli

ACQUAINTANCE WITH SITE CONDITIONS AND WORK CONDITIONS

1. The Contractor shall study the site conditions, general conditions and data included in the tender papers and get it verified from actual inspection of the site etc. before submitting the tender. In case of doubts about any items or data included in this tender or otherwise, it shall be got clarified by applying in writing to the Executive Engineer/Engineer in charge /Commissioner/Chief officer, 15 days in advance before date of submission of the tender. Once the tender is submitted, it shall be considered that the Contractor has verified and made himself conversant with all the details as required for quoting the rates and completing the work as per tender conditions and specifications.

2. Contractor shall not sell or otherwise dispose off or remove except for the purpose of this contract, the rubble, stone metal, sand or other material which may be obtained from any excavation made for the purpose of the contract. All such materials shall be SMKC/Council/Corporation's property and shall be disposed off in the manner and at place as may be directed by the Engineer-in-charge. Contractor may with the permission of the Engineer-in-charge in writing and when directed by him, use any of the materials free of cost.

3. Other unforeseen items to be done in the course of work will have to be done by the Contractor as per specifications in P.W.D. Hand book volume I and II and will be paid at mutually agreed rates, ISS and standard practice in vogue.
Extra charge of claims in respect of extra work shall not be allowed unless the work to which they relate are in the spirit and meaning of the specifications or unless such works are ordered in writing by the Engineer-in-charge and claimed for in the specified manner before the work is taken in hand.

MATERIALS:

4. The Contractor shall make his own arrangements for obtaining rubble, khandki, headers, metal, sand, murum etc. from SMKC/Council/Corporation or private quarry. Applications of the Contractor for reasonable area of Government land required for this purpose can be recommended to Revenue Authorities without any guarantee of making the land for quarry available.

All the materials involved in the construction shall be of best quality and specifications and shall be got approved from the Engineer-in-charge before use. If necessary, materials shall be got tested from the Laboratory at his cost. Samples requiring approval shall be submitted by the Contractor to the Engineer-in-charge in good time before the use of each material. The samples shall be properly marked to show the name of the materials place.

5. The Contractor shall provide all labour, skilled as well as unskilled, pages, lime, strings, site-rails (wooden as well as Steel etc.) as and when required as per approved design and make available such other materials for surveying, lining out, setting out, checking of work, taking measurements, testing of hydraulic and other structures, without any payment by the SMKC/Council/Corporation to him. He will also provide proper approach and access to all his works and stores without any extra cost over tendered rates for the items to be inspected.

6. Rates quoted include clearance of site (prior to commencement of work and its closure) in all respects and hold good for work under all conditions of sites, moisture, weather etc.

7. Failure to comply with any of the above instructions will result in the SMKC/Council/Corporation's doing the needful at the risk and cost of the contractor. These conditions are for all items and as such no extra payment shall be made for observing these conditions.

8. The contractor shall make his own arrangements for quarrying of rubble, stone, murum, sand, lime, metal etc.

9. Overburden in a quarry will have to be removed by the contractor at his own cost.

10. Unless a separate item is provided in Schedule 'B' minor dewatering of foundations in excavation and during the construction of foundation Masonry if required shall be done by the Contractor without claiming extra cost.

11. Masonry shall be kept wet for atleast 15 days and concrete work shall be kept wet for atleast 21 days commencing from the date of its final laying in position. In case during execution curing is found inadequate it will be carried out SMKC/Council/Corporation's and the cost thereof shall be recovered from the contractor. The contractor shall make

his own arrangements for getting water at site at his own cost.

12. The proportions of cement concrete specified in the Schedule 'B' are nominal and are only an indication of approximate proportion of cement, fine aggregate and coarse aggregate which may have to be altered suitably at site to obtain the desired strength and workability. However quantity of cement shall not be less than the one specified below.

NOMINAL MIX:

1:11/2:1	(M-300)	9.00 bags/one cum of cement concrete
1:1:5: 3	(M-200)	7.90 bags/one cum of cement concrete
1:2:4	(M-150)	6.30 bags/one cum of cement concrete
1:3:6	(M-100)	4.40 bags/one cum of cement concrete
1:4:8	(M-80)	3.40 bags/one cum of cement concrete

In case of major items of concrete for R.C.C. works, the Contractor shall prepare test blocks as per I.S. specifications for testing its tensile and compressive strength at his own cost. These block will be tested in any of the Government Test Laboratories at the cost of the Contractor. The number of test blocks, frequency etc. shall be directed by Engineer-In-Charge.

13. DAMAGE BY FLOODS OR ACCIDENT:

The Contractor shall take all precautions against damage by floods and from accidents. No compensation will be allowed to the contractor for his plant, material and work etc. Lost or damaged by floods or from other causes. The Contractor shall be liable to make good any part of material which is in charge of the Contractor and which is lost or damaged by floods or from any other cause. If the work executed is damaged, trenches filled due to any reason, Contractor shall have to make it good at his cost only.

14. SUPPLY OF RATE-ANALYSIS IN CASE OF EXTRA ITEMS

In case of the EIRL the Contractor shall supply Rate Analysis based on labour and material in case he is called upon to do so.

15. WATER REQUIRED FOR CONSTRUCTION :-

The Contractor has to make his own arrangements at his cost for water required for construction, testing, filling, structures, etc. either from local bodies or from else where, by paying the charges directly and arranging tankers etc. as per necessity. No claim for extra payment on account of non-availability of water nearby, or extra lead for bringing water shall be entertained. All required piping arrangements and pumping if required for water shall be made by the Contractor at his cost.

If Contractor fails to pay the water charges to local bodies or private parties these

shall be recovered by the SMKC/Council/Corporation from his bills. In case SMKC/Council/Corporation 's water supply is available, a connection at a suitable place may be sanctioned but all further arrangements of pumping if required, piping etc. shall be done by the Contractor at his cost, and water charges in such a case, shall be paid by the Contractor at the rates as decided by the Executive Engineer/Engineer in charge /Commissioner/Chief officer, which shall be final and binding on the Contractor.

Whenever Schedule 'B' provides for any dewatering item, payment shall be admissible under that item, but apart from that item no extra claims for dewatering required for executing various tender items, and for executing such items in wet condition shall be entertained as all these expenses are deemed to be included in the dewatering item.

16. LEADS AND LIFTS :-

Unless otherwise specifically mentioned in the tender item, the tendered rate for all items in tender shall cover all lifts and leads encountered for the executions of the work as directed.

17. Unless otherwise specifically provided for in the tender or a separate item is provided in Schedule 'B', all the sides of excavated trenches after the work is completed or in progress are to be filled by the Contractor to the original ground level from excavated stuff at no extra cost to the SMKC/Council/Corporation ,

18. Unless otherwise specifically mentioned in tender items, the net dimensions of RCC or CC members actually cast are only admissible for payment under RCC or Plain CC items. No increase in dimensions due to plastering or finishing shall be admissible for payment under RCC or plain CC items.

19. No claims for any desilting of trenches, foundation etc. filled due to floods, untimely rains, or any other reasons whatsoever shall be entertained and Contractor shall have to do this desilting operation together with dewatering operations entirely at his cost.

20. Electricity supply required for construction of work/labour camp, etc. shall be arranged by the contractor at his own cost.

FORM-B.1

FORM B.1
PERCENTAGE RATE TENDER AND CONTRACT FOR WORKS

DEPARTMENT Sangli Miraj and Kupwad City Muncipal Corporation

NAME OF WORK **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli**

GENERAL RULES AND DIRECTIONS FOR THE GUIDANCE OF CONTRACTORS

1. All works proposed to be executed by contractor shall be notified in a form of invitation to tender pasted on a Board hung up in the office of the City Engineer SMKC and signed by the Executive Engineer/Engineer in charge/Chief Officer/Commissioner.
   This form will state the works to be carried out as well as the date of submitting and opening tenders and the time allowed for carrying out the work, also the amount of earnest money to be deposited with the tender and the amount of the security deposit to be deposited by the successful tenderer and the percentage, if any to be deducted from bills. It will also state whether a refund of quarry fees, royalties and ground rents will be granted. Copies of the specifications, designs and drawings and estimated rates, schedule rates and any other documents required in connection with the work which will be signed by the Executive Engineer Water Supply and Dranage SMKC for the propose of identification shall also be open for Inspection by contractors at the office of the Executive Engineer Water Supply and Dranage SMKC during office hours.
   Where the works are proposed to be executed by the contractor according to the specifications recommended and approved by a competent authority on behalf of the SMKC, such specification with designs drawings shall form part of the accepted tender.
2. In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof, and in the event of the absence of any partner, it shall be signed on his behalf by a person holding a power – of - attorney authorizing him to do so.

   i)The contractor shall pay along with the tender the sum, of (Rs.

1,03,23,363/-) (Rs. Rupees One Crore Three Lakh(s) Twenty three Thousand Three Hundred Sixty three Only) as and by way of earnest money. The EMD shall be paid by SBI Net Banking. The said amount of earnest money shall not carry any interest whatsoever.

ii)In the event of his tender being accepted, to the provision of sub-clause(iii), below,
a) the said amount of earnest money shall be appropriated towards the amount of security deposit payable by him under conditions of General conditions of contract.
i) If, after, submitting the tender, the contractor withdraws his offer or modifies the same, or if after the acceptance of his Tender, the contractor fails or neglects to furnish the balance security deposit without prejudice to any other right and powers of the SMKC hereunder, or in law, SMKC shall be entitled to forfeit the full amount of the earnest money deposited by him.
ii) In the event of his Tender not being accepted, the amount of earnest money deposited by the contractor shall, unless it is prior thereto forfeited under the provision of sub-clause (iii) above, be refunded to him on his passing receipt therefore.

3. Receipts for payments made on account of any work, when executed by a firm should also be signed by all the partners except where the contractors are described in their tender as a firm. In which case the receipt shall be signed in the name of the firm by one of the partners or by some other person have authority to give effectual receipts of the firm.

4. Any person who submits tender shall fill up the usual printed form stating at what percentage above or below the rates specified in Schedule - B (memorandum showing items of work to be carried out) he is willing to undertake the work. Only one rate or such percentage on all the Estimated rates/ Schedule rates shall be named. Tenders which propose any alteration in the work specified in the said form of invitation of tender, or in the time allowed for carrying out the work, or which contain separate percentage over estimated rates / schedule rates for different sub work or item, or which any other conditions of any sort which are not filled with the percentage as the space provided for the purpose and not signed at proper place in the printed B-1 Tender

Form will be liable to rejection. No printed form of tender shall include a tender for more than one work. But, if contractors who wish to tender for more works, shall submit a separate tender for each work. Tenders shall have the name and the number of work to which they refer, written outside the envelopes.

5. The competent authority shall open tenders in the presence of any intending contractors who have submitted tenders or their representatives who may be present at the time, and he will enter the amount of the several tenders in a comparative statement in a suitable form. In the event of a tender being accepted, the contractor shall for the purpose of identification, sign copies of the specifications and other documents mentioned in Rule 1. In the events of a tender being rejected, the Executive Engineer Water Supply and Dranage SMKC shall arrange / authorized to refund the amount of the earnest money deposited to the tenderer, on his giving a receipt for the return of the money.
6. Competent authority is the final authority to reject all or any of the tenders.
7. No receipt for any payment alleged to have been made by a contractor in regard to any matter relating to this tender or the contract shall be valid and binding on SMKC unless it is signed by the Executive Engineer.
8. The memorandum of the work to be tendered for and the schedule of materials to be supplied by the (herein before and after called as …SMKC) and their rates shall be filled in and completed by the office of the Executive Engineer Water Supply and Dranage SMKC before the tender form is issued. If a form issued to an intending Tender has not been so filled in and completed, he shall request the said office to have this done before he completes and delivers his tender.
9. All work shall be measured net by standard measure and

according to the rules and customs of the PWD/SMKC and without reference to any local custom.

10. Under no circumstances shall any; contractor be entitled to claim enhanced rates for items in this contract.

11. Every registered contractor should produce along with his tender certificate of registration, as approved contractor in the appropriate class and renewal of such registration with date of expiry.

12. Corrections and additions should be initialed.

13. The measurements of work will be taken according to the usual methods in use in the PWD/SMKC and no proposals to adopt alternative methods will be accepted. The Engineer's decision as to what is the usual method in use will be final.

14. A tendering contractor shall furnish a declaration along with the tender showing all works for which he has already entered into contract, and the value of work that remains to be executed in each case on the date of submitting the tender. Such certificate shall be in the proforma attached in the tender documents.

15. In view of the difficult position regarding the availability of foreign exchange no foreign exchange would be released by the corporation/council for the purchase of plant and machinery or any other purpose for the execution of the work contracted for.

16. The contractor will have to construct shed, for storing controlled and valuable material issued to him under Schedule “A” of the agreement or brought him on work site, at work site having double locking arrangement. The materials will be taken for use in the presence of the department person. No. materials will be allowed to be removed from the site of works without written permission of the Engineer-in-charge.

17. The tenderer will have to produce to the satisfaction of the accepting authority a valid and current license issued in his favor under the provision of Contractor Labour Regulation and Abolition Act. 1973 before starting work, failing with acceptance of the tender will be liable for withdrawal and Earnest money / Security

Deposit will be forfeited to the Corporation.

18. The contractor shall comply with the provision of the Apprentices Act. 1961 and the rules and orders issued there under from time to time. The contract shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the Act.

19. In this tender 09 sub-works are included .As per Government resolution the work will be taken up in three phases. The work order will be issued accordingly by fixing time limit. Contractor has to complete the work within stipulated time for each phase. If he fails, action as per clause 2 will be initiated against the contractor.

20. As per clause 6 of B-1 form, extension of time limit will be governed. If contractor fails to apply for extension of time limit as per clause 6 to keep the tender alive, SMKC will grant the extension considering the progress of work and in the light of clause 2.
As per Government Resolution Price Variation Clause is applicable to tender.

21. The tender Rates are exclusive of all taxes such as GST, Cess, and General Tax etc. Contractor shall be deemed to have examined the work and site conditions including labour, the general and special conditions, specifications and drawings and shall be deemed to have visited the work site and to have fully informed himself regarding the local conditions and carried out his own investigations to arrive at rates quoted in the tender.

22. There shall be no corrections or overwriting and if any that shall be dully initialed by Contractor himself.

Note: The Commercial Offer must be filled online using individual's digital certificate. (An online form will be provided for this during online bid preparation stage).

. I / We hereby, tender for the execution for the SMKC for the work specified in the underwritten memorandum within the time specified in such memorandum at (Amrut-2 Kupwad Underground Drainage Scheme) in figures as well as in words percent below/above the estimated rates

entered in schedule ‘B’ memorandum showing items of work to be carried out and in accordance with all respects with the specifications, designs, drawings, and instructions in writing referred to in Rule hereof and in clause 12 of the annexed conditions of the contract and agree that what materials for the work are provided by the SMKC/Corporation/Council such materials are at the rates to be paid for them shall be as provided in schedule “A” here to.

Memorandum

a) General description *:* **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli**

a) if several sub works are included they should be detailed in a separate list

b) Estimated Cost. Rs. 206,46,72,610/-

c) Earnest Money. Rs.1,03,23,363/-

c) The amount of earnest money to be deposited shall be in accordance with the provision of paras 206 and 207 of the M.P.W. Manual.

d) **Security Deposit.**
Total 4% of estimated cost put to tender or accepted tender cost whichever is higher

d) This deposit shall, be in accordance with paras 213 and 214 of the M.P.W. Manual.

i) **Initial Security Deposit**
2% of estimated cost put to tender or accepted tender cost whichever is higher shall be in form of FDR from any Nationalized / Scheduled Bank or Bank Guarantee

ii) Balance 2% amount of Security deposit, will be recovered through
each Running Bill at The rate of 5% of the gross amount of running bill till the required total amount of Security Deposit is recovered

e) Percentage, if any, to be deducted from bills so as to make up the total amount required as security deposit by the time, half the work as measured by the cost is done.
5% (Five) Percent

e) This percentage where no security deposit is taken, will

vary from 5 % to 10 % according to the requirement of case where security deposit is taken see note to clause 1 this conditions of contractor.

f) **Additional Security Deposit. (Performance security)**

- If the tenderer has quoted the offer below than the estimated rates put to the tender, the tenderer shall have to submit Additional Security Deposit(ASD) (Performance security) in the form of bank guarantee of any nationalize or scheduled Bank in favor of the "The Commissioner Sangli Miraj and Kupwad City Corporation
- The tenderer shall submit the Bank Guarantee of Additional Security Deposit (ASD) within 8 days from opening of Financial Bid to the office of "The Commissioner Sangli Miraj and Kupwad City Corporation.".
- If the first lowest (L-1) tenderer failed to submit the Additional Performance Security Deposit within eight days then his tender shall be liable for rejection and his EMD will be forfeited. In such case, if the second lowest (L-2) tenderer agree to execute the work at less than the rates of first lowest tenderer, then his tender will be accepted. The 2nd lowest tenderer will have to submit the Additional Performance Security Deposit in form of Bank Guarantee / Demand Draft.
- The amount of the (ASD) Bank Guarantee shall be calculated by the tenderer in accordance with this following manner.
- If the tenderer has quoted below the estimated rates, the ASD (Performance security) shall be paid additionally as mentioned below.

Rate quoted to Estimated Rate	Additional Security Deposite (Performance security)
Below 0 % to	1) NIL
Lower than below 1% to	2) 1 % of estimated cost put to tender

Lower than below 10% to below 15%.	3) 1% + (% rate quoted -10%) For example : If 15% below is quoted the amount of performance security (Additional Security Deposit) shall be 1+ (15-10) = 6% Performance Security of estimated cost put to tender. If the amount is less than Rs. 1000/-, then minimum to be Rs. 1000/-
Lower than 15 % below	4) % as per Sr. No. 3 + (% rate quoted -15%) x 2 For example : If 19% below is quoted the amount of performance security (Additional Security Deposit) shall be 6+(19-15)x2 = 6%+8% = 14% Performance Security of estimated cost put to tender. If the amount is less than Rs. 1000/-, then minimum to be Rs. 1000/-.

- The bank Guarantee shall be valid upto defect liability period of the tender. It should bear MICR and IFS code.
- In case it is found that documents / Bank Guarantees submitted by the tenderer are faluse or misleading his earnest money shall be suspended for the period of 1 year. Additionally legal action may be initiated against the tenderer .
- The work order shall be given to the concerned tenderer after the clearance of the Bank Guarantee submitted by him.

REFUND OF PERFORMANCE SECURITY

- The amount of the performance security in the form of Bank Guarantee shall be released after completion of defect liability period of the tender.
- Non submission of additional security deposit in the form of Bank Guarantee shall be liable to summarily rejection of his tender.

The initial Security Deposit and additional security deposit may be in the form of Fixed deposit receipt OR Bank Guarantee by a Nationalized/Scheduled Bank in the name of "The Commissioner Sangli Miraj and Kupwad City Muncipal Corporation and shall be for a minimum period of 24 months (time limit) and shall be extended suitably if the work is not completed within the time limit. The tenderer shall have to furnish this security deposit with initial security deposit.

g)Time allowed for the work from date of written order to commence.24 Calender Months (including Mansoon).

I/We agree that the offer shall remain open for acceptance for a minimum period of 120 days from the date fixed for opening for the same and thereafter until it is withdrawn by me/ us notice in writing duly addressed to the authority opening the tenders and sent by registered post A.D. or otherwise delivered at the office of such authority. Term deposit Receipt No./Demand draft No. dated and date in respect of the sum of `…….( in wards `……) is herewith forwrded. The amount of earnest money shall not bear interest and shall be liable to be forfeited to the SMKC/MunicapalCouncil/Corporation should I/We fail to (i) abide by the stipulation to keep the offer open for the period mentioned above of (ii) sign and complete the contract documents as required by the Engineer and furnish the security deposit as specified in item. (d) of the memorandum contained in paragraph (1) above within the time limit laid down in clause (1) of the annexed General Conditions of contract, the amount of earnest money may be adjusted towards the security deposit or refunded to me/us in writing unless the same or any part thereof has been forfeited as aforesaid.

I/We have secured exemption from payment of earnest money after executing the necessary bond in favour of the SMKC/MunicapalCouncil/Corporation a true copy of which is enclosed herewith should any occasion for forfeiture of earnest money for this work arise due to failure on my/our part to abide by the stipulations to keep the offer open for the period mentioned above or to sign and complete the contract documents and furnish to security deposit as specified in item (d) of the Memorandum contained in paragraph (1) above within the time limit laid down in clause (i) of the annexed General Conditions of contract, the amount payable by me/us at the option of the Engineer, be recovered out of the amount deposited in lump sum for securing exemption in so far as the same may be extend in terms of the said bond and in the event of the deficiency out of any other moneys which are due to payable to me/us by the SMKC/MunicapalCouncil/Corporation under any other contract or transaction of any nature whatsoever or otherwise.

Should this tender be accepted I/We hereby agree to abide by and fulfill all the terms and provisions of the conditions of contract annexed hereto so far as applicable and in default thereof to forfeit and pay SMKC/Municipal Council/Corporation the sum of money mentioned in the said conditions. Term Deposit Receipt No. ……. Dated from The Bank…… at in respect of sum of Rs. …… ……. Is herewith forwarded representing the earnest money (a) the full value which is to be absolutely forfeited to the SMKC should I/We not deposit in the full amount of security deposit specified in the above memorandum in Accordance with (d) of clause (i) of the tender for works shall be refunded.

Strike out (a) such security deposit is to be taken.

Contractor

Signature of the contractor
before submission of tender.

Address

date of 2023

Witness

Signature of witness to

contractor's signature.

The above tender is hereby accepted by me for and one behalf of the SMKC
Dated

Executive Engineer
Water Supply and drainage

CONDITIONS OF CONTRACT

**(Modification as per the GR PWD NO. CAT-1087/ CR- 94/Bldg-2, dated 14.6.1989) **

Security Deposit

Clause 1 : The person / person whose tender may be accepted (hereinafter called the Contractor, which expression shall unless excluded by or repugnant to the context include his heirs, executors, administrators and assigns) shall (A) within ten days (which may be extended by the Chief Engineer/Commissioner/Chief Officer concerned upto 15 days if the Commissioner/Chief Officer thinks fit to do so) of the receipt by him of the notification of the acceptance of his tender deposit with the Engineer in-charge in Cash or Government securities endorsed to the Engineer in charge (if deposited for more than 12 months) of sum sufficient which will make up the full security deposit specified in the tender or (B) (permit SMKC/Corporation/Council at the time of making any payment to him for work done under the contract to deduct such sum as will amount to 4% of all moneys so payable; such deductions to be held by Corporation/Council by way of security deposit). Provided always that in the event of the Contractor depositing a lumpsum by way of security deposit as contemplated at (A) above, then and in such case, if the sum so deposited shall not to 4% of the total estimated cost of work or tendered cost whichever is higher, it shall be lawful for SMKC/Corporation/Council at the time of making any payment to the contractor for work done under the contract to make-up the full amount of Four (4) percent by deducting a sufficient sum from every such payment as last aforesaid until the full amount to the security deposit is made up. All compensation or other sums of moneys payable the contractor to SMKC/Corporation/Council under the terms of his contract may be deducted from or paid by the sale of sufficient part of his security deposit or from the interest arising there from, or from any sums which may become due by SMKC/Corporation/Council to the contractor under any other contract or transaction on any account whatsoever and in the event of his security deposit being reduced by reason of any such deduction or sale as aforesaid, the contractor shall, within ten days thereafter, make good in cash or Government securities endorsed as aforesaid or Bank Guarantee issued by bank

for any sum or sums which may have been deducted from or raised by sale of his security deposited or any part thereof. The Security deposit referred to, when paid in cash may, at the cost of the depositor, be converted into interest bearing securities provided that the depositor has expressly desired this in writing.

If the amount of the security deposit to be paid in a lump sum within the period specified at (A) above is not paid the tender/contract already accepted shall be considered as cancelled and legal steps taken against the Contractor for recovery of the amounts. The amount of security deposit lodged by Contractor shall be refunded along with the payment of the final bill, if the date upto, which the Contractor has agreed to maintain the work in good order, is over. If such date is not over only 50% amount of the security deposit shall be refunded along with the payment of the final bill. The amount of security deposit retained by SMKC/Corporation/Council shall be released after expiry of period upto, which the Contractor has agreed to maintain the work in good order, is over. In the event of Contractor failing or neglecting to complete rectification work within the period upto, which the Contractor has agreed to maintain the work in good order then subject to provisions of Clause 17 and 20 hereof, the amount of security deposit retained by SMKC/Corporation/Council shall be adjusted towards the excess cost incurred by the SMKC/Corporation/Council on rectification work.

Compensation Delay

Clause 2 - (1) As per the time limit for the scheme physically completion, Bar chart for the same is included in the tender documents. Bidder should submit the same with bid documents duly "accepted" and sign the same. OR. Bidder can
submit his own revised bar chart duly signed, without changing the time limit of the scheme, stated above (2) (a) Concern Deputy Engineer reviewed monthly and progress of work (Plan and work in progress) will be submitted to The Executive Engineer in the enclosed format (Annexure XVIII-CL-2(2)(a)) (b)
Division Office will examine the Annexure XVIII-CL-2(a) and will be issue notice to contractor if low progress noticed in the enclosed format (Annex-Cl- 2(2)(b)) (3) (a) Concern Executive Engineer reviewed the progress of work in the 2nd week of month- January and July of every year and recorded as par Annexure XVIII-Cl-2(3)(a)(b)While calculating the fine, amount of work,
contractor is not responsible for the delay, will be deducted.

(C) After the review, as per record and progress as per accepted bar chart, if the progress of work found low, as per column No. 12 of the Annexure XVIII-C1- 2(3)(a) by executive engineer, will prepare fine to be imposed proposal including all details within 7 days and will Compensation Delay 89 Contractor No. of corrections Executive Engineer submitted to SMKC.

(4) (a) Formula for calculation of fine4 imposed is as below - Difference in cost of work lagging according to bar chart (as per col. No.12 (Annexure XVIII-Cl- 2(3)(a) x 5 180 days or Work completion period whichever is less.

b) White calculating the fine, Accepted Cost of the tender and Estimated cost of tender, which is higher cost, will considered.

(c) After the review in month of January and July and progress will be not up to date as per accepted bar chart, fine will be charge from February and August.

(d) After each review of progress, fine will recalculate and imposed on cost of lagging work.

(e) Besides of the imposing and recovery of fine, If the contractor completed work within stipulated period and proposal of refund of fine if there, the proposal should be submitted in the month of March and September. Example for the refund of fine is enclosed herewith as Annex-CI-2(4) (e).

(5) Though, else above referred, during the Review or field visit, if the progress found slow or contractor does not follow the progress as per bar chart, fine will be imposed.

(6) (a) If the fine amount insufficient as compare to work done by him, or contractor comt completing the remaining work, action will be taken as per ctause 3(c).

(b) In this case, to complete the remaining works, there may be a possibility of more funds, then excess amount should be recover from fine and security deposit, after this, if the recovery remains, same will be recovered from other works of same contractors.

(7) Now fine imposing system has been switch over to fine as per sub work wise progress, hence maximum 5% amount of the accepted tender cost fine amount will be recovered. Full work in 24 Months for completion of Works and 3 months for Trial Run (21+3) =24 months including monsoon The particulars of implementation of this clause, would be ruled by the provisions of MJP Circular No 231 issued on 16th January 2020, the copy of which is appended with the present Tender document as part and parcel of same. The reference bar Chart directed in this circular is appended with the tender

documents as part and parcel of same.

In the event of the contractor failing to comply with these conditions he shall be liable to pay as compensation an amount equal to one percent or such smaller amount as Chief Engineer/Commissioner/Chief Officer (whose decision in writing shall be final) may decide of the said estimated cost of the whole work for everyday that the due quantity of work remains incomplete provided always that the total amount of compensation to be paid under the provisions of this clause shall not exceed 10% of the estimated cost of the work as shown in the tender. Chief Engineer/Commissioner/Chief Officer should be the final authority in this respect, irrespective of the fact that tender is accepted by State level technical Committee. However Commissioner /Chief officer shall seek the consent of the SMKC and/or approval of the State level technical committee.

Action when whole of security deposit is forfeited.

Clause 3: If any clause in which under any clause of this contract the Contractor shall have rendered himself liable to pay compensation amounting to the whole of his security deposit (whether paid in one sum or deducted by installment) or in the case of abandonment of the work owing to serious illness or death of the Contractor or any other cause, the Engineer in charge on behalf of the SMKC/Corporation/Council shall have power to adopt any of the following courses, as he may deem best suited to the interest of the SMKC/Corporation/Council

To rescind the contract (for which rescission notice in writing to the Contractor under the hands of Engineer in-charge shall be conclusive evidence) and in that case the security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of the SMKC/Corporation/Council

b) To carry out the work or any part of the work departmentally debiting the Contractor with the cost of the work, expenditure incurred on tools, plant and charges on additional supervisory staff including the cost of work-charged establishment employed for getting unexecuted part of the work completed and crediting him with the value of the work done departmentally in all respects in the same manner and at the same rates as if it has been carried out by the Contractor under the terms of his contract. The

certificate of the Engineer in-charge as to the cost and other allied expenses so incurred and as to the value of the work so done departmentally shall be final and conclusive against the Contractor.

c) The order that work of the Contractor be measured up and take such part thereof as shall be unexecuted out of his hands and to give it to another contractor to complete in which case all expenses incurred on advertisement for fixing a new contracting agency, additional supervisory staff including the cost of work-charged establishment and the cost of the work executed by the new contract agency will be debited to other contractors and the value of the work done or executed through the new contractor shall be credited to the Contractor in all respects and in the same manner and at the same rates as if it had been carried out by the Contractor under the terms of his contract. The certificate of the Engineer in-charge as to all the costs of the work and other expenses incurred as aforesaid for getting the unexecuted Work done by the new contractor and as to the value of the work so done shall be final and conclusive against the Contractor.

In case the contractor shall be rescinded under clause (a) above, the contractor shall not be entitled to recover or to be paid, any sum for any work therefore actually performed by him under this contract unless and until the City Engineer SMKCshall have certified in writing the performance of such work and the amount payable to him in respect thereof and he shall only be entitled to be paid the amount so certified. In the event of either the courses referred to in clause (b) or (c) being adopted and the cost of the work executed departmentally or through a new contractor and other allied expenses exceeding the value of such work credited to the contractors, the amount of excess shall be deducted from any money due to the contractor by SMKC/Council/Corporation under the contract or otherwise however or from his security deposit or the sale proceeds thereof provided however that the contractor shall have to claim against SMKC/Corporation/Council event if the certified value of the work done departmentally or through a new contractor exceeds the certified cost of such work and allied expenses, provided always that whichever of the three courses mentioned in clauses (a), (b) and (c) is adopted by the SMKC/ Corporation/Council, the contractor shall have no claim to

compensation for any loss sustained by him by reason of not having purchased or procured any materials, or entered into any engagements, or made any advance on account of or with a view to the execution of the work or the performance of the contract. The extra cost involved in the completion of the balance work carried out through the other contractor under

Amount of 3 (c) shall be recoverable from the contractor over and above the compensation levied under Clause 2 and the Security Deposit shall be apportioned against the total recoveries for this purpose also.

Action when the progress of any particular portion of the work is unsatisfactory.

Clause 4 : If the progress of the any particular portion of the work is unsatisfactory, the SMKC/Corporation/Council shall not withstanding that the general progress of the work is in accordance with the condition mentioned in clause 2 be entitled to take action under clause 3(b) after giving the contractor 10 days notice in writing. The contractor will have no claim for compensation, for any loss sustained by him owing to such action.

Contractor liable to pay compensation if action not taken under clause 3 and 4.

Clause 5 : In any case in which any of the powers conferred upon SMKC/Corporation/Council by Clause 3 and 4 hereof shall have become exercisable and the same shall not have been exercised the non exercise thereof shall not constitute waiving of any of the conditions hereof the such powers shall not withstanding be exercisable in the event of any future case of default by the contractor for under any clauses hereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of the contractor for past and future compensation shall remain unaffected. In the event of the SMKC taking action under Sub-Clause (a) or (c) of clause 3, he may, if he so desires, take possession of all or any tools and plants, materials and stores, in or upon the work or the site thereof or belonging to the contractor, or procured by him and intended to be used for the execution of the work or any part thereof paying or allowing for the same in account at the contract rates or in the case of contract rates not being applicable at current market rates to be certified by the SMKC/Corporation/Council whose certificate thereof shall be final. In the alternative the SMKC/Corporation/Council may after giving notice in writing to

the contractor or his clerk of the work, foreman or other authorized agent require him to remove such tools, plant, materials or stores from the premises within a time to do specified in such notice, and in the event of the contractor failing to comply with any such requisition, the SMKC/Corporation/Council may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respects, and the certificate of the SMKC/Corporation/Council as to the expenses of any such removal and the amount of the proceeds and expense of any such shall be final and conclusive against the contractor

Extension of time

Clause 6 : If the contractor shall desire an extension of the time for completion of work on the ground of his having been unavoidably hindered in its execution or on any other ground, he shall apply in writing to the SMKC/Corporation/Council before the expiration of the period stipulated in the tender on before the expiration of 30days from the date on which he was hindered as aforesaid or on which the cause for asking extension occurred, whichever is earlier and the Corporation/Council or in the opinion of Executive Engineer/Commissioner/Chief Officer, as the case may be, if in his opinion, there were reasonable grounds for granting the extension, grant such extension as he think necessary or proper. The decision of the SMKC/Corporation/Council in this matter shall be final.

Final Certificate.

Clause 7 : On the completion of the work the contractor shall be furnished with a certificate by the SMKC/Corporation/Council (hereinafter and hereinbefore called the Engineer-in-charge) of such completion but neither such certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall have been executed, all scaffolding surplus materials and rubbish , tools, plants and equipments and shall have cleaned off the dirt from all woodwork, doors, windows, walls, floor or other parts of any building in or upon which the work has been executed or of which he may have had possession for the purpose of executing the work nor until the work shall have been measured by the Engineer-in-charge or where the measurements have been taken by his subordinate until they have received approval of the Engineer-in-charge the said measurements being binding and

conclusive against the contractor, if the contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish and cleaning off the dirt on or before the date fixed for the completion of the work, the Engineer-in-charge may at the expense of the contractor, remove and rubbish and dispose off the same as the thinks fit and clean off such dirt as aforesaid and the contractor shall forthwith pay the amount of all expenses so incurred but shall have no claim in respect of any such scaffolding tools and plants equipments or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

Payment on intermediate certificate to be regarded as advance.

Clause 8 : No payment shall be made for any work estimated to cost less than Rupees one thousand till the whole of work shall have been completed and a certificate of completion given. But in the case of works estimated to cost more than Rupees one thousand the contractor shall on submitting a monthly bill therefore be entitled to receive payment proportionate to the part of the work then approved recommended by the Engineer-in-charge, whose certificate of such recommended and passing of the sum of payable shall be final and conclusive against the contractor. All such intermediate payments shall be regarded as payment by way of advance against the final payments only and not as payments for work actually done and completed and shall not preclude the Engineer-in-charge for requiring any bad. unsound, imperfect or unskillful work to be removed or taken away and reconstructed or re erected nor shall any such payment be considered as an admission of the due performance of the contract or any part thereof in any respect or the occurring of any claim nor shall it conclude determine or affect in any other way the powers of the Engineer-in-charge as to the final settlement and adjustment of the accounts or otherwise or is any other way very or affect the contract. The final bill shall be submitted by the contractor within one month of the date fixed for the completion of the work otherwise the Engineer-in-charge's certificate of the measurements and of the total amount payable for the work shall be final and binding on all parties.

Payment at reduced rates on account of items of work not accepted as completed, to be at the discretion of the Engineer-in-charge.

Clause 9: The rates for several items of works estimated to cost more than ` 1000/- agreed to within, shall be valid only when the item concerned is accepted as having been completed fully in accordance with the sanctioned specification. In cases where the items of are work not accepted as so completed by the Engineer-in-charge may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.

Bills to be submitted monthly

Clause 10 : A bill shall be submitted by the contractor in each month on or before the date fixed by the Engineer-in-charge for all work executed in the previous month and the Engineer-in-charge shall take or cause to be taken the requisite measurements for the purpose of having the same verified and the claim, so far as it is admissible shall be adjusted and paid if possible within ten days from the presentation of the bill. If the contractor does not submit the bill within the time fixed as aforesaid, the Engineer-in-charge may depute a subordinate to measure up the said work in the presence of the contractor or his duly authorized agent whose counter signature to the measurement list shall be sufficient warrant and the Engineer-in-charge may prepare a bill from such list which shall be binding on the contractor in all respects

Bills to be on printed form.

Clause 11 : The contractor shall submit all bills on the printed forms to be had on application at the office of the Engineer-in-charge. The charges to be made in the bills shall always be entered at the rates specified in the tender or in the case of any extra work ordered in pursuance of these conditions and not mentioned or provided for in the tender at the rates hereinafter provided for such work

Stores supplied by SMKC

Clause 12 : If the specification or estimate of the work provides for the use of any special description of materials to be supplied from the store of the SMKC/Corporation/Council or if it is required that the contractor shall use certain stores to be provided by the Engineer-in-charge (such material and stores and the prices to be charged therefore as hereinafter mentioned being so far as practicable for the convenience of the contractor but not so as in any way to control the meaning or effect of this contract specified in the schedule or memorandum hereto annexed) the contractor shall be supplied with such materials and stores as may be required from time to time to be used by him for the purposes

of the contract only and value of the full quantity of the materials and stores so supplied shall be set off or deducted from any sums then due, or thereafter to become due to the contractor under the contract or otherwise or from the security deposit or the proceeds of sale thereof if the security deposit is held in Government Securities, the same or a sufficient portion thereof shall in that case be sold for the purpose. All materials supplied to the contractor shall remain the absolute property of SMKC/Corporation/Council and shall not be removed from the site of the work and shall at all times be open to inspection by the Engineer-in-charge. Any such materials issued at cost but remained unused and in perfectly good condition at the time of completion or termination of the contract shall be returned to the SMKC/Corporation/Council, store if the Engineer-in-charge so required by a notice in writing given under his hand, but the contractor shall not be entitled to return any such material supplied to him as aforesaid but remaining unused by him or for any wastage in or, damage to any such materials. The contractor shall, however return all unused material at the time of completion, which was issued to him free of cost by the Engineer in charge and which has remained surplus with the contractor after accounting for the actual utilization of such material from the total quantity that was issued by the Engineer in charge. Cost of any material issued free of cost by the engineer and which has remained surplus with the Engineer from the contractor as mentioned in Schedule – 'A'

Storage of controlled material

Clause 12 (A) : All stores of materials such as cement, steel etc. supplied to the contractor by SMKC/Corporation/Council should be kept by the contractor in a separate store near the work site under lock and key and will be accessible for inspection by the SMKC/Corporation/Council or his agent at all the times.

Works to be executed in accordance with specifications drawings.

Clause 13 : The contractor shall execute the whole and every part of the work in the most substantial and workman like manner and both as regards materials and every other respect in strict order accordance. The contractor shall also conform exactly fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by the Engineer-in-charge and lodged in his office and to which the contractor shall be entitled to have access for the purpose of inspection at such office or on the site of

the work, during office hours. The contractor will be entitled to receive one sets of contract drawing and working drawings as well as one certified copy of the accepted tender along with the work order free of cost. Further, copies of the contract drawings and working drawings if requires by him shall supplied at the rate of ` 2000/- per set of contract drawings and ` 100/- per working drawing except where otherwise specified.

Alteration in specifications & designs not to invalidate

Clause 14 : The Engineer-in-charge shall have power to make any alterations in or additions to the original specifications, drawing, design and instructions that may appear to him to be necessary or contracts, advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Engineer-in-charge and such alterations shall not invalidate the contract and any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor on the same conditions in all respects on which he agreed to do the main work and at the same rates as are specified in the tender for the main work. And if the additional and altered work includes any class of work for which no rate is specified in this contract, then such class of work shall be carried out at the rates entered in the Schedule of Rates of the Division with due consideration for leads and lifts involved for materials and labour or at the rates mutually agreed upon between the Engineer-in-charge and the contractor, whichever are lower However, if the Engineer-in-charge is not empowered by SMKC/Corporation/Council to approve the rates of such additional or altered work then as far as possible he shall obtain prior approval to the changes and to the rates payable for such changes from competent authority of SMKC/Corporation/Council not entered in before ordering the Contractor to take up the alternation/ additional work. If the additional or altered work for which no rate is in the schedule or rates of the Division, is ordered to be carried out before the rates are agreed upon then the contractor shall within seven days of the date of receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate which it is his intention to charge for such class of work, and if the Engineer-in-charge does not agree to this rate he shall by notice in writing be at liberty to cancel his order carry out such class of work and arrange to carry

out in such manner as he may consider advisable provided always that if the contractor shall commence the work or incur any expenditure in regard thereto before the rates shall have been determined as lastly hereinbefore mentioned then in such case he shall only be entitled to be paid in respect of the work or incur any expenditure in regard there to before the rates shall have been determined as lastly hereinbefore mentioned then in such case he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of a dispute the decision of the Chief Engineer will be final.

Extension of time in consequences additions or alterations

Where, however, the work is to be executed according to the designs, drawings and specifications recommended by the contractor and accepted by the competent authority the alterations above referred to shall be within the scope of such designs, drawings and specifications appended to the tender. The time limit for the completion of the work shall be extended in the proportion that the increase in its cost occasioned by alterations or additions bears to the cost of the original contract work and the certificate of the Engineer-in-charge as to such proportion shall be conclusive.

Clause 15 :

No claim to any payment or compensation for alteration in or restriction of Work except specified in this clause.

i) If at any time after the execution of the contract documents the engineer shall for any reason what so ever (other than default on the of the contractor for which the SMKC/Corporation/Council is entitled to rescind the contract) desires that the whole or any part of the work specified in the tender should be suspended for any period of that the whole or part of the work should not be carried at all, he shall give to the contractor a notice in writing of such desire and upon the receipt of such notice the contractor shall forthwith suspend or stop the work wholly or in part as required after having due regard to the appropriate stage at which the work should be stopped or suspended so as not to cause any damage or injury to the work or any part of it could be or could have been safely stopped or suspended shall be final and conclusive against the Contractor. The Contractor shall have no claim to any payment or compensation whatsoever by reason of or in pursuance of any notice as aforesaid on account of any suspension, stoppage

or curtailment except to the extent specified hereinafter.

ii) Where the total suspension of work ordered as aforesaid continued for a continuous period exceeding 90 days the contractor shall be at liberty to withdraw from the contractual, obligations under the contract so for as it pertains to the unexecuted part of the work by giving a 10days prior notice in writing to the Engineer within 30 days of the expiry of the said period of 90 days of such intention and requiring the Engineer to record the final measurements of the work already done and to pay final bill. Upon giving such notice the Contractor shall be deemed to have been discharged from his obligation to complete the remaining unexecuted work under his contract. On receipt of such notice the Engineer shall proceed to complete the measurement and make such payment as may be finally due to the Contractor within a period of 90 days from the receipt of such notice in respect of the work already done by the Contractor. Such payment shall not in any manner prejudice the right of the Contractor to any further compensation under the remaining provisions of this clause.

iii) Where the Engineer in-charge requires the Contractor to suspend the work for a period in excess of 30 days at any time or 60 days in the aggregate, the contractor shall be entitled to apply to the Engineer within 30 days of the resumption of work after such suspension for payment of compensation to the extent of peculiarly loss suffered by him in respect of working machinery rendered idle on the site or on the account of his having had to pay the salary or wages to labour engaged by him during the said period of suspension, provided always that the Contractor shall not be entitled to any claim in respect of any such working machinery ,salary or wages for the first 30 days whether consecutive or in the aggregate of any suspension whatsoever occasioned by unsatisfactory work or other default on his part. The decision of the Engineer- in -charge in this regard shall be final and conclusive against the Contractor.

iv) In the event of

a) any total stoppage of work on notice from the Engineer under sub-clause (1) in that behalf.

b) Withdrawal by the Contractor from the contractual obligation to

complete the remaining un-executed work under sub-clause (2) on account of continued suspension of work for a period exceeding 90 days.

c) Curtailment in the quantity of item or items originally tendered on account of any alteration, omission or substitutions in the specifications, drawings, designs or instructions under Clause 14 where such curtailment exceeds 25% in quantity and the value of the quantity curtailed beyond 25% at the rates for the item specified in the tender is more than ` 5,000/-

It shall be open to the Contractor within 90 days from the service of

i) the notice of stoppage of work or

ii) the notice of withdrawal from the contractual obligations under the contract on account of the continued suspension of work or

iii) notice under Clause 14(i) resulting in such curtailment

to produce to the Engineer satisfactory documentary evidence that he had purchased or agreed to purchase material for use in the contracted work before receipt by him of the notice of stoppage, suspension or curtailment and required the Corporation/Council to take over on payment such material at the rates determined by the Engineer, provided, however, that such rates shall in no case exceed the rates at which the same was acquired by the Contractor. The SMKC/Corporation/Council shall thereafter take over the material so offered, provided the quantities offered are not in excess of the requirements of the unexecuted work as specified in the accepted tender and are of quality and specifications approved by the Engineer

No. claim to compensation on account of loss due to delay in supply of material by SMKC.

Clause 15 A : The Contractor shall not be entitled to claim any compensation from SMKC for the loss suffered by him on account of delay by SMKC/Corporation/Council in the supply of materials entered in Schedule 'A' where such delay is caused by.

i) Difficulties relating to the supply of railway wagons.

ii) Force majeure.

iii) Act of God.

iv)Act of enemies of the State or any other reasonable cause beyond the control of SMKC/Council/Corporation.

In the case of such delay in the supply of materials,SMKC/ Corporation/Council shall grant such extension of time for the completion of the works as shall appear to the

SMKC/Corporation/Council to be reasonable in accordance with the circumstances of the case. The decision of the SMKC/Corporation/Council as to the extension of time shall be accepted as final by the Contractor.

Time limit for unforeseen claims.

Clause 16 : Under no circumstances whatsoever shall the Contractor be entitled to any compensation from SMKC/Corporation/Council on any account unless the Contractor shall have submitted claim in writing to the Engineer-in-charge within one month of the case of such claim occurring.

Action and compensation payable in case of bad work.

Clause 17 : If at any time before the security deposit or any part of thereof is refunded to the Contractor it shall appear to the Engineer-in-charge or his subordinate –in-charge of the work that any work has been executed with unsound, imperfect or unskilled workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or quality is inferior to that contracted for, or are otherwise not in accordance with the contract, it shall be lawful for the Engineer-in-charge to intimate this fact in writing to the Contractor and then notwithstanding the fact that the work, materials or articles complained of may have been inadvertently passed, certified and paid for, the Contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or if so required shall remove the materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Engineer-in-charge in the written intimation aforesaid, the Contractor shall be liable to pay compensation at the rate of one percent on the amount of the estimate for everyday not exceeding 10 days during which the failure so continues and in the event of any such failure the Engineer-in-charge may rectify or remove and re execute the work or remove and replace the materials or articles complained of as the case may be at the risk and expense in all respects of the Contractor. Should the Engineer in charge consider that any such inferior work or materials as prescribed above may be accepted or made use of, it shall be within his discretion to accept the same reduced rates as he may fix therefore.

Work to be open to inspection.

Clause 18 : All work under or in course of execution or executed in pursuance of the contract shall at all times be open to inspection

Contractor or responsible agent to be present

and supervision of the Engineer-in-charge and his subordinates and the Contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Engineer-in-charge and his subordinates to visit the works shall have been given to the Contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for that purpose. Orders given to the Contractor's duly authorized agent shall be considered to have the same force and effect as if they had been given to the Contractor himself.

Notice to be given before work is covered up

Clause 19 : The Contractor shall give not less than five days' notice in writing to the Engineer-in-charge or his subordinate in-charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement and shall not cover up or place beyond the reach of measurement any work without the consent in writing of the Engineer-in-charge or his subordinate in-charge of the work, and if any work shall be covered up or placed beyond the reach of measurement, without such notice having been given or consent obtained, the same shall be uncovered at the Contractor's expense, and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.

Contractor liable for damage done and for imperfections

Clause 20 : If during the period as listed below, from the date of completion as certified by the Engineer-in-charge pursuant to Clause 7 of the Contract or for the period as mentioned below after commissioning the work whichever is earlier in the opinion of the Engineer in-charge, the said work is defective in any manner whatsoever the contractor, shall forthwith on receipt of notice in that behalf from the SMKC/Corporation/Council, duly commence execution and completely carry out at his cost in every respect all the work that may be necessary for rectifying and setting right the defects specified therein including dismantling and reconstruction of unsafe portion strictly in accordance with and in the manner prescribed and under the supervision of the SMKC/Corporation/Council. In the event of the Contractor failing or neglecting to commence execution of the said rectification work within the period prescribed therefore in the said notice and/ or to complete the same as aforesaid as required by the same notice, the

SMKC/Council/Corporation may get the same executed and carried out departmentally or by any other agency at the risk, on account and at the cost of the Contractor. The Contractor shall forthwith on demand pay to the SMKC/Corporation/Council the amount of such costs, charges and expenses sustained or incurred by the SMKC/Corporation/Council of which the certification of the SMKC/Corporation/Council shall be final and binding on the Contractor, Such costs, charges and expenses shall be deemed to be arrears of land revenue and in the event of the Contractor failing or neglecting to pay the same no demand as aforesaid without prejudice to any other rights and remedies of the SMKC/Corporation/Council, the same may be recovered from the Contractor as arrears of land revenue. The SMKC/Corporation/Council, shall also be entitled to deduct the same from any amount which may then be payable or which may thereafter become payable by the SMKC/Corporation/Council to the contractor either in respect of the said work or any other work whatsoever or from the amount of security deposit retained by the SMKC/Corporation/Council. During defect liability period, the work of daily maintenance and general repairs and expenses thereon would be out of scope of the tender. However, if any defects in the sub work or in the material are found, the same will be rectified by the Contractor at his cost and will be binding on him, failing to which legal action would be taken as per tender clauses. Ten percent amount will be withheld from security deposit depending upon the nature of work, till the defect liability period is over.

1. Pumping Machinery.

a) Pumping machinery and other allied mechanical, electrical installation (excluding those in the treatment plant contract), surge arrestors, water hammer control devices, chlorinators (excluding those provided in the treatment plant contract) — Five Years

Repairs to the works at (a) above. — Five Years

2. STP/Wet Well /GSR/BPT, Sump and Pump House, Balancing Tank Etc. head works, approach bridge

a) Based on Contractor's own design. — Five Year.
b) Based on Departmental design. — Five Years

c) Special repairs to ESR/ GSR/ BPT	Five Years
d) Ordinary repairs to ESR/GSR/BPT Sump and Pump House, etc.	Five Years

3. Pipe Lines.

i) Pumping Mains, Gravity Mains, Leading Mains including all the fixtures	Five Years
ii) Distribution system, laterals, branch sewers of sewerage system, etc.	Five Years
iii) Repairs to pipe lines under the works at (a) and (b) above.	Five Years

The instructions contained in the Government of Maharashtra (Public Works Department) Resolution dated 14th June, 1989 shall henceforth be applicable to all the works for which defect liability periods have been specified as above

Contractor to supply plant, ladders, scaffoldings, etc.

Clause 21 : The Contractor shall supply at his own cost all material (except such special materials, if any, as may in accordance with the contract be supplied from the SMKC/Corporation/Council stores), plant, tools, appliances, implements, ladders, tackles, scaffolding and temporary works requisite or proper execution of the work, in the original, altered or substituted from the whether included in the specification or other documents forming part of the contract of referred to in these conditions or not and which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer in charge as to any matter as to which under these conditions he is entitled to as satisfied or which he is entitled to require together with the carriage therefore to and from the work

And is liable for damages arising from non-provisions of lights, fencing, etc

The Contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or the materials, Failing which the same may be provided by the Engineer-in-charge at the expense of the Contractor and expenses may be deducted from any money due to the Contractor under the contract or from his security deposit or the proceeds of sale thereof or a sufficient portion thereof. The Contractor shall provide all necessary fencing and lights required to protect the public from accident and shall also be bound to bear the expenses of defense of every suit, action or other legal proceedings that may be brought by any person for injury sustained owing to

neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit action or other legal proceedings that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit action or proceedings to any such person, or which may with consent of the Contractor be paid for compromising any claim by any such person.
List of machinery in contractors possession and which he proposes to use on the work should be submitted along with the tender.

Clause 21 A : The Contractor shall provide suitable scaffolds and working platforms, gangways and stairways and shall comply with the following regulations in connection herewith.

a) Suitable scaffolds shall be provided for workmen for all works that cannot be safely done from a ladder or by other means.
b) A scaffolds shall not be constructed, taken down or substantially allowed except
i) Under the supervision of a competent and responsible person, and
ii) As far as possible by competent workers possessing adequate experience in this kind of work.

c) All scaffolds and appliances connected herewith and ladders shall.

i) be of sound material

ii) Be of adequate strength having regard to the loads and strains to which they will be subjected, and

iii) Be maintained in proper condition.

d Scaffolds shall be so constructed that no part thereof can be displaced in consequence of normal use.
e Scaffolds shall not be over – loaded and so far as practicable the load in consequenceof normal use
f Before installing lifting gear on scaffolds special precautions shall be taken to ensure the strength and stability of the scaffolds.
g Scaffolds shall be periodically inspected by a competent person.
h Before allowing a scaffold to be used by his workmen the Contractor shall whether the scaffold has been erected by his workmen or not, take steps to ensure that it complies fully with the regulations herein specified.
i Working platform, gangway, stairways shall:-

1) be so constructed that no part thereof can sag unduly or unequally.
2)be so constructed and maintained, having regard to the prevailing conditions as to reduce as far as practicable risks of persons tripping or slipping, and
3) kept free from any unnecessary obstruction.

j) In the case of working platform, gangways, working places and stairways at a height exceeding 2 meters (to be specified).

a) every working platform, gangways shall be closely boarded unless other adequate measures are taken to ensure safety,

b) every working platform, gangway shall have adequate width, and

c) every working platform, gangway, working place and stairway shall be provided with railing/ barricading

k) Every opening in the floor of a building or in a working platform shall except for the time and to the extent required to allow the excess of persons or the transport or shifting of material be provided with suitable means to prevent the fall of persons or material.

l)When persons are employed on a roof where there is a danger of falling from the height exceeding 3 meters (to be specified) suitable precautions shall be taken to prevent the fall of persons or material

m) Suitable precautions shall be taken to prevent persons being struck by articles, which might fall from scaffolds or other working places.

Liability of contractors forany damage done in or outside the work area

n) Safe means of access shall be provided to all working platforms and other working places.

o)The Contractor will have to make payments to laborers as per Minimum Wages Act.

Clause 21 B : The Contractor shall comply with the following regulations as regards the Hoisting appliances to be used by him.

a) Hoisting machines and tackles, including their attachments, anchorages and supports shall.

i) be of good mechanical construction, sound material and adequate strength and free from patent defect, and

ii) be kept in good repairs and in good working order.

Employment of female labor work on Sunday

b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of suitable quality and adequate strength and free from patent defect.

c) Hoisting machines and shackles shall be examined and adequately tested after erection on the site and before use and be re-examined in position at intervals to be prescribed by the SMKC/Corporation/Council.
d) Every chain, ring, hook, shackle, swivel and pulley block used in hoisting or lowering materials or as means of suspension shall be periodically examined.
e) Every crane driver or hoisting appliance operator shall be properly qualified.
f) No person who is below the age of 18 years shall be in control of any hoisting machine, including any scaffold, which gives signals to the operator.
g) In case of every machine and every chain, ring, hook, Shackle, swivel and pulley block used in hoisting or lowering or as a means of suspension, the safe working load shall be ascertained by adequate means.
h) Every hoisting machine and all gear referred to in proceeding regulation shall be plainly marked with the safe working load
i) In case of hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated.

j) No part of any hoisting machine or any gear referred to in regulation (g) above shall be loaded beyond the safe working load except for the purpose of testing.
k) Motors, gearing, transmissions, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards.
l) Hoisting appliances shall be provided with such means, which will reduce to minimum, and the risks of the accidental descend of load.
m) Adequate precaution shall be taken to reduce to a minimum the risk of any part of suspended load becoming accidentally displaced

Measures for prevention of fire.

Clause 22 : The Contractor shall not set fire to any standing jungle, trees, brushwood or grass without a written permission from the SMKC/Corporation/Council. When such permission is given and also in all cases when destroying, cut or dug up trees, brushwood, grass, etc. by fire, the Contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property. The Contractor shall make his own arrangements for drinking water

for the labor employed by him.

Liability of Contractor for any damage done in or outside work area.

Clause 23 : Compensation for all damages done intentionally or unintentionally by Contractor's labour whether in or beyond the limits of the SMKC/Corporation/Council property including any damage caused by the spreading of fire mentioned Clause 22 shall be estimated by the Engineer-in-charge or such other officer as he may appoint and the estimate of the Engineer-in-charge subject to the decision of the Chief Engineer/Commissioner on appeal shall be final and the Contractor shall be bound to pay the amount of the assessed compensation on demand, failing which the same will be recovered from the Contractor as damage in the manner prescribed in Clause 1 or deducted by the Engineer-in-charge from any sums that may be due or become due from SMKC/Corporation/Council to Contractor under this contract or otherwise.

The Contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of fire and he shall pay any damages and cost that may be awarded by the court in consequence.

Employment of female labor

Clause 24 : The employment of female laborers on works in neighborhood of soldiers barracks should be avoided as far as possible.

Work on Sunday.

Clause 25 : No work shall be done on Sunday without the sanction in writing of the Engineer-in-charge.

Work not to be sublet.. Contract may be rescinded and security deposit forfeited for subletting it without approval or for bribing a Public Officer or if Contractor becomes insolvent.

Clause 26 : The contract shall not be assigned or sublet without the written approval of the Engineer-in-charge, and if the Contractor shall assign or sublet his contract or attempt to do so, or become insolvent or commence any proceedings to get himself adjudicated and insolvent or make any composition with his creditors or attempt so to do so or if bribe, gratuity, gift, loan, perquisite, reward of advantage, pecuniary or otherwise shall either directly or indirectly be given, promised or offered by the Contractor or any of his servants or agents to any public officer or person in the employment of SMKC/Corporation/Council in any relating to his office or employment or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Engineer-in-

charge may thereupon by notice in writing rescind the contract, and the security deposit of the Contractor shall thereupon stand forfeited and be absolutely at the disposal of SMKC/Corporation/Council and the same consequences shall ensure as if the contract had been rescinded under Clause 3 hereof and in addition the Contractor shall not be entitled to recover or be paid for any work thereof actually performed under the contract.

Sum payable by way of compensation to be considered as reasonable without reference to actual loss

Clause 27 : All sums payable by a Contractor by way of compensation under any of these conditions shall be considered as a reasonable compensation to be applied to the use of SMKC/Corporation/Council without reference to the actual loss or damage sustained, and whether any damage has or has not been sustained

Changes in the constitution of the firm to be notified.

Clause 28 : In the case of tender by partners, any change in the constitution of a firm shall be forthwith notified by the Contractor to the Engineer-in-charge for his information.

Directions and control of the Engineer in charge

Clause 29 : All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the executive Engineer water supply and Dranage SMKC/Commissioner/Chief Officer, for the time being, who shall be entitled to direct at what point or points and in what manner they are to be commenced and from time to time carried out.

Directions and control of the Engineer in charge .

Clause 30.1 : Except where otherwise specified in the contract and subject to the powers delegated to him by SMKCCorporation/Council under the code, rules then in force, the decision of the Executive Engineer/Commissioner/Chief Officer for the time being shall be final, conclusive and binding on all parties of the contract, upon all questions relating to the meaning of the specifications, designs, drawings and instruction hereinbefore mentioned and as to the quality of workmanship, or materials used on the work or as to any other question, claim, right, matter or thing whatsoever, in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders, or these conditions, or otherwise concerning the works, or the execution, or failure to execute the same, whether arising during the progress of work, or after the completion or abandonment thereof.

Clause 30.2 : The Contractor may within thirty days of receipt by him of any order passed by the Commissioner as aforesaid appeal against it to the Commissioner SMKC with the contract work or project provided that.
a) The accepted value of the contract exceeds ` 10 lakhs(`. Ten lakhs)
b) Amount of claim is not less than ` 1.00 lakh (` One Lakh).

Clause 31 : ***Deleted***

Clause 32 : When the estimate on which a tender is made includes lump sums in respect of parts of the work, the Contractor shall be entitled to payment in respect of the items of work involved or the part of the work in question at the same rates as are payable under this contract for each item, or if the part of the work in question is not in the opinion of the engineer-in-charge capable of measurement, the Engineer-in-charge may at his discretion pay the lump sum amount entered in the estimate and the certificate in writing of the Engineer-in-charge shall be final and conclusive against the Contractor with regard to any sum or sums payable to him under the provisions of this clause.

Lump sums in estimates

Clause 33 : In the case of any class of work for which there is no such specification as is mentioned in Rule I of Form B-1, such work shall be carried out in accordance with the Divisional specifications and in the event of there being no Divisional specifications, the work shall be carried out in all respect in accordance with all instructions and requirements of the Engineer-in-charge.

Action where no specifications

Clause 34 : The expression 'Work' or 'Works' where used in these conditions, shall unless there be something in the subject or context repugnant to such construction, be constructed to mean the work or works contracted to be executed under or in virtue of the contract, whether temporary or permanent and whether original, altered, substituted or additional.

Definition of work

Clause 35 : The percentage referred to in the tender shall be deducted from/ added to the gross amount of the bill before deducting the value of any stock issued.

Contractor's percentage whether applied to net or gross amount of bill.

Quarry fees and royalties

Clause 36 : All quarry fees, royalties, octroi duties and ground rent for stacking materials, if any should be paid by Contractor, which will not be entitled to a refund of such charges from the SMKC. (Please see special clause for royalty).

Compensation under Workmen's Compensation Act.

Clause 37 : The Contractor shall be responsible for and shall pay any compensation to his workmen payable under the Workmen's Compensation Act., 1923 (VIII of 1923), (hereinafter called the said Act) for injuries caused to the workmen. If such compensation is payable/ paid by the SMKC as principal under sub-section (1) of Section 12 of the said Act on behalf of the Contractor, it shall be recoverable by the SMKC from the Contractor under the sub-section (2) of the said section. Such compensation shall be recovered in the manner laid down in Clause 1 above.

Clause 37 A : The Contractor shall be responsible for and shall pay the expenses of providing medical aid to any workman who may suffer a bodily injury as a result of an accident. If such expenses are incurred by SMKC, the same shall be recoverable from the Contractor forthwith and be deducted without prejudice to any other remedy of the SMKC/Corporation/Council from any amount due or that may become due to the Contractor.

Clause 37 B : The Contractor shall provide all necessary personal safety equipment and first aid apparatus available for the use of the persons employed on the site and shall maintain the same in condition suitable for immediate use at any time and shall comply with the following regulations in connection herewith.

a) The workers shall be required to use the equipments so provided by the Contractor and the Contractor shall take adequate steps to ensure proper use of the equipment by those concerned
b) When work is carried on in proximity to any place where there is a risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps shall be taken for the prompt rescue of any person in danger.
c) Adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work.

Clause 37 C : The Contractor shall duly comply with the provisions of 'The Apprentices Act, 1961' (III of 1961), the rules made thereunder

and the orders that may be issued from time to time under the said Act and the said Rules and on his failure or neglect to do so he shall be subjected to all the liabilities and penalties provided by said Act and said Rules.

Quantities put to tender are approximate. Excess quantity beyond quantity put to tender will be governed as per Cl.38

Clause 38 : I) Quantities in respect of the several items shown in the tender are approximate and no revision in the tendered rate shall be permitted in respect of any of the items so long as subject to any special provision contained in the specifications prescribing a different percentage of permissible variation in the quantity of the item does not exceed the tender quantity to more than 25% and so long as the value of the excess quantity beyond this limit at the rate of the item specified in the tender, is not more than ` 5,000/- (Whichever is more)

ii) the Contractor shall, if ordered in writing by the Engineer so to do, also carry out any quantities in excess of the limit mentioned above in sub –clause (1) hereof on the same conditions and in accordance with the specifications in the tender and the rates

a) derived from the rates entered in Current Schedule of Rates and in the absence of such rates
b)At the rates prevailing in the market.

The said rates being increased or decreased as the case may be by the percentage which the total tendered amount upon the schedule of rates applicable to the year in which the tender were accepted

For the purpose of operation of this clause ,this cost shall be worked out from the DSR prevailing at the time of inviting of tender. The cost of Clause 38 is Rs**. 206,46,72,610/- (Rs. Rupees Two Hundred Six Crore Forty Six Lakh(s) Seventy Two Thousand Six Hundred Ten Only)**
iii) This clause is not applicable to extra items.

iv) Claims arising out of reduction in the tendered quantity of any item beyond 25% will be governed by the provision of Clause 15 only when the amount of such reduction beyond 25% at the rate of the item specified in the tender is more than ` 5,000/- This reduction is exclusively the reduction in Clause Nos. 14 & 15 of the work and site conditions.

v) There is no change in the rate if the excess is less than or equal to 25%. Also there is no change in the rate if the quantity of work done is more than 25% of the tendered quantity, but the value of the excess work at the tendered rates does not exceed ` 5,000/-

vi) The quantities to be paid at the tendered rates shall include,

a) tendered quantity plus 25% excess of tendered quantity or the excess quantity of the value of ` 5,000/- at tendered rate whichever is more

Interim payment for excess quantity

Clause 38 A : The Executive Engineer SMKC shall see that claim towards excess quantity under this clause 38 is submitted to higher authority immediately on its cropping up. The Executive Engineer while making such payment shall see that the total expenditure shall not exceed sanctioned cost of the scheme. If the proposal of Clause 38 is submitted to competent authority for payment then interim 50% payment will be released as under

a) At accepted tender rate or current schedule rate whichever is less subject to condition that total expenditure on the tender shall not exceed sanctioned cost of the scheme

Clause 38-B : If the rate entered in to schedule B for the work of excavation of pipeline is a combined rate for different strata then the rate entered in Schedule-B will be applicable for quantity 25% in addition to the quantity mentioned in schedule-B of all items of excavation for pipe line trenches and for excess over 25% of Schedule-B quantity ,the rate payable to the contractor shall be worked out from the CSR by considering following percentage of excavation in different strata irrespective of actual strata met at the site for the increased quantity. **N.A.**

Clause 39 : The Contractor shall employ any famine, convict or other labour of a particular kind or class if ordered in writing to do so by the Engineer-in-charge.

Clause 40: No compensation shall be allowed for any delay caused in the starting of the work on account of acquisition of land or, in the case of clearance works, on account of any delay in accordance to sanction of estimates.

Clause 41: No compensation shall be allowed for any delays in the execution of the work on account of water standing in borrow pits or compartments. The rates are inclusive for hard or cracked soil, execution in mud, sub-soil, water standing in borrow pits and no claim for an extra rate shall be entertained unless otherwise expressly specified.

Clause 42 : The Contractor shall not enter upon or commence any portion of work except with written authority and instructions of the Engineer-in-charge of his subordinate in charge of the work. Failing

such authority the Contractor shall have no claim to ask for measurements of or payment for work.

Clause 43 :

i) No Contractor shall employ any person who is under the age of 18 years.

ii) No Contractor shall employ donkeys or other animals with breaching of string or thin rope. The breaching must be at least three inches wide and should be of tape (Nawar).

iii) No animal suffering from sores, lameness or emaciation or which is immature shall be employed on the work.

Minimum age of persons employed, the employment of donkeys and other animals and the payment of fair wages.

iv) The Engineer-in-charge or his agent is authorized to remove from the work, any person or animal found working which does not satisfy these conditions and no responsibility shall be accepted by the SMKC for any delay caused in the completion of the work by such removal.

vi) Contractor shall provide drinking water facilities to the workers. Similar amenities shall be provided to the workers engaged on large work in urban areas

vii) Contractor to take precautions against accidents which taken place on account of labour using loose garments while working near machinery.

Method of payment

Clause 44: Payment to Contractors shall be made by cheque drawn on City Engineer /Commissioner/Chief Officer/ Engineer in charge's account provided the amount exceeds ` 1000/- Amounts not exceeding 1000/- will be paid in cash.

Acceptance of conditions compulsory before tendering for work.

Clause 45: Any Contractor who does not accept these conditions shall not be allowed to tender for work.

Employment of scarcity labour

Clause 46 : If Government declares a site of scarcity or famine to exist in any village situated within 16 Kms of the work, the Contractor shall employ upon such parts of the work, as are suitable for unskilled labour, any person certified to him by the Executive Engineer/Engineer in chargeChief officer of Municipal

council/corporation, or by any person to whom the Executive Engineer/Engineer in chargeChief officer of Municipal council/corporation may have delegated this duty in writing to be in need on relief and shall be bound to pay to such person wages not below the minimum wages which Government may have fixed in this behalf. Any disputes which may arise in connection with the implementation of this clause shall be decided by the Engineer in charge whose decision shall be final and binding on the Contractor.

Price not to exceed controlled price fixed by Govt.

Clause 47: The price quoted by the Contractor shall not in any case exceed the control price, if any, fixed by Government or reasonable price which is permissible for him to charge a private purchaser for the same class and description, the control price or the price permissible under the provisions of Hoarding and Profiteering Preventing Ordinance, 1948 as amended from time to time. If the price quoted exceeds the controlled price or the price permissible under Hoarding and Profiteering Prevention Ordinance, the Contractor will specifically mention this fact in his tender along with the reasons for quoting such higher prices. The purchaser at his discretion will in such case exercise the right of revising the price at any stage so as to conform to the controlled price as permissible under the Hoarding and Profiteering Prevention Ordinance. This discretion will be exercised without prejudice to any other action that may be taken against the Contractor.

Rate inclusive of all taxes

Clause 47 A :

1) The rates to be quoted by the contractor must be inclusive of allother relevant taxes except GST.No. extra payment will be made to the **contractor**
   a) Bidder shall quote his rate excluding GST.
   b) GST shall be paid on the amount of bill of the work done as per prevailing guide lines rate of GST during the period of work done as applicable.
   c) The rates quoted by the contractor shall be deemed to be inclusive of the labour welfare cess and other taes (other than GST) that the contractor will have to pay for the performance of his contract. The employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

2) a) Bidder shall quote his rate considering the provisions counted under GST Act 2017.

a) Amount of GST 2% I.E.CGST and SGST each 1% will be deducted at source (T.D.S.) from 01.10.2018.

Sale tax on surplus material

Clause 48 : In case of materials that may remain surplus with the Contractor from those issued, the date of ascertainment of the materials being surplus will be taken as the date of sale for the purpose of GST and the GST will be recovered on such date.

Employment of local labour

Clause 50 : The Contractor shall employ at least 80 percent of the total number of unskilled labour to be employed by him on the said work from out of the persons ordinarily residing in the district in which site of the said work is located. Provided, however, that if required number of unskilled labour from that district is not available, the Contractor shall in the first instance employ such number of persons as is available and thereafter may with the previous permission in writing of the Engineer-in-charge of the said work obtain the rest of the requirement of unskilled labour from outside of district.

Wages to be paid to the skilled and unskilled labours employed by contractor.

Clause 51 : The Contractor shall pay the labourers – skilled and unskilled according to the wages prescribed by Minimum Wages Act applicable to the area in which the work of the Contractor is located. The Contractor shall comply with the provision of the Apprentices Act, 1961 and the Rules and Orders issued there under from time to time.. The Contractor shall be liable for any pecuniary liability arising on account of any violation by him of the provisions of the Act. The Contractor shall pay the labourers – skilled and unskilled- according to wages prescribed by Minimum Wages Act applicable to the area in which the work lies.

Clause 52 : All amounts whatsoever which the Contractor is liable to pay to the SMKC/Corporation/Council in connection with the execution of the work including the amount payable in respect of i)materials and/ or stores supplied/ issued hereunder by the Corporation/Council to the Contractor,

ii) hire charges in respect of heavy plant, machinery and equipment given on hire by the SMKC to the Contractor for execution by him of the work and/ or for which advances have

been given by the SMKC/Corporation/Council to the Contractor shall be deemed to be arrears of the land revenue and SMKC without prejudice to any other rights and remedies of the Corporation/Council recover the same from the contractor as a arrears of land revenue

Clause 53 : The Contractor shall duly comply with all the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 (37 of 1970) and the Maharashtra Contract Labour (Regulation and Abolition) Rules 1971 as amended from time to time and all other relevant statutes and statutory provisions concerning payment of wages particularly to workmen employed by the contractor and working on the site of the work. In particular and contractor shall pay wages to each worker employed by him on the site of the work at the rates prescribed under the Maharashtra Contract Labour (Regulation and Abolition) Rules 1971. If the contractor fails or neglect to pay wages at the said rates or makes short payment and the SMKC/Corporation/Council makes such payment of wages in full or part thereof less paid by the contractor, as the case may be, the amount so paid by the SMKC/Corporation/Council to such workers shall be deemed to be debt payable by the Contractor and the SMKC/Corporation/Council shall be entitled to recover the same as such from the contractor or deduct same from the amount payable by the SMKC/Corporation/Council to the contractor hereunder or from any other amounts payable to him by the SMKC/Corporation/Council.

Clause 54 : Where the work are required to work near Machine and are liable to accident they should not be allowed to wear loose clothes like Dhoti, Jhabba etc.

Clause 55 : The Contractor shall comply with the provisions of the Apprentices Act, 1961 and the Rules and Orders issued there under from time to time

Clause 56 : In view of the difficult position regarding the availability of the Foreign exchange, no foreign exchange, will be released by the Department for the purchase of the Plant and Machinery required for the execution for the work concerned work.

Clause 58 (A) : Conditions of Malaria Eradication.

Anti-Malaria and other health measures.

a) The anti malaria and the health measures shall be as directed by the Joint Director (Malaria and Filarial) of Health Service, Pune.

b) Contractor shall see that most autogenic conditions are not created so as to keep vector population to minimum level

c) Contractor shall carry out anti malaria measures in the area as per guidelines prescribed under National Malaria Eradication Programme and as directed by the Joint Director (M & F) of Health Services, Pune

d) In case of default in carrying out prescribed anti malaria measures resulting in increase in malaria incidence contractor shall be liable to pay to Government the amount spent by Government on anti malaria measures to control the situation in addition to fine.

e) Relations with Public Authorities.

The contractor shall make sufficient arrangements for draining away the sullage water as well as water coming from the bathing and washing places and shall dispose of this water in such a way as not to cause, any nuisance. He shall also keep the premises clean by employing sufficient number of sweepers.

The contractor shall comply with all rules, regulations, bye-laws and directions given from time to time by any local or public authority in connection with this work and shall pay fees or charge which are leviable on him without any extra cost to Government

Clause 58 (B) : The successful contractor will have to enter into agreement in form specified by SMKC/Corporation/Council on a stamp of required amount as per rules in force. The stamp charges shall be borne by the contractor

Clause 59 : PRICE VARIATION CLAUSE:

If during the operative period of the contract as defined in condition (1) below, there shall be any variation in the Consumer Price Index (New Series) for Industrial workers for Solapur Centre as per the Labour Gazette published by

the Commissioner of Labour, Govt. of Maharashtra &/or in the Wholesale Price Index for all commodities prepared by the Office of Economic Adviser, Ministry of Industry, Govt. of India or in the price of petrol/oil & lubricants & major construction materials like bitumen, cement, steel, various types of metals pipes etc. then subject to thje other conditions mentioned below, price adjustment on account of

i. Labour component
ii. Material component
iii. Cement components
iv. HYSD & mild steel components
v. Cement component

Calculated as per the formula hereinafter appearing, shall be made. Apart from these, no other adjustment shall be made to the contract price for any reason whatsoever. Component percentage as given bellow is as of the total cost of work put to tender.

for Working out the percentages of the values of the contractor's material, labour and POL components in the work, the total of these three components should be taken as 100 and other components shall be as per actual. Standard labour, material & POL components indicated in the table below can be used for the works related to Drainage projects. A. Standard labour, material & POL components to be used for the Water Supply Projects.

i. Labour component (K_1)%
ii. Material component (K_2)%
iii. Cement components
iv. HYSD & mild steel component.

Sr. No.	Description	(k) Percentage to be used for component		
		Labour	Material	Petrol, oil & Lubricant
1	Sewage pumping machinery including transformers motor cable, panel, starter	35	63	2

	etc.			
2	Sewage Rising main, collection system	25	70	5
3	STP, Wetwell Pumping Stations	40	55	5

. Note If Bitumen, HYSD, Mild Steel reinforcement, Structural Steel, Mild Steel plates , Cement, Liquid Chlorine, Alum/ PAC and Cl/DUHDPENDPE pipes are supplied on Schedule 'A', then respective component shall not be considered. Also if particular components is not relevant same shall be deleted.

. Value of k) with respect to the Break-Up of Material Components. percentage of Bitumen, HYSD, Mild Steel reinforcement, Structural Steel, Mild Steel plates , Cement, Liquid Chlorine, Alum/ PAC and Cl/D1/HDPE/MDPE pipes Components can be as per actual calculated on the basis of the break-up of relevant costs furnished by the tenderer in the tender on specific demand as per following formula.

% of component (k) = Cost of particular component in total work / Total cost of work

1) Formula for Labour components:

$$V_1 = 0.85P \times \frac{K_1}{100} \times \frac{L_1 - L_0}{L_0}$$

Where

V_1= Amount of price variation in Rupees to be allowed for Labour components

P= Cost of work done during the Quarter under consideration minus the cost of cement, HYSD and mind steel, Bitumen, CI & DI pipes calculated as the basic star rates as applicable for the tender, consumed during the quarter under consideration.

K_1= Percentage of LABOUR component as indicated above

L_0= Basic Consumer Price Index for Solapur center shall be average consumer price index for the preceding months in which the last date prescribed for receipt of tender falls.

L_1= Average consumer price index for Solapur center for the quarter for the consideration.

2) Formula for Material components:

$$V_2 = 0.85P \times \frac{K_2}{100} \times \frac{M_1 - M_0}{M_0}$$

Where
V_2= Amount of price variation in Rupees to be allowed for Material components
P= Same as work out for labour component
K_2= Percentage of Material component as indicated above
M_0= Basic Wholesale Price Index shall be average Wholesale price index for the preceding months in which the last date prescribed for receipt of tender falls.
M_1= Average wholesale price index for the quarter under consideration

3) Formula for HYSD & mild steel components

$$V_5 = S_0 \times \frac{(Sl_1 - Sl_0)}{Sl_0} \times T$$

Where
V_5= Amount of price variation in Rupees to be allowed for HYSD / mild steel components
S_0 = Basic rate of HYSD / mild stel in rupees per matric tonne excluding GST as considered form working out value of T.
Sl_1= Average steel index as per RBI bulletin during the quarter under consideration
Sl_0= Average of steel index as per RBI bulletin for the precending month in which the last date prescribed for receipt tender falls.
T= Tonnage of steel used in the permanent works for the quarter under consideration

4) Formula for cement components

$$V_6 = \left\{ C_0 \frac{(Cl_1 - Cl_2)}{Cl_0} \right\} T$$

Where
V_6=Amount of price escalation in Rupees to be allowed for

cement components

C_0= Basic rate of cement in Rupees per metric tonnes excluding GST as considered for working out value of P.

Cl_1= Average cement index published in the RBI bulletin for the quarter under consideration

Cl_0=Average of Cement Index published in the RBI Bullet in for the preceding the month in which the last date prescribed for receipt of tender falls.

T=Tonnage of cement use din the per man entworks for the quarter underconsideration.

(Basic rate excluding GST as below,

Basic rate of cement	**Rs. 6260/- per MT**
Basic rate of HYSD/mild steel	**Rs. 79340/- per MT**
Basic rate of Pig iron (For CI/DI pipes)	**Rs. 68500/- per MT**
Basic rate of Bitumen	**Rs.49862/- per MT**

The following conditions shall prevail:

i) The operative period of the contract shal lmean the period commencing from the date of the work order issued to the contractor & ending on the date on which the time allowed for the completion of work specified in the contract for work expires, taking in to considering the extension of time, if any, for completion of the work granted by Engineer under the relevant clauses of theConditions of Contract in cases other than those where such extension is necessitated on accountof default of the contractor. The decision of Engineer as regards the Operative period of thecontract shall be final & binding on the contractor. Where any compensation for liquidated damages is levied on the contractor on account of delay in completion or inadequate progress under the relevant contract provisions, the price adjustment amount for the balance of work from the date of levy of such compensation shall be worked out by pegging the indices L_1, M_2, P_1 ,B_1, Sl4, Cl1, D1 to levels corresponding to the date from which such compensation is levied.

ii) This price variation clause shall be applicable to all contracts in B1, B2 and SBD forms but shall not apply to piece works. The price variation shall be determined during each quarter as per formula given above in this clause.

iii) Price variation under this clause shall not be payable for the extra items required to be executed during the completion of the work & also on the excess quantities of items payable under the provision of Clause 4*1*/*37*/38 of the contract form B*1*/B2/SBD respectively. Since the rates payable for the extra items or the extra quantities under Clause 4*1*/*37*/*3*8 are to be fixed as per the current DSR or as mutually agreed to

yearly revision till completion of such work. In other words, when the completion/execution of extra items as well as extra quantities under Clause *41/37/3*8 of the Contract Form B*1*/B2/SBD extends beyond the operative date of the DSR, then rates payablefor the same beyond that date shall be revised with reference to the current DSR prevalent at that time on year to year basis or revised in accordance with mutual agreement thereon, as provided fo rin the contract, whichever is less

iv) This clause is operative both ways i.e. if the price variation as calculated above is onthe plus side, payment on account of the price variation shall be allowed to the contractor & if itis on the negative side, implementing agency shall be entitled to recover the same from the contractor & the amount shall be deductible from any amounts due & payable under the contract.

v) To the extent that full compensation for any rise or fall in costs to the contractor is notentirely covered by the provisions of this or other clauses in the contract, the unit rate & price included in the contract shall be deemed to include amount to cover the contingency of such other actual rise or fall in costs.

vi) Calculation for working out escalation payment on account of *m*aterial, labour & POL will be restricted to 2 digits only.

Insurance

Clause 60 : The contractor shall provide and maintain barricades, guards, guard rails, temporary bridges and walkways, watchmen, headlights and danger signals illuminated from sunset to sunrise and all other necessary appliances and safeguards to protect the work, life, property, the public excavations, equipment and materials. Barricades shall be substantial construction and shall be painted such as to increase their visibility at night. For any accident arising out of the neglect of above instructions, the contractor shall be bound to bear the expenses of defence of every suit, action or other legal proceedings, at law, that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay all damages and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the contractor be paid in compromising any claim by any such person.

Clause 61 : The contractor shall take out necessary insurance

policy /policies so as to provide adequate insurance cover for execution of the awarded work from the Director of insurance Maharashtra State Mumbai. However if contractor desire to effect insurance with local office of any insurance company same should be under the Co-insurance-come- servicing arrangement approved by the director of insurance if the policy taken out by the contractor is not Co – Insurance basis(GIF- 60% and insurance company -40%) the same will not be accepted and the amount of the premium calculated by director of insurance will be recovered directly from the amount payable to the contactors for the executed contract work.

1 Loss of or damage to the Civil and Mechanical and Electrical equipments supplied/installed including the materials such as pipes, valves, specials etc. brought on site
Loss of or damage to contractor's equipments including his vehicles.
Loss of or damage to property (except the works, Plant material and Equipment) in connection with the contractor, and :
Personal injury or death due to vehicles of the contractor and or due to any accident that may arise at or around the site to the Contractor personnel or to the SMKC staff or to any other person not connected with SMKC

2 Policies and certificates for insurance shall be delivered by the
. Contractor to the Engineer for the Engineer's approval before the date of actual starting of work. All such insurance shall provide for compensation to be payable in the types of proportions of currencies required to rectify the loss or damage incurred

3 If the contractor did not produce any of the policies and
. certificates required the Engineer may effect the Insurance for which the contractor should have produced the policies certificates and recover the premium it has paid from payment otherwise due to the contractor or, if no payments due to payment of the premiums shall be of debt due.

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

5. The minimum insurance cover for loss damages to physical property, injury and death shall be 10% of the contract cost per occurrence with number of occurrences as 3(Three). After each occurrence the contractor shall pay additional premium necessary so as to keep the insurance police valid always till the defect liability period is over

6. No payment will be released to the contractor until the insurance coverage with the Govt. Insurance fund, Maharashtra State is provided and unless the proof of insurance coverage is produced by the Contractor to the Engineer-in-Charge

Clause 62: During execution of work excavation is required to be carried out for various sub-works for which royalty is required is to be paid by the contractor.
During execution of work and till completion if point of royalty is raised by collector office it will be sole responsibility of the contractor to pay royalty charges/compensation if any to concern. Until the certificate from the collector office regarding royalty charges is not submitted by the contractor, final bill and security deposit for such work will not be payable to the contractor.

Executive Engineer

SMKC

ADDITIONAL CONDITIONS FOR MATERIALS

(BROUGHT BY CONTRACTOR)

NAME OF WORK : Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli

Schedule showing (approximately) the materials to be supplied from the **SMKC** store for the work contracted and ancillary work and the rates at which they are charged for..

Sr. No.	Particulars	Qty	Unit	Rates at which the material will be charged to the contractor		Place of Delivery
				In figures	In words	
1	2	3	4	5	6	7
				N I L		

Note –

1) The person on firm submitting the tender should see that the rates in the above schedule are filled up by the Executive Engineer In charge on the issue of the form prior to the submission of the tender.

2) The rates mentioned in Schedule “A” are inclusive of all taxes and storage charges.

(These rates shall be specified here)

Basic Rates (Excluding GST)

Basic rate of cement	**Rs. 6260/- per MT**
Basic rate of HYSD/mild steel	**Rs. 79340/- per MT**
Basic rate of Pig iron (For CI/DI pipes)	**Rs. 68500/- per MT**
Basic rate of Bitumen	**Rs.49862/- per MT**

1. All the materials shall be procured by the Contractor from approved Government Institutions or as directed by Engineer-in- charge only. The material shall be brought at the site of work well in advance by the Contractor. Supply of material should be of standard company. The contractor should inform to site in-charge the name of three standard companies. After finalization of standard company contractor should bring the material from that standard company only.

2. All the materials shall be procured by the Contractor from approved Government Institutions or as

directed by Engineer-in- charge only. The materials from any other source in lieu of the approved Institutions shall be allowed except under written permission from the Engineer in charge. In such case, Certificate for its quality shall be produced by the Contractor and samples of materials shall be tested from any Government Laboratory by the Contractor at his cost and the test results be supplied to the Department. The materials not conforming to the required standard shall be removed at once from the site of work by the Contractor as his own cost. The Contractor shall get necessary tests carried out to the frequency specified for each material in the specification and submit the test results to the Engineer-in-charge or his authorised representative. These materials shall be used on work by the Contractor, only if the test thereof are found satisfactory to the results Engineer-in-charge or his authorised representative.

3. The Contractor shall make his own arrangement for the safe custody of the materials brought by him on site of work.

4. The charges for conveying of materials from the place of purchase by the Contractor to the site of work and the actual spot on work site shall be entirely borne by the Contractor. No claims on this account shall be entertained.

5. Separate registers shall be maintained by the Contractor on the site for recording detailed item wise Asphalt, Cement and Steel consumption on the work. These registers shall be signed by Contractor or his authorised representative and got signed from the representative Engineer-in-charge.

6. The material required only for this work shall be kept in the godown at site. No material shall be shifted outside of the godown except for the work for which this arrangement is entered, without prior approval of the Engineer-in-charge.

7. The Contractor shall produce sufficient documentary evidence i.e. bill for the purchase, octroi receipts etc. for the purchase of material brought on the work site at once if so requested by the Department.

8. All these material shall be protected from any damages , rains etc. by the contractor at his own cost.

9. The contractor shall not use cement and other material for the item to be executed outside the scope of his contract except for such ancillary small item as are connected and absolutely necessary for execution of this work as may be decided by the Engineer-in-charge.

10. **INDEMNITY** : The condition regarding indemnity as defined will apply mutatis mutandis in case of material brought by contractor at the site for the execution of the work being executed under this contract.

11. In case the material brought by the Contractor become surplus owing to the change in the design of the work, the material should be taken back by the Contractor at his own cost after prior permission of Engineer-in-charge.

12. Department will not supply any material for execution of work The contractor has to arrange the same from his own source. The quality of the material brought to the site

by the contractor should be verified through the various tests provided as per relevant Indian Standards at the cost of the contractor.

Arrangement of Materials

1. The Contractor shall make his own arrangement for supply of materials including bitumen 60/70 grade, and 30/40 grade cement and steel , RCC pipes / Collars. The Contractor shall be responsible for all transportation and storage of the materials at the site and shall bear all the related costs. The Engineer shall be entitled at any time, to inspect or examine all such materials. The Contractor shall provide reasonable assistance for such inspection or examination as may be required.
2. The Contractor shall keep as accurate record of use of materials like bitumen, cement and steel used in the works in a manner prescribed by the Engineer.
3. After receiving the bitumen, the authorised challan / gate pass should be obtained from the refinery mentioned in the quality of bitumen, grade of bitumen, date, time of delivery etc. and it should be handed over to department for each consignment.
4. While transportation of bouzer a through transport pass should be obtained from the Corporation/ Municipality through which the bouzer is passed and same should be handed over the authorised person of the Department.
5. If there is any doubt regarding the material received, the same should be get tested from the Government laboratory at the cost of the Contractor, and if the results are substandard, the material or the work executed with such material will be rejected.
6. The day to day record of the receipt /utility/ balance of material should be kept by the Contractor at plant site / site of work / store and same will be checked by the Engineer-in-charge or authorized Engineer at any time.
7. The procurement of cement/ steel etc. should be from the authorised manufacturing company and the vouchers regarding purchase thereof shall be submitted to Engineer-in-charge.
8. The testing charges shall be entirely borne by the Contractor.

SPECIAL ATTENTION OF CONTRACTOR FOR EXECUTION

Procurement of Material :

Department will not supply any material for execution of work such as Cement, Tor Steel, Asphalt etc. The contractor has to arrange the same from his own source. The quality of the material brought to the site by the contractor should be verified through the various tests provided as per relevant Indian Standards at the cost of the contractor.

The adjustment for variation in cost prices of Mild steel and Tor steel bars, structural steel, cement (all tested quality) shall be separately made corresponding to the difference in the cost as per the basic price mentioned hereafter as per Price Variation Clause.

The contractor shall construct shed/sheds at his own cost and as per direction of Engineer-in-charge for storing the materials brought by him and provide double locking arrangements, one lock shall be in the charge of departmental person and the material shall be taken for use in presence of the departmental person only.

ENSURING GRADE OF ASPHALT BROUGHT ON SITE BY THE CONTRACTOR

It shall be mandatory on the part of the contractor to procure the asphalt from Government owned Refinery only. The contractor shall communicate the schedule of arrival of bouzer of asphalt to the Engineer- in-charge in advance. Apparatus and equipment for testing grade of asphalt shall be made available by the contractor at site. If the grade of asphalt is found as per specification written permission will be given for unloading the bouzer by the Engineer –in-charge ,otherwise written instructions will be given for not using the same on site.(Please refer Government Circular (Marathi) No. Misc 2005/CR-187/ N.H.2, dated 8/10/2007.

READY MIX CONCRETE : It shall be mandatory on the part of contractor to erect Ready Mix Concrete Plant at work site/in the vicinity to ensure the requirement of the Project. The Contractor shall communicate the schedule of arrival of Concrete Mix to the Engineer-in-charge. Apparatus and equipment for testing grade of Mix shall be made available by the contractor at site. If the grade of concrete mix is found as per specification, written permission will be granted for unloading otherwise written instructions will be given for not using the same on site. Contractor shall deploy all the necessary machinery such as Ready Mix Concrete. Pump etc. as required during the execution of work and shall be maintained in good condition through out the construction period.

GENERAL CONDITIONS AND SPECIFICATIONS

ADDITIONAL GENERAL CONDITIONS AND SPECIFICATIONS

1. **These are to apply as additional conditions and specifications unless otherwise already provided for contradictorily elsewhere in the contract.**

2. **CONTRACTOR TO STUDY SITE CONDTIONS**

The Contractor shall be deemed to have carefully examined the work and site conditions including labour, the general and the special conditions, specifications, schedules and drawings and shall be deemed to have visited the site of work and to have fully informed himself regarding the local conditions and carried out his own investigations to arrive at rates quoted in the tender . In this regard , he will be given necessary information to the best of knowledge of **SMKC** but without any guarantee about it.

If he shall have any doubt as to the meaning of any portions of these general conditions or the special conditions, or the scope of work or the specifications and drawings, or any other matter concerning the contract, he shall in good time, before submitting his tender, set forth the particulars thereof and submit them to the **Executive Engineer Water Supply and Drainage, SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** in writing in order that such doubts may be clarified authoritatively before tendering. Once a tender is submitted, the matter will be decided according to tender conditions in the absence of such authentic pre-clarification.

3. **DECLARATION OF THE CONTRACTOR** :

The Contractor should sign the declaration form on Page No.

4. **INDEMNITY** :

The Contractor shall indemnify the **SMKC** against all actions, suits, claims and demands brought or made against him in a respect of anything done or committed to be done by the Contractor in execution of or in connection with the work of this contract and against any loss or damage to the **SMKC** in consequence of any action or suit being brought against the Contractor for anything done or committed to be done in the execution of the work of this contract. The **SMKC** may at its discretion and entirely at the cost of the Contractor defend such suit, either jointly with the Contractor or single in case the latter choices not to defend the case.

5. **DEFINITIONS** :

Unless excluded by or repugnant to the context.

a) The expression "**SMKC**" as used in the tender papers shall mean Sangli Miraj and Kupwad City Muncipal Corporation, Sangli.

b) The expression "The City Engineer" as used anywhere in the tender papers shall mean the City Engineer of Sangli Miraj and Kupwad City Muncipal Corporation, Sangli who is designated as Authority on behalf of SMKC.

c) The expression " Superintending Engineer" as used in the tender papers shall mean an officer of Superintending Engineer's rank (by whatever designation he may be known) under whose control the work lies for the time being.

d) The expression "Engineer" or "Engineer-in-charge" as used in the tender papers shall mean the Executive Engineer-in-charge of the work for time being.

e) The expression "Contractor" used in the tender paper shall mean the successful tenderer whose tender has been accepted and who has been authorised to proceed with the work.

f) The expression "Contract" as used in tender papers shall mean the deed of contract together with its original accompaniments and those latter incorporated in it by mutual consent.

g) The expression "Plant" as used in the tender papers shall mean every temporary and necessary or considered necessary by the Engineer to execute, construct , complete and maintain the works and used in, altered, modified, substituted and additional work ordered in the time and the manner herein provided and all temporary materials and special and other articles of appliances of every sort, kind and description whatsoever intended or used therefor.

h) "Drawings" shall mean the drawings referred to in the specifications and any modifications of such drawings approved in writing by Engineer and such other drawings as may from time to time furnished or approved in writing by the Engineer.

i) "Engineer's representative" shall mean an assistant of the Engineer notified in writing to the Contractor by the Engineer.

j) "Provisional sum" or " Provisional lump sum" shall mean a lump sum included by **SMKC** in tender documents and shall represent the estimated value of work for which details are not available at the time of issue of tender.

k) "Provisional Items" shall mean items for which approximate quantities have been included in the tender documents.

l) The "site" shall mean the lands and /or other places , on under, in or through which the work is to be executed under the contract including any other lands or places which be allotted by **SMKC** or used for the purpose of contract.

m) The "Work" shall mean the works to be executed in accordance with the Contract or part(s) thereof as the case may be and shall include all extra or additional , altered or substituted works as required for performance of the Contract.

n) The “Contract Sum” shall mean the sum for which the tender is accepted.

o) The “Accepting Authority” shall mean the officer competent to accept the tender.

p) The “Day” shall mean a day of 24 hours from midnight to midnight irrespective of the number of hours worked in any day in that week.

q) “Temporary works” shall mean all temporary works of every kind required in or about the execution, completion, or maintenance of the works.

r) “Urgent works” shall men any measure which, in the opinion of the Engineer-in-charge , become necessary during the progress of the works to obviate any risk or accident or failure or which become necessary for security of the work or the persons working, thereon.

s) A "Week" shall means seven consecutive days without regards to the number of hours worked on any day in that week.

t) "Excepted Risks" are risks to riots (other wise than among contractors employees) and civil commotions (in so far as both these are uninsurable) war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion, revolution, insurrection, lightening and unprecedented floods over which the contractor has no control and accepted as such by the accepting authority. Where the context so requires, words importing the singular only also include the plural and vice-versa.

Heading and marginal notes, if any, to the general conditions shall not be deemed to form part thereof or be taken into consideration in the interpretation or construction thereof of the contract.

Wherever there is mention of “Schedule of rates” of the Division or simply D.SR. in this tender, it will be taken to mean as “ the Schedule of the rate of the Division in whose jurisdiction the work lies”.

6. <u>ERRORS, OMISSIONS AND DISCREPANCIES</u> :

a) In case of errors, omissions, and /or disagreement between written and scaled dimensions on the drawing or between drawings and specifications etc. , the following order of preference shall apply.

i) Between actual , scaled and written dimensions or descriptions on a drawing the letter shall be adopted.

ii) Between the written or shown description or dimensions in the drawing and corresponding one in the specifications, the latter shall apply.

iii) Between the quantities shown in schedule of quantities and those arrived at from the drawings, the latter shall be preferred.

iv) Between the written description of the item in the schedule of quantities and the detailed description in the specifications of the same items, the later shall be adopted.

In case of difference between the rates written in figures and words, the rate adopted by the contractor for working out the total amount of the item will be taken as correct. In other cases correct rate would be that, which is lower.

b) In case of discrepancy between percentage rate quoted in figures and words, the lowest of the two

will be considered for acceptance of tender.

c) In all cases of omissions and/or doubts or discrepancies in the dimensions or description of any item or specifications, a reference shall be made to the **The Executive Engineer Water Supply and Dranage SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** whose elucidation, elaboration or decision shall be considered as authentic. The Contractor shall be held responsible for any errors that may occur in the work through lack of such reference and precaution.

d) The special provision in detailed specifications and wording of any item shall gain precedence over corresponding contradictory provisions (if any) in the Standard Specifications of Public Works Department Hand Book where reference to such specifications is given without reproducing the details in contract.

7. PROGRAMME OF WORK

7.1 The work is required to be completed within a period of **24 (Twenty Four)** Calendar months (including the monsoon period) The Contractor shall submit the tentative Bar Chart before commencement of work.

7.2 **a) METHODOLOGY OF CONSTRUCTION AND CONSTRUCTION EQUIPMENTS.**

Construction Machinery / Equipments:

1 The methodology and equipments to be used on the project shall be furnished by the Contractor to the Engineer-In-Charge well in advance of commencement of work and approval of the Engineer-In-Charge obtained prior to its adoption and use.

2 The Contractor shall give, a trial run of the equipment for establishing its capability to achieve the laid down specifications and tolerance to the satisfaction of the Engineer-in-Charge before commencement of work, if so desired by the Engineer-In-Charge.

3 All equipments provided shall be of proven efficiency and shall be operated and maintained at all times in the manner acceptable to the Engineer-In-Charge.

4 No equipment or personnel shall be removed from the site without permission of the Engineer-In-Charge .

Contractor shall furnish at least 15 days in advance his programme of commencement of item of work, the details of actual methods that would be adopted by the Contractor for the execution of various items of work such as well sinking, cast- in-situ, super-structure for Bridge work and Earthwork, W.B.M., Black topping items etc. for Road works supported by necessary detailed drawing and sketches including those of the Plant and Machinery that would be used, their locations, arrangement for conveying and handling materials etc. and obtain prior approval of the Engineer-in-charge well in advance of starting of such item of work. The Engineer-in-charge reserves the right to suggest modifications or make complete changes in the method proposed by the Contractor, where accepted previously or not at any stage of the work, to obtain the desired accuracy, quantity and

progress of the work which shall be binding on the Contractor , and no claim on account of such change in method of execution will be entertained by **SMKC** so long as specifications of the item remain unaltered. The sole responsibility for the safety and adequacy of the methods adopted by the Contractor, will however, rest on the Contractor, irrespective of any approval given by the Engineer.

Abrasion Testing Machine for Tiles of standard make confirming to IS – 1237 & 1706 with suitable thickness measuring device to measure wear of the tile. It shall be suitable for operation on 415 v/50 Hz, 3 phase AC supply.

WORKING METHODS:

Contractor shall submit, within times stipulated time by the Engineer, in writing the details of actual methods that would be adopted by the contractor for the execution of any item as required by Engineer, at each of the locations, supported by necessary detailed drawings and sketches including those of the Plant and Machinery that would be used, their locations, arrangement for conveying and handling materials etc. And obtain prior approval of the Engineer-in-charge well in advance of starting of such item of work The Engineer-in-charge reserves the right to suggest modifications or make complete changes in the method proposed by the contractor, whether accepted previously or not, at any stage of the work. to obtain the desired accuracy, quantity and progress of the work which shall be binding on the contractor, and no claim on account of such change in method of execution will be entertained by **SMKC** so long as specifications of the item remain unaltered.

b) **CONSTRUCTION EQUIPMENT AND LOCATION** :

i) The Contractor shall be required to give a trial run of the equipment for establishing their capability to achieve and laid down specifications and tolerance to the satisfaction of the engineer before commencement of the work. All equipment provided shall be of proven efficiency and shall be operated and maintained at all times, in a manner acceptable to the Engineer and no equipment or personnel will be removed from site without permission of the Engineer.

ii) The Contractor's Hot Mix Plant shall be located within travelling distance of 40 Kms. from the site of work without interruption and natural obstructions and smooth plying of dumpers with average speed of 40 Kms. per hour. Location of Hot Mix Drum Mix Plant should be such that maximum time taken for transporting bitumen mix from plant site to the Paver does not exceed 60 minutes.

c) **PROGRESS SCHEDULE** :

The Contractor shall furnish within the period of one month of the order to start the work, the programme of work in CPM/PERT charts in quadruplicate indicating the date of actual start, the monthly/ progress expected to be achieved and the anticipated completion date of each major item of work to be done by him, also indicating dates of procurement and setting up of materials,

plant and machinery. The schedule is to be such as is practicable of achievement towards the completion of whole work in the time limit, the particular items, if any, on the due dates specified in the contract and shall have the approval of the Engineer-n-charge. No revised schedule shall be operative without such acceptance in writing. The Engineer is further empowered to ask for more detailed schedule or schedules say ; week by week for any item or items, in case of urgency of work as will be directed by him and the Contractor shall supply the same as and when asked for.

The Contractor shall furnish sufficient plant, equipment and labour as may be necessary to maintain the progress of schedule. The working and shift hours restricted to one shift a day for operations to be done under the **SMKC** supervision shall be such as may be approved by the Engineer-in-charge. They shall not be varied without the prior approval of the Engineer. Night work which requires supervision shall not be permitted except when specifically allowed by Engineer each time , if requested by the Contractor. The Contractor shall provide necessary lighting arrangements etc. for night work as directed by Engineer without any extra cost to **SMKC.**

Further, the Contractor shall submit the progress report of work in prescribed form and charts etc. at periodical intervals, as may be specified by the Engineer in charge. Schedule shall be in the form of progress charts, forms, progress statement and /or reports as may be approved by the Engineer.

The Contractor shall maintain proforma, charts, details regarding machinery, equipment, labour, materials, personnel etc. as may be specified by the Engineer and submit periodically returns thereof as may be specified by the Engineer-in-charge.

PRIORITIES OF WORKS TO BE EXECUTED:

Priorities for items to be executed shall be determined periodically keeping in view of the final time limit allowed for the work and all the time schedule fixed for intermediate stages of work.

Revised Programme of Work in case of slippage:

In case of slippage from the approved work programme at any stage, the contractor shall furnish revised programme to make up slippage within the stipulated time schedule and obtain the approval of the Engineer-in-charge to the revised programme.

Action in case disproportionate progress:

In case of extremely poor progress of the work or any item at any stages of work which in the opinion of the Engineer-In-Charge cannot be made good by the Contractor considering his available resources, the Engineer-In-Charge will get it accelerated to make up the lost time through any other

agency, and recover the additional cost incurred, If any, in getting the work done from the Contractor after informing him about the action envisaged by him.

TREASURE-TROVE:

In the event of discovery by the contractor or his employees, during the progress of the work of any treasure, fossils, minerals or any other articles of value or interest, the contractor shall give immediate intimation thereof to the Engineer and forthwith hand over to the Engineer such treasure or things which shall be the property of SMKC.

8. PROJECT ENGINEER AND WORK - ORDER BOOK :-

1. The Contractor shall engage an authorised Whole time qualified and Experienced project Engineer on the work capable of managing and guiding the work and understanding the specifications and contract conditions. He will take orders as will be given by the Engineer in charge or his representative and shall be responsible for carrying them out.

The Contractor shall engage / appoint the technical supervisory personals as listed in schedule "E" of this contract within 15 days from the date of work order.

The Contractor shall employ minimum technical supervisory staff as mentioned in schedule "E" this agreement. This project Engineer shall not be changed without prior intimation to the Engineer in charge and his representative on the work site The contractor shall provide to the Engineer in charge the details of all minimum technical supervisory and other staff employed by the Contractor and notify changes when made, and satisfy the Engineer-in-charge regarding the quantity and sufficiency of the staff, thus employed. The Engineer-in charge will have the unquestionable right to ask for changes in the quality and number of Contractor's supervisory staff and to order removal from work of any of such staff. The Contractor shall comply with such orders and effect replacement to the satisfaction of the Engineer-in-charge.

A work order book shall be maintained on site and shall be the property of Government and the Contractor shall promptly sign orders given therein by the Executive Engineer or his representative and his superior officers and comply with them. The compliance shall be reported by the Contractor to the Engineer in good time so that it can be checked. The blank work order book with machine numbered pages will be provided by the Department free of charge for this purpose. The Contractor will be allowed to copy out instructions therein from time to time.

9. <u>SETTING OUT FOR</u>

i) Setting out for Road:

Setting out the works as spelt out in clause 109 of Ministry's specifications for Road and Bridge works (2nd

Revision) will be carried out by the Contractor.

Immediately on receipt of the work order, the contractor shall at his own expenses clean the site and take up a provisional and final setting out and lining out of the work under the supervision of his responsible representative and shall provide necessary material, labour, tools, instruments etc. required for the same.

One tentative abutment location will be indicated by Engineer-in-charge and the center line of the bridge shall be defined by him. The contractor will then have to fix up the location of the other abutment. The abutment location will then be verified by the department and shall be adjusted if necessary. Once the final location of abutments is so finalized, it will be the contractor's responsibility to line out and locate the remaining foundation of piers.

The contractor shall be responsible for true and proper setting out of the work and for the correctness of the positions, level dimensions and arrangements of all parts of works and for providing all necessary instruments, appliances and labours in connection therewith at his own cost. Officers may assist the contractor in proper setting out. SMKC instruments may be allowed to be used for setting out of work for which no cost shall be recovered from the contractor. If at any time during the progress of work, any errors arise in regard to levels of dimensions or alignment of any part of the work, rectification thereof, on being required to do so, will be carried out by the contractor at his own cost, unless such errors are based on incorrect data, supplied in writing by the Engineer or his authorized representative in which case the expenses of the rectification shall be refunded by SMKC.

ii) SETTING OUT FOR (BUILDING WORKS)

The Engineer-in-charge shall furnish the contractor with only the four corners of the works site and a level bench mark and the contractor shall set out the works and shall provide an efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.The Contractor shall provide, fix and be responsible for the maintenance of all stacks, templates, level marks, profiles and other similar things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the Contractor. The work shall be set outto the satisfaction of the Engineer-in-charge. The approval there of or joining with the Contractor of any of his responsibilities. Before beginning the work, the Contractor shall at his own cost provide all necessary reference and level posts, pegs, gamboos, flags, ranging road, strings and other materials for proper layout of the work in accordance with the scheme for bearing marks acceptable to the Engineer-in-charge.

The centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars, Each pillar shall have distinct mark at the centre to enable the thodolite to be set over it. No

work shall be started until all these points are checked and approved by the Engineer-in-charge in writing but such approval shall not relieve the Contractor of any of his responsibilities.

The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction. Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the Contractor. On completion of works, the Contractor must submit the geodetic documents according to which the work was carried out.

RESPONSIBILITIES FOR LEVEL AND ALIGNMENT

The Contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectually any errors or imperfections therein, such rectifications shall be carried out by the Contractor, at his own cost, when instructions are issued to that effect by the Engineer-in-charge.

10. LEVELLING INSTRUMENT

If measurements of items of the work are based on volumetric measurements calculated from levels taken before and after construction of the item, large number of leveling staves, tapes etc. will have to be kept available by the Contractor at the site of work for this purpose. Lack of such leveling staves, tapes, etc. in required numbers may cause delay in measurements and the work. The Contractor will have, therefore, to keep sufficient number of these readily available at site.

To carry out activities mentioned above 10.1, 10.2 & 10.3

Contractor shall make all necessary arrangements to carry out all necessary detail surveys required as per the Specifications / Tender Conditions, during currency of work / project, and deliver desired outputs in printed / soft as instructed by engineer in charge at different stages of works as instructed by the engineer in-charge during the currency of the project, that is from start to finish of the work/project. To carry out such surveys and deliver desired outputs in printed form / soft copy as instructed by engineer in charge as mentioned above.

The Contractor shall appoint a survey agency with the approval of the engineer in charge, for that, Contractor shall submit list of three survey agencies to engineer in charge , along with the payment of his security deposit (as required under the clause one of the B-1 contract) . The engineer in charge on receipt of such list will select one survey agency out of three and communicate it, along with the work order to contractor. Contractor should appoint survey agency as selected by the engineer in charge. The survey agency shall not be changed without permission of the engineer in charge. The survey agency and / or contractor shall have

1) Latest survey instruments and/or equipments viz. total station, auto levels, plotter etc.

2) Auto CAD, non-auto CAD base software to deliver desired outputs based on survey carried out using (1) above, in printed/soft copy as instructed by engineer in charge.

3) Necessary trained manpower to work on and deliver as (1) and (2) above.

For appointing survey agency, to carry out such surveys and deliver desired outputs in printed/soft as instructed by engineer in charge as mentioned above the Contractor shall not be paid separately. His offer shall be inclusive of all.

11. AUTHORITIES OF THE ENGINEER-IN-CHARGE' REPRESENTATIVE :

The duties of the representative of the Engineer-in-charge are to watch and supervise the work and to test and examine any material to be used or workmanship employed in connection with the works.

The Engineer-in-charge may from time to time, in writing delegate to his representative any powers and authorities vested in the Engineer-in-charge and shall furnish to the Contractor a copy of all such delegation of powers and authorities. Any written instructions of approval given by the representative of the Engineer-in-charge to the Contractor within the terms of such delegations (but not otherwise) shall bind the Contractor and the **SMKC** as though it had been given by the Engineer-in- charge, provided always as follows.

Failure of the representative of the Engineer-in-charge to disapprove any work or materials shall not prejudice the power of the Engineer-in-charge thereafter to disapprove such work or materials and so order the putting down, removal or breaking up thereof.

The responsibility of assuring the quality of work shall be on the contractor who shall take actions as stipulated in standard specification as per " Schedule C"

12. CO-ORDINATION

When several agencies for different sub-works of the Project to work simultaneously on the Project site, there must be full co-ordination between different Contractors to ensure timely completion of the whole Project smoothly. The scheduled dates or completion specified in each contract shall therefore, be strictly adhered to. Each Contractor may make his independent arrangement for water, power, housing etc. if any so desire. On the other hand the Contractors are at liberty to mutual agreement in this behalf and make joint arrangements with the approval of the Engineer. No single Contractor shall take or cause to be taken any steps or action that may cause, disruption, discontent, or disturbance of work, labour or arrangement etc. of the other Contractor in the Project localities. Any action by any Contractor which the Engineer in his unquestioned discretion may consider as infringement of the above code, would be considered as a breach of the Contract Conditions and shall be dealt with accordingly.In case of any dispute, disagreement between

the Contractors, the Engineer's decision regarding the co-ordination , co-operation and facilities to be provided by any of the Contractors shall be final and binding on the Contractors concerned and such a decision or decisions shall not vitiate any Contract nor absolve the Contractor(s) of his/their obligations under the contract nor consider for the grant for any claim or compensation.

13. ASSISTANCE IN PROCURING PRIORITIES, PERMITS, ETC. :

The Engineer, on a written request by the Contractor, will, if in his opinion, the request is reasonable and in the interest of work and its progress, assist the Contractor in securing, the priorities for deliveries transport permits for controlled material etc. where such are needed. The **SMKC** , will not, however, be responsible for the non-availability of such facilities or delay in this behalf and no claims on account of such failures or delays shall be allowed by the **SMKC**.

The Contractor shall have to make his own arrangement for machinery required for the work. However, such machinery conveniently available with the **SMKC** may be spared as per the rules in force on recovery of necessary Security Deposit and rent with agreement in the prescribed form Such an Agreement shall be independent of this contract and the supply of machinery shall not form a ground for any claim or extension of time limit for this work.

14. QUARRIES :

14.1 The Contractor(s) shall have to arrange himself/themselves to procure the quarry. However, necessary assistance without any extra cost to **SMKC** will be rendered by the **SMKC** for procuring the quarries if required by the Contractor.

14.2 The quarrying operations shall be carried out by the Contractor with proper equipment such as compressors, Jack-hammers, drill bits, explosives etc. and sufficient number of workmen shall be employed so as to get required out turn.

14.3 The Contractor shall carry out the works in the quarries in conformity with all the rules and regulations already laid down or that may be laid down from time to time by **SMKC**. Any cost incurred by **SMKC** due to non-compliance of any rules or regulations or due to damages by the Contractor shall be the responsibility of the Contractor.

The Engineer-in-charge or his representative shall be given full facilities by the Contractor for inspection at all times of the working of the quarry, records maintained, the stocks of the explosives and detonators, etc., so as to enable him to check that the working records and storage are all in accordance with the relevant rules. The Engineer-in-charge or his representative shall at any times

be allowed to inspect the works, buildings, and equipment at the quarters.

14.4 The Contractor shall maintain at his own cost the books, registers etc. required to be maintained under the relevant rules and regulations and as directed by the Engineer-in-charge. These books shall be open for inspection at all times by the Engineer-in-charge or his representative and the Contractor shall furnish the copies or extracts of books or registers as and when required.

14.5 All quarrying operations shall be carried out by the Contractor in organized and expeditious manner, systematically and with proper planning. The Contractor shall engage licensed blasters and adopt electric blasting and/or any other approved method which would ensure complete safety to all the men engaged in the quarry and its surroundings. The Contractor shall himself provide suitable magazines and arrange to procure and store Explosives etc. as required under the rules at his own cost. The designs and the location of the magazine shall be got approved in advance from the Chief Inspector of Explosives and the Rules & Regulations in this connection as laid down by the Chief Inspector of Explosives from time to time shall be strictly adhered to by the Contractor. It is generally experienced that it take time to obtain the necessary license for blasting and license for storage of materials from the concerned authorities. The Contractor must, therefore, take timely advance action for procuring all such licenses so that the work progress may not be hampered.

14.6 The approaches to the quarrying place from the existing public roads shall have to be arranged by the Contractor at his own cost, and the approaches shall be maintained by the Contractor at his own cost till the work is over.

14.7 The quarrying operations shall be carried out by the Contractor to the entire satisfaction of the Engineer-in-charge and the development of the quarry shall be made efficiently so as to avoid wastage of stones. Only such stones as are of the required quality shall be used on the work. Any stone which is in the opinion of the Engineer-in-charge , not in accordance with the specifications or of required quality will be rejected at any time, at the quarry or at the site of work. The rejected stones shall not be used on the work and such rejected materials shall be removed to the place shown at the Contractor's cost.

14.8 Since all stones quarried from **SMKC** quarry (if made available) by the Contractor including the excavated over burden are the property of the **SMKC**. No stones or earth shall be supplied by the Contractor to any other agencies or works allowed to be taken away for any other works. All such surplus quarried materials not required for work under this contract shall be the property of the Government and shall be handed over by the Contractor to **SMKC** free of cost at quarry site duly

heaped at the spots indicated by the Engineer-in-charge. The rates for several items shown in the Schedule 'B' are inclusive of royalties to be paid to the **SMKC** on minor minerals and metals under relevant Acts. Full rate for any and every item shall be paid only after production of sufficient proof of having paid the royalty to Government. In absence of such proof, the item shall be paid at such reduced rates as the Engineer-in-charge may deem fit. If ,however, the **SMKC**, does not require such surplus materials , the Contractor may be allowed to dispose off or use such material elsewhere with prior written permission of the Engineer-in- charge. Leaving off a quarry face or opening of new quarry face shall be done only on the approval of the Engineer-in-charge.

14.9 Quarrying permission will have to be directly obtained by the Contractor, from the Collector of the District concerned for which purpose the Department will render necessary assistance. All quarry fees, royalty charges, Octroi duties, ground rent for stacking materials etc. , if any, to be paid , shall be paid directly by the Contractor as per rules in force.

14.10 The Contractor will be permitted to erect at his own risk and cost at the quarry site if suitable vacant space in **SMKC** area is available for the purpose, his own structures for stores, offices, etc. at places approved by the Engineer-in- charge. On completion of the work, the Contractor shall remove all the structures erected by him and restore the site to its original condition.

14.11 The Contractor shall not use any land in the quarry either for cultivation or for any other purpose except, that required for breaking or stacking or transporting stones.

15. <u>COLLECTION OF MATERIALS</u> :

i) Where suitable and approved **SMKC**'s quarries exist, the Contractor or piece worker will be allowed if otherwise there is no objection to obtain the materials to the extent required for the work from the quarry. He will be, however, liable to pay compensation, if any damage is caused to the quarry either deliberately or through negligence or for wastage of materials by himself or his staff or labour. Contractor shall pay necessary Royalty charges to the Revenue Authorities according to the Rules in force and shall submit accounts of materials extracted from the quarries as directed.

ii) Where no suitable **SMKC**'s quarries exist or when the quantity of the material required cannot be obtained from a **SMKC** 's quarry , the Contractor or piece-worker shall make his own arrangements to obtain the material from existing or a new quarry in **SMKC** waste land, private land or land belonging to other states or talukas, etc. After opening the quarry but before starting collection, the quarry shall be got approved by the Engineer-in-charge or his representatives. The Contractor or piece-worker shall pay all royalty charges , compensation etc. No claims or responsibility on account of any of obstructions caused to execution of the work by difficulties arising out of private owners of land, will be entertained.

iii) The rates in the tender include all incidental charges such as opening of a new quarry, opening out a new portion in an existing quarry, removing top soil and the unsuitable material, dewatering a quarry, cost of blasting powder and fuse, lift, lead, repairs to existing cart tracks, making new cart tracks, control charges, Central/State Government or Municipal Taxes , Local Boards, Cess, etc.

iv) The rates in the tender are for the delivery of the approved material on road side properly stacked at the places specified by the Engineer-in-charge and are inclusive of conveyance charges in respect of the leads and lifts. No claims on account of charges in lead will be entertained

v) No material shall be removed from the land within the road boundary or from the land touching it without the written permission of the Engineer-in-charge or his authorised agent. If any materials is unauthorisely obtained from such places the Contractor or piece worker shall have to make good the damages and pay such compensation, in addition as may be decided by the Executive Engineer and will have to stop further collection.

vi) Any material that falls on any **SMKC**. Road from the cart etc. during conveyance shall be immediately picked up and removed by the Contractor or piece worker, failing which it will be got removed departmentally at his cost. No heap shall be left prior to stacking even temporarily on the road surface or in any way so as to cause any obstruction or danger to the traffic. The Contractor or the piece worker shall be liable to pay for any claims of compensation etc. arising out of any accident, etc. Any such materials causing obstruction or danger etc. will be got removed departmentally at his cost and no claims for any loss or damage to the material , thus removed, will be entertained.

The Contractor shall also be responsible for the damage or accident etc. arising out of any material that falls on the road or track , not in charge of the Department and shall attend to any complain which be received.

vii) The materials shall not be stacked in place where it is liable to be damaged or lost due to traffic passing over it, to be washed away by rain or floods, to be buried under the land slides etc. or slip down an embankment or hill side etc. No claims for any loss due to these and similar causes will be entertained.

viii) Before stacking, the materials shall be free from all earth, rubbish vegetable matter and other extraneous substance and in the case of metal, screened to gauge, if so directed when ready. It shall be stacked entirely clear of the road way, on ground which has been cleaned of vegetation and leveled. On high banks, ghat roads etc. where it may not be practicable to stack it entirely clear of the roadway , it may be stacked with the permission of the Engineer-in-charge on terms in such a way as

to cause minimum danger and obstruction to the traffic or as may be directed by him.

ix) The size of the stacks for materials other than rubble shall be 1 m. x 1m. x 0.5 m. or such other size as may be directed by the Engineer-in-charge and all but one stack in 200 M. shall be of the same uniform size and shall be uniformly distributed over whole lengths. One stack (at the end) in each 200 M. may be of length different from the rest in order to adjust total quantity to be required but its width and height will be the same as those of the rest.

x) The Engineer in charge shall supply the Contractor with statement showing 200 M. wise quantities that will be required and the order in which the collection is to be done. No materials in excess of requirements in that 200 M. shall be stacked. Any excess quantity shall be removed at the expenses of the Contractor or piece worker to where it is required before the material in that 200 M. is finally measured.

xi) In stacking materials the deposition shall commence at the end of the Km. farthest from the quarry and be carried continuously to the other end (unless otherwise directed by the Executive Engineer). Stacking in one 200 M. shall be completed before it is started in another, unless directed otherwise, in writing by the Executive Engineer. Measurements of the material stacked in a 200 M. will not be recorded until the full quantity required has been stacked unless otherwise authorised by Engineer in writing. Collecting and spreading shall not be carried out at the same time in one and the same Km. or in two adjoining Km. except with the written permission of the Executive Engineer.

xii) Unless otherwise directed, the materials shall be collected in the following order according to availability of space : (1) Rubble (if included in tender), (2) Metal, (3) Soft murum and (4) hard murum. Hard murum shall be stacked on the side opposite to that on which soft murum has been stacked. Similarly , metal collected for petty repairs shall be stacked on the side opposite of metal for new layer. Where metal for two layers has to be stacked, as in the case of new roads, the metal for each layer shall be stacked on the opposite sides of the road.

xiii) All road material shall be examined and measured before it is spread. The labour for measurements (and check measurements wherever carried out) shall be supplied by the Contractor or piece worker. Immediately after the measurements are recorded the stacks shall be marked by the Contractor or piece worker by white wash or otherwise as may be directed by the Executive engineer to prevent from any possibility of the same material being measured and recorded over & again and to prevent any unauthorized tampering with the stacks.

If the Contractor or the piece worker fails to attend the measurements of material after receiving the notice from the Engineer in charge or his subordinate stating date and time of the intention to

me3asure the work, the same shall be measured nevertheless and no complaint in this respect will be entertained later on. If the Contractor or piece worker fails to supply sufficient labour for the materials required at the time of measurements or check measurements, after due notice has been given to him, the expenses incurred on account of employing departmental labour or material etc. shall be charged against his account.

xiv) No deduction will be made for voids.

16. TEMPORARY QUARTER AND SITE OFFICE :

i) The contractor shall at his own expense maintain sufficient experienced supervisory staff etc. required for the work and shall make his own arrangement, provide housing for them with all necessary arrangements, including fire preventive measures etc. as directed by the Engineer-in-charge. General layout plan for such structures shall be got approved from the Engineer-in-charge. It will be the responsibility of the Contractor to get his layout plan of temporary structure approved from the local competent authority.

ii) The Contractor shall provide, furnish, maintain and remove on completion of the work, a suitable office on the work site for the use of Executive Engineer's representative. The covered area exclusive of verandah should not be less than 40 Sq.m. it may have bamboo matting walls or brick walls , asbestos or corrugated iron roof, paved floor should be 45 cm. above ground level. He should provide a basket type or suitable latrine, urinals and keep them clean daily. This will be supposed to be included in his rate.

17. TREASURE-TROVE :

In the event of discovery by the Contractor or his employees, during the progress of the work of any treasure, fossils, minerals or any other articles of value or interest, the Contractor shall give immediate intimation thereof to the Engineer and forthwith hand over to the Engineer such treasure or things which shall be the property of **SMKC**.

18. PATENDED DEVICE, MATERIALS AND PROCESSES :

Whenever the Contractor desires to use any designed devices, materials or process covered by the letter of patent or copy right , the right for such use shall be secured by suitable legal arrangement and agreement with patent owner and the copy of their agreement shall be filed with the Engineer-in-charge if so desired by the letter.

19. EXPLOSIVES :

The Contractor shall at his own expense construct and maintain proper magazines. If such are required for the storage of explosives for use in connection with the work and such magazine

being situated, constructed and maintained in accordance with the Government Rules applicable in that behalf. The Contractor shall at his own expenses obtain such license or licenses as may be necessary for storing the using explosives. Notwithstanding that the location etc. or storage of explosives are approved by the Engineer, the **SMKC**, shall not be incurring any responsibility whatever in connection, therewith, all operations in or for which explosives are employed being at the risk of the Contractor and upon his sole responsibility and the Contractor hereby gives to **SMKC** an absolute indemnity in respect thereof.

20. DAMAGE BY FLOODS OR ACCIDENT :

The Contractor shall take all precautions against damage by floods or like or from accident etc. No compensation will be allowed to the Contractor on this account or for correcting and repairing any such damage to the work during construction. The

Contractor shall be liable to make good at his cost any plant or materials belonging to the **SMKC** lost or damaged by floods or from any other cause which is in his charge.

21. POLICE PROTECTION :

For the Special Protection of camp and of the Contractor's work, the **SMKC** will help the Contractor as far as possible to arrange for such protection with the concerned authorities, if so required by the Contractor in writing. The full cost of such protection shall be borne by the Contractor.

22. TRAFFIC REGULATION / Arrangement for traffic during construction:-

Action for arrangement for traffic during construction will be taken by the Contractor as envisaged in the contract documents and spelt out in clause 112 of MORTH Specification for Road and Bridge Work (2001)

22.1 Unless separately provided for in the contract, the Contractor shall have to make all necessary arrangements for regulating traffic, day and night during the period of construction to the entire satisfaction of the Engineer. This includes the construction and maintenance of diversions, if necessary. The Contractor shall have to provide necessary caution boards, barricades, flags, lights and watchmen etc. so as to comply with the latest Motor Vehicle Rules and Regulations and for traffic safety and he shall be responsible for all claims from accidents which may arise due to his negligence whether in regulating the traffic or in stacking materials on the roads, or due to any other reasons.

22.2 The Contractor shall at all times carry out the work on the road in a manner creating least interference to the flow of traffic, while consistent with the satisfactory execution of the same. For all works involving improvements to the existing road, the Contractor shall, in accordance with the directives of the Engineer- in-charge, provide and maintain , during the execution of work a passage

for traffic, either along or part of the existing carriageway under improvement or along a temporary diversion constructed close to the road.

22.3 TRAFFIC REGULATIONS FOR BRIDGES AND C.D. WORKS:

It is to be clearly understood that whatever work carried out by the Contractor for construction of diversion road including earthwork, W.B.M. bituminous surface dressing, R.C.C. pipe drains etc will be paid for only once if the items of temporary

diversion are included in the contract and if due to flow of traffic, due to floods or due to any ther causes, this diversion road and/or the R.C.C. drain gets damaged it shall be repaired and maintained by the Contractor in good conditions till completion of the whole work at his own expenses.

Traffic safety and control shall be as per Clause No. 112.4 of M.O.S.T. Specifications for Roads and Bridges (4th Revision, August 2001 Edition).

23. SUPERVISION AND INSPECTION OF WORKS AND QUALITY CONTROL:

23.1 SUPERVISION:

The Contractor shall appoint the separate 'Architect" to coordinate the work.

The Contractor shall either himself supervise the execution of works or shall appoint the competent agent approved by the Engineer-in-charge, to act on his behalf. If in the opinion of the Engineer-in-charge, the Contractor has himself no sufficient knowledge and experience of receiving instructions or cannot give his full attention to the works, the Contractor shall at his own expenses, employ as his accredited agent a qualified Engineer approved by the Engineer-in-charge.

Order given to the Contractor's agent shall be considered to have the force as if these had been given to the Contractor himself. If the Contractor fails to appoint a suitable agent as directed by the Engineer-in-charge, the Engineer-in-charge shall have full power to suspend the execution of the work until such date a suitable agent is appointed and the Contractor shall be responsible for the delay so caused to the works and the Contractor shall not be entitled for any compensation on this behalf.

23.2 INSPECTION :

The Contractor shall inform the Engineer-in-charge in writing when any portion of the work is ready for inspection giving him sufficient notice to enable him to inspect the same without affecting the further progress of the work. The work shall not be considered to have been completed in accordance with the terms of the contract until the Engineer-in-charge shall have certified in writing to that effect. Approval of materials or workmanship or approval of part of the work during the progress of execution shall not bind the Engineer-in-charge or in any way affect him even to reject the work which alleged to be completed and to suspend the issue of his certificate of completion until such alteration and modifications or reconstruction have been effected at the cost of the Contractor as shall enable him to certify that the work has been completed to his satisfaction.

The Contractor shall provide at his cost necessary ladders and such arrangements as to

provide necessary facilities and assistance for proper inspection of all parts of the work at his own cost.

24. INITIAL MEASUREMENTS FOR RECORD :

Where , for proper measurement of the work, it is necessary to have an initial set of levels or other measurements taken, the same as recorded in the authorised field book or measurement book of **SMKC** by the Engineer or his authorised representative will be signed by the Contractor who will be entitled to have a true copy of the same made at his cost. Any failure on the part of the Contractor to get such levels etc. recorded before starting the work will render him liable to accept the decision of the Engineer as to the basis of taking measurements. Like-wise the Contractor will not cover any work which will render its subsequent measurements difficult or impossible without first getting the same jointly measured by himself and the authorised representative of the City Engineer. The record of such measurements on the **SMKC** side will be signed by the Contractor and he will be entitled to have a true copy of the same made at his cost.

25. SAMPLES AND TESTING OF MATERIALS :

i) All materials to be used on work shall be got approved in advance from the Engineer-in-charge and shall pass the test and/or analysis required by him which will be :

a) as specified in the specification for the items concerned and/or

b) Red Book.

c) As specified by the Indian Roads Congress Standard Specification and cost of practice for Roads and Bridges 4th Revision , Section 900.

d) I.S.I. specifications (whichever and wherever applicable) or

e) Quality Control for road work.

f) such recognized specifications accepted to Engineer-in-charge as equivalent thereto or in absence of such authorised specification.

g) such requirement test and/or analysis as may be specified by the Engineer-in-charge in order of precedence given above.

ii) The Contractor shall at his risk and cost make all arrangements and/or shall provide for all such facilities as the Engineer-in-charge may require for collecting, preparing required number of samples for tests or for analysis at such time and to such place or places as may be directed by the Engineer and bear all such charges and cost of testing. Testing charges shall be reimbursed subject to conditons under this Clause 25 (viii) ‘a’ to ‘h’. Such samples shall also be deposited with the Engineer- in-charge.

iii) The Contractor shall if and when required, submit at his cost the samples of materials to be

tested or analyzed and if, so directed, shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and the materials, finally accepted by the Engineer-in-charge.

iv) The Contractor shall not be eligible for any claim or compensation either arising out the any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of the materials.

v) The Contractor or his authorised representative will be allowed to remain present in the department laboratory while testing samples furnished by him. However, the results of all the tests carried out in the departmental laboratory in the presence or absence of the Contractor or his authorised representative, will be binding on the Contractor.

vi) **a)** The Contractors shall at his own cost, set up **Field Laboratory**, get it checked and certified by the Executive Engineer, with all necessary equipments as given below, for testing of all materials, finished products used in the construction as per requirements of relevant specifications. The necessary testing equipment shall be calibrated under the supervision of Superintending Engineer, Vigilance & Quality Control Circle, Pune or authorized Government or Private Agency.

(b) **70% tests** shall have to be carried out in his **field laboratory** and **30% in Quality Control Laboratory**. In respect of other construction material which is not mentioned in the following table, **50%** tests shall be carried out in the Contractors field laboratory and **50% tests** in the nearest quality control laboratory of the **SMKC**. In case where there is no field laboratory, 100% tests shall be carried out in the nearest Quality Control Laboratory of the **SMKC**.

(c) The tests which cannot be carried out both in field laboratory and Vigilance & Quality Control Circle's laboratories, shall be carried out 100% in the laboratories of Government Engineering College / Government Polytechnic at the entire cost of Contractor.

vii) in case of materials supplied by the **SMKC**, if the Contractor demands certain testing, the charges thereof shall be paid by the Contractor if the testing results are satisfactory and by the **SMKC** if the same are not satisfactory.

viii) **a)** The test shall be carried out in accordance with the Clause "Samples & Testing of materials" given under **" Additional General Conditions & Specifications"** of this tender document.

b) The testing of materials shall be carried out as per the frequency specified by the indian standard codes and shall be the responsibility of Contractor.

c) The material required for testing shall be sent by the contractor to the specified laboratory at his own

risk and cost.

d) In case the desired results are not obtained during testing or the material is rejected due to unsatisfactory results, the testing charges shall not be paid to the contractor.

e) It shall be obligatory on contractor to produce the test results along with receipt of payment made to the Laboratory, for releasing payment towards Testing Charges.

f) In case additional testing of material is found necessary due to change in source, no separate payment shall be made and it shall be the entire responsibility of contractor.

g) Testing charges mentioned in the tender item are in view of rates published by the Superintending Engineer, Vigilance & Quality Circle, Pune vide their letter No. DSR 2011-12/2071/2011 dated 22/09/2011 and revised till the submission of offer to this tender.

No difference shall be payable to the contractor, in case testing charges are revised / increased by the Laboratory in future.

h) Material Testing shall be carried out as directed by the Engineer-in- charge.

ADDITIONAL CONDITION OF THE WORK

1. Contractor shall visit the site & get himself thoroughly conversant with the actual site conditions before tendering. No extra item shall be admissible on this ground.

2. Contractor shall prepare the bar chart of activities submit it to engineer in charge & strictly follow the time schedule.

3. The Scope of work includes supply, installation testing and commissioning & providing free fully comprehensive maintenance including all equipments, spares of system & consumables for the period of 24 months after commissioning the system.

4. The system provided shall be complete in all respect inclusive of all components ancillaries to give the desired results & as per design parameters. All material supplied shall confirm the technical specifications.

5. Material used must be out of approved brands as per list.

6. Contractor shall produce manufactures certificate in regard with components specifications for all equipment's along with catalogs & manuals. Free Replacement warranty/ Guaranty of defective equipment's for the period of **12 months for Electrical Installation & 36 months for LED fixtures** from the date of installations.

7. After completion of work as build drawing of work carried out shall be submitted by the tenderer by the
Engineer in charge.

8. The Site shall be cleaned after completion to the satisfaction of Engineer in charge. 9. Electrical work shall comply CEA Regulations -2010 & other related statutory provisions.

9. The Electrical wiring, accessories, fittings shall be suitable to perform at their desire standard

10. Any Tests if required to be carried out for confirmation of performance of any equipment's will be at contractors cost & risk. .

11. It is mandatory on the part of contractor to get tested the electrical materials used on this work as directed by Engineer-in-charge from MSME (WR) Saki Naka Mumbai -72 or any other, accredited testing lab of Govt . of Maharashtra / Govt. of India. Contractor shall pay the necessary testing fee / charges.

II) After testing, if the material used on the work fails the test, it will be the entire responsibility of the Contractor to replace it free of cost.

III) The final payment will be made only after producing the successful original test certificate of the material for which the testing has been done..

12. Successful Tenderer should be get approved the list of Material before execution of actual work by Engineer-in-Charge.

13. Contractor should arrange power supply at site at his own cost, no extra money will be paid on account of this.

14. Contractor shall prepare all documents & submit to supply company to take supply meter (connection) to site as per direction by Engineer-in-charge (Quotation amount will be paid by **SMKC**). Signature of Contactor No. of corrections Executive Engineer

15. If scaffolding is necessary during work contractor should arrange for the same no extra.

16. Sewer collection system work should start after finalizing and starting of Wet well Pumping station work after working survey.

ADDITIONAL CONDITIONS OF THE WORK

1. The Contractor shall get the list of make/brands approved by Engineer in-charge or any of his authorized representative well in advance before the execution of work.
2. The Contractor shall produce & submit original manufacture test certificate for the electrical item/ equipment to be used at site as mention in Schedule "B" (If applicable)
3. No deviation of Make/ Brands will be allowed subsequently.
4. The Contractor shall prepare Drawing as required by Electrical Inspector and get it approved before starting the work.
5. After the completion of work the contractor shall get necessary final charging permission from Electrical Inspector, before connecting the installation to license supply. (If applicable)
6. It will be the responsibility of contractor to handover installation with inventory to the MSEDCL Authority (User dept.) before Final bill with all original documents such as permission from Electrical Inspector, Approval of Drawing etc.and one set of papers /Documents shall be submitted to Engineer In charge (If applicable)

7. After the completion of work the contractor shall test the entire installation in the presence of Engineer in-charge or any of his authorized representatives and submit the test report.
8. If necessaty, Tree cutting shall be done by contractor with necessary permission of concern authority. Fees / charges if any shall be borne by the contractor.
9. During execution , if any permission required from local authority/police Deptt / MSEDCL,it will be the responsibly of the contractor get the permission at his own cost. (If applicable)
10. If during the execution of work, shut down of LT/HT line from MSEDCL side is necessary, in that case it will be the responsibility of contractor to take necessary shut down with permission of local MSEDCL authority. (If applicable)
11. All material purchased by contractor should be as per the MSEDCL company's specifications and approved by concerned Ex. Engineer & Engineer-in –charges ,manufacture test certificate of the material used should be submitted to concerned authority and related work will be executed as per MSEDCL company method of construction. (If applicable)
12. The responsibility of safety of worker during the execution of work is solely on contractor. The contractor will have to follow all the safety rules during the execution of work ,the responsibility of compensation will be of the contractor .In any case , this dept. Will not responsible for any compensation.
13. During the execution of said work, the contractor shall take care of avoiding any traffic obstacle on site.
14. It will be the responsibility of contractor to handover all dismantled material of said work to MSEDCL authority at his own cost and submit the receipts of same before final bill to Engineer -in- charge. (If applicable)
15. Arrangement for the curing of C C foundation muffing, brick masonry work etc shall be done by clean and soft water at site by the contractor at his own cost. (If applicable)
16. The contractor will have to use all required T & P while execution of work at his own cost.
17. The insurance labour / staff working at site shall be done by the contractor under the insurance act at his own cost.
18. Any fees/charges/taxes or penalties towards payment of Government/semi government/local/ private bodies arising during the execution of work is to be borne by the contractor. No refund will be paid for this

LIST OF PREFERRED MATERIALS		
Sr.No.	**ITEMS**	**MAKE/BRANDS**
1	PVC Cables (Copper)/ Allum	Finolex, RR Kables, HMT , POLYCAB , HAVELLS ,KEI
2	PVC inulated Aluminum / Copper Wire with stranded conductors. (FRLS/FR Grade)	Finolex, RR Kables, HMT , POLYCAB , HAVELLS ,KEI , Anchor
3	PVC Rigid Conduits / Casing-n- capping	Finolex , Precision, Diamond, Modi, Asian Press fit
4	Electrical Fittings (Fluorescent, CFL, MV, Metal halide etc.)	Philips, Bajaj, Crompton, Wipro, SYSKA
5	Ceiling Fans, exhaust Fans	Crompton, Orient, Havells, Usha, Almonard
6	HRC switch Fuse unit	GEC, L&T, Siemens , Cutler Hammer, HPL

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7	Cable Gland & lugs	Siemens, Dowels, Braco
8	Industrial Sockets	Crompton, MDS, Siemens, Cutler Hammer, Standard , LEGRAND
9	Fluorescent Tubes & BULB/SMKCs	Philips, Crompton, Bajaj, Wipro, Osram , syska
10	Electronic Fan Regulator (Step Type)	Anchor, Roma, Greatwhite, legrand
11	MCCB's & RCCB, RCBO (All Pols)	L&T, Siemens, Crompton, Schneider Electric (MG), ABB, Legrand, Havells, Standard, C & S , Anchor
12	MS & GI Conduits	AKG or ISI Marked Approved by C.E. (Elect.)PWD Mumbai
13	Isolators, Distribution Boxes	L&T, Siemens, Crompton, Schneider Electric (MG), ABB, Legrand, Havells, Standard, C & S , Anchor
14	Wiring Accessories: 1) Piano type switched, sockets, accessories. 2) Modular type switches sockets, accessories.	Anchor, Legrand, , Roma, GEM, Schneider
15	Fluorescent tubes, MF/GF Lamps	Osram, Crompton, Orpat, GE, Bajaj, Philips
16	L.E.D. Fitting Indoor & Outdoor	Crompton, Philips, , Syska , C&S, Bajaj , Wipro
17	Water Pump	Crompton Greaves, KSB, , Kirloskar, CRI
18	HT Cable	Plolycab, RR Cables, Finolex , Havells
19	HT Switchgears	Simens, schneider, Crompton Greaves, ABB, L&T , Legrand
20	Air Conditioning Units	Blue Star, Volts, Carrier, Diken
21	FIRE PUMPS :	KIRLOSKAR BROS. LTD / MATHER & PLATT / GRUNDFOS / FLOWMORE / KSB
22	G.I./ M.S. PIPES :	JINDAL(HISSAR) / TATA / SURYA / ZENITH
23	PIPE FITTINGS :	BHARAT FORGE / TUBE PRODUCTS / M.S. FITTINGS / VS BRAND / GOYAL / SANJAY FORGE / B & M
24	BUTTERFLY VALES :	AUDCO / KEY STONE / BDK / FOURESS / INTERVALVE i/New age
25	NON – RETURN VALVES :	H. SARKER / CRESENT / UPADHAYA / HAWA
26	GATE VALVES (Screwed end) :	LEADER / ZOLOTO / ITAP
27	BALL VALES (Screwed end) :	LEADER / ZOLOTO / ITAP
28	DG Set with AMF Panel	KIROSKAR / GREAVES / MAHINDRA / CUMMINS
28	STRAINERS :	GUJRAT OTO FILT / GRAND FRIX / TEL FLOW
29	C.I. GATE VALVES :	H. SARKER / CRESENT / UPADHAYA / HAWA
30	FLOW METRE :	FORBES MARSHALL / EUREKA
31	PRESSURE SWITCH :	INDFOS / SWITZER / DELTA CONTROL
32	PRESSURE GAUGE :	H. GURU / FIEBIG / PRICOL / BELLS CONTROL/done foss/fibe/uday.
33	ANTICORROSIVE MATERIAL :	I W L / RUSTECH
34	REINFORCEMENT STEEL [FE 500] :	JINDAL/ TATA TISCON / RAJURI / BHARAT
35	STRUCTURAL STEEL :	JINDAL/TATA
36	VITRIFIED TILES	KAZARIA/ JOHNSON / MARBONITE / RAK
37	CEMENT [OPC 43/53 GRADE]	ULTRATECH / JK / ACC / JSW / CHETINAD
38	ALLUMINIUM	JINDAL
39	HOSE BOX / FIRE DUCT SHUTTER	EVERSAFE / TYCO / NEWAGE / MINIMAX
40	FIRE EXTINGUISHERS	SAFEX / ACE FIRE / MINIMAX / VIJAY / EVERSAFE
41	SPRINKLERS	TYCO / VIKING / KIDDE
42	SPRINKLER ALARM VALVE	HD / TYCO / VIKING / KIDDE
43	FLOW SWITCH	SYSTEM SENSOR / POTTER / SWITZER/ LEVCON
44	PAINT	ASIAN / BERGER
45	AIR RELEASE VALVES	LEADER / BAJAJ / HAWA

46	WELDING ELECTRODES	ESAB 28/ ADVANI
47	FLEXIBLE DROPS	EASYFLEX / DONGA FLEX / ANY UL LISTED/FM APPROVED MATERIAL
48	ELECTRIC MOTORS	KIRLOSKAR ELECTRIC / CROMPTON GREAVES / SIEMENS / ABB
49	BATTERY	EXIDE / STANDARD / AMRON
50	MOTOR CONTROL CENTER	PRAGATHI CONTROLS / LOAD CONTROLS / DYNAMO / BRIGHT ENGINEERING/ELLINS / LOTUS
51	CONTROL / POWER CABLES	CCI/ FINOLEX/ POLICAB /HAVELL / RRKABEL
52	CONTROL MCB	ABB/LEGRAND / SIEMENS / HAVELL / MDS /CROMPTON GREAVES / LEGRAND
53	VOLT METER SELECT SWITCH	SALZER / L & T / KAYCEE
54	VOLTMETER (AC / DC)	MECO / AE
55	AMMETER (AC / DC)	MECO / AE
56	POWER CONTACTORS	ABB/LEGRAND / SIEMENS / HAVELL / MDS /CROMPTON GREAVES / LEGRAND
57	INDICATING LAPS (LED type)	BINAY / TEKNIC
58	PUSH BUTTONS	TEKNIC / SIEMENS
59	AUTO / MANUAL SELECTOR	SALZER / KAYCEE
60	TIMERS	EAPL / AE / L & T
61	TERMINAL BLOCKS	ELMEX / WAGO
62	CURRENT TRANSFORMERS	KALPA / VOLTAMPS / KAPPA
63	OVER LOAD RELAY	L & T / SIEMENS /CROMPTON GREAVES /
64	SINGLE PHASE PREVENTORS	MINILEC / AE /SIEMENS
65	ENGINE CONTROL SELECTOR	SALZER / KAYCEE / L&T
66	MAIN SUPPLY SELECTOR – DPMCB	SIEMENS / LEGRAND /ABB/ L&T / Crompton Breaves
67	BATTERY CHARGING SELECTOR	SALZER / L & T/ KAYCEE
68	BATTERY CHARGER	KAYBEE POWEREC / HBL-NIFE/ AFCO/CHABBI
69	SIREN / HOOTER	KHERAJ/EQUI
70	TOGGLE SWITCH	JAY / EQUI
71	END TERMINATIONS	DOWEWLS / MULTI
72	CABLE TRAY	STORACK / PAN / MAG
73	SMOKE DETECTORS	NOTIFIER / EST (Edwards) / SIMPLEX / APPOLO /HONEYWELL / SIEMENS / MIRTONE / SECUTRON
74	HEAT DETECTORS	NOTIFIER / EST / SIMPLEX / APPOLO / HONEYWELL / SIEMENS / MIRTONE / SECUTRON
75	MAIN CONTROL PANEL	NOTIFIER / EST / SIMPLEX / APPOLO / HONEYWELL / SIEMENS / MIRTONE / SECUTRON
76	MANUAL PULL STATIONS	NOTIFIER / EST / SIMPLEX / APPOLO / HONEYWELL / SIEMENS / MIRTONE / SECUTRON
77	HOOTERS / STROBES	NOTIFIER / EST / SIMPLEX / APPOLO / HONEYWELL / SIEMENS / MIRTONE / SECUTRON
78	MODULES	NOTIFIER / EST / SIMPLEX / APPOLO / HONEYWELL / SIEMENS / MIRTONE / SECUTRON
79	BATTERY	HITACHI / DRYSIL / JOHNSON / EXIDE / STANDRD / PABASONIC
80	COPPER CONDUCTOR CONTROL CABLE / WIRES	POLYCAB / VARSHA/ ANCHOR / SHAKTHCAB / FINECORE
81	COMMUNICATION WIRES	POLYCAB / VARSHA / SHAKTICAB/ FINECORE / ANCHOR
82	P.A. SPEAKERS	PHILIPS / AHUJA / AKG / BOSCH / BPL
83	P.A.CONSOLE	TYCO / KIDDE / FIRE PRO / CHERY TECH / BOSCH
84	P.A. AMPLIFIERS	PHILIPS / AHUJA / AKG / BOSCH
85	Data Cable(CAT 6, CAT6+)	AMP, D Link, Molex, Systimax

87	Projector	SONY / BenQ
88	Solar Inverter	Fronious , Polycab , Growaatt , Zerover , ABB , Sungrow
89	Solar “ON Grid” system	Vikram,,Greenbrillience, Tata Power Solar Systems Ltd. Goldigreen , Waaree Solar
90	Solar Panel	Vikram,,Greenbrillience, Tata Power Solar Systems Ltd. Goldigreen , Waaree Solar
91	Line Array Speaker , Line Array Sub Woofer , Twp way stage Monitor	Bose /Bosch /Sony
92	Power Amplifier (For line Array) , Power	Bose /Bosch /Sony
93	Equaliser (31+31)	Bosch / Yamaha /Soundcraft/ Bose
94	Live mixer	Bosch / Yamaha /Soundcraft/ Bose
95	Active Cross over stereo	Bosch / Sound Craft /Yamaha
96	Digital Signal Processor Drive Rack	DBX/Ahuja
97	Hanging Microphone	Shure/AKG/SENNHEISER /Bosch
98	Podium Gooseneck Microphone	Shure/AKG/SENNHEISER /Bosch
99	Boundary Microphone	Shure/AKG/SENNHEISER /Bosch
100	CCTV Cameras	Sony, Samsung, Honeywell , CP PLUS
100	Wireless Handheld Microphone , Wireless	Shure/AKG/SENNHEISER /Bosch
101	NVR & NVR Software	Sony, Samsung, Honeywell
101	Semi Open Headphone	AKG/SENNHEISER/Yamaha
102	Surveillance Hard Dist	Seagate, WD
102	Room Monitor speaker	Bosch / Bose/Sony
103	L.E.D. Display	Samsung, Sony, Panasonic
103	Sub Woofer For fly mounts speaker mounting brackets	Bosch / Bose/Sony
104	Gigabyte Poe & Ethernet Switches	CISCO, Alcatel, Juniper, D-Link
104	DVD Player	Sony/Philips/Samsang
105	UTP Cable, Fiber Optic Cable, I/O, Patch	R&M, CISCO, Systimax, AMP, D-Link
105	Microphone Cable	Falcon/Delta/Sunplast
106	Racks	APW, WQ, Vallrack, AMS Net Tech, Net Rack
106	Speaker Cable	Falcon/Delta/Sunplast
107	UPS	APC, Emerson, EATON, Numeric < Microteck
107	Microphone Patch panel , Speaker Patch Panel	MX/Neutrik/Leo
108	Octagonal Poles / High mast Poles	Bajaj, Wallmount, Crompton, Magnetic
109	Transformer	Voltamp, UPC, Static, Deltron , Mahati, Crompton Pactil , Transrail.
110	Telephone Cable	Finolex Polycab, Havells, Vinay , D-link , Anchor
111	Telephone Instruments	Panasonic, Beetel, Siemens
112	MDF Box	Roma, Legrand
113	Krone Module	Krone or ISI Marked Approved by C.E. (Elect.)PWD Mumbai.
114	Co-axial RG11 Cable	Polycab, Finolex, RPG
115	Modular Telephone Socket	Anchor, Legran, Schneider , Roma , Anchor , GM
116	Solar Hot Water System	Racold Solar Water Heating System , Tata Power Solar Systems Ltd , Kotak Urja Pvt. Ltd, Photon Energy Systems Ltd , Vikram Solar Pvt. Ltd , Waaree Energies Ltd , V.Guard , Skylark solar , Green Brilliance, Luxmi Solar

FREQUENCY CHART FOR TESTING OF MATERIALS

ANNEXURE- 'A'

Sr. No	Material	Test	Frequency of Testing	Remarks
1.	Sand	i) Fineness Modulus ii) Silt Content	One test per source. One test per day.	
2.	Metal	i) Crushing value ii) Impact value iii) Abrasion value iv) Water Absorption v) Flakiness Index vi) Stripping value	One test per source.	PWD Hand Book I.S. 2386 Part-II
		vii) Gradation	One test per 200 cubic meter.	
3.	Cement Concrete	i) Compressive Strength	Upto 5 Cu.M.– 1 set 6-15 Cu.M. – 2 sets 16-30 - 3 sets 31-50 - 4 sets 51 & above - 4 sets + One additional set for each additional 50 Cu.M. or part thereof.	M.O.S.T. Specification 1716.
		ii) slump	2 tests per day.	
4.	Cement	i) Comp. Strength ii) Initial setting time iii) Final setting time iv) Specific Gravity v) Soundness vi) Fineness	One test for each consignment of 50 M.T. (1000 bags) or part thereof. But minimum one test for each consignment.	I.S. 269 12269
5.	Masonry Stone	i) Compressive Strength ii) Crushing value iii) Specific gravity	One set of 5 stones for each quarry & for doubtful quality.	
6.	Bricks	i) Crushing Strength ii) Water Absorption iii) Efflorescence	One set of 50 Bricks for each 50000 consignment or part thereof.	

Sr. No	Material	Test	Frequency of Testing	Remarks
7.	Earthwork for embankment	i) Optimum moisture content ii) Maximum dry density iii) Plasticity Index	One test per 200 m3 of soil One test per 1000 m3 of soil One test per 1000 m3 soil	
8.	Aluminum section	1) Weight per running meter. 2) Thickness	One test per source	
9.	Particle Board	1) Thickness 2) Density 3) Moisture content	One test per source	
10	Water Bound Macadam Grade II & III	i) Aggregate Impact value ii) Gradation iii) Flakiness index & Elongation Index iv) Atterberg limits of binding material v) Atterberg limits of portion of aggregates passing 425 Micron.	1 test per 200 Cum. 1 test per 100 Cum. 1 test per 200 Cum. One test per 25 M3 of binding material One test per 100 Cum.	M.O.S.T. Specification Table 900-3.
11	Reinforcement Steel (TMT Fe 500/550)	i) Weight per meter. ii) Ultimate tensile stress iii) Yield stress iv) Elongation	One test per metric tone and for each diameter.	

Sr. No	Material	Test		Frequency of Testing	Remarks
12	Built up spray grout	1.	Quality of Binder (Straight-run Bitumen) (IS:73) a) Penetration Test b) R&B Softening Point Test c) Ductility Test		One test per lot --do-- --do--
		2.	Aggregate Impact value test (IS:2386 Part 4)		One test on representative sample per km length from each source identified by the contractor
		3.	Flakiness Index test (IS:2386 Part I)		--do--
		4.	Bitumen stripping of Aggregate test (IS:6241)		--do--
		5.	Water Absorption (IS:2386 Part 3)		--do--
		6.	Soundness test, if water absorption of aggregate exceeds 2% (IS:2386 Part 5)		--do--
		7.	Rate of spread of binder		At least one test daily
		8.	Rate of spread of aggregates		--do--
		9.	Aggregate Grading (IS:2386 Part 1)		--do--
		10.	Temperature of binder during spraying		Regularly at close intervals
		11.	Thickness of compacted layer		At random
13	Flooring Tiles	i) Flexural Strength, ii) Water Absorption		One set of 12 flooring tiles for every 2000 numbers or part thereof.	
14	Glazed Tiles	Water Absorption		One set of 16 glazed tiles for every 2000 numbers or part thereof.	
15	Cement morter for masonary and plaster	Compressive strength		A set of 6 cubes per day.	

Sr. No	Material	Test	Frequency of Testing	Remarks
16	Roofing Material	i) Thickness ii) Transparency	One test per source	
	Open graded premix surfacing	**BITUMEN:-** 1.Specific Gravity 2. Ductility 3. Penetration 4. Softening Point 5. Viscosity Test 6. Flask & Fire Point 7. Solubility in carbondisulphate	One test per Bouzer	
17		**Metal:-** 1. Gradation 2. Impact value 3. Crushing Value 4. Los angles abrasion value 5. Flackiness index 6. Water absorption	One test per 100 m3 One test per source	
		Mix Material:- 1. Extraction (Binder content)	Two test per day or Two test per 500 square metre whichever is more.	
18	Paints	1) Glass bead contents 2) Reflectance 3) Flowability 4) Softening paint 5) Drying time	One test per source	
19	Water	1) Sulphate contents 2) chloride content 3) PH value	Per source	
20	Thermoplastic Paint	i) Glass bead contents and grading analysis. ii) Reflectance and Yellowness index iii) Flow ability	One Test for 3 Km. Work. One Test for 3 Km. Work. One Test for 3 Km. Work.	

		iv) Softening Point v) Drying Time.	One Test for 3 Km. Work. One Test for 3 Km. Work.	

Sr. No	Material	Test	Frequency of Testing	Remarks
21	Granular Sub-base	i) Mix Design ii) Gradation iii) Atterberg limits iv) Moisture content prior to compaction v) Density of compacted layer vi) C.B.R.	1 Test per source/500 M3 1 Test per 100 M3 of Mix 1 Test per 250 M2 of mix 1 Test per 500 M2 of mix 1 Test per 500 M2 of soil 1 Test /Km of Length of road.	
22	Interlocking Concrete Paving Block	i) Compressive Strength ii) Water absorption iii) Flexural Test iv) Resistance to wear	A set of 8 blocks for every 10000 blocks. -----do------ -----do------ -----do------	
23	Wood work	i) End immersion tests ii) Knife test iii) Glue adhesion test iv) Density v) Moisture content	As per instructions of Engineer-in-charge 1 Test per source 1 Test per source	
24	Cement Concrete	Mix design for each grade of concrete	One test for each Source of materials./ One test per 500 M3 of concrete	

ADDITIONAL CONDITION FOR MATERIAL TESTING

It is mandatory on the part of Contractor to carry out all the required tests of various construction materials as mentioned in Schedule-'B' of the Tender.

If the contractor fails to submit required Test Results of the various construction materials as mentioned in the items of Schedule-'B', he will be liable to deposit the amount at penal rate of five times of the amount of particular test which he has not carried out. Contractor will be informed by the Engineer-in-charge by letter. On receipt of letter, contractor will have to either deposit the said amount or to carry out the required test within 10 days. If he again failed to carry out the required tests in stipulated time limit, the said tests will be carried out by the de-

partment and total expenditure incurred on the testing charges plus five times amount of testing charges will be recovered from the Contractor's bill.

As this recovery is only due to the negligence on the part of contractor to carry out work as per Tender Conditions and The City Engineer's decision will be final and binding on the Contractor and it cannot be challenged by the Contractor by way of Appeal, Arbitration or in the Court of Law.

28. CHANGE OF CEMENT CONTENTS ETC. :

If any additives in concrete/compounds for water proofing material besides the specifications etc. are ordered by the Engineer in charge in writing to be added to the mortar or concrete, no extra rate shall be payable for this and which shall be carried out as per directions of the Engineer in charge.

29. CEMENT CONCRETE :

29.1 GENERAL

a) All concrete shall be controlled concrete and machine mixed, unless otherwise directed by Engineer-in-charge. For controlled or high grade concrete, the grading of aggregates shall be got approved from the Engineer.

b) The correct proportions and the total amount of water for the mix will be determined by means of preliminary tests and shall be got approved by the Engineer. However, such approval does not relieve the Contractor from his responsibility regarding the minimum works strength requirements. Work test shall be taken in accordance with relevant codes and specifications.

All proportioning of aggregates shall be done by weight if so ordered by the Engineer.

c) **(i) READY MIX CONCRETE :** It shall be mandatory on the part of contractor to erect **Fully Automatic Micro Procrssor base Programme Logical Control (PLC) with SCADA Enabled "Reversible Drum Type Concrete Mixer of minimum 18 to 20 Cubic Meter per Hour capacity of any standard companey of Transit Mixers and or / Concrete Pumps of desired number and capacity with SCADA system** at work site / in the vicinity to ensure the requirement of the Project. The Contractor shall communicate the schedule of arrival of Concrete Mix to the Engineer-in-charge. Apparatus and equipment for testing grade of Mix shall be made available by the contractor at site. If the grade of concrete mix is found as per specifications, written permission will be granted for unloading otherwise written instruction will be given for not using the same on site. Contractor shall deploy all the necessary machinery such as Ready Mix Concrete plant, Pump etc. as required during the execution of work and shall be maintained in good condition throughout the construction period at no extra cost.

d) The form work used shall be of **new marine plywood** adjustable steel props (Vertical members) shall only be used for support. No steel plates allowed for formwork and wooden

bullies for centering purpose.

e) The concrete shall be mechanically vibrated for proper compaction by the method approved by the Engineer.

f) The concrete shall be cured only by sweet potable water for full 21 days after the time or the period specified in the detailed specification or as may be directed by Engineer-in-charge.

g) Minimum cement content of concrete shall be as per prevailing I.S. Code.

h) Where cement to be used for various items of the tender, it shall be either ordinary port land cement or Portland pozzolona cement. The decision of Engineer-in-charge shall be final and binding on contractor No claim in this regard shall be entertained.

REINFORCED CONCRETE WORK

The work included in this contract shall be carried out in addition to this specification detailed herein, in accordance with specifications and regulations as laid down in the following standard specifications.

IS 8112 - 1989	-	Specification for 43 grade ordinary Portland cement.
IS12269 -1989	-	Specification for 53 grade ordinary Portland cement.
IS1786 - 1985	-	Specification for cold twisted bars.
IS 383 - 1976	-	Specification for coarse and fine aggregate from natural Courses for concrete.
IS 432 - 1982	-	Specification for mild steel and medium steel bars
IS 456 - 2000	-	Code of practice for plain and reinforced concrete.
IS	-	For .Q.Q.C

For TMT (Fe-415 / Fe 500) reinforcement bars, prevailing I.S. code shall be followed.

30. <u>MISCELLANEOUS</u> :

30.1 Rate shall be inclusive of all taxes, royalties and cesses etc.

30.2 For providing electric wiring or water lines etc. recesses shall be provided if necessary through walls, slabs, beams, etc. and later on refilled up with bricks or stone chipping, cement mortar without any extra cost.

30.3 In case it becomes necessary for the due fulfillment and performance of the contract for the

Contractor to occupy land outside the **SMKC** limits, the Contractor will have to make his own arrangements with the land owners and to pay such rents if they are payable as mutually agreed between them. The **SMKC** will afford the Contractor all the reasonable assistance to enable him to obtain **SMKC** land for such purpose on usual terms and conditions as per rules of Government, if such land is available.

30.4 The special provision in detailed specifications or wording of any items shall gain precedence over corresponding contradictory provision (if any) in the standard specifications or PWD Hand Book, where reference to such specifications is given without reproducing the details in Contract.

30.5 Suitable separating barricades and enclosures shall be provided to separate material brought by Contractor and material issued by **SMKC** to Contractor under Schedule 'A'. Same applies for the material obtained from different sources of supply.

30.6 The stacking and storage of construction material at site shall be in such a manner as to prevent deterioration or infusion of foreign matter and to ensure the preservation of their quality, properties and fitness for the work. Suitable precautions shall be taken by the Contractor to protect material against atmospheric actions, fire and other hazards. The materials likely to be carried away by wind shall be stored in suitable stores or with suitable barricades and where there is likelihood of subsistence of soil, such heavy materials shall be stored on approved platforms.

30.7 For road and bridge works, the Contractor shall in addition to the specifications cited here, comply with requirements of relevant I.R.C. Code practice.

30.8 The Contractor shall be responsible for making good the damages done to the existing property during construction by his men.

30.9 If it is found necessary from safety point of view to test any part of the structure, the test shall be carried out the Contractor with the help of the **SMKC** at his own cost.

30.10 Defective work is liable to be rejected at any stage. The Contractor, on no account can refuse to rectify the defects merely on reasons that further work has been carried out. No extra payment shall be made for rectification.

30.11 In the Schedule 'B' the work has been divided into sections but notwithstanding this, every part of it shall be deemed supplementary to and complementary of every other part.

30.12 General directions or detailed description of work, materials and items coverage of rates given in the specifications are not necessarily repeated in the Bill of Quantities. Reference is, however, drawn to the appropriate section clause(s) of the General specifications in accordance with which the work is to

be carried out.

30.13 In absence of specific directions to the contrary, the rates and prices inserted in the items are to be considered as the full inclusive rates and prices for the finished work described thereunder and are to cover all labour, materials, wastage, temporary work, plant overhead charges and profits, as well as the general liabilities, obligations and risks arising out of the General Conditions of the Contract.

30.14 The quantities set down against the item in Schedule 'B' are only estimated quantities of each kind of work included in the contract and are not to be taken as guarantee that the quantities scheduled will be carried out or required or that they will not be exceeded.

30.15 All measurements will be made in accordance with the methods indicated in the specifications and read in conjunction with the General Conditions of the Contract.

30.16 The details shown on drawings and all other information pertaining to the work shall be treated as indicative and provisional only and are liable to variation as found necessary while preparing working drawing which will be supplied by the Government during execution. The Contractor shall not, on account of such variation be entitled to any increase over the ones quoted in the tender which are on quantity basis.

30.17 The recoveries if any due from Contractor will be effected as arrears of land revenue through the Collector of the District.

30.18 Clause 101 to 107 of specifications of Road and Bridges work adhered herewith will be applicable to works as per Schedule 'B' unless specified otherwise in the detailed specifications of the relevant items.

30.19 All materials used in the construction shall conform to the requirement of Specification Clause under Section 1000 "Materials for Structures" of Specification of Road and Bridge Work, M.O.S.T., New Delhi , August 2001 Edition.

30.20 Extraneous materials and steps to minimize dust nuisance during construction shall be as per Clause 111 of M.O.S.T. specification, New Delhi , August 2001 Edition.

PROTECTION OF UNDERGROUND TELEPHONE CABLE AND AERIAL ELEPHONE WIRES AND POLES, TRANSMISSION TOWERS, ELECTRICITY CABLES AND WATER

SUPPLY LINES :

During the execution of work it is likely that the Contractor may meet with telephone cable, electrical cables, water supply lines, etc. it will, therefore, be the responsibility of the Contractor to protect them carefully. All such cases should be brought to the notice of the Engineer-in-charge by the Contractor and also to the concerned Department. Any damages whatsoever done to these cables and pipelines by the Contractor shall be made good by him at his cost except teder quantity for water supply conections.

31. MEDICAL AND SANITARY ARRANGEMENTS TO BE PROVIDED FOR LABOUR EMPLOYED IN THE CONSTRUCTION BY THE CONTRACTOR :

a) The Contractor shall provide an adequate supply of potable water for the use of labourers on work and in Camps.

b) The Contractor shall construct trench or semi permanent latrines for the use of the Labourers. Separate latrines shall be provided for men and women.

c) The Contractor shall build sufficient number of buts on a suitable plot of land for use of the Labourers according to the following specifications. Huts of Bamboos and Grass may be constructed.

1. Huts of Bamboos and Grass may be constructed.

2. A good site not liable to submergence shall be selected on high ground remote from jungle but well provided with trees, shall be chosen where it is available. The neighborhood of tank, jungle, grass or wood would should be particularly avoided. Campus should not be established close to large cutting of earth work.

3. The lines of huts shall have open spaces of at lease ten yards between rows. When a good natural site cannot be procured, particular attention should be given to the drainage.

4. There should be no over crowding. Floor space at the rate of 3 Sq.m. per head shall be provided. Care should be taken to see that the huts are kept clean and good order.

5. The Contractor must find his own land and if he wants Government land, he should apply for it. Assessment for it if demanded will be payable by Contractor. However the Department does not bind itself for making available the required land.

6. The Contractor shall construct a sufficient number of bathing places. Washing places should also be provided for the purpose of washing clothes.

7. The Contractor shall make sufficient arrangements for draining away the surface and sewage water as well as water from the bating and washing places and shall dispose off this waster water in such

way as not to cause any nuisance. He shall also keep the premises clean by employing sufficient number of sweepers.

d) The Contractor shall engage a Medical Officer with a traveling dispensary for a Camp containing 500 or more persons if there is no **SMKC** or other private dispensary situated within 8 Kms. from the camp. In case of emergency the Contractor shall arrange at his cost for transport for quick medical help to his sick workers.

e) The Contractor shall provide the necessary staff for effecting a satisfactory drainage system and cleanliness of the camp to the satisfaction of the engineer. At least one sweeper per 200 persons should be engaged.

f) The Assistant Director of Public Health shall be consulted before opening a labour camp and his instruction on matters such as water supply, sanitary conveniences, the camp site accommodation and food supply shall be followed by the Contractor.

g) The Contractor shall make arrangements for all antimalaria measures to be provided for the labours employed on the work. The antimalaria measures should be provided as directed by the Assistant Director of Public Health.

h) In addition to above all provisions of the relevant labour act pertaining to basic amenities to be provided to the laborer shall be applicable which will be arranged by the contractor.

32. SAFETY CODE :

While executing the work, necessary precautions regarding safety of labour, supervisory staff, public and traffic users shall be taken by the agency according to rules and regulations specified by the Government of India / Government of Maharashtra and as directed by District Court, Sangli.

Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period works as can be done safely from ladders. When ladder is used an extra mazdoor shall be engaged for hold the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper than 1 to 4 (1 horizontal and 4 vertical).

Scaffolding or staging more than 3.25 m. above the ground or floors, swing or suspended from an overhead support or erected with stationary support, shall have a guard rail properly attached, bolted, braced and otherwise assured at least 1 m. high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such

openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

Working platform, gangways and stairways shall be so constructed that they do not sag unduly or is more than 3.25 m. above ground level or floor level, it shall be closely boarded , have adequate width and be suitably fenced as described in 2 above.

Every opening in floor of the building or in a working platform shall be provide with suitable protection to prevent fall of persons or materials by providing suitable fencing or railing with minimum height of 1 metre.

Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m. in length , width between side rails in a rung ladder shall in no case be less than 30 cm. for ladders upto and including 3 m. in length. For longer ladders with width shall be increased at least 6 mm. for each additional 30 cm. of length. Uniform step spacing shall not exceed 30 cm.

Adequate precautions shall be taken to prevent danger from electrical equipments. No materials on any of the site shall be stacked or placed as to cause danger or inconvenience to any person or the public. The Contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defense of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precaution and to pay any damages and costs which may be awarded in any such suit, action or proceeding to any such person or which may with the consent of the Contractor, to be paid to compromise any claim by any such person.

33. EXCAVATION AND TRENCHING :

All trenches, 1.5 meter or more in depth , shall at all times be supplied with atleast 1 ladder for each 30 metre in length or fraction thereof. Ladder shall be extended from bottom of trench to at least 1 metre above surface of the ground, sides of trench which is 1.5 M. or more in depth shall be stepped back to give suitable slope, or security held by timber bracing, so as to avoid the danger of sides collapsing. Excavated materials shall not be placed with 1.3 M. of edge of trench or half of depth of trench whichever is more. Cutting shall be done from top to bottom under no circumstances shall undermining or undercutting be done.

DEMOLITION :

Before any demolition work is commenced and also during the process of the work :-

a) All roads and open areas adjacent to the work site shall eight be closed or suitably protected.

b) No electric cable or apparatus which is liable to be a source of danger or a cable or apparatus used by operator shall remain electrically charged.

c) All practical steps, shall be taken to prevent danger to person employed, from risk or fire or explosion or hooding. No floor, roof or other part of building shall be so overloaded with debris of materials as to render it unsafe.

All necessary personal safety equipments as considered adequate by the Engineer-in-charge shall be available for use of persons employed on the site and maintained in condition suitable for immediate use and the Contractor shall take adequate step to ensure proper use of equipment by those concerned.

a) Workers employed on mixing asphaltic materials, cement and lime mortars concrete shall be provided with protective footwear and protective goggles.

b) Those engaged in handling any materials, which is injurious to eyes shall be provided with protective goggles.

c) Those engaged in welding works shall be provided with welder's protective eye-shields.

d) Stone breakers shall be provided with protection goggles and protective clothing and seated at sufficiently safe intervals.

e) When worker are employed in sewers and manholes which are in use, the Contractor shall ensure that manhole covers are opened and manholes are ventilated at least for an hour before worker are allowed to get into them. Manholes opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to public.

f) The Contractor shall not employ, men below the age of 18 and women on the work of painting with products containing lead in any form wherever men above the age of 18 are employed on the work of lead painting the following precautions shall be taken.

i) No paint containing lead or lead product shall be used except in the form of paste or ready-made paint.

ii) Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

iii) Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

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

Use of hoisting machines and shackles including the attachments, anchorage supports shall confirm to the following :-

a) i) These shall be of good mechanical construction, round materials and adequate strength and free from potent defect and shall be kept in good repair and in good working order.

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

b) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in-charge of any hoisting machine including any scaffolding.

c) In case of every hoisting machine and of every chain ring hook, shackle ownel and pulley block used in hoisting or lowering or as means of suspension safe working load shall be ascertained by adequate means. Every hoisting machines and all gear referred to above shall be plainly marked with safe working loads.

In case of hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated.

No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.

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

Motors, gearing , transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with such means as will reduce to the minimum risk of accidental descent of load. Adequate precaution shall be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced, when worker are employed. On electrical installations which are already energize insulating materials wearing approved such as gloves, sleeves and coats as may be necessary shall be provided. Workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

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

These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Persons responsible ensuring compliance with the safety code shall be named therein by the Contractor.

i) To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Engineer-in-charge or his representatives and the inspecting officers.

ii) Failure to comply with the provisions hereunder shall make the Contractor liable to pay to the

SMKC as penalty an amount not exceeding Rs. 50/- for each default and decision of the Engineer-in-charge shall be final and binding.

Not with standing the above conditions 1 to 14 the Contractor is not exempted from the operation of any other Act or rules inforce.

33.1 Safety in Excavation and trenching

a) All trenches, 1.5 meters or more in depth shall at all times be supplied with at least one ladder for each 30 meters in length or fraction thereof.

b) Ladder shall be extended from the bottom of the trench to at least 1 meter above surface of the ground. Sides of a trench which is 1.5 meters or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides collapsing. Excavated material shall not be placed within 1.5 meters of the edge of a trench or half of the depth of the trench, whichever is more.

c) Cutting shall be done from top to bottom. Under no circumstances shall undermining or undercutting should be done.

d) Minimum check and clear edge of Trench- There is a tendency to dump the excavated material just on the edge of the trench when excavation is done manually. The material may slide back into the trench or apply additional load on shoring. A provision of clear berm of a width not less than one third of the final depth of excavation is recommended. In areas where this width of the berm is not feasible, the reduced berm width of not less than one meter should be provided. It is always better to provide substantial toe board to prevent 'roll back' into the trench.

Plant and Machinery

e) The excavation equipment should be parked at a distance of not less than the depth of the trench, or at least 6 meters away from excavated sides for trenches deeper than six meters.

f) With the use of power shovels and draglines, the banks of trenches become instable and thus dangerous for persons working nearby. These conditions should be watched and suitably remedied.

g) The vehicles should not be permitted to be driven too close to the pit. Care should be taken for locating roads leading to or from the pit. While loading manually, the vehicle should not be taken too near the wall of the pit. Use of post legs will reduce the risk of accidents where the vehicle is reversed for loading.

h) Workers should be provided with proper tools. Overlooking the importance of providing the right tools and protective gears for the job is perhaps the most serious risk for workers.

Workers using tools should guard against the danger arising out of the sudden movement of material which may throw them off balance. They should be adequately spaced to avoid being accidentally struck by tools of others working nearby.

Fencing

j) Where deep excavation is going on and there is likelihood of the public or cattle frequenting the area, suitable protective fencing should be erected and also sufficient number of notice boards and danger signals should be provided to prevent accidents by falling in excavated trenches/pits.

k) For excavated sites close to public roads/pathways, the area notice boards should have lights during darkness hours.

l) Barriers or covering should be provided to excavations, shafts, pits and opening having a vertical fall distance of more than 2 meters, except during the period necessary for the access of persons and movement of plant, equipment and materials.

Shoring

m) As far as possible, the installation of shores should be done from the surface.

n) The trench jack or horizontal braces should never be used as a ladder for getting in or out a trench as they are not designed to take vertical load. Removal of shoring

o) When the removal of shoring is planned, the possible collapse of trench sides should be anticipated. The newly installed utility line will then be safeguarded in the normal course by being covered with loose or compact fill before the shores are removed. If the trench is likely to cave in on removal of the shores, it can be filled up to the bottom with horizontal brace, after which additional trench space can be filled up to the next horizontal brace or screw jack.

p) If the trench is to stay after the removal of shoring, the ladder should not be removed till all work within the trench is completed and the newly installed utility line has been protected or covered.

Access and Escape

q) The workers should be able to escape fast in the event of any mishap during excavation. It is recommended that one ladder should be provided for every length if 15 meters or fraction thereof in the case of relatively less hazardous work.

r) Quite often the pathways become slippery due to accumulation of mud, sand or gravel. This should be avoided. Further, the pathways should be strong enough to withstand the intended use.

Additional Precautions

s) The precautions should be taken of the power lines, cables during excavation and after operation. The alignment should be checked property prior to excavation for any power cable etc.

t) Ignorance and carelessness are major causes of accidents. Tendency to employ cheaper unskilled workers for jobs requiring proficiency sand skill can lead to accident. This should not be permitted.

u) Water for construction activities, rain water and water flowing in the drains are major cause of slides. Proper arrangement of diversion/bailing out of such water should be done.

33.2 Barricading, diversions, display boards for safety

The adequate & proper barricading shall be provided at site to have proper safety and facilitation to traffic / inhabitants in their day to day activities and should be decided by the Engineer in-charge to follow adequate safety measures based on prevailing site conditions. It should be ensured that the barricading has been carried out properly and display boards for diversion, warning, work in progress, schedule of completion of activity in the area are displayed at required places and proper lighting arrangement at work sites are made during night for convenience & safety of the public.

33.3 Occupied premises:-

Working in occupied or partially occupied buildings and adjacent to the general public calls for particular care, and special precautions need to be taken to protect the occupants and their visitors. Their means of access and escape must be maintained at all times and additional temporary measures may be necessary to ensure this. Measures must also be taken to protect them against falls, falling materials, dust, vibration, fumes and other hazards.

The work site is to be completely segregated from the occupied section of the building by hoarding panels. The working areas should be clearly marked and access denied to non - construction personnel.

There can also be major problems with noise levels and vibration, which affect not only the worker but also the occupants of the building. Where it is reasonably practicable, noise-reduced compressors and other machinery is to be used to reduce the inconvenience. The maximum noise levels near the construction site should be limited to 65 dB(A) Leq(5 min.).

It will be necessary to carry out noise monitoring to ensure this compliance.

Acoustic barriers should be placed near construction sites.

The existing staircase shall not be used by Contractor as well as construction crew personnel for shifting of construction materials as it is a office area.

Contractor has to make his own arrangement for construction of upper floor by means of constructing temporary staircase or by using Crain at his own cost.

The handling / collection of the construction material and equipment shall not make inconvenience to the staffs / building users.

The Contractor shall has to follow the instructions of collector or his representative for non-disturbance during the period of construction.

Contractor shall be fully responsible for any mishaps / accident at the time of construction.

No extension of time limit / extra claims will be entertained if delay in construction happens because of instructions given by collector or his representative regarding non-disturbance condition.

The collector office premises / site shall be kept clean by removing the debris, waste construction

material on day to day basis.

Services:-

Services should be inspected prior to commencement of the work. Arrangements must be made before the starting date to ensure that services to the occupied part of the building are not compromised and that any supplies to the work area are sufficient to cope with demand. Consideration should be given to fitting RCD breakers on services to the occupied section that could be damaged by contractor's activities.

Where work is to be carried out on the drainages system, it must be done in such a way as to leave the drainage to the occupied section in a working condition and protected from rodent infestation.

The contractor's offer shall be deemed to include the expenses for all the above safety provisions under clause 33.

34. SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK :

For item rate contracts, the contract unit rates for different items of work shall be payment in full for completing the work to the requirements of the specifications including full compensation for all the operations detailed in the relevant sections of these specifications under "Rates" . In the absence of any directions to the contrary, the rates are to be considered as the full inclusive rate for finished work covering all labour materials, wastage, temporary work, plant , equipment, overhead charges and profit as well as the general liabilities, obligations and risks arising out of the General of Contract.

The item rates quoted by the Contractor shall unless otherwise specified, also included compliance with /supply of the following :

i) General works such as setting out, clearance of site before setting out and clearance of works after compliance.

ii) A detailed programme for the construction and completion of the work (using CPM / PERT techniques) giving, in addition to construction activities, detailed network activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products/ equipments and their installations and testing and for all activities of the employer that are likely to effect the progress of work, etc. including updating of all such activities on the basis of the decisions taken at the periodic site review meeting or as directed by the Engineers.

iii) Samples of various materials proposed to be used on the work for conducting tests thereon as required as per the provisions of the contract.

iv) Designs of mixes as per the relevant clauses of the specifications given proportions of ingredients, sources of aggregates and binder along with accompanying trial mixes as per the relevant clauses of these specifications to be submitted to the engineer for his approval before use of the works.

v) Detailed design calculations and drawings for all temporary works (such as formwork,

staging, centering, specialized constructional handling and launching equipment and the like).

vi) Detailed drawings for templates, support and end anchorage, details for prestressing cable profiles, bar bending and cutting schedules for reinforcement, material lists for fabrication of structural steel etc.

vii) Mill test reports for all mild and high tensile steel and cast steel as per relevant provisions of the specifications.

viii) Testing of various finished items and materials including bitumen, cement concrete, bearings as required under these specifications and furnishing test reports/ certificates.

ix) Inspection reports in respect of formwork, staging, reinforcement and other items of work as per the relevant specifications.

x) Any other date which may be required as per the specifications or the conditions of contract or any other annexures/schedules forming part of the contract.

xi) Any item of work which is not specifically provided in the Bill of Quantities but which is necessary for complying with the provisions of the contract ; and

xii) All temporary works, formwork and false works.

Portions of road works beyond the limits and or any other work may be got constructed by the employer(SMKC) directly through other agencies. Accordingly, other agencies employed by the employer(SMKC) may be working in the vicinity of the work being executed by the Contractor. The Contractor shall liaise with such agencies and adjust his construction programme for the completion of the work accordingly and no claim or compensation due to any reason whatsoever will be entertained on this account. The SMKC will be indemnified by the Contractor for any claims from other agencies on this account.

35. PAYMENTS :

a) RUNNING BILLS

Two payments in a month will be granted by the Engineer-in-charge if the progress is satisfactory. Contractor should submit bills to the Engineer-in-charge in appropriate forms.

b) FINAL BILL

The Contractor should submit final bill within one month after completion of the work and the same will be paid within 3 months if it is in order. Disputed item and claims if any, shall be excluded from the final bill and settled separately later on.

36. HANDING OVER OF WORK :

All the works and materials before finally taken over by **SMKC** will be the entire liability of the Contractor for guarding, maintaining and making good any damages of any magnitude. Interim payments made for such work will not alter this position. The handing over by the Contractor and

taking over by the Engineer in charge or his authorised representative will be always in writing of which copies will got to the Engineer in charge or his authorised representative and the Contractor. It is, however, understood that before taking over such work, **SMKC** will not put it into regular use as distinct from casual or incidental one, except as specifically mentioned elsewhere in this contract, or as mutually agreed to.

37. CLAIMS :

Bills for extra work or for any claim shall be paid separately apart from the interim bills for the main work. The payment of bills for the main works shall not be withheld for want of decision on the extras or claims not covered in the appendices.

Claims for extra work shall be registered within 30 days of the occurrence of the event. However, bills for these claims including supporting data/details may be submitted subsequently.

38. MAINTENANCE:-

BUILDINGS

(i) The Contractor shall maintain the finished and completed item of work as per Schedule 'B' and specification for a period 10 years for water proofing and 7 years for polyurethane and 2 years for remaining items after the completion of work without any extra cost to **SMKC** irrespective of the design, standards and specifications etc. The Contractor shall get done the civil work as per specifications and drawing and keep the building in good condition through out the 10 years water proofing and polyurethane and 2 years for remaining items. 10% (Ten percent) amount of Anti terminate work and water proofing work only shall be withheld from running account bill for 10 years towards waterproofing from the date of actual completion of work as maintenance charges of the maintaining and keeping the building in good condition. This 10% amount withheld towards shall be allowed to replaced with bank guarantee or other recognized form and intermediate state if so desired in writing. The maintenance charges shall be addition to security deposit.

(ii) On completion of the work in all respects, necessary certificate will be issued by the City Engineer and the defects liability period will be counted from the date of issue of such certificates.

(iii) Defective work is liable to be rejected at any stage. The Contractor on no account can refuse to rectify the defects merely on reasons that further work has been carried out. No extra payment shall be made for such rectification.

39. In super session to whatever has been defined in Clause 10 and 11 of B-1 Agreement form or elsewhere in the N.I.T. documents, the Contractor shall submit detailed measurements of work done

along with each Monthly bill and Final bill. The Engineer-in-charge shall effect necessary measurements , if possible. If it is proved that the measurements are mindfully and swollen incorrect / irrelevant , the Engineer- in-charge shall deduct 25% of the actual payment due, towards correction of payment.

Working Drawing :

The Contractor shall submit two sets of working drawings on the base of which the measurements as aforesaid , shall be based.

40. TECHNICAL COMPLETION REPORT :

The Contractor shall submit Technical Completion Report along with his final bill, which shall include.

i) Detailed measurements

ii) Working Drawings

iii) Details of material brought on site and consumed in the work, which shall also indicate standard consumption and deviation, if any, with reasons.

iv) Test results of all materials used in work with an abstract of total tests carried out and required as per frequency of tests as laid down in acceptance criteria.

v) Rougho-metre survey data as laid down in the relevant M.O.R.T.& H. specifications.

vi) Design Calculations / Job-Mix formula / Mix Design etc.

41. QUALITY ASSURANCE AND MAINTENANCE (FOR WORKS COSTING MORE THAN 100 LAKHS) :

1. Ensure the specified quality of work which will also include necessary surveys, temporary works, etc. the contractor shall prepare a quality assurance plan and get the same approved from the Engineer-in-charge within one month form the date of work order. For this , the Contractor shall submit an organization chart of his technical personnel to be deployed on the work along with their qualifications, job descriptions defining the functions of reporting, supervising, inspecting and approving. The Contractor shall also submit a list of tools, equipments and the machinery and instrumentation which he proposes to use for the construction and for testing in the field and/or in the laboratory and monitoring. The Contractor shall modify/supplement the organization chart and the list of machinery, equipment , etc. as per the directions of the City Engineer and shall deploy the personnel and equipment on the field as per the approved chart and list respectively. The Contractor shall submit written method statements detailing his exact proposals of execution of the work in accordance with the specifications. He will have to get these approved from the Engineer-in-charge.

The quality of the work shall be properly documented through certificate, records, checklists and logbooks of results etc. Such records shall be complied from the beginning of the work and be continuously updated supplemented and this will be the responsibility of the Contractor. The forms should be got approved from the Executive Engineer-in-charge.

41.1.1 Contractor shall prepare a Quality Assurance Plan (QAP) for this work. The QAP shall include the following.

i) Bar chart and CPM/ PERT
ii) Personnel deployment with their responsibilities.
i) Schedule of weekly / Monthly Meeting at site office involving all functions
ii) Use of Computer for Project Management.
iii) Monthly Progress Reports.
iv) Quality Procedures.
vii) Calibration of instruments used on site
v) Material sources and testing frequency and reports.
vi) Safety measures.
vii) Reference to appropriate approved drawings.
viii) Defect Liability : how the contractor going to deal with this.
ix) Reference to specification, codes etc.

The contractor shall give the above plan to Engineer-in-charge within 15 days from the date of work order. The Engineer –in-charge will approve the plan within about a week's time. The contractor shall adhere to the procedure stipulated in the tender document and quality assurance plan prepared by him.

41.1.2 The contractor shall prepare detailed completion drawing after completion of the work. He shall also prepare and submit a maintenance manual giving procedure for maintenance, including inspection, tools and equipment to be used, means of accessibility for all parts of the structure. He shall also include in the manual, the specification for maintenance work that would be appropriate for his design and technique of construction. This manual shall be submitted within the contract period.

41.1.3 The contractor shall make comprehensive inspection of the structure every six months after completion of the work till the end of defect liability period. The defects noticed if any shall be rectified at his own cost under the supervision of Engineer-in- charge.

41.2 Where the work is to be done on lumpsum basis on Contractor's design, the Contractor shall also prepare and submit a maintenance manual giving procedure for maintenance, with the periodicity of

maintenance works including inspections, tools and equipment to be used, means of accessibility for all parts of the structure. He shall also include in the manual the specifications for maintenance work that would be appropriate for his design and technique of construction. This manual shall be submitted within the contract period.

42. PHOTOGRAPHS :

So as to observe the progress of work at different stage of execution of works, the Contractor shall take out **coloured photographs at 3 stages i.e. 1) Before execution, 2) During execution, and 3) After completion of work.** Contractor shall take out at least 15 photographs of different location of each sub works at each stage. The photographs will be of post card size and the same shall be submitted along with the running bill in duplicate.

No extra cost shall be paid to the Contractor on this account.

Additional Condition

While Building work is in Progress contractor shall plant at least 100 Numbers of trees by the site in Building premises as directed by Engineer in charge and shall have maintain them by watering etc. till the completion of work.

43. Additional Conditions for Green Building Norms :

The contractor shall follow the following guidelines laid here under so that the GRIHA rating is not suffered on account of acts and action, omission, negligence of the contractor or his team.

A) Preserve and protect landscape during construction & Soil conservation till post-construction :

1. The contractor shall preserve the topsoil and existing vegetation. The contractor shall by proper planning of timing of construction activity shall be minimize site disturbance such as soil pollution due to spilling of the construction material and its mixing rain water. The contractor shall use staging and spill prevention and control plan to restrict the spilling of the contaminated material on site. The contractor shall also control erosion and sedimentation.
2. The contractor shall restrict the construction to pre-planned/pre-designated areas with approval from Engineer-in-charge. The contractor shall submit site plan showing staging and spill prevention measures, erosion and sedimentation control measures along with photographic records to show that other areas have not been disrupted during construction and to show erosion and sedimentation control measures adopted. The contractor shall submit site plan showing demarcate areas on site from which top soil has to be gathered, designate area where it will be stored, measures adopted for top soil preservation.

3. The contractor shall immediately after award of work shall excavate the topsoil for a depth of 200 mm and re-store the same at pre-designated space (in consultation with Engineer-in-charge) and also take measures (stockpiling, mulching) that this topsoil is not disturbed till the same is utilized or the work is completed. The payment for excavation and preservation of topsoil shall be paid in the respective items of the agreement.

4. The contractor shall Vegetate/ mulch areas where vehicles do not ply. The contractor shall apply gravel / landscaping rock to the areas where mulching / paving is impractical. The contractor shall indentify roads on side that would be used for vehicular traffic. The contractor shall upgrade vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape, and mineral types that make up the surface and base. Add surface gravel to reduce source of dust emission and Limit amount of fine particles (smaller than 0.075 mm.) to 10% - 20%.

5. The contractor shall limit vehicular speed on site to 10 kilometer per Hour.

6. The contractor shall reduce air pollution by wetting the surface by spraying water
   a. On any dusty materials before transferring, loading , and unloading.
   b. Areas where demolition work is being carried out.
   c. Any unpaved main-haul road, and
   d. Areas where excavation or earth-moving activities are to be carried out and no extra claim shall be entertained for this.

7. The contractor shall minimize the disruption of the natural ecosystem.

B) Provide minimum level of sanitation / safety facilities for construction workers :

8. The contractor shall strictly follow the provisions contained in this document 'Additional General Conditions 29-30' for providing basic amenities to the workers. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and efficient provide clean drinking water and latrines and urinals as per applicable standard.

9. The contractor shall comply with the National Building Code 2005 norms on construction safety for ensuring safety during construction. The National Building Code 2005 have provisions for clean and hygienic accommodation. Toilet facilities, purified drinking water, general store, a subsidized canteen, medical facilities, day care centre and on site safety equipments, etc.

10. The contractor shall adopt additional best practices and prescribed norms as in NBC 2005.

11. The contractor shall submit sufficient documentary & photographic evidence in compliance to above

three paras.

C) Reduce air pollution during construction :

12. The contractor shall ensure proper screening, covering stockpiles, covering brick and loads of dusty materials, wheel-washing facility and water spraying facility to reduce air pollution during construction. The site roads should be regularly sprayed with water and wheels of all vehicles should be washed to prevent air.

13. The contractor shall install dust screen (at least 3 M high) around the disturbed area to prevent air pollution and spillage to undisturbed site area.

14. The contractor shall undertake the responsibility to prevent air pollution (dust & smoke), ensure availability of adequate water supply for dust suppression, devise methodology to minimize impact of dust on the surrounding environment and ensure that these methods are implemented. The contractor shall provide documentary evidence regarding the method of working, plant equipment and air-pollution-control system being adopted on the site.

15. The contractor shall efficiently use the natural resources (Water, energy & materials) and takes measures to conserve the natural resources.

D) Efficient water use during construction :

16. The contractor shall prevent wastage of water during curing. The contractor shall also make efforts to minimize use of potable water during construction by proper & efficient construction water management on site.

17. The contractor shall construct Sedimentation tank for collecting of excess curing water at his own cost.

E) Utilization of fly ash in building structure :

18. The PPC cement to be used in the construction shall be as per condition stipulated in the Additional conditions mentioned in tender document under heading “Technical Specifications”. The PPC cement shall have fly ash content as per prevailing IS code with prior approval to this from Engineer-in-charge and duly supported by test results from the supplier / manufacturer.

E) Reduction in waste during construction, Efficient waste segregation, Storage and disposal of wastes & Resource recovery form waste :

19. The contractor shall ensure maximum resource recovery and safe disposal of wastes generated during construction and reduce the burden on landfill. The contractor shall segregate inert, chemical and hazardous wastes separately. The contractor shall make all efforts to recycle / safe disposal of segregated wastes (Oil, paint, batteries & asbestos). The contractor shall dispose-off the inert waste at landfill sites duly approved by local body/Engineer-in-charge and no extra claim shall be entertained for this.

20. The contractor shall keep record off all waste generated during construction activity and storage facility for segregated inert and hazardous waste before recycling and disposal.

21. The contractor shall use multi-colored bins for waste segregation at source at his own cost.

22. The contractor shall (in consultation with Engineer-in-charge) allocate separate space for the collected waste before transferring to the recycling / disposal stations.

23. The contractor shall make arrangements for recycling of waste through local (junk) dealers. The contractor shall also keep record of such transactions and provide the same to the department as and when required.

24. The contractor shall make all efforts for achieving zero waste generation by adopting appropriate resource recovery measures.

F) Use low –VOC paints/adhesives/sealants :

25. The contractor shall use zero/low-Volatile Organic Compound paints duly approved by Engineer-in-charge. The contractor shall use water-based acrylic paints duly approved by Engineer-in-charge and shall not use solvent based oil paints. The contractor shall also submit certificates & vouchers from suppliers/manufactures that the paint used are zero/low-volatile organic compound paints.

The prescribed volatile organic compound limits for paints to be used are given in the table below :-

Paint applications	VOV limits (g of VOC per litre)	
Interior coatings	Flat	<50
	Non-Flat	<150
Exterior coatings	Flat	<200
	Non-Flat	<100
Anti corrosive	Glass/Semi gloss/flat	<250

26. The contractor shall use water based low-volatile organic compound sealants (acrylics, Silicones and siliconized acrylics) & adhesives (acrylics or phenolic resins) duly approved by Engineer-in-charge. The solvent oil based/low in oil solvent content sealants (urethanes and butyls) & adhesives shall not be used in the construction. The contractor shall also submit certificates & vouchers from suppliers/manufactures that the sealants/adhesives used are low-Volatile Organic Compound sealants/adhesives.

27. The contractor shall not use wood in construction. The composite wood products shall be free from urea-formaldehyde resins. The flush door proposed to be used as per the item of this tender document shall confirm to PWD Specification with upto date correction slips. The contractor shall also submit certificates & vouchers from suppliers/manufacturers that the composite wood products are free from urea-formaldehyde resins.

G) Minimize ozone depleting substances :

28. The contractor shall employ 100% zero ODP (ozone depletion potential), HCFC (hydrochloric-fluorocarbon) free and CFC (chloro-fluorocarbon) free insulation such as HCFC free rigid form insulation, mineral fibre cellulose insulation, glass fiber, wood fiber board, cork wool, expanded (bead) polystyrene, recycled newspaper and jute & cotton duly approved by Engineer-in-charge. The contractor shall not use materials which are not inherently zero-ODP such as polyurethane foams and polyisocyanurates. The contractor shall also submit certificates & vouchers from suppliers/manufacturers that the insulation used are ODP/CFC/HCFC free.

H) Ensure Water quality :

29. The contractor shall ensure that water used in construction meets the water quality norms as prescribed in the Indian Standards for various applications. The contractor shall get the water tested with regard to its suitability of use in the works and get written approval from the Engineer-in-charge before he proceeds with the use of same of execution of works. If the water is not suitable, the contractor shall arrange Municipal water or from any other sources at his own cost and nothing extra shall be paid to the contractor on this account. The water shall be got tested at frequency specified in latest PWD specifications/BIS code.

30. Supervising control and data acquisition (SCADA) for .....

30.1 Concrete Works-

I) Concrete Reversible Drum Type

Fully Automatic Micro processor based Logical Control (PLC) with SCADA Enabled Reversible Drum Type Concrete Mixer of minimum cubic metre/concrete batch mix plant (Pan mixer) of minimum 18-

20 cubic meter per hour capacity of any standard company.

Reversible Drum Type - It Shall have minimum following FEATURES (Technical Specification)

✱Fully Automatic; no skilled operator shall be required

✱Zero vibration if Diesel oprated.

✱Four Bin Digital Weighing System

✱Automised Digital Water Feeding System

✱ Automised Digital Admixture Feeding System

✱SCADA enabled Batch System

✱Centralized Lubrication System

✱Machine Output / Hour Minimim – 12 to 15 Cum / Hr./18-20 Cubic meter/hour

✱Water Tank Capacity Minimim 150 Liter.

✱Load Cell Based Weighing System with Digital Display

II) Curing System

Contractor shall install pressure control water curing system using necessary pumps, UPVC pipe network, water/flow meter linked with SCADA, etc complete.

III) Transportation- Transit Mixer / Pumps

Transit mixers and / or concrete pumps of desired number and capacity with SACADA

31.1 Machinery & Testing Equipments-

a) CTM

The contractor shall install Compression Testing Machine (CTM) for the testing cement mortar, concrete at the site, linked with "SCADA" etc. complete..

31.2 GIS MAP

Displaying locations of Hot mix Plants, Tippers used for hot mix material transportation, Roller/ compactor and Sprayer on GIS map.

Communicate the Data which is beyond the set parameters by SMS and e-mail to the representative of Engineer In charge for all 44.1 to 44.4 above

31.3 <u>THE OFFER OF THE CONTRACTOR SHALL INCLUDE:</u>

(1) The cost of procuring, establishing, running, operating & maintaining SCADA including all Censors, Vehicle Tracking System (VTS) and any other instrumentation, automation required to acquire the desired data, mentioned at **44.1 to 44.4** above.

2) Web connectivity to all locations where data is being acquired, transmitted, processed, stored and

retrieved with minimum speed of 1 MPBS and 100 % availability. The contactor shall provide the web application in such a manner that it shall first update the above data in real time.

3) Web-based application including Computer Software, Hardware etc. to transmit, process, store and retrieve the data in the forms and formats as prescribed by the Engineer In charge.

4) Arrangement for security of data, Disaster recovery arrangements shall be as per IT. Industry practice, during the construction period and upto defect liability period.(DLP). Handing over the data on the Web Server after DLP in Electronic form as instructed by Engineer In charge.

5) Calibration of all SCADA related attachments /accessories as per the specification:- Web based application to monitor the schedule of Calibration of all SCADA related attachment/accessories. The invalidity of calibration shall lead to non-acceptance of work or measurement and the Contractor shall not be paid for such non-accepted work or measurements

6) Submission of printed and authenticated reports to the Engineer Incharge as and when required.

7) Point (1) to (6) above shall be arranged and maintained during contract period and defect liability period.

8) Cost includes rectification, fine tuning, corrections, additions & alterations to the system to the satisfaction of Engineer Incharge.

9) All data generated as per this special condition of contract shall be the property of PWD.

31.4 The Contractor shall make all necessary arrangement required under Clause 30**.1 to 30.4** above (Supervising control and data acquisition for Bituminous / WBM / concrete works / all cement works / masonry / plaster / Testing Equipments items) well in advance before starting of the related items of work. All necessary arrangements so made shall be offered for inspection to Engineer In charge one month prior to the start of the related items of work. Changes if any, after his inspection suggested by the Engineer In charge shall be carried out at no extra cost and within the period of Three days. A fresh request for inspection, of Engineer In charge after such rectification's shall be requested by the Contractor and final approval to the SCADA arrangements as specified in Clause-19 shall be obtained.

GENERAL SPECIFICATIONS FOR WATERPROOFING

Rates for respective items shall include for the additional specifications :-

1. The work of water proofing described in the following items shall be carried out by the contractor only through a renowned specialist waterproofing agency using cement waterproofing compounds, as approved in writing by the Executive Engineer.

2. The contractor shall give before actual execution, detailed specifications for each item of work of waterproofing to be executed according to the specifications of specialist agency he proposes to employ, for approval. The work shall not be started unless approval in writing is given by the Engineer-in-charge to the said specification.

3. The contractor shall give a guarantee bond on requisite stamp paper for a minimum period of 10 (Ten) years for all the items of waterproofing done. During the guarantee period the contractor shall entirely be responsible in rectify any defect at his own cost to maintain the work in waterproof condition. The waterproofing contractor shall also have to make good all the surroundings disturbed by him during the rectification work at his own cost. The form of written guarantee shall be on a legal stamped agreement acceptable to the Government. The Guarantee shall be given within one month from the date of completion of waterproofing treatment but any delay in furnishing the guarantee shall not relieve the contractor from the implications of this clause.

4. 10% (ten percent) of the cost of the waterproofing work executed shall be retained as Retention Money" for a period of ten years covering the guarantee and the same shall be released only after satisfactory performance of the treatment during guarantee period of 10 years.

5. The waterproofing agency shall provide and install at its own cost the following for its own use and remove the same after completion of the work :
   i) Two pumps electrical / diesel operated for watering and curing at any level in the building. Curing for all items shall be carried out for a minimum period of 14 days.
   ii) Temporary Mild Steel water storage tanks.
   iii) Temporary galvanized iron piping and fittings for water line.
   iv) Flexible hose lengths.
   v) Cement godown, site office.

6. Injections to reinforced cement concrete slab, wherever required have to be undertaken by the contractor free of cost.

7. Before starting the waterproofing work the surface receiving the treatment shall be cleaned properly.

8. The item of waterproofing as given in the Schedule 'B' applies for work in any position and on any floor and at any height. The lift of materials shall not form any criteria for extra payment.

9. For the reference of contractor, guideline specifications for waterproofing are attached herein with the General Specifications.

Water Supply And Plumbing

Contractor shall get the Internal Water Supply and Plumbing design repaired from certified Consultant.

These design/drawing shall be got approved from Engineer-in-charge before execution of work.

GENERAL GUIDELINES FOR WATERPROOFING WORK FOR REFERENCE OF CONTRACTOR

(NOTE :- The contractor is required to give detailed specifications for each item of waterproof work).

1. Proof slab and Terrace :

Providing average 112 mm thick cement based waterproofing treatment with brick bat coba beddign by keeping the treatment minimum 75mm thick at the rain water pipe point and keeping the gradient not flatter than 1 in 100.

a) Cleaning the surface to the requirements.

b) Giving a cost of wash mixed with cement.

c) Providing 12mm thick cement mortar bed with admixture of waterproofing compound to form a bed for brick bats. Special care shall be taken at the junction of parapet and terrace slab to ensure gaps, if any, are properly sealed.

d) Placing brick bats of of varying sizes (average 80mm tick) to a proper slope and grouting their joints with chemical process in cement mortar with 2% with waterproofing compound.

e) Providing all around the terrace large waterproof wattas (roundings) upto a height of 30 cm. in P.C.C. or as directed above the furnished level of waterproof treatment.

f) Finishing and curing for 14 days.

g) Carrying out the test. Payment for the item shall be released only after results of pond test are satisfactory.

2. Toilets :

a) Cleaning the surface to the Department's requirements.

b) Giving a coat of wash mixed with cement.

c) Providing 25mm thick waterproof treatment to the bottom of toilet floors.

d) Providing 20mm to 25mm thick cement mortar waterproof treatment to the walls of toilets upto the height of 1.00 metre above the finished floor level.

e) Providing waterproof wattas all around the toilets.

f) Grouting the mouths of inlets and outlets.

g) Filling sunk portion with brick bats including water proof mortar and the top surface left rough to from a key for tiles.

OVERHEAD TANK :

The work under some items in Schedule 'B' of the tender pertains construction of underground / overhead water tank. After completion of the work, water tank as a whole shall be tested for water tightness and leakages if any shall be rectified forthwith without any extra cost to the Department.

GUARANTEE BOND FOR WATERPROOFING AND POLYURETHANE

(On Stamp Paper worth Rs. 100/-)

NAME OF WORK : **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli**

NAME OF AGENCY:

Agreement No.

The Contractor thereby declared that the waterproofing work carried out under this contract shall be of the best quality and workmanship and shall be strictly in accordance with the specifications and particulars contained / mentioned in the clause hereof and the contractor hereby guarantee that the said work would continue to conform to the description and quality aforesaid for a period of ten years from the date of handing over the said work to the Department and notwithstanding the fact that the Department may have inspected and or approved the said work. If during the aforesaid period of ten years, the said work be discovered not to conform to the description and quality aforesaid or have deteriorated (and the decision of the Engineer-in-charge in that behalf will be final and conclusive) the Department will be entitled to reject the said work or such portion thereof as may be discovered not to conform to the said description and quality. On such rejection, the work will be at the Contractor's risk and all the provisions herein contained relating to rejection of work etc. shall apply. The contractor shall, if so called upon have to make good the work etc. or such portion thereof, as is rejected by the Engineer-in-charge, otherwise the contractor shall pay to the Department, such damages, as may arise by the reason of the breach of the condition herein contained. Nothing herein contained shall prejudice any other right of the Department in that behalf under this contract or otherwise.

Date :

Place :

Contractor

"Annexure- I"

Additional Specifications to be included in General Conditions of Contract for use of VSI Crushed Sand / Artificial Sand/ Fine Aggregates.

1. VSI Crushed sand / Artificially manufactured sand / fine aggregates hereinafter referred to as "Crushed Sand" shall be as defined under Cl.3.1.2 of IS 383-2016.
2. The properties of "Crushed Sand" shall confirm to the provisions of IS 383:2016.
3. The "Crushed Sand" shall be free of dust and other Deleterious material.
4. The "Crushed Sand" shall be manufactured using "Automatic Vertical Shaft Impactor "type Crusher only.
5. The quantity of Microfines (Particles below 75 microns) in "Crushed Sand" shall not be more than 7 %.
6. The Contractor shall intimate the Engineer In-Charge regarding the source of supply of "crushed sand". The source of supply of "crushed sand" shall be got approved by the Executive Engineer (Engineer-In-charge) prior to the start of work.
7. Each Load of crushed sand whenever brought on site shall be tested for "Fineness modulus". Fineness modulus shall be within permissible limits, If it doesn't fall within acceptable limits, it shall be rejected.
8. The Test of Compressive strength of concrete / Mortar using "Crushed sand" shall be carried out in presence of Department's Engineer as given below...
   a) 100 % Cube testing in presence of Junior /Asst./Sectional Engineer.
   b) 25 % Cube testing in the presence of sub divisional Engineer
   c) 5 % Cube testing in the presence of Executive Engineer. (Engineer-In-charge)
9. The flakiness index and elongation index tests shall be within permissible limits.
10. The Concrete mix design for each grade of concrete using "Crushed sand" shall be carried out only in Government Quality Control laboratory and the same Mix Design shall be adopted.
11. As far as possible freshly produced "Crushed sand" shall be used. Stored "Crushed sand " shall not be used.
12. For Plastering purpose, if the use of crushed sand is proposed, it shall be used with

addition of super plasticisers at the rate of 100ml/bag of cement without any extra cost to Government .

13. The following tests shall be carried out for the use of "Crushed sand".

    a) Sieve analysis
    b) Specific gravity
    c) Water absorption
    d) Bulk density
    e) Alkali aggregate reaction
    f) Soundness
    g) Deleterious Material
    h) Organic impurities
    i) Micro fines Content
    j) Test for silt and clay.
    k) Fineness Modulus test.

14. Necessary Bond regarding the use of "Crushed sand" shall be submitted by the Contractor clearly stating that, if any defects are observed during execution and in defect liability period, the same shall be rectified at his own risk and cost.

15. Grading zone I and II mentioned under Clause 6.3 table 9 of fine aggregates in IS 383:2016 shall only be used for concreting.

16. Reversible drum type / Batch mix plant(pan type) concrete mixer shall be used for concrete.

15. Use of Concrete from Ready Mix Plant (RMC) shall be strictly Prohibited.

16. "Crushed sand" shall not be used for prestressed concrete works.

Government of Maharashtra, India
Public Works Department

मुख्य अभियंता
सा.बां. प्रादेशिक विभाग, मध्यवर्ती इमारत,पुणे यांचे कार्यालय
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जा.क्र. मुअपु/का-२/ इमारती-२ / ५९४० /२०१७ दिनांक - १७.१०.२०१७

परिपत्रक

विषय :- शासकीय बांधकामांमध्ये कृत्रिम वाळू (Crushed sand /Artificial Sand) चा वापर करणेबाबत.

संदर्भ :- १.शासन परिपत्रक क्रमांक - संकिर्ण - २००९ / प्र. क्र. १० / रस्ते-१, दि. २३/०७/२००९
२. या कार्यालयाचे परिपत्रक जा.क्र.का-२/नियोजन/१५०४/२०१३ . दि.८/३/२०१३

- 8 NOV 2017

कार्यकारी अभियंता सा. बां. (प्र.) विभाग, संगमनेर	
आवक क्र. :	9982
दिनांक :	- 8 NOV 2017
कार्य. अभियंता :	
उप कार्य. अभियंता :	
विभागीय लेखापाल :	
प्रथम लिपिक :	
शाखा :	

सार्वजनिक बांधकाम विभागामार्फत मोठ्या प्रमाणात शासकीय इमारतींची बांधकामे तसेच रस्ते व पूलांची बांधकामे हाती घेण्यात येतात. सदर बांधकामातील काँक्रीटच्या बाबींचे परिमाणेही खुप जास्त असतात. त्यामुळे काँक्रीटच्या घटक भागाचे म्हणजेच या प्रकरणी मुख्यत्वे वाळूच्या मागणी मध्ये प्रचंड प्रमाणात वाढ झाली आहे. बांधकामांसाठी लागणाऱ्या वाळूची मागणी ही उपलब्ध नैसर्गिक वाळूच्या व्यस्त प्रमाणात वाढते आहे. परिणामी वाळूचे बेकायदा उत्खनन वाढून नदी व नाल्यांच्या नैसर्गिक प्रवाहात बाधा पाहोचविण्याचे प्रकार वाढले आहेत. अशा परिस्थितीत नैसर्गिक वाळूचा बांधकामातील वापर कमी करून त्याऐवजी कृत्रिम वाळूचा वापर वाढविणे क्रमप्राप्त असून काळाची गरज आहे.

शासनाच्या दि. २३/०७/२००९ रोजीच्या परिपत्रकान्वये कृत्रिम वाळूच्या वापराच्या अनुषंगाने मार्गदर्शक सुचना निर्गमित केल्या आहेत. त्यास अनुसरून या कार्यालयाच्या दि.८/३/२०१३ रोजीच्या परिपत्रकान्वये क्षेत्रिय कार्यालयांसाठी मार्गदर्शक सुचना निर्गमित केल्या आहेत.

तथापि, आता क्षेत्रिय स्तरावर उपलब्ध यंत्रसामुग्री, त्या अनुषंगाने उपलब्ध होऊ शकणारी कृत्रिम वाळू व त्याची गुणवत्ता विषयक मानके तसेच कृत्रिम वाळूच्या वापरासंदर्भात दक्षता व गुणनियंत्रण मंडळाकडून प्राप्त झालेले अभिप्राय इत्यादींचा विचार करता, नव्याने प्रस्तावित शासकीय बांधकामांमध्ये कृत्रिम वाळूच्या वापरा संदर्भात नव्याने मार्गदर्शक सूचना निर्गमित करणे आवश्यक झाले आहे.

उपरोक्त अनुषंगाने शासकीय बांधकामांमध्ये नैसर्गिक वाळू ऐवजी १०० % कृत्रिम वाळू Crushed sand / Artificial Sand) वापरण्यास या परिपत्रकान्वये परवानगी देण्यात येत असून, त्याप्रमाणे कृत्रिम वाळू वापरताना खालील नमूद अटींचे पालन होणे अनिवार्य आहे.

१. बांधकामासाठी वापरात येणारी कृत्रिम वाळू ही IS ३८३ : २०१६ मधील खंड ३.१.२ मध्ये नमूद कृत्रिम वाळूच्या व्याख्येनुसार Automatic Vertical Shaft Impactor या मशिन मधुन चांगल्या प्रतिचा खाणीचा दगड भरडुन उत्पादित कलेली असावी.

२. संबंधीत क्षेत्रिय अधिकारी यांनी प्रचलित IS Code ३८३ - २०१६ मधील तक्ता क्र. ९ मध्ये नमूद केले प्रमाणे fine aggregate चे स्विकृती बाबतच्या ग्रेडींग झोन नुसार वर्गीकरण करून व तशा पध्दतीच्या तपासण्या प्रत्यक्ष बांधकामाच्या जागेवर घेतल्यानंतरच कृत्रिम वाळु वापरण्यास परवानगी देण्यात यावी.

३. बांधकाम सुरु करण्यापुर्वी कृत्रिम वाळुच्या स्त्रोतास (Source of Crushed sand/Artificial sand) कार्यकारी अभियंता यांनी लिखीत स्वरूपात मान्यता देणे बंधनकारक राहील.

४. कृत्रिम वाळुचा वापर करणेपूर्वी अन्य आवश्यक चाचण्यांसह काँक्रीटकरिता चे Mix Design शासकीय प्रयोगशाळेतूनच करून घेणे अनिवार्य राहील.

५. Prestressed Concrete च्या बाबींमध्ये कृत्रिम वाळूचा वापर करण्यात येऊ नये.

६. बांधकामाच्या काँक्रीटच्या बाबीं करिता Ready Mix Concrete चा वापर टाळणे अनिवार्य आहे.

७. कृत्रिम वाळूचा वापर बांधकामामध्ये करताना कृत्रिम वाळूच्या वापरा बाबतचे विनिर्देश सोबत Annexure-I स्वतंत्रपणे या परिपत्रकासोबत जोडण्यात येत आहेत. त्यानुसार त्या कामाच्या निविदेमध्ये Additional General Specification चा अंतर्भाव करण्यात यावा.

८. सद्यस्थितीत प्रगतीपथावर असलेल्या बांधकामांमध्ये कृत्रिम वाळूचा वापर करणे अनिवार्य झाल्यास या बाबत तांत्रिक मान्यता प्रदान करणा-या सक्षम प्राधिकारी यांना अवगत करण्यात यावी.

९. कृत्रिम वाळूचा वापराबाबत वरील नमूद १ ते ६ अटींचे तंतोतंत पालन करण्यात यावे.तसेच कृत्रिम वाळू वापरल्यास आरसीसी कामास विहीत प्रमाणापेक्षा जास्त सिमेंट लागल्यास त्याकरिता संबंधीत ठेकेदारास अतिरिक्त मोबदला देण्यात येणार नाही.

१०. नैसर्गिक वाळू ऐवजी कृत्रिम वाळूचा वापर ज्या बाबींसाठी प्रस्तावित करण्यात येईल अशा बाबींसाठीच्या कमी दरांबाबत अंदाजपत्रकानुसार दोन्ही साहित्यांच्या बेसिक दर व साहित्यांचे वाहतुकीचे अंतर विचारात घेऊन संबंधीत क्षेत्रिय अधिकारी यांनी उचित कार्यवाही करावी. तसेच कामावर होणा-या एकंदर खर्च विहित मर्यादेपेक्षा जास्त होणार नाही याची दक्षता संबंधीत क्षेत्रिय अधिकारी यांनी घेण्यात यावी.

सहपत्र- Annexure I

स्थळ प्रतीवर मा.मु.अ.यांची स्वाक्षरी असे.

मुख्य अभियंता
सा.बां.प्रादेशिक विभाग
पुणे करिता

प्रत:- अधीक्षक अभियंता,दक्षता व गुण नियंत्रण मंडळ ,पुणे, माहिती साठी पुढील उचित कार्यवाही साठी.

प्रत:- अधीक्षक अभियंता,सा.बां.मंडळ, पुणे, सातारा, कोल्हापूर , सोलापूर यांना माहिती साठी पुढील उचित कार्यवाही साठी.

प्रत:- कार्यकारी अभियंता,सा.बां.विभाग पुणे,सा.बां.पूर्व/उत्तर/दक्षिण/इमारती विभाग,पुणे
कार्यकारी अभियंता,सा.बां.विभाग सातारा/सा.बां.पश्चिम विभाग,सातारा
कार्यकारी अभियंता, सा.बां.विभाग ,कोल्हापूर /सा.बां.विभाग (दक्षिण) विभाग ,कोल्हापूर/ विशेष प्रकल्प (सा.बां) विभाग, कोल्हापूर / सा.बां.विभाग विभाग ,मिरज/ सा.बां.विभाग (पश्चिम) विभाग , सांगली, कार्यकारी अभियंता, सा.बां.विभाग क्र.१ /क्र.२,सोलापूर/सा.बां.विभाग,अकलूज/ सा.बां.विभाग,पंढरपूर यांना माहिती साठी व आवश्यक कार्यवही साठी रवाना.

प्रत:- सहा.मुख्य अभियंता (रस्ते/इमारती) यांना माहिती साठी व आवश्यक कार्यवाहीसाठी.

प्रत:- उप अभियंता रस्ते /नाबार्ड/इमारती-१ /इमारती-२ यांना माहितीसाठी व उचित कार्यवाहीसाठी.

INTEGRITY PACT

Between

SANGLI MIRAJ AND KUPWAD CITY MUMCIPAL CORPORATION

having its Office : Opposite City Police Station, Rajwada Chouk. Sangli, Maharashtra.

hereinafter referred to as

"SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION"

and

[Insert the name of the Sole Bidder/ Lead partner of Joint Venture]

having its Registered Office at _

(Insert full Address)

---

and

[Insert the name of the Partner(s) of Joint Venture, as applicable]

having its Registered Office at _

(Insert full Address)

---

hereinafter referred to as

"The Bidder / Contractor"

Preamble

SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION intends to award, under laid down organizational procedures, contract(s) for [Kupwad Underground Drainage Scheme] SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION values full compliance with all relevant laws and regulations, and the principles economical use of resources and of fairness and transparency in its relations with its Bidders/ Contractors.

In order to achieve these goals, SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION and the above named Bidder / Contractor enter into this agreement called '**Integrity Pact**' which will form a part of the bid.

It is hereby agreed by and between the parties as under:-

Section I -Commitments of the SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION

(१) SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION commits itself to take all measures necessary to prevent corruption and to observe the following principle:-

a) No employee of the SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION , personally or through family members, will in connection with the tender , or the execution of the contract, demand, take a promise for or accept, for him/ hereself or third person, any material or other benefit Which he/she is not legally entitled to.

b) SANGLI MIRAJ AND KUPWAD CITY MUMCIPAL CORPORATION will, during the tender process treat all Bidder(s) with equity and fairness. SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an ad-

vantage in relation to the tender process or the contract execution.

c) SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION will exclude from evaluation of Bids it such employee(s) who has any personnel interest in the Companies / Agencies participating in the Bidding / Tendering process.

(२) If Principle Secretary, Maharashtra Government obtains information on the conduct of any employee of SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION which is a criminal offence under the relevant Anti-Corruption Laws of India,or if there be a substantive suspicion in this regard, he will inform its Chief Vigilance Officer and in addition can initiate disciplinary actions under its Rules.

Section II - Commitments of the Bidder/ Contractor

(1) The Bidder/ Contractor commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

a) The Bidder/ Contractor will not, directly or through any other person or firm, offer, promise or give to SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION, or to and of SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION s employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange an advantage during the tender process or during the execution of the contract.

b) The Bidder/ Contractor will not enter into any illegal agreement or understanding, whether formal or informal with other Bidders/ Contractors. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission or bids or actions to restrict competitiveness or to introduce cartelization in the bidding process.

c) The Bidder/ Contractor will not commit any offence under the relevant Anti-corruption Laws of India; further the Bidder/ Contractor will not use for illegitimate purposes or for purpose of restrictive completion or personal gain, or pass on to others, any infor-

mation or document provided by SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

d) The Bidder/ Contractor of foreign origin shall disclose the name and address of the Agents/ representatives in India. If any, involved directly or indirectly in the Bidding. Similarly the Bidder/ Contractor of Indian Nationality shall furnish the name and address of the foreign principle, if any, involved directly or indirectly in the Bidding.

e) The Bidder/ Contractor will, when presenting his bid, disclose any and all payments he has made, or committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and / or with the execution of the contract

f) The Bidder/ Contractor will not misrepresent facts or furnish false/ forged documents/ informations in order to influence the bidding process or the execution of the contract to the detriment of SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION.

(2) The Bidder/ Contractor will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section III – Disqualification from tender process and exclusion from future contracts

(१) If the Bidder/ Contractor before award, has committed a serious transgression through a violation of Section II or in any other from such as to put his reliability or credibility as Bidder into question, SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION may disqualify the Bidder from the tender process or terminate the contract, if already signed, for such reason.

(२) If the Bidder/Contractor has committed a transgression through a violation of Section II such as to put his reliability or credibility into question, the SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION may after following due procedures also exclude the Bidder/ Contractor from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of the transgression. The severity will be de-

termined by the circumstances of the case particularly the number of transgressions, the position of the transgressors within the company hierarchy or the Bidder/Contractor and the amount of the damage. The exclusion will be imposed for a minimum of ९२ months and maximum of ३ year.

(३) If the Bidder/Contractor can prove that he has restored/recouped the damage caused by him and has installed a suitable corruption prevention system, SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION may revoke the exclusion prematurely.

Section IV – Liability for violation of Integrity Pact

(१) If SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION has disqualified the Bidder from the tender process prior to the award according to Section III, SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION may forfeit the Bid Guarantee under the Bid.

(२) If SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION has terminated the Contract under Section III, SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION may forfeit the Contract Performance Guarantee of this contract besides resorting to other remedies under the contract.

Section V – Previous Transgression

(१) The Bidder shall declare in his Bid that no previous transgression occurred in the last ३ years with any other Public Sector Undertaking or Government Department that could justify his exclusion from the lender process.

(२) If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section VI – Equal treatment of all Bidders/ Contractors

(१) The SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION will enter SANGLI MIRAJ

AND KUPWAD CITY MUNCIPAL CORPORATION CORPORATION will disqualify from the lender process any Bidders who does not sign this Pact violate its provisions.

Section VII – Criminal charges against violating Bidder/ Contractor

If the SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION obtains knowledge of conduct of a Bidder or Contractor or his subcontractor or of an employee or a representative or an associate of a Bidder or contractor or his Subcontractor which constitutes corruption, or if SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION has substantive suspicion in this regard, the SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION will inform the Chief Vigilance Officer (CVO).

Section VIII – Independent External Monitor /Monitors

1) **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** has appointed a panel of Independent External Monitor (IEMs) for this Pact. with the approval of Central Vigilance Commission (CVC), Government of India, out of which one of the IEMs has been indicated in the NIT/IFB.

2) The IEM is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement. He has right of access to all project documentation. The IEM may examine nay complaint received by him and submit a report to Principle Secretary , Maharashtra Government, at the earliest. He may also submit a report directly to the CVO and the CVC, in case of suspicion of serious irregularities attracting the provisions of the PC Act. However, for ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process, the matter shall be referred to the full panel of IEMs, who would examine the records, conduct the investigations and submit report to Principle Secretary, Maharashtra Government, giving joint findings.

3) The IEM is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the Principle Secretary, Maharashtra Government.

4) The Bidder(s)/Contractor(s) accepts that the IEM has the right to access without restriction to all documentation of **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** related to this contract including that provided by the Contractor/Bidder. The Bidder/ Contractor will also grant

the IEM, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his documentation. The same is applicable to Subcontractors. The IEM is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s)/ subcontractor(s) with confidentiality.

5) **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** will provide to the IEM information as sought by him which could have an impact on the contractual relations between **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** and the Bidder/ Contractor related to this constract.

6) As soon as the IEM notices, or believes to notice, a violation of this agreement, he will so inform the Principle Secretary, Maharashtra Government, and request the Principle Secretary, Maharashtra Government, to discontinue or corrective action, or to take other relevant action. The IEM can in this regard submit non- binding recommendations. Beyond this, the IEM has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action. However, the IEM shall give an opportunity to **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** and the Bidder/Contractor, as deemed fit, to present its case before making its recommendations to **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION**.

7) The IEM will submit a written report to the Principle Secretary, Maharashtra Government, within 8 to10 weeks from the date of reference or intimation to him by the **SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION** and, should the occasion arise, submit proposals for correcting problematic situations.

8) If the IEM has reported to the Principle Secretary, Maharashtra Government, , a substantiated suspicion of an offence under relevant Anti-Corruption Laws of India, and the Principle Secretary, Maharashtra Government, has not, within the reasonable time taken visible action to proceed against such offence or reported it to the CVO, the Monitor may also transmit this information directly to the CVC, Government of India.
9) The word '**IEM**' would include both singular and plural.

(*) *This Section shall be applicable for only those packages wheren the IEMs have been identified in section -I : Invitation for Bids and / or Clause ITB ९.३ in Section-III: Bid Data Sheets of Conditions of Contract, Volume-I of the Bidding Documents.*

Section IX – Pact Duration

This Pact begins when both parties have legally signed it. It expires for the Contractor after the closure of the contract and for all other Bidder's six months after this Contract has been

awarded.

Section X – Other Provisions

(१) This agreement is subject of Indian Law Place of performance and jurisdiction is the establishment of SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION, The Arbitration clause provided in the main tender document/ contract shall not be applicable for any issue/ dispute arising under Integrity Pact.

(२) Changes and supplements as well as termination notices need to be made in writing.

(३) If the Contractor is a partnership firm or a Consortium or Joint Venture, this agreement must be signed by all partners, Consortium members and Joint Venture partners.

(४) Nothing this agreement shall effect the rights of the parties available under the General Conditions of Contract (GCC) and Special Conditions of Contract (SCC).

(५) Views expressed or suggestions / submissions made by the parties and the recommendations of the CVO/IEM# in respect of the violation of this agreement , shall not be relied on or introduced as evidence in the arbitral or judicial proceeding (arising out of arbitral proceedings) by the parties in connection with the disputes / differences arising out of the subject contract.

 # CVO shall be applicable for packages wherein IEM are not indentified in Section IFB/ BDS of Condition of Contract, Valume-I. IEM shall be applicable for packages wherein IEM are indentified in Section IFB/BDS of Condition of Contract, Valume-I.

(६) Should one or several provisions of this agreement turn out to be invalid, the remainder for this agreement remains valid. In this case, the parties will be strive to come to an agreement to their original intensions.

(Signature) (Signature)

Contractor No of Correction Executive Engineer SMKC

(For & On behalf of SANGLI MIRAJ AND KUPWAD CITY MUNCIPAL CORPORATION)

(Office Seal)

Name :
Designation :

Witness १:

(Name & Address)
_____
_____

_____
_____

Witness २:

(Name & Address)
_____
_____

_____
_____

(For & On behalf of Bidder/Partner(s) of Joint Venture/Contractor)

(Office Seal)

Name :
Designation :

Witness १:

(Name & Address)
_____
_____

_____
_____

Witness २:

(Name & Address)
_____
_____

_____
_____

Name of Work : **Kupwad Underground Drainage Scheme under Central Govt. program Amrut-2 Tal.Miraj Dist. Sangli**

BARCHART

Saperatly Attached

Schedule A

Schedule B

Saperatly Attached

GENERAL SPECIFICATION

GS-1

1) All the materials used in the work shall be of best quality and the material rejected shall be removed from the site by the contractor within 36 hours in the presence of the Engineer in charge at his own cost.

2) All other rules regarding workmen compensations etc. will be binding on the contractor.

Unwanted persons shall be dispensed with if called upon by the Engineer in charge.

3) Other unforeseen items to be executed in course of work will have to be done by the contractor as per specifications, in P.W.D. Hand book volume I and II (Latest Edition) I.S. code of practice and as per standard specifications book of latest edition.

4) The contractor shall be responsible and liable to pay for the damages caused by him to public property etc.

5) All T and P machinery shall be provided by the contractor. Non availability of the same shall not be an excuse for application for extension of time limit.

6) Water of good quality for labour, construction, washing and such other purposes shall be provided by the contractor without any claim for extra cost.

7) Materials belonging to contractor if not removed from site of works after completion of the work within a period of 15 days shall be taken over by SMKC department at contractors risk and cost and then shall be auctioned at the contractor's risk and cost. The amount so recover shall be credited to contractor's account after recovery of any dues or over payments etc.

8) The final bill and deposits will not be paid unless the site is cleared off all rubbish materials and contractor's stores etc from the site of the work.

9) The contractor will have to pay the royalties and municipal taxes, if charged by the Sangli Miraj Kupwad Municipal Corporation. The same will not be refunded.

10) Specifications given for relevant nature and type of work, for any particular item of the tender shall also be applicable to the other item of work when similar work is repeated or carried out in part or full although the item numbers may not have been mentioned especially against the particular specifications.

11) The contractor shall be responsible for obtaining permission from Government

local bodies, private party for storing, stacking of materials required for execution of work.

12) Necessary sign board, danger flags, red lamps shall be provided by the contractor to avoid accidents. Necessary guarding will also have to be provided.

13) Before entering any land, the contractor shall make independent enquiry regarding ownership of land. Any action regarding trespassing will be at the risk of contractor.

14) Materials remaining unsold or unserviceable as per discretion of the Executive Engineer shall be confiscated destroyed or disposed off without any compensation to the contractor, who will be responsible for all legal disputes at his own cost and consequences without reference to the department.

15) In case of legal disputes for materials brought and stores at site without permission of the Executive Engineer, the contractor will be responsible for all legal disputes at his own cost and consequences without reference to the department.

GS 2: SPECIFICATION OF WORK:

The work shall be carried out as per practices and procedures laid down in P.W.D. Hand book Volume - I & II Latest Edition and Public Works Department's standard specifications (Latest Publication of Government of Maharashtra) with amendments from time to time and as per I. S. applicable for respective items of works, as directed by the Engineer in charge.

GS 3: MOTIVE POWER:

No electric power supply shall be entered by the Sangli Miraj Kupwad Municipal Corporation construction and testing of various structures under different sub-works. The contractor shall have to make his own arrangement for the same at is cost. During trial period of the plant, power supply shall be made available by the department. The firm should inform within one month from the date of receipt of work order, the total electrical load required for successful operation of the treatment plant. This electrical load shall also include lighting load for inside and outside light points etc. attached to the buildings in proper as well as premises of the plant.

GS 4: FOUNDATION CONDITIONS AND PRESCRIBED BEARING CAPACITIES

The tenderer shall acquaint himself for results of S.B.C. by taking actual trial pits on site and refilling them afterwards at his cost. The foundation depth shall be considered as minimum 3.00 m below G.L. for the construction of BPT, MBR & E.S.R. The bearing capacities of the actual strata met with the foundation levels shall wherever be required got tested from reputed institution, at contractor's cost and in the presence of Engineer-in-charge. Detailed design shall be prepared and submitted by the contractor and got approved from the department after actual confirmation of S.B.C.

GS 5: WATER TIGHTNESS TEST

All the water retaining and carrying structures will have to be tested for their water tightness by filling them with water up to their designed F.S.L. Similarly the pipe line will have to be tested hydraulically. Structures will be considered water tight when the reductions in filled up level is not more than 6 mm in 48 hours with outer surface dry. As regards pipe line, they should hold pressure as directed by Engineer in charge without reduction for thirty minutes. The contractor will have to give all such hydraulic tests by making his own arrangements for water supply, filling and disposing off water after the test. He shall repeat this test if necessary until the above results are achieved and certified by the Engineer-in-charge without any claim for extra cost. The contractor shall carry out the rectification of the structures or pipe lines to achieve the above tests at his own cost. The structures and pipe lines shall be kept filled with water upto F.S.L. after the above test are over at his own cost.

GS 6: SATISFACTORY COMPLETION OF VARIOUS ITEMS:

The sub works included in the schedule of works for Wet Well Pumping Station and STP, Sangli and Miraj UGD remaining work on Lump sum basis.

The various items of the sub work are to fit in perfectly in the whole system physically, hydraulically, architecturally and mechanically.

GS 7: DISPOSAL OF EXCAVATED STUFF:

All materials obtained from any excavation carried out under this contract will be the property of Sangli Miraj Kupwad Municipal Corporationand the contractor shall not have any claim on it. It will not be used by the contractor for any other purpose than the legitimate use on the work itself. Stuff still remaining surplus shall be spreaded

over the different site of work or disposed off as directed by the Engineer in charge without extra cost.

GS 8: SUBMISSION OF DETAILED DESIGNS AND DRAWINGS AFTER ACCEPTANCE OF TENDER:

For Lump sum job works the contractor shall submit complete detailed designs and drawings within 15 days from the date of issue of work order for approval If the department to the same. Piecemeal submission of designs and drawings shall not be permitted to commence the actual work at site unless detailed structural designs and working drawing are approved by the department. If called upon, the contractor shall also submit within reasonable time relevant books and other literature which have been referred to by him in working out the design for civil, mechanical or electrical works involved in the construction. Such books and literature will be returned to him. Reason of secrecy in regard to details of designs, materials, equipments etc. shall not be placed by the contractor in the name of 'TRADE SECRET' for not furnishing the requisite details called for the Sangli Miraj Kupwad Municipal Corporation. The design get approved from Govt. Engineering College structural consultants approved enlisted in SMKC shall be subjected to modifications if found necessary and such modification shall not violet the contract. The contractor shall be responsible for the correctness and soundness of the designs submitted by him. The structures shall be as per recognized engineering practices and if any provisions, are found inadequate or faulty, necessary modifications will have to be carried out by him at any stage up to the expiry of guarantee period and no extra payment will be made on the account.

Six copies of all the approved designs and drawings should be furnished by the contractor to the department free of cost.

GS-9: REQUIREMENT OF STRENGTH OF CONCRETE

The contractor shall make field arrangements for testing of all materials for cement concrete i.e. slumps test, compression test etc. The concrete cube moulds 3 Nos. of 15 x 15 x 15 cm size shall be kept during concreting operation. Three cubes shall be prepared from at site during concreting to be used in work for compression test, for each concreting to be used in work for compression test, for each concreting

of the structures. One cube shall be tested for test at 7 days age and two at 28 days in Regional Testing Laboratory at Govt. Polytechnic/Engineering college / or at any approved laboratory, by Engineer –In-Charge. ALL THE TESTING CHARGES SHALL BE PAID BY CONTRACTOR. The entire responsibility of the testing of materials will be borne by the contractor.

Mixing of concrete shall be done with Concrete Mixers.

a) The contractor will make his own arrangement for receiving all materials, tools, etc. required for the work.

b) No extra charges for the carriages of water will be allowed.

c) The rates for all items are inclusive of all charges such as carting, lifting etc. No extra payment for any lead and lifts will be paid for any item.

d) The contractor should not be subleted without written permission of the Engineer-In-Charge.

e) The conditions in the tender notice will be binding on the contractor and the Tender Notice will form a part of agreement.

f) The material required for carrying out the work for which the tender is offered shall be brought by the tenderer.

GS-10:ORDINARY CONCRETE

Full payment shall be made when 75% of the result are equal and above the specified strength and the remaining 25% of the result are above 75% of specified strength.

Cases failing outside the above limit shall be examined by the Engineer-In-Change on merits in each case.

1) The charges for preliminary design of concrete mix shall be entirely borne by the contractor.

2) For grades of concrete M-20 and above where cement is to be used by weighment, the cost of extra cement required to make up underweight bags shall be borne by the contractor.

3) For the item of concrete and other items in the agreement where cement is not

to be used by weighment the cement bags are received from the manufacturer shall be assumed to contain cement of 50 kg. Net weight. The work shall carried out as per this method of reckoning.

GS-11: GENERAL NOTES

The Employer requires that all goods and materials to be used in the works are new unused, of the most recent or current models and incorporate all recent improvements in design and material.

Only the Employer's Requirements and design brief are specified in the following section. These are not restrictive. The Contractor has to draft, the technical specification and the specification of standards for goods, materials and workmanship with recognized codes and standards.

GS-12: SUBMITTALS

The submittals include but is not limited to work required to comply in accordance with general and specified procedures for transmittal of submissions; submission review and subsequent actions; schedule of submissions; resubmission; construction schedule; coordination of drawings; submission of drawings; insert and sleeve location drawings; reproduction of submitted drawings; sample; and construction photocopies.

GS-13: DESIGN, DRAWINGS, DOCUMENTS AND DATA

General Obligations

The Contractor shall carry out, and be responsible for, the design of the Works. Design shall be prepared by qualified designers/professionals who comply with the criteria stated in the Employer’s Requirements. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer In-charge at all reasonable times during the Contract Period.

Basic Design Parameters

The bidder is required to examine and check the Employer’s design criteria, specifications etc., as included in the Bid documents to confirm their correctness in its bid and to assume full responsibility for them.

Submission of Design Calculations, Drawings and Other Documents by the Contractor

(a) After signing the Contract, within 28 days from the date intimated by the Employer to proceed with the work, the Contractor shall supply to the Engineer In-charge 6 (six) hard copies (along with workable soft copies in a CD) each of the design calculations for the process and sizing of all components of the plant including mechanical and electrical equipment, supported by flow diagrams, and general arrangement drawings, reference catalogues /literature of manufacturers, other reference documents used for the design purpose, for approval of the Engineer In-charge . The Contractor shall incorporate all necessary comments of the Engineer In-charge in the above design and drawings, if any, and shall re-submit further 6 (six) copies each of the revised design and drawings within 14 (fourteen) days for final approval of the Engineer In-charge. The Contractor shall thereafter submit 6 (six) copies each of the approved design and workable soft copies of all approved designs, calculations and drawings. The entire cost shall be borne by the Contractor and the Employer does not hold reliability on this account at any cost and any time.

(b) Design calculations and drawings shall be submitted in sequence as per schedule to be drawn and agreed upon mutually, immediately after submission of the general arrangement drawing. The entire process of submission of all such documents by the Contractor in initial copies and final copies after approval of the Engineer In-charge shall be completed within 90 days from the date of the work order. These documents shall cover:

- Site Plan.
- Layout Plan and hydraulic flow diagram, process design, P & I diagram
- Architectural Drawings
- GA drawing of each / individual unit
- Detailed structural design and good for execution drawings pertaining to all components of the plant and other associated works.
- Drawings showing the size, position and other necessary details of all

mechanical and electrical equipment and fixtures.

- Wiring diagrams, pressure control, pumps and motor control gear particulars.
- Details of foundations, position of openings, etc., for the pumps, motors, starting cubicles, LT/HT panels, etc.
- Elementary diagram and manufacturers' shop and part drawings for all equipment's.
- Services like internal illumination and ventilation, building water supply, sanitation and plumbing, area lighting, etc.
- Landscaping & Plant beautification plan
- Any other design and drawings to fulfill the Employer's requirement.

Format of Drawings

All drawings submitted for approval shall be ISO standard size sheets. Every drawing shall have a title block in the bottom right corner showing:

Employer's Name :

Contract No. :

Consultant :

Contractor :

Project :

Drawing Title :

Drawing Number :

Revision Number :

Date :

Each drawing shall bear the signature of the Project Manager on behalf of the Contractor to the effect that the drawing whether his own or from any other source has been checked by the Contractor before submission to the department.

Each revision shall be properly recorded to show the number, date, specific description of revision(s) carried out, and signature of the Project Manager in the revision block. The Contractor shall be responsible for incorporating all the comments issued by the Engineer In-charge.

Construction Documents

As-Built Drawings

The Contractor shall prepare, and keep up-to-date, a complete set of “As Built” records of the execution of the Works, showing the exact “as built” location, sizes and details of the work as executed, with cross references to relevant specifications and data sheets. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-clause. Two hard copies shall be submitted to the Engineer In-charge prior to the Tests on Completion.

In addition, the Contractor shall prepare and submit to the Engineer In-charge “As Built drawings” of the Works, showing all Works as executed. The drawings shall be prepared as the Works proceed, and shall be submitted to the Engineer In-charge for his inspection. The Contractor shall obtain the consent of the Engineer In-charge as to their size, the referencing system, and other pertinent details.

Prior to the issue of substantial completion Certificate, the Contractor shall submit to the Engineer In-charge one soft copy, workable CD, one full-size original copy of the relevant “As Built Drawings”, and any further Construction Documents specified in the Employer’s Requirements. The Works shall not be considered to be completed for issue of substantial completion certificate until such documents have submitted to the Engineer In-charge.

Coordination Drawings

Coordination drawings shall be prepared and shall comprise composite section drawings showing coordination of mechanical and electrical work to structural work. The composite drawings shall be in sufficient detail to show overall dimensions of ductwork, piping, conduit, and related items and clearance between structural members, lighting and related features for review and approval of relative locations of work in allocated spaces. The drawings shall indicate any conflicts of clearance

problems between various trades. Coordination drawings shall be submitted to the Employer's Representative. Coordination drawings will not be submitted for approval but for review only.

Equipment and Interconnection Diagram

Equipment room layout drawings shall be based on actual requirements of equipment furnished and be consolidated for all trades, shall be to scale and shall show all pertinent structural and penetration features and other items, such as electrical cabinets, which affect available space. All mechanical and electrical equipment including electrical conduits, accessories, ductwork and piping shall be shown to scale in plan and also in elevation and / or section and resolve any conflicts or clearance problems. Physical descriptions of the various mechanical and electrical items shown on these drawings shall be submitted concurrently.

Quality

Proof of quality of manufacture and reliability in field application. Such proof will normally constitute evidence that the product / equipment has been manufactured by the manufacturer, or fabricator of the quality assured for a unit or item over a period of time and has an established field service record. It shall include installation locations, dates and year of operating service. If there is no experience for an identical unit or item it may relate to a similar unit or item by the same manufacturer.

Manufacturer's Data

Manufacturer's data shall include catalogue cuts, brochures, circular, specifications, equipment operations and maintenance manuals and other printed information in sufficient detail and scope to verify compliance to the requirements.

Performance Data

Performance Data shall include certified curves of equipment responses and performance characteristics as required.

Parts and Special Tools Lists

a) Parts lists shall include a complete list of component parts of an item of equipment together with an expanded view or equivalent means to identify the

parts.

b) Special Tools lists shall include all tools and devices required for assembly, disassembly, operation and maintenance of the equipment and an indication of the use of each item.

c) The lists shall further identify the sources of manufacture and supply of consumable supplies and those parts, special tools and supplies that are normally furnished with the purchase of the equipment or are specified to be furnished.

d) In additions, a list shall be provided showing items recommended by the manufacturer to support normal maintenance based on the manufacturer's anticipated life cycle of the part for continuous normal operation.

Certificates of Compliance

Certificate of compliance shall include material or product manufacturer’s statement that the supplied items or systems conform to the specifications.

Test Reports

Test reports shall be provided as required and as follows:

a) Shop tests shall show the results of required shop tests of equipment or systems certified in writing by the manufacturer or its authorized Representative. However, the Employer / its representative along with consultant is free to visit and inspect the equipment and systems at manufacturing unit before dispatch. The cost toward such inspections shall be borne by the contractor.

b) Field test reports shall show the results of required field tests and compliance with approved procedures and shall be certified in writing.

Maintenance Instructions

Maintenance instructions shall cover finish material including but not limited to hard-surfaced materials. Instructions shall include cleaning, tarnishing, dents and stains from various chemicals.

SUBMISSION REVIEW AND SUBSEQUENT ACTION PROCEDURES

i) Submission will be returned by the Employer's Representative to the Contractor

indicating the appropriate action to be taken by the Contractor as follows:

a) Except in cases where local jurisdictional authority approval is required to validate a particular submittal, fabrication, manufacturer, construction or purchasing may proceed.

b) The submission does not comply with contract requirements, and fabrication, manufacturer and construction shall not proceed. The Contractor shall make revisions and resubmit. The Contractor has 14 calendar days from date of receipt of advice of the Engineer In-charge as to compliance with his comments and to resubmit drawings evidencing such compliance.

ii) Failure of the Contractor to process submissions for review shall not relieve the Contractor of his responsibilities under the contract.

iii) Do not proceed with work dependent on submissions until the submissions have been verified by the Contractor and reviewed by the Employer. Making good work which has proceeded in error because of non-compliance with these requirements shall be at the Contractor's expense. Review of Resubmissions shall not relieve the Contractor of his responsibility for execution of the works in accordance with contract document.

iv) The Contractor shall not be relieved of responsibility for deviations from the contract or errors of any kind in the submissions or from the necessity of furnishing work required by the contract which may have been omitted from the submissions reviewed by the Engineer In-charge. The Engineer In-charge’s review of individual items in submissions shall not be constructed as a review of the complete assembly in which it functions.

v) No authorization of an increase in total contracting price or time or completion shall be implied by comments marked on submissions or submission transmittals by the Engineer In-charge.

vi) Review of submission shall not absolve the Contractor from the responsibility of correctly locating all items in the works.

vii) Employer's approval of substitutions, alternatives and deviations:

Whenever and wherever the Contractor proposes to make substitutions to the specified construction method or process or proposes the use of non-specified manufacturer's, products or to deviate from the material specified, the Contractor must make a full submission as required in the contract. The Contractor is advised that only the Employer has the final authority to approve or reject proposed substitutions, alternates and / or deviations from the contract.

CONSTRUCTION PHOTOGRAPHS

i) Work shall include progress photographs for each work of construction taken each month made by a professional photographer.

ii) Photographs shall show general extent of the works by both exterior and interior views. Each viewpoint will be selected and the number of monthly repetitive photographs taken from exactly the same viewpoint as decided by the owners authorized representative.

iii) Submit six 200mm x 254mm glossy color prints of each photograph to the owners authorized representative at the first of each month duly attached / pasted in the Progress Report.

iv) Title and mount each photograph per the owners authorized representative's requirements. As a minimum include on title: Project name, direction of view, and date when taken.

v) Video shooting during major construction stages of plant or at least once every month must be carried out by the contractor and shall be submitted to the Employer / authorized representative.

QUALITY ASSURANCE

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. Such system shall be in accordance with the details stated in the Contract. Compliance with the quality assurance system shall not relieve the Contractor of his duties, obligations or responsibilities.

Details of all procedures and compliance documents shall be submitted to the Engineer In-charge for his information before each design and execution stage is commenced.

When any document is issued to the Engineer In-charge, it shall be accompanied by the signed quality statements for such document, in accordance with the details stated in the Contract. The Engineer In-charge shall be entitled to audit any aspect of the system and require corrective action to be taken. The quality assurance system and the audit of any aspect of system and necessary corrective action shall be at contractor's risk and cost.

Quality assurance shall include, but shall not be restricted to as noted herein.

The Quality Assurance system should ensure the quality and quantity continuously through monitoring systems as envisaged in Project Management and Construction proforma so as to give daily progress report, labour / manpower deployed, quantity executed on periodic basis, observations thereof through following proforma placed at the end of this subsection.

- Bar bending schedule
- Pour Card
- Post Concreting check ups
- Form work check up
- Tests on materials

QUALITY ASSURNCE IN GENERAL

i) Maintain continuity of quality assurance surveillance throughout fabrication of products and execution of work.

ii) Submit details of quality assurance tests and methods inclusive of the specification.

iii) Perform inspection and testing in accordance with specified reference standards, or as otherwise approved by the Employer's Representative.

iv) Calibrate measuring and testing devices periodically against certified standard equipment. Calibration shall be verified by inspection firm.

QUALITY ASSURANCE OF THE WORKS ON SITE

i) Provide an assurance system to ensure quality assurance by phased inspection as

follows:

Preparatory Phase Inspection

Perform inspections prior to commencement of each part of the works which shall include a review of requirements with the supervisors directly responsible for that part of the works. Such review shall be in the form of written statements of the processes to be followed and critical characteristics, tests and similar evaluations which will be a part of inspection procedures. Verify that products incorporated with that part of the works which have been tested and applicable submissions have been made for control testing. Verify that preceding work has been completed and approved. Verify products incorporated with that part of the works conform to submission data and Contract requirements and that necessary materials and equipment are easily and readily available.

Continuing Inspection

i) Perform inspection on a continuing basis as each part of the works commences and on a regular basis to ensure constant compliance with the tender requirements.

ii) Provide samples of materials to be tested in required quantities at locations where testing is performed.

iii) Provide labour, instruments, testing devices, facilities and required shelter at the site:

a) To determine ambient and material temperature by thermometers with Celsius scale.

b) To determine relative humidity of air and moisture content of materials.

c) To facilitate inspection and tests.

d) For obtaining and handling of samples at site and plant.

iv) Upon receipt of items at the job site, the Contractor's quality assurance representative at the site shall be responsible on receipt of items at the site for noting damage suffered by them during transit and for directing that they be

replaced.

v) The Contractor shall be responsible for protecting and maintaining items on the site free from damage during storage, erection, installation and maintenance.

vi) When it is discovered on inspection that work is proceeding with incorrect materials or methods, ensure that corrections are immediately made and that improperly complete work is replaced.

QUALITY ASSURANCE OF OFF-SITE WORKS

i) The Contractor shall impose quality assurance methods at the location of manufacture, fabrication and assembly of items to be incorporated in the works to ensure that they conform to requirements of the Contract Documents. This quality assurance shall not apply to proprietary catalogue production products except as may be deemed necessary by the Contractor or as directed by the Employer's Representative.

ii) The Contractor's quality assurance representative off-site shall be responsible for the release of items for transit to the job site.

iii) In addition to the Contractor shall provide notice to the Employer's representative in writing at least 4 weeks in advance of packing of every batch of product components or assemblies so that the Employer or Employer's Consultants and their designated representatives may have opportunity at his / their choice of inspecting any such product components or assemblies prior to transportation at the cost of the bidder.

SCHEDULE OF QUALITY ASSURANCE OPERATIONS

Provide the Employer's Representative with a minimum of three copies of a schedule of quality assurance operations, both on-site and off-site, to outline the procedures, instructions and reports which will be used, as follows:

i) Quality assurance organization.

ii) Qualifications of quality assurance personnel.

iii) Authority and responsibilities of each quality assurance person.

iv) Schedule of inspections and tests with personnel assigned to each task and duration of each task.

v) Schedule of required services to be provided by inspection and testing firms.

vi) Co-ordination required in order that quality assurance is integrated.

vii) Test methods which will be utilized.

viii) Methods of performing and documenting quality assurance operations.

TESTS REQUIRED BY JURISDICTIONAL AUTHORITIES

i) The Contractor shall be responsible for inspection and testing required by jurisdictional authorities in conformance with the performance requirements.

iii) If the Engineer In-charge so desires, he may delegate inspection and testing of materials or Plant by an independent body / agency. Any such delegation shall be effected for this purpose shall be considered as an assistant of the Engineer-in-Charge. Notice of such appointment (not being less than 14 days) shall be given by the Engineer In-charge to the Contractor.

QUALITY ASSURANCE REPORTS

i) Document each test and inspection on a report and submit the report in triplicate to the Employer's Representative.

ii) Reports shall be in an approved format and shall certify off-site items produced correctly for on-site work of installed correctly, as applicable. Similarly the report shall certify items that are defective with a statement of records on corrective measures taken.

iii) Include on each report the purpose of the inspection or test, a description of methods used, observations made and personnel involved.

iv) The Contractor shall also maintain in the approved format a log book of all tests performed which shall include the date of test, type of test and the results of the test.

v) If inspection and testing procedures are sub-contracted to an approved inspection and testing firm, only copies of test reports signed by the approved inspection and testing firm will be acceptable.

GS-14 VALUE ADDED TAX

The value added tax shall be deducted at 2% from the contractor or at appropriate

rate as may be determined by the sale tax department from time to time on basis of actual work done by the contractor from each R.A. bill and shall be remitted to sales tax department. No payment on account of reimbursement of value added tax will be made to contractor by Sangli Miraj Kupwad Municipal Corporation.

GS-15 CONDITION RELATING TO INSURANCE

Contractor shall take out necessary insurance policy / policies so as to provide adequate insurance cover for execution of the awarded contract work from the Director of insurance, Maharashtra State Mumbai 51, only. Its postal address for correspondence is 264-1St floor, MHADA, Opposite Kala Nagar, Bandra (East), Mumbai-51 (Tel. No. 26438403 / Fax – 26438461 / 26438690). Insurance policy / policies taken out from any other company will not be accepted. However if the contractor desires to effect insurance with the local office of any insurance company, the same should be under the co-insurance cum servicing arrangement approved by the Director of Insurance. The policy taken out by the contractor is not on co-insurance basis (G.I.F. 60% and Insurance Company 40%). The same will not be accepted and amount of premium calculated by Director of Insurance will be recovered directly from the amount payable to the contractor for the executed contract work which may be noted.

GENERAL TECHNICAL SPECIFICATIONS

1.1 GENERAL

This section deals with civil construction of the entire plant, piping etc. complete work under this contract.

i) All the civil & structural works shall be carried out as per latest CPWD / PWD specifications Vol. I to III and Vol. IV to VI with up to date corrections slips issued up to the date of submission of tender unless otherwise specified herein. In case the CPWD / PWD specifications are not found applicable or inadequate, then the relevant BIS specifications (latest version) on the date of submission of tender shall be used. Further, in case, any of above two is not applicable, to particular/specialized works, then the manufacturer's specifications or their relevant instructions shall be followed. Specifications mentioned anywhere in the bid document will prevail over CPWD / PWD Specifications and BIS specifications as the case may be.

ii) All raw materials including Cement and reinforcement/structural steel wherever to be used by the contractor shall confirm the latest BIS/CPWD / PWD specifications. All mandatory tests as required by BIS/CPWD / PWD specifications shall be carried out and test certificates to be submitted to Engineer – in charge. However, the contractor shall be fully responsible for required performances of civil/ structural work. Costs of such tests are to be borne by the contractor.

iii) For testing of all materials, following shall be strictly adhered to -

a) All the tests shall be done in laboratories approved by the Employer. The contractor is required to take written approval from Engineer In-charge, in this respect.

b) Cement and Steel shall be of a make approved by the Employer as detailed out in respective material sections of this document.

1.1.1 MATERIALS

1.1.1.1 Cement

i) The Contractor shall procure minimum 43 grade, unless otherwise stated

separately confirming to BIS specifications, ordinary Portland cement, as required in the work only, from reputed manufacturers such as L&T, ACC, Gujarat Ambuja, Cement Corporation of India, Vikram, J.P. etc. and as approved by the Employer, Ministry of Industry, Government of India and holding license to use BIS certification mark for their product, whose name shall be got approved from Engineer In-charge. Supply of cement shall be taken either in silos or in 50 kg. Bags bearing manufacturer's name and BIS marking. Samples of cement arranged by the Contractor shall be taken by the Engineer In-charge and got tested in accordance with provisions of relevant BIS codes. Cost of such tests shall be borne by the contractor. In case test results indicate that the cement arranged by contractor does not conform to be relevant BIS codes, the same stand rejected and shall be removed from the site by the Contractor at his own cost within one week time of written order from the Engineer In-charge.

ii) The cement shall be brought at site in bulk supply of approximately 50 tones from the manufacturer direct, or as decided and approved by the Engineer In-charge, as the case may be.

iii) The cement godown of the sufficient capacity should be constructed by the contractor and at all time it should have a stock of minimum of 2000 bags. The contractor shall facilitate the inspection of the cement godown by the Engineer In-charge at any time. Storage of cement shall be as per CPWD / PWD specification.

iv) Cement brought at site and cement remaining unused after completion of work shall not be removed from site without written permission of the Engineer In-charge.

1.1.1.2 Steel

(a) Reinforcement Steel & Structural Steel

i) The contractor shall procure high strength CRS steel reinforcement bars and structural steel conforming to relevant BIS codes from main producers such as SAIL, TISCO, RATHI or as approved by the Ministry of Steel. The steel reinforcement, structural steel shall be brought to the site in bulk supply of 10 tons or more or as decided by the Engineer In-charge. For small or occasional quantities of steel reinforcement bars that less than 10 MT, the Engineer In-charge may authorize the

contractor to purchase the same from authorized dealers of the approved manufacturers. The contractor shall have to obtain and furnish test certificates to the Engineer In-charge in respect of all supplies of steel brought by him to the site of work. Samples shall also be taken and got tested by the as per the provisions in this regard in relevant CPWD / PWD/BIS codes. Cost of such tests shall be borne by the contractor. In case the test results indicate that the steel arranged by the contractor does not conform to CPWD / PWD/BIS codes, the same shall stand Engineer In-charge rejected and shall be removed from the site of work by the Contractor at his cost within a week's time after written orders from the.

ii) The steel reinforcement, structural steel shall be stored by the contractor at site of work in such a way as to prevent distortion and corrosion. Bars of different sizes and lengths shall be stored separately.

iv) For checking nominal mass, tensile strength, bend test, re-eand- test etc. specimen of sufficient length shall be cut from each size of the bar at random at frequency not less than that specified below: -

Size of Bar	For consignment below 100 tonnes	For consignment over 100 tonnes
Under 10 mm dia.	One sample for each 25 tonnes or part thereof	One sample for each 40 tonnes or part thereof.
10mm to 16 mm dia.	One sample for each 35 tonnes or part thereof	One sample for each 45 tonnes or part thereof.
Over 16 mm dia.	One sample for each 45 tonnes or part thereof	One sample for each 50 tonnes or part thereof.

Steel brought to site and steel remaining unused shall not be removed from site without the written permission of the Engineer-in-charge.

1.1.1.3 Quarry Materials

The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, murum, etc., and to make his own arrangements for collection and transportation of the materials irrespective of the leads and lifts required. The quarry thus identified by the Contractor should have proper license from the concerned Government. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications

and shall be subject to the approval of the Engineer In-charge. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account.

1.1.2 PRECAUTIONS DURING EXECUTION

i) The successful tenderer shall comply with all instructions in all respects issued by the Employer in respect of road maintenance and inter utility code of conduct for excavating trenches across and along various roads and other places.

ii) The contractor shall have to provide GI sheet barricading up to a minimum height of 2m above ground level all around the site of excavation and trenches as per direction of Engineer In-charge. Such barricading must be provided before taking up the excavation work and must remain in position till complete filling back of excavated trenches and resurfacing work, if any. The GI sheets must be painted in red & White stripes with fluorescent paint.

iii) Proper supporting of all underground services such as water mains, sewers, cables, drains, water and sewer connections shall be provided by the contractor without any additional cost. If the services/connections are damaged, the contractor will be responsible for the restoration of the same to original specifications at his own cost.

iv) The contractor shall provide necessary warning sign boards painted and written with luminous paint as per direction of Engineer In-charge. The warning notice boards should be put at least 100 meters before the approach to the area on either side where the work is going on. In addition proper lighting arrangement will be made for all excavations works.

v) Proposed alignment of rising mains to cross cables, water mains, and other underground services. Contractor shall be required to work under these constraints. Costs of such items are to be included in the bid of the contractor. Necessary statutory permission for road cutting will have to be arranged by the Contractor at his own cost and fee deposited to the concerned dept. will be reimbursed by the Employer on actual basis.

vi) During excavation of trenches, the underground services (UGS) such as

water mains, electric poles/cables/Telephone cable and sewer line etc. may become exposed and unsupported. It will be the responsibility of the contractor to make suitable and necessary arrangement for supporting such UGS to keep them functional. Such arrangement will be done as per direction of the Engineer In-charge. No separate payment for supporting the services will be made by the dept. Any damages caused to the above mentioned underground services due to negligence of the contractor or otherwise shall be made good by the contractor at his own cost. After laying the pipe, the contractor shall have to construct masonry pillars, to support the water lines/U.G.S. before the temporary supports are removed and filling of trenches is done.

vii) Existing drains shall not be blocked by excavated earth or any other materials; the contractor shall ensure that sullage/storm water flow uninterrupted.

In addition: throughout the design, construction, commissioning, operation and maintenance stages of the project, the following safety principles shall apply:

Workforce, contractors, visitors and the public shall be safeguarded against hazards, risk of serious injury and disease.

Adequate training shall be made available for the use of all related equipment's.

Appropriate responsibilities will have to be assigned throughout each stage of a project.

Safety consciousness shall have to be promoted by effective internal communication, signs and media.

Safety performance shall be easily audited during operation and maintenance.

All accidents or potential serious incidents shall have to be reported and investigated.

Routine requirement to enter confined spaces needs to be eliminated, where practicable.

Safe access to all working areas shall have to be provided. Concrete slab over wet wells, tanks and chambers shall have double steel reinforcing.

Lifting eyes and bolts for slabs to be stainless steel or any other durable and non-corrosive material.

Protection against falling needs to be provided, where the drop exceeds 1.5 m.

Where the drop exceeds 2.0 m, edge protection will have to be provided.

Power driven machinery needs to be guarded.

Within plants and installations, all wells, sumps, channels. Chambers, tanks etc., containing liquid shall be covered, walled and railed.

Electrical equipments and controls will have to be protected from unauthorized access.

Individual electrical drives to be capable of being isolated and locked off.

Electrical motors should be rated as continuous run.

Junction boxes for submersible pumps and float controls shall be above floor level not in the wet well.

Major hazards to be identified and posted on site.

Protection against counter measures against spillage of dangerous chemicals to be provided.

Appropriate training for the end users to be identified and stipulated in construction and procurement documents.

All equipment to be regularly checked and prominently marked accordingly.

Safety information and operating documents to be provided by suppliers.

All electrical equipment in sumps, wet wells, inlet channels, inlet chambers, cited below coping level to be explosion proof.

Lighting, appropriate to the needs of the end user, to be provided in working areas.

Emergency contact list, showing telephone numbers of key personnel and emergency services during office hours, to be circulated to all parties involved in the project.

All treatment plants, installation and construction sites shall be provided with perimeter fencing adequate to protect the public from entry. All fencing shall be securely fixed and inspected.

All treatment plants, installations and construction sites shall be adequate warning

signs at or near the perimeter.

Access to construction sites shall be controlled to prevent unauthorized access.

Any confined space requiring routine person entry, which contains sewage, sludge or other foul water to be ventilated.

Safe lifting is unrestricted areas is 16 kg. For heavier objects and/or in very tight locations, provision of crane or access for truck mounted crane to be made.

Fixed vertical ladders to be avoided in:

Inlet sump

Dry wells with a height greater than 3 m

1.1.3 REBOUND HAMMER TEST

As per CPWD / PWD specification, Rebound Hammer Test for concrete is mandatory and the same shall be carried out as per the provision. Rebound Hammer required for conducting the test shall be procured by the contractor at his own cost for testing and the same shall be made available at site as and when required by the Engineer In-charge.

1.1.4 BAR BENDING SCHEDULE

The Contractor will be required to prepare the bar bending schedule prior to taking up all the reinforcement cutting and bending works at site. No reinforcement work will be allowed without the bar bending schedule.

Note: All the data and details as provided are indicative only and bidders are advised to verify them before submission of their offer. No extra payments shall be made against any discrepancy found anywhere in the bid document.

1.2 CIVIL AND BUILDING WORKS

1.2.1 General

This part of the specification covers the design loads to be considered and specifications of material and workmanship for the civil works. Material used and workmanship for the civil works of Raw Sewage Pumping Station, Sewage treatment plant, campus development, civil works associated with pipe laying etc. to be done

under the contract will adhere to the provisions laid down in this chapter.

The bidder shall have to get Soil Analysis carried out for determining the Safe Bearing Capacity (SBC) of the soil as per relevant code through a reputed firm. The charges for the same shall be included in the offer. The lesser SBC out of the two i.e. one which is given in the tender and other one got carried out by the tenderer will be followed for design of foundation of various structures. Nothing extra shall be paid due to decrease in SBC.

The bidder should ascertain about the actual Sub Soil Water Table at site. Price quoted shall be inclusive of cost of pumping Sub Soil Water / seepage water from any other source required for execution of work. No extra payment shall be made due to variation in Sub Soil Water Level if mentioned anywhere in the tender documents either for designing or execution, on account of fluctuation due to any reason whatsoever.

Materials for which specifications are not given the requirement of respective Indian Standards are to be fulfilled. The contractor shall get prior approval of the materials proposed to be used under the contract from the Engineer In-charge.

1.2.2 Design Considerations:

1.2.2.1 Design Submissions

The contractor shall be responsible for the safety of structures, correctness of design and drawings, even after the approval of the same by Engineer In-charge. Complete detailed design calculations of foundations and superstructure together with general arrangement drawings and explanatory sketches shall be submitted to the Engineer-in-charge. Separate calculations for foundations or superstructures submitted independent of each other shall be deemed to be incomplete and will not be accepted by the Engineer-in-charge.

The design considerations described hereunder establish the minimum basic requirements of plain and reinforced concrete structures, masonry structures and structural steel works. However, any particular structure shall be designed for the satisfactory performance of the functions for which the same is being constructed.

1.2.2.2 Design Standards

All civil designs shall be based on the latest BIS/PWD/CPWD norms.

1.2.2.3 Design Loading

1.2.2.3.1 General

All buildings and structures shall be designed to resist the worst combination of the following loads/ stresses under test and working conditions: dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials dynamic load, vehicular load and uplift pressure etc.

Dead Load

This shall comprise all permanent construction including walls, floors, roofs, partitions, stairways fixed, service equipment's and other items of machinery. In estimating the loads of process equipment for the purpose of design, the empty weight of the equipment including all fixtures and attached piping, but excluding contents, shall be considered. Dead loads shall be taken as per relevant BIS codes.

Live Load

Live loads shall be in general as per BIS: 875. Surcharge load for underground structures, if any shall be considered as per actual condition. Equipment load shall be considered as per manufacturer's specification

In the absence of any suitable provisions for live loads in BIS codes or as given above for any particular type of floor of structure, assumptions made must receive the approval of the Department / prior to taking up the design work. Apart from the specified live loads or any other load due to material stored, any other equipment load or possible overloading during maintenance or erection shall be considered and shall be partial or full whichever causes the most critical condition.

Wind Load

Wind loads shall be as per BIS: 875.

Earthquake Load

Earthquake load shall be computed as per B.I.S. 1893 taking into consideration

soil foundation system, importance factor appropriate to the type of structure, basic horizontal seismic coefficient/ seismic zone factor & average acceleration coefficient as applicable.

Dynamic Load

Dynamic Loads due to working of machines / equipments such as pumps, blowers, compressors, switch gears, travelling cranes, etc. shall be considered in the design of structures as given by the manufacturers or in BIS code, whichever is more.

Vehicular Load

IRC Class AA (wheeled vehicle) loading shall be considered for design of structures under or by the side of roads.

1.2.2.4

Design Conditions for Underground or Partly Underground Liquid Retaining Structures

Liquid retaining/conveying structures including the members covering the same (such as roof of a chamber, channel etc.) shall be designed by BIS: 3370 latest. Shear shall be checked by working stress method as per BIS: 456. Minimum temperature and shrinkage reinforcement shall be adequately considered in each direction.

All underground or partly underground liquid containing structures shall be designed for the following conditions:

Liquid depth up to full height of wall including free board: no relief due to soil pressure from outside to be considered.

Structure empty (i.e. Empty of liquid, any material, etc.) : Full earth pressure and surcharge pressure wherever applicable, to be considered;

Partition wall between dry sump and wet sump: to be designed for full liquid depth up to full height of wall; including free board

Partition wall between two compartments: to be designed as one compartment empty and other full including free board;

Structures shall be designed for uplift in empty conditions with the water table and due care should be taken for seasonal variation on higher side, wherever required.

Underground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with

appropriate ground/uplift pressures below base slab. The design shall be such that the minimum gravity weight (empty conditions) exceeds the uplift pressure at least by 15%.

1.2.2.5 Foundations

A detailed topography survey and soil investigation report has been enclosed with the bid documents. All the data and details as provided are indicative only and bidders are advised to verify them before submission of their offers. No extra payment shall be made against any discrepancies in the above documents.

Foundation depths and the type of footings shall be appropriately computed from the parameters given in the soil report or obtained during the soil testing by the contractor whichever is stringent, and got reviewed and approved by department.

The minimum depth of foundations for all structures, equipments, buildings and frame foundations and load bearing walls shall be as per the recommendation of BIS provided adequate bearing pressure is available at that depth.

Bearing capacity of soil shall be determined as per BIS: 6403.

Care shall be taken to avoid the foundations of adjacent buildings or structure foundations, either existing or not within the scope of this contract. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. No extra claims for such adjustments shall be accepted by the Employer.

A structure subjected to groundwater pressure shall be designed to resist floatation. The dead weight of empty structure shall provide a factor of safety of 1.2 against uplift during construction and service.

1.2.2.6 Pressure Release Valve

Use of pressure release valves to reduce uplift pressure due to ground water table shall not be allowed.

1.2.2.7 Design Requirements

1.2.2.7.1 General

The Civil & Structural design shall be carried out in accordance to BIS: 456 and

BIS: 3370 and other relevant Indian Codes. For the seismic forces, the structure should be designed as per IS: 1893 and all the factors as applicable.

The following are the design requirements for all reinforced or plain concrete structures.

a) All blinding and leveling concrete shall be of minimum 100 mm thickness of concrete mix- M10, unless otherwise specified.

b) Liquid Retaining Structures/Buildings:

All structural reinforced concrete for liquid retaining structures or buildings shall be of a minimum M25 grade with a maximum 20 mm aggregate size.

c) The minimum reinforcement in walls, floors and roofs of liquid retaining structures in each of two directions at right angles shall be adequately considered using CRS STEEL bars.

d) All buildings shall be provided with damp proofing for basement and floors and water proofing for roofs as specified in specific requirements.

e) Any structure or pipeline crossing below roads shall be designed for Class AA of IRC loading or as classified by the respective authority. NP2 RCC pipe (with encases) shall be used below roads inside the plant.

f) All pipes and conduits laid below the structural units shall be embedded in reinforced concrete of grade M20 of minimum thickness 150 mm.

f) Suitable admixtures may be used with the approval of engineer in charge.

1.2.2.7.2 Minimum Thickness

The following minimum thickness shall be used for different reinforced concrete members, irrespective of design thickness.

Walls for liquid retaining structures except at (x) below	200 mm
Roof slabs for liquid retaining structures (other than flat slabs)	150 mm
Bottom slabs for liquid retaining structures	200 mm
Floor slabs including roof slabs, walkways, canopy slabs	125 mm
Wall of cables/ pipe trenches, underground pits	150 mm

Column footings	300 mm
Parapets, Chajja	100 mm
Pre-Cast trench cover	75 mm
Beams, columns	230 mm
Channels, launder	150 mm

1.2.2.7.3 Minimum Cement Content:

The following Minimum cement content shall be used for different grades of reinforced concrete as per IS456 & IS3370:

Grade of Concrete	Minimum Cement in Concrete (Kg/m3) of finished concrete)
M20	300
M25	300
M30	320
M35	340

1.2.3 Materials & Standards

The term "materials" shall mean all materials, goods and articles of every kind whether raw, processed or manufactured and equipment of every kind to be supplied by the Contractor for incorporation in the Works.

Except as may be otherwise specified for particular parts of the works the provision of clauses in "Materials and Workmanship" shall apply to materials and workmanship for any part of the works.

All materials shall be new and of the kinds and qualities described in the Contract and shall be at least equal to approved samples.

Materials and workmanship shall comply with the relevant CPWD Specification (with amendments) current as on the date of submission of the tender.

Where the relevant standard provides for the furnishing of a certificate to the Engineer-in-charge, at his request, stating that the materials supplied comply in all respects with the standard, the Contractor shall obtain the certificates and forward it to the Engineer-in-charge.

The specifications, standards and codes listed below are considered to be part of this Bid specification. All standards, specifications, codes of practices referred to herein

shall be the latest editions including all applicable official amendments and revisions as on the date of submission of the tender.

In case of discrepancy between two standards the provisions, more stringent shall be followed.

BIS No.	Title
4082	Recommendation on stacking and storage of construction materials at site (first revision)
7969	Safety code for handling and storage of building materials
1498	Classification and identification of soils for general engineering purposes (first revision) (Amendments 2) (Reaffirmed)
2682 : 1984	Chlordane emulsifiable concentrates (second revision) (Amendment 1) (Reaffirmed 1994)
3764: 1992	Excavation work - Code of safety (first revision)
6313(Part2)	Code of practice for anti-termite measures in buildings : Part 2 Pre-constructional chemical treatment measures (Reaffirmed)
875 (Part 1)	Code of practice for design loads (other than earthquake) for buildings and structures : Part 1 Dead loads -Unit weights of building material and stored materials
875 (Part 2)	Code of practice for design loads (other than earthquake) for buildings and structures : Part 2 Imposed loads
875 (Part 3)	Code of practice for design loads (other than earthquake) for buildings and structures : Part 3 Wind loads
875 (Part 4)	Code of practice for design loads (other than earthquake) for buildings and structures : Part 4 Snow loads
875 (Part 5)	Code of practice for design loads (other than earthquake) for buildings and structures : Part 5 Special loads and load combinations
1080 : 1986	Code of practice for design and construction of shallow foundations on soils (other than raft, ring and shell)
1904	Code of practice for design and construction of foundations in soils: General requirements
2950(Part1)	Code of practice for design and construction of raft foundations: Part 1 Design
2974(Part1)	Code of practice for design and construction of machine foundations: Part 1 Foundations for reciprocating type machines
2974(Part2)	Code of practice for design and construction of machine foundations: Part 2 Foundations for impact type machines (hammer foundations)
2974(Part3)	Design and construction of machine foundations - Code of practice : Part 3 Foundations for rotary type machines (medium and high frequency)
2974(Part4)	Code of practice for design and construction of machine

BIS No.	Title
	foundations: Part 4 Foundations for rotary type machines of low frequency
2974(Part5)	Code of practice for design and construction of machine foundations: Part 5 Foundation for impact machines other than hammers (forging and stamping press, pig breakers, drop crusher and jolter)
6403	Code of practice for determination of bearing capacity of shallow foundations.
8009(Part1)	Code of practice for calculation of settlement of foundations : Part 1 Shallow foundations subject to symmetrical static vertical loads
8009(Part2)	Code of practice for calculation of settlement of foundations: Part 2 Deep foundations subjected to symmetrical static vertical loading.
11089	Code of practice for design and construction of ring foundation
13094	Guidelines for selection of ground improvement techniques for foundation in weak soils.
13301	Guidelines for vibration isolation for machine foundations
SP 36 (Part 2): 1988	Compendium of Indian Standards on soil engineering: Part 2 Field testing
2720 (Parts 1 to 41)	Methods of test for soils
6452	Specification for high alumina cement for structural use
6909	Specification for supersulphated cement
8041	Rapid hardening Portland cement
8042	White Portland cement
8043	Hydrophobic Portland cement
8112	43 grade ordinary Portland cement
13330	Sulphate resisting Portland Cement
383	Coarse and fine aggregates from natural sources for concrete
432 (Part 1& 2)	Mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement
456	Code of practice for plain and reinforced concrete
516	Method of test for strength of concrete
650	Standard sand for testing of cement
1199	Methods of sampling and analysis of concrete
1343	Code of practice for Pre-stressed concrete
1566	Hard-drawn steel wire fabric for concrete reinforcement
1786	High strength deformed steel bars and wires for concrete reinforcement
2386 (Part 1 to 8)	Methods of test for aggregates for concrete
2502	Code of practice for bending and fixing of bars for concrete reinforcement
2595	Code of practice for radiographic testing

BIS No.	Title
2645	Integral cement waterproofing compounds
3025	Methods of sampling and test (physical and chemical) for water used in industry
3085	Method of test for permeability of cement mortar & concrete
3370 (Part 1to 4)	Code of practice for concrete structures for the storage of liquids
3466	Masonry cement
3812	Fly ash for use as pozzolana and admixture
4031 (Part 1)	Methods of physical tests for hydraulic cement : Part 1 Determination of fineness by dry sieving
5816	Method of test for splitting tensile strength of concrete cylinders
6452	Specification for high alumina cement for structural use
7861 (Part 1)	Code of practice for extreme weather concreting : Part 1 Recommended practice for hot weather concreting
7861 (Part 2)	Code of practice for extreme weather concreting : Part 2 Recommended practice for cold weather concreting
8142	Method of test for determining setting time of concrete by penetration resistance
9012	Recommended practice for Concreting
9013	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens
9077	Code of practice for corrosion protection of steel reinforcement in RB and RCC construction
9103	Admixtures for concrete
9284	Method of test for abrasion resistance of concrete
10262	Recommended guidelines for concrete mix design
13311 (Part 1)	Non-destructive testing of concrete - Methods of test : Part 1 Ultrasonic pulse velocity
13311 (Part 2)	Non-destructive testing of concrete - Methods of test : Part 2 Rebound hammer
SP 20 (S &T)	Handbook on masonry design and construction
SP 21 (S &T)	Summaries of Indian Standards for building materials
SP 23 (S & T)	Handbook on concrete mixes (based on Indian Standards)
SP 24 (S & T)	Explanatory handbook on Indian Standard Code for plain and reinforced concrete
SP 34 (S & T)	Handbook on concrete reinforcement and detailing
3696 (Part 1)	Safety code of scaffolds and ladders : Part 1 Scaffolds
4014 Part 1 & 2	Code of practice for steel tubular scaffolding
2116	Sand for masonry mortars
2212	Code of practice for brick work
2250	Code of practice for preparation and use of masonry mortars
SP 25 (S & T)	Handbook on caused and prevention of cracks in building

BIS No.	Title
1123	Method of identification of natural building stones
1127	Recommendations for dimensions and workmanship of natural building stones for masonry work
1129	Recommendation for dressing of natural building stones
1597 (Part 1)	Code of practice for construction of stone masonry : Part 1 Rubble stone masonry
3622	Specification for sandstone (slab and tiles)
4101 (Part 1)	Code of practice for external facing and veneers : Part 1 Stone facing
303	Plywood for general purposes
4990	Plywood for concrete shuttering work
6313 (Part 1)	Code of practice for anti-termite measures in buildings : Part 1 Constructional measures
6313 (Part 2)	Code of practice for anti-termite measures in buildings : Part 2 Pre-constructional chemical treatment measures(first revision) (Amendments 3)
737	Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes
883	Design of structural timber in building - Code of practice
1003 (Part 1)	Timber panelled and glazed shutters : Part 1 Door shutters
1003 (Part 2)	Timber panelled and glazed shutters : Part 2 Window and ventilator shutters
1038	Steel doors, windows and ventilators
1081	Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators
1361	Steel windows for industrial buildings, ventilation blinds for windows
1826	Venation blinds for windows
1948	Aluminium doors, windows and ventilators
1977	Structural steel (ordinary quality)
2062	Steel for general structural purposes
2191 (Part 1)	Wooden flush door shutters (cellular and hollow core type) : Part 1 Plywood face panels
2202 (Part 1)	Wooden flush door shutters (solid core type) : Part 1 Plywood face panels
2202 (Part 2)	Wooden flush door shutters (solid core type) : Part 2 Particle board and hard board face panels
3548	Code of practice for glazing in building
3629	Specification for structural timber in building (first revision) (Reaffirmed 1991)
4020 (Parts 1-16)	Door shutters, method of test
4021	Timber door, window and ventilator frames
4351	Specification for steel door frames
4913	Code of practice for selection, installation and maintenance of

BIS No.	Title
	timber doors and windows
4962	Specification for wooden side sliding doors
5509	Fire retardant plywood
5539	Specification for preservative treated plywood
6248	Specification for metal rolling shutters and rolling grills
7205	Safety code for erection of structural steel work
7452	Hot-rolled steel sections for doors, windows and ventilators
12896	Classification of Indian timbers for door and window shutters and frames
2074	Ready mixed paint, air drying, red oxide-zinc chrome, priming
809	Rubber flooring materials for general purposes
1195	Bitumen mastic for flooring
1196	Code of practice for laying bitumen mastic flooring
1197	Code of practice for laying of rubber floors
1198	Code of practice for laying, fixing and maintenance of linoleum floor
1237	Cement concrete flooring tiles
1322	Bitumen felts for waterproofing and damp-proofing
1443	Code of practice for laying and finishing of cement concrete flooring tiles
1580	Bituminous compounds for water proofing and caulking purposes
1609	Code of practice for laying damp-proofing treatment using bitumen felts
1661	Code of practice for application of cement and cement-lime plaster finishes
2114	Code of practice for laying in-situ terrazzo floor finish
2571	Code of practice for laying in-situ cement concrete flooring
3384	Specification for bitumen primer for use in waterproofing and damp proofing
3414	Code of practice for design and installation of joints in buildings
3461	Specification for PVC - asbestos floor tiles
3462	Specification for unbacked flexible PVC flooring
3478	Specification for high density wood particle boards
3502	Steel Chequered plates
3629	Specification for structural timber in building
3670	Code of practice for construction of timber floors
4443	Code of practice for use of resin type chemical resistant mortars
4457	Ceramic unglazed vitreous acid resisting tile
4631	Code of practice for laying of epoxy resin floor toppings
4860	Acid resistant bricks
4971	Recommendations for selection of industrial floor finishes
5318	Code of practice for laying of flexible PVC sheet and tile flooring
5389	Code of practice for laying of hardwood parquet and wood block floors

BIS No.	Title
5491	Code of practice for laying of in-situ granolithic concrete flooring topping
9197	Epoxy resin, hardness and epoxy resin compositions for floor toppings
9472	Code of practice for laying mosaic parquet flooring
10440	Code of practice for construction of RB and RBC floors and roofs
459	Corrugated and semi-corrugated asbestos cement sheets
777	Glazed earthenware wall tiles
1414	Code of practice for fixing wall covering
1661	Code of practice for application of cement and cement-lime plaster finishes
1946	Code of practice for use of fixing devices in walls, ceilings and floors of solid construction
2095	Gypsum plaster boards
2098	Asbestos cement building boards
2402	Code of practice for external rendered finishes
2441	Code of practice for fixing ceiling covering
3630	Code of practice for construction of non-load bearing gypsum block partitions
4671	Expanded polystyrene for thermal insulation purposes
5390	Code of practice for construction of timber ceiling
5509	Fire retardant plywood
7316	Decorative plywood using plurality of veneers for decorative faces
1322	Bitumen felts for waterproofing and damp-proofing
1346	Code of practice for waterproofing of roofs with bitumen felts
1580	Bituminous compounds for water proofing and caulking purposes
1609	Code of practice for laying damp-proofing treatment using bitumen felts
1834	Hot applied sealing compound for joint in concrete
2508	Low density polyethylene films
2527	Code of practice for fixing rainwater gutters and down pipes for roof drainage
2645	Integral cement water proofing compounds
3037	Bitumen mastic for use in waterproofing of roofs
3067	Code of practice for general design details and preparatory work for damp-proofing and waterproofing of buildings
3384	Specification for bitumen primer for use in waterproofing and damp proofing
4365	Code of practice for application of bitumen mastic for water proofing of roofs
5871	Bitumen mastic for tanking and damp-proofing
6494	Code of practice for waterproofing of underground water reservoirs and swimming pools

BIS No.	Title
7198	Code of practice for damp-proofing using bitumen mastic
7290	Recommendations for use of polyethylene film for waterproofing of roofs
9759	Guidelines for dewatering during construction
13182	Waterproofing and damp-proofing of wet areas in building Recommendations
1172	Code of basic requirements of water supply, drainage and sanitation
1239 (Part 1)	Mild steel tubes, tubular and other wrought steel fittings : Part 1 Mild steel tubes
1536	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage
1537	Vertically cast iron pressure pipes for water, gas and sewage
1592	Asbestos cement pressure pipes
3114	Code of practice for laying of cast iron pipes
5822	Code of practice for welded steel pipes for water supply
1626 (Part 1)	Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings : Part 1 (Pipe and pipe fittings)
2064	Selection, installation an maintenance of sanitary appliances - Code of practice
2065	Code of practice for water supply in buildings
3076	Low density polyethylene pipes of potable water supplies; sewage and industrial effluents
4984	Specification for high density polyethylene pipes for potable water supplies; sewage and industrial effluents
4985	Specification for un-plasticized PVC pipes for potable water supplied
7634 (Part 2)	Code of practice for plastics pipe work for potable water supplies : Part 2 Laying and jointing polyethylene (PE) pipes
7634 (Part 3)	Code of practice for plastics pipe work for potable water supplies : Part 3 Laying and jointing of UPVC pipes
1916	Steel cylinder pipes with lining and coating
4127	Code of practice for laying of salt glazed stoneware pipes
12709	Glass fiber reinforced plastic pipes, joints and rings for potable water supply
3597	Concrete pipes-methods of test
7319	Perforated concrete pipes
NBC	National Building Code of India
SP 35 (S & T)	Handbook of water supply and drainage with special emphasis on plumbing
277	Galvanized steel sheet (plain and corrugated)
458	Precast concrete pipes (with and without reinforcement)
651	Salt glazed stoneware pipes and fittings

BIS No.	Title
782	Caulking lead
783	Code of Practice for laying of concrete pipes
1626 (Part 1)	Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings : Part 1 (Pipe and pipe fittings)
1726	Cast iron manhole covers and frames
1742	Code of Practice for building drainage
3006	Specification for chemically resistant glazed stoneware pipes and fittings
4111 (Parts 1 to 5)	Code of Practice for ancillary structures in sewerage system
4733	Methods of sampling and test for sewage effluents
12592 (Parts 1 & 2)	Precast manhole covers & frames
2470 (Parts 1 & 2)	Code of Practice for installation of septic tank
784	Pre-stressed concrete pipes
1893	Criteria for earthquake resistant design of structures
4326	Earthquake resistant design and construction of buildings- Code of practice
13920	Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice
13935	Repair and seismic strengthening of buildings - Guidelines
2190	Selection, installation and maintenance of first-aid fire extinguishers - Code of practice
3696 (Part 2)	Safety code of scaffolds and ladders : Part 2 Ladders
4912	Safety requirements for floor and wall openings, railings and toe boards
10005	S.I. units and recommendations for use of their multiples and of certain other units
6060	Code of practice for day lighting of factory buildings
3103	Code of practice for industrial ventilation
3483	Code of practice for noise reduction in industrial buildings
2440	Guide for day lighting of buildings
1200 (1 to 28)	Method of measurement of Building and Civil Engg. Works
7973	Code of practice for architectural and building working drawings
962	Code of practice for architectural and building drawings
13415	Code of safety for protective barrier in and around buildings
8969	Safety code for erection of concrete framed structures

In addition to the above-referred codes, CPHEEO manual on sewerage and sewage treatment and other relevant codes shall be applicable as per requirement. Copies of all relevant codes, reference literature shall have to be submitted to the Employer.

1.2.4 Samples and Tests of Materials

The Contractor shall submit samples of such materials as may be required by the Engineer-in-charge and shall carry out the specified tests directed by the Engineer-in-charge at the Site, at the supplier's premises or at a laboratory approved by the Engineer-in-charge. Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer-in-charge.

The cost of such test and material shall be borne by the contractor and nothing shall be paid on this account.

DETAILED TECHNICAL SPECIFICATION

DS 1

Excavation for foundation/pipeline trenches in earth, soils of all types, sand gravel & soft murum, hard murum, hard murum with boulder, soft rock and old cement and lime masonry foundation asphalt road, Hard strata including blasting or chiseling ..... Etc.

EXCAVATION IN ALL SOFT AND HARD STRATA MATERIAL

General The specifications contained in the standard specification volume IInd published by Public Works and Housing Department, Govt. of Maharashtra, Chapter Bd.A (1,A-2, A-3, A-4 & A-6 etc. on page No. 259) (Red Book) shall apply

The excavation shall be done to the required depth and section as per design drawing and as directed by Engineer-in-Charge. Extra depth shall be made up clear with concrete or other suitable materials as directed by Engineer-in-charge. At the cost of contractor. The excavated material shall be not be placed nearer than 300 m. from the edges of excavated portion. No. Compensation shall be admissible to the contractor due to any delay such as permission etc. After refilling of the trenches, the balanced stuff should be disposed off as directed. Refilling and disposal will be paid separately in relevant items if Schedule 'B'.

1.1 Site Clearance

The area to be excavated shall be cleared off. All trees and bushes and rubbish and other objectionable materials removed shall be burnt or disposed off as directed by the Engineer-in-Charge. The cost of such clearing shall be deemed to have been included in the rates accepted for different items under excavation.

During excavation, if masonry, concrete structure roots of trees etc are met with the same shall be removed without extra cost. The loss to public or private utility services such as telephone or electric cables/water mains or such other if comes across the trenches, shall have to be made good at the cost of the contractor. The permission for such crossing if required form the competent authority shall be obtained through Department. However delay in obtaining such permission shall not be considered as cause of delay for the works and no compensation shall be admissible to the contractor

due to such delay.

1.2 Dewatering

No distinction shall be made as to whether the material being excavated is dry, moist or wet. The item also includes bailing out of water manually to keep the trenches reasonably dry for all further works of concerning, lowering, laying & Jointing and testing of the pipe line till the completion of the work. Separate item of Dewatering is incorporated in the tender, if any ground water sources are met during excavation. No extra over the tendered provision shall be paid to contractor for this reason on any account.

1.3 SHORING AND STRUTTING

The item includes all shoring and strutting that may be required. On no account the width of trenches more than these mentioned here in after shall be measured. If excavation width more than the specified is required for the purpose of keeping machinery, steeping due to loose material or for any other reasons the same shall be at the Contractors cost.

1.4 Fencing, Lighting and Watching:-

The contractors shall made all proper arrangement for protecting the work by means of fencing, watching, and lighting at night, as directed by the Engineer-in-charge. The post of fencing shall be of timber, securely fixed in the ground not more than 3m. apart, and they shall not be less than 75 mm in diameter or less than 1.2 m. above the surface of the ground. There shall be two rails, one near the top of the posts and the other about 450 mm above the surface of the ground and each shall be from 50 mm to 70 mm in diameter and sufficiently long to run form post to post, to which they shall be bound with strong rope. The method of projecting not be allowed on any account. All along the edges of the excavated trenches a bank of earth about 1.20 m high shall be formed where required by the Engineer-in-charge for further protection. Proper provision shall be made for lighting at night and watchman shall be kept to see that this is properly done. In the event of the contractors not fully complying with the

provisions of these clauses, The Engineer-in-charge may put up a fence or improve the fence already put up or provide or improve the lighting or adopt such measures as he may deem necessary without prior intimation to the contractor and all the cost of such procedure as may be adopted by the Engineer-in-charge, shall be borne by the contractor.

In addition to the normal lighting arrangements, the contractor shall be provide, wherever a sewer work is in progress, battery operated linking lights (6 Volts) in the beginning and end of a trench with a view to provide suitable indication to the vehicular traffic. The contractor shall also provide and display special boards painted with fluorescent paints indicating the progress of the work along a particular road.

The items of excavation are including necessary lighting at night at suitable intervals, but not more than 15 meter along the excavated trenches and at all crossing and barricading the same by fencing so as to avoid the accident. Chowkidars shall be employed at place where the trenches cross over any traffic road to caution the vehicles and pedestrians etc. The arrangements shall be maintained till completion of work and at the cost of the Contractor.

1.5 Alignment and levels. :-

Before the excavation of trench is commenced, sight rails shall be erected at every 30 m. and at all points of change of direction, gradient and at ends. The excavation work shall be proceeded by a joint survey along with alignment of the main, to obtain ground level at every 30 m. or less distance. Temporary Bench Marks shall be constructed at every 300 m. distance along the alignment and shall be maintained till the completion of the work. All labour and materials for the survey work of fixing Bench Marks etc. shall be provided by the contractor at his own cost. Since the lines to be laid are drainage lines. The grade and level are very important factors. Those shall be maintained very carefully. For any mistakes in survey the Contractor is fully responsible. He should not lay the pipes, unless the alignment is thoroughly checked by the Engineer-in-Charge or his authorized representative who is empowered to sign the work order book in token of checking the exact grade and level

of the trenches excavation.

Excavation at random places shall not be measured by the SMKCEngineer. Any non-technical practices during the excavation of the contracted work shall be viewed very seriously by the SMKC and a note to that effect will be recorded against the Contractor in his name.

1.6 Depth and Grades of trenches:-

The trenches shall be excavated to the required grades and depth as shown on approved drawings or as directed by the Engineer-in-charge. If not so, the payment for the item will not be paid to the Contractor. The depths of excavation and the level of the pipe inverts shall be checked by means of boning rods of suitable lengths. Additional depths if required to be excavated for pits for sockets, collars, specials, joints, and for any other working facility shall not be measured and paid separately. The minimum cover above the pipe shall be 0.90 m. The bottom of trench shall be leveled both longitudinally land transversely and stepped as directed by Engineer-in-charge.

The Contractor shall notify the Engineer when the trenches are ready for bedding so that the Engineer can inspect and record the depth. Only on explicit approval by Engineer, the bedding shall be provided by the Contractor. If any public utility i.e. electrical cable, telephone cable, water connections, sewer connections, gutter damage etc. then same will be rectified by contractor at his own cost.

1.7 Width of trenches for excavation:-

The maximum width of trench allowable for different diameter of pipe sewer is given in the table below.

Sr.No.	Dia of Pipe	Lift 0.0 m. to 1.50 m.	Lift 1.5 m. to 3.00 m.	Lift 3.00 m. to 4.50 m.	Lift 4.50 m. to 6.00 m.	Lift beyond 6.00 m
1	150 mm	0.85 m	0.95 m	1.15 m	1.35 m	1.55 m
2	170 mm	0.87 m	0.97 m	1.17 m	1.37 m	1.57 m
3	200 mm	0.90 m	1.00 m	1.20 m	1.40 m	1.60 m
4	250 mm	0.95 m	1.05 m	1.25 m	1.45 m	1.65 m
5	300 mm	1.00 m.	1.10 m.	1.30 m.	1.50 m.	1.70 m
6	350 mm	1.05 m.	1.15 m.	1.35 m.	1.55 m.	1.75 m
7	400 mm	1.10 m.	1.20 m.	1.40 m.	1.60 m.	1.80 m
8	450 mm	1.15 m.	1.25 m	1.45 m	1.65 m	1.85 m
9	500 mm	1.20 m.	1.30 m.	1.50 m.	1.70 m.	1.90 m
10	600 mm	1.30 m.	1.40 m.	1.60 m.	1.80 m	2.00 m
11	700 mm	1.40 m.	1.50 m.	1.70 m.	1.90 m	2.10 m
12	800 mm	1.50 m.	1.60 m.	1.80 m	2.00 m	2.20 m
13	900 mm	1.60 m.	1.70 m.	1.90 m	2.10 m	2.30 m
14	1000 mm	1.70 m.	1.80 m.	2.00 m	2.20 m	2.40 m
15	1100 mm	1.80 m.	1.90 m.	2.10 m	2.30 m	2.50 m
16	1200 mm	1.90 m.	2.00 m	2.20 m	2.40 m	2.60 m

The offset for width is allowable for every additional depth of trenches as tabulated for soft strata only. Sides of the trenches shall be as nearly vertical as possible. The bottom of the trench shall be flat side to side.

The maximum width as mentioned in the table of different depth of trenches or the actual width whichever is less shall be taken into account for measurement and payment. No. extra width is allowable due to large quantity or big boulders met with in the trenches Dressing and consolidation of the trenches.

The bed of the trenches shall be well rammed before laying of the murum or sand for bedding hollows, if any, shall be filled with murum duly rammed and watered

to required level and grade at cost of the Contractor.

The contractor shall properly assess the work involved in above description and quote accordingly. The Executive Engineer's decision regarding any of the issue of scope of work here in and rates payable shall be final, conclusive and binding on contractor.

Any damages to the telephone cables / electrical cables shall be borne by the contractor, if demanded by the concerned authority. The cost of damages shall be directly paid by the Executive Engineer to the authority and such amounts shall be recoverable from the contractor through his due payments/ security deposits. In case water mains is damaged by the contractor during execution and quantity of water is wasted due to his negligence, that amount of wastage of water shall be recoverable from the contractor as per the SMKC's water rate prevailing at the time of execution through his running bill.

For excavated width whichever is less shall be recorded and paid for. Extra widths for pits at sockets, collars, specials, joints, construction and also for working liabilities shall neither be measured nor paid for. However, excavation required for providing and casting fixity block, thrust blocks, encasing etc. will be measured and paid for under relevant item of excavation. The pits for welding joints will also be paid under relevant item of excavation.

1.8 CLASSIFICATION OF MATERIALS IN TRENCHES

The exact classification of the strata met with during the excavation shall be done by the representative of Engineer-in-Charge and accordingly measurement shall be recorded under different items of excavation provided under Annexure to Clause-38 of tender for the purpose of excess quantity. In case of any, dispute regarding classification of strata, the decision of Engineer-in-Charge shall be final and binding. The strata classifications and its quantity shown are indicative only. The Contractor therefore, shall carry out his own assessment regarding the strata at different depth along the alignment, before submission of the tender.

1.9 Disposal of Surplus Stuff:-

The contractor shall carefully excavate the road surfaces and stack the

materials obtained from for road surface cutting systematically for selectively reusing the same for remarking the road. At times it may be necessary for the contractor to remove the excavated stuff to a suitable destination away from the excavation work. This stuff stacked as directed within 50 m. lead shall be brought back for refilling by the contractor without any extra payment on this account.

The excavated stuff remaining in balance after refilling and remaking of road shall be conveyed, unloaded and leveled by the contractor at a destination as directed by Engineer-in-charge within a radius of 5 Kms form site of work. The same shall be paid to the contractor separately under relevant item of Schedule 'B' if it is seen that the surplus excavated stuff is being sold by the agency the agency will be penalized as decided by the Engineer-In-Charge.

1.10 EXCAVATION BY CHISELLING MECHANICAL MEANS (In Hard Strata)

Excavation in hard strata shall be done by chiseling, wedging or line drilling as specified any mechanical all means or ordered by the Engineer. The excavation refers to excavation generally for foundation, wet or dry, in hard rock by chiseling, wedging or line drilling and shall comply with the specifications. The maximum width of the trenches admissible for payment shall be as under

Sr. No.	Internal dia of pipe	Width of excavation of trenches	Nature of strata
1.	80 mm and below	0.70 M	In soft and hard material
2.	100 m	0.75 M	In soft and hard material
3.	150 mm	0.75 M	In soft and hard material
4.	200 mm	0.85 M	In soft and hard material
5.	250 mm	0.85 M	In soft and hard material
6.	300 mm	0.90 M	In soft and hard material
7.	350 mm	0.95 M	In soft and hard material
8.	400 mm	1.10 M	In soft and hard material
9.	450 mm	1.15 M	In soft and hard material
10.	500 mm	1.20 M	In soft and hard material
11.	550 mm	1.25 M	In soft and hard material
12.	600 mm	1.25 M	In soft and hard material
13.	700 mm	1.30 M	In soft and hard material

14.	750 mm	1.40 M	In soft and hard material
15.	More than 750 mm	OD + 0.60 M	In soft and hard material

1.11 MODE OF MEASUREMENT AND PAYMENT

The excavation shall be measured in Cubic meters only. Dimensions shall be measured correct to two decimal of meter and quantity shall be calculated to two places of Decimal of Cubic meters. The item mentioned in Schedule-B in which includes disposing excess excavated material remained after refilling will not be paid separately for disposing excavated material.

DS2

Open timbering in trench ……..etc. complete.

Providing and fixing approved type of shoring …….etc. complete.

The item shall comply as per relevant item of Schedule 'B' as per standard specification of latest Edition of Red Book and N.B.O. Item No.4, 15 page No. 59. This item shall be executed with prior permission of Superintending Engineer.

When the depth of trench required to be excavated is more than 1.5 M. and the strata met with is unstable, timbering of trenches shall be done to prevent caving or collapse of side walls. Precautions to prevent extensive caving shall be adopted for minimizing danger when the depths exceed 1.5 m as stated above. Only in such cases, the timbering shall be done from top to bottom of the trench.

The sheeting and the other members like polling Boards, struts walling shall be strong enough to withstand against the soil pressure. Timbering shall be done only at the required places. The location of timbering is required to be carried out shall necessarily be approved and finalized by competent authority. Timbering unnecessary provided shall not be measured and paid for. The contractor shall take photographs of timbering work done by him at his own cost and shall be submitted to the Department from time to time.

2.1 Shoring:-

Wherever shoring May deemed necessary by the Engineer-in-charge the contractor shall provide the same in the best possible manner with the best materials

and to the satisfaction of the Engineer-in-charge. The contractor shall employ such kinds or kinds of shoring as the Engineer-in-charge any consider the exigencies of the work of require and it is to be distinctly understood that the work „shoring" is to comprise all clauses of such work and all appliances and appurtenances including polling boards, sheet piling of runners (Whether the joints be butt, groove and tongue, feather edge and groove, birds mouth and double splay, rebated or otherwise), together with walling struts prop, point blank shores, blocks, wedges, iron dog, bolts, screws, nails and everything that may be required for due execution of the work. No part of the shoring shall at any time be removed by the contractor without obtaining permission from the Engineer-in-charge. While taking out shoring plank the hollows if any, formed must simultaneously be filed in with of earth well rammed with rammers and with water.

2.2 Shoring left in trenches:-

The Engineer-in-charge may order portions of shoring to be left in the trenches at such places, where it is found absolutely necessary to do so as to avoid any damages which may be caused to building cables, gas-mains water mains, sewers etc. in close proximity of the excavation, by pulling out the shoring from the excavations. No extra payment shall be made to the contractor on account of shoring left in trench.

2.3 Engineer-in-charge may put up or improve shoring:-

In the event of the contractors not complying with the provisions of this contract in respect of shoring, already put up or adopt such other measures as he may deem necessary and all the cost of such procedures adopted by the Engineer-in-charge shall be borne by the contractor.

2.4 Liability for Timbering:-

a) No work done by the Engineer-in-charge or his workmen for the fact that the timbering has complied with his specification shall absolve the contractor from his responsibility and he will be responsible for making good any damage caused as a result of the timbering failing to give proper support to the sides of the Excavation.

b) The timbering to the sides of excavation for structures shall be carried out in such a way that there is no obstruction caused to the work. The supporting struts and walling

shall be removed by the contractor in stages to suit the progress of work.

c) If the Engineer-in-charge is not satisfied that the standard of timbering is equal to that the sides of the excavation have not been secured in a manner to render such excavating safe for working, he may, one hour after notifying the contractor or his representative in writing, employ his own men to alter the timbering and the cost of such workman and materials employed shall be paid for by the contractors.

2.5 Contractor's responsibility for secure shoring and or all damages:-

The contractors will be held responsible for providing secure shoring and for adopting every other precaution which may be necessary or proper for protecting and building which may be damaged or be liable to damage by the excavation of any trench or otherwise by the excavation of the works in the vicinity of such building. If the Engineer-in-charge shall require the adoption of any special or extra measures or precautions the contractors shall forth with adopt & supply the same but this proportion is not to be read or understood as in any degree of relieving the contractors from responsibility or from liability under relevant clause contract, in respect of claims made against the department by for loss or damage which may be caused to any such building by the excavation of any of the works or otherwise. After the work is completed near buildings, the contractors shall remove any shoring and make good any cutting out or other damage that may have been done.

2.6 Mode of Payment:-

The item shall be measured and paid for on square meter basis. The area shall be calculated by considering the length and height of open timbering and shoring provided for each side of trench separately. The timbering shall be paid to the extent of 85% only after its objective of protecting the excavation till the lowering, laying, jointing, testing of the sewer line is completed and the section is refilled. 15% payment shall be made after the zone completion

DS 3

Providing, lowering, laying and jointing DWC HDPE Pipes …… etc. complete.

The pipes and fittings shall be manufactured out of virgin PE material as per ISO 21138 - 2007 or latest edition. The pipes shall be manufactured out of PE 100 grade com-

pounded resin. The factory testing of pipes shall be carried out as specified in ISO 21138.

The resin used shall be tested through third party inspection agencies like Bodycote and according to the specification for the resins.

No recycled material shall be used in manufacturing.

The stiffness class as mentioned in the BoQ shall be followed.

The jointing material shall be SBR or EPDM rubber ring with socket and spigot type of joints.

The laying and jointing shall be carried out as per relevant IS - 16098 duly applying the following sections

Transportation –

Annex A -1

Handling A-2

Pipe Storage site A-3

Construction methods a-4

Table 21 min. trench width

Table 22 minimum cover

A 4.1.2.4 Bedding

A 4.4.2.2 Underground services

A 4.1.2.3 Dewatering

A 4.2.2 Jointing

A 4.2.4 Sewer connections

1. Annex B

Structural Design.

2. Annex C

Determination of oxidation Induction Time

3. Annex D

Methods for visually assessing the effects of heating.

4. Annex E

Test method for mechanical strength or flexibility of fabricated fitting

5. Annex F

Water tightness of joints.

6. Annex G
Test methods for resistance to combined temp. Cycling and external loading.

3.1 DWC Pipes for use in underground Sewerage System

3.1.1 Technical Specification

Class SN 8 Structured Double Wall (Non-Smooth External Annular Corrugated wall & Smooth Internal wall) Polyethylene Piping System for non-pressure underground Sewerage & Drainage Applications.

3.1.2 Scope

This specification covers the requirements for manufacturing, supplying, transportation, handling, stacking, installation, jointing, and testing of Class SN 8 Structured Double Wall (Non-Smooth External Annular Corrugated wall & Smooth Internal wall) Polyethylene Piping System for non-pressure underground Sewerage & Drainage Applications herein after called the DWC PE Piping System.

3.1.3 Applicable Codes

The manufacturing, testing at factory, supplying, transportation, handling, stacking, installation, jointing, and testing at sites shall comply with all currently applicable statutes, manuals, regulation, standards & codes. In particular, in addition to all relevant National Standards, following International standards with latest revisions shall be referred. If requirements of these specifications are at variance with any other standards, this particular document shall govern the proceedings.

I) EN 13476-1

Plastics piping Systems for non-pressure underground drainage and sewerage Structured-wall piping systems of Polyethylene (PE) Part 1: General requirements and performance characteristics.

II) EN 13476-3

Plastics piping Systems for non-pressure underground drainage and sewerage Structured-wall piping systems of Polyethylene (PE) Part 3: Specifications for pipes and fittings with smooth internal and profiled external surface and the system, Type B Other International Codes / Standards (EN/ ISO) which are integral part of above two standards as normative references form a significant portion of this specification document.

3.1.4 Manufacturing

The DWC PE Piping System of stiffness class designation SN 8 shall confirm to the European Union standards as mentioned above and shall be configured as per the indicative Cross-sectional Drawing annexed herewith. Each pipe shall be coupler (on-line or off-line) and spigot type along with rubber sealing ring (as designated under above international specifications)

3.1.5 Transportation

The arrangement of loading the pipes in a telescopic manner is advised, i.e. smaller diameters inserted into the next higher sizes of pipes. While loading the pipes onto the truck, care should be taken that the coupler- end should be arranged alternatively in the corresponding layers so as to avoid the damage to the coupling/ socket ends.

3.1.6 Handling

Following Recommendations shall be followed while handling the pipes: Adherence to National Safety requirements Pipes to be smoothly lowered to the ground Pipes should not be dragged against the ground to avoid the damages to the Coupler/pipes.800mm and larger diameter pipes are carried with Slings at two points spaced approximately at 3 Meters apart For smaller diameters (400mm 800mm) one lift point shall be sufficient & can be handled either manually or mechanically Do not use a loading Boom or Fork Lift directly on or inside pipe.

3.1.7 Pipe Storage at Site

Stockpiling shall be done temporarily on a Flat Clear Area as per Fig. 1 & 2.For avoiding collapse of Stacks, use Wooden Posts or Blocks Stacking shall not be higher than 2.5 Meters While stacking, alternate the socket/coupler ends at each row of stacked pipes as per Fig. 2.Lowering, Laying & jointing of Pipes The width of a Sewer Trench depends on the soil condition, type of side protection needed and the working space required at the bottom of Trench for smooth installations. Increase in width over required minimum would unduly increase the load on pipe and cost of road restoration. Considering all above factors, the Minimum Trench Width is specified as per Table below:-Indicative Minimum Trench Widths.

Pipe Diameter (mm)	Trench Width (M)

75-170	0.6
250	0.7
400	0.9
600	1.2
800	1.3
1000	1.8

In actual practice the trench width can be as narrow as possible but adequate to allow the workmen to execute the job satisfactorily. The pipe segment between two manholes shall be laid approximately in straight line without any vertical undulations. However, on the strength of its flexibility, the DWC PE Piping system can be laid in very smooth curve if found necessary. The piping system shall rest on the carefully prepared bedding portion of the Backfill Envelope (ref fig. III, Annexure I) and at appropriate jointing locations the trenches shall be excavated deeper to accommodate the bulges of coupler-spigot joints. However, special care shall be ensured as mentioned below:-

Excavation of trenches shall be carried out in accordance with the drawing & specifications and as directed by the field engineer as well. The piping system shall be laid and jointed in true to gradient with the help of sight rails and boning rods as detailed in CPHEEO, MoUD, GoI Manual on Sewerage and sewerage treatment. The levels need be checked with calibrated modern Levelling Instrument. Specific care shall be taken to prevent entry of sand / mud /slush/ any other foreign material etc. into the system during the installation operation. The structural property of the system suggests that a minimum cover of 300 mm adequate even for maximum quantum of superimposed (live) load. In case of wider trenches than required (above table), the permission of the competent authority shall be necessary.

The bedding area (ref. fig. III) is an essential portion of Back fill Envelope and shall be constructed with proper bedding material as computed in accordance with appropriate international code of practice for structural bedding design mentioned in the list of normative references under EN 13476.The bedding shall be laid to specified thickness and gradient with proper manual compaction of the aggregate.

The moulded on-line coupler (or separate coupler integrated to the pipe in case of lower sizes) will have a suitable internal surface for push-fitting the said end over the spigot end of the next pipe. On first valley of the corrugation of said spigot end

(destined to receive the pushed coupler) the sealing rubber ring of standard (EN 13476) quality shall be placed so that the coupler end of the pipe smoothly but tightly slides over the sealing ring for making an absolute watertight joint. Similar system is also used for fabricated accessories or moulded fittings required such as Tee, Bends, Elbows, Reducer end caps for the purpose of installation of the system related to drainage/sewerage.

3.1.8 Jointing

For quality connections following steps are to be ensured, failing which the performance aspects are to be severely compromised:-

The non-coupler (socket) end needs to be thoroughly cleared and shall be free from any foreign material Clean and lubricate the coupler end of the pipe, if required Lubricate the exposed Gasket in the same manner, if required. Keep the non-coupler end free from dirt, backfill material, and foreign matter so that the joint integrity is not compromised. Push the coupler into non-coupler and align properly. Always push coupler end into non-coupler end. For smaller diameter pipes simple manual insertion shall be sufficient. It should be ensured that the coup -coupler end to ensure installation and tight joining seal. Therefore prior to insertion always place 'homing mark 'on appropriate corrugation of non-coupler end. Construction of backfill envelope and final backfilling of the trenches DWC PE Piping System with well compacted Backfill Envelope along with the bottom and sides of trench (native soil) work together to support soil overburden and superimposed (traffic) loads. The carefully constructed Backfill Envelop has three distinct but non-isolated stages (Ref. enclosed C/S Drawing III, Annexure I).The construction need to be done stage by stage as per the sequence stated below:

- Bedding portion
- Up to Haunch level
- Remaining portion

The material for backfill envelop shall be in accordance with the structural design of flexible buried conduit as per relevant international codes mentioned in the list of Standards as normative references of EN 13476 /1 & 3. It can be the same material that were removed in the course of excavation or it can be fine sand/course sand/gravel / murum /other form of course / fine aggregates depending on the affected Design Load [Overburden + Superimposed (Live) load]. However, in no circumstances, the flexible pipe should not be embedded in cement concrete (un-reinforced or reinforced) which invariably induces undesired rigidity in the system. The remaining portion of backfilling which do not contribute to the structural integrity of the system may be the materials that were removed in the course of excavation or any other foreign material as may be required to suit the particular site condition. These materials shall consist of at least clean earth and shall be free from large clod or stone above 75 mm, ashes, refuse and other injurious materials. After completion of lying of

pipes, etc., first the Backfill Envelope shall be constructed as per design around the pipe. Voids must be eliminated by knifing under and around pipe or by some other indigenous tools. The compaction, by hand rammers or compactors with necessary watering to a possible maximum level of proctor density shall be ensured. Backfilling shall start only after ensuring the water tightness test of joints for the concerned sewer segments. However, partial filling may be done keeping the joints open. Precautions shall be taken against floatation (if at all necessary) as per the specified methodology and the minimum required cover for indicative.

3.2 Continuity Test /Hydraulic Testing

Continuity of the pipe segments in between two manholes is required to be ensured in the same modality as practiced for non-pressure RCC pipeline. Hydraulic testing of pipes shall be done, if specifically asked for by the client for any specific stretch. The procedure for hydraulic testing shall be similar to that for non-pressure RCC pipes.

Hydraulic testing of pipes shall be done, if specifically asked for by the client for any specific stretch. The procedure for hydraulic testing shall be similar to that for non-pressure RCC pipes.

3.3 Measurements:

The lengths of pipe shall be measured in the running meters nearest to a cm as laid, lowered and jointed from inside of one manhole to the inside of the other manhole. The length shall be taken along the entire line of the pipes. All fittings such as bends, junction, etc., which shall not be measured separately. Excavation, refilling, shoring and timbering in trenches and cement concreting where ever required shall be measured separately under relevant item of work.

Security money for testing should be kept at 10 % of the value of the work.

After testing of the complete sewerage system to the satisfaction of the engineer in-charge the same shall be released.

Rate

The rate shall include the cost of material and labour involved in all the operation described above including the cost of concrete which shall be paid separately.

Note:

1) In case of item of supply of pipes, valves, specials etc, 80% amount of supplied item will be paid to the contractor on receipt of material (after satisfactory third

party inspection), 10% amount will be released after lowering, laying, jointing and remaining 10 % amount will be released after satisfactory hydraulic testing.

2) **10% cost of item included in pipeline sub work excluding supply items (pipes, all types of valves and Specials) shall be retained till satisfactory hydraulic testing is give as per tender specification.**

DS 4

Providing, lowering, laying and jointing ISI std. Mark R.C.C.Spun Pipes ……etc. complete.

The relevant item shall comply as per Schedule 'B'

Contractor shall provide R.C.C. S/S Spun Pipes of required diameter and class in standard length as per schedule conforming to latest version of I.S. 458/1956 and the materials required for manufacturing of pipes such as cement shall confirm to I.S. 269 of latest version, sand or fine aggregate and coarse aggregate shall confirm to I.S. 383 of latest version reinforcement shall confirm to I.S. 432,1786, 1566, 1139, and 226 of latest version R.C.C. work shall confirm to I.S. 456 – 2000, and rubber rings shall be confirm to latest version I.S. The contractor shall supply all the latest I.S. codes related to this item to the Department at his cost.

The pipes supplied by the contractor shall be transported from factory & stacked along the alignments of the line in such a way that no hindrance is created to the traffic / pedestrians. Cracked / damaged pipes shall be rejected outright. Damaged pipe shall not be allowed to be transported at work site. If it happens contractor shall be penalized for such activities in terms of fine as decided by the Engineer-In-Charge. Contractor should take prior permission from Engineer - in - charge before placing the order for RCC Spun pipes. The work is to be carried out zone by zone and in no case pipes required for other zones than the one in which work is going on shall be ordered or brought to site. The work in one zone shall be completed including house connections, commissioned and then only the work for other shall be taken in hand.

After supply of R.C.C. Spun Pipes and rubber rings at the site of work by the contractor, the same material shall be issued to the contractor on "Unstamped Receipt." Record of consumptions and balance shall be maintained and shall be kept in

the custody of Department. One rubber ring shall be supplied with each full length socketed pipe at the site of work and the contractor at his own cost shall submit certificate of testing for the same. The contractor at his own cost shall keep the material at site with chowkidar. The site Engineer can checked the balance material any time at site store of the contractor, if any shortage is found, the cost of Short materials with penal rate shall be recovered through R.A. Bill of contractor in single installment without any excuse after the pipes are supplied by the contractor, the responsibility of security and safety shall still rest with the contractor till the pipes are laid, jointed and tested commissioned and the work completed and taken over by the MC.

The pipe shall be laid to line, levels and slopes as indicated on the drawings or as directed by the Engineer, Sight rails or leveling instruments in sufficient numbers shall be provided for this purpose by the contractor.

The pipe shall be laid to line, levels and slopes as indicated on the drawings or as directed by the Engineer. Sight rails or leveling instruments of sufficient numbers shall be provided for this purpose by the contractor.

The handling laying of the concrete pipes shall confirm to IS – 783– 1959 (relevant para) the joints shall be done as per paragraph 10.2.3.1 of I.S. 783 – 1959. Any pipe damaged during laying shall be replaced by the contractor at his cost proper alignments tools and facilities shall be provided by the contractor for lowering the pipes, fittings in to trenches to prevent damage. Dumping shall not be permitted. Chain pulley block may be used for pipes above 300 mm. diameter.

All joints shall be done leak proof by providing spun yarn in C.M. 1:1 with Hardcrete. The leaking Joint found shall be made water tight at the cost of contractor.

No materials shall be supplied by SMKC for manufacturing of R.C.C. Spun pipes and any other allied works.

The pipe shall be inspected, as per relevant latest I.S.S. by Third Party Inspection (TPI) agency approved by the ULB and enlisted with MJP and certificate to that extent shall be produced by the contractor. The charges of TPI are deemed to have

been included in the rates. The payment of RCC Spun Pipes shall not be made till receipt of TPI certificate. The seal of TPI agency shall be embossed inside portion of each pipe after inspection including the details such as date of manufacturing, batch no. class and diameter of pipe and name of ULB.

4.1 Sight rails and boning staves:-

In laying the pipe sewers, the center for each manhole must be marked by a peg, or otherwise, as may be determined by the Engineer. The contractors are then to dig holes for and set up two posts (about 100 mm x 100 mm x 1800 mm) at each manhole at nearly equal distance from the peg and a sufficient distances there from to be well clear of all intended excavation, so arranged that a sight rail when fixed level against the post will cross the center of manhole. The posts must also be so set up that the longitudinal direction of the rail may be as clear as possible of the direction of any of the lines of pipes or drains converging to the manhole. If walls of building afford suitable means of fixing the sight-rail, the post may, however be dispensed with. The sight rails must not in any case be more than 30 M. apart. Intermediate rails therefore are put up if necessary.

4.2 Construction of boning staves:-

Boning staves shall be prepared by the contractors about 75 mm x 50 mm made of a square section of various length, each length being of a certain fraction of meter and with a fixed tee – head and a fixed intermediate cross piece, each about 300 mm. long. The top edge of the cross piece must be fixed at distance below the top edge of this tee-head, equal to as the case may be, the outside diameter of the pipe or thickness of the concrete bed to be laid. The boning staff must be marked on both sides to indicate its full length. According to the circumstances of each case, a suitable length of boning staff will be determined upon, and the reduced level of the bed of the pipe or bottom of concrete of drain at each added to the selected boning staff will be marked by a horizontal line on both posts, or on walls or fences to which the sight-rail is to be fixed.

4.3Sites Rails:-

a) The sight-rails (about 25 cm wide and 40 mm thick) is to be screwed with the top edge against the level marks. The centerline of the pipe sewer or the drain will be

marked on the rail and this mark will denote the meeting point of the centerlines of any converging drains or pipe sewers. A line drawn from the top edge of one rail to the top edge of the next rail will be vertically parallel with the bed of the sewer or drain and the depth of the bed of the sewer or drain at any intermediate point may be easily determined by letting down the selected boning staff until the tee head comes in the line of sight from rail to rail.

b) The posts and rails are to be perfectly square and smooth on all sides and edges. The rails are to be painted with white oil paint on both sides, and the tee heads and cross piece of the boning staves are to be painted with black oil paint.

c) If the pipes of drains converging to a manhole coming at various levels, there must be rail fixed for every different level when a rail comes within 0.60 M. of the surface of the ground, a higher sight – rail must be fixed for use with the rail over the next point.

d) The posts and rails must in no case be removed until the trenches is excavated, the drains are constructed or the pipes are laid and permission given to proceed with the filling in.

4.4 Laying of RCC Pipes:-

a) The pipes are to be laid with socket facing up the gradients beginning at the lower end. No pipe to be laid until the trench has been excavated its required depth for distance of 20 m. in front of the pipe to be laid (This distance may very as directed by the Engineer In Charge)

b) All the pipes are to be laid perfectly, both in line and gradient. The pipes in a trench shall be laid and fitted previous to the jointing being commenced.

c) Properly fitted temporary wooden stoppers shall be provided and constantly used to close the ends of all in completed pipelines. The stoppers are only to be removed when pipes are being laid and jointed.

4.5 Jointing R.C.C. Pipes:-

a) Each concrete pipes with the rubber rings accurately positioned on the spigot shall be pushed well into the socket of the previously laid pipe by means of uniformly applied pressure with the aid of a jack or similar appliance.

b) Concrete pipes of the spigot and socket type with roll on rubber rings shall be used, and the manufacturer's instructions shall be deemed to form a part of this specification.

c) Rubber rings shall be lubricated before making the joint and the lubricant shall only be soft soap water or an approved lubricant supplied by the manufacture.

d) In case of R.C.C. pipe entering or leaving a manhole a flexible joint may be provided at least within 0.60 m. from the outer end of the manhole.

e) A drop in water level of not more than 50 mm in one hour shall be permitted, in case of hydraulic test of manhole.

4.6 All works to be water tight:-

a) The drains, manholes and all joints of pipes must be made thoroughly sound and water tight and if any joint which is proved to be leakage at any time during the progress of works or during the contractors subsequent period of maintenance shall be immediately made sound by the contractors at their own expenses. The contractors shall at their own cost prove all works to be water tight for filling it with water to such a height as desire by the Engineer-In-Charge. Any additional precautionary measures or appliances that may be found necessary to ensure the water tight joints of pipes shall be adopted by the contractor without extra charges, the responsibility of making them complete watertight rest with the contractor. Hardcrete shall only be used for preparing mortar for jointing of RCC Spun Pipes.

b) Immediately after the test with the double disc or cylinder has been completed and any defect hereby disclosed have to be made good, the contractor shall prove the joints of the stretch of the under-ground pipe whether of stoneware, Cast iron or R.C.C. Pipes, to be water tight by the filling in pipes with water before filling in the trenches to the level of 1.5 M. above top of the highest pipe in the stretch and heading the water up for the period of one hour of such further time as the Engineer may direct. The apparatus used for the purpose of testing shall be approved by the Engineer. The contractor, if required by the Engineer, shall pump the excavation dry and keep it so during the period of testing. No test applied at part of a stretch when complete. The loss of water over a period of 30 minutes should be measured adding water from a measuring vessel at regular 10 minutes interval, and

noting the quantity required to maintain the original water level. (For purpose of this test, the average quantity added should not excess 1 liter / hour / 100 liner meters/ 10 of nominal internal diameter.)

Any leakages including excessive sweating which cause a drop in the test water level will be visible and the defective part of the work should be removed and made good. The testing of laid pipeline shall be given as per specification CPHEEO manual for sewer work.

4.7 Inspection of the joints:-

After the joints of any pipes in underground work have thoroughly set the Engineer (or any person whom he may appoint) may inspect the joints and if he has any doubt at their soundness contractor shall arrange to cut, open and clean away the cement as the case may be of any joint, that he may select and to make good the same at their expense provided that unless defect to be found, they shall not be required to open more than one joint in 20 M. of pipes though if the defect be found the Engineer may direct them to open as many joints as may seem necessary.

4.8 Cleaning of the pipes:-

a) As soon as stretch of R.C.C. Spun pipes has been laid complete from manhole, the contractor shall run through the pipes both back words and forwards a double disc or solid or closed cylinder 75 mm or less in diameter than the internal diameter of the pipes. The open end of an incomplete stretch of pipe line shall be securely closed as may be directed by the Engineer to prevent entry of mud or silt or any foreign material etc.

b) If, as a result of the removal of the obstruction, the Engineer considers that damages may have been caused to the pipe shall be entitled to order the length to be retest at the expense of the contractor. If such retest prove unsatisfactory, the contractor shall amend the work and carry out such further tests as are required by the Engineer, at his own expenses.

c) It shall also be ascertained by the contractor that each stretch from manhole to manhole is absolute clear and without any obstruction visual examination of the in-

terior of the pipe line suitably enlightened by the projected sunlight or other means.

4.9 Fracture of Pipes:-

a) In the events of pipes being fractured at the time of laying, refilling due to dumping of the material for refilling have been improperly selected or any other causes, the contractor in every instance will be held responsible and will be called up to replace the defective pipes at his own cost, if such defect appears before the expiration of the period of maintenance.

b) Any pipe or length of pipe found to be defective shall be immediately removed and replaced at the contractor's expense, and leaking joints shall be remade, the inspections tests shall then be repeated as often as necessary, until the whole line under inspection or test is accepted by the Engineer.

4.10 All Works to be cleared clean and perfect:-

a) The contractor, shall after completion or whenever required by the Engineer, prove all pipes and fittings to be clear, clean and perfect, and for this purpose shall, at their own expense and in the presence of the Engineer, or his appointee provide suitable instruments and appliances and pass then through the pipes and shall if required, through in water and show that it passed freely through every portion of the work. Brick mortar and rubbish shall not be allowed to fall into the manholes or sewer lines while fixing or if allowed shall be removed by the contractor at their own expenses.

4.11 Mode of Payment (DWC/ RCC Pipe)

For Supply of Pipes

a) 80% payment will be made against supply of DWC or S/S R.C.C. Spun pipes with rubber rings at site along with inspection certificates from TPI agency. 10 % payment will be made after lowering, laying, jointing, & Remaining 10 % after satisfactory water tightness testing of the laid pipe line, property connections, and commissioning of the complete zone is completed. The item shall be measured and paid for one running meter length of actual pipeline laid.

Note:

1) In case of item of supply of pipes, valves, specials etc, 80% amount of supplied item will be paid to the contractor on receipt of material (after satisfactory third party inspection), 10% amount will be released after lowering, laying, jointing and remaining 10 % amount will be released after satisfactory hydraulic testing.

2) **10% cost of item included in pipeline sub work excluding supply items (pipes, all types of valves and Specials) shall be retained till satisfactory hydraulic testing is give as per tender specification.**

For Laying of Pipes

a) 85 % payment shall be made after lowering, laying & jointing R.C.C. Spun pipes and 15 % payment shall be released after satisfactory water tightness test of the laid pipeline, property connections, and commissioning of the complete zone is completed. The item shall be measured and paid for one running meter length of actual pipeline laid.

DS 5

Providing and constructing B.B. Masonry circular Manhole chamber…….etc. completed.

The item includes excavation in all types of strata for all lifts, P.C.C. for foundation in M-150 grade of various thickness B.B. Masonry in 1:3 proportion of various thickness ranging from 23 cm to 46 cm as per type design, R.C.C. slab in M-150 grade including cost of reinforcement, 20 mm thick cement plaster in two coats in C.M. 1:3 proportion from inside and outside, top C.C. coping in – 150 grade (1:2:4) providing and fixing C.I. Dapuri steps or P.V.C. coated of approved make steps at 0.30 m c/c, refilling, disposal of surplus excavated stuff up to 5 Kms. Lead including curing, testing etc. complete as directed.

Following specifications contained in standard specifications book (Red Book) shall apply.

i)	Excavation in all type of strata.	Bd-A-1 to A-6 on Page No. 259
ii)	P.C.C. 1:2:4 (M-50 grade)	Bd-E-1 Page No. 287
iii)	R.C.C. Work such as slab etc.	Bd-G-1 Page No. 313
iv)	R.C.C. work such as slab etc.	Bd-F-3,22,23 & 24 on Page No. 282,292 & 293.
v)	Reinforcement	Bd-F-17 Page No. 306
vi)	20mm thick cement plaster in C.M. 1:3	Bd-L-5 Page No. 368
vii)	Refilling.	Bd-A-10 Page No. 263

Slab shall be provided at intermediate stage as per type drawing. The intermediate slab is to be cast in situ. The reinforcement in this slab is expected to be around 1% of concrete volume and design of reinforcement shall be given by contractor and got approved by Executive Engineer. The frame and cover for the top slab (Manhole) should be of Steel Fibber Reinforced Concrete (S.F.R.C.) of Bharat, Pratibha and K.K. Technology. The brochure of S.F.R.C. frame and cover shall be submitted by the contractor and got approved from Engineer-in-charge. The frame and cover shall be branded with the letter 'A.M.C.'

Kiln burnt bricks for manhole of approved quality only be used and shall be got approved from Engineer-in-charge. The samples of bricks shall be tested as per I.S. for various test in Government Engineering College. The testing certificate shall be produced by the contractor at his own cost. No. extra payment shall be made to the contractor on account of testing including transportation of samples etc. All the materials such as cement, bricks, aggregate, frame and cover, steps etc. shall be brought at the site of work at the cost of contractor.

The detailed specification for materials such as cement, fine and coarse aggregate and others shall be referred as per specification of I. No. (3) As mentioned in this tender.

The manhole than they have been raised above the highest subsoil water level expected in the monsoon shall similarly tested for water tight as far the pipe lines. The procedure for testing shall be as follows.

The mouths of all pipes entering the manhole shall be suitably plugged with bricks, wooden or any other types of plug. The manhole under test shall then be filled with water up to the general subsoil water level and observe for and period of one hour. If the level dose not drop by more than 50 mm in one hour, it shall be assumed that the manholes is watertight.

During the period of test, the outside trench shall be kept free from any accumulation of subsoil water. In case of a drop of more than 50 mm in water level, the contractor shall note the places from where the leakage's taking places and take step to stop the leakages satisfactory.

All manholes shall be tested for water tightness in all conditions by adopting the procedure as mentioned above. The manholes shall be cleared of all debris etc. and shall be thoroughly cleaned. No utility services such as cable, pipe line etc. shall be allowed to remain inside the manhole. Care should be taken to shift the same outside the manhole with the cost or contractor.

The type design/drawing or various types, sizes and depth of manhole is attached herewith. In case of any discrepancy between the drawing and specification the decision of Engineer-in-charge shall be final and binding on the contractor. The rate given in Schedule 'B' is for particular depth. The Depth of chamber is the height of masonry as shown in the type design. For the purpose of measurement the top of bottom P.C.C. to the top of slab/cover as shown in the drawing shall be considered.

During course of execution any manhole chamber/cover damaged due to whatever may be the reason shall be made good by the contractor at his own cost. This shall be applicable till scheme is commissioned. After execution if it is found that manhole chamber level is not matching with the road level that shall be matched by the contractor at his own cost.

Mode of payment:-

90% payment after completion of construction work and 10% after hydraulic testing of

manhole.

DS 6

B.B. Masonry valve chambers for House service connections

Construction of B.B. masonry valve chamber includes excavation to the required size and depth, Providing and placing in position PCC for levelling course, followed by 15 cm thick M: 15 P.C.C. foundation bedding, The chamber walls shall be in B.B. masonry in c.m. 1:5 proportion and inside cement plaster in c.m. 1:3, and external cement pointing including precast SFRC frame and cover as directed by Engineer in charge etc complete. The curing shall be carried out as per the specifications before refilling the sides.

Note: wall thickness 0.23 m for depth of 1.2 m and 0.35 m for balance depth exceeding 1.2 m

1) Internal Size 0.6 X 0.45 X 0.9 m

This item shall be executed as described in schedule 'B' for relevant item and directed by Engineer-in-charge. The items like concrete, plaster, brick work etc. shall be executed as per PWD Specification and as per direction of Engineer-in-charge. The frame & Cover shall be of SFRC & behave good quality. Damaged cover and frame shall not be fixed. The chamber shall be constructed well sufficient marginally above the G.L. so as rain water shall not enter into the chamber according to the site condition and desired slope to pass the waste water as per standard manhole specification will be maintained at bottom as directed by Engineer-in-charge.

Measurement and Payment will be on number Basis and similar to specifications of B.B. Masonry manhole chambers.

DS 7

Dewatering the excavated trenches and pools of water...as directed.

The item shall comply as per standard specification No.Bd-A-9, on page No. 261.

This item is provided for Dewatering during excavation of entire work when it is

not possible to bail out the water manually, the item includes all machinery, fuel, labour etc. The contractors shall provide all dewatering pumps, engines and machinery required to keep the trenches dry laying sewer lines, drains or foundations and all other excavations shall be clear of water, whether sub-soil water, storm water leakage from tanks, wells drains, sewers water, mains, tide water etc. so that there may be no accumulations of such water. And that no setting out may be done the pumping shall be continued so long after execution of any portion of work and repeated so after as the Engineer-in-charge may determine to be sufficient at any particular time, or he may himself supply pumps and power at contractor expenses, so he may stop the work all together until he is satisfied and also impose a fine upon the contractor. It is the contractor's responsibility to keep dewatering machinery in up to date working condition to keep the trenches dry for laying pipes or for placing the concrete.

Mode of Payment:-

25% payment will be released after completion of 50% work & remaining 75% shall be made after completion of Work, in a zone. The necessary documents shall be submitted by the agency the provision of dewatering is on lump sum basis for whole items of the sub work to be executed. However the payment will be made, in proportionate with the quantity of work executed. No extra payment will be made if quantity of items is increased. Maximum quantity of dewatering will be considered hot trunk sewer line in nalla bed and rest of the quantity will be considered for laterals, as directed by Engineer-in-charge.

DS 8

MURUM BEDDING

General

The specification contained in the Standard Specification Volume-II published by Public Works and Housing Department, Govt. of Maharashtra, Chapter Bd.A-10, Page 263 shall apply. In addition to above, following specifications shall govern.

Murum bedding shall be done with approved quality of soft murum, selected from excavated stuff and approved by the Engineer-in-Charge. The murum shall be collected from available excavates stuff and to be utilized if murum is not available from

selected excavated stuff, it should be brought from outside and rates payable will be as stipulated in the tender item. Thickness of murum bedding will be 15 cm.. The contractor shall be paid for one Cubic Meter of the filling laid and compacted and will be paid up to two place of decimal of Cum.

Murum bedding shall be laid in exact 15 cm thickness for full width of excavation, it shall be well rammed with hand rammers so that pipe line is laid on firm bedding. Collection of murum from excavated stuff and carting up to the work site is included in the item and contractor shall make his own arrangement for procurement and carting of murum at his cost.

Filling in plinth and floors/trenches with contractor's murum……..etc. complete.

For bedding, only murum brought from outside as approved by Engineer-in-charge. Shall be used. Bedding shall be done before laying of pipes to the desired grade, line and level with necessary watering and compaction etc. complete. This shall be executed when B.C. Soil and hard rock met at the bottom of trench for certain length. The filling in trench around the pipes and 0.30 m on top of pipe line shall be done in B.C. Soil and rock as directed. The item includes lead beyond 0.50 kms. And lift as required.

Mode of Measurement and Payment

Quantity shall be measured in Cubic Meter. The dimensions shall be measured up to two Decimal of Cubic meters and quantity shall be calculated up to two places of Decimal of Cubic meter. Payment for murum bedding will be made after lowering, laying and jointing of the pipe.

IDS 9

Providing dry rubble stone soling ------etc. Complete.

This item shall be executed as per detailed s specification No.Bd-A-12 On page No. 264 for trench, plinth etc as directed by Engineer-in-charge.

Rubble stone shall be brought from approved quarry by the P.W.Deparments including landing unloading stacking, lying, transportation Charges etc complete.

If the material is rejected by Engineer-in-charge or his representative it

Shall be removed immediately from of work without any extra calms by the Contractor. Rubble stone soiling shall be laid in layers including compaction watering Etc, as directed by Engineer-in-charge.

9.1 GENERAL

After the structural foundation, plinth construction and filling are completed, rubble soling of specified thickness shall be laid over the consolidated plinth filling, hand packed and compacted. The specification of the work as per Standard Specification Bd.A-12)

9.2 MATERIALS

The stones to be used shall be broken rubble with fairly regular shape and free from weathered, soft and decayed portion. The rubble shall be of sound stones of the type mentioned in the item and selected for their larger size. Stones shall be of the full height of the soling and the length and width shall not generally exceed 2 times the height. The stones to be used for wedging in the joints between larger stones, shall be chips of the largest size possible to fit in the interstices. All sound and suitable rubble obtained from the foundation excavation and approved by the Engineer shall be necessarily made use of first unless otherwise directed.

9.3 CONSTRUCTION

The bed on which rubble filling is to be laid shall be cleared of all loose materials, leveled, watered and compacted and got approved by the Engineer before laying rubble soling.

Rubble soling shall be laid to the specified thickness closely packed by hand and firmly with their broadest face downwards. The interstices between adjacent stones shall be wedged in with stones of the proper size and shape and well driven in with wooden mallets to ensure a tightly packed layer. Such wedging shall closely follow the placing of the larger stones. After hand packing and wedging, compaction of the soling shall be done thoroughly with log rammers. Adequate care shall be taken by the contractor while laying and compacting the rubble soling to see that the masonry or any part of the structure Is not damaged. Rubble soling shall be started only after the masonry is fully cured.

9.4 BROKEN RUBBLE

a) Supplying broken rubble of approved of approved quality and size at site.

b) All labour, material, tools and equipment for handling, laying, hand packing and compacting the rubble.

Any other incidental charges to complete the work as per sanctioned plan.

9.5 MODE OF MEASUREMENT & PAYMENT

Rubble soling shall be measured and paid in cubic meters limiting the dimensions to those shown on the drawings or as directed by the Engineer. The dimensions shall be measured correct to 2 places of decimals of a meter and quantities worked out correct to 2 places of decimals of a cubic meter. No deduction shall be made for voids.

DS 10

Providing and constructing 110 mm PVC and 100 mm dia. G.I. Pipe ventilator…….etc. complete.

The item is provided for escape and ventilation of the gasses formed in the system. This includes required excavation in any strata in all lift and refilling the same after completion along with necessary disposal required if any, providing, laying, erecting and jointing 110mm dia PVC pipe of length 6 m laid across the road horizontally below ground and 100 mm dia G.I. pipe of length 5 m should laid vertically including all pvc specials for jointing. Also Providing P.C.C. 1:2:4 base at bed and block/of size cement concrete in M-150 size grade 0.45 x 0.45 x 2.00 m. height as shown in the drawing attached, 12 mm thick plaster in C.M. 1:3 proportion shall be provided to the concrete block. The item also includes providing and fixing wire gauge dome vent pipe. In case of any discrepancy in drawing and the specification, the decision of Engineer-in-charge shall be final and binding on the contractor. The location shall be given by the Engineer and the item shall be paid on number basis.

DS 11

Refilling The trenches with available excavated stuff with soft material……etc. complete.

The item shall be done as per standard specification No. Bd-A-10, Page No.263

After lowering, laying, jointing and welding of pipe line, site gunitting and concreting work, refilling of trenches with available excavated stuff shall be done
For beding only approved quality of excavated materials from trenches shall be used. Beding shall be done before laying of pipe line to the desired grade as directed by Engineer-in-charge.

For refilling purpose, approved excavated stuff shall only be used. The refilling shall be done in layers of 15 to 20 cms. Each layers should be watered and compacted properly before the upper layer is laid till the required level is reached. First 2 layers of 15 to 20 cms shall be free from stones or chips or any harmful material, to protect the pipe from damage. Only soil or soft murum shall be used for filling. Originally filling shall be done 30 to 40 cms above natural ground or road level. Sinking below the road or ground level, if noticed till the completion of work, the contractor shall have to make it level at his cost.

This item includes,..

a) Clearing useful excavated material of rubbish bracking clods, stone, etc.

b) Conveying the useful excavated material upto 500 M and filling in layers, watering and compacting.

c) All labour, equipment and other arrangements necessary for the satisfactory completion and completion of the item.

After water tightness test etc. the trench shall be refilled in layers and shall be rammed manually. The filling shall be kept above ground level for subsequent settlement. In the case of trench in rock, cushioning from approved excavated materials shall be provided at sides and 0.30 m. on top of pipe line by manually to avoid the damages to the laid pipes. The item includes free lead of 50 meters for actual operation. After refilling of trenches, it shall be watered and compacted satisfactory by the roller as directed by Engineer-in-charge.

The contractor shall have to cart the selected excavated stuff from site of work to any other site for refilling as per requirements as directed. The payment shall be made to contractor under relevant item No.11 for disposal in Schedule 'B'

Mode of Payment:-

The payment of refilling shall be made to the contractor only after completion

of water tightness satisfactory test etc. of the pipe line. The measurement of work shall be taken in cubic meter up two place of decimals. Mode of measurement and payment of the rate shall be for a unit of 1 Cum of compacted trench filling with approved excavated material.

The measurement shall be net for the compacted filing and no deduction for shrinkage or voids shall be made. However, deduction for pipe volume will be made. Depth of filling for measurement will be limited from natural ground level only. No payment will be made for filling for 30 to 40 cms above natural ground level, if so insisted by the Engineer-in-charge.

Surplus excavated material is the property of SMKC. So contractor is not empowered to sell this excavated material to any other agency.

This disposal will not be considered for initial 500 M lead from edge of pipe line trenches and so will not be paid for.The material shall be conveyed by means of suitable devices/manner.The material conveyed to the place of disposal shall either be stocked or spread as directed by Engineer-in-charge or his representative.

The route opening and maintenance, payment of any royalties, compensation to land owners and for damaged of any etc. during the process of conveyance etc. shall be the entire responsibility of the contractor.

10% amount will be withheld till satisfactory hydraulic testing of pipe line.

90 % payment s made after completion of lowering, laying and remaining 10% amount will be withheld till satisfactory hydraulic testing of pipe line is given.

DS 12

Disposing of excavated stuff ……..etc. complete.

1) After refilling of trenches, surplus excavated stuff remaining at the site of work have to be disposal off at suitable places within five Km. distance, as directed by Engineer-in-charge.
2) Surplus excavated materials is the property of M.J.P. and therefore contractor is not empowered to sell this excavated materials to any other agency.

3) This disposal will not be considered for initial 50 M. lead from site of work, so will not be paid for

4) The materials shall be conveyed by means of suitable devices.

5) The material conveyed to the place of disposal shall either be stacked or spread as directed by Engineer-in-charge or his representative.

6) The route for operation and maintenance, payment of any royalties, compensation to land owners and for damages if any etc. during the process of conveyance etc. shall be the entire responsibility of the contractor.

7) This item includes all labours, materials and equipment's required for loading, conveyance, unloading, stacking or spreading the material.

8) The tender rate shall be for one cubic meter of excavation quantity conveyance to the place of disposal.

9) The quantity conveyed and disposed of shall be calculated from the trench excavation after deduction of quantities for bedding, concrete or any other refilled materials and balanced net excavation quantity will be payable under this item.

10) The excavated stuff shall be used for construction/Reinstating of road if required or demanded prior to preapproval in written from Engineer In charge & as directed by him at no extra cost than this item.

DS 13

Providing laying in situ P.C.C. (M-150) 1:2:4 …….etc. complete. (The specification will be applied for all sub works included in the tender.)

This shall comply as per standard specification No. Bd-E-1 on page No.287 or latest edition.

13.1 Materials

13.1.1) Cement:-

All cement for use on the works except otherwise stated shall be the standard ordinary Portland cement manufactured in India and shall conform to the I.S. 269 latest version. It shall be of make and quality approved by the Engineer-in-charge.

The cement shall be stored in weather proof godown specially constructed for the purpose, of such a manner as to prevent deterioration due to moisture or instruction of foreign matter. The weather proof godown shall have solid impervious

floor raised 300 mm above the general ground level so that the cement stored there on shall not come in direct contact with the sub-soil moisture. The passages and the general construction shall be such that it affords full protection from whether effects. Large stock cement shall not be kept at the works but only sufficient quantities should be kept to maintain continuity of work.

Storage of Cement:-

If cement is supplied in bags a suitable weighing scale shall be provided and shall required by the Engineer be used for checking the weight of every bag at the contractor's expense. Bags under weight by more than 2 percent of the nominal weight shall be rejected and removed from the site.

No cement has been store for more than 90 days ordinarily be allowed to be used on the works. Cement stored for longer period more than 90 days shall be used on work only with the specific written permission of the Engineer-in-charge who shall ascertain its quality after due testing in the laboratory before giving such permission. All expenses in connection with the test shall be borne by the contractors.

For testing the quality of cement, samples shall be taken from every consignment arrived at the site of work at the option of the Engineer. The contractors shall afford every facility to the Engineer for inspection for sampling the cement. The cement godown shall be so arranged by the contractors that each consignment could be stocked separately and in such manner so as to allow counting bags in each row with case. The test result shall, ordinarily. Be available within a week of sampling and the contractors shall not use any part of the consignment until the results of the tests are received and found satisfactory. However, the use of such cement becomes imperative before the test result are received, the contractors may do so entirely at their own risk and cost and the whole of such work carried out by them is liable for rejection, if the tests results are found unsatisfactory. Any consignment failing to meet the requirements to I.S. 269 shall be rejected and shall be removed from the work site within 48 hours of the intimation from the Engineer. The decision of the Engineer-in-charge in this respect shall be final and binding on the contractors.

The cement in connection with the testing of cement such as transport of samples, testing fees, etc. shall be borne by the contractors.

The cement used in any type of concrete shall always be measured by weight

and one cubic meter shall be taken as per table 30 of A.C.C. Hand Book.

13.1.2 Aggregates:-

All the aggregates shall confirm to the latest I.S. 383. The aggregate shall consist of naturally occurring sand and gravel or stone crushed or uncrushed or a combination thereof. They are classified broadly under two categories, viz (i) Sand of fine aggregates and (ii) course, aggregates, depending upon their size. The fine aggregates are those which pass through I.S. Sieve No. 480. And the coarse aggregate are those which retained on I.S. sieve 480.

(i) Storage of Aggregate:-

The fine and coarse aggregates shall be stored separately and in such a manner that segregation of the various sized particle shall not occur, the stock shall be formed on a platform of weak concrete, timber or similar approved hard standing and aggregates shall be kept clean and free from foreign substance.

(ii) Aggregates shall not be unloaded on to roadways or pathways the Engineer may reject any stock pile of part of a stock pile if improper storage has opinion, caused contamination with foreign substances.

(iii) Storage piles of aggregate shall be arranged with proper drainage and protection from rainfall in order to prevent excessive changes in moisture content taking place during concerning.

(iv) The aggregates both fine and coarse shall be hard, strong, durable, clean, free from veins and adherent coatings. The use of flaky and elongated pieces of aggregates shall be prohibited.

(v) The aggregate shall not contain deleterious materials such as iron pyrite, coal, mica, shale or similar laminate material, clay, alkali, soft fragments, sea shells, organic impurities etc. in such quantity as to affect the strength of durability of concrete or the reinforcement embedded in such reinforcement concrete.

(vi) The maximum quantities of deleterious material that may be permitted shall conform to the following limits by weight.

Deleterious substance	Fine aggregates percent by weight	Coarse aggregates percent by weight.

	Uncrushed	Crushed	Uncrushed	Crushed
1. Local and lignite	1.00	1.00	1.00	1.00
2. Clay lumps	1.00	1.00	1.00	1.00
3. Soft fragments	-	-	3.00	-
4. Material passing through 75 micro sieve.	3.00	3.00	3.00	1.00
5. Shale	1.00	-	-	-

(vii) The total of various deleterious materials occurring in any sample shall, no case, exceed 5 percent.

(viii) If the aggregate supplied is unclean, it shall be washed. If it is not properly graded, it shall be screened by hand or by mechanical means and the various sizes proportioned to get the required grading.

(ix) Storing of aggregate on dusty, muddy and grassy spots shall be avoided. They shall be stored on the works in such a manner as to prevent intrusion of foreign matter and protected from exposure to dust. They shall be placed in stock piles individual units of suitable sizes and in suitable layers to prevent segregation. They shall not be allowed to run down slopes.

13.1.3 Sand or fine aggregates :-

All fine aggregates shall consist of clean, hard, strong, durable uncoated siliceous gitty material consisting of well graded particles obtained from rock fragment. It shall be free from clay lumps injurious amount of dust, mica shell, soft or flaky particles, shale, alkali, organic matter lead or other deleterious substances.

i) The sand shall be taken from sources approved by the Engineer-in-charge. The sand or fine aggregate shall conform to the latest I.S. No. 383

ii) If the Engineer-in-charge considers if necessary, it shall be washed and / or screened before use, at the expense of the contractors.

iii) The sand shall have a fineness modulus of not less than 2.5 and not more than 3.0 and the grading shall confirm as far as possible to the following analysis.

I.S. Sieve No.	Percentage Passing	
	Natural sand or crushed gravel	Crushed Stone
480	95-10	90-100
240	70-95	60-90
120	45-85	40-80
60	25-60	20-50
30	5-30	5-30
15	0-10	0-15

iv) the specific gravity of sand shall not be less than 2.6

v) In no case shall fine aggregate be accepted, containing more than 2 % by dry weight not more than 3.5% by dry volume, not more than 5% by dry volume of clay, loam, or silt. If any sample of fine aggregate shown more than 5% of clay, loam, silt in one hour's settlement after shaking in excess of water, the lot represented by the sample shall be rejected.

vi) The following two field tests are recommended for ascertaining the percentage of clay lumps and impervious organic material and the contractors shall carry out the same if the Engineer-in-charge deems necessary.

1. Test for determining silt in sand: -

Fill a calibrated tumbler with sand to half its volume and water there to until the tumbler is three quarters full. Shake up the mixture vigorously and allow it to settle for about an hour. The volume of silt visible on top the sand shall be measure. If the volumes of the silt standing over the sand exceed 5% of total volume of sand. The same shall be rejected.

2. Calorimetric test for impurities:-

The sample of sand shall be mixed with equal volume of 3% solution (about one ounce, in a quarter of water) of caustic soda / sodium hydroxide taken in a plain glass and the mixture shall be allowed to stand for 24 hours. The liquid standing above the sand shall not be darker than lights straw (pale yellow) color. If the color marked yellow or brown, the test would indicate presence of organic material in excessive

amount.

In case suitable sand is not available in adequate quantities within a reasonable and economical limit, the contractor may be allowed to use the crushed or pulverized stone or gravel either alone or mixed within natural sand in parts. The stone or gravel shall be clean sharp and free from dust etc. and shall conform to the latest. I.S. 383.

The percentage of crushed stone to be mixed with sad shall be such as to obtain in fineness modules of blended sand within the units specified above and / or as approved by Engineer after laboratory test.

13.1.4 Course Aggregates:-

All coarse aggregates use in concrete work shall consist of crushed rock gravel or other approved inert material.

i) Broken or crushed rock from sound blue basalt or black trap free from zealot or other common impurities shall be used in the concrete as coarse aggregate. The particles of aggregate shall be clean, hard, tough durable, free from deleterious substance and shall contain no soft, flat or elongated pieces. The course aggregate shall have specific gravity not less than 2.6 and the water absorption measured after being immersed for 24 hours in water shall not be more than 6% by weight. The maximum percentage of deleterious materials in the coarse aggregate shall not exceed 5 % by weight in the aggregate when tested in conformity with I.S. No.383.

ii) The nominal size of the coarse aggregate for reinforced concrete work shall be 20 mm larger coarse aggregate up to 40 mm size may be used if approved by the Engineer-in-charge, in plain concrete work. The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case shall be greater than one quarter than one quarter of the maximum thickness of the member, provided that the concrete can be placed in from work without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form work. The minimum size of coarse aggregate shall be, as mentioned earlier, such as to retain most of the material (90%-95%) on L.S. Sieve No. 480.

iii) The aggregate shall be screened and, if necessary, blended to give the required grading when tested in the laboratory at contractors cost by means of standard mesh sieve, the grading shall fall within the following limits.

Sieve Size	Percentage retain by weight	
	Plain C.C.	R.C.C.
40 mm	-	-
25 mm	10 to 15	-
20 mm	35 to 40	15 to 0
10 mm	75 to 80	100 to 80
No. 480	98 to 100	100 to 95

The percentage given above are for guidance and the Engineer-in-charge reserves the right to modify the same to any other lower or higher value if considered necessary by him, in consonance with the requirements of the work.

iv) in the event of undesirable segregation occurring in coarse aggregates, the contractor shall separate the coarse aggregates in two or more suitable fraction as directed by the Engineer-in-charge, who shall set up the required limit of each such fraction. The grading so specified shall be such as to give a dense, water tight concretes of specified proportion and strength and required consistency.

v) The Engineer-in-charge shall have the right and authority to carry out routine control tests and analysis of the broken rock at any stage of the work processing and / or concerning operation and the contractors shall give all necessary facilities in respect of such testing. The sampling and testing shall be carried out as per standard I.S. practice entirely at the cost of the contractor.

13.1.5 Water

The water use for the preparation of concrete., for washing sand etc. and for curing shall be clean and free from objectionable quantities of silt, organic material, acid , alkali, salts, oil and other deleterious impurities and it shall be obtained from the sources approved by the Engineer-in-charge. Potable water shall generally be found fit for preparation of concrete. The quantity of water to be added shall generally be properly measured and controlled.

i) Water Cement Ratio:-

Suitable water cement ratios for the different mixes and used shall be determined in consultation with the Engineer-in-charge and they shall generally not be

exceeding 0.5 (i.e. 50% by weight), the exact values being fixed after taking into account all relevant factors such as strength required, weather condition, water absorbed by material, work ability and slump required consistent with the work requirements, method of compaction etc. The concrete mix shall be designed with the materials which will be used hence forth for the preparation of concrete. The same task shall be repeated if there is change in the quarries for the fine and the coarse aggregate.

13.2 Concrete:-

All cement concrete, whether used in R.C.C. work or plain concrete work shall be M-150, M-200 and M-250, as per latest LS. Code.

13.3 Gauge Boxes

Gauge boxes approved type shall be used for measuring sand and coarse aggregate in required proportion whenever concrete is allowed to be prepared by mixing the aggregate on volumetric basis. Such boxes shall be of seasoned timber or steel and shall be of such size and shape and shall be used in a manner as to enable the proportion of the material to be checked readily. The cement used in concrete is however shall not be used by measuring it in gauge boxes, but it shall be measured by weight, whatever may be the type of concrete.

13.4 Manufacture and Placement of concrete:-

a) Batching:-

Whether controlled or ordinary concrete is to be mixed, the quantity of cement shall be determined by weight. If the mixers weight per bag is to be used, the same shall be verified by weighing a reasonable number of bags.

Whenever direct use of bagged cement is allowed, one bag of cement shall be considered to contain 50 kg of net weight of cement. This shall, however, be verified at site by weighing for which the contractor shall provide an accurate weighing apparatus on work sites

Having once decided the mix, the Engineer-in-charge may permit further mixing of the aggregate to be done on volumetric basis.

Wherever the concrete is to be laid in trenches, the trench shall cleaned, watered and compacted before placing. The sub soil water which met shall be removed and the trench shall be kept dry during and after two hours of placing of

concrete. For more depth of P.C.C. mechanical vibrator shall be used for compaction by the contractor.

The damages to concrete during laying of pipe line shall be rectified free of cost. The rate for the concrete includes all labour, material centering shuttering securing etc. all leads and lifts. Mixing of concrete shall be done with concrete mixer. For providing Electric wiring duct, tubes of the required diameter and length shall be provided through walls beams and floors, slabs as and when directed without any extra cost.

a) The contractor will make his own arrangement for receiving all material tools etc. required for the work.
b) No extra charges for the carriages of water will be allowed.
c) The rates for all items are inclusive of all charges such as carting, lifting, etc. No extra payment for any lead and lifts will be paid for any item.
d) The contractor should not be Sublette without written permission of the Engineer-in-Charge

Cement cubes of size 15 cm x 15 cm x 15 cm are taken during the concreting of important structure like RCC well, water treatment plant, elevated service reservoirs, bridge etc. to check the strength of the concrete and its acceptability it is observed that while taking cubes the requirement specified in the relevant Indian Standard specification are not observed properly and cubes are not cast in the required numbers. Due to this the acceptability of the concrete cannot be decided correctly. Similarly, proper care is also not taken for curing of the cubes the requirements specified in the ISS in respect of casting of concrete cubes and curing thereof, with acceptability criteria of concrete are reproduced below, which shall be following scrupulously.

FREQUENCY OF SAMPLING (IS: 456:2000 (Clause 15.2)

a) Number of samples to be taken during concreting based on the quantum of concrete cast shall be as below.

Quantity of concrete in Cum	No. of samples
01 to 05	1
06 to 15	2
16 to 30	3
31 to 50	4
50 and above	4 + 1 for every 50 cum part thereof.

At least one sample shall be taken from each shift of concrete and three test specimens (cubes of size (15 x 15 x 15 cm) shall be cast from each such sample for testing of the compressive strength additional three cubes will also have to be taken

for 7 days test.

The test strength of the sample shall be the average the strength of the three specimen.

13.5 ACCEPTANCE CRITERIA (IS: 456:2000 Clause 16)

The concrete cost shall be supposed to be acceptable in the compressive strength (i.e. average strength of the three specimen) of the samples fulfill the following requirements.

a) Every sample has a test strength not less than characteristic value.

OR

b) The strength of one or more samples, though less the characteristic value is in each case, not less than the greater of following.

i) The characteristic strength minus 1.35 times the standard deviation.

And

ii) 0.80 times the characteristics strength.

c) And the average strength of all the samples is not less than the characteristic strength plus

$$1.65 * \frac{1.65}{\text{No. of samples}} = \text{times the standard deviation}$$

d) However, it should be noted that individual variation should not be more than the percent of average.

STANDARD DEVIATION VALUES

Grade of Concrete	Assumed Standard deviation in Kg/Cm^2
M-100	35.00
M-200	46.00
M-250	53.00
M-300	80.00

13.6 **CURING OF CONCRETE CUBES** (IS: 516:1959, CLAUSE 3.3)

The test specimen (cubes) shall be stored on the site at place free from vibration, under damp matting, sacks or other similar material for 24 hours + ½ hour from the time of adding the water to the other ingredients. The temperature of the place of storage shall be within the range of 22^o to 32^{o}C. After the period of 24 hours, stored in clean water at temperature of 24^o to 30^{o}C until those are transported to the testing laboratory. Samples shall be sent to the testing laboratory well packed in damp sand, damp sacks or other suitable material as to arrive there in a damp condition, not less than 24 hours before the time of test.

On arrival at the testing laboratory, the specimen shall be stored in water at a temperature of 27^o + 2^o C until the time of test. Record of the daily minimum and

maximum temperature shall be kept, both during the period specimen remain on the site and in the laboratory.

13.7 **TEST PROCEDURE** (IS: 516:1959 CLAUSE 5.5)

Specimen stored in water shall be tested immediately on removal from water and while those are still in the wet condition. Surface water and grit shall be wiped off the specimens and any projecting fins removed. Specimen, when received dry, shall be kept in water for 24 hours before taken for testing. The dimensions of the specimens to the nearest 0.2 mm and also weight shall be noted before testing.

13.8 **OTHER THINGS**

Here, it should be specifically noted that age of concrete cube will be age as on the date of testing i.e. time difference between addition of water to dry ingredient and actual testing.

13.9 **MIX DESIGN**

The following instructions shall be followed as regards preliminary design of mix and methods of batching of plain cement and reinforced cement concrete. These instructions should be treated as supplementary to the relevant provision in the specifications for the respective items contained in the book of standard specification and will be carried the provisions contained therein, wherever they are contrary to the following instructions.

The preliminary design and batching for various grades of concrete shall be governed by the following guidelines.

No.	Concrete Grade	Guidelines
1	Upto M-150	This should only be ordinarily concrete. No change may be prescribed in the present practice as regards preliminary design of mix and permitting volume batching.
2.	M-200 to M-250	Preliminary mix design must be carried out for these mixes. However, weigh batching shall be insisted for cement, fine aggregate and course aggregate.
3.	Above M-250	Preliminary mix design must be prepare for such mixes weigh batching should be for cement fine aggregate and course aggregate.

For the grades of concrete M-200 and above the preliminary mix design shall be carried out from the approved laboratory. The rate quoted by the contractor in the agreement for these items shall be final and binding on him, irrespective of content of

cement required as per preliminary mix design and there shall be no adjustment in the agreement rate for these item on this account.

The charges for preliminary design of concrete mix shall be entirely borne by the contractor.

For grades of concrete M-200 and above where cement is to be used by weightment, the cost of extra cement required to make up the under weight bags shall be borne by the contractor.

For the items of concrete of grades lower than M-200 and other items in the agreement where cement is not to be used by weightment the cement bags as received from the manufacturer and shall be assumed to contain cement of 50 kg net weight.

This shall be as per specification of P.W.D. (Hand Book) and as directed by Engineer-in-charge. Only trap stone shall be used other than the specification for this item in Standard Specification Book.

(a) Proportions of concrete for types of work

i) M-100 – For leveling course and foundation of chairs and thrust blocks etc

ii) M-150 PCC with temperature nominal 0.15% reinforcement for footing thrust blocks, anchor blocks, chairs and encasing of pipes etc.

iii) M-200 PCC for water retaining structure

iv) M-300 for Construction of Jack well, Pump House & Water Retaining Structure. Such as ESR, WTP, MBR, BPT.

v) M-250 Pump house and bridges (excluding sub-merged portion)

b) General specifications of this work shall be as per standard specification of Public Works Department, latest edition, for PCC Bd.-E1 to E-7 and for RCC Bd.F2 to F16.

c) Whenever concrete is to be laid in trenches, the trench shall be cleaned, and watered before placing. The sub-soil water which is met shall be removed and the trench shall be kept dry during and after 2 hours of placing concrete.

d) Pedestal pier shall be perpendiculars to center line of pipe.

e) Proper seat shall be left on top of pedestal pier to construct saddle. Seat shall be strictly done within 24 hours, failing which SMKC will not accept it for payment

f) RCC saddle shall be constructed as per detailed drawing. The top of saddle where pipe rests shall be provided with wearing plate fixed in CM 1.3 smoothly and CM

grouting may be done after pipe is placed and no extra payment will be made for this.

13.10 MODE OF MEASUREMENT AND PAYMENT.

The tender rate shall be for one cubic meter of concrete. The concrete shall be measured for its length, breadth and depth limiting dimensions to those specified in drawing or as per direction of Engineer-in-Charge.

DS 14

Reinstating the road surface, includes

a) Providing and laying Water Bound Macadam road……..etc. complete.

b) Providing and laying hot mix hot laid per mix carpet……etc. complete.

c) Providing and laying concrete road……..etc. complete.

The item shall comply as per relevant item of Schedule 'B' and as per the detailed specifications given as under and as directed by Engineer In charge.

Sr. No.	Description of Item	Reference of Red Book
1.	Excavation for roadway in earth soil of all sorts, sand gravel or soft murum …….etc. complete.	Specification No. Rd.-2,P.No.180
2.	Supplying 80 mm trap / granite / quartzite /gneiss stone metal……..etc. complete.	Specification No. Rd.-19,P.No.197
3.	Supplying 40 mm trap / granite / quartzite / gneiss stone size metal...Etc. complete.	Specification No. Rd.-22,P.No.201
4.	Supplying hard murum at the road side ……etc. complete.	Specification No. Rd.-23,P.No.202
5.	Supplying soft murum at the road side……..etc. complete.	Specification No. Rd.-24,P.No.203
6.	Spreading 50 mm / 60 mm / 80 mm metal ……etc. complete.	Specification No. Rd.-29 A, P. No. 205.
7.	Spreading 40 mm metal including sectioning complete.	Specification No. Rd.-29 A, P.No. 205
8.	Spreading gravel / sand / soft murum / hard	Specification No. Rd.-28 A,

	murum / over rubble soling/WBM surface complete.	P.No. 205
9.	Compacting the sub-grade / gravel oversize / metal……etc. complete.	Specification No. Rd.-32 A, P.No. 205
10.	Compacting the sub-grade / gravel / oversize / metal (100 mm loose) layers……etc. complete.	Specification No. Rd.-35 A, P.No. 209
11.	Providing and laying hot mix hot laid premix carpet 25 mm average thickness…….etc. complete.	Specification No. MOTO 39 B.
12.	Providing and laying premix seal coat to the black topped surface……..etc. complete.	Specification No. MOTO 39 B.

Concrete road: This item shall be executed as per the description given in the schedule B of relevant item and as directed by Engineer-in-charge.

The work includes supply and spreading of 40 mm metal, The murum of good quality be laid in 5 to 6 cm over the spread metal. The complete layer then compacted. 75 mm thick bituminous bound macadam layer be placed over the compacted surface. Cement concrete of M-20 of 0.2 M thick shall be laid matching the nearby level of road.

Royalty for road reinstating work only will be reimbursed after submission of necessary royalty payment slips of concerned official govt. department.

Mode of Payment: Murum, stone aggregate, concrete and royalty will be paid on cum basis while all other items will be paid on sq.m basis as per detail in schedule B items.

DS 15

PROVIDING AND SUPPLYING C.I. /D.I. FLANGED PIPES

The item includes supply CI/DI flanged pipes as per latest IS and approved by Engineer-in-Charge. The cost of pipe should be including all taxes central and local, railway freight, and transportation up to site of work or departmental store.

MODE OF MEASUREMENT

The item will be measured and paid on the Running Meter basis. The 10% payment will be withheld for till satisfactory hydraulic testing is given.

DS 16

PROVIDING AND SUPPLYING DI/CI/MS SPECIALS

The items include providing ,supplying DI/CI/MS Double flanged specials suitable for diameter as required and of required thickness and including all materials labour charges with epoxy paint from inside and outside including all taxes (Central & local) Octroi if necessary, inspection charges, transportation to stores/ sites & stacking etc. complete. As per requirement a machine ends DI specials suitable for PCCP/BWSC/D.I .pipes will also be supplied under this item.

16.1 Scope: The item cover supply of DI/CI/MS double socket and flanged specials of various diameters including conveyance of specials form manufacture's works to site stores, stacking them properly and protecting till commissioning of work.

16.2 General: The specials shall confirm to relevant I.S.S.

16.3 Materials: The specials shall be manufactured form cast iron conforming to IS 210 Gr. 20.

16.4 Coating: The specials shall be coated by bitumen by not dipping process.

16.5 Tests: The specials shall be tested at factory for 25 kg/sq/cm/ Pressure.

16.6 Flanges: The flanges shall be drilled to IS-1538.

16.7 Tolerance: The tolerance in weight and dimensions shall be as per ISS. Only the specials fitting within tolerance limit shall be accepted

16.8 The mode of measurement of payment shall be on weight (Kg) basis.

DS 17

Providing and casting in situ C.C. of trap/ granite/ quartzite/ gneiss metal ------ for R.C.C work etc. complete.

17.1 R.C.C Works

1) R.C.C works as per I.S.S. 456-2000 (latest edition) in R.C.C M-200 and M-250 with 12mm to 20mm gigue metal. The work shall also be carried out standard specifications No. Bd-F-3, Bd-F-22-23-24 on page No. 282,292 and 293 respectively.

2) R.C.C words in contact with sewage shall be executed as per I.S.S 3370 part I and II in R.C.C M-250 structure shall be finished with 20-mm thick Cement plaster in C.M.1:2 from inside in suplphate Resistant cement

17.2 MATERIALS

a) Cement.

43 grate Ordinary port land suplphate Resistant cement of SMKC Approved Cement Company is company is only admissible.

b) Sand

This shall be clean, hard strong. Uncoated and well graded particles, the Sours of sand will be app. [proved by Executive Engineer, and in no case clay, silt, Admixtures will exceed 3% by weight or volume. Screening and washing shall be done to stand to confirm specificatio0n. All sand shall pass through a screen with 3/16" mash only Kaman sand is permitted for R.C.C work of all grade for Construction of RCC compound wall & others works quality of Wareham sand Shall only be used

c) Coarse Aggregate

All aggregates shall confirm to I.S 383-1963,IS 515-1969 and Should be as specified in I.S 456_2000, gigue of metal to be used shall be decided According to the type of works by the Engineer-in-charge the metal of approved Qualities to be brought from quarry approved by Executive Engineer, and P.W Department

d) Storage of Material

Sand and coarse aggregates shall be properly and separately stored on Site on hard ground so as to keep them safe from admixtures of foreign material such As clay, grass etc. it shall be as per I.S.456-2000.

e) Form Work

The steel centering shall be preferable. If wooden formwork is used, it shall consist of planks not less than 40 mm thickness and of strong props etc, This Shall be provided as per I.S 456-2000, clause of formwork. Timber used for Formwork shall be best hard wood and got approved by Engineer-in-charge. The item Is covered in the rate either for plain or R.C.C items for bottom slab, beams etc. P.V.C or plastic paper should be provided over the centering to make the same Watertight,

f) Separators

From bottom covers of beam, slabs .columns .vertical Walls, etc., Separators of pre-cast cement mortar block of suitable size will be used and tied to the Reinforcement by binding wires between layers of reinforcement. Separators or M.S Case required over to the bars will be ensured beyond bout as per I.S.456-2000 and I.S.3370-1965 part-II closure 7.2

g) Water

The water used be as per I.S 456-2000, approved measures for water will be provided by the contractor the amount of water to be used will be decided by the workability and strength consideration which will be assured by the Contractor.

h) Concrete mixing

Concrete shall be only machine mixed as per standard practice.

i) Placing

The from work shall be just moisture before placing of concrete the Concrete shall be placed in position within 20 minutes after adding water to the Concrete it shall be slowly deposited in its place in uniform layers it should Generally comply with I.S-456-2000 under clause No. 12.2

j) Tamping

While concrete is being placed in position it shall vigorously rotted and tamped by bars of appropriate size and other means to ensure dense concrete and complete filling of forms. All around and in beaten the reinforcement the efficiency Of tamping and consolidation will be judged by complete the efficiently of tamping and Honey combing after removal of forms and any deficiency in this respect will result in Pulling down and redoing of affected work at the cost of contractor. For work of ‘any magnitude or importance. Mechanical vibrators of both immersion and surface Type will be used as a rule; no work without mechanical vibrator will be permitted. When concrete is so vibrated the water cement ratio will least practicable.

k) Curing

All R.C.C works will be watered and kept constantly wet for at least 21 Days after casting by means of wet gunny gabs this operation shall start immediately. After initial set of concrete out satisfactorily and actual expenses made shall be recovered from the contractor, bill without any prior intimation.

j) Removal of forms.

Removal of forms will be carried out as below subjects to the prior approval Of Engineer-in-charge in writing.

a)	Columns	:-	48 hrs, or as may be directed by the Engineer-in-charge.
b)	Side of beam	:-	3 days,
c)	Vertical wall	: -	6 days.
d)	Bottom of slab/chhajja /canopies etc.	: -	15 days.
e)	Bottom of beam	: -	14 days. Unto 5m. Span
f)	Bottom of beam above	: -	21 days.5 m, span

m) Inspection

The work at each stage of operation i.e. completion of from work, Completion of assembling and placing reinforcement concreting removal of forms must be get inspected by the Engineer-in-charge or sub Divisional Officer in charge Of the work who will record necessary certificate to be done in the presence do Engineer In-charge or his authorized representative for major work such as centering Reinforcement of slab etc, shall be checked by the contractor designer before Concreting at the cast of contractor in the presence of Engineer-in-charge.

n) Finishing

All R.C.C. works will be finished as provided in the item concrete surface not in contact with form work and not subjects to any further finish will be finished smooth by a float to parents a uniform appearance. Surface to receive plaster or rendering will immediately on removal of

Forms be roughened by extensive hacking by a pointed tamping tool In all cases Where is it required to match with rest of the structure and present harmonious Appearance to be decided by Engineer-in-charge, such fishing included in the rate Of contract but will not be measured

o) Testing

i) Cubes

On any day when concerting of M-2000 and after mix is done for 4 Hours or 5 cum and more, concrete cubes of 15cm, x25cm, x15cm, shall be casted Per day equally spread over period of concrete. Every time seven cubes will be Taken for testing

crushing strength three No's of cubes at 7 days and three No,s of Cubes at 28 days and one at 3 month the seventh cube will be kept as reserved to Be tested immediately after 28 days in case of the cubes tests 7 days 28 days Show unsatisfactory result the casting and curing and testing of for moulds etc.5he cost of contractor the contractor shall make his own arrangement for moulds etc. Number of cubes shall be taken out as per recent circular of M.J.P. or as directed by Engineer-in-charge., cubes shall be tested in the laboratory of government Engineer College at the cast of contractor & cube test certificated shall be produce by the Contractor at the time of submission of bill.

Ii) Mater

The contractor shall test the samples of cement sand coarse aggregate, Etc, required for R.C.C work at this own coat in the laboratory of Government Engineering college and submit the result to the department for according necessary Approval for the same various tests of each material shall be carried out as per I.S. and Recent circular of M.J.P. at the cost of contractor only.

Iii) The minimum strength of 15x15x15cm. Concrete cube shall be As under.

Grade of concrete	7 days period	28days period	3Months, period
M-200 M-250	135 kg/sq, cm. 170 kg/sq.cm.	200 kg/sq.cm 250 kg/sq.cm.	220 kg/sq.cm. 275kg/sq.c.m.
M-300	210 kg/sq.cm.	300 kg/sq.cm.	330 kg/sq.c.m.

The place where R.C.C is to laid shall be absolutely dry and it shall Be maintained dry from the time of starting the work unto six hours after the work is Completed (i.e. still concrete is set). A pit shall be excavated to such a size and depth that By dewatering from this pit will keep the ground water table below the level where Concreting is to carried out. The contractor should keep the pump of required ready at the Time of work. The rate of providing and laying concrete shall include expenditure or Keeping and maintaining ground dry.

17.3 General

In general RCC work is to be executed as per IS: 456-2000 or its latest revision. The water storage tanks/reservoirs shall be followed by IS: 3370 Part I to IV & latest revision. Steel reinforcement bars shall be of High Yield Strength Deformed (HYSD)/TMT

steel bars as per IS: 1786 and shall be free from corrosion, loose rust scales, oil, grease, paint, etc. Wire mesh or fabric shall be in accordance with IS: 1566. The steel bar shall be capable" of being bent without fracture. Bars shall be bent accurately and placed in position as per design drawing and bar bending schedule and bound together tight with 20 SWG annealed steel wire @ 10 kg/ton of reinforcement at their point of intersection. Formwork and shuttering shall be made with steel plate close and tight to prevent leakage of cement slurry, with necessary props, bracings and wedges, sufficiently strong and stable and should not yield on laying concrete and made in such a way that they can be slackened and removed gradually without disturbing the line, level and the shapes of concrete. For slab and beam small camber should be given in centering, 1 cm per 2.5 m with a maximum of 4 cm for quick drainage of water. Centering should not be removed before 14 days in general (4 days for RCC columns, 10 days for roof slab, and 14 days for beams).The centering and the form work shall be strong enough to take the shocks of the Mechanical Vibrators.

The grade of concrete to be used shall be as mentioned in specifications/shown on drawings.

Table - Minimum compressive strength of 15 cm cubes at 7 and 28 days after mixing, conducted in accordance with IS: 516	Preliminary Test N/mm2		Work Test N/mm2		Maximum size of Aggregate mm	Locations for Use
Class	At 7 days	At 28 days	At 7 days	At 28 days		
M40	33.50	50.00	27.00	40.00	20	As indicated in the specifications or as required
M35	30.00	44.00	23.50	35.00	20	-do-

M30	25.00	38.00	20.00	30.00	20	--do-
M25	22.00	32.00	17.00	25.00	20	--do-
M20	17.50	26.00	13.50	20.00	20	--do-

The coarse aggregate shall usually be 20 mm to 12 mm gauge unless otherwise specified. For heavily reinforced concrete members as in the case of ribs of main beams the maximum size of aggregate should usually be restricted to 5 mm less than the minimum clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller.

Mixing is done in the same manner as in PCC.

Before laying the concrete, the shuttering shall be clean, free from dust, dirt and other foreign matters. The concrete mix shall be mixed in the drum for at least 2 to 2.5 minutes. The concrete shall be deposited (not dropped) in its final position. In case of columns and wall, it is desirable to place concrete in full height if practical so as to avoid construction joints but the progress of concreting in the vertical direction shall be restricted to 1.2 meter. Care should be taken that the time between mixing and placing of concrete shall not exceed 20 minutes so that the initial setting process is not interfered with. During the winters concreting shall not be done if the temperature falls below 4ºC.

Concrete shall be compacted by mechanical vibrating machine until a dense concrete is obtained. The vibration shall continue during the entire period of placing concrete. Compaction shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to the dry mixture. Over-vibration which will separate coarse aggregate from concrete shall be avoided. After removal of the form work in due time, the concrete surface shall be free from honey combing, air holes or any other defect.

Following Indian Standards as revised most recently along with amendments will be followed for the works included in the contract. IS:8112	Ordinary, Portland cement
IS:383	Coarse and fine aggregates from natural sources for concrete
IS:445	Portland slag cement
IS:456-2000	Code of practice for plaint and reinforced concrete
IS:516	Method of test for strength of concrete
Methods of sampling and analysis of concrete	

IS:2386	Methods of test for aggregates for concrete (Part I to VI)
IS:3414	Code of practice design and installation of expansion and contraction joints in building.
IS: 3370 Part- I to IV	Code of practice for water storage Tanks

Concrete shall be laid continuously, if laying is suspended for rest or for the following day the end shall be shuttered and vibrated to achieve dense concrete and made rough after deshuttering for further jointing. When the work is resumed, the pervious portion shall be roughened, cleaned and watered and a grout of neat cement shall be applied and the fresh concrete shall be laid. For successive layer the upper layer shall be laid before the lower has set.

Pre-cast concrete shall be provided with lifting device.

17.4 **Standards**

Standards on special subjects have been mentioned elsewhere in this Para and also shall be followed.

17.5 Forms, false work or centering

Definitions

"Forms, formwork or shuttering" shall include all temporary moulds for forming the concrete to the required shape, together with any special lining that may be required to produce the concrete finish specified.

"False work or centering" shall consist of furnishing, placing and removal of all temporary construction such as forming, props and struts required for the support of forms.

17.6 Materials

Steel shuttering shall be provided as directed by the Engineer-in-Charge.

17.6.1 Forms

All forms shall be of mild steel approved by the Engineer-in-Charge and shall be fabricated and prepared water tight and of sufficient rigidly to prevent distortion due to the pressure of the concrete and other incidental loads incident to the construction

operations. All form shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods which shall be specified hereinafter. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer-in-Charge shall order to stop the work until the defects have been corrected.

All formwork shall be approved by the engineer-in-charge before concrete is placed within it. The contractor shall be required to submit copies of his calculations of the strength and stability of the formwork or false work but not withstanding the Engineer-in-Charge's approval of these calculations, nothing shall relieve the contractor of his responsibility for the safely or adequacy of the formwork. Formwork shall be true to line and braced and strutted 10 prevent deformation under the weight and pressure of the unset concrete, constructional load, wind and other forces. The deflection shall not exceed 3 mm. Beam bottom shall be erected with an upward chamber of 2 mm per meter of the span. The form work for a column may be erected. One side shall be left open and shall be built up in sections as placing of the concrete proceeds. Before placing the concrete, bolts and fixtures shall be in position, and cores and other devices, used for forming openings, holes, chases, recesses and other cavities shall be filled to the formwork. No holes shall be cut in any concrete unless approved. Approved mould oil or other material shall be applied to faces of formwork in contact with unset concrete to prevent adherence of the non-staying concrete. Such coating shall be insoluble in water, non-staying and non-detrimental to the concrete and shall not be flaky or removed by wash water.

Tolerance in finished concrete

(As per IS code 456-2000, 0.1)

The form work shall be so made as to produce a finished concrete true to shape, lines, level, plumb and dimensions as shown in the drawing subject to the following tolerances, unless otherwise specified in drawings or directed by the Engineer-in-Charge.

For Deviation from specified

Dimensions of cross-section of columns

And beams = -6mm +12mm

b. Deviations of dimension of footings

(See Note)

Dimensions in plane = -12mm +50mm

Eccentricity = 0.02 times the width of footing in the direction of deviation but not more than 50 mm

Thickness = +/- 0.05 times the specified thickness

Note: Tolerances applied to concrete dimensions only, not to positioning of vertical reinforcing steel or dowels.

17.6.2 False work and Centering

Detailed plans for false work or centering shall be supplied by the contractor if specifically asked for by the Engineer-in-Charge at least 14 days in advance of the time the contractor begins construction of the false work. Notwithstanding the approval by the Engineer-in-Charge of any designs for false work submitted by the contractor, the contractor shall be solely responsible for the strength, safety and adequacy of the false work or centering. All false work shall be designed and constructed to provide the necessary rigidity and to support the loads from the weight of green concrete and shuttering and incidental construction loads. False work or centering shall be founded upon a solid footing safe against undermining and protected from softening. False work which cannot be founded on satisfactory footing shall be supported on piling which shall be spaced, driven and removed in a manner approved by the Engineer-in-Charge. The Engineer-in-Charge may require the contractor to employ screw jacks or hardwood wedges to make up any settlement in the formwork either before or during the placing of concrete. Props of the upper story shall be placed directly over those in the story immediately below. False work shall be set to give the finished structure the required grade and camber specified on the plans.

17.6.3 Formwork and Construction Joints

Where permanent or temporary joints are to be made in horizontal or inclined members, stout stopping off boards shall be securely fixed across the mould to form a watertight joint. The form of the permanent construction joint shall be as shown on the drawings. Temporary construction joints shall have blocks of timber at least 75 mm thick, slightly tapered to facilitate withdrawal and securely fixed to the face of the stopping off board. The area of the key or keys so formed shall be at least 30% the area of the member. The blocks shall be kept back at least 50 mm from the exposed face of the concrete. Where reinforcement passes through the face of a construction joint

the stopping off board shall be drilled so that the bars can pass through, or the board shall be made in sections which a half round indentation in the joint faces for each bar so that when laced, the board is a neat and accurate fit and no grout leaks from the concrete through the bar holes or joints.

17.6.4 Removal of Forms and False work

In the determination of the time for the removal of forms, false work and housing, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the settings of the concrete and the materials used in the mix.MS shuttering/formwork and scaffolding should be of standard reputed make to ensure better quality of concrete finish. Forms shall be removed in such a manner as not to injure the concrete and no formwork shall be removed before the concrete has sufficiently set and hardened. The minimum periods which shall elapse between the placing and compacting of normal Portland cement concrete for the various parts of the structures are given in the following table, but compliance with these requirements shall not relieve the contractor of the obligation to delay the removal of the forms if the concrete has not set sufficiently hard.

Forms shall not be struck until the concrete has reached strength at least twice the stress to which the concrete may be subject at the time of removal of formwork. In normal circumstance, generally where the temperatures are above 20ºC and where ordinary Portland cement is used, form may generally be removed after the expiry of the following periods, according to the Clause 10.3, IS: 456-2000.

Table Removal of the Forms a.	Walls columns and vertical faces of all structural members	24 to 48 hours as may be decided by the engineer-in-charge
b.	Slabs (Props left under)	3 days
c.	Beam soffit (props left under)	7 days
d.	Removal of props under slabs	7 days
	1. Spanning up to 4.5m	14 days
	2. Spanning above 4.5 m	
e.	Removal of props under beams and arches	14 days 21 days
	1. Spanning up to 4.5m	
	2. Spanning above 4.5 m	

Where sulphate resistant cement is used, manufacturer's instructions are to be followed. The Engineer-in-Charge may modify these requirements taking into account the type of cement and method of compaction used, and contractor shall obtain the Engineer-in-Charge's written approval for any decrease in time of stripping of the formwork given above. The contractor shall notify the Engineer-in-Charge when he proposes to stripe of any formwork and no formwork shall be struck except in the presence of the Engineer-in-Charge or his representative

17.6.5 Reuse of Forms

Only mild steel formwork of best quality as per approved vendor list given by Engineer-in-Charge shall be used for concreting purpose. These shuttering shall not be reused unless it is properly scraped cleaned and repaired, so that it gives a plane, even, fair and dense concrete surface.

Cleaning and treatment of Forms

All forms shall be thoroughly cleaned of old concrete, wood shavings, sawdust, dirt and dust sticking to them before these is fixed in position. All rubbish, loose concrete, chippings, shavings, saw dust etc. should be scrupulously removed from the interior of the forms before concrete is poured. Wire brushes, brooms, compressed air jet and/or water jet etc. shall be kept handy for cleaning, if directed by the Engineer-In-Charge. Before formwork is placed in position, the form surface that will be in contact with concrete shall be treated with approved non-staining oil or composition, which is insoluble in water and not injurious to concrete. Care shall be taken that the oil or composition does not come in contact with reinforcing steel or stain the concrete surface. Burnt oil shall not be allowed to be used especially where the concrete surface will require finishing and/or plaster.

17.7 Materials for Concrete

Water

Water used for cement concrete mortar, plaster, grout, curing or washing of sand shall be clear and free from injurious amount of Oil, Acid, Alkali, Organic matter or other harmful substances in such amounts that may impair the strength or durability of the structure. Potable water shall generally be considered satisfactory for mixing and cur-

ing concrete. In case of doubt regarding development of strength, the suitability of water for making concrete shall be ascertained by compressive strength and initial setting time specified in the IS: 456 Code of Practice for Plain and Reinforced concrete. The Engineer-in-Charge may require the contractor to get the water tested from an approved laboratory at his own expense and in case the water contains any salts for an excess of acid, alkali, any injurious substances etc., the Engineer-in-Charge may refuse its use. And the contractor shall be required to arrange suitable water at his own cost.

Aggregate

General

Coarse and Fine Aggregates for concrete shall confirm in all respect to PWD Specification / IS: 383 Specification for Coarse and Fine Aggregates from Natural Sources for Concrete. Aggregates shall be obtained from a source known to produce satisfactory material for concrete. Aggregates shall consist of naturally occurring sand and gravel or stone, crushed or uncrushed or a combination thereof. They shall be chemically inert, hard strong, dense, durable, clean and free from veins and adherent coatings and of limited porosity. Flaky and elongated pieces shall not be used. Whenever required by the Engineer-in-Charge the aggregates shall be washed by the Contractor before use in the work.The source of aggregates shall be approved by the Engineer-in-Charge and shall not be changed during the course of the job without his approval. Rejected aggregates shall be promptly removed from the work site by the contractor at his own expense.

Deleterious Materials

Aggregates shall not contain any harmful material, such as iron pyrites, coal, mica, shale or similar laminated materials, clay, alkali, soft fragments, sea shells, organic impurities etc, in such quantities as to affect the strength or durability of the concrete and in addition to the above, for reinforced concrete, any material which might cause corrosion of the reinforcement. Aggregates which are chemically reactive with the alkalis of cement shall not be used. The maximum quantities of deleterious materials in the aggregate, shall be in accordance with IS: 2386 (Part II). Methods of Test for Aggregates for Concrete, shall not exceed the limit given in Table I of IS: 383. The sum of

the percentages of all deleterious materials shall not exceed five. Deleterious materials also include material passing 75 micron IS sieve.

Coarse Aggregates

Coarse aggregate is aggregate most of which is retained on 4.75 mm IS: sieve. Coarse aggregate for concrete shall conform to IS: 383. These may be obtained from crushed or uncrushed gravel or stone and shall be clean and free from elongated, Flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter. Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits.

Table : Grading of Coarse Aggregates IS Sieve size (mm)	Percentage Passing For Single Sized Aggregate of Normal Size					Percentage Passing for Graded Aggregate of Normal Size			
40mm	20mm	16mm	12.5mm	10mm	40mm	20mm	16mm	12.5mm	
63	100	-	-	-	-	100	-	-	-
40	85-100	100	-	-	-	95-100	100	-	-
20	0-20	85-100	100	-	-	30-70	95-100	100	-
16	-	-	85-100	100	-	-	-	90-100	-
12.5	-	-	-	85-100	100	-	-	-	90-100

The Engineer-in-Charge may allow graded aggregates to be used provided they satisfy the requirements and Table IV of IS: 383.

Fine Aggregates

Fine aggregates is aggregate most of which passes 4.75 mm IS sieve but not more than 10% passes through 150 micron IS Sieve. These shall comply with the requirements of grading zones I, II and 1II as given in Table III of 15:383. Fine aggregate conforming to grading zone IV shall not be normally used in reinforced concrete unless tests have been made by the contractor to ascertain the suitability of the proposed mix proportions and approved by the Engineer-in-Charge. As per IS: 383 Table is given below:

Table : Grading of Aggregates IS: Sieve Designation	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV

10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	5-90	75-100	90-100
600 microns	15-34	35-59	60-79	80-100
300 microns	5-20	8-30	12-40	15-50
150 microns	0-10	0-10	0-10	0-15

Note: To use the sand falling in Zone -IV, IS: 383 shall be followed.

Fine aggregates shall consist of natural sand resulting from natural disintegration of rock and which has been deposited by streams or glacial agencies, or crushed stone sand or crushed gravel sand.

17.8 Sampling and Testing

Sampling and testing shall be carried out by the contractor, at the contractor's expense, in accordance with:

IS: 516 Method of test for strength of concrete

IS: 2386 Methods of test for aggregates for concrete

Storage of Aggregates

The contractor shall at all times maintain at the site of work such quantities of aggregates as are considered by the Engineer-in-Charge to be sufficient to ensure continuity of work.

Each type and grade of aggregate shall be stored separately on hard firm ground having sufficient slope to provide adequate drainage to rain water.

Any aggregate delivered to site in a wet condition or becoming wet at site due to rain shall be kept in storage for at least 24 hours to obtain adequate drainage, before it is used for concreting, or the water content of mix must be suitably adjusted as directed by Engineer-in-Charge.

Cement

General

The cement used shall be ordinary Portland cement conforming to IS: 8112 or as specified in the particular specifications/drawings or as directed by the Engineer-in-charge.

Storage on the site

The cement shall be stored in a suitable weatherproof building and in such a manner as to permit easy access for proper inspection and counting. The cement shall be stored in such a manner as to prevent deterioration. Cement of different types and brands

shall be kept in separate stacks and marked accordingly. Cement older than two months shall not be used on site.

All cement stored on the site shall be arranged in batches, and used in the same order as received from the manufacturer. A cement register shall be maintained at site in which all entries shall be completed day to day, showing the quantities received date of receipt, source of receipt, type of cement etc, and also the daily cement consumption on site. This register shall be accessible to the Engineer-in-charge for his certification.

Rejection of Cement

The Engineer-in-charge may reject any cement as a result of any tests, thereof, notwithstanding the manufacturer's certificate. He may also reject cement, which has deteriorated owing to inadequate protection during storage from moisture or due to intrusion of foreign matter or other causes. Any such cement which is considered defective by the Engineer-in-Charge shall not be used, and shall be promptly removed from the site of the work by the contractor at his own expense.

17.9 Other Materials

AI materials including admixtures, joint filters and joint sealants not fully specified herein and which may be used in the work shall be of quality approved by the Engineer-in-Charge and he shall have the right to determine whether all or any of the materials offered or delivered for use in the works are suitable for the purpose Contractor shall give the samples of materials to the Engineer-in-Charge and shall get them approved before procurement and use.

17.9.1 Reinforcement

All reinforcement shall be clean and free from pitting, loose mill scales, dust and coats of paints. Oil or other coating which may destroy or reduce the bond.

Welded Joints

Welding of joints in reinforcement for bars of 28 mm dia and below shall not be allowed. However, in case of using welded joints for bars 32 mm and above the approval of the Engineer-in-Charge shall be obtained. The Engineer-in-Charge may require the Contractor, prior to the use of welded joints to have tests carried out at the contractor's expense to prove that the joints are of the full strength of the bars connected. The welding of the reinforcement shall be done in accordance with the recommenda-

tion of IS: 2751 code of practice for welding of mild steel bars for reinforced concrete construction. Special precautions are required in the welding of cold worked reinforcing bars. No extra payment for welded joints shall be made to the contractor unless specifically mentioned in the schedule of rates or bill of quantities and approved by the Engineer-in-Charge. Tack welding may be permitted by the Engineer-in-Charge under certain conditions for fixing reinforcements.

17.9.2 Reinforcement Splices

Laps & anchorage length of reinforcing bars shall be in accordance with IS: 456, unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller dia will guide the lap lengths. Laps shall be staggered as far as practicable and as directed by Engineer-in-Charge and not more than 50% of the bars shall be lapped at a particular section. Mechanical connections, for splicing reinforcement bars in congested locations may be used by the contractor, only if approved by the Engineer-in-Charge. Reinforcement bars shall not be lapped unless the length required exceeds the maximum available lengths of the bars at site. Unless otherwise specified the splices shall be wired contact lap splices as per the relevant standards. No splicing of vertical bars shall be allowed except at specified or approved horizontal construction joints. Splices in horizontal bars shall be lapped with at least one continuous bar between adjacent splices. The minimum spacing of splices in anyone run of bar shall be 6.0 m with splices in adjacent bars offset at least 3.0 m where walls or slab contain two layers of reinforcement, splices in opposite layer shall be offset by at least 1.50m.

17.9.3 Fabrication and placement

Bars shall be pre-fabricated accurately to dimensions, forms and shapes, bending procedure shall be approved by the Engineer-In-Charge. Placing and typing of reinforcement shall conform to IS: 2502-1963 Code of practice for bending and fixing of bars for concrete reinforcement. Bar bending schedules for the reinforced concrete works shown on the drawings shall be prepared by the contractors and furnished to the Engineer-in-Charge at least two weeks before the commencement of bending. Dimensions shown as furnished by the collector's shall be his responsibility and approval of the schedule shall not constitute the approval of the dimensions thereon.

17.10 Field Control

The contractor shall appoint a qualified Engineer experienced in reinforcement cutting, bending and placing the same correctly, binding and cleaning before pouring the concrete. The reinforcement shall be continuously kept in correct position during connections.

17.11 Steel Reinforcement

The reinforcement shall be High Yield Strength Deformed (HYSD) bars or TMT bars of Grade Fe-500 conforming to IS: 1786-1985 shall be used unless otherwise specified.

Placement of reinforcement should be as per IS: 456 Clause 11.3.

Approved Manufacturers: TISCO, SAIL, Rashtriya Ispat Nigam

17.12 Structural Steel

Structural steel shall conform to IS: 226 and IS: 2062.

Electrodes for welding shall conform to IS: 814 or IS: 815 or equivalent.

All bolts and nuts shall conform to IS: 1367. Stainless steel nuts and bolts shall be of SS 307 type. All materials shall be of new and unused stocks. Manufacturer's test certificate shall be made available to the Engineer-in-charge when called for.

17.13 Storage

The steel reinforcement and structural steel shall be stored in steel yard in such a way as to prevent deterioration and corrosion, preferably at least 150 mm above ground by supporting on wooden or concrete sleepers at contractor's expenses.

17.14 Proportioning of Concrete

The determination of the water-cement ratio and proportions of the aggregates to obtain the required strength shall be made from preliminary tests by designing the concrete mix as per provisions laid down in IS: 456-2000 &IS: 10262 or its latest revision. Design mix shall be admissible only if contractor is able to manage the quality control of design mix e.g. weighbridge, proper water measuring device etc. and designing the concrete mix as and when source of any of the consistent of concrete is changed. If contractor fails to comply with the requirements of design mix concrete, he shall have to follow the nominal mix as tabulated below

Table- Recommended Water-Cement Ratio (As per IS: 456-2000) Grade of Con-	Nominal Mix of Concrete	Quantity of Water per 50 Kg. of cement (Max)

crete		
M 5	1:5:10	60 litres
M 7.5	1:4:8	45 litres
M 10	1:3:6	34 litres
M 15	1:2:4	32 litres
M 20	1:1.5:3	30 litres
M-25	1:1:2	26 litres

Cube tests shall be carried out by the contractor on the trail mixes before the actual concreting operation starts. Based on the strength of the concrete mix sanction for its use has to be obtained from Engineer-in-charge.

If during the execution of the works it is found necessary to revise the mix because of the cube tests lower strengths than the required one due to inconsistency of quality of material or otherwise, the Engineer-in-charge shall ask for fresh trial mixes to be made by the contractor. No extra claim shall be entertained due to such change in mix variations, as it is the contractor‟s responsibility to produce the concrete of the required grade. Great care shall be exercised when mixing the actual works concrete using the proportions of the selected trial mix. The final concrete mix shall have the same proportions of cement, fine and coarse aggregates and water as that of the approved selected mix. Where the weight of cement is determined by accepting the manufacturer‟s weight per bag, a reasonable number of bags should be weighed separately to check the next weight. Proper control of mixing water is deemed to be of paramount importance. If mixers with automatic addition of water are used water should be either measured by volume in calibrated buckets, tins or weighed. All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked and certified and the Engineer-in-Charge‟s approval obtained.The Engineer-in-Charge may require the contractor to carry out moisture content tests in both fine and coarse aggregates. The amount of the added water shall then be adjusted to compensate for any observed variations in the moisture contents. For the determination of moisture content IS: 2386 shall be referred to. No substitution in material, used on the work or alternation in the established proportions shall be made without additional tests to show that the quality and strength of concrete are satisfactory. No alternations shall be permitted .without the prior sanction of the Engineer-in-Charge.

17.15 Mixing of Concrete

The mixing of concrete shall be strictly carried out in an approved type of mechanical concrete mixer. The mixing equipment shall be capable of combining the aggregates, cement and water within the specified time into a thoroughly mixed and uniform mass, and of discharging the mixture without segregation. The entire batch shall be discharged before recharging. Mixing periods shall be measured from the time when all of the solid materials are in the mixing time has elapsed. The mixing time in no case shall be less than two minutes. The mixer speed shall not be less than 14 and not more than 20 revolutions per minute. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in color and consistency. Hand mixing of concrete shall not be permitted at all.

17.16 Grades of Concrete

The different grades of concrete shall conform to the strength as required by IS: 456-2000. Standard deviation shall be calculated as stated in clause 14.5 of IS: 456-2000. The acceptable criteria for concrete shall be as stated in clause 15 of IS: 456-2000.

The assumed standard deviations as given in table 6 of 18:456-2000 have to be followed. and are given hereunder :

Table : Assumed Standard Deviation Grade of Concrete	Assumed standard Deviation N/mm2
M 10	2.3
M 15	3.5
M 20	4.6
M 25	5.3

In order to get a quick idea of quality of concrete, the optional tests are conducted as stipulated in 14.1.1 of IS: 456-2000 and the results are analyzed according to table 5 of IS: 456-2000.

17.17 Concrete

Table - Characteristics Compressive strength of Concrete Grade Designation	Proportion of cement : fine aggregate: coarse aggregate	Specified characteristic compressive strength at 28 days (N/mm2)

In	M 15	1:2:4	15	general
	M 20	1:1.5:3	20	design
	M 25	1:1:2	25	

mix concrete shall be used conforming to IS: 456-2000. Nominal Mix concrete batching by volume can only be if the contractor is not able to adhere to the quality control provision of the design mix. The mix proportions for all grades of nominal mix concrete shall be provided corresponding to the values specified in Table -4.7 below for respective grades of concrete.

The maximum water-cement ratio for all concrete works shall be as specified in IS: 456-2000 and required by the Engineer-in-Charge.

To keep the water cement ratio to the designed value, allowance shall be made for the moisture contents in both fine and coarse aggregates and determination of the same shall be made as frequently as directed by the Engineer-in-charge. The determination of moisture contents shall be according to IS: 2386 (Part III).

17.18 Controlled concrete

Controlled concrete shall be used on all concreting works except where specified Otherwise. The mix proportions for all grades of concrete shall be designed to obtain strengths corresponding to the values specified in Table 1 below for respective grades of concrete.

Table –	Grade of Concrete	Specified characteristic compressive strength at 28 days [N/mm2]
	M 15	15
	M20	20
	M25	25
	M30	30

The maximum water cement ratio for all controlled concrete works shall be as specified in IS: 456 and Preliminary tests as specified in the IS code and required by the Engineer shall be carried out, sufficiently ahead of the actual commencement of the work with different grades of concrete, made form representative sample of aggregates and cement expected to be used on the job to ascertain the ratios by weight of cement, of total quantity of fine and coarse aggregates and the water cement ration required to produce a concrete of specified strength and desired workability The minimum cement content for each grade of concrete shall be as per Table-2 below. If the requirement of cement is found to be more than that specified below then such excess quantities of cement shall be used and for which no extra payment shall be made.

Table –

Minimum Cement Content In Concrete Grade of Concrete	Minimum cement content as per IS: 456 in kg./cu.m of finished Concrete
M 15	310
M20	360
M25	410
M30	500

At least 4 (four) trial batches are to be made and 7 (seven) test cubes taken for each batch noting the slump on each mix. These cubes shall then be properly cured and two cubes for each mix shall be tested in a testing laboratory approved by the Engineer at 7 (seven) days and others at 28 (twenty eight) days for obtaining the ultimate compressive strength. The test reports shall be submitted to the Engineer. The cost of mix design and testing shall be borne by the contractor. On the basis of the preliminary test reports for trial mix, a proportion of mix by weight and water cement ration will be approved by the Engineer, which shall be expected to give the required strength, consistency and workability and the proportions so decided for different grades of concrete shall be adhered to, during all concreting operations. If however, at any time the Engineer feels that the quality of material being used has been changed from those used for preliminary mix design, the contractor shall have to run similar trial mixes to ascertain the mix proportions and consistency. The mix once approved must not be varied without prior approval of the Engineer. However, should the contractor anticipate any change in the quality of future supply of materials than that used for preliminary mix design, he shall inform the same to engineer and bring fresh samples sufficiently ahead to carry out fresh trial mixes. The Engineer shall have access to all places and laboratory where design mix is prepared. Design mix will indicate by means of graphs and curves etc. the extent of variation in the grading of aggregates which can be allowed. In designing the mix proportions of concrete, the quantity of both cement, and aggregate and water shall be determined by weight. All measuring equipment shall be maintained in clean and serviceable condition and their accuracy periodical checked. To keep the water cement ratio to the designed value, allowance shall be made for the moisture contents in both fine and coarse aggregates and determination of the same shall be made as frequently as directed by the Engineer. The determination of moisture contents shall be according to IS: 2386 (Part III).

17.19 Strength Requirements

Where ordinary Pozzolona Portland cement conforming to IS: 269 is used the compressive strength requirements for various grades of concrete shall be as shown in Table -2 of IS: 456 -2000 where rapid hardening Portland cement is used the 28 days compressive strength requirements specified in Table-2 shall be met in 7 days. The strength requirements specified in Table-2 as previously given shall apply to both controlled concrete and ordinary concrete. Other requirements of concrete strength as may be desired by the Engineer-in-Charge shall be in accordance with India Standard IS: 456-2000. The acceptance of strength of concrete shall be as per clause 14 "Sampling and Strength Test of Concrete" and clause. 15 "Acceptance Criteria" of IS: 456-2000 subject to stipulations and/or modifications stated elsewhere in this specification. if any. Concrete work found unsuitable for acceptance shall have to be dismantled and replaced to the satisfaction of the Engineer-in-charge by the contractor free of cost to the Department. No payment for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. washed 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 water quantity has to be increased in special cases, cement also be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment for the additional cement shall be made.

17.20 Workability

The workability of concrete shall be checked at frequent intervals by slump test. Where facilities exist and if required by the Engineer-in-Charge, alternatively the Compacting Factor test in accordance with IS: 1199 shall be carried out. The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of formwork and round the reinforcement to give the required surface finish shall depend on the type and nature of the structure and shall be based on experience and tests. The limits of consistency for structures are as specified in Table 4.8 below:

Table : Limits of Consistency (as per IS:

Degree of Workability	Values of Workability

456) Placing Conditions		
Concreting of shallow sections with vibration	Very low	20.1 0 seconds, vee-bee time or 0.75.-0.60 compacting factor
Concreting of lightly reinforced sections with vibration	Low	10-05 seconds, vee-bee time or 0.80 - 0.85

* For smaller aggregate the values shall be lower.

17.21 Workmanship

All workmanship shall be according to the latest relevant standards. Before starting a pour the contractor shall obtain the approval of the Engineer-in-Charge or his representative in a "Pour Card" maintained for this purpose. He shall obtain complete instructions about the material and proportion to be used, slump, workability, quantity of water per unit of cement, number of test cubes to be taken, finishing to be done, any admixture to be added, etc.

17.22 Transportation and Pouring

The concrete mixer shall be as close to the place of concreting as possible but not as close as to produce vibration and disturbance to the shuttering and reinforcements. It shall be located at such a position that time lapse for transportation of unloaded concrete mix from the mixer to the place of deposition of concrete is minimum. When there is a difference in level between the unloading platforms of concrete from the mixer to the actual place of deposition of concrete, the concrete shall be transported manually as by means of builders" hoist/crane or concrete pump to the actual level of concreting, depending on requirement as approved by Engineer-in-charge.

Chutes for transporting the concrete shall not normally be used. The Engineer-in-Charge's written permission shall be taken for transporting by means of chutes. If use of chutes is permitted then the concrete shall be again thoroughly mixed by using spades manually before placing the concrete in the moulds /shuttering to avoid segregation of concrete. It shall be ensured that initial setting of the concrete shall not take place and the mix of the concrete is as good as that of freshly poured concrete delivered directly into the moulds /shuttering. It shall be ensured that the drop of concrete is not from an excessive height and that the vibration and deposition of concrete are

simultaneously carried out Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned and all debris shall be removed from the place to be occupied by the concrete. All form and soil surface shall be finished to desired levels and shall be thoroughly wetted immediately prior to placing of concrete. No concrete shall be placed until the Engineer-in-Charge has approved the excavation formwork and the reinforcement. The competent formwork maker and steel fixer shall be in attendance during concreting operation. The Pour card shall be signed by the contractor, designer and the representative of the consultants indicating the checking of the reinforcement, forms, and the sizes of the member to be concreted. Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable by methods, which shall prevent the segregation or loss of any of the ingredients. If segregation does occur during transport, the concrete shall be remixed before being placed. The concrete shall be place and compacted before setting commences and shall not be subsequently disturbed. To ensure bond and water tightness between old concrete surface and the concrete to be place PVC water stops of approved make and size 150 mm wide, 10 mm thick should be used. The bonding of old and new concrete shall be done by applying cement slurry after thoroughly watering the old concrete surface and. removing all loose particles.

In specified cases, with approval of Engineer-in-charge the surface shall be cleaned and roughened by initial green cut by wire brushes or chipping. The initial green cutting may be done after 6 hours of placing concrete in order to facilitate the work. The old concrete walls/members shall be given a shear of 50 x 65 mm deep. This key shall also be thoroughly cleaned with wire brush in green stage before next lift pouring to avoid percolation of works.

17.23 Special methods of Concreting

If the contractor proposes to use the special methods of concreting not included in this specification, such as pumping concrete or using vacuum moulds he shall obtain the Engineer"s approval before commencing work and comply with any subsequent specifications made by the Engineer for this special methods of concreting. Contractor is advised to use modern techniques in adapting methods of laying/finishing concrete in raft/wall etc., e.g. in raft, us of any other acceptable and proven method will be wel-

comed. The contractor may elaborate same on while quoting the offer. No extra payment shall be entertained for the approval of concreting by the special methods.

17.24 Placing of concrete in slabs and beams

Concrete in slabs shall be placed in one continuous operation for each span unless otherwise directed. Longitudinal construction joints, if required by reason of the width to be placed shall be located as shown on the drawings or as directed by the Engineer-in-Charge. Concrete in the stem and slab of T -beam shall be placed in one continuous operation and shall be deposited uniformly for the full length of the beam and brought up evenly in horizontal layers. Where the size of the member is such that it cannot be made in one pour, transverse vertical construction joints shall preferably be located within the area of contra flexure. For continuous spans, where required by design considerations the concrete placing sequence shall be approved by the Engineer-in-Charge.

17.25 Concreting floors

Concreting in floor shall be done in a chess board pattern, allowing sufficient time to elapse before the adjacent band in cast. The panel size is restricted to 7.5m in reinforced concrete slab. Concreting shall not be started unless the electrical conduits or any other piping Puddle Collars wherever required or laid by the concerned agency. The civil contractor shall afford all the facilities and maintain co-ordination of work with other agencies engaged in electrical and such other works as directed by the Engineer-in-Charge. Where concrete is placed on soil it shall be placed only on firm undisturbed ground. Any concrete that is placed on a well compacted fill shall have the prior approval of the Engineer-in-Charge. Concrete shall not be placed in standing water, on sub-grade or in foundation Excavation.

17.26 Compaction

Concrete during and immediately after depositing shall be thoroughly compacted. The compaction shall be done by mechanical vibration subject to the following provisions:

a. The vibration shall be internal unless special authorization of other methods is given by the Engineer-in-charge or as provided herein.

b. Vibrators shall be of type and design approved by the Engineer-in-charge. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4,500 impulses per minute.

c. The intensity of vibration shall be such as to visibly affect a mass of concrete of 25 mm slump over a radius of at least 0.5m

d. The contractor shall provide a sufficiently number of vibrators to properly compact each batch immediately after it is placed in the forms.

e.Vibrators shall be manipulated so as to have thoroughly work the concrete around the reinforcement and embedded fixtures, and into the corners and angles of the forms.

Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted into and withdrawn out of the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed. Application of vibration shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

a. Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in forms over distances so great as to cause segregation and vibrators shall not be used to transport concrete in the forms.

b. Vibration shall be supplemented by Roding/spading as necessary to ensure smooth surface and dense concrete along form surfaces and in corners and locations impossible to reach with the vibrators. The whole process starting from the mixing of concrete to the placing and compaction shall not take more than 20 minutes and the process shall be completed before the initial setting takes place.

17.27 Curing

Curing shall be accomplished in accordance with IS: 456-2000 by keeping the concrete covered with a layer of sacking canvas, hessian or similar absorbent materials and kept constantly wet for at least ten days in continuation from the date of placing of concrete unless otherwise specified. The approval of the Engineer-in-Charge shall be ob-

tained for the method of curing the contractor proposes to use on the work. In very hot weather precautions shall be taken to see that temperature of wet concrete does not exceed 38ºC while placing.Heavy loads shall not be placed on or moved across over the floor slabs until curing is complete. Care shall be taken to prevent floor surface from being marred during curing period. Freshly laid concrete form work shall not be jarred. Concrete placed in trenches or Excavation shall be protected from falling earth during and after placing.

17.28 Consistency

The consistency of concrete shall be frequently checked by means of a slump test performed as per the relevant Indian Standard by the Engineer-in-Charge. The maximum and minimum slump for each class of concrete shall be as directed by the Engineer-in-Charge, and any concrete as represented by the slump test which fails to comply with these directions shall be removed from the site and disposal off at the contractors cost.

17.29 Finishing Concrete

On striking the formwork, all blowholes and honeycombing observed shall be brought to the notice of Engineer-in-Charge. The Engineer-in-Charge may, at his discretion allow such honeycombing or blowholes to be rectified by necessary chippings and packing or grouting with concrete or cement mortar. If mortar is used, it shall be 1:2 mix or as specified by Engineer-in-Charge. However, if honey combing or blowholes are of such extent as being undesirable, the Engineer-in-Charge may reject the work totally and his decision shall be binding. No extra payment shall be made for rectifying these defects. All burrs and uneven faces shall be rubbed smooth with the help of carborundum stone. The surface of non-shuttered faces shall be smoothened with a wooden float to give a finish equal to that of the rubbed down shuttered faces. Concealed concrete faces shall be Left as from the shuttering except that honeycombed surface shall be made good as detailed above. The top faces of slabs not intended to be surfaced shall be leveled and floated to a smooth finish at the levels or falls shown on the drawings or elsewhere. The floating shall not be executed to the extent of bringing excess fine material to the surface.

The top faces of slabs intended to be covered with screed, granolithic or similar faces shall be left with a rough finish.

17.30 Work in Extreme Weather

During hot weather (atmospheric temperature above 40 degree centigrade) or cold weather (atmospheric temperature at 5 degree centigrade and below) the concreting shall be done as per the procedure and precautions set out in IS: 7861 (Part I and II).

Dependence shall not be placed on salt or other chemicals for the prevention of freezing. Calcium chloride shall not be used as an accelerator except with the approval of the Engineer-in-Charge. Recommendation given in relevant clauses of IS: 456 shall be strictly adhered to.

17.31 Loading of the Structures

No concrete structures shall be loaded until the concrete is at least 28 days old and only then with the approval of the Engineer-in-Charge and subject to such conditions as he may lay down.

17.32 Testing and Acceptance Criteria of Concrete

The sampling of concrete making the test specimens, curing and testing procedures etc. shall be in accordance with IS: 1199, IS: 3085 and IS: 516, the size of specimen being 15 cm cubes. Normally only compression tests shall be performed in accordance with IS: 516. For each grade of concrete and for each 8 hours of work or portion thereof the following samples shall be taken. At least six specimens shall be taken from the first 15.0 m3 or part thereof and three of these shall be tested at 7 days and the remaining at 28 days. Four additional specimens shall be taken from each additional 15.0 m3 of concrete or portion thereof of which 2 specimens shall be tested at 7 days and the remaining at 28 days. To control the consistency of concrete from every mixing plant slump tests, and/or compacting factor tests in accordance with IS: 1199 shall be carried out by the contractor every two hours or as directed by the Engineer-in-Charge. Slumps corresponding to the test specimens shall be recorded for reference. The acceptance criteria of concrete shall be in accordance with IS: 456-2000. Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specifications by the contractor. No payment for the dismantled concrete, the relevant formwork and reinforcement embedded fixtures etc. shall be paid. In the course of dismantling if any damage is done to, the embedded items or adjacent structures the same shall be made good free of charge by the contractor to the satisfaction of the Engineer-in-Charge.

17.33 Load Test of Structures

The Engineer-in-Charge may instruct for a load test to be carried out on any structure if in his opinion such a test is deemed necessary for any of the following reasons. The works site made concrete test-cube failing to attain the specified strength, as per the criteria laid down in IS: 456-2000. Suspected overloading during construction of the structure under review shuttering being prematurely removed and not as per the specification The concrete is being improperly cured. Visible deficiencies of the concrete If the results of the load test be unsatisfactory, the Engineer-in-Charge may instruct the Contractor to demolish and reconstruct the structure or part thereof at the contractor's cost. The load test of structures shall be carried out as per the clause 16.5 of IS: 456-2000.

17.34 Special methods of concreting

The contractor should propose to use special methods of concreting not included in the specifications, such as pumping concrete or using vacuum moulds, he shall obtain the Engineer-in-Charge's approval before commencing work and comply with any subsequent specification made by the Engineer-in-Charge for this special method of concreting. Contractor is advised to use modern techniques in adopting methods of laying/finishing concrete in raft/walls etc. e.g. in raft use of any other acceptable and proven method will be welcomed. The contractor may elaborate same on while quoting the offer.

17.35 Codes and Standards

All applicable standards, specifications, etc. and codes of practice shall generally be the latest editions, including all applicable official amendments and revisions. A complete set of all these documents shall generally be available at site, with the contractor. All work shall be carried out as per the stipulations contained in various sections of these specifications and the latest Indian Standards, Acts, Codes and best practices. In case of conflict between the stipulations contained in various" sections of these specifications and stipulations of Indian Standard, Codes, etc. the requirements of stipulations contained in various sections of these specifications, shall prevail over that of Indian Standards, Codes, etc.

Some of the applicable Indian Standard Codes, etc. are referred to

Specification for paving bitumen

here below. IS:73

IS:2060	Specification for structural steel
IS-8112	Specification for ordinary Portland cement 43 grade.
IS:280	Specification for mild steel wire for general engineering purposes
IS:383	Specification for coarse and fine aggregates from natural sources for concrete
IS:432 (Part I & II)	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
IS:455	Specification for Portland Slag Cement
IS:456	Code of practice for plain and reinforced concrete
IS:457	Code of Practice for general construction of plain & reinforced concrete for dams and other massive structure.
IS:516	Method of test for strength of Concrete
IS:650	Specification for standard sand for testing of cement
IS:702	Specification for industrial bitumen
IS:816	Code of practice for use of metal as welding for general construction in mild steel
IS:1199	Methods of sampling and analysis of concrete
IS:1200 (Part II, V, VIII, XVIII, SVIII)	Method of measurement of building and civil engineering works, water proofing and damp proofing
IS:1367	Technical supply conditions for threaded steel fasteners
IS:1489	Specification for Portland pozzolona cement (Part I) Fly ash based & (Part II) Calcite clay based
IS:1566	Specification for Hard drawn steel wire fabric for concrete reinforcement
IS:1609	Code of practice for laying damp proof treatment. Using bitumen felts.
IS:1786	Specification for high strength deformed steel bars and wires for con-

	crete reinforcement
IS:1791	General requirements for batch type concrete mixer.
IS: 1838	Specification for performed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type)
IS:2204	Code of practice for construction of reinforced concrete shell roof
IS:2210	Criteria for the design of reinforced concrete shell structures and folded plate
IS:2386 (Part 1 to VIII)	Methods for test of aggregates for concrete
IS:2438	Specification for roller pan mixer
IS:2502	Code of practice of bending and fixing of bars for concrete reinforcement
IS:2505	General requirements for concrete vibrators, immersion type
IS:2506	General requirements for concrete vibrators, screen board type
IS:2514	Specification for concrete vibrating tables
IS:2571	Code of practice for laying in situ cement concrete flooring
IS:2645	Specification for integral cement water proofing compounds
IS:2722	Specification for portable swing weigh batchers for concrete (single and double bucket type)
IS:2750	Specification for steel scaffoldings
IS:2751	Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction
IS:3025	Methods of sampling and test waste water
IS:3067	Code of practice for general design details and preparatory work for damp proofing & water proofing of buildings
IS:3150	Specification for hexagonal wire netting for general purposes
IS:3366	Specification for pan vibrators
IS:3370 (Part I & II)	Code of practice for concrete structures for the storage of liquids
IS:3384	Specification for bitumen primer for

	use in water proofing & damp proofing
IS:3414	Code of practice for design and installation of joints in buildings
IS:3550	Methods of test for routine control for water used in industry
IS:3558	Code of practice for use in immersion vibrators for consolidating concrete
IS:3696 (Part I & II)	Safety code for scaffolds and ladders
IS:4014 (Part I & II)	Code of practice for steel tubular scaffolding
IS:4031	Methods for physical tests for hydraulic cement
IS:4130	Safety code for demolition of buildings.
IS:4326	Code of practice for earthquake resistant design and construction of buildings
IS:4461	Code of practice for joints in surface hydroelectric power stations
IS:4656	Specification for form vibrators for concrete
IS:4925	Specification for batching and mixing plant
IS:4990	Specification for plywood for concrete shuttering work
IS:4995 (Part I & II)	Criteria for design of reinforced concrete bins for the storage of granular and powdery materials
IS:5121	Safety code for piling and other deep foundations
IS:5256	Code of practice for sealing joints in concrete lining on canals
IS:5525	Recommendations for detailing of reinforcement in reinforced concrete work
IS:5624	Specification for foundation bolts
IS:6461	Glossary of terms relating to cement concrete
IS:6494	Code of practice for water proofing of underground water reservoirs and swimming pools
IS:6509	Code of practice for installation of joints in concrete payments
IS:7193	Specification for glass fiber base

	coal tar pitch and bitumen felts
IS:7293	Safety code for working with construction machinery
IS:7861 (Part I & II)	Code of practice for extreme weather concreting
IS:9012	Recommended practice for shuttering
IS:9103	Specification for admixtures for concrete
IS:9417	Recommendations for welding cold worked steel bars for reinforced concrete construction.
IS:9595	Recommendations for metal-arc welding of carbon and carbon manganese steels
IS:10262	Recommended guidelines for concrete mix design
IS:11384	Code of practice for composite construction in structural steel and concrete
IS:12118	Specification for two parts polysulphide.
IS:122000	Code of practice for provision of water slops at transverse contraction joints in masonry and concrete dams
IS:12269	53 grade ordinary Portland cement
IS:12600	Portland cement, low heat
IS:23	Handbook of concrete mixes
IS:24	Explanatory Handbook on IS:456-1978
IS:34	Handbook on concrete reinforcement and detailing.

DS 18

MILD STEEL AND TOR STEEL REINFORCEMENT FOR RCC WORKS

The item provides for supply of mild steel, tor steel bars, cutting, bending with G.I. wire and placing in position, welding for reinforcement in the RCC.

Mild steel and tor steel bars shall confirm to Specification A-10 of Standard Specification of Public Works Department, Latest Edition.

The binding wire shall confirm to Specification A-15 of Standard Specification of Public Works Department, Latest Edition.

During contractor's supply, if any, the steel bars shall be supplied directly to the site of

work.

Bending reinforcement confirm accurately to the dimensions and shapes in the details drawings (approved) or as directed by the Engineer-in-charge.

Bars shall be bend cold only. In no way bending by heat will be allowed.

Bars with kinks, bends or cracks shall not be used.

Details of length, size, laps and bending diagram shall be got approved by the Engineer-in-charge.

As far as possible full length of bars shall be placed as per drawing details. When full lengths are not available, bars be supplies only after written permission of the Engineer-in-charge. Supplies shall be staggered and in tension zone shall be avoided strictly. Bars shall be lapped as specified in IS: 456-2000 with due regards to the grade of concrete. Welding may be used for large diameter of bar only after permission of Engineer-in-charge.

Welding, if permitted shall conform to specification B.10.7 of Standard Specification of Public Works Department.

All reinforcement shall be accurately placed in position with spacing and cover shown in detailed drawing and firmly held during the placing and setting of concrete. Bars shall be ties at all intersections. Binding wire of 1.63 mm or 1.22 mm diameter (about 16 or 18 gauge) shall be used. Spacing of the bars shall be maintained by means of stays, blocks ties, spacers, hangers or other approved supports at sufficient close intervals so that bars will not be displaced. During placing vibrating or compacting concrete, placing bars for reinforcement on a layer of fresh concrete as the work progress will not be permitted. The use of pieces of broken stones or bricks or wooden blocks for maintaining spacing or cover shall not be permitted. Layers of bars shall be separated by precast cement blocks, spacer bars or other devices.

Full details of numbers, sizes, lengths, weights, laps, welds, spacing of bars placed in position in different parts of the work shall be recorded by the contractor and certified and signed by the Engineer-in-charge or his representative to show that all reinforcement has been placed correctly as per sanctioned drawing or as directed by the Engineer-in-charge in writing, before placing concrete. No concrete shall be placed in position until the certified the correctness of reinforcement, recording the steel measurements and has given permission in writing to place concrete. After

approval of reinforcement as above, it will be the contractor's responsibility to seal that the spacing of reinforcement and arrangements are not tampered with in any way before or during concreting. Any steel is required to be procured by Contractor. He shall produce the test certificate. In addition, actual test shall be carried out according to IS: 432-1982, in a Government laboratory and the cost of test shall be borne by the contractor, including all transport, etc.

This item includes,

a) Cost of labour, materials, use of tools, plant and tackle and other incidental items to complete the work satisfactorily.

b) Supplying, conveying, cleaning, cutting, bending, binding with (1.63 mm or 1.22 mm diameter – 16 to 18 gauge) wire on spot, welding and placing reinforcement in position and maintaining it clean and in position till the concrete is laid.

C) Cost of sampling and testing, as required.

In no case, any foreign material e.g. oil, grease, etc. which prevent bonding between steel and concrete shall remain on steel on steel bars during placing of concrete.

MODE OF MEASUREMENT AND PAYMENT

The tender rate shall be on weight basis for MT of MS/tor steel reinforcement. The weight of steel reinforcement used for the item of concrete will be measured in tons based on total compacted weight for the sizes and lengths of bars as shown in drawing or as directed by Engineer-in-charge.

The lengths of the bars shall be measured correct to 2 places of decimals of meters. The weights for payments shall be calculated according to standard weights mentioned in the ISI Hand Book correct up to 0.10 Kg.

DS 19

PROVIDING, FIXING RSJ AND OTHER STRUCTURAL STEEL WORK

The specification of the work as per standard specification Bd.C2 and the item cover fixing MS/RS girders, M.S. angle, channels, flats, base plate gusset plates, cleat, bracket etc. and other accessories as per requirement and as directed and fabricating the assembly by cutting, drilling holes etc and erecting and fixing item as site with necessary riveted or welded joints fixtures with nuts and bolts etc. wherever necessary

together with their proper fixing and embedding in masonry or slabs of concrete as directed. Structural steel works materials shall be procured by the Contractor from open market at his cost. The item includes 3 coats of oil paint of shade as directed to all structural work.

All above operations including cost of materials and labour thereof are included in the tender item. The measurement and payment shall be on the weigh basis in the unit as mentioned in Schedule-B actually erected at site as directed shall be admissible for payment. RSJ channels, angles, flats, gusset plates, brackets base plate, cleats, packing pieces actual used as directed shall be admissible for payment but not the rivets, nuts and bolts etc. The riveted or welded joints or fixing with nuts are included in the tendered rates. The specifications for this item given in Standard Specification (Red Book) published by B&C Department will be followed.

19.1 **STRUCTURAL STEEL WORK** (for pipe line, outlet arrangement work only)

Requirements specified in this section will form a part of detailed specifications for items of works failing under this category. Indian Standard shall apply as if included herein. Design of structure shall be compliance with Indian Standard (IS) viz. Rivet IS: 1148-1964 for bolts IS: 1148-1964 and IS: 800-1962 for structural fabrication IS: 800-1962, etc.

19.2 **PRINCIPAL ITEMS**

1) Structural steel members
2) Steel joints
3) Plates and connection
4) Steel chair assembly
5) Pipe supports and hangers for piping in all locations
6) Pipe railing
7) Ladders and stairs
8) Misc. metal work for water supply and sewerage disposal Installations.

19.3 **QUALITY ASSURANCE**

Unless otherwise specified all work specified herein and shown on the drawings shall

conform to the applicable requirements of the following specifications and codes.

A) Fabrication and erection of structural steel shall be in accordance with IS: 800-1962. (Latest edition)

B) **WELDING INSPECTION**

The contractor shall perform all structural field welding under continuous inspection of a representative of the SMKC. Notice will be given at least 24 hours in advance of needed inspection.

19.4 SUB METALS

SHOP DRAWINGS

The contractor shall submit shop drawings for approval before fabrications of any of the work. Complete fabrication details with material and specification lists showing all welds, fabrication and finish details, and shop painting will be shown with the drawing. In approving shop drawings, the owner does not assume responsibility for accuracy of the work relative to other components as constructed.

SHOP FABRICATION

GENERAL

A) The maximum possible fabrication on structural steel work shall be manufactured off-site in a fabrication shop.

B) Shop connections shall be welded or bolted, unless otherwise indicated.

C) In so far as possible all work shall be fitted and assembled in shop ready for erection.

19.5 **MEMBERS**

A) All members shall be free from twists, kinks, buckles or open joints.

B) All members, holes and their spacing shall be so accurately made that when assembled the parts shall cone together and bolt without distortion.

C) Parts assembled with bolts shall be in close contact, except where separators are required where unlike metals are in contact, to insulate as necessary to prevent corrosion.

D) Bolt holes will be provided to secure special items, if any, to structural members.

E) Bearing surface shall be planned to true beds. Abutting surface shall be closely fitted. Steel requiring accurate alignment shall be provided with slotted holes and/or washers for aligning the steel.

F) All materials shall delivered in the order, in which they will be required so as to avoid all delay in completion of the project.

19.6 **WELDING**

A) Welding in shop and field shall be done by qualified operators who have experience of similar work. The standard for welders will be as required by IS: 817-1966.

B) All steel before being fabricated shall be thoroughly wire brushed, cleaned of all scale and rust and thoroughly straightened by approved methods that will not injure the materials being worked on. Welding shall be continuous along the entire line of contact except where tack or intermittent welding is permitted. Where exposed welds shall be cleaned of flux and slag and ground smooth.

19.7 **ERECTION**

A) Erection shall include the installation and erection of all steel as called for in this section. The contractor shall verify correctness before starting erection.

B) As erection progresses, the work shall be securely bolted up to take care of all dead-load, wind and erection stresses.

C) No final bolting or welding shall be done until each portion of the structure has been properly aligned and plumbed.

D) Bolts shall be drawn up tight and threads set so that nuts cannot become loose.

E) **DAMAGED MEMBERS**

During erection, members which are bent, twisted or damaged shall be straightened or replaced as directed. If heating is required in straightening, a heat method shall be used, which will ensure uniform temperature throughout the entire members. Members which in the opinion of the SMKC are damaged to an extent impairing appearance, strength or service ability, shall be removed

and replaced with new members.

F) **ANCHOR BOLTS AND ANCHORS**

Anchor bolts and anchors shall be properly located and built into connection work. Bolts and nuts shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately. Embedded anchor bolts that are submerged in process, water or pump room floors, or are in enclosed tanks or spaces exposed to process gas or moisture shall be of stainless steel with nuts of same material. To such stainless steel bolts, a non-oxidizing lubricant grease will be applied before bolting.

G) **BEARING PLATES**

Bearing plates shall be provided under beams and columns resting on walls or footings. Bearing plates may be attached or loose and aligned on steel wedges or shims. After the supported members have been plumbed and properly positioned and the anchor nuts tightened, the entire bearing are under the plate shall be dry packed solidly with bedding mortar. Wedges and shims shall be cut off flush with edge of bearing plate and shall be left in place.

H) **SUBSTITUTIONS**

Unless otherwise directed, the exact sections, shapes, thickness, sizes, weights and the details of construction shown for the structural steel work, shall be furnished. However the contractor, because of his stock or shop practices, may suggest change of the net area of section is not thereby reduced, if the section properties are at least equivalent and if the overall dimensions are not exceeded. All substitutions or otherwise deviations from drawings and/or specifications shall be specifically noted or 'clouded' on the shop drawing submittals.

I) **FLAME CUTTING**

Flame cutting by the use of a gas cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. The use of a flame cutting torch will be permitted only on minor members, when the members is not under stress, and only after the approval of

the SMKC has been obtained.

J) **STORAGE OF MATERIALS**

Structural materials, either plain or fabricated shall be stored above ground upon platforms, skids, or other supports. Materials shall be kept free from dirt, grease and other foreign matter and shall be protected for corrosion.

K) TEST REPORTS

Certified physical and chemical mill test reports for material used for major structural members shall be furnished. All tests shall be performed in accordance with applicable Indian Specification Standards.

19.8 MATERIALS AND WORKMANSHIP

A) STRUCTURAL STEEL AND MISCELLANEOUS METAL WORKS

i) **GENERAL**

This work shall include the furnishing and installation of all structural steel and miscellaneous metal work and related work including grating and grating supports, pipe hangers and supports, tanks, manhole steps, equipment guards, anchors and other appurtenances and any other shown on the drawings or herein specified. All materials shall be new, sound and of the best quality available.

ii) **MATERIAL**

Steel rolled sections, plates and bars shall conform to the latest editions of IS: 226, 808, 1730, 1731, 1732 and 3954. Pipe used for columns or other structural purposes shall conform to IS: 1161-1968. Iron for castings shall conform to IS: 210.

B) **STEEL JOINTS**

These shall be fabricated true to size and details shown on drawings in strict conformance with requirements of reference standards.

C) **COMMON BOLTS**

Bolts and nuts shall conform to IS:1363-1967.

D) **WELDING ELECTRODES**

The electrodes shall conform to the requirements of IS:814, latest edition.

E) **SHOP PAINTING**

Structural steel not designated to be galvanized shall e shop coated, using priming coat of red lead as specified in painting section, of these specifications. The portion of steel to be embedded in concrete shall not be painted.

F) **GALVANIZING**

All metal work shown or specified to be galvanized, shall be zinc coated, as per IS: 2629-1966. The zinc coating should be free from defects and shall have uniform thickness of coating.

Galvanizing coating marred or damaged during erection or fabrication shall be repaired by any approved process as directed by the Engineer.

G) **SHOP PAINTING**

Before leaving the shop all steel not shown or specified to be galvanized shall be given one coat of primer red lead. Final painting shall be in specified coats of approved and approved brand oil paint. The portion of steel to be embedded in concrete shall not be painted.

H) **TEST REPORTS**

Certified physical and chemical mill test reports for material used for major structural members shall be furnished by the contractor.

I) **SHOP DRAWINGS**

Five sets of shop drawings shall be submitted to the Engineer, for approval before fabrications of any of the work. In approving shop drawings, the Engineer does not assume responsibility for accuracy of the work relative to other plant components, as constructed.

J) **ANCHOR BOLTS**

Anchor bolts shall be galvanized and shall be fabricated as shown or as specified by the equipment manufacturer.

Suitable expansion bolts may be used in lieu of anchor bolts, at certain locations. It shall be the responsibility of the contractor to request the substitution and obtain the Engineer's approval, regarding type an location of

expansion and bolts proposed to be used prior to pouring concrete.

K) **STEEL GRATING**

Seat angles and anchors shall be of steel, grating and support shall be galvanized. Gratings to be supplied and installed as detailed in the drawings.

L) **MECHANICAL EQUIPMENT GUARDS**

All rotating belts, pulleys and shafting shall be covered and guarded in conformity with applicable safety requirements or as directed by the Engineer.

19.9 MODE OF MEASUREMENT

This item will be calculated as per Metric Ton basis.

DS20

BURNT BRICK MASONRY SECOND CLASS

20.1 GENERAL

This specification lays down the requirements for B.B. Masonry 1st class in cement mortar of specified proportion required for various structures, including necessary scaffolding, watering etc. The specifications shall conform to IS: 2212-1991 its latest revision.

20.2 **MATERIALS**

BRICKS: Bricks shall be first class and shall conform IS: 1077-1992.

20.3 **MORTAR**

The quantity of mortar to be used per Cum of B.B. masonry shall be about 30 to 32% or 300 to 320 liters for conventional bricks and 32 to 33% or 320 to 330 liters for ISI bricks. The proportion of mortar shall be as specified in the item of the tender.

20.4 **CONSTRUCTION**

JOINTS: Joints shall not exceed 12 mm (about ½") in thickness and shall be uniform

Throughout.

All other specifications of KB-1 for B.B. masonry first class shall apply to this class of

masonry also.

Mode of Measurement:

The contract rate shall be for a unit of one cubic meter of Masonry. The concrete shall be measured for its length, breadth and depth limiting dimensions to those specified on the plan or as directed by Engineer-in-Charge. No deduction shall be made for reinforcement in concrete in RCC work. Individual dimension shall be measured in Cum. And quantities shall be worked out correct up to three places of decimal of a cubic meter.

DS 21

Providing and fixing rolling steel shutters

This shall be done as per standard specification No. Bd-T-56 pageNo.511 and relevant item of schedule 'B'. The specifications lays down requirements of providing and fixing steel rolling shutters with accessories locking arrangement top hood cover and painting in three coats of synthetic enamel paint of approved quality and shade.

21.1 MATERIALS

The rolling shutters shall conform to IS:6248:1979. Rolling shutter shall be supplied of specified type with accessories Such as top cover (in or out]) handles, bearings, springs, axles, locking arrangements, guide rails, iron pulleys push and pull arrangements This shall be of approved quality, make and type, 10 gauge (MS solid laths or grill) The size of the rolling shutters shall be as specified in the drawings The shutters shall be constructed with interlocking lathe sections foamed from cold rolled steel strips not less than 0.9 mm thick and 80 mm wide for shutters up to 3.5 m width and not less than 1.25 mm thick and 80 mm wide for shutters 3.5 m width and above unless otherwise specified. Guide channels shall be of mild steel deep channel section and or rolled pressed or built up (fabricated) joint less construction. The thickness of sheet used shall not be less than 3.15 mm. Head cover shall be made of M.S. sheet not less than 0.9 mm thick for shutters up to 3.5 m width. For shutters having width 3.5 mm and above the thickness of M.S. sheet for the hood cover shall not be less than 1.25 mm. The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all po-

sitions. The spring pipe shaft etc. shall be supported on strong M.S. or Malleable C.I. brackets the brackets shall be fixed on or under the lintel as specified with raw plugs and screws bolts etc. Both the side guides and bottom rail shall be joint less and of shaft, spring etc. shall be of same material as that of lathe. The side guides fixed with plates welded to guides shall be property fixed with screws, bolts and concealed in plaster

The rolling shutters shall be self-rolling type up to 8 Sq.mt clear area without ball bearing and upto 12 Sqm.. Clear area with ball bearing. If the rolling shutters are of larger size, then gear operated type shutters shall be used. The locking arrangement shall be provided at the bottom of shutters at bottom ends. The shutters shall be opened from outside. The shutter shall be either push and pull type as operated with special type of reduction / bevel arrangement operated with mechanical device. Shutter up to 10.20 - sqm. Or outside width less than 3 m shall be push and pull and shutter above 10.20 sq. m. or whose width is more than 3 m will be mechanically operated.

The shutters shall be complete with door suspension shafts, locking arrangements, pulling hooks, handless and other accessories.

21.2 WORKMANSHIP

Rolling shutters and top hood with all accessories shall be supplied of specified type and shall be got approved before fixing by the Engineer-in-Charge. The fixing shall be done in true line and level. The damaged work shall be made good to the level of original works. The fixing work shall be done to the entire satisfaction of the Engineer-in-Charge. After the erection and fixing, the rolling shutters with hood should be painted with on coat of approved primer and two coats of approved enamel paint (or any other approved superior quality paint as needed for protection against environment prevailing in the area)

21.3 MODE OF MEASUREMENT AND PAYMENT

The item shall include –

a) Providing and fixing the rolling shutters of specified size, material with all accessories, locking arrangement and top hood cover.

b) Painting the same with approved synthetic enamel paint in three coats.

c) Redoing the damaged works

The item will be measured and paid in Sq mt. basis of the shutter area

DS 22

Providing and fixing steel window/ventilators of various sizes as per detailed drawings----etc. complete.

This item shall comply with the specification No.Bd-T-53 on page No. 509, Standards as per IS 1038 and relevant item of Schedule 'B'.

DS 23

Providing internal cement plaster……complete.

This shall be done as per standard specification No.Bd-L-5 page No.368. The item shall comply with specification B.11.b subject to the additional clauses Bd.L 1.2, Bd.L 1.3, Bd.L 1.4

i) 20mmyhick cement plaster in C.M.1:2 with water proofing (Wet well) shall be provided to inner face of vertical wall of sump (Wet well) & pump house (dry well) and screen chamber.

ii) 20mm thick cement plaster in C.M. 1:3 shall be provided to external Face of brick work to pump house.

iii) 12mm thick cement plaster in C.M. 1:3 shall be provided to internal Faces of brick work to pump house, external face of screen chamber, wet well and dry landings (bottom portion), waist slab ceiling and sides, roof slap ceiling etc.

All above plaster shall be done in Sulphate Resistant Cement only Number of cubes for Cement mortar shall be taken as per I.S. and recent circular of M.J.P. and shall be tested in the laboratory of Government Engineering College at the Cost of contractor. Certificate of testing shall be submitted by the contractor to the department. Cement mortar used for plastering shall be of the mix proportions and thickness as specified on the drawings or bill of quantities or particular specifications for the various different parts of the works. The materials used i.e. cement, sand and water shall be of the same quality and of the same specifications as indicated for plain and reinforced cement concrete works according to the specifications and approved by the Engineer-in-Charge. Sand further shall meet the specifications as laid down in IS: 1542-1977 Specification for sand for plaster.

The sand for preparation of mortar for plastering shall confirm to the following gradation, shown in Table

Table
: Grading of fine aggregates *Percentage by weight passing IS Sieve*

IS Sieve Designation	Class -A	Class-B
4.75 mm	100	100
2.36 mm	90 to 100	90 to 100
1.18 mm	70 to 100	70 to 100
600 Microns	40 to 85	40 to 95
300 Microns	50 to 50	10 to 65
150 Microns	0 to 10	0 to 15

For the purpose of indicating the suitability for use, the sand is classified as Class A and Class B in accordance with the limits of grading. Class A sand shall be used generally for plastering and when they are not available, Class B sand may be used with the approval of Engineer-in-Charge.

The procurement of sand for Mortar for plastering and pointing shall confirm to be specifications given in Table. Surface that are to be applied with plaster shall be thoroughly cleaned to remove dust, dirt, loose particle, oil, soil, salts etc., that may be sticking to the surfaces. The surfaces shall be washed, clean and watered properly for 4 hours before applying plaster. For masonry all joints in the frame work that is to be plastered shall be raked out to a depth not less than the width of the joints or as directed by the Engineer-in-charge. The raking shall be done taking care not to allow any chipping of masonry. In new work the raking out shall be done while the mortar in the joints in still green. Smooth surface of concrete or plaster etc. must be suitably roughened to provide necessary bond for the plaster all dirt, soot oil paint or any other materials that might interfere with satisfactory bond shall remove and surface wetted before plastering is started. Plaster shall not, in any case, be thinner than specified. It shall have uniform specified thickness. When smooth finishing is required the cement plastering shall be floated over with neat cement within 15 minutes after application of the last coat of plastering. The plaster shall be protected from the sun and rain by such means as the Engineer-in-Charge may approve.

The plastered surface shall be cured for 10 (ten) days. Construction joints in plastering shall be kept at places approved by the Engineer-in-charge. When the thick-

ness of the plaster specified is to be made up in more than one layer the second layer shall be applied only when the lower coat is still green. Wherever specified approved brands of additives like water proofing compounds, shall be added in specified quantities as recommended by the manufacturer of the compound or as directed by the Engineer-in-Charge.

Wherever scaffolds are necessary for plastering they shall be provided as specified for scaffolds under clause 3.2.2. Stage scaffolding shall be provided for ceiling plaster. To ensure even thickness and true surface, patches of plaster about 15 cm x 15 cm shall be first applied both horizontally and vertically 2.0 m apart. Plastering shall be done. From top of bottom and care shall be taken to avoid joints on continuous surface. In case any other finish like rough cast finish or dry dash finish is specified in the drawings the small shall be provided as directed by the Engineer-in-Charge. Surface which is to be plastered shall be roughened while they are still green or raked so as to give proper bond between the surface and plaster. When cement finish is specified, coat of pure Portland cement slurry 1.5 mm (1/6') thick shall be applied to the plastered surface while the second coat is still fresh. If neeru finish is specified, then the surface shall be finished as per specification for Item Bd.L-10.

All corners junctions shall be truly vertical or horizontal as the case may be and carefully finished. Rounding or chamfering of corners shall be carried out with proper templates to the required size and shapes. The work shall be tested frequently with a straight edge and plumb bob. At the end of the day the plaster shall be left cut clean to line. When the next day's plastering is started, the. Day the plaster shall be left cut clean to line. When the next day's plastering is started the edge of the old work shall be scrapped, cleaned and wetted with cement slurry. At the end of the day the plastering shall be closed on the body of the wall and not nearer than 15 cm to any corner. Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The plaster shall be kept wet for at least 10 days. Any defective plaster shall be cut in rectangular shape and replaced. The thickness of the cement plaster shall be 12 mm excluding cement or neeru finish.

23.1 MATERIALS

Cement mortar shall be prepared from cement and as specified for RCC work and

mixed in the proportion specified. Sand shall be screened and washed if called upon to do so. Water proofing compound of directed make in directed quantities shall be added where it is water proof plaster, scaffolding shall be prepared from sound materials and shall be provided, where ever situation demands for facility of proper working.

23.2 GAUGES

Patch of plaster 15 x 15 cm shall be put on about 3 m apart as gauges to ensure even plastering in one place.

23.3 FINISHING

In any continuous face of wall, finishing treatment of any type shall be carried out continuously and day to day breaks made to coincide with architectural breaks in order to avoid unsightly junctions. All mouldings shall be worked true to template and drawn neat, clean and level. All exposed angles, junctions and openings shall be carefully finished.

23.4 WATERING

All pointing work shall be kept damp continuously for a period of 14 days. To prevent excessive evaporation of the sunny and wind ward side of the building in hot, dry weather matting or gunny bags may be hung over on the outside of the plaster in the beginning and kept moist. If the contractor fails to water the work to the satisfaction of the Engineer-in-charge, the requisite labour, materials and equipment to water the work properly shall be engaged departmentally at the cost of the contractor. Cost all scaffolding is included in the tender rate.

23.5 Mode of measurement

As per NdL-1.7 on square meter basis

DS 24

SAND FACED CEMENT PLASTER

24.1 GENERAL

The item shall comply with the specification B.11 in all pertinent particulars. In addition Bd.L.1.2, Bd.L 1.3, Bd.L 1.4 and the following specifications shall also be complied with.

24.2 Base Coat: The base coat plaster shall be of cement mortar 1:4. Water

proofing compound of approved make like Pudlo, Sika, Accorproof shall be added according to the maker's instruction in Bd.L 2 which a thickness of 15 mm for brick work and concrete surfaces and 20 mm for rubble stone masonry. Keys shall be formed on the surface by thoroughly combing it with wavy horizontal lines about 12 mm apart and about 3 mm deep when the mortar is still plastic.

24.3 Sand Faced Treatment: The cement mortar fo sand faced plaster shall have washed Kharsalia or Kasaba or similar type of approved sand with slightly larger proportion of coarse material The proportion of cement to sand shall be 1:4. The water is added gradually to make the mixture homogeneous. The thickness of finishing coat shall not exceed 8 mm. After applications the surface should be finished with a wooden float lined with cork and tapped gently to retain a coarse surface texture. When the finishing coat has hardened the surface shall be kept moist continuously for 14 days.

Item to include relevant portion of Bd.L 1.6. It shall also be include the base coat and san face treatment of above.

24.4 Mode of Measurement and payment

Per Bd.L 1.7 on square meter basis

The specification lays down the requirements of applying sand faced plaster in specified thickness with cement mortar to concrete or masonry surface in specified coats. This shall conform to specification for ordinary cement plaster where ever it is not irrelevant and in addition following shall also be applicable.

Tools and accessories used in plastering work be thoroughly cleaned before plastering is done. The programming of other building operations before during and after plastering shall be according to the instructions contained in Clause 4 of IS: 1661-1960 or its latest revision. The item shall be executed as per Red book specification BdL-7 to 7.50 page No. 351)

Care shall be taken that other parts of work of adjacent work are not damaged while plastering. The base coat plaster shall be of cement mortar of specified proportion 1:4 and thickness as mentioned in the item or otherwise, it shall be of cement mortar 1:3 and thickness 15 mm to 20 mm. The base coat shall be laid in a similar manner as

stipulated in. However, instead of finishing the top surface smooth keys shall be formed on the surface thoroughly combined in with wavy horizontal lines about 12 mm apart and about 3 mm deep when the mortar is still plastic. The base coat shall be cured for suitable period as per relevant code.

DS 25

Oil Emulsion (oil bound) washable distempering.

25.1 Materials

Oil emulsion (Oil Bound) washable distemper (IS: 428:1969428) of approved brand and manufacture shall be used. The primer where used as on new work shall be cement primer or distemper primer as described in the item. These shall be of the same manufacture as distemper. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day's work shall be prepared. The distemper and primer shall be brought by the contractor in sealed tins in sufficient quantities at a time to suffice for a fortnight's work, and the same shall be kept in the joint custody of the contractor and owner.

25.2 Preparation of the Surface.

For new work the surface shall be thoroughly cleaned of dust, old white or color wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any evenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry. In the case of old work, all loose pieces and scales shall be removed by sand papering. The surface shall be cleaned of all grease, dirt etc. Pitting in plaster shall be made good with plaster of Paris mixed with the color to be used. The surface shall then be rubbed down again with a fine grade sand paper and made smooth. A coat of the distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.
Application

25.3 Priming Coat:

The priming coat shall be with distemper primer or cement primer, as required in the description of the item. The application of the distemper primer shall be as described.
Note: If the wall surface plaster has not dried completely, cement primer shall be applied before distempering the walls. But if distempering is done after the wall surface is dried completely, distemper primer shall be applied. Oil bound distemper is not recommended to be applied, within six months of the completion of wall plaster. However, newly plastered surfaces if required to be distempered before a period of six months shall be given a coat alkali resistant priming Paint conforming to IS 109 and allowed to dry for at least 48 hours before distempering is commenced.
For old work no primer coat is necessary.

25.4 Cement Primer coat

Cement primer coat is used as a base coat on wall finish of cement, lime or lime cement plaster or on non-asbestos cement surfaces before oil emulsion distemper Paints are applied on them. The cement primer is composed of a medium and pigment which are resistant to the alkalis" present in the cement, lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of oil emulsion distemper Paints. Primer coat shall be preferably applied by brushing and not by spraying. Hurried priming shall be avoided particularly on absorbent surfaces. New plaster patches in old work should also be treated with cement primer before applying oil emulsion Paints etc.

25.5 Preparation of the Surface

The surface shall be thoroughly cleaned of dust, old white or color wash by washing and scrubbing and all cracks, boles and surface defects shall be repaired with gypsum and allowed to set hard.. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered smooth and wiped clean to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry. The surface so prepared must be completely dry and free from dust before distempering is commenced. In the case of walls newly plastered, special care shall be taken to see that it is completely dry before any treatment is attempted.

25.6 Application

The cement primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before oil emulsion Paint is applied. The Specifications in respect of scaffolding, protective measures, measurements and rate shall be as described under.

25.7 Distemper Coat:

For new work, after the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. One coat of distemper properly diluted with thinner (water or other liquid as stipulated by the manufacturer) shall be applied with brushes in horizontal strokes followed immediately by vertical ones which together constitute one coat. The subsequent coats shall be applied in the same way. Two or more coats of distemper as are found necessary shall be applied over the primer coat to obtain an even shade. A time interval of at least 24 hours shall be allowed between successive coats to permit proper drying of the preceding coat. For old work the distemper shall be applied over the prepared surface in the same manner as in new work. One or more coats of distemper as are found necessary shall be applied to obtain an even and uniform shade. 15 cm double bristled distemper brushes shall be used. After each day's work, brushes shall be thoroughly Washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

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The specifications in respect of scaffolding, protective measures and measurements shall be as described under

25.8 Rate

The rate shall include the cost of all labor and materials involved in all the above operations (including priming coat) described above.

The rate shall include all labour, material, equipment's and tools for carrying out the following operations.

- Providing the primer and distemper and mixing the distemper.
- Scaffolding
- Preparing the surface to receive the primer and finishing coats.
- Applying the priming coat
- Applying the distemper as specified above in the number of coats, mentioned in the item.

25.9 Mode of Measurement & Payment

This item will be measured and paid in Sqm basis.

DS 26

Providing and applying acrylic emulsion …etc. Complete

Providing and applying washable acrylic emulsion paint of approved manufacture and of approved colour to the plastered surface including scaffolding if necessary and preparing the surface complete.

26.1 Washable acrylic emulsion paint --The washable acrylic emulsion paint shall be of approved manufacture and it shall be approved colour and shade. The contractor shall bring them to the site in original airtight containers with seal intact.

26.2 Brushes._ the brushes to be used shall be as specified by the manufacture of the oil paint and they be got approved by the Engineer.

26.3 Scaffolding._ Scaffolding if necessary shall be double and as specified in B.9.11.

26.4 Preparatory Work_ The surface to be painted shall be prepared as specified the manufacture of the paint. The surface shall be thoroughly cleaned free from dirt, dust etc. by brushing and washing down with clean water. Any grease, oil paint, or any other foreign material shall be removed by approved methods.

Lime wash and water bound distemper, shall be thoroughly removed by washing, brushing and if necessary, the accumulated coats of old paint shall be removed by thoroughly brushing or scraping and washing and a clean even surface obtained.

Rough cast and pebble dash surface shall be thoroughly brushed and washed to remove dirt and dust.

26.5 Mixing the paint: - In mixing and application, the contractor must follow the manufacturer's instruction. Paint for the application by brush shall be strained through paint strainer. The paint shall be kept stirred used within the specified time Hardened or damaged paint shall not be used.

26.6 Application: - The paint shall be applied by means of brushes and in the manner specified by the manufacture. The number of coats shall be as mentioned in the wording of the item. When more than one coat is ordered, subsequent coat shall be applied after the preceding coat is properly cured and has thoroughly hardened, inspected and approved and as per manufactures specification.

Absorbent surface shall be evenly damped so as to give even suction. In dry weather, freshly painted surface shall be kept damp for at least 2 days and protected from direc0t sun.

Item to include._ the rate shall include all labour, material, and use of tools to carry out the following operations:-

Splaying and mixing the paint as specified=

Scaffolding including erection and dismantling.

Preparation of the surface before painting.

Application of paint as specified.

Curing and protecting the painted surface.

The work shall be carried out as per the description of the tender item and as directed by Engineer-in charge. It shall be washable acrylic emulsion paint. Shade and make shall be as directed by Engineer in charge and for decorative purpose, SMKC. May ask for different shades to be provided for different components or different parts of the same component which the Contractor shall have to do within his tendered rate only at no extra cost. Cost of priming coat as directed, scaffolding, etc. is included in the tender item. The work shall be executed as per the specifications of P.W.D. Hand Book latest edition and specification for painting in Standard Specification Book (Red Book) published by B and C Department.

26.7 Mode of measurement and Payment:-

This item measured and paid in sq. meter. The quantity worked out to correct two decimal.

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Designing the pumping station …… etc. complete.

This item shall be complied as item described in schedule of the tender and directed by Engineer in charge.

Note :- Tentative sizes of sump and pump house is considered to work out the quantities for tender , but the agency has to submit final and approved detailed drawing & design showing structural and hydraulic calculations for the same as per obligatory condition and mechanical specification of tender .Necessary required accommodation to install and easy for maintenance and repairs of pumps of intermediate stage and ultimate stage should be considered in detailed drawings

submitted by the agency.

Structural Designer has to visit the site before commencement of work, similarly he has to visit and certify during important concreting works. Engineering in charge may direct to arrange the visit of representative or M.J.P. Consultant along with the structural Designer of the contractor & the charges shall be borne by the contractor.

DS 28

Providing, lowering, laying, jointing, testing ductile iron pipes & specials

28.1. Scope

This specification covers the requirements for manufacturing, supplying, laying, jointing, testing and commissioning of Ductile iron pipeline and fittings including associated civil works required for the same. Reference should also made to the requirements of Part 6 where appropriate.

28.1.1 Standards

The following standards, specifications and codes are part of this specification. In all cases, the latest revision of the codes including all applicable official amendments and revisions shall be referred to. In case discrepancy between this specification and those referred to herein, this specification shall govern. IS: 8329	Centrifugally Cast (spun) ductile Iron pressure pipes for water, gas and sewage.
IS: 638	Sheet rubber jointing and rubber insertion jointing.
IS: 1387	General requirements for supply of metallurgical materials.
IS: 1500	Methods for Brinell hardness test for metallic materials.
IS: 9523	Ductile Iron fittings for pressure pipes for water, gas and sewage.
IS: 12820	Dimensional requirements of rubber gaskets for mechanical joints and push on joints for use with cast iron pipes and fittings for carrying water, gas and sewage.
ISO: 4179	Ductile iron pipes for pressure and non-pressure – Centrifugal cement mortar lining – General requirements.

ISO: 2531	Ductile iron pipes, fittings and accessories for pressure pipe lines.
IS: 5382	Specification for Rubber Sealing Rings for Gas Mains, Water Mains and Sewers
AWWA C600	Installation of ductile iron water mains and their appurtenances.
IS: 11906	Recommendations for cement-mortar lining for cast iron, mild steel and ductile iron pipes and fittings for transportation of water
IS: 3764	Excavation Work – code of Safety.
IS: 12288	Code of practice for use & laying of Ductile iron pipes.
IS: 460	Test sieves – Part I
IS: 8112	Specification for 43 Grade Ordinary Portland Cement.
BS: 3416	Bitumen based coatings for cold application, suitable for use in contact with potable water.
BS EN 545	Ductile iron pipes, fittings, accessories and their joints for water pipelines – Requirements and Test Methods.

28.2 Manufacturing

28.2.1 General

DI pipes and fittings (Class K9) shall be in accordance with IS 8329 and IS 9523.

Pipes and fittings shall be procured from reputed manufacturers with Engineer's approval. Engineer shall at all reasonable times have free access to the place where the pipes and fittings are manufactured for the purpose of examining and testing the pipes and fittings and for witnessing the test and manufacturing. All tests specified either in this specification or in the relevant Indian Standards specified above shall be performed by the supplier/contractor at his own cost and in presence of Engineer if desired. For this, sufficient notice before testing of the pipes and fittings shall be given to Engineer. If the test is found unsatisfactory, Engineer may reject any or all pipes and fittings of that lot. The decision of Engineer in this matter shall be final and binding on the contractor and not subject to any arbitration or appeal. The pipes and fittings shall be stripped, with all precautions necessary to avoid warping or shrinking defects. The pipes and fittings shall be free from defects. Any defect in pipes and fittings in the opinion of Engineer shall be rejected and shall be replaced by new one. In the case of spigot and socket pipes and fittings the socket shall be without the centering

ring. In the case of flanged pipes the flanges shall be at the right angles to the axis of the pipe and machined on face. The bolt-holes shall be drilled and located symmetrically off the centerline. The bolt hole circle shall be concentric with the bore and bolt holes equally spaced. The flanges shall be integrally cast with the pipes and fittings and the two flanges of the pipe shall be correctly aligned.

28.2.2 Materials

The materials used in the manufacture of pipes and fittings shall comply with requirements specified in IS8329 and IS 9523

28.2.3 Dimensions and Tolerances

The internal diameter, thickness and length of barrel, dimensions of pipes and fittings shall be as per the relevant tables of IS 8329/ IS 9523 for different class of pipes and fittings. Pipe class K9 or as per requirement, pipe nominal diameters of 450, 800 and 1000mm and standard length of 6m is recommended and other properties for pipes and fittings shall be as per IS 8329/IS9523. Each pipe supplied shall be of uniform thickness throughout its length. The tolerances for pipes and fittings regarding dimensions, mass, ovality and deviations from straight line in case of pipes shall be as per IS 8329/ IS 9523.

28.2.4 Testing

a) Mechanical Tests

Mechanical tests shall be carried out during manufacture of pipes and fittings as specified in IS 8329/IS 9523. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 8329. The test results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS 8329/ IS 9523.

b) Brinell Hardness Test

For checking the Brinell hardness, the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS 1500. The test shall comply with the requirements specified in IS 1500/IS 8329.

c) Retests

If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the

test results satisfy the specified requirements, the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

d) Hydrostatic Test

For hydrostatic test at works, the pipes and fittings shall be kept under test pressure as specified in IS 8329/ IS 9523 for a period of minimum 15 seconds, during which the pipes shall be struck moderately with 700g hammer for conformation of satisfactory sound. They shall withstand the pressure test without showing any leakage, sweating or other defect of any kind. The hydrostatic test shall be conducted before surface coating and lining.

28.2.5 Joints

a) **General**

Jointing of DI pipes and fittings shall be done as per IS 12288 and manufacturer's recommendations. After jointing, extraneous material, if any, shall be removed from the inside of the pipe. Rubber sealing rings/gaskets used for jointing shall be of SBR or EPDM rubber and conform to IS 638, IS 12820 and IS 5382.

b) Spigot and Socket joints

These shall have sockets which are integral with the pipe and incorporate an elastomeric rubber ring gasket conforming to IS 12820.The gaskets/sealant used for joints shall be suitable for water conveyance. In jointing DI pipes and fitting, the contractor shall take into account the manufacturer's recommendations as to the methods and equipment to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that the rubber ring as per IS 12820 and IS 5382 is correctly positioned in line, before the joint is made. The rubber rings and any recommended lubricant shall be obtained only through the pipe supplier or as otherwise directed by the Engineer.

c) Gaskets for Flanges

The gaskets used between flanges of pipes shall be of SBR or EPDM rubber conforming to IS 638 of thickness between 1.5 to 3 mm suitable for conveyance of sewage and waste water and as specified by manufacturer.

d) Flanged joints

These shall be of PN 16 rating and shall comply with dimensions and drilling details as specified in IS 8329. These shall have isolation gaskets between the flanges, isolation sleeves around all bolts and isolation washers under all bolt heads and nuts. All material shall be supplied by a reputed manufacturer and shall be approved by the Engineer. Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The recommended bolting torque to be followed for assembling flanges shall be as specified in manufacturer"s instructions. The practice of fully tightening the bolts one after another is highly undesirable. The bolts shall be of mild steel unless otherwise specified. They shall be coated with coal tar epoxy coating after tightening.

28.2.6 Coatings

a) General

Unless otherwise specified, DI pipes and fittings shall be Zinc coated with Bitumen over coating in accordance with following specifications. At buried DI pipes and fittings shall also have factory or site applied polythene sleeving. Coating shall not be applied to pipe and fittings unless its surface is clean, dry and free from rust. Pipe coatings shall be inspected at site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

b) Zinc coating

Zinc coating shall comply with ISO 8179 and shall be applied as a spray coating. The mass of sprayed metal shall not be less than 130g/m3 in accordance with ISO 8179.

c) Bitumen coating

Bitumen coating shall be of normal thickness of 75 microns unless otherwise specified. It shall be a cold applied compound complying with the requirements of BS 3416 Type II, suitable for tropical climates, factory applied in accordance with the manufacturer's instructions. Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

d) Polythene Sleeving

Where polythene sleeving is specified to be applied in addition to bitumen coating above it shall comply with ISO 8180. Site applied sleeving shall be stored under cover out of direct sunlight and its exposure to sunlight shall be kept to a minimum. Pipes having a factory applied sleeving must be stored in the same conditions. Joints in the

sleeving shall be properly overlapped and taped in accordance with manufacturer's instructions to provide in continuous sleeving.

28.2.7 Cement mortar lining

All pipes and fittings shall be internally lined with cement mortar in accordance with ISO 4179/IS: 11906. Cement mortar lining shall be applied at the factory in conformance with the above mentioned standards. No admixtures in the mortar shall be used without the approval of the Engineer. Pipe linings shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer. Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be 5 mm for DN 450 mm pipe; and 6 mm for DN 800/1000 mm pipes, respectively.

28.2.8 Marking

Each pipe and fitting shall have cast, stamped or indelibly painted on it the following appropriate marks:

a) The nominal diameter.

b) Class reference

c) Mass of pipe.

d) Date of manufacture and

e) Manufacturer's name, initials or identification mark.

Marking shall be done as per IS 8329 and IS 9523.

28.2.9 Third party Inspection of the pipes is mandatory in the manufacturing unit. The test certificate shall be produced in this effect by the contractor at his own cost. The agencies performing the TPI shall be enlisted in the list of Maharashtra Jeevan Pradhikaran.

28.3 TRANSPORTATION, HANDLING AND INSPECTION.

Transportation – Pipes should be loaded in such a way that they are secured and that no movement should take place on the vehicle during transit.

The pipes should be loaded on vehicles in pyramid or straight sided information. In case of pyramid loading, the pipes in the bottom layer should be restrained by the use of broad wooden wedges secured to the vehicle being loaded. The pyramid is to be formed by resting pipes between the pairs of pieces in the preceding layer with the sockets in layers reversed. Straight sided loading may be

used with supports along the sides of the vehicles. The use of straight sided loading is advantageous for utilizing full capacity of the vehicle.

Off – Loading – Cranes should be preferred for off – loading. However, for pipes up to 400 mm nominal bore, skid timbers and ropes may be used.

When using mechanical handling equipment, it is necessary to employ sufficient personnel to carry out the operation efficiently with safety. The pipes should be lifted smoothly without any jerking motion and pipe movement should be controlled by the use of guide ropes in order to prevent damage caused by pipes bumping together or against surrounding objects.

Where the crane operator does not have a clear view, he should be guided by the personnel supervising the operation. When cranes are used, the whole sequence of operation should be carried out smoothly and without snatch. Properly designed hooks and adequate stead ropes are essential. The hooks should be of suitable shape to ensure positive engagement when entered into the ends of the pipes and then should pass over any protective packing fitted around the pipe ends.

The use of slings passed around bundles of pipes is not recommended because bundles become unstable as the sling is drawn tight or released. However, when it is necessary to use the central slinging method for lifting single pipe, a broad webbing sling is recommended which minimizes the risk of the pipe slipping. Chain slings may slip and are dangerous.

Staking – Pipes being taken to a stock ground for storage and held pending further distribution should be arranged into stacks. The first layer of pipes should be laid on a firms formations consisting of solid timers set level on the ground. Subsequent layers should be placed according to the method of staking adopted. Care should be taken so that the pipes do not rest on their sockets. The height of any stack should not exceed 2 m.

Methods adopted for staking pipes are described in above paragraph.

Square Stacking – In square stacking method, second and subsequent layers are set at right angles to the pervious layer with spigots and sockets alternating in each layer and sockets project beyond spigot end. The pipes rest directly upon those beneath it and care is needed in placing to prevent damage.

Parallel Stacking with Timbers -All the pipes are parallel with the sockets

of successive layers reversed end-to-end with sockets projecting beyond spigot end.

Timber battens, placed about 600 mm from each end at right angles to the pipes, are used to separate the successive layers. Wedges at both ends of each batten prevent pipe movement.

Nested Stacking (Pyramid Stacking)–Nested stacking consist of placing each pipe between the two pipes underneath it, with the sockets being all at one end of each layer and layer should be firmly anchored to prevent the stack collapse.

Stringing – Stringing consist of placing pipes on the ground in line ready for laying. Care should be taken to prevent damage during this operation.

Pipes and fittings/specials shall be transported from the factory to the work sites at places along the alignment of pipeline as directed by Engineer and as specified by manufacturer. Contractor shall be responsible for the safety of pipes and fittings/specials in transit, loading/unloading. Every care shall be exercised in handling pipes and fitting/specials to avoid damage. While unloading, the pipes and fittings/specials shall not be thrown down from the truck on to hard surfaces. They should be unloaded on timber skids with steadying ropes and/or by any other approved means. Padding shall be provided between coated pipes, fittings/specials and timber skids to avoid damage to the coating. Suitable gaps between pipes should be left at intervals in order to permit access from one side to the other. In case of spigot socket pipes, care should be taken regarding orientation of pipes while unloading. As far as possible pipes shall be unloaded on one side of the trench only.

The pipes shall be checked for any visible damage (such as broken edges, cracking or spalling of pipe) while unloading and shall be sorted out for replacement. Any pipe which shows damage in the opinion of Engineer shall be discarded and replaced by new one. Dragging of pipes and fitting/specials along concrete and similar pavement with hard surfaces shall be prohibited.

28.4 INSPECTION OF PIPES:-

The pipes shall be got inspected through EIL/SGS/RITES. All charges of EIL/SGS/RITES inspection shall be borne by the contractor. The testing shall be done as per relevant IS.

Mode of Payment: - On receipt of the pipe on site 85% payment shall be released and remaining 15% percent payment will be released after Laying & satisfactory hydraulic testing.

28.5 Storage

Each stack of pipes shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible. Storage shall be done on firm level and clean ground and wedges shall be provided at bottom layer to keep the stack shall be in pyramid shape or the pipes laid length wise and crosswise in alternate layers. The pyramid stack shall be made for smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5m Fittings/specials shall be stacked under cover and separated from pipes.Rubber rings shall be stored in a clean, cool store away from windows, boiler, electrical equipment and petrol, oils or other chemicals. In the field the rubber rings shall be handled such that they are not left out on the ground in the sun or overnight under heavy frost or snow conditions.

28.6 Laying

28.6.1 Trenching

Trenching includes all excavation, which is carried out either by hand or by machine and shall be carried out in accordance with all general requirements of civil works specifications mentioned for sub work. In addition to those general requirements, the following requirements shall apply to pipelines:

The excavation shall be done such that it does not get far ahead of laying operations. Before excavating trench the alignment of pipeline shall be approved by Engineer. Cuttings length and other appurtenances shall be provided to suit detailed pipe configurations required. To protect persons from injury and to avoid damage to property, adequate barricades, construction signs, red lanterns and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for the traffic to use the roadways. The relevant Indian standards and the rules and regulations of local authorities in regards to safety provisions shall be observed. The road metal and also the rubble packing shall first be stripped off for the whole width of the trench/pit and separately deposited in such place or places as may be determined by Contractor and approved by Engineer.

During excavation, large stones and rubble shall be separated and removed from the excavated soil and stacked separately. The material from excavation shall be deposited on either side of the trench leaving adequate clear distance from the edges of the trench and pit, or as may be necessary to prevent the sides of the trench pit to slip or fall, or at such a distance and in such a manner as to avoid covering fire hydrants, sluice valves, manholes covers etc. and so as to avoid abutting the wall or structure or causing inconvenience to the public and other service organizations or otherwise as Engineer may direct.

Contractor shall take into account additional excavation if any as Engineer may require in order to locate the position of water pipes, drains, sewers etc., or any other works which may be met with, in or about the excavation of trenches while quoting the rates for excavation of trenches while quoting the rates for excavation. Such service lines if met with during excavation shall be properly maintained by Contractor, by means of shoring, strutting, planking over, padding or otherwise as Engineer may direct, and shall be protected by the Contractor from damage during the progress of the work. Any damage to the service lines shall be borne by Contractor. All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure pipe line of water, gas, sewage etc.

28.6.2 Bedding

The depth and type of bedding shall be as shown on the Drawings and the requirements specified in sub work.

28.6.3 Laying of Pipes and Fittings

Pipes and fittings shall be laid in accordance with IS12288 and manufacturer's instructions. In addition the requirements specified in Part-6 Clause 6.9.5 shall also be followed.

All precautions shall be taken during excavation and laying operations to guard against possible damage to any existing structure/pipeline of water, gas, sewage etc. After excavation of trenches pipes shall not be lowered unless the dimensions of trenches and bedding work for pipes at the bottom of the trenches are approved and measured by Engineer. Pipes and fittings/specials shall be carefully lowered in the trenches. Special arrangements such as cranes, tripods with chain pulley block for lowering the pipes and fittings shall be made by Contractor. In no case pipes and fittings shall be

dropped. Slings of canvas or equally non-abrasive material of suitable width or special attachment to fit the ends of pipe and fittings/specials shall be used to lift and lower the coated pipes and fittings/specials. The pipes and fittings/specials shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. If doubt persists, further confirmation shall be done by pouring a little kerosene/dye on the inside of the pipe at the suspected spot. No sign of kerosene/dye should appear on the outside surface. Pipes and fittings damaged during lowering aligning shall be rejected by Engineer and shall be replaced by new one.

All the pipes are to be laid perfectly true both in alignment and to gradient specified. In case of spigot and socket pipe the socket end of the pipe shall face upstream, except when the pipeline runs uphill in which case the socket ends should face the upgrade. The laying of pipes shall always proceed upgrade of a slope. After placing a pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to required gradient. The pipes shall be secured in place with approved backfill material tamped under it except at the socket. Pipes and fittings which do not allow a sufficient and uniform space for joints shall be removed and replaced with pipes and fittings/specials of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the jointing space. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by Engineer. During the period that the plug's on, the Contractor shall take proper precautions against floating of the pipe owing to entry of water into the trench. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted the deflection allowed at joints shall not exceed 2o for 800 and 1000mm; and 3o for 350 mm diameter pipes. The cutting of pipe for inserting valves, fittings or specials shall be done in a neat and workman like manner by using tools and taking precautions as per manufacturer's recommendations without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. For this purpose, pipe cutting machine shall be used.

28.6.4 Thrust Blocks and Anchor Blocks

Thrust blocks and anchor blocks shall be provided as per the design and drawing provided by the Engineer-in-charge.

28.6.5 Back filling

Trenches shall be back filled with approved selected excavated material only after the successful testing of the pipeline as directed by Engineer. Back filling shall be in accordance with requirements and as directed by the Engineer in Charge.

28.6.6 Pipelines under Existing Roads

Pipelines laid along a road shall be laid in trench. The sewage rising mains shall be continuously ascending and shall not form many vertical kinks.

28.6.7 Reinstatement of Roads

Reinstatement of roads/footpath shall be done as per the requirements of local authorities and requirements specified in sub work 1

28.7 Cleaning of Pipes and Fittings

Pipelines shall be cleaned of all dirt, debris, dust or other deposits before hydraulic test to the satisfaction of engineer. The requirements specified in sub work 1 shall be followed.

28.8 Hydraulic Testing

Pipelines and fittings shall be subjected to hydraulic pressure tests in the presence of the Engineer which shall comply with IS 12288 unless otherwise specified.

Testing shall be carried out in two stages:

a. Test of sections as construction proceeds.

b. A test of the whole of the pipeline on completion.

The Contractor shall equip himself with all plant, equipment, fittings and water necessary for the hydraulic tests. The Contractor shall submit to the Engineer, well in advance of the time of tests, details of his proposals, including the supply of water either by tankers or bore holes. No connections from the existing pipelines will be allowed, nor will any connections to the pipeline and pipe work which would involve cutting, tapping or altering the Permanent Works be allowed. Test gauges shall be of approved manufacture having dials at least 200 mm diameter, graduated such that the test pressure is at least 75% of the full scale reading shall be used. If necessary different gauges shall be supplied for different pipeline sections. Two gauges shall be provided for the sole use of the Engineer and shall remain in Engineer's possession for the duration of the Contract. All gauges shall be dead weight tested and calibrated at the commencement of work and at regular intervals as required by the Engineer.

The contractor's arrangements for testing shall include a suitable means of quick installation and removal of the Engineer's gauges during testing.

28.8.1 Testing procedure

The Sectional Hydraulic Test shall be carried out after the pipeline section to be tested has been laid, jointed and back filled to a depth sufficient to prevent floatation, but leaving the joints exposed which have not been tested. The sections to be tested shall be to the approval of the Engineer and shall not be longer than 2000m or 500m when either the pipeline is laid adjacent to or underneath the carriage way or when section includes an air valve chamber. The joints between each tested section shall be left exposed until the pipeline has passed the Test on completion.

In addition to the above requirements the Contractor shall perform a hydraulic test on the first 200 m length of pipeline to be laid under the contract. This test shall be undertaken within one month of the Contractor commencing the laying of pipes. Should the pipeline fail the test or the Contractor fails to undertake the test, all laying and welding work shall come to a halt until that section of pipeline passes a hydraulic test.

Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Washout valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test.

Proposals for testing where thrusts on structures are involved, even where thrust flanges on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval.

The method of filling the pipeline with water shall be approved by the Engineer. The length under test shall be filled making certain that all air is displaced through an air valve installed at the top of the blank flange situated at the high end of the line. The length shall then remain under constant moderate pressure, 10 to 20m head of water, for a period of several hours until the pressure can be maintained without additional pumping.

The pressure shall then be slowly increased at a maximum rate of 1 bar per minute to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10m, whichever occurs earlier. Thereafter pumping shall be resumed and

continued until the test pressure has been restored. The quantity of water pumped restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe length shall pass the test if the leakage is not more than 1.079 liters per mm diameter per kilometer per 24 hours for each 100m head of pressure applied and the full test pressure has been sustained for at least eight hours.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, at his own cost, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test.

No pipeline shall be accepted until the leakage on any length is not more than the rate of leakage specified above and all sources of leakage have been rectified.

The Test on Completion shall be carried out after all the pipeline sections have been satisfactorily tested and the joints between each section completed to provide a continuous test length between contract interfaces.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

28.8.2 Test Pressures

Test pressures are to be measured in bars at the center of the blank flange situated at the lowest end of the pipeline under test. Unless otherwise specified or shown on the drawings pipeline test pressure shall be in accordance with the following:

DI pipe and fittings 16 bar

For testing of sections of pipeline containing air valve chambers the Contractor should verify from manufacturer that the air valves are capable of operating under and sustaining the test pressure.

28.9 Pipeline Disinfection

Upon completion of a newly laid main shall be cleaned, disinfected using chlorine solution in accordance with procedure specified in IS 12288. Alternative methods may be adopted with the approval of the Engineer. The chlorinated water shall stand in pipeline for a minimum period of 24 hours and all valves in the system shall be operated twice during this period.

The chlorinated water shall be neutralized and disposed off as directed by Engineer.

After final flushing and before the pipeline is placed into service, water samples shall be collected and tested for bacteriological quality and shall not indicate the presence of coliforms. If the initial disinfection fails to produce satisfactory results, disinfection shall be repeated and satisfactory samples are obtained.

The Contractor is expected to carry out the cleaning, disinfecting and dewatering work as a part of laying the pipes and his rates for laying the pipes should include the cost of cleaning and other related works.

28.10 Chamber Markings

Details like valve type, size, and cistern number shall be painted on all valve chambers as directed by Engineer. Where valve chambers are flush with the ground, suitable marker posts shall be provided adjacent to the chambers at a suitable location with all details approved by Engineer.

In case of the pipeline laid above ground details such as chainage, invert levels of pipe saddle number culvert number, anchor/thrust block number etc., shall be suitably painted either on the pipeline or the supporting structure in distinct color.

28.11 Measurement and Payment

The measurement for pipes for items specified in Bill of Quantities shall be on running of the net length along the center line of the pipe excluding the length of specials and appurtenances. Payment for pipes shall be made in running meters after production of test certificates specified and directed by Engineer.

Specials shall be paid separately on the basis of each piece used. For the payment purpose, flanges shall be either included in or excluded as described in the Bill of Quantities. However material such as nuts, bolts and washers, etc., shall be included in the respective items.

Valves and Expansion joints shall be paid on number basis after erection and successful testing.

Payment for laying the pipes and specials shall be made 80% ON SUPPLY, 10% ON LAYING AND 10% ON TESTING

Note:

1) In case of item of supply of pipes, valves, specials etc, 80% amount of supplied item will be paid to the contractor on receipt of material (after satisfactory third

party inspection), 10% amount will be released after lowering, laying, jointing and remaining 10 % amount will be released after satisfactory hydraulic testing.

2) **10% cost of item included in pipeline sub work excluding supply items (pipes, all types of valves and Specials) shall be retained till satisfactory hydraulic testing is give as per tender specification.**

DS 29

PROVIDING & FIXING SLUICE VALVES & BUTTERFLY VALVES, SPECIFICATION FOR MANUFACTURE, SUPPLY AND DELIVERY OF SLUICE VALVES, BUTTERFLY VALVES

SLUICE VALVES

These specifications cover general provisions and requirements and are supplementary to the General conditions of contract.

29.1 GENERAL

The Sluice Valves proposed to be procured through this tender are to be used for drinking water supply schemes under execution.

29.2 WORK UNDER THIS CONTRACT

The work entitled manufacture, supply and delivery of Sluice valves for transmission mains shall comprise the manufacture, supply and delivery of the goods as mentioned in the Bill of Quantities.

a)	Sluice Valves	PN 1.0 of IS: 2906:1984. of various sizes, ranging from 350 mm to 1200 mm.
b)	Sluice Valves	PN 1.0 of IS:780:1980, of various sizes, ranging from 200 mm to 300 mm.

NOTE:

The above goods to be used for conveyance of potable water at temperatures varying from 10 degree centigrade to 40 degree centigrade.

The tender price shall include all labour and machinery and all materials necessary for the proper, manufacture of the goods, for tests at the contractor's works for the insurance and for delivery to works for the proper maintenance and for discharging

every obligations and requirement of the contract, in accordance with the intent of the contract documents, as stated in the General Conditions of Contract.

29.3 STANDARDS

Where reference is made to a particular standard, it shall be the latest revision of the Indian Standard Institution. Unless otherwise specified, the sluice valves shall be in accordance with the provisions of IS: 780:1980 and IS: 2906:1984 or sizes of the sluice valves covered under relevant standards.

29.4 MARKING OF SLUICE VALVES

Each sluice valve shall be marked as per IS: 780:1980, Para-II for sizes (50 mm to 300 mm) and IS:2906:1984, page: 11.1 (for sizes 350 mm to 1200 mm).

29.5 PACKING AND HANDLING

The contractor shall dispatch from the manufacturer's works goods adequately protected to prevent damage and deterioration during transportation and storage, etc. The packing is to be quite robust to withstanding rough handling during the transit by road/ rail/ sea and storage.

Each package / create will contain sluice valve of one size only in relevant class.

The packing procedure followed shall be in accordance with para 12 of IS: 780:1980 and para 12.1 of IS: 2906:1984

The contractor shall use proper handling equipment or follow suitable handling method as approved by the Engineer to unload the materials at the delivery site to prevent damage to the goods and equipment's. Third party inspection from agency approved by MJP should be carried out at contractor's cost only.

The contractor should produce manufacturer's test certificate conforming that the valves have been tested in accordance with I.S. specifications, stating the actual pressure and the medium used in the test. The design workmanship, material, strength and dimensions of all parts shall be as per I.S.S. The product shall be of proven quality rendering reliable service during maintenance and requirement.

29.6 THIRD PARTY INSPECTION

Third party inspection shall be carried as per MJP approved third party agency as per latest MJP circular.

The valve shall be tested in factory by third party in presence of Sangli Miraj Kupwad Municipal Corporationrepresentative at least for

a. Review of martial of construction

b Overall dimension of all component

c. Hydraulic testing.

This item shall be executed as per provision in the detailed relevant item of Schedule "B". This includes cost of supply, freight, transportation and allied taxes and delivery at the site of work. The item includes, labour, cost of jointing materials such as nuts bolts, rubber packing of champion make for making flanged joint etc. and fixing the valves in proper position and alignment including hydraulic testing conducted along with testing of pipe line for ascertaining the chain ages of the valves so fixed as occupied in the pipe line. The length of vales shall be recorded for actual length of valve without any financial implication Plain ended sluice valves will not be accepted. The sluice valves shall confirm to IS-780 and IS – 2906 – 1984 or as per subsequently modified IS of relevant year. This shall be of solid wedge gate construction with cast iron body and brass / Gunmetal trim. (Or in a variety of other materials specification as ordered.) These sluice valves shall stand to the working pressure of 10 Kg/Sq.cm.

After supply of above material at the site of work by the contractor. The same shall be issued to the contractor on "Unstamped Receipt" The contractor at his owns cost shall keep material at site store. The contractor shall maintain the register of consumption, duly signed by the site Engineer. Site Engineer can be checked the balanced materials, any time at site store of contractor. If any shortage is found, the cost of short materials with penal rate shall be recovered from the contractor in single installment through bill without any prior intimation to the contractor.

29.7 Mode of Measurement

This item will be measured and paid as per unit basis 80% payment shall be released

after supplying CIDF sluice valve at site of work and 25% payment shall be released after lowering, laying and jointing in position and completion of satisfactory hydraulic testing etc., the laying of valve shall be done as per specification No. Bd-V-, 6 Page No. 510. The item includes hydraulic testing of valves also along with the pipe line testing. Without inspection certificate, materials will not be accepted. . 10% amount of this item will be withheld for hydraulic testing respectively and will be released after satisfactory hydraulic test. Payment against the item of fixing valves is 10 % after laying. The valves shall be got inspected through IRS/SGS/QS&S all charges of inspection shall be borne by the contractor. Laying of valve shall be done as per specification No. Bd-V-, 6 Page No. 510. The item includes hydraulic testing of valves also along with the pipe line testing. Without inspection certificate, materials will not be accepted.

DS 30

Item No. :- Providing, lowering, laying and fixing in position C.I. D/F Reflux valve ……..etc. complete.

C.I.D.F. Refluxe valve as per I.S. 532 part 1 – 1984, PN-1 and these are of non-rusting stainless steel spindle and internal working parts stainless steel, Including loading, unloading stacking hydraulic testing etc. complete (IVC or kirloskar only.)

Mode of Measurement

This item will be measured and paid as per unit basis. 10% amount of this item will be withheld for hydraulic test and will be released after satisfactory hydraulic test. Basis 80% payment shall be released after supplying valve at site of work and 10% payment shall be released after lowering, laying and jointing in position etc.

DS 31

Providing and supplying Kinetic Double Orifice type Air Valves...

Kinetic Air Valves, etc.

Unless otherwise specifically mentioned in the tender items the required sluice valves, scour valves, air valves, etc. shall be supplied by the Contractor. The materials supplied shall be flanged as per requirement. The valves are to be carted to the site

from supply place, lowered in the trenches and jointed to the pipeline as directed with cost of all jointing materials, such as lead, aloe-rope, rubber packing, nuts and bolts, fire wood, etc. and the labour cost, which included in the tender items. The joints may be either flanged or S & S lead joints depending upon the nature of valves supplied and Contractor shall have no extra claims for any particular type of joint required to be done. The required number of jointing for fixing these valves is included in the tender item. The measurement will be per number of valve and the length for tail pieces will be payable under item of laying and jointing. 80% amount will be paid on its supply, 10% amount will be released on completion of fixing and 10% after satisfactory hydraulic testing.

DS 32

PUSHING M.S. PIPE BY PUSH THROUGH METHOD

The pipes pushed through the Railway / Road embankment should have minimum cushion of 2.0 m (As shown in the Railway's approved Drawing) above the pipes. The cautionary boards should be kept at sufficient distance from the point of crossing. The pushing should be done with the use of hydraulic jacks / winch machine as per the standard procedure of the Railways, Every precaution should be taken that while pushing no settlement takes place in the track / road the embankment should be protected with sand bags to avoid any slippage during working. The temporary thrust bed / thrust walls constructed for pushing should be dismantled after completion of pushing work. The M.S. pipe barrels shall be field welded with electric arc welding machine. The entire work should be carried as per the latest specifications of the Railway Department for pushing of pipe work. Jacking of the M.S. Pipes to form the opening under the Railway track under running traffic condition maximum allowable deviations from the theoretical alignment will be limited to 200 mm horizontally and 100 mm vertically. Any deviation beyond this tolerance will be rectified by the tenderer at his own cost. Any temporary structures such as thrust walls etc. shall be dismantled immediately after completion of the pushing work. Minor seepage water which can be dewatered manually be bucket etc. shall be done by the contractor and no extra payment will be paid for this however if the subsoil water is heavy and needs dewatering by pumps than it will be paid as per regular practice of SMKC.

Mode of Payment

Payment shall be made on RMT basis.

DS **33**

B.B. Masonry valve chambers

Construction of B.B. masonry valve chamber includes excavation to the required size and depth, Providing and placing in position PCC for levelling course, followed by 15 cm thick M: 15 P.C.C. foundation bedding, The chamber walls shall be in B.B. masonry in c.m. 1:5 proportion and inside cement plaster in c.m. 1:3, and external cement pointing including precast R.C.C. frame and cover as directed by Engineer in charge etc. complete. The curing shall be carried out as per the specifications before refilling the sides.

1) Size 1.5 x 1.5 x 2.1 m

This item shall be executed as described in schedule 'B' for relevant item and directed by Engineer-in-charge. The items like concrete, plaster, brick work etc. shall be executed as per PWD Specification and as per direction of Engineer-in-charge. The frame & Cover shall be of RCC & behave good quality. Damaged cover and frame shall not be fixed. The chamber shall be constructed well sufficient above the G.L. so as rain water shall not enter into the chamber. The bottom shall be constructed below bottom of valve, so that nut bolts of valve can easily be operate; Hence suitable depth of chamber shall be kept according to the site condition and as directed by Engineer-in-charge.

DS 34

HYDRAULIC TESTING OF PIPELINE:

After the work of laying pipeline is completed and before it is commissioned, the pipeline shall be tested in the field both for its strength and leakage in the following manner.

NOTE

Whether stated specifically elsewhere or not, the testing in section of 1 km shall have to be completed within 3 months of laying and jointing.

The pipeline laid length will be divided into sections specified by Engineer-in-Charge. The contractor shall recheck pipe and valves for cleanliness and shall recheck operations of the valves. The open ends of the pipeline or sections thereof shall normally be stopped off by blank flanges or cap ends additionally secured where

necessary by temporary struts and wedges. All anchor and thrust blocks must have been completed and all pipe straps and other devices intended to prevent movement of pipe must have been securely fastened. The contractor shall clean out the whole pipeline and flush it with water, so as to remove dust, dirt and any foreign matter laying in the pipeline. No separate payment for the work of cleaning will be made and the rates under various items of work include thereof.

Each valves section of the pipeline shall be subjected to hydraulic test in section. For this test, the pipe shall be slowly filled with clean water by opening cross connection with the existing mains or otherwise by pumping water into the line (water and pumping arrangement is to be arranged by contractor) as directed and all air shall be expelled from the pipeline through hydrants, air valves and blow off fixed on the pipeline. Once the pipe is full, the cross connection or pumping shall be closed. The pressure in the pipeline should then be raised in stages and built up and maintained by means of suitable approved pumps, to the specified test pressure based on the elevation of the lowest point on the line or per section under test.

The pipe line should be tested hydraulically up to required pressure as per IS specification or as per detailed specification for the Sub-Work. Before starting the pressure test, the expansion joint shall be tightened the test pressure shall be maintained for at least 24 hours. The drop in pressure shall not exceed 0.7 kg/cm2 within a period of 2 hours after the full test pressure is built-up. Under this pressure no leak or sweating shall be visible at the joints. During the test, the pipe shall be struck sharp blows with 1.5 kg hammer. Water shall not spout, ooze or sweat through any part. In case of any leak observed anywhere in the field joints whether welded or bolted, the same shall be repaired entirely at the contractor's cost which shall include repairs to welding and regunitting etc. The repaired joint shall be subjected to retest. No section shall be accepted unless it is perfectly water tight.

The entire cost of testing, retesting including cost of water taken together shall be paid under relevant item or Bill of Quantities. The contractor shall make all the arrangements for all labour, pumps, pressure gauge equipment etc. The gauges should

be got tested if insisted by the Engineer-in-Charge. The contractor shall arrange for labour required for operating air valves, scour valves etc. Any labour of SMKC employed for the above activities of the test other than supervision shall charge to the contractor as per rules.

The hydraulic testing of the water main will be carried out for entire length as directed by Engineer-in-Charge. If any leakages are observed even during defects liability period due to defective workmanship, the same shall be rectified immediately. The charges of repairs if done departmentally will be recovered from the amount of retention money. Repairs on live water mains are to be carried out immediately to avoid wastage of water and other problems such as disruption of water supply and traffic etc. In view of this, it will be very difficult to give prior intimation to concerned contractor. As such the cost of repairs, being the expenditure will be recovered from the contractor's retention money withheld in deposit without giving any prior intimation. The contractor will not challenge or claim any extra for such action on the part of the Department.

Generally the contractor shall be required to test the pipe line sections of 2 km using necessary equipment. However, if the Engineer-in-Charge directs, to test full pipeline lengths in further suitable sections in the interest of the work, the tenderers will have to carry out the test in such sections as directed by Engineer-in-Charge.

Mode of Measurement
This item will be measured and paid as per km basis measured up to 3 digits

DS 35

M.S. gate/Wicket gate

This work should be carried out as per details given in the item. The work should be carried out as per standard specifications and as directed by Engineer in charge.
Mode of Measurement and Payment:-
The mode of measurement of payment shall be on per no. Basis

DS 36

Providing, Supplying with lowering and laying HDPE Pipes and HDPE specials

The specifications for HDPE pipes of various diameters are confirming to I.S.4984 – 1995.

Grade of Raw Material
Raw material used to manufacture the HDPE pipes shall be pre compounded at

manufacturing stage. PE 100 is resin proposed to be used for manufacturing of the pipes.

General:-

1) The material used for the manufacturer of pipe should not constitute toxic hazard, should not support microbial growth and should not give rise to unpleasant taste and odour or discoloration of water. Pipe manufacturer shall obtain a certificate to this effect from the manufacturer of raw material.

2) High density polyethylene (HDPE) used for the manufacture to designation PEEWA – 45 – T – 006 of IS 7328: 1992. HDPE conforming PEEWA – 45 – T012 of IS 7328: 1992 may also be used with exception that met flow rating (MTR) shall not exceed 1.10 g/10 minutes – In addition the material shall also conform to 5.6.2 of IS 7328: 1992.

3) The specified base density shall be 946.5 Kg/m^3 and 946.4 Kg/m^3 (Both inclusive) when determined at 270 C according to procedure prescribed in IS 7328: 1992.The value of the density shall also not differ than 3 Kg/m^3

4) The melting flow rating (MFR) shall be between 0.41 and 1.10 (both inclusive) when tested at 1900 C with nominal load of 5 Kg & as determined by method prescribed in 7 of IS 2530 : 1963. The MFR of the material shall also be within 20% of the value declared by the manufacturer.

5) The resin shall be compounded with carbon black. The carbon black content in the material shall be within 2.5 0.5% and dispersion of carbon black shall be satisfactory when tested according to the procedure described in IS 2530: 1963.

6) The percentage of the antioxidant used shall not be more than 0.3 percent by mass of finished resin.

Quality Assurance Certificate

Quality assurance certificate for the raw material proposed to be used for the project, from one of the certifying agencies such as Body coat or Slevan or Advantica or any other internationally reputed organization shall be submitted along with the supply.

The manufacturer should submit the above raw material certificates for proposed grade of material PE – 100 at time of supply of pipe.

Contractor shall submit the following Certificates from the manufacturer.

Pressure Rating

The pressure rating of HDPE pipes and specials shall be confirming to I.S. 4984-1995 for 6 Kg/cm^2 (working pressure) for material grade PE 100.

Colour of pipes

The Colour of the HDPE pipe shall be as specified in IS code is black. The pipe shall be designed for the temperature of 450 C maximum.

Reworked material.

The addition not more than 10% of the manufacturer's own rework material resulting from the manufacturer of pipes is only permissible.

Dimensions

The pipe dimensions shall be as per latest revisions and amendment of specified in standards IS 4984-1995. The pipes shall be supplied in straight lengths of 20 m. Short length of 3 m (Min) upto maximum of 10% of total supply will be permitted.

The internal diameter, wall thickness, length and other dimensions of pipes shall be as per relevant clauses given in IS 4984 applicable, for different class of pipes. Each pipe shall be of uniform thickness throughout its length.

The dimension to tolerances shall be as per specified I.S. standards.

Performance requirements

The pipe supplied should have passed the acceptance tests as per clause given in specified IS standards. The manufacturer should provide the test certificates for the tests conducted, as required in specified standards along with the supply of pipes. These acceptance tests can be performed in the in house laboratory of the pipe manufacturing factory of the successful Contractor. Third party inspection shall be carried from MJP's valid prevailing approved agency. The probable third party agencies as specified in above items shall have to submit to Department / MC, after supply of pipe at site. Then only it can be measured and recommended for further payment.

Marking

As per the provisions of clause given in specified standards each straight length of the pipe shall be clearly marked in inedible ink/paint the following information shall be marked.

a. ISI stamping with marking of IS 4984(or IS 14333)
b. The manufacturer's name and /trade mark.
c. Designation of the pipe as per IS 4984 (or 14333)
d. Lot number /Batch number

BIS License

The pipe manufacturer who is going to supply the pipes for the project has to have a valid BIS license.

Bid without these licenses may be treated as non-responsive

Fittings/Specials

All HDPE fittings/specials shall be fabricated in accordance with IS: 8360 (Part I & III). PE Injection moulded fittings shall be in accordance with IS: 8008 (Part I to IX). All fittings /specials shall be fabricated or injection moulded at factory only. No fabrication or moulding will be allowed at site, unless specifically permitted by the Engineer.

Fittings will be butt welded on to the pipes or other fittings by use of heat fusion.

Bends

HDPE Bends shall be plain square ended as per IS: 8360 part I & III specifications. Bend

may be moulded shall be manufactured or fabricated from pipes elements.

Tees

HDPE Tees shall be plain square ended as per IS: 8360 Part I & II specifications. Tees may be equal tees or reduced bench off tees. Tees may be moulded or fabricated from pipes elements.

Reducers

HDPE Reducers shall be plain square ended as per IS: 8008 Part - I & VII Specifications.

Flanged HDPE Pipe Ends.

HDPE Stub ends shall be square ended as per IS: 8008 Part & VII Specifications. Stub ends will be welded on the pipe. Flange will be of slip on flange type as described below.

Slip on Flanged

Slip-on-flanges shall be metallic flanges covered by epoxy coating or plastic powder coating. Slip on flanges shall be conforming to standard mating relevant flange of valves, pipes etc. Nominal pressure rating of flanges will be PN 10.

Welding

Procedure

Jointing between HDPE pipes and specials shall be done as per the latest IS: 7634 Part II. Method of jointing between the pipes to pipes and pipes to specials shall be with butt fusion welding using semi-automatic, hydraulically operated, superior quality butt fusion machines which will ensure good quality butt fusion welding of HDPE pipes.

Normally butt fusion welding shall include following activities.

Alignment of pipe on welding M/C
Surface preparation for welding.
Heating of pipe ends
Holding pipe ends for welding
Cooling etc.

Installation and Commissioning of HDPE PIPES

Installation

a. Supplying, laying, jointing, testing and commissioning of pipes shall conform to relevant IS codes, as applicable.

b. The alignment of pipelines shown in drawings of the tender documents is only indicative and the exact alignment will be as per drawings and /or as directed by the Engineer or his representative.

c. The HDPE pipes shall be laid in accordance with the latest IS 7634 Part -2.

Hydraulic Testing of HDPE Pipe Line

a. The Sectional Hydraulic Test shall be carried out after the pipeline section to be tested has been laid jointed and backfilled to a depth sufficient to prevent floatation

b. Each length of the pipeline to be tested shall be capped or blanked off at each end and securely strutted or restrained to withstand the forces which will be exerted

when the test pressure is applied.

c. Proposals for testing where thrusts on structures are involved even where thrust flanges on the piping are installed shall be with the prior approval of the Engineer.

d. The proper method of filling the pipeline with water shall be used. The length under test shall be filled making certain that all air is displaced through an air valve or any other appropriate mechanism. The test length shall then remain under constant moderate pressure as per testing method given in the IS 7634.

e. As per IS code water required to build up allowable drop in pressure during test will be treated as a makeup water.

f. Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint, the Contractor shall, have to be repaired at his own cost, replace the pipe or repair the pipe or remake the joint and repeat the hydraulic test is the responsibility of the contractor. The additional payment will not be made.

g. Test pressures are to be measured in kg/cm^2 at the Centre of the bank flange situated at the lowest end of the pipeline under test.

HDPE pipes and Fittings

All the pipes specials and fitting of HDPE shall be supplied and shall be tested along pipeline as per relevant IS codes and specifications.

h. Daily O & M of HDPE pipeline should be done & maintain by contractor for two years free of cost. No extra payment will be done by SMKC for this.

The Following code shall be used for:

a. Site Test Pressure: as per IS 7634 Part I.

Suitable section length shall be 500 to 800 m as directed by the Engineer in charge shall be taken for such testing from time to time during progress of the work and satisfactory test given for that section. All testing apparatus, gauges, connections, etc. and water required for testing shall be arranged by the Contractor at his cost. The SMKC does not undertake any responsibility to supply water for testing, If there is delay in testing, the contractor shall refill the trenches for the time being and reopen them at time of testing at his own cost, failure of which shall entitle the SMKC to do the refilling the reopening of trenches at the risk and cost of the contractor. If the trenches are filled due to any reason whatsoever before testing the contractor shall have to open for testing at no extra cost.

Satisfactory hydraulic test shall be recorded when the section under test shall withstand the pressure as specified by the Engineer in charge for about 15 minutes without operating the test pump. The test pressure being maintained at the specified figures during that 15 minutes interval.

The field pressure to be imposed should be not less than the maximum of following

a) 1.5 times the maximum sustained operating pressure.

b) 1.5 times the maximum static pressure in the pipe line.

c) Sum of maximum sustained operating pressure and maximum surge pressure.

d) Sum of maximum pipe line static pressure and maximum surge pressure. Subject to the maximum equal to the work test pressure to any pipe fitting incorporated.

e) The field test pressure should wherever possible be not less than 2/3 rd work test pressure and should be applied and maintained for at least 15 minutes.

The test pressure shall be gradually raised at the rate of 1 Kg/ cm2/min. If the pressure measurements are not made at the lowest point of the section, an allowance should be made for the difference in static head between the lowest point and point of measurement to ensure that the maximum pressure is not exceeded at the lowest point. If a drop in pressure occur, the quantity of water added in order to re-establish the test pressure should be carefully measured. This should not exceed 0.1 lit/ mm of pipe dia. per Km. of pipeline per day for each 30 cm. head of pressure applied.

During testing if any joints are found leaking they shall be repaired and /or redone by the contractor at his cost till the test is found satisfactory. Similarly, any pipes, collars, specials, show hair cracks, leaks etc. during testing the contractor shall replace them with sound pipes and specials etc. free of cost. The hydraulic test shall be given in presence of the Engineer in charge.

15% payment of total sub work of pipe line work shall be withheld till hydraulic test is given which shall be released only on giving satisfactory test.

Mode of Payment
80% payment shall be released against providing HDPE pipes, after submitting third party inspection certificate from MJP's valid prevailing approved agency. 10% payment will be made after lowering, laying, jointing of pipes. 10% payment will be released after satisfactory hydraulic testing is given by contractor. The cost all types specials required as per site conditions is on number basis .The payment will be made as per rate list attached separately.
Specials will be paid as per actual consumption. The balance specials are not accepted by Department.

DS 37

Reinstating damaged house connection MDPE pipes and Specials...

This item shall be executed as per the description given in the schedule B of relevant item and as directed by Engineer-in-charge.
Item to include: providing and fixing MDPE pipe with necessary specials and jointing material with no extra payment for excavation and the water supply of same connection shall be resumed within a period of 24 hours.

Mode of measurements:
The item of reinstating of house connection for MDPE pipe should be measured per RMT basis while specials provided as required on site will be paid on number basis as per rate list attached separately as below.

DS38

Manufacturing, providing and supplying spirally welded / ERW/ SAW / fabricated M. S. Pipes (Commercial Quality) ……. etc., complete as per IS - 3589 and IS-5504 as applicable as per specifications (No negative tolerance in thickness is permissible).

DETAILED SPECIFICATIONS FOR MS PIPELINE

THE PIPES TO BE SUPPLIED WITH INTERNAL CLEAR DIAMETER WITH INSIDEMORTAR LINING.

1. Pipes to be supplied under this contract shall conform to IS:3589-2001, (latest version) and IS:5504 (Latest version) Indian Standard for Electric Resistance welded or seamless or spirally welded steel pipes for water, gas and sewage (subject to specific requirements given below).

2. in case supplier proposes to supply pipes to the standards superior to the above standards no weightage will be given while evaluating the bid and for payment.

Method of Manufacture	Electric resistance welded (ERW)
Applicable Standards (with latest edition)	
Welded or seamless steel tubes for water, gas and sewage	ISO-1977
Steel pipes and tubes for pressure purposes, carbon steel, ordinary duties	BS:3601 (Latest version)
Specification for gas line pipe	API 5L-1980
Specification for electrically welded steel pipes for water, gas and sewage.	IS:3589-2001 IS:5504 (Latest version)
Methods of sampling of steel pipes, tubes and fittings	IS:5711- (latest version)
Methods of tensile testing of steel tubes	IS:1984 (latest version)
Code of practice for laying and jointing MS pipes	IS:5822- (latest version)

38.1 .INSPECTION
Inspection of MS pipe is divided in 2 parts. Inspection during manufacturing.
a) Identification of plate/strip material for manufacturing.
b) Qualification of welding process to be used for manufacturing of pipes.
c) Qualification of welders.
d) Dimensional check before start of welding to avoid rejection at a later stage.
Inspection of ready built pipes.

38.2. SPECIFICATION FOR LAYING OF MS PIPELINE
Warped or deformed timber shall not be used for shoring. Shoring shall project at least 150 comes above ground and shall extended the trench as approved by the Engineer. Planks shall be placed close enough to avoid any running in of sand or earth through the joints.

For walling pieces round timber shall not be allowed.
Spacing of struts shall be as per the requirements of the design of shoring. The shoring material shall be of the minimum sizes as specified below unless steel sheet piling is used.
a) Planks 5 cms thick. b) Walling Pieces 20 x 10 cms c) Struts 20 x 15 cms
Shoring shall be removed only after the approval of the Engineer-in- Charge. In case shoring may be required to be left in trenches after confirmation that its removal is likely to cause damage to the structure or utilities etc. the same shall be left therein permanently with all accessories without any compensation or extra cost. Payment for providing shoring in square meter of area shored and leaving it in the trench in cubic meter of timber left is included in the item of excavation. Projection above ground level after attaining final depth, however, shall not be retained in any circumstances.

38.3 .UNDERGROUND PIPE LAYING GENERAL
Pipe laying shall be done as shown on the drawings or as directed by Engineer, to the correct line and level. The Engineer, at his discretion, may change the alignment and/or levels depending on the site conditions. The minimum cover under roadway etc. where traffic is expected over the pipeline shall be 120 cm as specified in IS: 5822 (latest version). The minimum cover for pipeline along the major district road and State Highway shall generally be 1.0 m, where traffic is not expected over the pipeline. Pipes and specials to be laid underground shall be provided either with C.M. gunitting Coal tar wrapping or cement concrete encasing as specified separately as per requirement. Care shall be taken to see that while handling these pipes, the pipe and unitted portion is not damaged. The rate includes all expenses on account of labour, machinery, material etc. required for complete process of lying. No extra rate for any reason for this job will be admissible even if the process of lowering and laying of these pipes requires additional labour, machinery, materials etc. From safety point of view.

38.4 LAYING PROCEDURE

The Contractor shall lower the pipes of standard lengths short lengths pipes shall be lowered only if found necessary and only after obtaining the permission of Engineer-in- Charge. The pipes shall be lowered in the trench on prepared bedding or concrete bedding as per the decision of Engineer-in-Charge. Pipes shall not be laid on the open rock bottom as it may damage the pipe shell on account of point loads.

The alignment and levels shall be checked by the theodolite. Cutting of pipes shall not be allowed for matching the sides of trenches excavated. While assembling the pipes the ends shall be brought close enough to leave a uniform gap not exceeding 3 mm. Marginal

Cutting and grinding shall be done if found necessary, for which no extra payment shall be made. There shall be no lateral displacement between pipe faces to be

jointed.

When the pipe is properly assembled and checked by Engineer-in-Charge for correct line and level, it shall be firmly supported on wooden beams and wedges and then tack welded.

In the trenches where shoring is provided, care shall be taken to see that during lowering of pipes, only required struts are removed at a time with additional precautions to keep the shoring in position if necessary.

38.5 SPECIAL PRECAUTIONS FOR MAINTAINING CIRCULAR SHAPE OF PIPE

Special attention of the tenderer is drawn to the fact that the proposed pipeline is to be provided with cement mortar lining. It is therefore very necessary that the circular shape of the pipes be maintained till these pipes are mortars lined. The contractor shall provide adjustable steel struts of the approved design for this purpose. Minimum three sets of struts shall be provided per pipe length of 6 meter. They shall be retained till complete refilling is done and properly consolidated or till concrete encasing is set. Any diametric variation beyond + 2% shall have to be rectified by the contractor at his cost, which may include, removing the section of the pipeline and relaying it along with all other ancillary operations. Providing required number of adjustable struts and all other operations involved as above shall be deemed to have been included in the item of laying and no separate payment on this account will be admissible.

38.6 MODE OF MEASUREMENT

The payment for MS pipe, the measurement of this will be taken on runing meter basis and paid in runing meter basis at the rate specified in Schedule-B. The break-up of payment shall be as under Supply of MS pipe with inside 60% of cost mentioned in mortar lining and third party Inspection report
Laying of pipes & outside wrapping 25% -- do – of pipes
Hydraulic testing of pipe line 15% -- do -- And 'C' value test of 140

38.8 SPECIFICATIONS FOR LAYING SPECIALS

a)GENERAL

All specials like distance pieces, straps, tapers, saddles, branches, tees etc. Shall be generally fabricated in the factory. Only small kinks or bends or saddles may be fabricated on site, care being taken to see that the length of the fabricated fitting is at least equal to the diameter of the pipe to which it is being fixed. Such fabrication of specials on site shall be done only on approval of the Engineer and as his direction. As specified earlier, only kinks or bends shall be fabricated on site by cutting the pipe faces and then welding shall be carried out as specified hereinafter and shall be paid separately.

All specials shall necessarily be in steel and shall be laid in the same manner specified in pipes section.

b) STRAPS

Whenever the pipe laying work proceeds from two ends and if gap between two faces is less than 30 cm., this gap shall be bridged by providing a strap. Strap shall also be provided during fixing of expansion joints as has been specified earlier. Such strap shall be fabricated on site by cutting a piece from the pipe. This piece shall be split longitudinal and stepped over the gap. A minimum gap of 8 cm shall be kept on both the pipes to be connected and strap shall be welded with required number of fillet welds from inside and outside. The gap between the ends of straps shall be welded longitudinally butt welded.

c) DISTANCE PIECES

Distance piece shall be provided with the gap between the pipe faces to be jointed is more than 30 cm measured in the evening. Distance pieces shall be cut from the pipe pieces on site or can be cut in factory. These will be measured and paid for laying as special

d) TAPERS AND BENDS ETC.

These shall be fabricated in the factory and shall be welded on site as per requirements. Laying of tapers shall be paid for laying as specials for the diameter in the larger size. Bends shall be measured along the mean length and paid for in the respective items of Bill of Quantities.

38.8 MODE OF MEASUREMENT

The MS specials including all above described will be paid on weight basis in Kg. Unit on supply, while lowering, laying of specials will be paid as mentioned in Schedule-B. However, 10% of the amount of lowering, laying will be withheld till satisfactory hydraulic testing of pipe line is given.

38.9 WELDING JOINTS

a) GENERAL

Before aligning, assembling and welding the pipe faces shall be cleared by scraping with wire brushes or by any other method approved by the Engineer. Welding of pipes in field shall conform to ISS:816-1969 (code of practice for use of metal arc welding for general construction in Mild Steel). In case of variance, specifications hereunder shall have precedence.
Welder shall be qualified, experienced and approved by the Engineer-in- Charge to

do the welding at the locations welding shall not be allowed to be done by helpers. Contractor shall remove such of the welders form the job, whose work is not found to be satisfactory. The Engineer may ask them to do test welding before approving their employment on the job.

The contractor shall keep record of the welding for each circumferential joint. It shall contain the name of the Welder, Operator and Date of Completion of such run of internal and external welding.

b) GOUSING AND CHIPPING

MS Pipes of diameter larger than 1016 mm shall be welded with two number of runs from inside and a sealing run from outside. External sealing run shall be done only after internal welding is completed. Before starting the external welding the weld material in the joint shall be cleaned by clipping out loose scales. Goosing shall be done before rectification of any defective welding wherever necessary and as directed by the Engineer. Gousing or chipping shall not be paid for separately and the rate for welding shall be deemed to include the cost of gousing

c) ELECTRODES

Welding electrodes to be used for welding in this contract shall conform the Indian Standard Specifications ISS:814-1971 (Specification for covered electrodes for metal arc welding of Mild Steel) The contractor shall use standard electrodes depending on the thickness of the plates to be welded and the type of joint. The contractor shall also use standard current and A.C. voltage required for the machine as per manufacturer's directions.

d) TYPES OF WELDED JOINTS

The circumferential joints of the pipes shall be butt welded with required number of runs externally and internally.

All fillet welds shall have a throat thickness not less than 0.7 times the thickness of the pipe to be welded.

e) WELDING PROCEDURE

All parts of pipes, specials, etc. shall have all loose scale, slag, rust, paint and any other foreign material shall be removed with wire brush and left clean and dry. All scale and slag shall be removed from each run of weld when that run is completed.

Openings in the form of manholes in the laid pipeline at suitable distance of access for the work of cleaning, repairs etc. Such manholes, as far as possible shall be provided on sides of the pipe line and cutting manholes at the crown shall be strictly avoided.

Patch Plates for plugging the above manholes shall be cut from a separate

pipe of the same diameter. Edges of the patch plate shall be properly shaped and shall be inserted in the opening leaving a gap of 3 to
4 mm and tacked. Welding of patch plate shall be done in segments in a proper sequence conforming to Indian Standard Specifications IS: 823

f) TESTING OF WELDED JOINTS:

Welded joints shall be tested in accordance with procedure laid down in Indian Standard Specifications (IS: 3600, Part I –1985 of procedure for Testing Fusion welded joints and weld metals in steel)

At least one test specimen shall be taken out for testing for every fifty field
Joints done. Test pieces shall be taken out from the places pointed out by the Engineer. These shall be machined and tested early as possible.

The shape of the test pieces removed for testing shall be such that it shall be such that it shall give the specimen of the required dimensions with the weld in the middle of the specimen and at the same time leave the holes in the pipe with rounded corner. This hole shall be patched with a plate of suitable size cut from a separate pipe of same diameter. It must ensure good butt weld.

g) TENSILE TEST

The test specimen taken perpendicularly across the weld shall be shaped in accordance with Indian Standard Specifications IS: 223. The tension test specimen shall be machined. The protruding welded portion from inside as well as outside shall be machined. The protruding welded portion from inside as well as outside shall be removed by machining before the specimen is tested.

If the specimen shows defective machining or develops flaws not associated with welding, it shall be discarded and another specimen substituted. The welded joint shall show a strength not less than the minimum tensile strength for the plate in accordance with ISS:226

h) BEND TEST -Bend Test specimen shall also be prepared in the same fashion as the tensile test specimen. The specimen shall stand being bent cold 180o around a pin that has a diameter equal to 4.5 times the plate thickness, without developing cracks. For this test face representing inside of the pipe shall be placed next to the pin.

i) TRE-PANNED PLUG:

Tre-Panned plugs shall be taken out from any welded portion as pointed out by the Engineer. These plugs shall not show any defect in welding such as inclusion of slag, blow holes cavities, etc. the plug shall be 12 mm in dia and shall be taken out by means of suitable electrically operated holes. Such holes in the pipe shall either be filled back by inserting a steel stud and welding around or threading the hole and

providing suitable G.I. plug. This test shall be done only if considered necessary by the Engineer.

j) PROCEDURE OF FAILURE OF TEST SPECIMEN

If the test fails in either tensile or bend test or in both, two additional test specimen shall be taken out from the section and shall be tested for tensile and bend tests. If any one of them fails, extensive goosing and rewelding shall be done for the welded joints in that section to the full
satisfaction of the Engineer of However, if both the sample gives satisfactory results, the joint form which the original sample was taken

and had failed shall be repaired to the satisfaction fo the Engineer by gousing and welding etc. at contractor's cost. Welder who has done the welding of the joint that has failed shall be solely held responsible for bad workmanship and failure. Since all other factors like electrodes, current, arc voltage etc. are already controlled, on negligence on the part of the welder only is responsible for such failure. For first such failure the welder shall be warned and if the welded joint done by him fails for the second time, he shall be removed from the job.

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Subwork No. 9 A: - Remaining works of sangli UGD
Subwork No. 9 B: - Remaining works of Miraj UGD

The Job includes planning, surveying, designing of remaining sewer lines from Sangli and Miraj UGD schemes adjacent to kupwad ugd scheme and further execution of the work on site which includes excavation, providing, supplying,lowering & laying of sewer lines with necessary murum filling, refilling, dewatering if required and reinstating of road work as mentioned in relevant item specifications of Pipeline sub work and directed by Engineer In charge

Mode of Measurement and payment:

The item will be measured and paid as per the relevant item mentioned specification for measurement and payment in pipeline sub work.

Note:

1) In case of item of supply of pipes, valves, specials etc, 80% amount of supplied item will be paid to the contractor on receipt of material (after satisfactory third party inspection), 10% amount will be released after lowering, laying, jointing and remaining 10 % amount will be released after satisfactory hydraulic testing.
2) 10% cost of item included in pipeline sub work excluding supply items (pipes, all types of valves and Specials) shall be retained till satisfactory hydraulic testing is give as per tender specification.

MECHANICAL / ELECTRICAL WORK

DETAILED TECHNICAL SPECIFICATIONS

Submersible Non-Clog Sewage Pump Set:

The submersible sewage pump shall be non-clog type. It shall be suitable for pumping raw unscreened sewage containing sludge, storm water, long fibers, plastics, sand etc. The pump shall be able to pass through soft solids up to 100 mm dia for all flows and capable of dealing with the sewage / sludge with specific gravity of 1.05. Pump shall be of maximum 1500 rpm (Syn). Head range of pump operation shall be -25% to +10% of duty point.

The duty conditions shall be as follows,

S. N.	Name of Pumping Station	Minimum Flow Pump (1 Working + 1 Standby)(1/2 DWF)			Peak Flow Pump (2Working + 1 standby)(1DWF)		
		Q in LPS	H in Mt	HP	Q in LPS	H in Mt	HP
1	**Ahilya nagar PS-1**	**21**	**30**	**15**	**41**	**30**	**30**
2	**Tuljai nagar PS-2**	**80**	**29**	**60**	**160**	**29**	**120**
3	**Kumbhar mala PS-3**	**180**	**22**	**120**	**360**	**22**	**215**

The pump installation design shall be such as to facilitate automatic installation and removal of the pump without having to enter into the sewage pit by lowering or lifting on single guide pipe by interlocking with delivery flange through special automatic coupling without disturbing discharge pipe and without tightening bolts and nuts on discharge flange. Gasket profile shall be provided with automatic coupling system so as to avoid metal contact between the pump and delivery bend to ensure leak proof joint. The reverse rotation prevention system shall be incorporated in the pump design to ensure that pump dose not start rotating in the reverse directions due to wrong electrical connection.

PUMP COMPONENTS.

Pump set shall include the following:

Guide rail assembly consisting of S.G. iron pedestal, bracket auto coupling delivery bend and upper guide rail holder. Guide pipe, stainless steel of appropriate length as required. Lift chain with shackles, stainless steel as of required length.

PUMP CONSTRUCTION:

1. Pump Casing.

The pumps casing shall be of C.I. as per I.S. 210 Gr. FG. 260. The internal surface shall be free of rough spots. The casing shall be with integral suction and central line delivery.

2. Impeller.

Impeller shall be of Cast steel of grade ASTMA 351/351M –CF8M. Impeller shall be of double vane semi open, non-clog design. Additionally a special contra block cutting inlet with waved tearing edge system should also be incorporated on the suction sides and coarse toothed tearing blade on upper side of impeller of the pump for disposing of soft material which would otherwise clog the pump.

3. Pump Shaft.

The pump shaft shall be of SS 410. The shaft shall be in one-piece construction.

4. Pump bearing.

Pump bearing shall be of maintenance free anti friction type designed for minimum 40000 hours. The bearings shall be able to take normal radial and axial forces at any point of operation and to take care of thrust load due to unbalanced hydraulic load on impellers plus the weight of all rotating parts of the pumps. Pump bearings shall be designed with a minimum life of …….. hours, the bearing shall be grease lubricated for life and shall be maintenance free.

5. Guide Rail Assembly Suitable to site condition.

The assembly shall consist of S.G. Iron pedestal, bracket, auto coupling stand, lifting chain delivery bend, MS guide pipe with galvanized coating, upper guide, rail holder, Rail pipe of 50 mm NB of Class C of length suitable to site situation with double run.

The pedestal and bracket shall provide automatic coupling between pump delivery flange and discharge bend. The item includes providing, erecting in single length stainless steel guide pipe of 50 mm dia for hoisting of pump set. The diameter shall match the guide rail assembly being supplied by the manufacturer. Each pump shall be provided with carbon steel forged chain of adequate strength. The chain shall have rings of same size as chain, fixed at an interval of about one meter for engaging the hook of chain pulley block. The size of chain shall be as recommended by the manufacturer of the pump being supplied.

6. Mechanical Seals.

Double mechanical seals shall be provided to prevent pumped liquid entering into the motor winding. The seal shall be situated in oil chamber to ensure proper lubrication. The face combination of mechanical seals shall be Silicon Carbide V/S Silicon Carbide.

7. Fasteners.

All pump fasteners shall be in Stainless Steel SS 304 only.

8. Foundation Nut and Bolts. Stainless steel foundation nuts and bolts shall be provided.

9. Protective Coating.

The pumps shall be anti-corrosive epoxy painted. For better efficiency Special Surface Treatment shall be provided to the inner surface of pump casing. The coating used for bringing about efficiency improvement shall be polymer based system, which is a cold cured highly modified chemically resistant, two-pack resin system filled with stabilizing enforcement to Improve flow characteristics.

10. Pump Balance.

All rotating parts shall be statically and dynamically balanced as per relevant standards.

11. A Submersible Motor.

The submersible motor shall be dry, totally enclosed, squirrel cage induction motor working on 415 V + 10% and frequency 50 Hz + 2% suitable for three phase AC supply,

continuous duty with class “F” insulation operating at 1500 rpm (Syn.). Winding of the motor shall be in copper and shall be impregnated by resin, motor shall have integral cable entry port and cable entry shall be properly sealed. Water tight cable joint with cable sleeve to relive strain shall be provided. No cable jointing will be allowed between submersible motor to starter in any case.

The motor shall have copper bar rotor or aluminum dia. cast rotor. The motor shall have reverse rotation protection. The enclosure of motor shall be IP 68. Each phase of the motor shall be provided with three mica switches or bimetallic Electro mechanical sensor for thermal protection against overheating. The sensor"s feedback should be given to individual pump set starter for further protection mechanism. The motor shall operate satisfactorily at all operating levels in wet well. Motor shall be sealed against entry of liquid being pumped by using two mechanical seals. The motor hermetically sealed shall be cooled by surrounding liquid. The motor shall have minimum reserve margin of 10% over the entire working range of the pump i.e. - 25% to +10 % of duty head.

11. B Automation in pump operation

The pumping station shall be provided with a water level sensor and based on the level, the pumps shall switch ON and OFF. The sequence of switching on and off for four duty and two standby pumps will be decided. The auto-control shall be through the PLC provided and programmed for this. The input to PLC will be the station water level and the control will be through the starters of motor. The auto and manual mode operation shall be provided.

12. Moisture Sensor.

Moisture sensor shall be provided in the oil chamber to detect the failure of the mechanical seal. The sensor will trip the pump motor in case of ingress of moisture in the oil chamber.

13. Submersible Motor Cable.

Each pump shall be provided with 30 meters long adequate size cables, copper conductor, both for power and control, which shall be terminated in the pump starter panel.

14. Testing.

Manufacturer will conduct and furnish test certificates for the following;

a) Hydraulic test on casing.

b) Routine tests on motor including H.V. test and megger test.

c) Material test for major components certifying the grades of the material used.

All pump sets shall be subjected to factory tests in presence of Engineer-in charge or his representative and third party inspection agency approved by Deptt. The test shall be according to IS 5120.

A. Factory Test.

Each pump shall be shop tested by manufacturer to determine following characteristics.

1. Head Capacity curve.

2. BHP curve.

3. Efficiency Curve.

4. Total power consumed.

5. Rotating assembly balancing.

a) Hydrostatic Test.

Pump casing shall be tested at hydrostatic pressure equal to twice duty head or 1.5 times shut off head whichever is higher as per IS:5120.

b) Performance Test.

Performance test of each pump should be carried out. The test shall generally be carried out as per IS: 9137 for Acceptance test for pumps of Class-C. The test shall be carried out at full speed and full load at manufacturer"s work. The test shall cover six points i.e.

Duty point.

Two points above duty point.

Two points below duty point.

Shut off head.

The test shall be documented by obtaining concurrent readings showing motor voltage, current, discharge, head and power consumed at each point.

c) Strip Inspection. Any one of the pump sets after completion of their performance tests and as selected by the Engineer or Inspector at random will be offered for strip-inspection and dimensional checking. The manufacturer/ contractor shall submit all required dimensional drawings. Minimum points as under shall be checked.

1. Original dimensions of impeller.

2. Dynamic balancing of impellers.

3. Finish of water passage in impeller.

4. Review of raw material test certificate and quality control procedure.

Any deviation from tenders specifications and related IS shall be pointed out in inspection report. Material test certificate to the various pump components shall be furnished.

B. Field Performance Test.

The test shall be carried out as per relevant IS code of acceptance test of pump Class-C.

As regards P – Q characteristics for acceptance, it shall be checked whether motor is not getting overloaded within specified range.

a. Volumetric.

Volumetric measurement shall be taken by Ultrasonic calibrated flow meter arranged by the contractor at his cost. The head shall be measured with calibrated pressure gauge of accuracy 1% or better. At least three pressure gauges shall be used dully calibrated from two different institutions with prior approval of the Engineer. The gauge shall be fitted at suitable place on the discharge pipe. The input power to motor shall be measured with portable energy analyzer. The field test shall be taken with entire head range in such a manner that it would cover at least 6 points (i.e. duty point, 2

above, 2 below and shut off). The guarantees for head and discharge shall be deemed to be fulfilled.

The field performance test at site is absolutely essential as above (a) to (e).

CI / DI D/f sluice valve:

The item includes providing, laying, jointing with jointing material, commissioning and giving satisfactory test of CI / DI D/F Sluice Valve of approved make and shall be provided in the delivery of each pump. The C.I. Sluice Valve shall be suitable for PN 1.0 rating conforming to IS: 14846. The sluice valve shall be double flanged, water works pattern, inside screw, non-rising spindle type, electrically operated. The valves shall be installed on delivery floor as per sizes mentioned below,

Sr. N.	Name of Pumping Station	Average Flow Pump (1/2 DWF)	Peak Flow Pump (1 DWF)	Header main
		Dia.	Dia.	Dia.
1	**Ahilya nagar PS-1**	**100 mm**	**150 mm**	**200 mm**
2	**Tuljai nagar PS-2**	**200 mm**	**250 mm**	**350 mm**
3	**Kumbhar mala PS-3**	**250 mm**	**400 mm**	**500 mm**

Material of Construction: Sr. No.	**Component**	**Preferred Material**	**Ref. To IS No.**	**Grade of Design**
1.	Body, bonnet, dome, stool cover, wedge, stuffing box, gland thrust plate, cap.	Grey cast iron	210	FG 200
2.	Hand wheel	Grey cast iron	210	FG 200
3.	Stem	Stainless steel	6603	
4.	Wedge nut, shoe channel.	LT bronze	318	LTB-2
5.	Body seat ring, wedge facing ring, bushes.	LT bronze	318	LTB-2
6.	Bolts	Carbon steel	1363	Class 4.6
7.	Nuts	Carbon steel	1363	Class 4.0
8.	Gasket	Rubber	638	Type B

9.	Gland packing	Jute, hemp	5414	
10.	Gear	SG iron	1865	Gr 500/7
11.	Gear housing	Grey cast iron	210	FG 200
12.	Pinion & pin-ion shaft	carbon steel	1570	C55 Mn75

C. I. / D. I. D/F Reflux Valve:

The item includes providing, laying, jointing with jointing material, commissioning and giving satisfactory test of CI/DI D/F Non Return Valve of approved make with PN 1.0 rating, on delivery side conforming to IS 5312 (I).

Sr. N.	Name of Pumping Station	Average Flow Pump (1/2 DWF)	Peak Flow Pump (1 DWF)	Header main
		Dia.	Dia.	Dia.
1	**Ahilya nagar PS-1**	**100 mm**	**150 mm**	**200 mm**
2	**Tuljai nagar PS-2**	**200 mm**	**250 mm**	**350 mm**
3	**Kumbhar mala PS-3**	**250 mm**	**400 mm**	**500 mm**

The Non Return valves shall be single door type, free acting, quick closing, giving rapid non slam closure and with low head loss characteristics when in open position. The valves shall be suitable for following working pressure and shall be tested at factory.
Test Pressure for
i) Seat 10 Kg/cm2 for 5 minutes.
ii) Body 15 Kg/cm2 for 10 minutes.

Material of construction: Body, Cover, door face etc.	Cast Iron conforming to grade IS: 210 Grade FG 200.
Hinges	Cast Steel conforming to IS: 1030.
Hinge pins, door pins and door suspen-sion pins.	Stainless steel conforming to IS: 6603.
Bearing bushes, body Hinges and door faces.	Gun Meal conforming to grade 2 of IS: 318 LTB
Fasteners	Stainless steel.

Testing:
All Non Return valves shall be tested at manufacturer"s works as per relevant IS. The scope of inspection is as given below.

Review of raw material test certificates and quality control procedure.

Body and seat test.

Kinetic Air valve:

The item includes providing, supplying, laying, jointing with jointing material, commissioning and giving satisfactory test of Kinetic Double Orifice type Air Valve, 80 mm dia, 100 mm dia. PN 1.0 rating as per MJP's standard specifications having small orifice elastic ball resting on a gun metal orifice nipple, large orifice vulcanite ball seating on moulded seat ring, with built-in kinetic features and isolating sluice valve of same size and rating mounted in horizontal portion, operated by wheel gearing, inlet face and drilled etc. complete.

MS/ CI / DI DF pipes and Specials:

The item includes providing, erecting, jointing with jointing material and commissioning double flanged MS/ CI / DI pipes and specials for the deliveries of all pumps and common manifold well outside the pump house. The weight given is tentative. The contractor shall provide required quantity as per site condition and as approved by the Engineer-In-Charge. All pipes and specials shall be adequately supported and properly clamped when in vertical position. The contractor shall submit and get approved the layout drawing before procuring the material. The specials and pipes shall be given two coats of anti-corrosive paint.

Flanged Joints:

The item includes providing and making flanged joints to flanged CI/ MS / DI pipes and specials including cost of all jointing material (rubber packing, nu bolts etc.), labour, hydraulic testing etc. complete. The quantity in schedule B is tentative. Payment will be made on actually provided joints.

ELECTRIC VALVE ACTUATOR:

Electromechanical valve actuator shall be provided for every sluice valve of individual pump delivery line the actuator shall be electrically operated. However features shall

be incorporated to disengage electric motor and operate the actuators manually as per schedule B.

The actuator shall be designed to open and close with manual push button operation considering actual torque required for opening and closing of actuator and under shut off condition. The operating speed shall be designed for valve stroke of approximate 250 mm per minute during valve closing and opening operation. The enclosure shall be fully weatherproof it shall incorporate double 'O' sealing arrangement for protection of electrical component from moisture and dust at all time even when terminal covers are removed, mechanical indicator for sluice valve close and open should be provided on actuator. The actuator shall also incorporate hammer blow feature to open the valve.

MOTOR

The electric motor shall be 3 phase squirrel cage, Class-B insulated with a time rating of 10 minutes or twice the valve stroking time, whichever is longer. The HP of motor shall be with 30% extra margin.

DRIVE

The actuator gear box shall be of the totally closed oil/greased lubricated type the arrangement shall be such that the gear case can be opened for inspection or disassembled without taking the valve out of the service. The drive shall incorporate bottom entry drive bushing which shall be easily detachable and machined to fit on valve spindle.

MANUAL OPERATION

A hand wheel shall be provided at appropriate level for manual operation.

The Mechanism shall be such that the manual operation is possible only when motor is disengaged by means of lever.

LIMIT SWITCHES

Limit switches shall be provided for open and close torque and/or positions. Means shall be provided to prevent the open torque switch tripping during initial unseating hammer blow effect. All required electrical and mechanical connections including power and control cables shall be provided and cost of all such items shall be deemed to be included in the quoted cost for valve and actuator.

Necessary support in CC block shall be provided underneath the valve. If required CC

platform shall be provided to ensure that height of hand wheel is 1m above the platform cost of CC support and platform shall be separately under relevant item in Schedule-B.

4.1 All local controls shall be protected by a lockable cover.

4.2 Each actuator shall be adequately sized to suit the application and be continuously rated to suit the modulating control required. The gearbox shall be oil or grease filled, and capable of installation in any position. All operating spindles, gears and headstocks shall be provided with adequate points for lubrication.

4.3 The valve actuator shall be capable of producing not less than 1½ times the required valve torque and shall be suitable for at least 15 minutes continuous operation.

4.4 The actuator starters shall be integrally housed with the actuator in robustly constructed and totally enclosed weatherproof housing. The motor starter shall be capable of starting the motor under the most severe conditions.

4.5 The starter housing shall be fitted with contacts and terminals for power supply, remote control and remote position indication.

4.6 The weather protection class for the actuator shall be IP-65 conforming to IS 13947.

4.7 Each starter shall be equipped as follows:

a) 2 nos. three phase magnetically operated line contactors (AC-4 duty) with no-volt release and electrical and mechanical interlock.

b) 1 No. Three phase thermal cut-out device.

c) 1 No. Control circuit transformer fully protected by fuses on primary and secondary circuits.

d) 1 No. Set of "Open", "Close" and "Stop" buttons.

e) 1 No. Local- Off-Remote switch with padlocking facilities.

f) 1 Nos. Set of torque and limit switches for "Open" and "Close" positions.

g) 3 Nos. Sets of auxiliary limit switches in each direction.

h) Valve position indicator and handwheel for manual operation.

i) Reduction gear unit

j) 1 No. Monitor relay (to detect loss of phase, thermostat tripped, ocal stop PB locked or local mode selected)

TESTING

All the Sluice valves & Valve actuators shall be subject to factory test in presence of federation representative , Superintending Engineer (M) or his representative and third party inspection agency approved by MJP.

Acceptable makes: As per Mechanical approved make of MJP.

Main Panel:

The item includes designing, providing, installing, commissioning and giving test of Main Panel, floor mounting cubicle with following accessories fitted,

	Ahilya nagar Pumping Station PS-1		
S. N.	Description of Material	QTY	Unit
1	3 Pole MCCB of 400 A, 415V capacity with S.C. rating 36 kA (Ics=100% of Icu), thermal and magnetic setting with provided leads on iron/G.I. frame as per specification No. SW-SWR/MCCB (Main Incomer + DG + Bus coupler)	3	No
2	FPMCB 40A to 63A in provided distribution board as per specification no. SW-SWR/MCB (30 Hp)	4	No
3	FPMCB 6A to 32A in provided distribution board as per specification no. SW-SWR/MCB (15 Hp)	3	No
4	FPMCB 40A to 63A in provided distribution board as per specification no. SW-SWR/MCB (Panel + lighting + APFC panel)	3	No
5	G.I. sheet 1.6mm (16 gauge) to be used for fabrication of boxes panel boards etc.	170	Kg
6	panel mounting type digital ammeter having Three and half digit LED display, external C.T. operated, calibrated for	5	No

	suitable to operate on 500V, 0 to 1000A AC supply with necessary PVC wire leads and lugs and mounting hardware on provided panel		
7	dual source intelligent flush mounted panel meter three phase four wire (IPM) 415V CT/ PT site programmable class I flush mounted (96 x 96 mm) meter with voltage, current, frequency, power factor , ON hrs, kWh, EB and DG set metering with LED display (excluding CT'S) complete with RS 485 communication protocol, class I accuracy and wiring connections and mounting hardware on provided panels complete with calibration certificate from manufacturer. LT current transformer with bar primary 50/5 to 1000/5 ratio with 15 VA burden erected in provided CRCA box duly secured with insulating materials connected to the meter with test certificates.	1	No
8	panel mounting type digital voltmeter having Three and half digit LED display, calibrated for 0 to 750V AC suitable to operate on 500V AC supply with necessary PVC wire leads and lugs and mounting hardware on provided panel complete with calibration certificate from manufacturer.	1	No
9	LED type indicating pilot lamp with LED colours Red / Yellow / Green, 230 / 250V on provided box / panel	5	No
10	Panel wiring (30 Hp x 3 + 15 Hp x 2)	1	Job
11	GI sheet 1.6 mm (16 SWG) caution board of size 200 x 150 mm duly painted with red oxide and enamel paint in Marathi and Hindi erected at position for medium voltage installation.	2	No
12	PVC synthetic elastomer electrically insulating mat with class B insulation conforming to IS: 15652 – 2006 & CPRI tested having 2.5 mm thickness upto 11 kV	6	sqm
13	EMPR for protection like overload, phase failure, locked ro-	5	No

	tor, phase reversal with trip indication and adjustable over current function, DIN rail mounted.		
14	Integral DOL starter for Actuators	5	No
15	Iron, sheet metal work consisting of CRCA Sheets, Various sections of iron, Plates, Chequered Plates, Rods, Bars, MS pipes, etc. for panel board or any other purposes complete with bending, cutting, drilling and welding complete erected at the position with necessary materials duly painted with one coat of red oxide and two coats of enamel paint to match the switchgears or as per directions by the authority	190	Kg
16	bus bar chamber triple pole with neutral with four aluminium bars, 500V 200A complete as per specification no. CP-BB	3	mtr
	Tuljai nagar Pumping Station PS-2		
	Description of Material	QTY	Unit
1	air circuit breaker manually operated non-drawout type of 1000A rated at 50° C without deration, 500V, 3 pole having short circuit rating 50 kA (Ics=Icu=Icw for 1s), with standard accessories and thermal magnetic release on provided iron frame as per specification no. SWSWR/ACB (Main Incomer + DG + Bus coupler)	3	No
2	3 Pole MCCB of 315/400A, 415V capacity with short circuit rating 36 kA (Ics=100% of Icu), adjustable thermal (overload) setting and fixed magnetic setting with provided leads, provision for installation of shunt/ UV/ trip alarm contact and MCCB should have phase barriers both sides, in provided enclosure on iron /GI frame as per specification no. SWSWR/MCCB (120 Hp + spare)	4	No
3	3 Pole MCCB of 200A,415V capacity with short circuit rating 25 kA (Ics=100% of Icu) adjustable thermal (overload) setting and fixed magnetic setting with provided leads, provision for installation of shunt/ UV/ trip alarm contact and MCCB	4	No

	should have phase barriers both sides, in provided enclosure on iron /GI frame as per specification no. SW-SWR/MCCB (60 Hp + APFC panel + spare)		
4	bus bar chamber triple pole with neutral with four aluminium bars, 500V 630A complete as per specification no. CP-BB	3	mtr
5	G.I. sheet 1.6mm (16 gauge) to be used for fabrication of boxes panel boards etc.	230	Kg
6	FPMCB 40A to 63A in provided distribution board as per specification no. SW-SWR/MCB (Actuators + Panel + lighting + spare)	9	No
7	panel mounting type digital ammeter having Three and half digit LED display, external C.T. operated, calibrated for suitable to operate on 500V, 0 to 1000A AC supply with necessary PVC wire leads and lugs and mounting hardware on provided panel	5	No
8	dual source intelligent flush mounted panel meter three phase four wire (IPM) 415V CT/ PT site programmable class I flush mounted (96 x 96 mm) meter with voltage, current, frequency, power factor , ON hrs, kWh, EB and DG set metering with LED display (excluding CT'S) complete with RS 485 communication protocol, class I accuracy and wiring connections and mounting hardware on provided panels complete with calibration certificate from manufacturer. LT current transformer with bar primary 50/5 to 1000/5 ratio with 15 VA burden erected in provided CRCA box duly secured with insulating materials connected to the meter with test certificates.	1	No
9	panel mounting type digital voltmeter having Three and half digit LED display, calibrated for 0 to 750V AC suitable to operate on 500V AC supply with necessary PVC wire leads and lugs and mounting hardware on provided panel complete	1	No

	with calibration certificate from manufacturer.		
10	LED type indicating pilot lamp with LED colours Red / Yellow / Green, 230 / 250V on provided box / panel	5	No
11	Panel wiring (120 Hp x 3 + 60 Hp x 2)	1	Job
12	GI sheet 1.6 mm (16 SWG) caution board of size 200 x 150 mm duly painted with red oxide and enamel paint in Marathi and Hindi erected at position for medium voltage installation.	2	No
13	PVC synthetic elastomer electrically insulating mat with class B insulation conforming to IS: 15652 – 2006 & CPRI tested having 2.5 mm thickness upto 11 kV	6	sqm
14	EMPR for protection like overload, phase failure, locked rotor, phase reversal with trip indication and adjustable over current function, DIN rail mounted.	5	No
15	Integral DOL starter for Actuators	5	No
16	Iron, sheet metal work consisting of CRCA Sheets, Various sections of iron, Plates, Chequered Plates, Rods, Bars, MS pipes, etc. for panel board or any other purposes complete with bending, cutting, drilling and welding complete erected at the position with necessary materials duly painted with one coat of red oxide and two coats of enamel paint to match the switchgears or as per directions by the authority	240	Kg
	Kumbhar mala Pumping Station PS-3		
	Description of Material	QTY	Unit
1	air circuit breaker manually operated non-drawout type of 1600A rated at 50° C without deration, 500V, 3 pole having short circuit rating 50 kA (Ics=Icu=Icw for 1s), with standard accessories and thermal magnetic release on provided iron frame as per specification no. SWSWR/ACB (Main Incomer + DG + Bus coupler)	4	No
2	3 Pole MCCB of 800A, 415V capacity with short circuit rating	4	No

	50 kA ,(Ics=100% of Icu), adjustable thermal (overload) setting and fixed magnetic setting with provided leads, provision for installation of shunt/ UV/ trip alarm contact and MCCB should have phase barriers both sides, in provided enclosure on iron /GI frame as per specification no. SW-SWR/MCCB (240 Hp + spare)		
3	3 Pole MCCB of 315/400A, 415V capacity with short circuit rating 36 kA (Ics=100% of Icu), adjustable thermal (overload) setting and fixed magnetic setting with provided leads, provision for installation of shunt/ UV/ trip alarm contact and MCCB should have phase barriers both sides, in provided enclosure on iron /GI frame as per specification no. SW-SWR/MCCB (120 Hp + APFC panel)	4	No
4	electrolyte aluminium patti or bar in bus bar chamber / in panel or any other purpose, 500 V with require capacity with 99.9% aluminium purity with fixing arrangement (like lug or bottle type lug) to both the end with high grade polyolefin insulation sleeve complete as per specification no. BCP-BB	90	Kg
5	G.I. sheet 1.6mm (16 gauge) to be used for fabrication of boxes panel boards etc.	230	Kg
6	FPMCB 40A to 63A in provided distribution board as per specification no. SW-SWR/MCB (Actuators + Panel + lighting + spare)	9	No
7	panel mounting type digital ammeter having Three and half digit LED display, external C.T. operated, calibrated for suitable to operate on 500V, 0 to 1000A AC supply with necessary PVC wire leads and lugs and mounting hardware on provided panel	5	No
8	dual source intelligent flush mounted panel meter three phase four wire (IPM) 415V CT/ PT site programmable class I flush mounted (96 x 96 mm) meter with voltage, current,	1	No

	frequency, power factor , ON hrs, kWh, EB and DG set metering with LED display (excluding CT'S) complete with RS 485 communication protocol, class I accuracy and wiring connections and mounting hardware on provided panels complete with calibration certificate from manufacturer. LT current transformer with bar primary 50/5 to 1000/5 ratio with 15 VA burden erected in provided CRCA box duly secured with insulating materials connected to the meter with test certificates.		
9	panel mounting type digital voltmeter having Three and half digit LED display, calibrated for 0 to 750V AC suitable to operate on 500V AC supply with necessary PVC wire leads and lugs and mounting hardware on provided panel complete with calibration certificate from manufacturer.	1	No
10	LED type indicating pilot lamp with LED colours Red / Yellow / Green, 230 / 250V on provided box / panel	5	No
11	Panel wiring (120 Hp x 3 + 60 Hp x 2)	1	Job
12	GI sheet 1.6 mm (16 SWG) caution board of size 200 x 150 mm duly painted with red oxide and enamel paint in Marathi and Hindi erected at position for medium voltage installation.	2	No
13	PVC synthetic elastomer electrically insulating mat with class B insulation conforming to IS: 15652 – 2006 & CPRI tested having 2.5 mm thickness upto 11 kV	8	sqm
14	EMPR for protection like overload, phase failure, locked rotor, phase reversal with trip indication and adjustable over current function, DIN rail mounted.	5	No
15	Integral DOL starter for Actuators	5	No
16	Iron, sheet metal work consisting of CRCA Sheets, Various sections of iron, Plates, Chequered Plates, Rods, Bars, MS pipes, etc. for panel board or any other purposes complete	240	Kg

	with bending, cutting, drilling and welding complete erected at the position with necessary materials duly painted with one coat of red oxide and two coats of enamel paint to match the switchgears or as per directions by the authority		

The panel shall be provided with rectangular base frame fabricated from ISMC 75. Two earthing terminals shall be provided. The panel shall be painted with powder coated paint of approved color. An electrical grade PVC synthetic elastomer mat IS marked, 2 mm thick, conforming to IS 15652, 1 m wide extending full length of panel shall be provided.

Starter panels:

Separate DOL starter panels, standalone shall be provided for individual motor with air break contactors of AC 3 duty. The panel shall be cubicle type, floor mounting, made from 14/16 SWG MS sheet, powder coated. The cubicles shall be provided with screened louvers for cooling. The panel shall incorporate low voltage protection, over-load protection, single phasing prevention, thermostat protection, reverse rotation protection, seals monitor relay and automatic sewage level controller. Ammeter of ad-equate range shall be provided. Indicator lamps for phase indication, starter on, off and trip indication shall be provided. The pump shall be controlled by automatic sew-age level controller when the pump is in auto mode. The sensing electrodes shall be fixed in the well. Necessary control wiring shall be done.

The starter shall be housed in totally enclosed sheet metal clad, vermin and dust proof cubical box, suitable for floor / plinth mounted for indoor operation. The panel shall be fabricated from MS sheet SWG 14, with hinged door at front. Limit switch shall be provided to trip the motor in the event of opening of door. The panel framework shall have ICSMC-100 base channels.

The size of the cubical box shall be sufficient for ease in maintenance work and proper ventilation. At least two number of ventilating louvers shall be provided on side walls, at top to exit the hot air, and one number louver at bottom to allow fresh air inlet.

The terminal box shall be of waterproof construction suitable for outdoor service. Gaskets shall be provided at the cover joints and between box and the motor frame.

The terminal box shall be suitable for termination of alluminium armoured three and half core PVC/XLPE cable . The Contractor should make this arrangement specially, the cost for which in included in the rate of item.

Terminal box shall be complete with stud type terminals, plain washers, spring washers, check nuts, cable glands and lugs.

The panel shall be painted with one coat of primer and two coats of enamel paint of approved shade.

Bus bar, copper strips, copper leads shall be designed for twice the full load current. The potential wiring shall be carried out in 1.5 Sq.mm copper cable, and CT. circuitry wiring shall be carried in 2.5 Sq.mm copper cable.

Fully automatic auto transformer starter shall be housed in totally enclosed sheet metal clad, vermin and dust proof cubical box, suitable for floor / plinth mounted for indoor operation. The panel shall be fabricated from MS sheet SWG 14, with hinged door at front. Limit switch shall be provided to trip the motor in the event of opening of door. The panel framework shall have ICMC-100 base channels.

The size of the cubical box shall be sufficient for ease in maintenance work and proper ventilation. However the size of the cubical should not be less than 1.25 X 0.75 X 0.45 Mt. At least two number of ventilating louvers shall be provided on side walls, at top to exit the hot air, and one number louver at bottom to allow fresh air inlet.

The terminal box shall be of waterproof construction suitable for outdoor service. Gaskets shall be provided at the cover joints and between box and the motor frame.

The terminal box shall be suitable for termination of 120 Sq.mm alluminum armoured three core PVC cable . The Contractor should make this arrangement specially, the cost for which in included in the rate of item.

Terminal box shall be complete with stud type terminals, plain washers, spring washers, check nuts, cable glands and lugs.

The panel shall be painted with one coat of primer and two coats of enamel paint of approved shade.

Bus bar, copper strips, copper leads shall be designed for twice the full load current. The potential wiring shall be carried out in 1.5 Sq.mm copper cable, and CT. circuitry wiring shall be carried in 2.5 Sq.mm copper cable.

The Auto transformer starter shall incorporate following equipment.

- Triple pole AC3 rating power contactor For 15 & 30 HP – 200 Amp With required number of NO & NC
- MAIN CONTACTOR 2 Nos.
- AUXILLARY CONTACTOR, 110 Amp. 1 No.
- Oil immersed, copper wound Auto transformer

  With tapings, 50%, 65%, 80% with first fill of

  Best quality transformer oil. 1 No
- CT operated bimetallic over load relay. 1 No
- ON & OFF Pneumatic timer (0.05 to 30 Sec) 1 No
- ON delay pneumatic timer (0.05 to 30 Sec) 1 No
- Master timer 1 No.
- ON OFF Push buttons. 2 Nos.
- HRC control fuses. 2 Nos.
- Suitable rating Ammeter with metering CTS

& Selector switch. 1 No

- Thermostat with 1No.+ 1 NC. for oil temperature 1 No
- Door limit switch. (1 NO +1 NC) 1 No
- Current sensing Single phasing presenter with CTS 1 No
- No volt release 1 No
- Motor Protection Relay, SOLID state with protection CT's 1 No.
- Indicating lamps, Motor ON, OFF, TRIP 3 Nos.

(Protection CTs 10P3 / 10 VA)

F.C.M.A. STARTERS

FCMA / HFSR soft starter working on flux compensated magnetic amplifier (FCMA) principle suitable to operate L.T. V.H.S. Motors.

1) The High Voltage Soft starter for LT motor will be based on Flux Compensated Magnetic Amplifier principle and shall be installed on the Neutral side of each LT Motor.

2) The Flux Compensated Magnetic Amplifier (FCMA) Soft Starter shall be suitable for operation on specified Voltage at 3 ph.,50 Hz. A.C. Supply and suitable for connection to the phase segregated Neutral Terminal Box of the LT motor for Neutral Soft Starter & between DOL Starter and Motor for line Side Soft Starter.

3) The rating of soft starter shall be 1 % more than motor rated power and shall be capable of operating satisfactorily with the motor over the entire operating range. The soft starter rating offered shall not be less than the rated KW of the motor.

4) The soft starter shall reduce the starting current of the motor at least to 80 % of the direct on line starting current of the motor. The soft starter shall have a facility to further reduce the current upto 50 % of the direct on line starting current if the motor & load torque speed curves permit so. The soft starter shall control the starting torque in such a manner so as to effect smooth starting of the HT motor drive.

The Soft Starter shall be provided with suitable rated ammeter to indicate the motor current during starting.

5) The Flux Compensated Magnetic Amplifier (FCMA) shall work on the principal of unsaturated core in the working zone and shall not lead to generation of harmonics. The L.T. control circuit shall be suitable to operate on 230 V A.C. 50 c/s electric supply.

6) The Soft Starter shall be so rated as to allow at least two consecutive starts from cold or four hot start per hour.

7) The Soft Starter shall be designed for supply voltage variation of + 6% and frequency variation of + 3%.

8) The required LT control cable from panel to soft starter is included in cost of item.

9) The windings of the soft starters shall be with insulation class H Max. Temperature of winding shall be limited to that of Class -B.

10) The FCMA Soft Starter shall be housed in a sheet steel enclosure of thickness not less than 14 gauge and painted with corrosion resistive paint such as Epoxy or Polyurethane. The degree of protection shall be IP-41.

11) FCMA The Soft Starter unit shall have anti condensation heater, complete with switch and thermostat. The heater shall have interlocking in such a way that is is switched 'OFF' when motor is in run mode.

12) FCMA The Soft Starter shall not contain any active electronic components.

13) FCMA The Soft Starter shall have a built in facility for run mode bypass so that the incoming voltage to the motor is equal to the supply voltage.

14) The FCMA unit should be Air Natural Cooled.

15) The FCMA Soft Starter shall be dust and vermin proof and suitable for indoor mounting.

16) A suitable by pass arrangement to operate the motor in case of any difficulty with the starter shall be kept.

Sr. N.	Name of Pumping Station	Average Flow Pump (1/2 DWF)	Peak Flow Pump (1 DWF)
		Starter panel	Starter panel
1	**Ahilya nagar PS-1**	**FASD 15 Hp**	**FASD 30 Hp**
2	**Tuljai nagar PS-2**	**ATS 60 Hp**	**FCMA 120 Hp**
3	**Kumbhar mala PS-3**	**FCMA 120 Hp**	**FCMA 250 Hp**

FACTORY INSPECTION AND TEST:

The Starter, shall be inspected and tested by third party approved by M.J.P. in presence of SMC and Superintending Engineer (Mech.) or his representative.

The scope of inspection as per Third Party Inspection schedule.

Cables:

The items include providing, laying, electrically connecting and commissioning aluminum conductor, XLPE insulated, armored cables with all accessories like glands, termination kits etc. complete as per rating given in schedule B. The cables shall be conforming to IS 1554 or IS 7098. The cables shall be properly terminated with crimped lugs and cable glands. The cables shall be run through cable trays of adequate sizes. The sizes of cables as mentioned below shall be minimum and the contractor may provide higher sizes if required.

Power cable used in 415 V system shall be 11/1.1 KV grade 1 core, 3 core or 3.5 core as applicable aluminium / Copper conductor XLPE cable armoured type conforming to IS : 1554 & of MJP approved make. Cable shall be of sizes rated to carry full load current continuous at 0.85 PF or to withstand short circuit current of 17.6 KA for cable from transformer, for 0.1 second duration whichever is greater, but shall not be less than size specified in subsequent clause.

CABLE SCHEDULE :

The cable lengths stated in the schedule are estimated quantity and shall form the base for comparison of the tender offers. However, for contract works, quantity of the cables as actually required shall be supplied at the tendered rates with prior approval to cable schedule from the engineer-in-charge. Cables shall not be procured without prior approval.

The sizes of the cable stated in the schedule are the minimum acceptable size and shall form the base for comparison of tender offers.

Cable schedule for pumping machinery. :

11kV 3 Core, XLPE Insulated Aluminium Conductor Cable of sizes and lengths are to be

provided from MSEDCL point of supply to power transformer as mentioned in above table of items of 11kV HT Substation works of all pumping stations

1.1kV ,3.5Core XLPE Insulated Aluminium /Copper Conductor power and control Cable of sizes and lengths are to be provided from power transformer to 415 V LT Panel board of every pumphouse as mentioned in above table of items of 11 kV HT Substation works of pumping station.

1.1 kV ,XLPE Insulated Aluminium / Copper Conductor power and control cables of sizes and lengths as mentioned in above tables of LT Panel board of all twelve pumping stations are to be provided for APFC Panels, ATS Starters from 415V LT Panel boards.
Cables shall be laid in provided trenches, in ground, ducts, trays while passing through wall and trays, in and outside the pump house, and in R.C.C. duct / R.C.C. trenches, Every cable shall be neatly run vertically, horizontally or parallel to adjacent walls, beams or columns. At both for termination, the cable shall approach from a common direction and are individually terminated in an orderly and symmetrical fashion. RCC trenches with covers shall be provided for cables in substation and RCC duct for road crossing. The cables shall be terminated in mechanical glands which shall be suitable to provide adequate support by locking on the anchor for additional earth continuity. Suitable compression type copper cable lugs, shall be used for cable terminations.
The point of entry, exit of the cables from the building shall be sealed from outside with on approved asbestos compound followed by, about 40 mm. Thick bituminous compound or a weak mortor. Care shall be taken not to damage sheathing of cable due to hot bituminous compound while easling.

Cable route markers of approved design shall be installed at the following position.

i) Entry and exist point of underground duct/trench.

ii) Exits from the building.

iii) At every 5 m. distance of straight run.

iv) Any other position necessary to trace route.

A metallic plastic tag bearing cable reference number indicated in cable schedule at every 4 m run or part thereof and at both ends shall be provided for sake of identifica-

tion and route tracing. The cable schedule shall be prepared by the contractor and submitted for approval.

Control Cable / Communication Cable / Cable Trays/CABLES AND ACCESSORIES

POWER AND CONTROL CABLES

Design criteria

Power and control cable shall be suitable for installation in a tropical monsoon area having a hot humid climate. The reference ambient temperature to be considered for the purpose of this specification is 50 Deg C.

The de-rating factor for various conditions of installation including the following shall be considered while choosing the conductor size and calculations shall be submitted for Owner's approval:

i. Maximum ambient air temperature.

ii. Maximum ground temperature

iii. Depth of laying wherever applicable

iv. Grouping of cables

The maximum continuous conductor temperature and the maximum allowable conductor temperature during short circuit are to be taken as 70 deg C and 160 deg C respectively in case of PVC insulated cables and 90 deg C and 250 deg C respectively in case of XLPE insulated cables.

The cables shall be capable of continuous satisfactory operation under a power supply system frequency variation of (±) 5%, voltage variation of (±) 10% and combined frequency and voltage variation of 10% (absolute sum).

The cables shall in general comply with the requirements of the latest revision of IS-1554 (Part – I) for the LT PVC power and control cables or the relevant IEC International Standard unless otherwise specified in this specification. The design,

manufacture, installation, testing and performance of the cables, shall comply with the latest revisions of IS/ IEC/ NEMA/ ASTM Standard and the most stringent conditions specified in these specification shall be applicable.

General technical requirements

a. Type of cable:-

The cable shall be multi-core/ single core (XLPE), PVC and any polymeric/ elastomeric insulation type as specified.

b. Conductor:-

The cable conductor shall be made from standard copper to form compact conductor having a resistance within the limits specified. All the cables of size (……) sqmm and above shall have sector shape conductors. The minimum no. of strands in conductor shall be 7 (seven) except as otherwise specified. Power cables shall be of stranded Copper conductor with size (……) sqmm minimum and the control cables shall be stranded copper (electrolytic) conductor with a minimum size of 1.5 mm.

c. Conductor Shield

The conductor having a semi-conducting screen shall ensure perfectly smooth profile and avoid stress concentration. The conductor screen shall be extruded in the same operation as the insulation, the semi-conducting polymer shall be cross linked for XLPE cables.

d. Insulation

The insulation of the cable shall be extruded type and shall be designed and manufactured for the specified system voltage. The manufacturing process shall ensure that insulation shall be free from voids. The insulation shall withstand mechanical and thermal stresses under steady state and transient operating conditions. The extrusion method should give a very smooth interface between

semi conducting screen and insulation. The insulation of the cables shall be of high standard quality. The minimum volume resistivity of the PVC insulation of all the PVC insulated cables shall be 1x1014 ohm-cm at 27 deg C and 1x1011 ohm-cm at 70 deg C.

e. Insulation shield

In XLPE cables, to confine electrical field to the insulation, a non-magnetic semi conducting shield shall be put over the insulation. The insulation shield shall be extruded in the same operation as the conductor shield and the insulation by triple extrusion/process. The XLPE cable insulation shield shall be strippable. Metallic screening for all type of power, control and special cables shall be provided.

f. Inner Sheath

The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of adequate thickness and applied by a continuous process to produce a sheath of consistent quality free from all defects. PVC sheath shall be extruded.

g. Armour

Hard drawn Aluminium wire armouring / galvanized steel tape/ wire armouring shall be used for single core and multi-core cable respectively. The hard drawn aluminium wire for armour shall be of H4 grade, as per IS-8130 (having tensile strength above 150 N/mm) The diameter of the aluminium wire shall be as per the table for the dimensions of the galvanized steel wire armour given in the relevant standard.

h. Serving/ outer sheath

Extruded PVC serving as per IS: 5831 or as specified otherwise shall be applied over the armouring with suitable additives to prevent attach by rodent and termites. All serving must be given anti-termite treatment.

Codes and standards

All cables to be supplied shall conform to the latest revisions of IS or any other international standards acceptable to Owner. Some of the Indian Standards/ IEC considered relevant to the cables are given below:

Sr. No.	Standard	Description
1	IS:1554 (Part-I)	PVC insulated (heavy duty) electric cables for working voltage up to and including 1100 V.
2	IS:1554 (Part-II)	PVC insulated (heavy duty) electric cables for working voltage from 3.3kV up to and including 11kV.
3	IS:3961	Recommended current ratings for cables.
4	IS:8130	Conductors for insulated electric cables and flexible cords.
5	IS:5831	PVC insulation and sheath of electric cables.
6	IS:2982	Copper conductor in insulated cables and cords.
7	IS:3975	Mild steel wires, strips and tapes for armouring cables
8	IS:5609	Specification for low frequency wirers and cables with PVC insulation and PVC Sheath.
9	IS:6380	Spec. of elastomeric insulation of sheath of electric cables.
10	IS:434(I and II)	Specification for rubber insulation cables
11	IEC:540	The methods for insulations and sheaths of electric cables and cords (elastomeric and thermoplastic compounds).
12	IEC:230	Impulse tests on cables and their accessories.
13	IEC:60	High voltage test techniques.
14	IEC:287	Calculations of the continuous current rating of cables (100% load factor).

15	IEC:288	Nominal cross-sectional area and composition of conductor of insulated cables.
16	IEC:502	Extruded solid dielectric insulated power cables for rated voltages from 1.00 kV upto 30 kV.
17	NEMA-WC-5	Thermoplastic insulated wires and cables for transmission and distribution of electrical energy.
18	IEC: 332-1	Test on electric cables under fire conditions.
19	ASTM-D-2843	Standard test method for density of smoke from burning/decomposition of plastics.
20	ASTM-D-2863	Test for determination of Oxygen Index.
21	IEC-754-I	Test method for acid gas generation.
22	IEC-331	Fire resisting characteristics of electric cables.

Constructional requirements

Cable shall have suitable filters laid up with the conductors to provide a substantially circular cross section before the sheath is applied. Fillers shall be suitable for the operating temperature of the cable and compatible with the insulating material. All materials shall be new, unused and of finest quality. Workmanship shall be neat, clean and of highest grade.

a. 415V system power cables - The cable shall be 1.1kV, grade, heavy duty, stranded aluminium conductor, PVC Type-A Insulated galvanized steel wire/strip armoured, flame retardant low smoke (FRLS) extruded PVC type ST1 outer sheathed.

b. Control cables - The cable shall be 1.1kV grade, heavy duty, stranded copper conductor, PVC Type-A insulated, galvanized steel wire / strip armoured, flame retardant low smoke (FRLS) extruded PVC of Type-ST1 outer sheathed.

Identification of cores

The insulated cores of LT power cables shall be identified by color code. The control cables shall have identification by means of printing of numbers of its cores at intervals not more than 75 mm. At least 20% cores shall be kept as spares in the multi-core control cables.

Arrangement of cables

As far as feasible, separate cables shall be provided for circuits of different plant and auxiliaries, for circuits of different voltages, and for circuit used separately. Power, control and instrumentation circuit shall invariably be taken through different routes, which shall not be laid together on the same cable trays.

Drums lengths

Drum lengths of the cables shall be so chosen that straight through joints are eliminated. However, the drum lengths shall not be less than the following lengths:

i) 415 Volt, 1.1kV grade power cables 500 M

ii) 1.1kV grade control and instrumentation cables 1000M

Installation of cables and earthing system

The GI/Al cable trays, and accessories, supports, conduits, cable glands, lugs, ferrules, tags, clamps and other accessories for installation of cables in cable trays, trenches etc. earthing system network/earth mat including interconnections at necessary area of plant shall be provided.

Design and Constructional Features

a. Inter Plant Cabling:

Interplant cabling for main routes shall be laid along overhead trestles /duct banks. However, from tap-offs, same can be through shallow trenches. In case of Duct banks, pull-pits shall be filled with sand and provided with a RCC covering.

Directly buried cables, if essential, shall not have concentration of more than 4 cables in one route.

b. Cable entry: Shall be decided during detail engineering

c. Trenches: PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.

Cable trays, fittings and accessories

a. GI Cable trays shall be ladder/ perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, GI strap, hook etc.) as required. Cable tray shall be ladder type for power and control cables and perforated for instrumentation cables.

b. Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.

c. Cable trays shall have standard width of 80mm, 200 mm, 300 mm and 600 mm and standard lengths of 2.5 metre. Minimum thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be minimum 3 mm.

d. Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of minimum thickness 2 mm and shall be hot dip galvanized as per relevant IS. Troughs shall be standard width of 50 mm and 75 mm with depth of 25 mm.

e. The size of the cable tray (80mm to 600mm width) depends on the size of the cables and routing of the trays. Bidder has to decide based on site visit. The tray loading should not be more than 70% of tray capacity , none of cable will be laid over the cable. The cable cost includes cost of tray and no separate payment will be made for cable tray.

Support system for cable trays

d. Cable tray support system shall be pre-fabricated.

e. Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types:

- Having provision of supporting cable trays on one side and
- Having provision of supporting cable trays on both sides.

In general, the support system shall be as follows :

i. Cable supporting steel work for cable racks / cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hard wares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.

ii. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hard wares fittings and accessories shall be prefabricated factory galvanized.

iii. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanized surface shall be brushed and red lead primer, oil primer and aluminium paint shall be applied.

iv. All steel components, accessories, fittings and hardware shall be hot dip galvanized after completing welding, cutting, drilling and other machining operation.

v. The main support channel and cantilever arms shall be fabricated out of minimum 2.5 thick rolled steel sheet conforming to IS.

vi. Cantilever arms of 300 mm, 600 mm and 750 mm in length are required. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.

Junction boxes

f. Junction Boxes with IP:55 degree of protection, shall comprise of a case with hinged door constructed from cold rolled sheet steel of minimum thickness 2 mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3 mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity, hot dip galvanized as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation

g. Terminal blocks shall be 650 volts grade, rated for 10 Amps and in one piece moulding. It shall be complete with insulating barriers, Clip-on type terminals and identification strips. Marking on terminal strip shall correspond to the terminal numbering on wiring diagrams. It shall be Elmex type CSLT-1 with insulating material of Melamine conforming to ESI Standard 12.1 or equivalent. Terminal block shall be suitable for terminating 2 wires of 2.5mm on both sides arranged to facilitate easy termination

Terminations and straight through joints

1.1 kV grade straight through joints shall be of proven design. A suitable care to be taken during joint and termination.

Cable glands

Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS:6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene and of tested quality. Necessary cable dimensions shall be furnished to the successful Contractor.

Cable lugs/ ferrules

Cable lugs for power cables shall be Aluminium solder less crimping type conforming to IS:8309 suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper conforming to IS:8309. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments.

Cable clamps and straps

The cable clamps required to clamp multi core cables on vertical run shall be made up of Aluminium strip of 25x3 mm size. For clamping the multi core cables, self-locking, de-interlocking type nylon clamps/ straps shall be used. The clamps/ straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment.

Installation

Cable tray and support system installation

a. Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures. All cable trays shall be in vertical configuration in boiler and ESP areas.

b. Horizontally running cable trays shall be clamped by bolting to cantilever

arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/ clamps on both top and bottom side rails at an interval of 2000 mm. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted.

c. The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated in the relevant tray layout drawings

d. All cable way sections shall have identification, designations as per cable way layout drawings and painted/ stencilled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/ stencilled with identification numbers at every floor.

e. In certain cases it may be necessary to site fabricate portions of trays, supports and other non-standard bends where the normal prefabricated trays, supports and accessories may not be suitable. In such cases the Contractor shall fabricate at site suitable sections of trays, supports and accessories to make the installation complete for the specific purpose after obtaining Project Manager's prior approval, which shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.

Conduits/ Pipes/ Ducts installation

f. All openings in the floor/ roof/ wall/ cable tunnel/ cable trenches made for conduit installation shall be sealed and made water proof. GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.

g. Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/ pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/ pipes shall be sealed with Glass-wool/ Cement Mortar/ Putty to prevent entrance of moisture and foreign material.

h. Exposed conduit/ pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits / pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise.

The typical conduit sizes shall be per below table:

Sr. No.	Particular	Description
1	Conduit/ pipe size (dia)	Spacing
2	Up to 40 mm	1.0 m
3	50 mm	2.0 m
4	65-85 mm	2.5 m
5	100	3 m

Junction boxes installation

Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings or as decided by Project Manager and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.

Cable installation

1. Cable installation shall be carried out as per IS:1255 and other applicable

standards. Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For un-reeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.

2. While laying cable, ground rollers shall be used at every 2 metre interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables.

3. Cables shall be laid on cable trays strictly in line with cable schedule furnished.

4. Power and control cables shall be laid on separate tiers. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, 415 V power cables (1.1kV) shall be laid on top most tier and cables of subsequent lower voltage grades/control cables on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two metre. All multi-core cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/ support with self locking type nylon cable straps with de-interlocking facilities. For

horizontal trays arrangements, multi-core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi-core power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be tied to trays/ supports by aluminium strips at every five meter interval and at every bend.

5. Bending radii for cables shall be as per manufacturer's recommendations and IS:1255.

6. Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ PVC pipe.

7. Joints for less than 250 Meters run of cable shall not be permitted.

8. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.

9. The installation work shall be carried out in a neat workman like manner and areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. RCC/ Steel trench covers shall be replaced after the installation work in a particular area is completed or when further work is not likely to be taken up for some time.

10. Separation - At least 300mm clearance shall be provided between :

- HT power and LT power cables,
- LT power and LT control/ instrumentation cables,

11. Segregation

Segregation means physical isolation to prevent fire jumping.

All cables associated with the unit shall be segregated from cables of other units.

Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.

m. Minimum number of spare cores required to be left for interconnection in control cables shall be as follows :

Sr	No. of cores in cable	No. of spare cores
1	2C, 3C	NIL
2	5C	1
3	7C-10C	2
4	14C and above	3

n. Cable fire sealing

Wherever the cables pass through walls/ floors, fire proof cable penetration seals rated for two hours shall be provided. This shall be by suitable block system using individual blocks with suitable framework or by silicon RTV foaming system. In case foaming system is offered, damming board, if used, shall not be considered for fire rating criteria. Any of the system offered shall be of proven type as per BS:476 (Part- 20) or equivalent standard.

o. Directly buried cables

- Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255.

- RCC cable route and RCC joint markers shall be provided wherever required.

The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription “Cable Joint”. The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.

p. Cable tags shall be provided on all cables at each end (just before entering the equipment (enclosure), on both sides of a wall or floor crossing, on each duct/ conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centres, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick Aluminium with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, cable tags made of nylon, cable marking ties of ‘TY-CAB’ or equivalent type with cable number heat stamped on the cable tags may also be provided.

q. While crossing the floors, un-armoured cables shall be protected in conduits up to a height of 500 mm from floor level if not laid in tray.

Cable terminations and connections

12. The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer instructions, drawings etc. Cable jointer shall be qualified to carryout satisfactory cable jointing/ termination.

13. Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeves over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job.

14. The equipment will be generally provided with undrilled gland plates for cables/ conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.

15. Control cable cores entering control panel/ switchgear/ MCCs etc. Shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.

16. The panels where a larger number of cables are to be terminated and cable identification may be difficult, each core ferrule shall include the complete cable number as per the drawings. The ferrules shall be indelible interlocking type and shall fit tightly on cores. Spare cores shall have similarly ferrules with a suffix letter 'S' along with cable numbers and coiled up after end sealing.

17. All cable terminations shall be appropriately tightened to ensure secure and reliable connections.

INSTRUMENTATION CABLES

General Requirements

a. The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope.

b. Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by the Contractor.

c. Other type of cables like co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) also shall be furnished by the Contractor.

d. Contractor shall supply all cable erection and laying hardware like cable trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.

e. In addition to above, Contractor shall supply all the cables including co-axial cables for station Wide LAN interconnecting entire control system in Contractor's scope as well as the control systems which are already in existence.

Instrumentation Cable Specifications

f. All the instrumentation cables i.e. twisted and shielded multi pair cables, compensating cables, pre-fabricated cables etc. shall be flame retardant low smoke (FRLS) type. The Cables shall be supplied in non-returnable drums. The drum length shall be 1000m (+/-5%) up to & including 8 pairs and 500 m (+/- 5%) above 8 pairs.

g. Voltage grade of the instrumentation cables shall be 225V (peak value).

All instrumentation cables covered in this specification shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816,VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and its amendments read along with this specification.

COMMUNICATION CABLES

CAT6 CABLE (CATEGORY 6 PLUS)

1. SCOPE

This specification is based on the specifications of UL 444, ANSI/TIA/EIA-568-B,ISO/IEC 11801, UL 1685(CM) and covers the requirements for Unshielded Twisted Pair (UTP) cables of 100 Ω, Cat6 (U/UTP 6+) for Wideband Technology. Applicable cable size and type: 4 pairs, PVC sheath, CM Grade.

2.1 CONDUCTORS

Each conductor shall be **solid** bare copper wire, circular in cross-section,

uniform in quality and free from defects. The diameter of each conductor shall be AWG 23 (Nom O.D.0.54 +/- 0.005).

2.2 INSULATION

Each conductor shall be insulated with solid high density Polyethylene (HDPE).

It shall be applied uniformly around the conductor with a minimum concentricity of 90%.

The nominal insulation diameter shall be 0.98mm±0.03mm and the specific maximum diameter shall be 1.22mm. If the concentricity of the conductor can be tested on the manufacturing process before completing the product, it could be omitted in the test.

2.1.3 PAIRS

Two insulated conductors, designated "A" and "B" shall be uniformly twisted together to form a pair. The insulation shall be coloured and striped longitudinally, as per Table 1.

The stripe colouring shall not be removable by normal stripping and wiring operations.

2.1.4 CABLE CORE ASSEMBLY

Two insulated conductors shall be twisted into a pair. Four twisted pairs shall be assembled into a cable core. The cross-shaped filler shall be inserted between pairs for sufficient isolations of pairs to improve crosstalk characteristics. Rip cord forms part of the cable construction.

2.1.5 SHEATH

The material shall, as a minimum, meet the requirements of UL 444. The sheath shall be applied over the cable assembly by an extrusion tubing technique, being close fitting, but not adhering to the insulation, and readily removable for installation termination. The sheath shall have a minimum wall thickness of 0.50mm and nominal 0.55mm. The acceptable maximum cable diameter shall be 6.4mm. The sheath colours

are given in Table 2.

2.1.6 SHEATH MARKING

The cable shall be marked on the sheath to designate the transmission performance

and others. The marking shall be printed through the outer sheath clearly.

The specific legend requirements are given in Table 3.

2.2 PHYSICAL PERFORMANCE

2.2.1 SHEATH

The unaged tensile strength and elongation, measured in accordance with clause 7.8 of

UL 444 shall be minimum 13.5MPa and 150%, respectively. The heat-aged tensile strength and elongation, measured in accordance with clause 7.8 of UL 444 shall be minimum 12.5MP and 125%, respectively.

2.2.2 CABLE COLD BEND

All cables shall meet the requirements of clause 7.10 of UL 444. Cold bend (20deg +/- 2deg x 4h): 8 x Cable O.D. , no visible cracks. Page 4 of 5 Document ID: 130520_CAT6PLUS_UTP_Specification_Ver4_Z_Cust

2.2.3 FLAME REQUIREMENT

A cable marked CM shall comply with the vertical-tray flame test specified in

UL 1685 or IEC 60332-3.

2.2.4 CROSS-SHAPED FILLER

Cross-shaped filler (separator) complies with ROHS requirements. O.D. 4.5mm, thickness 0.45mm

11 kV INDOOR TERMINATION KIT

Job includes 0f providing & fixing of heat shrinkable indoor termination kit for 11 kV for incoming and outgoing to 11 KV HT Panels, ring main unit / cubical metering and power transformer with necessary jointing materials etc. complete. The joint should be carried under supervision of certificate holder of cable termination.

11 kV OUTDOOR TERMINATION KIT

Job includes of providing & fixing of heat shrinkable outdoor termination kit for 11 kV for to Supply point and 11 KV HT DP structure incoming with necessary jointing materials etc. complete. The joint should be carried under supervision of certificate holder of cable termination.

CABLE TRENCH

Making the trench in hard murum/ tar road of suitable width and depth for laying provided L.T. Cable of 10 sq mm complete as per detailed specifications.

MAKING TRENCH

Making the trench in hard murum/ tar road of suitable width and depth for laying provided L.T. Cable of 25 sq mm & above covered with half round hume pipe complete .

CABLE TRAY

Providing & erecting Hot dipped galvanized cover suitable for perforated type cable tray manufactured from 18 swg (1.2 mm thick) GI sheet of 200 mm width & 20 mm height complete with necessary hardware in approved manner.

LT Earthing:

The item includes providing suitable plate type earthing to indoor equipments conforming to IS 3043 and as approved by the Electrical Inspector. The earthings stipulated below are minimum requirements. It shall how ever be the responsibility of the contractor to design and provide adequate earthing arrangement without any extra cost. The earthing shall include supplying and erecting galvanized cast iron earth plate size 60 cm x 60 cm x 0.6 cm buried in specially prepared earth pit so as to keep top of earth plate 1.5 m below ground with 40 kg each charcoal and salt with alternative lay-

ers with 19 mm dia GI pipe with funnel with a wire mesh for watering and brick masonry block, cover complete with necessary length of GI wire connected to nearest switch gear, duly tested by earth tester and recording the results. All electrical equipments shall be connected by two distinct earth terminals to the earth plates provided.
The item includes providing and extending earth leads from earth plates to all electrical equipments by using GI strip or 8 SWG GI wire. The weight in schedule B is tentative. Payment shall be made on actually provided weight only.

The earthing arrangement for sub-station switch yard and indoor equipment shall be designed in conformity with the I.E. rules 1956 and IS: 3043 and Rules/ Regulation/ Instructions of statutory authorities, as applicable for the class of work under the contract. The arrangement specifications and quantity/size stipulated hereunder are minimum requirements. It shall however, be the responsibility of the contractor to design and provide the earthing arrangement as stated above without any extra cost. Required excavation for above system by Mechanical Means should be done by concern contractor without any extra cost.

EARTH ELECTRODE AND EARTH PITS

All earth electrodes shall be of Galvanised cast iron earth plate size 60 x 60 x 0.6 cms. with funnel with a wire mesh for watering and brick masonry block C. l. cover complete with all materials, testing & recording the results as per specification No. EA-EP .The electrodes shall not be situated at a distance less than 1.5 m from building fencing structure and equipment foundations. The earth pits shall confirm to the provisions in IS and shall be constructed in M-150 concrete. Required quantity of salt and charcoal shall be provided. Each earth pit shall have funnel arrangement for watering, minimum requirements of each pits/ electrodes are as under.

Earthing for 0.44 KV system

Each earth electrode shall have disconnecting link to disconnect and measure resistance of earth electrode. RCC chamber shall be provided with C.I. cover to each earth pit. RCC chamber's top shall be flushing to metal spreading level in switch yard.
A ring bus shall be formed in a pole yard and transformer yard to which individual earth electrode shall be connected. Earth leads from equipment, structure etc. shall

be connected separately to the ring bus. Both ring buses shall be interconnected with two parallel earth leads at two opposite points on each ring bus.

EARTH LEADS

Minimum size of earth leads for earthing of equipment shall be as under.
The earth leads run on the structure shall be severely bolted or clamped. Neutral earth leads shall run on separate support without touching body of the transformer. The run and arrangement of earth lead shall be neat and in parallel and at right angles formation with reference to general layout of switch yard and equipment. The bend in flat shall be gradual to prevent mechanical damage and 90o multiple bends if required in earth leads shall be located below ground level.
Inter connections of the earth continuity conductor and main/branch earth shall be bolted ensuring reliable, permanent and good electrical connection and further brazed. Earth leads shall be protected against mechanical damage and corrosion particularly at the point of connection.

The earthing shall be generally as specified above and as detailed.

a) Earth electrodes for 11 kV and 415V system shall be 50 mm diameter G.I. and of 3m long.
b) Separate ring bus shall be formed for each system to which individual earth electrode of the system shall be connected. Earth leads from equipment shall be connected separately to the ring bus.
c) Two earth leads from each equipment shall be connected to ring bus independently.
d) A disconnecting link shall be provided at each pit for disconnection and measuring earth electrode resistance.
e) Water tap connection with necessary G.I. pipe & isolating valves(Brass) shall be provided for watering earthing pit. The water connection shall be tapped from rising main with suitable arrangement of isolation.

TESTING

The contractor shall arrange for taking the actual earth tests for all electrodes as per I.E. Rules & relevant BIS code. These tests shall be taken in presence of Engineer-in-

charge & test results shall be submitted in five copies for record. The Tenderer shall submit the details earthing system layout drawing for HT & L.T. earthing system from Competent Authority before starting / Execute the above work.

EARTHING STRIP

All electrical equipment shall be double earthed with suitable size GI earth lead as per IE rule and IS 3043 / 1966. All earth electrodes shall be inter connected by GI strip of suitable size through a common circular ring. The earth resistance should not exceed the limit prescribed in IS / IE rule.

HOT / EOT Crane:

The item includes providing, erecting and commissioning single girder Hand Operated Travelling Crane with chain pulley block, ISI marked and travelling trolley both tested for 50% overload including arrangement for circular travel and cross travel with wheels, hand chain. The item includes providing and fixing square bars of EN 8 material or rails of suitable section.

Electric hoists shall be complete with hoisting motor, wire rope drum, wire rope, hook, necessary gearing, sheaves, electromagnetic brake for hoisting motion, weather & dust-proof push button station, contactor panel, all wiring, limit switches, etc.

Electric hoists shall conform to IS:3938 and shall be suitable for outdoor application. All the parts of the hoist shall be designed to withstand surrounding atmospheric conditions without any deterioration.

Rope drums shall be either cast or welded to sustain concentrated loads resulting from rope pull. Drums shall be machine grooved right and left with grooves of a proper shape for the rope used.

Gears shall be cut from solid cast or forged steel blanks or shall be of stress-relieved welded steel construction or built-up from steel billets and welded together to form a one piece gear section.

Hoist ropes shall be extra flexible, improved plough steel rope with a well lubricated hemp core and having six strands of 37 wires per strand with minimum ultimate tensile strength of 1.6 x 106 KN / Sq.m.

Hooks shall be solid, forged, heat treated alloy or carbon steel of rugged construction of the single hook type and provided with a standard depress type safety latch.

Hoisting motor shall be equipped with electrically released, spring set, friction shoe type brakes having torque capable of holding 125% of the full rated hook load. Brake shall apply when either the motor controller or the main power switch is in „OFF" position or in the event of power failure.

Drive motors shall be designed for frequent reversal, braking and acceleration and shall be as per IS:325. Pendant control switch, controllers and resistors, controls, electrical protective devices, cables and conductors, earthing guards etc. shall be as per IS:3938. Limit switches shall be provided for over-hoisting and over-lowering.

The electric hoists shall be of Class II duty.

25% overload test, speed tests, limit switch tests and brake test shall be conducted for the hoist and trolley at manufacturer"s works.

e) The contractor should designed & provide the E.O.T. of safe working capacity tested to 1.25 times working capacity, electrically operated overhead travelling crane with all equipment's & accessories shall be provided. Functional requirements of the crane are as under.
f) To lift complete weight of the pump or motor from any point, in the pump house. The electrically lift of Hoist crane should be specified. The provision for micro speed should be incorporated.
g) To travel longitudinally along specified entire length of the pump house including, loading bay. Operation shall be electrical.
h) To travel laterally across entire span nominal pump bay span, Operation shall be electrical.
i) DSL arrangement along with circular travel. as per requirement/and Rectangular travel as per requirement.

The Sub-work includes.

Bridge girder mounted on track wheels and end carriages.

Motorized mechanisms (Hoist speed limited to 4 Mt/minutes.)

Hoist suitable for 6 Mt. lifts.

Trolley and hoist.

Push button operated with control cable to operate crane from floor level of pump house.

control gears and switch gears including earthling.

Minimum capacity of crane, ISMB, square bars/rail section are stated above. It shall be the responsibility of the tender to provide higher capacity if the heaviest load of the equipment's to be handled need so, without any extra cost.

The crane shall generally conform to IS : 3177 and IS : 807.

Bridge, Rails and Supporting RSJ's

The bridge girder shall be designed to carry specified load at any position during travel. The wheel of end carriage shall be machined and shall have flanged on both sides. Common shaft extending shall drive the end carriage full span for longitudinal travel, power to end carriage shall be through reduction gearbox.

The rails shall be either square bars, not less than 40 mm x 40 mm or equivalent rail sections. The rails/square bars shall be secured on supporting RCC corbel beam with all required fasteners and end stops to prevent over-travel.

The Rail section shall be secured on the provided M.S. plate on RCC corbel beams.

Traveling Trolley and Hoist.

The travelling shall have single flanged 4 wheels and shall be mounted on bridge. Suitable stops shall be provided to prevent over travel of trolley.

The hoist shall be mounted below travelling trolley. The hoist shall incorporate swivel hook with ball and roller bearing.

Reduction Gear Boxes.

The reduction gear boxes shall be of robust construction and for arduous duty. They shall be fully enclosed with oil level marking for minimum and maximum levels. The bearings shall be ball and roller types and taper roller bearings shall be provided where thrust loads are to be sustained.

Brakes and Clutches.

Automatic Electro-mechanical brake system shall be provided for hoisting motion. The hoisting motion shall have limit switch to stop motion automatically at upper and lower limits. Electro-magnetic clutches or similar safety device shall be provided on all power transmission system to disengage the motors in case of over loading and

obstruction.

Motors.

The electric motors shall be totally enclosed, fan cooled with enclosure conforming to IP 54 or superior. The shall be squirrel cage induction 230 V/415 V.A.C. Supply with class F insulation. The motors shall preferably be foot mounted and shall be designed of S.5 duty per IS :325. For smooth & accurate operation of crane, VFD shall be provided.

Switch Gears, Control Gears Electrical Works.

A panel fabricated from mild steel sheets of 2.0 mm thickness and down shop leads shall be provided to meet the functional requirement of the crane. The essential features shall be as under.

i) Reception and distribution of power for Electric motorized operation.

Control gears for start and stop the motors with reversing operation.

Operation of hoisting motion including reversing motion by means of suspended mobile pendant set for operation from pump floor level for Drainage water pump house.

Limit switches for automatic stop of hoisting motion.

Earthling arrangement.

L.T. cable as required.

Holder and bulb fixture should be provided to trolley, so as to travel with trolley for required rumination at work site.

EOT crane shall have optional alarm arrangement while travelling from one place to another during lifting and lowering of loads.

Material of Construction

Material of constructions for components shall be stipulated below or superior.

Structural steel conforming to IS : 808

End carriage steel to IS : 2061.

Track trolley wheel carbon steel casting to IS : 1030.

Hook steel to IS : 1875/Forged steel.

Testing -The crane shall be tested at manufacturer work in presence of the Third party agency approved by MJP, Municipal Corporation Engineer and Engineer-in -charge or his representative. Site condition shall be simulated for deflection test.

Note :-Span to be confirmed before placing order for crane.

(Capacity & Span As specified in schedule B).

Pressure gauges:

The item includes providing, fixing and connecting diaphragm type pressure gauge of 150 mm dial on each pump delivery and common manifold. The item includes piping connection with required hardware as well.

Pump house Lighting:

The item includes providing Lighting for the entire pump house building, transformers yard, sub-station area as per I.E. rules including 100 watts sodium vapour lamps all round outside, 1200 mm long twin fluorescent tube lamps with industrial type reflectors for pump house including a portable hand lamp and 1200 mm ceiling fan etc. complete as directed by Engineer-In-Charge. The plan of electrification and allied equipments shall be got approved from Engineer-In-Charge prior to execution.

AHILYA NAGAR PUMPING STATION PS-1

Sr. No.	Description	Quantity	Unit
	Internal Electrification (Panel room + pump house)		
1	Supplying & erecting LED 20W tube light fitting (4 feet) with aluminium housing, heat sink, integrated HF electronic driver complete.	6.00	No
2	Pedestal Fan 600 mm sweep oscillating type	2	No
3	Exhaust fan medium duty 230 V A.C. 50c/s 225 mm 1400 RPM	2.00	No
4	Ceiling fan heavy duty 230 V A.C. 1400 mm Sweep	2	No
5	Point Wiring	15	No
6	corridor/passage light fitting (2 feet) including 9W LED lamp	4	No

	External Electrification		
7	Supplying and erecting LED square / circular 16 to 20W downlighter having pressure die-cast aluminium housing, opal translucent cover, mounting arrangement with board for surface type or spring loaded mounting clips for flush type complete.	8	No
8	Street light bracket for erection of Double fitting on tubular welded pole with 40 mm. dia. 1.0 m long "B" grade G. I. pipe along with pole cap of 125 mm dia 600 mm long duly welded as per specification	4	No
9	Supplying and erecting LED street light fitting suitable for above75W - 90W lamp, including lamp, with PF > 0.95 class IP 65 and above housing of pressure die cast aluminium alloy and heat sink extruded aluminium complete per specification No. FGODF/ FLS2.	4	No
10	Steel tubular swaged pole 139.7 x 114.3 x 88.9 mm. dia with 4.5x3.65x3.25 mm thickness (5 + 1.75 + 1.75 m) length respectively and total 8.5 m long with pole cap, base plate in provided foundation.(weight 109 kg.) as per specification	4	No
11	Pipe type earthing with 40 mm. dia. G.l. pipe or 20 mm dia. G.l. Rod complete with all materials as per specification	4	No
12	Cement concrete foundation including excavation for the poles 60 cm x 60 cm x 1.5 m deep in 1:3:6 cement concrete (20 x 25 mm stone metal) and 45 cm x 45 cm x 45 cm /45 cm dia. x 45 cm height plinth duly plastered and with necessary curing and finishing in an approved manner. (for 8.5 to 9 m poles)	4	No

13	Mains with 2 x 2.5 sq.mm F.R.L.S copper PVC insulated wire laid in provided conduit/trunking/inside pole/Bus bars or any other places. as per specification	40	Mtr
14	PVC armoured cable 4 core 10 sq mm aluminium conductor with continuous 5.48 sq mm (12 SWG) G.I. earth wire complete erected with glands & lugs, on wall/ trusses/pole or laid in provided trench/ pipe as per specification	40	Mtr
15	FRP box of size 150mm x 125mm x 100 mm, 2.7 mm thick complete on pole as per specification No. CB-SB	4	No
16	GI Pipe 40 mm dia B class for enclosing PVC Armoured cable on wall or Pole as per specification	15	Mtr
17	Supplying, erecting & marking DPMCB 6 A to 32 A B- series (for lighting) in provided distribution board as per specification no. SWSWR/ MCB	10	Nos

TULJAI NAGAR PUMPING STATION PS-2

Sr. No.	Description	Quantity	Unit
	Internal Electrification (Panel room + pump house)		
1	Supplying & erecting LED 20W tube light fitting (4 feet) with aluminium housing, heat sink, integrated HF electronic driver complete.	6.00	No
2	Pedestal Fan 600 mm sweep oscillating type	2	No
3	Exhaust fan medium duty 230 V A.C. 50c/s 225 mm 1400 RPM	2.00	No
4	Ceiling fan heavy duty 230 V A.C. 1400 mm Sweep	2	No

5	Point Wiring	15	No
6	corridor/passage light fitting (2 feet) including 9W LED lamp	4	No
	External Electrification		
7	Supplying and erecting LED square / circular 16 to 20W downlighter having pressure die-cast aluminium housing, opal translucent cover, mounting arrangement with board for surface type or spring loaded mounting clips for flush type complete.	8	No
8	Street light bracket for erection of Double fitting on tubular welded pole with 40 mm.dia 1.0 m long "B" grade G.I.pipe along with pole cap of 125 mm dia 600 mm long duly welded as per specification	4	No
9	Supplying and erecting LED street light fitting suitable for above75W - 90W lamp, including lamp, with PF > 0.95 class IP 65 and above housing of pressure die cast aluminium alloy and heat sink extruded aluminium complete per specification No. FGODF/ FLS2.	4	No
10	Steel tubular swaged pole 139.7 x 114.3 x 88.9 mm. dia with 4.5x3.65x3.25 mm thickness (5 + 1.75 + 1.75 m) length respectively and total 8.5 m long with pole cap, base plate in provided foundation.(weight 109 kg.) as per specification	4	No
11	Pipe type earthing with 40 mm. dia. G.l. pipe or 20 mm dia. G.l. Rod complete with all materials as per specification	4	No
12	Cement concrete foundation including excavation for the poles 60 cm x 60 cm x 1.5 m deep in 1:3:6 cement concrete (20 x 25 mm stone metal) and 45 cm x 45 cm x	4	No

	45 cm /45 cm dia. x 45 cm height plinth duly plastered and with necessary curing and finishing in an approved manner. (for 8.5 to 9 m poles)		
13	Mains with 2 x 2.5 sq.mm F.R.L.S copper PVC insulated wire laid in provided conduit/trunking/inside pole/Bus bars or any other places. as per specification	40	Mtr
14	PVC armoured cable 4 core 10 sq mm aluminium conductor with continuous 5.48 sq mm (12 SWG) G.I. earth wire complete erected with glands & lugs, on wall/ trusses/pole or laid in provided trench/ pipe as per specification	40	Mtr
15	FRP box of size 150mm x 125mm x 100 mm, 2.7 mm thick complete on pole as per specification No. CB-SB	4	No
16	GI Pipe 40 mm dia B class for enclosing PVC Armoured cable on wall or Pole as per specification	15	Mtr
17	Supplying, erecting & marking DPMCB 6 A to 32 A B- series (for lighting) in provided distribution board as per specification no. SWSWR/ MCB	10	Nos

KUMBHAR MALA PUMPING STATION PS-3

Sr. No.	Description	Quantity	Unit
	Internal Electrification (Panel room + pump house)		
1	Supplying & erecting LED 20W tube light fitting (4 feet) with aluminium housing, heat sink, integrated HF electronic driver complete.	6.00	No
2	Pedastal Fan 600 mm sweep ocillating type	2	No

3	Exacust fan medium duty 230 V A.C. 50c/s 225 mm 1400 RPM	2.00	No
4	Ceiling fan heavy duty 230 V A.C. 1400 mm Sweep	2	No
5	Point Wiring	15	No
6	corridor/passage light fitting (2 feet) including 9W LED lamp	4	No
	External Electrification		
7	Supplying and erecting LED square / circular 16 to 20W downlighter having pressure die-cast aluminium housing, opal translucent cover, mounting arrangement with board for surface type or spring loaded mounting clips for flush type complete.	8	No
8	Street light bracket for erection of Double fitting on tubular welded pole with 40 mm.dia 1.0 m long "B" grade G.I.pipe along with pole cap of 125 mm dia 600 mm long duly welded as per specification	4	No
9	Supplying and erecting LED street light fitting suitable for above75W - 90W lamp, including lamp, with PF > 0.95 class IP 65 and above housing of pressure die cast aluminium alloy and heat sink extruded aluminium complete per specification No. FGODF/ FLS2.	4	No
10	Steel tubular swaged pole 139.7 x 114.3 x 88.9 mm. dia with 4.5x3.65x3.25 mm thickness (5 + 1.75 + 1.75 m) length respectively and total 8.5 m long with pole cap, base plate in provided foundation.(weight 109 kg.) as per specification	4	No
11	Pipe type earthing with 40 mm. dia. G.l. pipe or 20 mm dia. G.l. Rod complete with all materials as per specifi-	4	No

	cation		
12	Cement concrete foundation including excavation for the poles 60 cm x 60 cm x 1.5 m deep in 1:3:6 cement concrete (20 x 25 mm stone metal) and 45 cm x 45 cm x 45 cm /45 cm dia. x 45 cm height plinth duly plastered and with necessary curing and finishing in an approved manner. (for 8.5 to 9 m poles)	4	No
13	Mains with 2 x 2.5 sq.mm F.R.L.S copper PVC insulated wire laid in provided conduit/trunking/inside pole/Bus bars or any other places. as per specification	40	Mtr
14	PVC armoured cable 4 core 10 sq mm aluminium conductor with continuous 5.48 sq mm (12 SWG) G.I. earth wire complete erected with glands & lugs, on wall/ trusses/pole or laid in provided trench/ pipe as per specification	40	Mtr
15	FRP box of size 150mm x 125mm x 100 mm, 2.7 mm thick complete on pole as per specification No. CB-SB	4	No
16	GI Pipe 40 mm dia B class for enclosing PVC Armoured cable on wall or Pole as per specification	15	Mtr
17	Supplying, erecting & marking DPMCB 6 A to 32 A B- series (for lighting) in provided distribution board as per specification no. SWSWR/ MCB	10	Nos

CONCRETE FOUNDATION

The work includes excavation in all types of strata, reinforcement casting of RCC works as required with curing etc. complete. Payment shall be made on the basis of finished concrete work. Excavation disposal of excavated stuff refilling., form work and curing etc. shall not be paid separately and deemed to be included in cost of RCC/PCC work.

The thrust block for foundation NRV/SV using M-200 concrete shall be provided. All

foundations shall be made finished with proper edges and surfaces.

C.C. FOUNDATIONS

a) The support for valves and pipes, platform for valve operation, shall be cast in M-200 concrete. The dimensions and spacing of block shall be submitted for prior approval.

Suitably designed and adequate numbers of concrete supports for pipe work and all sluice valves and non-return valves shall be provided. Minimum design criteria as under shall be adopted.

i) Span shall be such as to restrict deflection within 1/360 of span.

ii) Width of the support shall be equal to pipe diameter (+) 200 mm.

iii) Cradle thickness shall be $^{1}/_{4}^{th}$ of pipe diameter but not less than 300 mm.

iv) Minimum cradle depth shall be $^{1}/_{4}^{th}$ of pipe diameter.

v) Bearing angle shall be 120^{o}

b) The free end of 200 mm dia common delivery line shall be suitably anchored to withstand and relieve pipe work and fasteners from stresses due to thrust.

The thrust block to common manifold free end / bend should be designed and got approved from the Dept. Proper RCC chairs blocks should be provided to common manifold.

c) There should be separate foundation blocks for all valves.

DG Set with AMF Panel:

The item includes providing outdoor DG set at site, carrying out all preparatory works, assembling, installing, making adjustments, confirming all pre-commissioning require-ments as per manufacturer"s instructions, commissioning, final testing, putting in to operation and handing over of the complete system including inspection of Electrical Inspector. The work includes necessary minor civil works such as opening on wall/ slab/ floor and making good as it was and comprehensive maintenance of the DG set for 1 year from date of commissioning.

The engine shall be of standard design of original manufacturer. It shall be totally enclosed air cooled diesel engine with 4 stroke multi cylinder developing suitable power at the load terminals of alternator at 1500 rpm at armature temperature of 400 C. The engine shall be capable of delivering specified power at variable loads for power factor of 0.8 lagging with 10% overload available in excess of specified output for 1 hour in every 12 hours. The average load factor of the engine over a period of 24 hours shall be 0.85 for power output. The engine shall conform to IS 10000.

Sr. N.	Name of Pumping Station	Capacity of DG set
1	**Ahilya nagar PS-1**	**40 KVA**
2	**Tuljai nagar PS-2**	**160 KVA**
3	**Kumbhar mala PS-3**	**320 KVA**

For Kumbhar mala pumping station, DG set requirement will be confirmed after availability of STP DG set. If DG set of STP found suitable for operation of Kumbhar mala pumping station, then the provision will be cancelled.

The engine shall be fitted with following accessories,

1) Dynamically balanced fly wheel.
2) Flexible coupling and guard for alternator and engine.
3) Lubricating oil cooler.
4) Air cleaner.
5) Lubricating oil pressure gauge.
6) Lubricating oil filter with replaceable element.
7) Dry exhaust manifold with silencer and vertical hot air duct of required length.
8) 24 V electric starting equipment complete with standard batteries, dynamo, cutout, ammeter, self-starter etc.
9) Mechanical governor of class A2.
10) Radiator.
11) Daily fuel tank of required capacity.

Engine control panel shall be fitted with following accessories/ indicators,

Start/ stop key switch

Lube oil pressure indication

Water temperature indication
RPM indicator
Engine hours indication
Battery charging indication
Low lube oil trip indication
Over speed indication

a) Alternator along with its excitation system auxiliaries, circuits, control panel, metering and protection circuits.

b) Diesel engine along with its accessories and starting system.

c) Flexible / semi flexible couplings.

d) Common heavy-duty channel for base frame supported by anti-vibration damper at bottom.

e) Cooling arrangements etc.

f) Exhaust piping with heavy-duty residential type silencer, insulation of exhaust piping and etc height of piping as per pollution control regulation.

g) Starting lead Acid batteries with battery charger having trickle and boost charging arrangements complete with Ammeter with switch and voltmeter with fuse and switch to read battery voltage, starting motor, fuel oil, service tank, fuel oil piping etc.

h) All control and power wiring between D.G. set, control panel batteries, safety controls, pumps and AMF panel etc.

i) First fill of fuel oil, lubricating oil; etc including cleaning and flushing out of the system after the test at manufacture facility.

j) Fuel and oil for testing, trials runs and up to commissioning

k) Obtaining all licenses, approval from local authorities including but not limited

to any or all of the following:

1) Electric Supply Utility.

2) Electrical Inspector of Govt. of Maharashtra.

3) Pollution Control Board.

4) Fire Department of the local Fire Brigade.

5) Traffic Advisory Committee.

6) Municipal Corporation.

All requirement offered shall be provide design and reliable in operation. Diesel Generator set capacity specified is at site condition.

The Tenderer shall specify in detail all equipment offered including auxiliaries, associated piping, cabling based on typical layout.

DG set with individual Auto Transfer starting facilities is required to provide electric power to the essential loads in the events of failure of normal power supply or when normal supply is switched off under abnormal conditions like fire. When normal power fails or is tripped manually, the D.G. set should start automatically and restore electrical supply for essential loads. It should have provision to start all the equipments one by one so as to reduce higher starting current. The DG set shall also run continuously to supply power to the loads till restoration of normal power supply.

The starting time of the DG set should be as less as possible, but not exceeding 15 sec. to come on load. In case the first starting operation is not successful, two more attempts with preset time intervals should be attempts; the particular set should be locked out. When an engine speeds up and alternator develops desired voltage in frequency, generator circuit breakers will be switched on.

Both the engine and Generator shall be rated for continuous duty at full load and have an overload capacity of 10% for an hour in 12 hours operation. The excitation system

shall be designed to maintain the rated voltage constant even if a load of 150% of rated load is imposed on to the Generator for duration of 15 secs. Tenderer shall indicate power consumed by auxiliaries along with the Tender document.

The diesel engine shall be indoors type, multi cylinder, totally enclosed, continuous duty, direct fuel injection, series Turbo charged compression ignition, complete with its self-contained lubricating system. The lube oil system shall be provided with Engine Driven Lube Oil Pump only.

The Contractor shall carry out the installation of the DG sets including but not limited to the following:

a) Installation of the DG Set, testing, commissioning, alignment, mounting along with AVM pads on ready floor, foundation to be made by the Contractor and the cost shall be included in the rate for supply and installation of the D.G. set.

b) Installation of fuel oil system complete with day tank and Lube oil system with necessary piping, valves, fittings, supports, etc.

c) Installation of air intake system, exhaust gas system complete with residential type silencer, expansion bellows, etc. and necessary piping, valve, fitting. Supports etc.

d) Installation of Auto Transfer Switch and any other electrical panel.

e) The Contractor to supply and install the required 8" dia MS exhaust pipe upto the required height (as stipulated by Pollution Control Board Authorities) above the building in which the D.G. set are housed. The scope also includes providing insulation.

f) Installation and charging of battery along with leads, battery stand, etc.

The fuel used for the DG set shall be High-speed diesel (HSD) only. The day tank shall be filled manually by operating Hand pump. In order to transfer fuel from day tank to engine has to be done through fuel transfer pump which should be engine driven only. The fuel oil day tank shall be provided with gauge glass, filling, drainage and vent

connections with valves. The contractor has to arrange oil, fuel & consumables for the operation of DG set during testing period with his own cost.

Radiator shall be offered by the Contractor to cool the water received from the engine or any other coolingsystem as specified by Engineer-in-charge.

Manual Electrical starting arrangements of the engine in case of power failure shall be provided. The system will consist of DC starter motor mounted on turning gear will receive power from the set of 24V DC Batteries.

The generator shall also conform to 15 4722 or equivalent.

Tests

1. Equipment shall be tested to conform to the appropriate standard and the following tests shall beconducted in the presence of purchasers.

2. Functional tests, continuity tests and high voltage test on control panel to establish theperformance called for in the specification.

3. Power frequency voltage test on switchgear and mechanical / electrical operation check.

4. Routine test for alternator as per IS 4722.

5. Over speed test (1.2 times the rated speed for 2 minutes)

6. Transient response tests for sudden application and rejection of loads of 25°/0/ 50%, 75%, and100% of rated capacity.

7. Wave from test (type test result are acceptable).

8. Please sequence test.

9. Vibration test.

10. Noise level test

11. Dimensional and alignment.

Samples:

Contractor shall be required to obtain the Employer approval for samples of items such as lighting fixtures of each type, ceiling fans, switch socket outlets of each type and rating, light/fan control switch of each type and rating, push buttons, conduits of various sizes, junction boxes, cable trays, wires and earthing conductor to be used for lighting system etc. before commencement of installation work.

DRAWINGS:

Following minimum data / information shall be made available on contractors drawing:
a). Single line diagrams for AC and DC system.

i). All equipment with rating. ii). Cable details for all circuits.

iii). Details of relays and major components related associated with each circuit. iv). Bus bar details makes of equipment/ components.

v). Relevant reference drawings.

b). General arrangement drawings (equipment, cabling, earthing, lighting, lightning protection etc.).

i). Dimensional layout drawing composite layout of these items.

ii). Plans and sections as required to show access space/ clearances etc.

iii). Civil foundation details, details of cutouts, openings, supporting/ mounting details etc. iv). Bill of material, identification of components / rooms / area etc.

The battery charger shall be trickle and boost type suitable to charge required number of batteries at 12 V complete with transformer, rectifier, charge rate selector switch, indicating ammeter, voltmeter and battery over charging protection with audible alarm.

Battery capacity shall be 180 AH with copper cable of 70 sq. mm size. Alternator shall be 415 V, 1500 rpm, 3 phases, 50 Hz with 0.8 lagging power factor at 400 C armature temperature, brushless type, self-regulated. Engine and alternator shall be coupled by means of flexible coupling as per manufacturer"s design and both units shall be mounted a common base plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations.

The Automatic Mains Failure panel shall consist of power module, control and metering module, protection module etc as specified under PWD specifications.

Testing:

DG set shall be tested in the presence of Engineer-In-Charge or his authorized representative for following before dispatch,

Full load trial for 12 hours

10% overload trial for 1 hour within 12 hour test.

Certificates:

Manufacturer"s test certificates for engine, alternator, and of the set.

Certificate for the engine model so selected along with compliance of noise and emission norms as per latest CPCB guidelines.

Permission from the Electrical Inspector.

APFC PANEL:

The contractor shall design, supply, erect, commission & give satisfactory test & trial of Automatic power factor correction panel. The panel shall be designed in such a way that the system P.F. shall be improved to 0.99 or above. But in any case the system P.F. should not be on leading side. The tentative technical details of the equipment is given below. But it is the responsibility of the contractor to provide necessary accessories for proper functioning of the equipment. The P.F. shall be improved by min.4 step CONTACTOR SWITCHED APFC PANEL. MPP / APP type capacitor units with detuned aluminium filter 7% reactors with circuit breaker as main incomer and MCCB

for each branch protection. Each bank shall be of suitable KVAR . Two banks of suitable KVAR shall be kept spare.

The APFC panel board shall be completely factory wired ready for connecting the equipment. All internal wiring of the panel is to be carried out by PVC insulated PVC sheathed copper cable of adequate capacity. Incoming and outgoing cable entries shall be enclosed in metal clad dust and vermin proof enclosure and suitable size cable glands shall be provided for cable entries from bottom. The drawing of the panel shall be got approved before actual manufacturing and the panel board shall be tested at manufacturers work in presence of departments representatives. The rating of APFC panel will be as per Schedule-B of each pumping station.

FACTORY INSPECTION AND TEST.

The APFC Panel shall be inspected and tested by third party agency approved by M.J.P. in presence of Superintending Engineer (Mech.) or his representative.

11 KV H.T. METERING CUBICAL:

The work comprises of providing, installing, testing, commissioning 11 KV HT metering cubical (compact type) approved by MSEDCL/licensee fabricated with 2 mm (14 SWG) M.S. sheets with supporting angle and channel, painted with powder coating / epoxy paint of required shade copper bus bar size 25 x 6 mm electronic security lock and heavy duty mechanical lock, with counter meter for measuring no of times the opening of doors, top side cover (CT, PT cover) interlock with meter doors, epoxy coated 3 nos CT having required ratio between 5/5A to 50/5A, VA10,Class0.5S, 11000/V3/110/V3 VA 50, class 0.5 epoxy terminal block suitable for provided trivector meter, and provision for incoming and outgoing cables etc. complete duly tested by licensee with necessary test certificates and erected on provided plinth/ cc foundation.

Ultrasonic Insertion Fixed type flow meter:

Ultrasonic Insertion Fixed type flow meter working on conditions & specifications, calibration, inspection, testing, training, guarantee and manufacturers test certificate/ declaration copy along with accessories as mentioned below & with inbuilt assembly to fix the insertion type transducer on the pipeline.

Mandatory Accessories:

1) Integrated signal converter transmitter enclosed in die cast aluminum case / any anticorrosive material confirming to IP-68 - 1 No.

2) Pair of transducers (Sensors) confirming to IP-68 with junction boxes - 1 No.

3)Stainless steel straps for mounting clamp on type sensors - 2 Nos.

4) Grease count plant, 100 ml : Bottle - 5 Nos.

5) Signal & power cables for each transducer -50 Mtrs. length/each (insertion type flow meter) & 10 mtrs. length /each (portable type flow meter)

6) a) for fixed type flow meter-UPS working on 230 V AC, 50 Hz power supply suitable for 12 hrs continuous operation.-1 No. (only required for category C)

b) Built in portable type battery backup for minimum 5 Hrs continuous operation with spare battery and separate battery charger working on 230 V AC, 50 Hz power supply for charging battery- 1 No. (only required for category A)

c) Aluminium / anticorrosive carrying case for flow meter and all accessories (only required for category C-1)

7)Data storage capacity with built in or separate for date, time, actual flow rate, totaliser & error messages if any with storage capacity of 120 days and at 5 minutes interval data logging along with local indication and necessary cables and software to download data to laptop -1 No

8) Proper earthing shall be provided for protection against high voltage surge (only required for category B,C)

9) Suitable over voltage protection unit for protection of instrument from higher voltage (upto 275 V-300 V AC)

10) M.S. sensor protection boxes with suitable size for above ground lines where construction of chamber is not possible. (only required for category C-2)

11) Magnetic clamp for metallic pipe lines and Nylon / SS strips, chain arrangement for clamp on sensors suitable for pipe diameters 50 mm to 3000 mm (only required for category C-1)

12) Battery powered ultrasonic thickness gauge along with charger, test sample, coupling agent and carrying case suitable measuring thickness of 1 mm to 100 mm (only required for category C)

13) 5 meter steel measurement tape with level bottle.

14) Communication facility through GSM(without sim card (for category C)

15) Guarantee period shall be 36 months.

Mechanical & Manual Screen:

The screen with openings generally of uniform size to remove suspended or floating matters in sewage to be provided. The velocity to be maintained so as to avoid settling of grit or organic matter. This includes supply, erection, testing and commissioning of 1 No. Mechanical (Working) & 1 no manual (Standby) bar screens. This shall be provided in the screen chambers after the Stilling Chamber.

Coarse screens are to be provided up stream of Wet well for removal of floating and oversized material coming with the sewage. The coarse screens should be capable to screen out most of the medium & large floating and

oversized material such as plastic rags, debris, weeds, paper, cloth, rags etc. which could clog the waste water pump impellers. The coarse screen shall be inclined bar screen (Single or multi rake). It should be of sturdy design to take care of all sorts of materials envisaged in the gravity sewer. The screenings shall be dropped in bin above the top of the screen channel. The screening material as collected will drop into a wheelbarrows for its disposal.

S. N.	Name of Pumping Station	Mechanical Screen size	Manual Screen size
1	**Ahilya nagar PS-1**	**700 x 6730 mm**	**700 x 950 mm**
2	**Tuljai nagar PS-2**	**1200 x 5430 mm**	**1200 x 1250 mm**
3	**Kumbhar mala PS-3**	**1750 x 7950 mm**	**1750 x 1700 mm**

Suction cum jetting machine:

This work includes providing, erecting, testing & commissioning Jetting machine for cleaning of underground drain lines as well as Suction i.e. sucking of sludge from the chambers with tank capacity 8000 liters. Choked drainage/sewer lines ranging from 50mm dia. to 900mm dia. or more should be cleaned effectively & efficiently by high-pressure jetting operation. Whereas sludge with high solid contents / silts settled in the manhole / septic tank should be sucked from a depth of approx. 08 meters by operating Suction operation.

Automation:

Designing, Supplying, Installing, Testing & Commissioning of Automation & Web based monitoring system

This work includes complete designing, supplying, installing, testing & commissioning of SCADA at all pumping stations, to monitor the operation of sewage pumping machinery as per the levels in the sump, flow monitoring of STP and Sewage Pumping Stations, level, pressure, energy & transmitting the data of various parameters to the Centralised Historian Server, Secondary Computer station, &to be displayed on the LCD monitor in Control room & can be viewed & monitored on any server through Web monitoring system. It is responsibility of the contractor to design the PLC's & development of SCADA software & getting all data on the computer installed in the office of the Engineer in charge in Municipal Corporation. If any changes & modification required as per site condition which is not mentioned in the specifications, then the same shall have to be carried out by the Contractor with no extra cost. The work also includes development of Web Based Monitoring System (EMS) to view & control various parameters such as flow, level, pressure, energy of all pumping stations & providing GPRS system to collect this data from the pumping stations & send itto Web based software for day to day control, GPRS to collect the energy Meter data and Alarms and alerts for power fail, Voltage Imbalance, Current Imbalance and Power factor imbalance for supply quality monitoring and early detection of faults. The Web based software shall be for easy access of data without any pre-installed desktop software. The proposed EMS system should be hosted at a Central Data Centre and the system must be web based. The EMS application software should be accessible through a web browser via Internet. There should not be any requirement of client license on the User workstation. In addition to this, the automation system shall have provision for operation of valve through PLC compatible actuator panel suitable for operation of all Valve actuators with capabilities of manual, electric and PLC operations and electronic feedback for ON/OFF/ status/ Trip of actuators etc.

The entire SCADA/ Atomized operation system should be self-sufficient to control Valve Actuator & pump operations etc. automatically. The system should be robust and tamper proof and should maintain and built data base of all inflows and outflows at every lifting and delivery points.

The Contractor has to submit all drawing, details as required in Automation work for approval from the Competent authority before procurement of material & start of work.

The details of item wise specifications and requirements are as follows.

Ultrasonic Level transmitter:-

The Ultrasonic Level transmitter shall be with specifications as under & shall be installed at all pumping stations to know the level in the sump for continues monitoring & control through PLC's & SCADA & Web monitoring & Control system. The ULT shall be capable to work for depths up to15 m.

i) Ultrasonic Level transmitter Transmitter	
Type	Ultrasonic
Principle	Pulse Time of flight
Output	4-20 mA HART/Profibus
Housing	Aluminum
Electromagnetic compatibility	Interference emission to EN 61326; Equipment class B Interference immunity to EN 61326; Appendix A industrial)
Ingress Protection	IP68/NEMA6P
Accuracy	+/- 2 mm or 4 mm depending on selection or 0.2% of set measuring distance whichever is greater.
Area Classification	Non-Hazardous

Temperature range	-40°C ... +80°C
Display	4 line LCD display. Menu guided operation.
	Display of Envelope curve.
Configuration	Using Keypad on display
ii) Sensor	
Level Range Temperature range	Liquids 0 to 5m and 0 -10m depending on Tank size -40°C ... +80°C
Max Pressure	3 bar abs
Materials	Sensor: PVDF Seal: EPDM
Process connection	Threaded or universal flange dependent on model selection
Degree of protection	IP68/NEMA6P

Pressure transmitter:

Pressure measuring systems shall consist of a combined pressure transducer, transmitter digital indicator and connecting pipe work and valves. Pressure measuring system shall be rigid in construction. They shall be designed for operation over 130% of full range. And be capable of withstanding surge pressures likely to occur in the monitored system. Pressure transmitters shall be suitable for field mounting. The pressure transmitter shall have two wire system and shall provide a 4-20 mA DC output proportional to pressure.

Function	Transmit & indicate
Mounting	In Line
Process Connection	½ " NPT

Service	Raw water/ Clear water
Damping	Adjustable
Turn on time	<1 sec. with minimum damping
Pressure Range	0-12 KG/CM2
Enclosure Class	Weather proof (NEMA 4X and IP 65)
Accuracy	+ 0.1%
Turn down ratio	10:1
Response time	250 m Sec or less
Operating Temp.	0 to 55 oC
Humidity	Up to 100 % Rh, Non condensing
Transmitter	
Type	Microprocessor based or similar
Power supply	10.5 to 42 V DC (Nominal 24 VDC)
Out put	4-20 mA DC
Communication protocol	Analog
Span and zero adjustment	Provided
Integral Indicator	5 digit numeric LCD display
Element	
Sensor	Standard
Load resistance	Max 600 Ohm.
Zero Elevation/ Suppression	Provided
Diaphragm Material	316 L SS

Process Connection Material	316 L SS
Sensor Housing	Mfg. standard
Electronic Housing Material	Mfg. standard
Mounting Bracket	Carbon Steel

Multifunction Meter for pumps:-

Job includes of designing, supplying, Installing, commissioning & testing of Multifunction meter interfacing to PLC Panel with RS-485 output, as per IEC 62053 and in the prescribed format and shall be configured with main SCADA for report generation for following parameters.

1. 1.1 Line/phase Voltage
2. Line/phase Current
3. Power Factor
4. kWh
5. Frequency
6. kVA

Multifunction meter capture detailed electrical parameters available for power analysis

It shall be measure of Voltage ,Current, Power factor, Frequency, Demand ,consumption data for each phase minimum 1 record per minute

Active , Reactive ,Apparent power measurements.

Accuracy shall be certified for class 0.5 S, and shall meet class 0.2 S

Energy consumption(KWH/ KVAH/KVARH lead/ KVARH lag)

Power factor for each phase and Total power factor. It should be measure all electrical parameters.(Voltage, Current, Power factor)

Software:-

The application software should be controllable through a web browser via internet.

This centrallised application to provide access to users/ Managers to browse

through the history report s and current dashboards for the efficiency of the pumps. Web based software solution providers proposed solution should based on industry standards.

The software shall be purely web based and does not need any client installation.

The system should be very reliable data collection mechanism from the field and is scalable to report large number of meters on the field.

The system should be equipped with rugged field device interface data collection server.

Reporting:-

Export report facility, Select individually sensor /equipment for remote monitoring, On line display of graphically charts for various process parameters, Define group of equipment /sensors/Meters to get more details report & to compare. Define reports on the basis of quality of power supply like voltage imbalance, Current imbalance, Voltage fluctuation etc., System should generate reports for all measured parameters.

Special of reports suggested by MJP for detailed analysis:

KWH/ML report

Voltage imbalance report

Current imbalance report

KWH/ totallised flow

KWH/efficiency report

KWH/Running hours report

Dash board for analysis whole day data on single screen

It should have pump status ON/OFF

Running hours report with chart & graphs

Current flow rate with chart & graphs

Totalised flow rate with charts & graphs

Minimum & maximum voltage on the same day.

Minimum & maximum current on the same day.

Minimum & maximum power factor on the same day.

Minimum & maximum KVA on the same day

Minimum & maximum KWH on the same day.

Alerts/Alarams:-

Disconnection intimation generated by server when device get disconnected from server.

Alerts should be generate for Low Voltage/current/ frequency/KWH/Active power

High Voltage/current/ frequency/KWH/Active power

Low low Voltage/current/ frequency/KWH/Active power

High High Voltage/current/ frequency/KWH/Active power

Energy monitoring system interfacing to PLC panel for pumps:-Power Analyser-

Job includes of designing, supplying, Installing, commissioning & testing of energy monitoring system interfacing to PLC panel. It shall be developed in the line with the dept. & in the prescribed format and shall be configured with main SCADA for report generation of various parameters & operating on supply Voltage: 24V DC, Output:4-20mA

a Technical Specification :

Controller: Micro-controller based system with 32bit ARM CPU, 180MHz or more

Memory: Minimum 128MB FLASH & 32MB SDRAM

Display: Minimum 128×64 pixel LCD, LED back-light

Input: More than 16 Keys keypad or Touch screen

Power supply: 220-440V 50Hz AC Three Phase

The system shall communicate 24x7 with Web based software and continuously send data at least 50MB or more per month.

It shall also have sufficient buffer memory for 72hrs in case the remote connection with the server could not be established.

Local wireless communication: WiFi / Bluetooth / Zig bee for local wireless communication between multiple controllers in plant.

In case Remote web communication is lost by one of the controllers, it shall be capable of sending data via other controllers by using local wireless network
Inbuilt Real time Clock (RTC)with battery backup

Additional 8 hrs Li On /Li Polymer battery backup for complete controller in case of power failure.

System shall be capable of expanding and incorporating additional modules for lan tautomation

Working Environment-

Operating Temperature: 0℃ ~ 50℃; Humidity: 10% ~ 90% (non-condense)

Storage Environment

Temperature: -20℃ ~ 60℃; Humidity: 5% ~ 95% (non-condense)

Unit weight not more than 15 KG

Unit size not more than 400 X 400 X 210 mm

b Electrical measurements :

Capture detailed electrical parameters available for power analysis

Detailed measurement of Voltage, Current, Power Factor, Frequency, Demand, Consumption data for each phase minimum 1 record per 5 /10/15 minute

Active, Reactive, Apparent power measurements

Total harmonic Distortion, Total Demand Distortion measurements

Harmonics up to 63rd

Accuracy shall be certified for Class 0.5S , and shall meet Class 0.2S

Energy Consumption (KWh /KVAh /KVARh Lead /KVARh Lag)

Power Factor for each phase and Total Power factor

It should measure all electrical parameters parameters.(Voltage ,current, power factor)

c Controlling :-

Relay card for controlling up to five pumps

Detailed measurement of Voltage, Current, Power Factor, Frequency, Demand, Consumption data for each phase minimum 1 record per 5 /10/15 minute

d Sensor Integration :

Level Sensor data acquisition

Acquire data as per site requirements

Directly capture Level values from existing level sensors

All data of Level should be displayed in form of graphs & charts

Additional sensor data acquisition

Capture data from additional sensors like

- o Flow
- o Temperature
- o Pressure
- o Water level

Directly capture values from existing sensors

All data of sensor should be displayed in form of graphs & charts

e Remote communication

GSM/GPRS/3G for remote web communication as per Indian telecom standards

In case of GSM/GPRS/3G failure, the device should send data through SMS every 15 minutes

Two way communication shall be established between Controller and Web based Software via GSM/GPRS/3G as well as SMS

It must scalable for future Integration and up gradations

Adding new sensor , digital input or digital output in system remotely for future Integration and up gradations

Web based software shall provide option to reset the firmware/software of any controller remotely to handle network and data issues both via GSM/GPRS/3G and SMS.

f Local communication-

Need-In case GSM/GPRS/3G as well as SMS connectivity fails in any controller, there shall be provision where the controller can communicate with other controllers via additional wireless connectivity and send its data to the software. Additional WiFi or Zig bee wireless communication modules required for communication between multiple controllers inside the plant. Wi-Fi can be use for local wireless communication between multiple controllers in plants well as communication with server.

g Security features :-

Only authorized person shall be able to make changes to the settings in the

controller. The system shall identify the authorized person using Smart card and allow access to settings System shall generate mobile alerts for any attempt to make changes by an un-authorized person Control panel shall have security lock. Backup of all the settings in an controller shall be also stored on the web based software. In case any controller is replaced , it shall have option to automatically download all settings as saved for the earlier controller at this site.

h Signal cable with impedance matching:-

Designing, Supplying, Installing, commissioning & testing with Terminating & Interfacing 9 core 0.5 sq.mm. copper armoured conductor as per IS 694 on wall in GI tray or in ground. with suitable cores having matching impedance.

PLC Panel :

Job consists of designing, Supplying, Installing, commissioning & testing of PLC Panel. Including PLC with CPU & Power supply unit, power supply cables interfacing cards, interfacing cables, wireless modules with 25% extra quantity of all accessories.

PLC based control monitoring & communication panel:

i) PLC Control panel for Instrument Control Panel (ICP)

a. General

The exterior corners and edges shall be rounded to give a smooth overall appearance with projections kept to a minimum. Lifting lugs shall be provided for installation purposes and shall be replaced with corrosion resistant bolts after installation. ICP shall be completely metal enclosed and shall be dust, moisture and vermin proof. Control Panels and instrument enclosures shall give a degree of protection as follows :

b. Indoor Installation

Non-air-conditioned areas : IP 52

Air-conditioned areas : IP 44

Outdoor Installation : IP 65

The panels shall provide separate areas for the control circuits, internal power distribution, instrumentation, field cabling termination and for surge

protection devices (SPDs).

Mounting

All equipment on front of panel shall be mounted flush or semi-flush. In case of semi-flush mounting, only flange or bezel shall be visible from the front. Equipment shall be mounted

such that removal and replacement can be accomplished individually without interruption of service to adjacent equipment. Equipment mounted inside the panel shall be so located that terminals and adjacent devices are readily accessible without the use of special tools. Terminal markings shall be clearly visible.

Cut-outs and wiring for free issue items, if any, shall be according to corresponding equipment manufacturer's drawing. Cut-outs, if any, provided for future mounting of equipment shall be properly blanked-off. Wherever required, panels shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment on the front.

PLC / Controller :

The Controller shall be situated in a suitable panel.

PC For Operation, Engineering, Maintenance etc. Each workstation can be dedicated to a single function, or functions can be combined as required		
Network engineering and control strategy configuration tool		
Scalable SCADA program		
Asset management tool (FDT) for PROFIBUS/transparent and HART devices		
Continuous via Function blocks, independent of Field Controller		Discrete
Hybrid (IEC 61131)	Ladder Diagram	
Bus type	Ethernet	
Media types	SSTP CAT 5	
Data transmission speed	100/10 Mbps	

Max. Length	100 m for CAT 6 cable
Communication load	Typically less than 70%
Supported protocols	FF HSE, Modbus TCP (All Ethernet TCP/IP protocols)
Type	OPC client-server,
Number of servers	One server independent of number of controllers and protocol
Interface	HSE, transparent, Profibus, Foundation Fieldbus, Modbus, Analog, Discrete, Pulse, Temperature
Bridges	Ethernet/FF 1
	Ethernet/PROFIBUS DP
Gateways	Ethernet/PROFIBUS DP
I/O Rack	Max. 14 I/O racks when using local I/O, Each Rack to hold at least 4 modules
I/O Points	Max. 256 I/O points per Field Controller
Foundation	Foundation Fieldbus H1
	PROFIBUS P/PA
	Temperature, analog, discrete, pulse and other signals via local or Remote I/O
	MODBUS as slave or master via Modbus TC Por RS232C/485
No. of inputs	16
ON state level (True logic)	18 – 30 VDC
OFF state level (False logic)	0 – 5 VDC
Typical impedance	3900 Ω
Input current per point	typically 7.5 mA per point
Switching time (electrical)	Time from "0" to "1: 30 µs
	Time from "1" to "0: 50 µs
No. of Inputs	8
Measuring range	0-20 mA, 4-20 mA, 0-5 V, 1-5 V,0-10 V, ± 10 V
Typical Impedance	1000 Ω for voltage input,

	250 Ω for current input	
A/D conversion	Conversion time: 20 ms	
	Resolution: 16 bits	
Accuracy at 25 °C	For Range : 0-5 V, 1-5 V, 0-10 V,0-20 mA, 4-20 mA	
	± 0.12% of span (Linearity/Interference)	
	For Range: ±10 V	
	± 0.2% of span (Linearity/Interference)	
Ambient temperature effect	For Range : 0-5 V, 1-5 V, 0-10 V,0-20 mA, 4-20 mA	
	± 0.2% of span / 25° C	
	For Range: ±10 V	
	± 0.1% of span / 25° C	
No. of inputs	16	
Output voltage range	0 - 30 VAC; 0 - 30 VDC	
Max. current per output	30 VAC:	5 A (resistive);
		2 A (inductive)
	30 VDC:	5 A (resistive);
		2 A (inductive)
Initial contact resistance	Max. 100 mΩ	
Switching time (electrical)	Activation: max. 10 ms	
	De-activation: max. 10 ms	
No. of Inputs	4	
Output range	Current: 4 - 20 mA, 0 - 20 mA, 0 - 20 mA	
	Voltage (OFF): 1 - 5 V, 0 - 5 V, -5 - +5 V	
	Voltage (ON): 2 - 10 V, 0 - 10 V, -10 - +10 V	
Load impedance	5 V: 2 kΩ minimum	
	10 V: 5 kΩ minimum	
	20 mA: 750 Ω maximum	
A/D conversion	Conversion speed: 8 ms	
	Resolution: 12 bits	
Accuracy	± 0.5% of span	
Modules with failure circuit with LED and relay output		
Back-up LAS in field devices for FF		
Field control (loop integrity) for FF devices		
All modules are suitable for industrial use and conform with the following		

standard :	
EN 61326: 1997/A1: 1998	
Interference emission:	Class A apparatus
Interference immunity:	as per Annex A, industrial environment

FOR EACH PUMPING STATION :-

Sr. No.	Description	Qty	unit
1	**Item No 1:- Ultrasonic level transmitter**		
	Ultrasonic Raddar type level transmitter CE marked with following technical parameters at Raw Water Pump House and Interfacing with PLC panel including mounting Output-4-20 mA Power supply - 24V DC ext. Display - 4" LED Range- 0 to …….. mtrs Accuracy - +/- 0.25% of Full Scale or better Enclosure- IP 67 Mounting - On PLC panel	1.00	No
2	**Item No. 2 :- Pressure Transmitter**		
	pressure transmitter CE mark with following technical parameters at Raw Water Pump House and Interfacing with PLC panel. Medium- Water Pressure - 0-20 kg/cm2 Output 4-20 mA Power supply - 24V DC ext. Display - Large LCD Accuracy - +/- 0.5 % of full scale or better Temp.- suitable for Ambient .temp. Enclosure- IP 65	6.00	No

	Mounting - In Line		
3	**Item No 3 - Power Analyser**	5.00	No
	Power Analyser interfacing to PLC Panel with modbus communication port , as per IEC 62053 and in the prescribed format including mounting arrangement.		
4	**Item No 4 - PLC Panel suitable for Wireless communication**	1.00	No
	Panel control, monitoring and communication system along with PLC Panel at Central monitoring system.		
5	**Item No 5 - PLC based control monitoring and communication software**	1.00	No
	Designing, Supplying, Installing, commissioning & testing of PLC based control monitoring & communication software as per IEC 61131 at Raw water Jackwell / Sump suitable for monitoring and control of Raw water Pumps, Pressure Transmitters, Level Transmitter, Flow Transmitter complete. based control monitoring and communication		

6	**Item No 6 - Power Cable**	100.00	Mtrs
	2 C x 1.5 sq.mm as per IS 694 twisted shielded copper armoured conductor on wall in GI tray or in ground suitable for supplied D. C. Voltage.		
7	**Item No. 7:- Signal Cable**		
	Designing, Supplying, Installing, commissioning & testing with Terminating & Interfacing of following cables, as per IS 694 copper shieled, twisted, multistranded armoured cable on wall in GI tray or on ground.		
	2 pair x 1.0 sq.mm	50.00	Mtrs
	3 pair x 1.0 sq.mm.	50.00	Mtrs
	4.5 pair x 1.0 sq.mm.	50.00	Mtrs
	8 pair x 1.0 sq.mm.	50.00	Mtrs
8	**Item No.8:- Communication Cable**	50.00	Mtrs
	CAT 6 as per ISO/IEC-11801 std. cable for networking on wall in GI tray or on ground etc.		
9	**Item No 9 :- Cable Tray as required**		
	perforated GI tray 200*100mm for laying of cable as per detail specification.	50.00	Mtrs
	perforated GI tray 200X100mm for laying of cable as per detail specification.	50.00	Mtrs
1	**Item No 10 :- Surveillance System**		

0	CCTV IR water proof camera suitable for upto 100ft.with IR Dome camera, control key board, DVR, Hard Disk, cables, UPT trans receivers etc. complete.	1.00	Nos.
1	**Item No. 11 :- pH Analyser**	1.00	No
1	**pH Analyser** as per IUPAC (International Union for Pure & Applied Chemistry) at A.F. and -Interfacing with PLC panel including Mounting arrangement. pH Accuracy : Better than 0.5% of full scale , Supply Voltage : 24V dc, Output : 4 20 mA		
1	**Item No. 12 :- Earthing**	9.00	No
2	Providing earthing with galvanized iron earth plate size 60 x 60 x 0.6 cm with funnel with a wire mesh for watering and brick masonry block C.l. cover complete with all materials, testing & recording the results as per specification no. EA-EP		
1 3	**Item No. 13 :- Comprehensive Operation and Maintenance -**	6	year
	Comprehensive Operation and Maintenance charges of the whole scheme on SCADA & PLC … etc. complete as per specification		

Communication cable-CAT – 6 cable:-
This job includes of Designing, Supplying, Installing, commissioning & testing with Terminating & Interfacing of CAT 6 as per ISO/IEC - 11801 std. cable for networking on wall in G.I. tray or in ground required for Ethernet communication as per requirement and as directed by Engineer in charge.

Signal cable-

Contractor should Designing, Supplying, Installing, commissioning & testing with Terminating & Interfacing of 2 pair x 1.0 sq.mm. as per IS 694 copper shielded, twisted, multistranded armoured cable on wall in GI tray or on ground as per requirement and as directed by Engineer in charge.

Pair cable-

Job inclusive of providing, jointing & terminating an interfacing of 8 Pair X 1.0 sq. mm. cable as per IS 694 copper armoured conductor on wall in GI tray or in ground required for all actuators control to PLC panel. as per requirement and and as directed by Engineer in charge.

Cable Tray- GI tray 80 x 20 mm x3mm thick.

Job includes of Designing, Providing and fitting of G.I. perforated cable trays of suitable size including fixing on provided angles. Length as per actual requirement. and as directed by Engineer in charge.

Cable tray- Perforated GI tray 200 x 20 x 3mmthick

Job includes of Designing, Providing and fitting of G.I. perforated cable trays of suitable size including fixing on provided angles. Length as per actual requirement. and as directed by Engineer in charge.

CCTV & Surveillance System for Pumping station -

The item includes of Designing, supplying, installing, commissioning and testing of CCTV IR water proof camera suitable for up to 100ft with IR demo camera, control key board, DVR, Hard disk, cables, UPT transceivers etc. as directed by Engineer in charge.

1.1. Surveillance CCTV system is required to ensure effective surveillance of an area as well as create a tamperproof record for post event analysis. The System shall provide an online display of video images on TFT monitors/Video Wall/Large plasma monitors located in Central as well as Local control rooms.

1.2. System should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users present in the LAN.

1.3. System should provide inter-operability of hardware, OS, software, networking, printing, database connectivity, reporting, and communication protocols. System expansion should be possible through off-the-shelf available

hardware.

1.4. Equipment with better specifications shall be accepted.

2. General Specifications:

2.1. Proposed CCTV system shall be an open standard based integrated system with IP network centric functional and management architecture aimed at providing high-speed manual /automatic operation for best performance.

2.2. System shall use video signals from various types of indoor/outdoor CCD colour cameras installed at different locations, process them for viewing on workstations / monitors at Central Control Room/local control rooms and simultaneously record all the cameras after compression using MPEG 4 or better standard. Joystick or Mouse-Keyboard controllers shall be used for Pan, Tilt, Zoom, and other functions of desired cameras.

2.3. System shall have combination of Digital CCD Colour video Cameras with individual IP address, analog CCD Colour Video Cameras with Fixed or P/T/Z Lens, encoders / decoders, Network Video recorders (NVR/CAMERA SERVER), Network attached storage (NAS) / Raid backup device for recording, Application software, Colour Video Monitors, Keyboards with Joystick controllers / Mouse-Keyboard, software based Video Matrix Switcher, workstation for System Administration / Management / Maintenance etc.

2.5. Video Recorder shall offer both video stream management and video stream storage management. Recording frame rate & resolution in respect of individual channel shall be programmable.

2.6. System should ensure that once recorded, the video cannot be altered, ensuring the audit trail is intact for evidential purposes.

2.7. System shall provide sufficient storage of all the camera recordings for a period of 30 days or more @ 25 FPS, at 4 CIF or better quality using necessary compression techniques for all cameras (extended capacity of cameras i.e. present capacity+25 %).

2.8. System shall use a combination of IP enabled cameras & analog CCD

cameras with external encoder. The video shall be compressed using MPEG-4 or better standard and streamed over the IP network.

2.9. Encoders shall digitize analog video, compress the digital video using various

compression algorithms (MPEG - 4 or better standard), and transmit the compressed digital video over packet-based IP network. Encoders shall have less than 200 ms of latency and shall support dual stream – MPEG 4.

2.10. The recording resolution and frame rate for each camera shall be user programmable.

2.11. The Area under surveillance shall be monitored and controlled from Central/Local Control Room(s) through Joystick controllers.

2.12. Surveillance CCTV System shall operate on 230 V, 50 Hz single -phase power supply. Power for all the equipment will be conditioned using on-line UPS with minimum 30 minutes or more back up. If any equipment operates on any voltage other than the supply voltage and supply frequency, necessary conversion/correction device for supply shall be supplied along with the equipment.

2.14. All the indoor cameras & control equipment shall be suitable for operation at ambient temp. 45^0 C.

3. System requirements:

3.1 Camera with external encoder or IP Camera shall be used for image capture.

3.2 Indoor cameras shall be either with fixed focal length lens or with Pan/Tilt

& Zoom lens as per site requirement. All outdoor Cameras shall be Day/Night cameras.

3.3 Housing of cameras meant for indoor use shall be of IP 42 rating whereas outdoor camera housing shall be of IP 66 or better rating. These must be integrated by the camera manufacturer.

3.4 System must provide built-in facility of watermarking or Digital certificate to ensure tamperproof recording so that these can be used as

evidence at a later date, if so desired. The recording shall support audit trail feature.

3.5 All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password.

3.6 Facility of camera recording in real-time mode (25 FPS)/15/12.5/10 or lower FPS as well as in any desired combination must be available in the system.

3.7 Facility of Camera recording in CIF, 2CIF, 4 CIF as well as in any combination i.e. Any camera can be recorded in any quality – Selective or Group of cameras must be available in the system.

3.8 System to have facility of additional camera installation beyond the originally planned capacity.

3.9 In order to optimize the memory, while recording, video shall be compressed using MPEG-4 or better standard and streamed over the IP network. Once on the network, video can be viewed on a Control room workstation or on analog monitor using a hardware decoder (MPEG-4/compatible standard Receiver) and shall be recorded on NVR

3.10 System shall be triplex i.e. it should provide facility of Viewing, Recording &

Replay Simultaneously.

3.11 The offered system shall have facility to export the desired portion of clipping (from a desired date/time to another desired date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.

3.12 PTZ Cameras shall have 64 or more pre-defined positions, to be selected through suitable input alarm.

3.14 System shall have provision of WAN connectivity for remote monitoring.

4. System design:

4.1 Each camera should be connected to a Hardware Encoder, through cable, which shall support minimum dual streams. Alternatively, the camera shall be IP based, UTP ready. The encoders should be capable of producing streams @ 25 fps for each camera for viewing on LAN and on monitors and also recording into the NVR user selectable as per requirement, for each individual camera.

4.2 Encoders shall be Power Over Ethernet (POE) compliant and connected to Layer or Layer 3 switch as per system design using UTP CAT 6 Cable or fiber optic cable and the required connectors as per standards.

4.3 Central/Local Control Room will have workstations along with controllers for Camera operation. For monitoring purposes, Video monitors/Plasma monitors/Video wall shall be setup with suitable mounting arrangements, as per user requirements. Facility for viewing and controlling all the cameras at various other locations, as required, shall be provided.

4.4 Monitoring at Local control rooms may be restricted to operation of certain cameras only & system administrator should be able to configure the system, accordingly. More than one Local Control rooms may be required in the proposed system with individual configuration.

4.5 Each control room may have one or more Operators simultaneously using the installed Video monitors/Video wall. Operator control on cameras shall be on a static basis or rotary basis depending on the policies to be decided at site.

4.6 There shall be a Control System with Video Control Software to manage all the video surveillance devices.

4.7 help in proper System administration & management of redundancies etc.

4.8 Video stream from individual cameras shall be recorded on respective NVR System shall have provision to automatically over-write the new information after the period of 30/31 days & necessary script/algorithm must be available in the Application.

At Pumping Station

a) 4 Mp full HD work IR Bullet Camera 9Professional series)-3 Nos.

b) Wireless connectivity point to multi point (TX/RX) 3 Km Range -1 no.

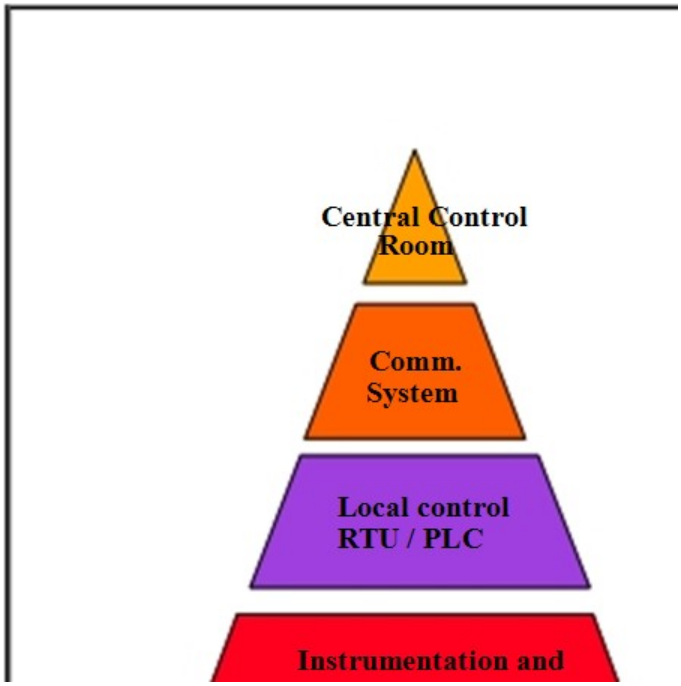
c) 18 CAt - 6 ALSZH cable for LAN/WAn -200 Mt..

d) Mains with 2 X 1.5 sq mm. FRLS copper wire in 16 gauge 20mm dia. rigid steel pipe with G.I. earth wire-100 Mt.

SCADA SYSTEM & DESCRIPTION:

The proposed SCADA system is hierarchical that can be best described by four functional areas:

- Operation Control Center (OCC) or Central Control Room (CCR)
- Communications System
- Local (Remote Stations) Control (PLC, GPRS)
- Instrumentation and Process Automation



The above triangular structure is typical for many SCADA systems and has

been adopted for proposed project. To ease the reading the technical proposal is following this division and order as much as possible.

The SCADA shall be of the distributed type, confirmed by the control levels. In the Scope of Works associated with the SCADA, these generally do not include level 0 (this is part of Control Circuits of MCC) of the equipment own, as for example: valve's actuator). Each level's function is described in general form as follows:

i. **Level Zero**: Direct operation and supervision in each particular equipment.

ii. **Level One**: Local operation and supervision of groups of equipment by means of boards with instrumentation, controls, indication and other tools for safe process operation. In this level two control modes are possible:

a. LOCAL MANUAL: The operator will have the handling of the equipment, and the control from higher levels will be disabled.

b. LOCAL AUTOMATIC: If available, the control will be made by the control elements of the equipment. The control from higher levels is disabled.

The control from higher levels will be informed about this operation mode and will not have.

iii. **Level Two:** This refers to the set of automation that controls all the operations of a station. It monitors all the equipment, is capable of executing locally- or remotely-requested general station operation orders, and can produce operation reports as detailed as required.

Control level 2 will be the first level of basic control for the equipment, either of each one in individual or of a limited set of equipment. Some level 2 equipment will have their own microprocessor- based control and others will be integrated to a PLC-based local control, therefore a commutation system shall be available for selecting the desired control mode. the

possibility of controlling it.

There shall be three control modes in level two:

- Manual local
- Automatic local
- Remote: The control is made from higher levels, it is the normal operation mode

In the "Local Manual" control mode the operator will have the handling of the equipment and the control from higher levels is disabled.

In the "Local Automatic" control mode the equipment microprocessors and the local control equipment will have the control, aided by the local programs that will perform all the operation functions. In this mode the control from the higher levels remains disabled.

In the "Remote" control mode, control is given to the higher levels. This mode will be the normal control mode for the system operation, while the local control remains disabled, except for the protections, which will have priority for stopping the equipment or for holding them during the waiting or start up periods.

All level two equipment communicate with those of level three by means of the communications network.

iv. **Level Three: This corresponds to the SCADA where the operators will have all the information from the** system and will distribute operation commands to the various sites. Monitoring and operation reports for each site will be available.

A database for system operation analysis shall be constructed. Practically this refers to the Control Center.

This level will comprise the set of application programs that from the

mentioned operational control and information system, will automatically define operation commands for each site that requires them based on the information collected in the historical archives and based on the operation data pre-established by statistical behavior patterns of the system

CONTROL OF DIFFERENT PUMPING UNITS:

The control of diverse elements of the system such as pumping will be made in two ways : Local and Remote.

The LOCAL way of operation is detailed further ahead in the section referring to PLC, whereas the REMOTE way is handled from Control Centre Room. The decision on which way will the equipment operate is based on a precedence order and it will be taken in the site by means of a control switch (LOCAL/REMOTE).

The REMOTE operation to be executed by the Control Centre will be REMOTE/AUTOMATIC or REMOTE/MANUAL. AUTOMATIC operation refers to the way of operation pre-programmed according to the criteria established for each site in individual, and the operation.

MANUAL will be performed under the command and supervision of the system operator, according to the effective instructions for normal or emergency operation, which is practically a forced way, executed directly by the operator.

Proposed system shall have 1No. work station at each location having latest PC with at least21" LED Monitor. PCs shall be loaded with licensed software Controller packages.

LOCAL CONTROL PANEL FOR PUMPING STATIONS AND RESERVOIRS:

Each one of these installations shall have a local control panel or PLC Local Control Panel shall be housed with a PLC Controller for Local Operations.

Local PLC Controller shall work in coordination with Main System in fully auto mode. However, in event of requirement of Local Operation local PLC Controller shall be fully capable of handling all local operations independently.

Manual or automatic control of different pumping or valve units; each RTU will be equipped with a REMOTE/LOCAL control switch. The state of this switch will be transmitted to the Control Center, and it will be presented in the corresponding screens. In the REMOTE mode the handling of all the equipment will be executed from the Control Center, according to previous details. In case of loss of communication, the equipment will continue operating or maintaining the state according to the last updated command.

In LOCAL mode the equipment will be operated by means of the PLC according to the information available in the site, automatically. The Control Center will not be able to send command to operate the equipment in this mode, while it shall still be normally receiving the information. Also, the possibility exists of programming a clock that allows the operation during 24 hours.

Additionally each PLC will be equipped with an amount of control switches equal to the same number of devices (pumps, valves, etc.) to be controlled. This switch will have three positions: AUTOMATIC/O/MANUAL. The state of this switch will be transmitted to the Control Center and displayed in the corresponding screens. The switch will allow choosing, for each pumping or valve unit, its operation mode, according to the decision of the operation personnel in the PLC site. In the AUTOMATIC mode the equipment will be controlled by means of the PLC according to the state of the control switch REMOTE/LOCAL.

In the "O" mode the equipment will stop and it will not allow any operation.

The MANUAL mode will disconnect the PLC equipment and it will be handled in conventional manual form. In this way the PLC will not have any possibility

of taking part in the operation of the equipment, not even in the activation of the hydraulic protections, but if it will continue with the data collection and its transmission to the Control Center for its processing and normal presentation.

Local control Panel (LCP) or PLC with following facilities:

- Selector switch for Local/Off/Remote for LCP. to choose the mode of operation of PLC
- Auto mode is selected all the pumps/valves/gates etc. can be operated from the SCADA
- START/STOP push buttons for corresponding Pump

SCADA receive the following feedback from the LCP:

- RUN and combined TRIP feedback for corresponding Pump
- Local/Off/Remote feedback for corresponding Pump
- Emergency Stop feedback for corresponding Pump.
- Auto/Off/Manual soft switch shall be provided at SCADA.

Start Permissive for different Modes;

In Remote Manual /Auto Modes the Logic shall execute only when the following conditions are met:

- The water level is not out of the operating range Duty Mode has to be selected in SCADA.
- Respective mode is available (Remote mode, Non Failure of mains power supply) for operation.
- Respective on – off discharge valves (if any) are available (Remote mode & Non Failure of mains power supply for operation.
- No trips are generated by protection

Stop Permissive for different Modes;

The drives shall trip under the following abnormal conditions to ensure safe operation and protection of Pumps:

- Tank/Sump level out of range.
- Respective drive is not available
- Any trip alarm generated.

Pumps & Motorized valve/gate operation;

Local Mode:

When Local/Remote selector switch in pumps & valve/gate is in Local Mode, each pumps & valve/gate can be operated through Push Button (PB) provided in at LCP or PMCC/MCC valve/gate actuator panel.

Remote Mode:

When Local/Remote selector switch in pumps &valve/gate is in Remote Mode, each pumps & valve/gate can be operated through RTU and /or SCADA in Control room.

Auto Mode

When the selector switch is in Auto mode, each pumps & valve/gate shall operate automatically based on the Control sequence logic built in the PLC or SCADA in Control room

Manual Mode:

The operator in the Control Room can select Manual mode from SCADA for enabling Manual operation from SCADA. In this mode all the pumps & valves/gate can be operated individually.

Signal Interface to PLC Drives;

The following signals are hardwired between PLC and MCC/Soft Starter Panel

- Drive Run feedback
- Drive Trip feedback
- Drive in Local/Off/ Remote Mode status
- Drive Start/Stop Command
- Drive Emergency Stop feedback

Motorized Valves/Gates;

The actuators for electrically operated Gates have their own inbuilt display board and local control logic in built with the Actuators. The following controls are provided:

Each actuator has the following facilities for local operation:

- Lockable Selector switch for LOCAL / OFF / REMOTE.
- OPEN / STOP / CLOSE push buttons
- Lamp indication for Fully OPEN position / Fully CLOSED position
- Lamps for Fault indication including HIGH Torque and other Fault indications as per manufacturer requirement in the Display Board.
- Lamps for status indication of Actuator towards Open Position, Actuator towards Close position, Actuator in Local mode, Actuator in Remote mode and other status as per manufacturer requirement in the Display Board.

PLC receives the following feedback from the actuators:

- Collective fault indication for Actuator including the High Torque Fault
- LOCAL / OFF / REMOTE position feedback
- Valve/ Gate Fully open / fully closed position feedback.
- Position indicating transmitter shall be available along with each control valve actuator for position control based on desired set points.

The details of complete automation system / SCADA, make of equipments / sensors / software etc. shall be submitted to the Superintending Engineer (Mech) & shall be got approved before actual execution of

work.

COPPER PLATE TYPE EARTHING:

All pumping stations with substation equipments should have minimum categories earthing as LT/HT as per given details. For Copper plate earthing, copper plate of size 60 x 60 x 0.315 cm shall be used for earthing of DTC Meters, HT Metering Kiosk and SCADA Panel .For copper Earth Plate Earthing, Copper Plate of size 60x60x0.6cm size shall be used for earthing of all other electrical equipments as per approval of Electrical Inspector. All the earth plate electrodes shall not be situated at a distance less than 1.5 m from building fencing structure and equipment foundations. The earth pits shall confirm to the provision in IS and shall be constructed, in M-150 concrete. Required quantity of salt and charcoal shall be provided. Each earth pit shall have funnel arrangement for watering. Each earth electrode shall have disconnecting link to disconnect and measure resistance of earth electrode. RCC chamber shall be provided with C.I. cover to each earth pit CC chambers top shall be flushing to metal spreading level in switch yard. A ring bus shall be formed in the yard and transformer yard to which individual earth electrode shall be connected. Earth leads from equipments, structure etc., shall be connected separately to the ring bus. Both ring buses shall be interconnected with two parallel earth leads at two opposite points on each ring bus. Minimum size of earth leads for earthing of Metering Kiosk, DTC Meters and SCADA Panel shall be of copper earthing strip of size 32 x 6 mm. The earth leads run on the structure shall be severely bolted or clamped. Neutral earth leads shall run on separate support without touching body of the transformer. The run and arrangement of earth lead shall be neat and in parallel and at right angles formation with reference to general layout of the switch yard and equipment. Inter connections of the earth continuity conductor and main/branch earth leads shall be bolted ensuring reliable, permanent and good electrical connection and further brazed earth leads shall be protected against mechanical damage and corrosion particularly at

the point of connection. The earthing shall be done as per IE rule and drawing attached with tender. Copper plate earthing shall be done for following equipment. The arrangement specifications and quantity/size stipulated hereunder are minimum requirements. It shall however, be the responsibility of the contractor to design and provide the earthing arrangement as stated below with prior approval from MSEDCL authority.

EARTHING STRIP

All electrical equipment shall be double earthed with suitable size copper earth lead as per IE rule and IS 3043 / 1966. All earth electrodes shall be inter connected by GI strip of suitable size through a common circular ring. The earth resistance should not exceed the limit prescribed in IS / IE rule.

B-O & M Comprehensive-

Operation and Maintenance Charges of the whole water supply scheme on SCADA and generation of daily report of water quality parameters and electrical parameters with specific consumption in kWh/ml . The report shall be mailed daily to the headquarters for monitoring purpose.

Test and Trial:

Giving satisfactory test and trial of pumping machinery and allied equipment for one month period. Commissioning, running and maintaining the scheme to quantities , rated capacity including manning necessary personnel such as pump operator, valve man etc. as per requirement of the scheme and who should also administer pumping machinery &maintain log book record such as Date/Time/Voltage reading/Current reading /pressure gauge reading and pump running record etc. for a period of one months together with training of personnel spared by M.J.P. / Local body and handing over the scheme to local body after completion of the above period as directed by Engineer- incharge etc. complete.

G.A. Drawing, S.L.D., BOM etc. of all mechanical and electrical works shall be get it approved MJP authority with due recommendation from concern.

Make: As per MJP Approved only and approved by Executive Engineer (M) only.

Note: The makes of the electrical and mechanical equipment's shall be as per Elect/Mech Automation approved list enclosed.

Record Drawing:- After satisfactory completion of the work in all respects the contractor shall submit 2 sets of record drawing of each along with instructions, operation and maintenance manual of all electrical and mechanical equipment's.

Third Party Inspection and as per MJP Circular No 4161 dt 10-12-1998

1.Submersible Non clog pump set-All
2.Sluice Valve-350mm and above
3.Valve Actuator-All
4.Non return valve-350mm and above
5.EOT Crane-3Tone and above
6.Full bore EM Flow Meter-150mm and above
7.LT Panel-100HP
8.FCMA Starter-All
9.APFC Panel-All
10.Transformer 315kVA and above
11.DG Set-All
12.AMF Panel-All
13.PLC Panel-All

Third party inspection shall be carried out from MJP approved agencies along with SMKC, MJP representative and successful report shall be submitted to the office. The expenditure for third party inspection, travelling charges, lodging charges, etc. shall be borne by the contractor.

The item includes test and trial of all equipments installed after their commissioning. It includes field tests of pumps, transformers etc. to prove their suitability as per contractual conditions and applicable Indian standards. Manufacturers" recommendations for testing shall be followed. It includes

providing skilled and unskilled man power for operation and maintenance for a period of 1 month after commissioning.

The contractor shall carry out operation and maintenance of sub-station, pump house, all equipments and the works involved in the scope of this tender. The intention of carrying out operation and maintenance through the contractor is to operate the pumping machinery as per the requirement of the department and impart training to departmental staff in a systematic manner.

The contractor shall provide sundry material as required during this period.

Tools:

The item includes supplying set of tools and spares as recommended by the pump manufacture r in addition to the tools listed below **for each pumping station**,

Sr. No.	Description	Qty	unit
1	D.E. Open Jaw fix spanner 12 piece set 6-32 mm	1	Set
2	Bi-hexagon Ring spanner 12 piece set 6-32 mm	1	Set
3	Ball pen hammer with handle 800 gm	1	Each
4	Combination side cutting plier 200 mm KDPE coated	1	Each
5	Adjustable wrench chrome vanadium 250mm-30mm	1	Each
6	Pipe wrench stillson pattern carbon steel 450 mm-60mm	1	Each
7	Pipe wrench stillson pattern carbon steel 600 mm-76 mm	1	Each
8	Screw driver Engineering pattern 6 x 300 mm	1	Each
9	Screw driver Engineering pattern 8 x 200 mm	1	Each
10	Screw driver Engineering pattern 5 x 300 mm	1	Each
11	Screw driver with green neon bulb line tester 3.6 x 60 mm	1	Each
12	Hack saw frame 300 mm size with heavy duty blade	1	Each
13	Tool box fabricated from MS sheet of 18SWG of size 50 x 30 x 30 cm with locking arrangement	1	Each
14	Hydraulic flip flop crimping tool suitable for 6 to 500 sq mm size cable lugs (Usha-Ismail or similar make)	1	Each
15	Hand operated crimping tool with set of dies ranging from 6	1	Each

	to 185 sq mm cable lug, in pairs of hand ratches		
16	Insulator tester (Megger) cranking type having metal body of range 100 volts 1000 ohms	1	Each
17	Earth Tester-4 terminals of range 0-10-100-1000-10000 Ohms	1	Each
18	Tong Tester (clip on meter) of range0-10-30-100-1000 Amps and 0-300-600 Volts	1	Each
19	Tubular box spanner set with Tommy bar 8 piece 6-22 mm	1	Set
20	Long nose pliers carbon steel 200 mm PVC coated	1	Each

SUCTION CUM JETTING MACHINE:

This job includes supplying, erecting, testing & commissioning of Heavy Truck Chassis Mounted Suction Cum Jetting Machine of 8000 liter Tank Capacity, BS-6 with Tilt & Telescopic Power Steering, Radial Tires, Electronic Anti-Fuel Theft System, GPS, 8m Turning Radius with Chassis Certification by ARAI/VRDE/ICAT. It must comply with Form 22 A - For compliance with pollution standards, safety standards of components and road worthiness as per CMVR Rules.

Suction cum jetting machine must be Conforming to IS:13496 for cleaning Sewers, Manholes and ancillary structures provided on sewer line and closed storm water drains Conforming to IS:11387 for high pressure jetting machine for sewer cleaning. Availability of test reports for all critical components from the manufacturer or OEM of Jetting Pumps, vacuum pumps, power takeoff unit, Jetting Hose etc. shall be from any ILAC /NABL accredited / Central Govt Lab to be furnished on demand. Registration To Local RTO (Regional Transport Office)/RTA(Regional Transport Authority) will be the responsibility of the contractor.

Following minimum parameters shall be confirmed while procuring the machine.

Chassis Type	Heavy Motor Vehicle

Type of Fuel	Diesel
Chassis Gross Vehicle Weight	18500 kilogram
Kerb Weight	4985 kilogram
Engine Capacity (cc)	5600
Pay Load Capacity (Tonne Load)	13515
Vehicle Emission Compliance	BS-VI
Engine BHP	180 horsepower
Engine Torque Max@rpm	850 Newton
Maximum Speed of Vehicle(KM/Hr)	80
No of Speed/ Forward Gears	6
Braking Distance	10 meter
Gradeability of Vehicle (%)	30
Wheel Base	4225 millimeter
Engine Aspiration System	Turbocharged Intercooler
Mount Type	Truck Mounted Unit
Fuel Tank Capacity	365 liter

Constructional parameters

Capacity of Split Shaft PTO of the vehicle (kgm)	400
Overall Length	7000 millimeter
Overall Width	2500 millimeter
Equipment Length	7000 millimeter

Equipment Height	3750 millimeter
Equipment Rear Over Hang	Yes
If Yes, Declare Equipment Rear Over Hang	2200 millimeter
Type of Front Axle and Suspension System	Semi-elliptical
Type of Rear Axle and Suspension System	Semi-elliptical
Derrick Arm Available	No
Vacuum Pump - Rotary Vane / Sliding Vane	Yes
Type Of Cooling	AIR Cooling
Vacuum Pump Flow (cum/hr)	540
Vacuum Pump Power (hp@rpm)	15.2
Vacuum Relief Valve Size	1.5 inch
Vacuum Suction Depth	8 meter
Suction Hose - Lightweight, heavy duty ,reinforced ,PVC along with quick connect coupling arrangement	Yes
Suction Hose Internal Diameter	100 millimeter
Suction Hose Length	3 meter
Number of Suction Hose (Nos)	5
Safety Equipments	YES
Silencer/ Filter(Micro Strainer)	Yes
Exhaust Silencer and injection	Yes

cooling air Inlet Silencer/ Filter	
Blower Outlet and Air- Exhaust Silencer	Yes
Check valve	Yes
Vacuum Limitation Valve	Yes
Drain Off valve	Yes
High Pressure Jetting Pump With pressure regulating Arrangement	Yes
Jetting Pump - Triplex plunger reciprocating pump	Yes
Working Pressure Range of Jetting Pump	150 bar
Water Flow for Pump of Jetting Machine (LPM)	260
Pressure Relief Valve Size	1.5 inch
Jetting hose inner Diameter (Capable of withstanding one point five times the maximum pressure generated by the pump)	25 millimeter
Jetting Hose Length	120 meter
Number of Nozzles for removing Blockage (Conical Head)	1
Number of Nozzles for Flushing Sewer lines(Round Head)	1
Number of balanced Nozzles for dry silt	1
Water storage Tank Capacity	5000 liter

Sludge Storage Tank capacity	3000 liter
Total Tank Capacity	8000 liter
Maximum working pressure of Jetting Hose	206 bar
Minimum Burst pressure of Jetting Hose	517 bar
Thickness of tank plate of SS 304 with proper re inforcement to withstand the required forces	6 millimeter
Material of tank	Mild Steel (Grade - A) confirming IS 2062 latest
Surface preparation and finish of tank's Exterior - sanded prior to spray painting and spray painted with two coats of superior quality anti corrosive primer and two coats of enamel metal paint	Yes
Surface preparation and finish of Tank's Interior - clean water two coats anti corrosive primer & two coats of grey enamel paint & Sludge shall be with two coats of epoxy paint to resist corrosion	Yes
Provision for locking and unlocking arrangement of rear gate of tank, to be operated hydraulically for quick tipping and cleaning	Yes
Hose Reel Drive operated by hydraulic motor	Yes
Dished Head	Yes

Tank Rear Door Opening by hydraulic system	Yes
Reinforcement rings in pipes	Yes
Hydraulic Pump Type	Gear Type
Water Level Indicator Type (with safety coverage)	ACRYLIC TUBE
Water Level Indicator Nos	2
Thickness of Cover for Engine, Pump and Hose Reel compartment	3 millimeter
Material of Cover for Engine, Pump and Hose Reel compartment	MS Sheet
Full bore Quick Acting Valves in the sewage path	Yes
Air Pumps to safeguard the pump from overloading	Yes
Make and Model of Air Pump	Standard
Sludge Trap between the Air Pump and the Tank	Yes
Float cut out valve to seal the pump suction line	Yes
Lubricating system for reducing friction loss	Yes
Three sewer cleaning nozzles with varying rearward angles	Yes
One nozzle extension for easy fixing of the hose and the nozzle	Yes
Two stop tank strainer elements	Yes

Two sets of operation and service manuals and spare parts lists	Yes
Hose guide	Yes
Counter	Yes

Essential spares

Set of seal kit for Hydraulic Cylinder	Yes
Set of seal kit for Hydraulic Motors	Yes
Set of seal kit for Hydraulic Pumps	Yes
Set of Filters for Hydraulic Systems	Yes
Suction hose 30mtr and Jetting hose 120mtr	Yes

Performance parameters

Warranty Time	24 month
Warranty Distance	50000 kilometer
No of Free Service (Minimum 3 per year)	Yes

Maharashtra Jeevan Pradhikaran

Up-dated List of Approved Makes (Elect. / Mech. / Automation)
as on 1/11/2022

Sr. No.	Name of Company /Brand	Category Awarded	Manufacturer's Correspond-ence address	Contact Details	Valid Up-to
1	Pumps				
A)	Submersible Pump Borewell				
a)	For 100 mm (4") pumps				
	Nil			Make to be approved at EEM level.	
b)	For 150 mm (6") and above				
1)	Dec-can-Karvel	No Limit	M/s. Deccan Indus-tries No 1390, Sathy Main Road, Ganpathy, Coimbatore-641006 Tamilnadu	Mr. Gopal Krishnan Mobile No. - 9965796960 go-pal@deccanindustries.com Mr. Rohan Inam-dar Mobile No.- 9623830404 ro-han@karvel.in	31.12.2023
2)	Duke	No Limit	M/s. Duke Plasto Technique Pvt. Ltd, N.H. 27, deesa high-way, Opp. Greenwood Hotel, Badarpura, Pal-anpur - 385510	Mr. Parth Patel Mobile No.- 9978905921 parth@dukeplasto.com Mr. Nirav Gajjar Mobile No.- 9408701762 / 9724506183	31.03.2024

				info@dukeplasto.com niravgaj-jar@dukeplasto.com	
3)	Falcon	No Limit	**M/s. Falcon Pumps Pvt. Ltd.,** PO Vavadi, Rajkot. 360 004. Ph. No. 0281-2370801/5.	**Mr. Ridhish Dobaria** Mobile No. 7718821200 9727700566 / 9727700573. brg@falconpumps .in tech-nical@falconpum ps.in	**30.06.2023**
4)	Saga	Upto 15 HP	**M/s. Saga Windel Pumps Pvt. Ltd.,** Khodiyar Estate, Opp, Reliance Petrol Pump, Memco- Bapunagar Road Naroda, Ahmeda-bad-382345.	**Mr.** Phone No:- 9825015990 Mob No. 9377771599 **Email.id-** sagawindel@gmail.com	**31.08.2023**
5)	JASCO	No Limit	**M/s.JASCO Pumps Pvt.Ltd.** Plot No.47, phase- 1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad- 382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. - 9374063726 hiresh.pandya@ya hoo.com **Mr. Manish Pu-ranik** Mobile No. - 9898059021 jascopump47@gm ail.com	**30.06.2024**
6)	KSB	No Limit	**M/s. KSB Ltd.,** E - 3 & 4, MIDC Sinner, Nashik -422113. Ph No. 022 / 21681300, 020 / 27101273,	**Mr. Niket Mehta** Mobile No. - 9769208641 ni-ket.mehta@ksb. com **Mr. Jiten-dra Patankar** Mobile No. - 9765556995 jiten-	**31.07.2024**

				dra.patankar@ksb.com	
7)	Lubi	No Limit	M/s. LUBI industries LLP, Near Kalyan Mills, Naroda Road, Ahmedabad - 380025	Mr. Alkesh Dalwadi Mobile No. - 9052044887 Mr. Avinash Ingrulkar Mobile No. - 9619492067 adal-wa-di@lubipumps.com	31.01.2024
8)	MBH Pumps	No Limit	M/s. MBH Pumps (Guj) Pvt. Ltd, 14, GIDC Industrial Estate, Naroda, Ahmedabad -Phone no. 079 / 22823066, 22822094	Mr. Yogesh Vachhani Asst. Manager Marketing Mobile No. - 9427533830 marketing@mbhpumps.com Mr. Parth Kamania Mobile No. - 9825467472	30.09.2024
9)	U-neel	No Limit	M/s. Unnati Industrial Corporation, D-61, Diamond Park, GIDC Naroda, Ahmedabad-382330 Phone No. 079 - 22811320 / 21	Mr. G. B. Patel Mobile No. - 9825044355 / 9825039815 Mr. Chetan Prajapati Mobile No. - 9979508668 pump.uneel@gmail.com	30.06.2024
10)	Unnati	No Limit	M/s. Unnati Pumps Pvt. Ltd. 81 to 86, Amarnath Industrial Estate, Opp. Shayona Estate, Naroda Road, Ahmedabad- 380025	Mr. Vishal Modasariya Mobile No. - 9825400370 Mr. Parag Modak Mobile No. - 9130036911 sales@unnatipumps.com liaison@unnatipumps.com	31.03.2024

11)	**Colin Submersi-ble& Self Priming**	**No Limit**	Hari Om Industries PlotNo.48, Rd.No.-11, G.I.D.C. Ph-II, Kathwada, Ahmeda-bad-382415.	Mr. Nilesh ModiMob-9227226108 hari-ompumps@gmail.com	**30.06.2023**
12)	**Calama**	**No Limit**	Calama Technolo-giesPvt. Ltd., Siyagang, Indore 452009	Ph./ Mob. 0731-2810014, 9165012014 EmailId sales@calama.com, vinodrai1963@ymail.com	**30.09.2025**

13	VARUNA	No Limit	La Gajjar machineries Pvt. Ltd., Ahmedabad.	Ph./ Mob. 079-22777487, 9099935857 Emailld crm@lgmindia.com ,	31/10/2023
14)	Harison	Upto 30 HP	**M/s. Harison Pumps Pvt. Ltd .** MIDC, Hingana Industrial Area, Nagpur - 28	**Mr. Bharath Deshmukh** MobileNo. - 9422106645Ph No. 07104-237100 harison-pump@gmail.com	30.06.2023
15)	Waterman &optima	Upto 30 HP	**M/s. waterrman Industres Pvt. Ltd., Changodar,Ahmedabad 342213**	Mobile No. - 9978900506,8000952603 be@watermanpump.com, saleshead@watermanpump.com	30.09.2025
16)	Delite Pumps	Upto 20 HP	**M/s.Delite Pumps,** 40 & 42 A+B, Tirupati Estate, Nr. Amber Cinema, Bapunagar, Ahmedabad -382330 Ph. No. 079-22746175	**Mr. JitendraKumar B. Patel**MobileNo. - 9426353968 **Mr. Nishant J. Patel** Mobile No.- 9723338327 mail@delitepumps.com	29.02.2025
17)	Mascot	Upto 20 HP	**M/s. Mascot Pumps Ltd.,** 185/B, Phase-1, Nr. Havmor Ice cream, GIDC, Naroda, Ahmedabad- 382330 Ph. No. 079-22821252	**Mr. N. M. Prajapati** Mobile No. - 9879059434 **Mr. Chetan N. Prajapati** Mobile No. - 9979508668 mascot-pumpltd@gmai.com	29.02.2023
18)	Topland	Upto 20 HP	**M/s. Topland PumpsPvt. Ltd.**1-Umakant Pandit Udyog Nagar, Mavdi Plot, Rajkot - 360004.	**Mr. Bhavin Shah** Mobile No. - 9374125002 bhavin.shah@topland-india.com**Mr. Prakash Tale** Mobile No. - 9409103401 prakash.tale@topland-india.com	31.10.2024

19)	Ajanta	Up-to 15 HP	**M/s.Ajanta Industries,** Kishan gate, 3, Behind Sahyog Complex, Plot No. G-413 GIDC Metoda, Rajkot-21.	**Mr. Ritesh Patel** Mobile No. - 9825215350 **Mr. Kamlesh Patel** Mobile No. - 9727681901 /8866010555 in-fo@ajantaindustries.co.in	**31.03.2024**
20)	CNP	Up-to 15 HP	**M/s. CNP Pumps India Pvt. Ltd.,** Plot No. 502, Sambhav IT Park, TJSB House, Wagle Industrial Estate, Thane - 400604 sales@cnpindia.com	**Mr. Vivekanand Pai** Contact No: 9167209935 vsp@cnpindia.com **Mrs. Rashmi Nandgaonkar** Mobile No. 9167495323 rashmi.n@cnpindia.com	**31.12.2024**
21)	M.Tech	Up-to 15 HP	M/s. M. Tech Engineering Com. Vavadi Rajkot-360004.	Mo. 9824232165 Email-info@m-techpump.in	**30.11.2022**
22)	Flotech	Up-to 15 HP	M/s. Flotech Engineering Pvt. Ltd., Rani Industrial Area, Shapar-Main Road, Shapar, (Veraval-360024.	Mo No. 9727797919/908 100335	**31.07.2025**
23)	Fillox	Up-to 15 HP	M/s. Divine pump Industries , Kathwada, GIDC, Ahmedabad. 382430	Mo No. 9898986300 Email Id tender.divinepump@gmail.com	**31.10.2023**
24)	Sagawindel	Upto 15 HP	M/S. Sagawindel pumps Pvt. Ltd.,Naroda, Ahmedabad. 382345	Mob. No. 9825015990, 9377771599 Email Id Sagawindel@gmail.com	**31.08.2023**
B)	**Open Well Submersible Monoblock Pump**				

1)	Calama	No Limit	Calama Technol-ogiesPvt. Ltd., Siyagang, Indore 452009	Ph./ Mob. 0731-2810014, 9165012014 Emailld sales@calama.com, vinodrai1963@ymail.com	30.09.2025
2)	VARUNA	No Limit	La Gajjar ma-chineriesPvt. Ltd., Ahmeda-bad.	Ph./ Mob. 079-22777487, 9099935857 Emailld crm@lgmindia.com,	31/10/2023
2)	Dec-can-Karvel	Upto 50 HP	**M/s. Deccan Indus-tries**No 1390, Sathy Main Road, Ganpathy, Coimba-tore-641006 Ta-milnadu	**Mr. Gopal Krishnan** Mobile No. - 9965796960 go-pal@deccanindustries.com**Mr. Rohan Inamdar** Mobile No.- 9623830404ro-han@karvel.in	31.12.2023
3)	Lubi	Upto 30 HP	**M/s. LUBI indus-triesLLP,** Near Kalyan Mills, Naroda Road, Ahmeda-bad - 380025	**Mr. Alkesh Dalwadi** Mobile No.:- 9052044887 **Mr. Avinash Ingrulkar** Mobile No.:- 9619492067 adalwa-di@lubipumps.com	31.01.2024
4)	MBH Pumps	Upto 30 HP	**M/s. MBH Pumps (Guj)Pvt. Ltd,** 14, GIDC Industrial Estate, Naroda, Ahmeda-bad -Phone no. 079 / 22823066, 22822094	**Mr. Yogesh Vachhani** Asst. Manager Marketing Mobile No. - 9427533830 market-ing@mbhpumps.com**Mr. Parth Kamania** Mobile No. - 9825467472	30.09.2024
5)	Water-man& optima	Upto 30 HP	**M/s. waterrman Industres Pvt. Ltd., Chango-dar,Ahmedabad 342213**	Mobile No. - 9978900506,80 00952603 be@watermanpump.com, saleshead@waterman pump.com	30.09.2025

Contractor No of Correction Executive Engineer SMKC

6)	**Duke**	**Upto 25 HP**	**M/s. Duke Plasto Technique Pvt. Ltd,** N.H. 27, deesa highway, Opp. Greenwood Hotel, Badarpura, Palanpur - 385510	**Mr. Parth Patel** Mobile No.- 9978905921 parth@dukeplasto.com **Mr. Nirav Gajjar** Mobile No.- 9408701762 /9724506183 info@dukeplasto.com niravgajjar@dukeplasto.com	**31.03.2024**
7)	**Harison**	**Upto 25 HP**	**M/s. Harison Pumps Pvt. Ltd .** MIDC, Hingana Industrial Area, Nagpur. 440 028	**Mr. Bharath Deshmukh** Mobile No. - 9422106645Ph No. 07104-237100 harison-pump@gmail.com	**30.06.2023**
8)	**JASCO**	**Upto 25 HP**	**M/s.JASCO Pumps Pvt.Ltd.** Plot No.47, phase- 1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad- 382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. -9374063726 hiresh.pandya@yahoo.com**Mr. Manish Puranik** Mobile No. -9898059021 jascopump47@gmail.com	**30.06.2024**
9)	**C.R.I.** Pumps	**Upto 25 HP**	C.R.I. Pumps Pvt. Ltd.,No.7/51, A, keranatham Road,sarvanam patti.coimbtore-641035	M/s. Jaipal Shetty Mo. 9022202 95 mumbai@cripumps.com www.crigroups.com	**31.05.2023**
10)	**Flotech**	**Upto 20 HP**	M/s. Flotech Engineering Pvt. Ltd.,Rani Industrial Area, Shapar-Main Road, Shapar, (Vera-	Mo No. 9727797919/908 100335	**31.07.2025**

			val- 360024.		
11)	**Ajanta**	**Upto 15 HP**	**M/s.Ajanta Industries,** Kishan gate, 3, Behind Sahyog Complex, Plot No. G-413 GIDC Metoda, Rajkot-360021.	**Mr. Ritesh Patel** Mobile No. - 9825215350 **Mr. Kamlesh Patel** Mobile No. - 9727681901 /8866010555 info@ajantaindustries.co.in	**31.03.2024**
12)	**U-neel**	**Upto 15 HP**	**M/s. Unnati Industrial Corporation,** D-61, Diamond Park, GIDC Naroda, Ahmedabad-382330 Phone No. 079 - 22811320 / 21	**Mr. G. B. Patel** Mobile No. - 9825044355 / 9825039815 **Mr. Chetan Prajapati** Mobile No. - 9979508668 pump.uneel@gmail.com	**30.06.2024**
13)	**Unnati**	**Upto 15 HP**	**M/s. Unnati Pumps Pvt. Ltd.** 81 to 86, Amarnath Industrial Estate, Opp. Shayona Estate, Naroda Road, Ahmedabad-380025	**Mr. Vishal Modasariya** Mobile No. - 9825400370 **Mr. Parag Modak** Mobile No. - 9130036911 sales@unnatipumps.com liaison@unnatipumps.com	**31.03.2024**
14)	**Delite Pumps**	**Upto 10 HP**	**M/s.Delite Pumps,** 40 & 42 A+B, Tirupati Estate, Nr. Amber Cinema, Bapunagar, Ahmedabad -382330 Ph. No.	**Mr. JitendraKumar B. Patel** Mobile No. - 9426353968 **Mr. Nishant J. Patel** Mobile No.-	**29.02.2025**

			079-22746175	9723338327 mail@delitepumps.com	
15)	**Mascot**	Upto 10 HP	**M/s. Mascot Pumps Ltd.,** 185/B, Phase-1, Nr. Havmor Ice cream, GIDC, Naroda, Ahmedabad- 382330 Ph. No. 079-22821252 / 22803161	**Mr. N. M. Prajapati** Mobile No. - 9879059434 **Mr. Chetan N. Prajapati** Mobile No. - 9979508668 mascot-pumpltd@gmai.com	**29.02.2023**
16)	**Saga**	Upto 15 HP	**M/s. Saga Windel Pumps Pvt. Ltd.,** Khodiyar Estate, Opp, Reliance Petrol Pump, Memco-Bapunagar Road Naroda, Ahmedabad-382345.	**Mr.** Phone No:- 9825015990 Mob No. 9377771599 **Email.id-** sagawindel@gmail.com	**31.08.2023**
17)	**Fillox**	Upto 15 HP	M/s. Divine pump Industries , Kathwada, GIDC, Ahmedabad. 382430	Mo No. 9898986300 Email Id tender.divinepump@gmail.com	**31.10.2023**
18)	Sagawindel	Upto 15 HP	M/S. Sagawindel pumps Pvt. Ltd.,Naroda, Ahmedabad. 382345	Mob. No. 9825015990, 9377771599 Email Id Sagawindel@gmail.com	**31.08.2023**
C)	**Centrifugal Monoblock Pump**				
1)	**JSL**	Upto 20 HP	**M/s. JSL industries Ltd,** N. H. No. 8, Mogar-388340, Tal. & Dist. Anand Gujarat. Phone No. 02692-	**Mr. D. B. Dave** Vice President MarketingMobile No:9687626893 vp@jslmogar.com **Mr. Gaurang P. Patel** Mobile No:	**31.12.2022**

			280224, 280254, 280316 .	9879944157 gppatel@jslmogar.com	
2)	**Mascot**	**Upto 2 HP**	**M/s. Mascot Pumps Ltd.,** 185/B, Phase-1, Nr. Havmor Ice cream, GIDC, Naroda, Ah-medabad- 382330 Ph. No. 079-22821252 / 22803161	**Mr. N. M. Prajapati** Mobile No. - 9879059434 **Mr. Chetan N. Prajapati** Mobile No. - 9979508668 mascot-pumpltd@gmai.com	**29.02.2023**
3)	**C.R.I.** Pumps	**Upto 25 HP**	C.R.I. Pumps Pvt. Ltd.,No.7/51, A, keranatham Road,sarvanam patti.coimbtore-641035	M/s. Jaipal Shetty Mo. 9022202 95 mumbai@cripumps.com www.crigroups.com	**31.05.2023**
4)	**VARUNA**	**No Limit**	La Gajjar ma-chineriesPvt. Ltd., Ahmeda-bad.	Ph./ Mob. 079-22777487, 9099935857 Emailld crm@lgmindia.com,	**31/10/2023**
D)	**Polder Submersible Pumps**				
1)	**JASCO**	**Upto 200 HP**	**M/s.JASCO Pumps Pvt.Ltd.** Plot No.47, phase- 1, Opp Mangal Estate, GIDC, Naroda, Ah-medabad- 382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. - 9374063726 hiresh.pandya@yahoo.com **Mr. Manish Puranik** Mobile No. - 9898059021 jascopump47@gmail.com	**30.06.2024**

2)	MBH Pumps	Upto 125 HP	**M/s. MBH Pumps (Guj)Pvt. Ltd,** 14, GIDC Industrial Estate, Naroda, Ahmedabad -Phone no. 079 / 22823066, 22822094	**Mr. Yogesh Vachhani** Asst. Manager Marketing Mobile No. - 9427533830 marketing@mbhpumps.com **Mr. Parth Kamania** Mobile No. - 9825467472	**30.09.2024**
3)	Harison	Upto 25 HP	**M/s. Harison Pumps Pvt. Ltd .** MIDC, Hingana Industrial Area, Nagpur. 440 028	**Mr. Bharath Deshmukh** Mobile No. - 9422106645Ph No. 07104-237100 harisonpump@gmail.com	**30.06.2023**
E)	**Submerged Centrifugal Pump Horizontal**				
1)	Aqua	No Limit	**M/s. Aqua MachineriesPvt Ltd.** Vatva, Ahmedabad-382445 Ph. No. 079-25840954 /240 / 915	**Mr. Ram Ghanvat** Contact No:- 9284711342 /9975174552 **Mr. Ajay Kulkarni** Contact No :- 8983223966 ace@aquapumps.com bpg@aquapumps.com	**31.10.2024**
2)	JASCO	Upto 200 HP	**M/s. JASCO Pumps Pvt. Ltd.** Plot No.47, phase-1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad-382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. - 9374063726 hiresh.pandya@yahoo.com **Mr. Manish Puranik** Mobile No. - 9898059021 jascopump47@gmail.com	**30.06.2024**
3)	MBH Pumps	Upto 150 HP	**M/s. MBH Pumps (Guj)Pvt. Ltd,** 14, GIDC Industrial Estate, Naroda, Ahmedabad -Phone no. 079 / 22823066, 22822094	**Mr. Yogesh Vachhani** Asst. Manager Marketing Mobile No. - 9427533830 marketing@mbhpumps.com **Mr. Parth Kamania** Mobile No. - 9825467472	**30.09.2024**

F)	Submerged Centrifugal Pump Vertical				
1)	Aqua	No Limit	M/s. Aqua Machineries Pvt Ltd. Vatva, Ahmedabad-382445 Ph. No. 079-25840954 /240 / 915	Mr. Ram Ghanvat Mobile No:- 9284711342 / 9975174552 Mr. Ajay Kulkarni Mobile No :- 8983223966 ace@aquapumps.com bpg@aquapumps.com	31.10.2024
2)	JASCO	Upto 200 HP	M/s.JASCO Pumps Pvt.Ltd. Plot No.47, phase- 1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad- 382330, Ph. No. 079-22821240	Mr. Hiresh Pandya Mobile No. - 9374063726 hiresh.pandya@yahoo.com Mr. Manish Puranik Mobile No. - 9898059021 jascopump47@gmail.com	30.06.2024
3)	MBH Pumps	Upto 150 HP	M/s. MBH Pumps (Guj)Pvt. Ltd, 14, GIDC Industrial Estate, Naroda, Ahmedabad Phone no. 079 / 22823066, 22822094	Mr. Yogesh Vachhani Asst. Manager Marketing Mobile No. - 9427533830 marketing@mbhpumps.com Mr. Parth Kamania Mobile No. - 9825467472	30.09.2024
G)	Vertical Submersible Turbine Pump				
1)	Aqua	No Limit	M/s. Aqua Machineries Pvt Ltd. Vatva, Ahmedabad-382445 Ph. No. 079-25840954 /240 / 915	Mr. Ram Ghanvat Mobile No:- 9284711342 / 9975174552 Mr. Ajay Kulkarni Mobile No :- 8983223966 ace@aquapumps.com bpg@aquapumps.com	31.10.2024

2)	JASCO	Upto 100 HP	**M/s. JASCO Pumps Pvt. Ltd.** Plot No.47, phase-1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad-382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. - 9374063726 hiresh.pandya@yahoo.com **Mr. Manish Puranik** Mobile No. - 9898059021 jascopump47@gmail.com	**30.06.2024**
H)	**Submersible Dewatering Pump**				
1)	JASCO	Upto 30 HP	**M/s.JASCO Pumps Pvt.Ltd.** Plot No.47, phase- 1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad- 382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. - 9374063726 hiresh.pandya@yahoo.com **Mr. Manish Puranik** Mobile No. - 9898059021 jascopump47@gmail.com	**30.06.2024**
2)	Harison	Upto 30 HP	**M/s. Harison Pumps Pvt. Ltd .** MIDC, Hingana Ind. Area Nagpur 440 028	**Mr. Bharath Deshmukh** Mobile No. - 9422106645 Ph No. 07104-237100 harisonpump@gmail.com	**30.06.2023**
I)	**Submersible Non Clog Sewage Pump**				
1)	Aqua	No Limit	**M/s. Aqua Machineries Pvt Ltd.** Vatva, Ahmedabad-382445 Ph. No. 079-25840954 / 240 / 915	**Mr. Ajay Kulkarni** Mobile No :- 8983223966 ace@aquapumps.com **Mrs. Hetal Shah** Mobile No:- 8000153324 marketing@aquapumps.com	**31.10.2024**
2)	JASCO	Upto 350 HP	**M/s.JASCO Pumps Pvt.Ltd.** Plot No.47, phase- 1, Opp Mangal Estate, GIDC, Naroda, Ahmedabad- 382330, Ph. No. 079-22821240	**Mr. Hiresh Pandya** Mobile No. - 9374063726 hiresh.pandya@yahoo.com **Mr. Manish Puranik** Mobile No. -	**30.06.2024**

				9898059021 jascopump47@gmail.com	
3)	MBH Pumps	Upto 150 HP	M/s. MBH Pumps (Guj) Pvt. Ltd, 14, GIDC Industrial Estate, Naroda, Ahmedabad -Phone no. 079 / 22823066, 22822094	Mr. Yogesh Vachhani Asst. Manager Marketing Mobile No. - 9427533830 marketing@mbhpumps.com Mr. Parth Kamania Mobile No. - 9825467472	30.09.2024
4)	CNP	Upto 50 HP	M/s. CNP Pumps India Pvt. Ltd., Plot No. 502, Sambhav IT Park, TJSB House, Wagle Industrial Estate, Thane - 400604 sales@cnpindia.com	Mr. Vivekanand Pai Contact No: 9167209935 vsp@cnpindia.com Mrs. Rashmi Nandgaonkar Mobile No. 9167495323 rashmi.n@cnpindia.com	31.12.2024
5)	Harison	Upto 25 HP	M/s. Harison Pumps Pvt. Ltd . MIDC, Hingana Industrial Area, Nagpur. 440 028	Mr. Bharath Deshmukh Mobile No. - 9422106645 Ph No. 07104-237100 harisonpump@gmail.com	30.06.2023
J)	Vertical Non Clog Pump				
1)	Kishor		M/s Kishor Pumps Pvt. Ltd., MIDC , Pimpari , Pune 411018	Ph. 020-27472616, 9011012802 Email info@kishorpumps.com	30.09.2025
K)	Vertical Turbine Pump				
1)	Flowmore	No Limit	M/s. Flowmore Ltd, 714 / 715, Marathon Max, Mulund Goregaon Link Road, Mulund (W), Mumbai - 400080	Mr. Ajishkumar Mobile No. 9323805918 / 9930105918 ajish.kumar@flowmoregroup.com Mr. Ramanuj Pandey Mobile No. 9322876872 ramanujpandey@flowmoregroup.in	30.09.2024

2)	JYOTI	No Limit	M/s. Jyoti Ltd., Nanubhai Amin Marg, PO Chemical Industrial,Vadodara-390003.	Ph.No.0265-3054444 Mob.No.924174649/ 9324028701	31.07.2025
3)	CNP	Upto 200 HP	**M/s. CNP Pumps India Pvt. Ltd.,** Plot No. 502, Sambhav IT Park, TJSB House, Wagle Industrial Estate, Thane - 400604 sales@cnpindia.com	**Mr. Vivekanand Pai** Contact No: 9167209935 vsp@cnpindia.com **Mrs. Rashmi Nandgaonkar** Mobile No. 9167495323 rashmi.n@cnpindia.com	31.12.2024
4)	Deccan-Karvel	Upto 200 HP	**M/s. Deccan Industries** No 1390, Sathy Main Road, Ganpathy, Coimbatore-641006 Tamilnadu	**Mr. Gopal Krishnan** Mobile No. - 9965796960 gopal@deccanindustries.com **Mr. Rohan Inamdar** Mobile No.- 9623830404 rohan@karvel.in	31.12.2023
L)	**Centrifugal Horizontal Split Case Pump**				
1)	Flowmore	No Limit	**M/s. Flowmore Ltd,** 714 / 715, Marathon Max, Mulund Goregaon Link Road,Mulund (W),Mumbai - 400080	**Mr. Ajishkumar** Mobile No. 9323805918 / 9930105918 ajish.kumar@flowmoregroup.com **Mr. Ramanuj Pandey** Mobile No. 9322876872 ramanujpandey@flowmoregroup.in	30.09.2024
2)	JYOTI	No Limit	M/s. Jyoti Ltd., Nanubhai Amin Marg, PO Chemical Industrial,Vadodara-390003.	Ph.No.0265-3054444 Mob.No.924174649/ 9324028701	31.07.2025
3)	Deccan-Karvel	Upto 200 HP	**M/s. Deccan Industries** No 1390, Sathy Main Road, Ganpathy, Coimba-	**Mr. Gopal Krishnan** Mobile No. - 9965796960 gopal@deccanindustries.com **Mr. Rohan Inamdar**	31.12.2023

			tore-641006 Tamilnadu	Mobile No.- 9623830404 rohan@karvel.in	
4)	CNP	Upto 100 HP	**M/s. CNP Pumps India Pvt. Ltd.,** Plot No. 502, Sambhav IT Park, TJSB House, Wagle Industrial Estate, Thane - 400604 sales@cnpindia.com	**Mr. Vivekanand Pai** Contact No: 9167209935 vsp@cnpindia.com **Mrs. Rashmi Nandgaonkar** Mobile No. 9167495323 rashmi.n@cnpindia.com	**31.12.2024**
5)	MBH Pumps	Upto 100 HP	**M/s. MBH Pumps (Guj) Pvt. Ltd,** 14, GIDC Industrial Estate, Naroda, Ahmedabad -Phone no. 079 / 22823066, 22822094	**Mr. Yogesh Vachhani** Asst. Manager Marketing Mobile No. - 9427533830 marketing@mbhpumps.com **Mr. Parth Kamania** Mobile No. - 9825467472	**30.09.2024**
2	Cast Iron Valves PN 1.0 & 1.6 rating				
A)	Cast Iron Sluice Valves as per IS 14846 : 2000				
1)	Durga & DVPL	Upto 1500 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah - 711104. Ph. No. 033 - 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mumbai@durgavalves.com dvplmum.offers@gmail.com **Mr. Pijush Roy** Mobile No.: 9830023032 kolkata@durgavalves.com	**31.10.2024**

2)	**MARCK Brand**	**Up to 1500 mm dia**	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles UnitNo. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
3)	**Jupiter**	**Upto 1400 mm Dia**	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
4)	**Balaji**	**Upto 1200 mm dia**	**M/s. Shree Balaji Industries,** 72/A, Manikpirtala, 2nd bye lane, Shibtola, Baltikuri, Howrah - 711 113.	**Mr. Yash Surekha** Mobile No. 9748225649 / 9331006076 balajivalveskol@gmail.com	**31.10.2024**
5)	**Cair**	**Upto 1200 mm dia**	**M/s. Cair Euromatic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405. gov.cairindia@gmail.com	**Mr. Shaukat Inamdar** Mobile No. 9545550059 / mkt@caireuromatic.com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr. Shakir Tamboli** Mobile No.: 9545558156	**30.06.2024**

6)	Infra	Upto 1200 mm dia	**M/s. Shree Krishna Industries,** P - 261 / 1, Benaras Road, Belgachia, Howrah - 711108 (West Bengal)	**Mr. Rahul Nandy** Mobile No.: / 9163905657 skivalves@gmail.com **Mr. Premjit Mohanty** Mobile No.: 9348602402 skivalves.mkt@gmail.com	**31.08.2024**
7)	Kamala	Up to 1200 mm dia	**M/s. Kamala Valves & Engineering Pvt. Ltd.** 41 / 2, 'Q' Road, Belgachia, Howrah -711108.	**Mr. Bimal Mukherjee** Mobile No.:- 9433023637 kamalavalves@rediffmail.com	**31.03.2024**
8)	KEW	Up to 1200 mm dia	**M/s. Ketan Engineering Works,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Rajkot Highway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- ketanengiw@yahoo.in **Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**
9)	Super	Up to 1200 mm dia	**Super Valve Manufacturing Co.,**	**Ph. No. 033-26675343 , 8334945454, 9830329954 Email** super-valve2002@yahoo.co.in	**30.09.2025**
10)	KPM	Up to 1200 mm dia	**M/s. K.P.Mondal & Sons,** 206 / 1, Panchanantala Road, Kadamatala, Howrah -711101 (West Bengal) Phone 033-26530673	**Mr. K.P.Mondal** Mobile No. 9883071922 contact@kpmvalves.com kpmondal&sons@gmail.com	**31.12.2024**

Contractor No of Correction Executive Engineer SMKC

11)	KVMC Brand	Up to 1200 mm dia	**M/s. Kamala Valves Manufacturing Concern**, Kazipara, Howrah. 711 108 Ph. No. 033-26517016	**Mr. Kamal Mukherjee** Mobile No. 9830089590 kamalkvmc@gmai.com kamalkvmc@yahoo.in	**30.06.2023**
12)	LP	Up to 1200 mm dia	**M/s. Perfect Valves Pvt. Ltd.,** Wariana Industrial Complex, Sangal Sohal Road, Jalandhar-144013	**Mr. Vivek Sehgal, Director** Mobile No. : 9814060747 / 8700258549 mktg.lpvalve@gmail.com	**30.11.2023**
13)	Mahadevi	Up to 1200 mm dia	**M/s. Mahadevi Industries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 - 26537777	**Mr. Shashikant Sharma** Mobile No. 9421801904 / 9130943964 mahadevi.maharashtra@gmail.com mahadevi.kolkata@gmail.com	**30.09.2024**
14)	Mayur	Up to 1200 mm dia	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhydro@gmail.com **Mr. Nandkumar Kulkarni** Mobile No: 9130929088	**31.12.2024**
15)	R.D. Multiples	Up to 1200 mm dia	**M/s. R.D.Multiples (Metal cast) Pvt. Ltd.** GIDC Pardi, Valsad, Gujarat - 396125	**Ph. No. 022- 40044425 to 29** Email id - mumbai@rdmultiples.com, pardi@rdmultiples.com	**31.01.2023**

16)	**SSPR**	**Up to 1200 mm dia**	**M/s. SSPR Valve Manufacturing Pvt.Ltd.,** ONGC Road, Dakshin Jhapordha, Domjur, Howrah - 711405	**Mr. Prasenjit Dey** Mobile No: 9836137167 / 7044090444 info@ssprvalve.com **Mr. Shashanka Dey** Contact No: 8013270171 dey_shashanka@rediffmail .com	**31.12.2024**
17)	kejriwal	**Up to 1200 mm dia**	M/s. Kejriwal Costing Ltd., NH-06, Chamrail, Near Kona power Substation How-rah- 711323.	Mr. Pawan Jalan Mo.98314227 21 Email in-fo@kejriwalcastings.com	**31.05.2023**
18)	**GM Brand**	**Up to 1000 mm dia**	**M/s G.M.Engineering Pvt Ltd.** Village Metoda, Rajkot - 3600 21 Ph. No. 02827- 287658	**Mr. H. Rajarama** As-sociate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com, hrajara-ma@gmengg.com	**31.08.2023**
19)	**AARKO**	**Upto 1000 mm dia**	AARKO Mfg. Company 74-75, Ind. Estate, Be-hind-Checks,Jalandh ar Punjab-144012.	Kamal Kohlu Mob- 9463502625 aarkomfg@gmail.com	**29.02.2025**
20)	**Calsens**	**Up to 800 mm dia**	M/s. Calsens Pri-vate Ltd., 40 / 1 A, Makardah Road, P. O. Kadamtala, How-rah -711101	Mobile No. - 9903022200. Phone No. 033- 22486527 / 22430665. E-mail ho@calsens.com	**30.06.2023**

21)	**Agro**	**Upto 600 mm dia**	**M/s. Jay Ess Industries,** S-141, Industrial Area, Sodal Road, Jalandhar, Punjab. 144004 Ph. No. 0181/ 5054790	**Mr. Amrik Singh** Mobile No.: 9815035140 / 9592130301 **Mr. G. P. Singh** Mobile No.: 9316998889 agrovalve@gmail.com, amrik_singh55@yahoo.in	**31.05.2024**
22)	**DECO**	**Up to 600 mm dia**	**M/s. Tirupati Industries,** 38/3 ,Kantapukur lane, Howrah, 711 101.	**Mr. Girish Nargunde** Mobile No. 9819983497 / 9433119199. tirupati.valves@gmail.com Phone No. 033- 26771007	**30.06.2023**
23)	**Kartar**	**Up to 600 mm dia**	**M/s. Kartar Valves Pvt. Ltd.,** Juneja Complex, Villlage Varina, Kapurthala Road, Jalandhar - 144013	Ph No. 0181-2651500, 1551, 0321 Mob.No-09915762416 info@kartarvalves.com, tilak@kartarvalves.com	**31.08.2023**
24)	**Leader**	**Up to 500 mm dia**	**M/s. Leader Valves Ltd.,** S-3, S-4 Industrial Area, Jalandhar – 144004 Punjab.	**Mr. Jogesh Saini** Mobile No.: 9216976955 **Mr. Rajeev Gupta** Mobile No.: 9223174939 info@leadervalves.com	**31.03.2024**

B)	**Cast Iron Non Return Valves as per IS 5312 (Part 1) : 2004**				
1)	**MARCK Brand**	**Up to 1800 mm dia**	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles UnitNo. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
2)	**Durga & DVPL**	**Upto 1500 mm dia**	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mumbai@durgavalves.com dvplmum.offers@gmail.com**Mr. Pijush Roy** Mobile No.: 9830023032 kolkata@durgavalves.com	**31.10.2024**
3)	**Jupiter**	**Upto 1400 mm Dia**	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
4)	**Calsens**	**Up to 800 mm dia**	**M/s. Calsens Private Ltd.,** 40 / 1 A, MakardahRoad, P. O. Kadamtala, Howrah -711101	**Mobile No. 9903022200** Phone No. 033- 22486527 / 22430665. E-mail ho@calsens.com	**30.06.2023**

5)	Mahadevi	Up to 800 mm dia	**M/s. Mahadevi Industries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 – 26537777	**Mr. Shashikant Sharma** Mobile No. 9421801904 / 9130943964 mahadevi.maharashtra@gmail.com mahadevi.kolkata@gmail.com	**30.09.2024**
6)	Mayur	Up to 800 mm dia	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik – 422007. Phone No. 0253 – 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhydro@gmail.com **Mr. Nandkumar Kulkarni** Mobile No: 9130929088	**31.12.2024**
7)	Super	Up to 800mm dia	**Super Valve Manufacturing Co.,**	**Ph. No. 033-26675343 , 8334945454, 9830329954 Email** super-valve2002@yahoo.co.in	**30.09.2025**
8)	Agro	Upto 600 mm dia	**M/s. Jay Ess Industries,** S-141, Industrial Area, Sodal Road, Jalandhar, Punjab. 144004 Ph. No. 0181/ 5054790	**Mr. Amrik Singh** Mobile No.: 9815035140 / 9592130301 **Mr. G. P. Singh** Mobile No.: 9316998889 agrovalve@gmail.com, amrik_singh55@yahoo.in	**31.05.2024**
9)	GM Brand	Up to 600 mm dia	**M/s. G.M.Engineering Pvt Ltd.** Village Metoda,Rajkot -360021 Ph. No. 02827- 287658	**Mr. H. Rajarama** Associate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com, hrajarama@gmengg.com	**31.08.2023**

10)	Infra	Upto 600 mm dia	**M/s. Shree Krishna Industries,** P - 261 / 1, Benaras Road, Belgachia, Howrah – 711108(West Bengal)	**Mr. Rahul Nandy** Mobile No.: / 9163905657 skivalves@gmail.com **Mr. Premjit Mohanty** Mobile No.: 9348602402 skivalves.mkt@gmail.com	**31.08.2024**
11)	Kartar	Up to 600 mm dia	**M/s. Kartar Valves Pvt. Ltd.,** Juneja Complex, Villlage Varina, Kapurthala Road, Jalandhar - 144013	Ph No. 0181-2651500, 1551, 0321 Mob.No-09915762416 Email- info@kartarvalves.com, tilak@kartarvalves.com	**31.08.2023**
12)	KEW	Up to 600 mm dia	**M/s. Ketan Engineering Works,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Rajkot Highway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- ketanengiw@yahoo.in **Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**
13)	KPM	Up to 600 mm dia	**M/s. K.P.Mondal & Sons,** 206 / 1, Panchanantala Road, Kadamatala, Howrah -711101 (West Bengal) Phone 033-26530673	**Mr. K.P.Mondal** Mobile No. 9883071922 contact@kpmvalves.com kpmondal&sons@gmail.com	**31.12.2024**
14)	AARKO	Upto 600 mm dia	AARKO Mfg. Company 74-75, Ind. Estate, Behind-Checks,Jalandhar Punjab-144012.	Kamal Kohli Mob-9463502625 aarkomfg@gmail.co	**29.02.2025**

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15)	**SSPR**	**Up to 600 mm dia**	**M/s. SSPR Valve Manufacturing Pvt.Ltd.,** ONGC Road, Dakshin Jhapordha, Domjur, Howrah - 711405	**Mr. Prasenjit Dey** Mobile No: 9836137167 / 7044090444 info@ssprvalve.com **Mr. Shashanka Dey** Contact No: 8013270171 dey_shashanka@rediffmail.com	**31.12.2024**
16)	**Kejriwal**	**Up to 600 mm dia**	M/s. Kejriwal Costing Ltd., NH-06, Chamrail, Near Kona power Sub-station Howrah-711323.	Mr. Pawan Jalan Mo.98314227 21 Email in-fo@kejriwalcastings.com	31.05.2023
17)	**Leader**	**Up to 500 mm dia**	**M/s. Leader Valves Ltd.,** S-3, S-4 In-dustrialArea, Jal-andhar – 144004 Punjab, India.	**Mr. Jogesh Saini** Mobile No.: 9216976955**Mr. Rajeev Gupta** Mo-bile No.: 9223174939in-fo@leadervalves.com	**31.03.2024**
18)	**LP**	**Up to 300 mm dia**	**M/s. Perfect Valves Pvt.Ltd.,** Wariana Industrial Complex, Sangal Sohal Road, Jalandhar-144013	**Mr. Vivek Sehgal, Direc-tor** Mobile No. : 9814060747 / 8700258549 mktg.lpvalve@gmail.com	**30.11.2023**
C)	**Cast Iron Knife Edge Gate Valves**				

1)	**MARCK Brand**	**Up to 1200mmdia**	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles UnitNo. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** MobileNo. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com**Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
2)	**AARKO**	**Up to 600 mm dia**	AARKO Mfg. Company 74-75, Ind. Estate, Behind-Checks,Jalandhar Punjab-144012.	Kamal Kohli Mob-9463502625 aarkomfg@gmail.com	29.02.2025
3)	**Kejriwal**	**Up to 600 mm dia**	M/s. Kejriwal Casting Ltd., NH-06, Chamrail,Near Kona power Substation Howrah-711323.	Mr. Pawan Jalan Mo.98314227 21 Email info@kejriwalcastings.com	31.05.2023
4)	**Leader**	**Up to 400 mm dia**	**M/s. Leader Valves Ltd.,** S-3, S-4 IndustrialArea, Jalandhar - 144004 Punjab, India.	**Mr. Jogesh Saini** Mobile No.: 9216976955**Mr. Rajeev Gupta** Mobile No.: 9223174939 info@leadervalves.com	**31.03.2024**
D)	**Cast Iron Butterfly Valves as per IS 13095 : 1991**				
1)	**Durga &DVPL**	**Upto 2000 mm dia**	**M/s. Durga ValvesPvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah - 711104.	**Mr. Mayank DK Dube** MobileNo.: 9324515987 / 9867025324 mumbai@durgavalves.com	**31.10.2024**

			Ph. No. 033 -26778088 / 26778713	dvplmum.offers@gmail.com **Mr. Pijush Roy** Mobile No.: 9830023032 kol-kat-ta@durgavalves.com	
2)	**Jupiter**	Upto 2000 mm Dia	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** MobileNo. 9830266882 ho@jupitervalves.com **Mr.Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
3)	**KEW**	Up to 2000 mm dia	**M/s. Ketan EngineeringWorks,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - RajkotHighway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- ketanengiw@yahoo.in **Mr. Ajay D Chandesara** Mobile No.8160509267/7211110575	**31.10.2024**
4)	**MARCK Brand**	Up to 2000 mm dia	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles UnitNo. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
5)	**Dynamic**	Upto 1800 mm dia	**M/s. Dynamic Valves Pvt. Ltd.** R-353, RabaleMIDC, Navi Mumbai.-400701	**Mr. Nagesh Soparkar** Mobile No. 9892276921 info@dynamicvalves.c	**30.09.2024**

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6)	R.D. Multiples	Up to 1600 mm dia	M/s. R.D.Multiples (Metal cast) Pvt. Ltd.,GIDC Pardi, Valsad, Gujarat - 396125	Ph. No. 022- 40044425 to 29 Email id - mum-bai@rdmultiples.com , pardi@rdmultiples.com	31.01.2023
7)	Infra	Upto 1500 mm dia	M/s. Shree Krishna In-dustries, P - 261 / 1, Benaras Road, Belgachia, How-rah - 711108(West Bengal)	Mr. Rahul Nandy Mobile No.: / 9163905657 skivalves@gmail.com Mr. Premjit Mohan-ty Mobile No.: 9348602402 skivalves.mkt@gmail.com	31.08.2024
8)	Cair	Up to 1200 mm dia	M/s. Cair Euro-matic Automation Pvt. Ltd., Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405.	Mr. Shaukat Inam-dar Mobile No. 9545550059 / mkt@caireuromatic.com Mr. Tousif Sayyed Mobile No.: 9545519666 gov.cairindia@gmail.com	30.06.2024
9)	GM Brand	Up to 1200 mm dia	M/s G.M.Engineering Pvt Ltd. Village Metoda, Rajkot - 3600 21, Ph. No. 02827- 287658	Mr. H. Rajarama Associate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com , hrajara-ma@gmengg.com	31.08.2023

10)	Kamala	Up to 1200 mm dia	**M/s. Kamala Valves & Engineering Pvt. Ltd.** 41 / 2, 'Q' Road, Belgachia, Howrah -711108.	**Mr. Bimal Mukherjee** Mobile No.:- 9433023637 Email id :- kamala-valves@rediffmail.com	**31.03.2024**
11)	KPM	Up to 1200 mm dia	**M/s. K.P.Mondal & Sons,** 206 / 1, Panchanantala Road, Kadamatala, Howrah -711101 (West Bengal) Phone 033-26530673	**Mr. K.P.Mondal** Mobile No. 9883071922 contact@kpmvalves.com kpmondal&sons@gmail.com	**31.12.2024**
12)	Mahadevi	Up to 1200 mm dia	**M/s. Mahadevi-Industries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 – 26537777	**Mr. Shashikant Sharma** Mobile No. 9421801904 / 9130943964 mahadevi.maharashtra@gmail.com mmahadevi.kolkata@gmail.com	**30.09.2024**
13)	Kejriwal	Up to 1200 mm dia	M/s. Kejriwal Costing Ltd., NH-06, Chamrail, Near Kona power Substation Howrah- 711323.	Mr. Pawan Jalan Mo.9831422721 Email info@kejriwalcastings.com	**31.05.2023**
14)	AARKO	Up to 600 mm dia	AARKO Mfg. Company 74-75, Ind. Estate, Behind-Checks, Jalandhar Punjab-144012.	Kamal Kohlu Mob-9463502625 aarkomfg@gmail.com	**29.02.2025**
15)	SSPR	Up to 1100 mm	**M/s. SSPR Valve Manufacturing Pvt.Ltd.,** ONGC Road, Dakshin Jhapordha,	**Mr. Prasenjit Dey** Mobile No: 9836137167 /7044090444 info@ssprvalve.com **Mr. Shashanka Dey**	**31.12.2024**

		dia	Domjur, Howrah - 711405	Contact No: 8013270171 dey_shashanka@rediffmail.com	
16)	Leader	Up to 400 mm dia	**M/s. Leader Valves Ltd.,** S-3, S-4 Industrial Area, Jalandhar – 144004 Punjab, India.	**Mr. Jogesh Saini** Mobile No.: 9216976955**Mr. Rajeev Gupta** Mobile No.: 9223174939 info@leadervalves.com	**31.03.2024**
E)	**Cast Iron Air Valve & Kinetic Air Valves as per IS 14845 : 2000**				
1)	Durga & DVPL	Upto 300 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, CanalSide, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mumbai@durgavalves.com dvplmum.offers@gmail.com**Mr. Pijush Roy** Mobile No.: 9830023032 kolkata@durgavalves.com	**31.10.2024**
2)	Jupiter	Upto 300 mm Dia	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
3)	Calsens	Up to 200 mm dia	**M/s. Calsens Private Ltd.,** 40 / 1 A, Makardah Road, P. O. Kadamtala, Howrah -711101	Phone No. 033- 22486527 / 22430665. Mobile No. 9903022200. E-mail ho@calsens.com	**30.06.2023**

4)	Infra	Upto 200 mm dia	**M/s. Shree Krishna In-dustries,** P - 261 / 1, Benaras Road, Belgachia, How-rah - 711108(West Bengal)	Mr. Rahul Nandy Mobile No.: / 9163905657 skivalves@gmail.co m Mr. Premjit Mo-hanty Mobile No.: 9348602402 skivalves.mkt@gmail.co m	**31.08.20 24**
5)	Kamala	Up to 200 mm dia	**M/s. Kamala Valves & Engineering Pvt. Ltd.** 41 / 2, 'Q' Road, Belgachia, How-rah -711108.	Mr. Bimal Mukher-jee Mobile No.:- 9433023637 Email id :- kama-la-valves@rediffmail.com	**31.03.20 24**
6)	Kartar	Up to 200 mm dia	**M/s. Kartar Valves Pvt. Ltd.,** Juneja Complex, Villlage Varina, Kapurthala Road, Jalandhar - 144013	Ph No. 0181-2651500, 1551, 0321 Mob.No-09915762416 Email- in-fo@kartarvalves.com, til-ak@kartarvalves.com	**31.08.20 23**
7)	KEW	Up to 200 mm dia	**M/s. Ketan Engi-neering Works,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Raj-kot Highway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- keta-nengiw@yahoo.in **Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.20 24**
8)	KPM	Up to 200 mm dia	**M/s. K.P.Mondal & Sons,** 206 / 1, Panchanantala Road, Kadamatala, Howrah -711101 (West Bengal) Phone 033-26530673	**Mr. K.P.Mondal** Mobile No. 9883071922 con-tact@kpmvalves.com kpmon-dal&sons@gmail.com	**31.12.2 024**

9)	**KVMC Brand**	**Up to 200 mm dia**	**M/s. Kamala Valves Manufacturing Concern,** Kazipara, Howrah. 711 108 Ph. No. 033-26517016	**Mr. Kamal Mukherjee** Mobile No. 9830089590 kamalkvmc@gmai. com kamalkvmc@yahoo .in	**30.06.2023**
10)	**LP**	**Up to 200 mm dia**	**M/s. Perfect Valves Pvt. Ltd.,** Wariana Industrial Complex, Sangal Sohal Road, Jalandhar-144013	**Mr. Vivek Sehgal, Director** Mobile No. : 9814060747 / 8700258549 Email id :- mktg.lpvalve@gmai l.com	**30.11.2023**
11)	**Mahadevi**	**Up to 200 mm dia**	**M/s. Mahadevi Industries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 - 26537777	**Mr. Shashikant Sharma** Mobile No. 9421801904 / 9130943964 mahade-vi.maharashtra@gmail.com mahade-vi.kolkata@gmail.com	**30.09.2024**
12)	**MARCK Brand**	**Up to 200 mm dia**	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles Unit No. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd .com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marck-hawa.cair@gmail.com	**30.09.2024**
13)	**Mayur**	**Up to 200 mm dia**	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhy-dro@gmail.com **Mr. Nandkumar Kulkarni** Mobile No: 9130929088	**31.12.2024**

14)	SSPR	Up to 200 mm dia	M/s. SSPR Valve Manufacturing Pvt.Ltd.,ONGC Road, Dakshin Jhapordha, Domjur, Howrah - 711405	Mr. Prasenjit Dey Mobile No: 9836137167 / 7044090444 info@ssprvalve.com Mr. Shashanka Dey Contact No: 8013270171 dey_shashanka@rediffmail.com	31.12.2024
15)	Kejriwal	Up to 200 mm dia	M/s. Kejriwal Costing Ltd., NH-06, Chamrail,Near Kona power Sub-station Howrah-711323.	Mr. Pawan Jalan Mo.9831422721 Email in-fo@kejriwalcastings.com	31.05.2023
F)	Cast Iron Temper Proof Air Valves				
1)	Durga & DVPL	Upto 300 mm dia	M/s. Durga Valves Pvt. Ltd. Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	Mr. Mayank DK Dube Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.comMr. Pijush Roy Mobile No.: 9830023032 kol-katta@durgavalves.com	31.10.2024
2)	Jupiter	Upto 300 mm Dia	M/s. Jupiter Engi-neering Company, Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	Mr. Avijeet Karar Mobile No. 9830266882 ho@jupitervalves.com Mr. Sunil Pawar Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	31.12.2024
3)	KEW	Up to 200 mm	M/s. Ketan Engi-neeringWorks, Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Raj-	Mr. Sandip B Patel Mobile No. 8238036592/9925236592 Email- keta-nengiw@yahoo.inMr. Ajay D Chandesara Mobile No.	31.10.2024

		dia	kot Highway, Surendranagar - 363001.	8160509267/7211110575	
4)	Infra	Upto 200 mm dia	**M/s. Shree Krishna In-dustries,** P - 261 / 1, Benaras Road, Belgachia, How-rah - 711108 (West Bengal)	**Mr. Rahul Nandy** Mobile No.: / 9163905657 skivalves@gmail.co m **Mr. Premjit Mohanty** Mobile No.: 9348602402 skivalves.mkt@gmai l.com	**31.08.20 24**
5)	KPM	Up to 200 mm dia	**M/s. K.P.Mondal & Sons,** 206 / 1, Panchanantala Road, Kadamatala, Howrah -711101 (West Bengal) Phone 033-26530673	**Mr. K.P.Mondal** Mobile No. 9883071922 con-tact@kpmvalves.co m kpmon-dal&sons@gmail.com	**31.12.20 24**
6.	Mayur	Up to 200 mm dia	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhy-dro@gmail.com **Mr. Nandkumar Kul-karni** Mobile No: 9130929088	**31.12.20 24**
7)	SSPR	Up to 200 mm dia	**M/s. SSPR Valve Manufacturing Pvt.Ltd.,** ONGC Road, Dakshin Jhapordha, Domjur, Howrah - 711405	**Mr. Prasenjit Dey** Mobile No: 9836137167 / 7044090444 info@ssprvalve.com **Mr. Shashanka Dey** Contact No: 8013270171 dey_shashanka@rediffma il.com	**31.12.20 24**

8)	Super	Up to 200mm dia	Super Valve Manufacturing Co.,	Ph. No. 033-26675343 , 8334945454, 9830329954 Email super-valve2002@yahoo.co.in	30.09.2025
G)	Cast Iron Sluice Gates				
1)	Jupiter	Upto 2000 x 2000 mm	M/s. Jupiter Engineering Company, Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	Mr. Avijeet Karar Mobile No. 9830266882 ho@jupitervalves.com Mr. Sunil Pawar Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	31.12.2024
3	Ductile Iron / S. G. Iron Valves PN 1.0 & 1.6 rating				
A)	Ductile Iron / S. G. Iron Sluice Valve Metal & Resilient Seated Glandless Type				
1)	Durga & DVPL	Upto 1500 mm dia	M/s. Durga Valves Pvt. Ltd. Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	Mr. Mayank DK Dube Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.comMr. Pijush Roy Mobile No.: 9830023032 kol-kat-ta@durgavalves.com	31.10.2024
2)	Jupiter	Upto 1400 mm Dia	M/s. Jupiter Engineering Company, Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	Mr. Avijeet Karar Mobile No. 9830266882 ho@jupitervalves.com Mr. Sunil Pawar Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	31.12.2024

3)	Infra	Upto 1200 mm dia	**M/s. Shree Krishna Industries,** P - 261 / 1, Benaras Road, Belgachia, Howrah - 711108(West Bengal)	**Mr. Rahul Nandy** Mobile No.: / 9163905657 skivalves@gmail.com **Mr. Premjit Mohanty** Mobile No.: 9348602402 skivalves.mkt@gmail.com	**31.08.2024**
4)	LP	Up to 1200 mm dia	**M/s. Perfect Valves Pvt. Ltd.,** Wariana Industrial Complex, Sangal Sohal Road, Jalandhar-144013	**Mr. Vivek Sehgal, Director** Mobile No. : 9814060747 / 8700258549 mktg.lpvalve@gmail.com	**30.11.2023**
5)	Mahadevi	Up to 1200 mm dia	**M/s. Mahadevi Industries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 - 26537777	**Mr. Shashikant Sharma** Mobile No. 9421801904 / 9130943964 mahadevi.maharashtra@gmail.com mahadevi.kolkata@gmail.com	**30.09.2024**
6)	MARCK Brand	Up to 1200 mm dia	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles Unit No. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
7)	Cair	Up to 1200 mm dia	**M/s. Cair Euromatic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol	**Mr. Shaukat Inamdar** Mobile No. 9545550059 / mkt@caireuromatic.com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr.**	**30.09.2025**

			Road, Ahmedabad - 382405.	**Shakir Tamboli** Mobile No.: 9545558156 gov.cairindia@gmail.com	
7)	**GM Brand**	**Up to 1000 mm dia**	**M/s G.M.Engineering Pvt Ltd.** Village Metoda, Rajkot - 3600 21, Ph. No. 02827- 287658	**Mr. H. Rajarama** Associate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com , hrajara-ma@gmengg.com	**31.08.2023**
8.	**KEW**	**Up to 1000 mm dia**	**M/s. Ketan Engi-neeringWorks,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Raj-kot Highway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- keta-nengiw@yahoo.in**Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**
9)	**Mayur**	**Up to 600 mm dia**	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik – 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhy-dro@gmail.com **Mr. Nandkumar Kul-karni**Mobile No: 9130929088	**31.12.2024**
10)	**Super**	**Up to 1200mm dia**	**Super Valve Man-ufacturing Co.,**	**Ph. No. 033-26675343 , 8334945454, 9830329954 Email super-valve2002@yahoo.co.in**	**30.09.2025**
B)	**Ductile Iron / S. G. Iron Non return Valves**				

1)	Durga & DVPL	Upto 1500 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 2677871	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail .com**Mr. Pijush Roy** Mobile No.: 9830023032 kol-katta@durgavalves.com	**31.10.2024**
2)	R.D. Multiples	Up to 1500 mm dia	**M/s. R.D.Multiples** (Metal cast) Pvt. Ltd. GIDC Pardi, Valsad, Guajrat - 396125	Ph. No. 022- 40044425 to 29. Email id - mum-bai@rdmultiples.co m, pardi@rdmultiples.c om	**31.01.2023**
3)	Jupiter	Upto 1400 mm Dia	**M/s. Jupiter Engi-neering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves. com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
4)	Mahadevi	Up to 800 mm dia	**M/s. MahadeviIndus-tries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 – 26537777	**Mr. Shashikant Sharma**Mobile No. 9421801904 / 9130943964 mahade-vi.maharashtra@gmail.c om mahade-vi.kolkata@gmail.com	**30.09.2024**
5)	Super	Up to 800mm dia	**Super Valve Man-ufacturing Co.,**	**Ph. No. 033-26675343 , 8334945454, 9830329954 Email super-valve2002@yahoo.co.in**	**30.09.2025**

6)	**Cair**	**Up to 800mm dia**	**M/s. Cair Euro-matic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405.	**Mr. Shaukat Inam-dar** Mobile No. 9545550059 / mkt@caireuromatic .com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr. Shakir Tamboli** Mobile No.: 9545558156 gov.cairindia@gmail.com	**30.09.2025**
7)	**GM Brand**	**Up to 600 mm dia**	**M/s. G. M. Engi-neeringPvt Ltd.** Vil-lage Metoda, Rajkot - 3600 21, Ph. No. 02827- 287658	**Mr. H. Rajarama** Associate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com , hrajara-ma@gmengg.com	**31.08.2023**
8)	**Infra**	**Upto 600 mm dia**	**M/s. Shree Krishna In-dustries,** P - 261 / 1, Benaras Road, Belgachia, How-rah - 711108(West Bengal)	**Mr. Rahul Nandy** Mobile No.: / 9163905657 skivalves@gmail.co m **Mr. Premjit Mohan-ty** Business Devel-opment Mobile No.: 9348602402 skivalves.mkt@gmail .com	**31.08.2024**
9)	**KEW**	**Up to 300 mm dia**	**M/s. Ketan Engi-neeringWorks,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Raj-kot Highway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- keta-nengiw@yahoo.in**Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**

10)	LP	Up to 300 mm dia	**M/s. Perfect Valves Pvt. Ltd.,** Wariana Industrial Complex, Sangal Sohal Road, Jalandhar-144013	**Mr. Vivek Sehgal, Director** Mobile No. : 9814060747 / 8700258549 mktg.lpvalve@gmail.com	**30.11.2023**
C)	**Ductile Iron / S. G. Iron Duel Plate Check Valves**				
1)	**MARCK Brand**	Up to 1800 mm dia	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles Unit No. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad 05	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
D)	**Ductile Iron / S. G. Iron Butterfly Valves Metal & Resilient Seated**				
1)	**Durga & DVPL**	Upto 2000 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mumbai@durgavalves.com dvplmum.offers@gmail.com**Mr. Pijush Roy** Mobile No.: 9830023032 kolkata@durgavalves.com	**31.10.2024**
2)	**Jupiter**	Upto 2000 mm Dia	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**

3)	**MARCK Brand**	**Up to 2000 mm dia**	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles Unit No. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
4)	**Dynamic**	**Upto 1800 mm dia**	**M/s. Dynamic Valves Pvt. Ltd.** R-353, Rabale MIDC, Navi Mumbai.- 400701	**Mr. Nagesh Soparkar** Mobile No. 9892276921 info@dynamicvalves.com	**30.09.2024**
5)	**KEW**	**Up to 1600 mm dia**	**M/s. Ketan Engineering Works,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Rajkot Highway, Surendranagar - 363001.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- ketanengiw@yahoo.in **Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**
6)	**GM Brand**	**Up to 1200 mm dia**	**M/s G.M. Engineering Pvt Ltd.** Village Metoda, Rajkot - 3600 21, Ph. No. 02827-287658	**Mr. H. Rajarama** Associate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com , hrajarama@gmengg.com	**31.08.2023**
7)	**Super**	**Up to 1600 mm dia**	**Super Valve Manufacturing Co.,**	**Ph. No. 033-26675343 , 8334945454, 9830329954 Email super-valve2002@yahoo.co.in**	**30.09.2025**

8)	Mahadevi	Up to 1200 mm dia	**M/s. Mahadevi Industries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 - 26537777	**Mr. Shashikant Sharma** Mobile No. 9421801904 / 9130943964 mahade-vi.maharashtra@gmail.com mahade-vi.kolkata@gmail.com	**30.09.2024**
9)	Cair	Up to 1200 mm dia	**M/s. Cair Euro-matic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405.	**Mr. Shaukat Inam-dar** Mobile No. 9545550059 / mkt@caireuromatic.com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr. Shakir Tamboli** Mobile No.: 9545558156 gov.cairindia@gmail.com	**30.09.2025**
10)	Calsens	Up to 1000 mm dia	**M/s. Calsens Private Ltd.,** 40 / 1 A, Makardah Road, P. O. Kadamtala, Howrah -711101	Phone No. 033-22486527 / 22430665. Mobile No. 9903022200. E-mail ho@calsens.com	**30.06.2023**
11)	Mayur	Up to 800 mm dia	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhy-dro@gmail.com **Mr. Nandkumar Kul-karni** Mobile No: 9130929088	**31.12.2024**
E)	**Ductile Iron / S. G. Iron Air Valve & Kinetic Air Valves**				
1)	Durga & DVPL	Upto 300 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah - 711104. Ph. No. 033 -	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail	**31.10.2024**

			26778088 / 26778713	.com**Mr. Pijush Roy** Mobile No.: 9830023032	
2)	**GM Brand**	**Up to 200 mm dia**	**M/s. G. M. Engineering Pvt Ltd.** Village Metoda, Rajkot - 3600 21 Ph. No. 02827- 287658	**Mr. H. Rajarama** Associate V.P. (Mktg) Mobile No. 9869763109 valve@gmengg.com , hrajarama@gmengg.com	**31.08.2023**
3)	**Jupiter**	**Upto 300 mm Dia**	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
4)	**KEW**	**Up to 200 mm dia**	**M/s. Ketan EngineeringWorks,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Rajkot Highway, Surendranagar - 01.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- ketanengiw@yahoo.in**Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**
5)	**LP**	**Up to 200 mm dia**	**M/s. Perfect Valves Pvt.Ltd.,** Wariana Industrial Complex, Sangal Sohal Road, Jalandhar-144013	**Mr. Vivek Sehgal, Director** Mobile No. : 9814060747 / 8700258549 Email id :- mktg.lpvalve@gmail.com	**30.11.2023**

6)	**Mahadevi**	**Up to 200 mm dia**	**M/s. MahadeviIndustries,** Salap, NH-6, Domjur, Howrah-711409. (WB) Phone No. 033 - 26537777	**Mr. Shashikant Sharma**Mobile No. 9421801904 / 9130943964 mahadevi.maharashtra@gmail.com mahadevi.kolkata@gmail.com	**30.09.2024**
7)	**Mayur**	**Up to 200 mm dia**	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhydro@gmail.com **Mr. Nandkumar Kulkarni**Mobile No: 9130929088	**31.12.2024**
8)	**R.D. Multiples**	**Up to 200 mm dia**	**M/s. R.D.Multiples (Metal cast) Pvt. Ltd.** GIDC Pardi, Valsad, Gujarat - 396125	Ph. No. 022- 40044425 to 29. Email id - mumbai@rdmultiples.com, pardi@rdmultiples.com	**31.01.2023**
9)	**AARKO**	**Up to 200 mm dia**	AARKO Mfg. Company 74-75, Ind. Estate, Behind-Checks,Jalandhar Punjab-144012.	Kamal Kohlu Mob- 9463502625 aarkomfg@gmail.com	**20.02.2025**
10)	**Super**	**Up to 200mm dia**	**Super Valve Manufacturing Co.,**	**Ph. No. 033-26675343 , 8334945454, 9830329954 Email super-valve2002@yahoo.co.in**	**30.09.2025**

11)	Cair	Up to 200mm dia	**M/s. Cair Euro-matic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405.	**Mr. Shaukat Inam-dar** Mobile No. 9545550059 / mkt@caireuromatic.com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr. Shakir Tamboli** Mobile No.: 9545558156 gov.cairindia@gmail.com	**30.09.2025**
F)	**Ductile Iron / S. G. Iron Temper proof Air Valves**				
1)	**Durga & DVPL**	Upto 300 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.com **Mr. Pijush Roy** Mobile No.: 9830023032 kol-kat-ta@durgavalves.com	**31.10.2024**
2)	**Jupiter**	Upto 300 mm Dia	**M/s. Jupiter Engi-neering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
3)	**KEW**	Up to 200 mm dia	**M/s. Ketan Engi-neeringWorks,** Plot No. 34, Nr. Pooja Dhanadal, Opp. Pramukh Packaging, Surendranagar - Rajkot Highway, Surendranagar - 01.	**Mr. Sandip B Patel** Mobile No. 8238036592/9925236592 Email- keta-nengiw@yahoo.in **Mr. Ajay D Chandesara** Mobile No. 8160509267/7211110575	**31.10.2024**

4)	**MARCK Brand**	**Up to 200 mm dia**	**M/s. Hawa Engineers Ltd.,** 267/2, Near Balkrishna Textiles UnitNo. 2, Behind Eagle Motors, N.H. 8, Shahwadi, Narol, Ahmedabad - 382405	**Mr. Zafar Hawa** Mobile No. 9825005766 zafar@hawaengltd.com hawaengineers@gmail.com **Mr. Yogesh Mishra** Mobile No.: 7879145143 marckhawa.cair@gmail.com	**30.09.2024**
5)	**Mayur**	**Up to 200 mm dia**	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik – 422007. Phone No. 0253 – 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhydro@gmail.com **Mr. Nandkumar Kulkarni** Mobile No: 9130929088	**31.12.2024**

4)	Cast Steel Valves Class 150 & Class 300 rating				
A)	Cast Steel Double Flanged Sluice Valves				
1)	Jupiter	Upto 1400 mm Dia	M/s. Jupiter Engineering Company, Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	Mr. Avijeet Karar Mobile No. 9830266882 ho@jupitervalves.com Mr. Sunil Pawar Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	31.12.2024
2)	Durga & DVPL	Upto 1000 mm dia	M/s. Durga Valves Pvt. Ltd. Ichapur Road, Canal Side, Santragachi, Howrah - 711104. Ph. No. 033 - 26778088 / 26778713	Mr. Mayank DK Dube Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.com Mr. Pijush Roy Mobile No.: 9830023032	31.10.2024
B)	Cast Steel Double Flanged Non Return Valves				
1)	Jupiter	Upto 1400 mm Dia	M/s. Jupiter Engineering Company, Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	Mr. Avijeet Karar Mobile No. 9830266882 ho@jupitervalves.com Mr. Sunil Pawar Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	31.12.2024
2)	Durga & DVPL	Upto 1000 mm dia	M/s. Durga Valves Pvt. Ltd. Ichapur Road, Canal Side, Santragachi, Howrah - 711104. Ph. No. 033 - 26778088 / 26778713	Mr. Mayank DK Dube Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.com Mr. Pijush Roy Mobile No.: 9830023032	31.10.2024
C)	Cast Steel Double Flanged Butterfly Valves				

1)	Durga & DVPL	Upto 2000 mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah – 711104.	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.com	**31.10.2024**
2)	Jupiter	Upto 2000 mm Dia	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
D)	Cast Steel Air Valve & Kinetic Air Valves				
1)	Durga & DVPL	Upto 300mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah – 711104. Ph. No. 033 – 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.com **Mr. Pijush Roy** Mobile No.: 9830023032 kol-kat-ta@durgavalves.com	**31.10.2024**
2)	Jupiter	Upto 300mm Dia	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**

3)	Mayur	Up to 200mm dia	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhy-dro@gmail.com **Mr. Nandkumar Kulkarni** Mobile No: 9130929088	**31.12.2024**
E)	Cast Steel Temper proof Air Valves				
1)	Durga & DVPL	Upto 200mm dia	**M/s. Durga Valves Pvt. Ltd.** Ichapur Road, Canal Side, Santragachi, Howrah - 711104. Ph. No. 033 - 26778088 / 26778713	**Mr. Mayank DK Dube** Mobile No.: 9324515987 / 9867025324 mum-bai@durgavalves.com dvplmum.offers@gmail.com**Mr. Pijush Roy** Mobile No.: 9830023032 kol-kat-ta@durgavalves.com	**31.10.2024**
2)	Jupiter	Upto 300mm Dia	**M/s. Jupiter Engi-neering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Ben-gal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
3)	Mayur	Up to 200mm dia	**M/s. Mayur Valve Company,** W-95 (A), MIDC Satpur, Nashik - 422007. Phone No. 0253 - 6695990 - 92	**Mr. B. S. Bhandari** Mobile No: 9403702192 / 7.30871000 mayurhy-dro@gmail.com **Mr. Nandkumar Kulkarni** Mobile No: 9130929088	**31.12.2024**
5	Hydraulic Control Valves				

A)	**Flow Control Valve**				
1)	**Alpine & AFC**	**Upto 800mm dia**	**M/s. Alpine Flow-tech,** Unit No. 1, B Wing, Swarajya Complex, Rajlax-mi Compound, Opp. Bewakoof Textile Factory Outlet, Kasheli, Kalher, Tal. Bhiwandi, Thane	**Mr. Mayank DK Dube** Mobile No.: 9324515987/ 9867025324 alpineflow-tech@gmail.com **Mr. Manish Gupta** Mobile No.: 8978558585	**31.05.2024**
B)	**Pressure Reducing Valve**				
1)	**Alpine & AFC**	**Upto 500mm dia**	**M/s. Alpine Flow-tech,** Unit No. 1, B Wing, Swarajya Complex, Rajlax-mi Compound, Opp. Bewakoof Textile Factory Outlet, Kasheli, Kalher, Tal. Bhiwandi, Dist. Thane -	**Mr. Mayank DK Dube** Mobile No.: 9324515987/ 9867025324 alpineflow-tech@gmail.com **Mr. Manish Gupta** Mobile No.: 8978558585	**31.05.2024**
2)	**Cair Euromatic**	**Upto 300mm dia**	**M/s. Cair Euro-matic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405.	**Mr. Shaukat Inam-dar** Mobile No. 9545550059 / mkt@caireuromatic.com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr. Shakir Tamboli** Mo-bile No.: 9545558156 gov.cairindia@gmail.com	**30.06.2024**
D)	**Altitude Control Valve**				

1)	Alpine &AFC	Upto 500mm dia	**M/s. Alpine Flow-tech,** Unit No. 1, B Wing, Swarajya Complex, Rajlax-mi Compound, Opp. Bewakoof Textile Factory Outlet, Kasheli, Kalher, Tal. Bhiwandi, Dist. Thane -421302.	**Mr. Mayank DK Dube** Mobile No.: 9324515987/ 9867025324 alpineflow-tech@gmail.com **Mr. Manish Gupta** Mobile No.: 8978558585	**31.05.2024**
E)	**Surge Anticipating Valve**				
1)	Alpine &AFC	Upto 400mm dia	**M/s. Alpine Flow-tech,** Unit No. 1, B Wing,Swarajya Complex, Rajlaxmi Compound, Opp. Bewakoof Textile Factory Outlet, Kasheli, Kalher, Tal. Bhiwandi,Thane - 421302.	**Mr. Mayank DK Dube** Mobile No.: 9324515987/ 9867025324 alpineflow-tech@gmail.com **Mr. Manish Gupta** Mobile No.: 8978558585	**31.05.2024**
F)	**Zero Velocity Valve MS**				
1)	Jupiter	Upto 1000 mm Dia	**M/s. Jupiter Engi-neering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Ben-gal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	**31.12.2024**
G)	**Air Cushion Valve**				
1)	Jupiter	Upto 300mm Dia	**M/s. Jupiter Engi-neering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Ben-	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar**	**31.12.2024**

			gal)	Mobile No. 7021264379 / 9029041480 jecovalve@gmail.com	
6)	**Electrical Valve Actuators**				
1)	**Auma**	**No limit**	**M/s. Auma India Pvt. Ltd.,** Plot No. 38-A, & 39-B, II Phase, Peenya Industrial Area, Banglore - 560058 Karnataka Ph. No. 080 / 30412222	**Mr. N. C. Patil,** Business Head -West & East Mobile No: +91-9763728261 auma-pune@auma.co.in ncpatil@aumaindia.com	**30.11.2023**
2)	**S.D Tork**	**No limit**	M/s. S.D. Tork Control Pvt. Ltd., 1106, 10 Main Road, RPC layout Near-Hump Nagar Bus Stop, Ban-glure-560104	Mr. Sunil Kurkute Mob. 9822980003 scpl@sdtork.com	**30.11.2023**
3)	**Marsh / Emtork**	**No limit**	**M/s. Marsh Automation Pvt. Ltd.** 98 A- 25 A, Hadapsar Ind. Estate, Pune - 411013. Phone No. 020 / 26875424 / 9475 re-sponse@marshautom ation.com mar-shautoma-tion@gmail .com	**Mr. R. S. Desh-pande (Manager Marketing)** Mobile No: 9552021799 rsdesh-pande@marshautomation.com **Mr. S. M. Kulkarni GM** Mobile No: 9881721316 smkul-karni@marshautomation.com	**31.12.2024**

4)	SDTORK	No limit	**M/s. Sdtork Controls Pvt. Ltd.,** Gat No 94/2, Plot No 2, Alandi - Markal Road, Village - Dhanore, Taluka - Khed, Pune-412105	**Mr. Sunil P. Kurkute, Director** Mobile No.: 9822980003 Email: scpl@sdtork.com	**30.11.2023**
5)	Cair Euromatic	Upto 1000 mm dia	**M/s. Cair Euromatic Automation Pvt. Ltd.,** Plot No.177 - 179, Shiv Shakti Estate, Nr. V-trans, Narol Road, Ahmedabad - 382405.	**Mr. Shaukat Inamdar** Mobile No. 9545550059 / mkt@caireuromatic.com **Mr. Tousif Sayyed** Mobile No.: 9545519666 **Mr. Shakir Tamboli** Mobile No.: 9545558156 gov.cairindia@gmail.com	**30.06.2024**
7)	Dismantaling & Expansion Joint				
1)	Jupiter	Upto 1200 mm Dia	**M/s. Jupiter Engineering Company,** Ichapur Canal site, Radhagovindo Road, Howrah - 711104 (West Bengal)	**Mr. Avijeet Karar** Mobile No. 9830266882 ho@jupitervalves.com **Mr. Sunil Pawar** Mobile No. 7021264379 /9029041480 jecovalve@gmail.com	**31.12.2024**
8	Lifting Arrangement				
A)	Chain Pulley Block with travelling trolley				
1)	Shree Abhay Cranes	Upto 5 MT	M/s. Shree Abhay Cranes Pvt. Ltd. Shegaon Buldhana. Ph. No. 07265-252401 / 254200	**Mr. Bharat Paldiwal** Mobile No. 9420497004Email id - shreeabhaygroup@gmail.com	**31.07.2025**
2)	JAPS	Upto 10	M/s.JAPS Project, 565, Phasse-II, Opp. Vatva Railway	**Mr. Gaurang Shah** Mob. 9978900589/ 9825019138 Email Id : sales.japs@gmail.com/	**31.12.202**

		MT	Station, GIDC, Vatva Ahmedabad-382445. (Gujarat)	japspro@yahoo.co.in	4
B)	HOT Cranes				
1)	Shree Abhay Cranes	Upto 5 MT	**M/s. Shree Abhay Cranes Pvt. Ltd.** Shegaon Buldhana. Ph. No. 07265-252401 /254200	**Mr. Bharat Paldiwal** Mobile No. 9420497004 shree-ab-haygroup@gmail.com	31.07.2025
2)	JAPS	Upto 10 MT	M/s.JAPS Project, 565, Phasse-II, Opp. Vatva Railway Station, GIDC, Vatva Ahmedabad-382445. (Gujarat)	**Mr. Gaurang Shah** Mob. 9978900589/ 9825019138 Email Id : sales.japs@gmail.com/ japspro@yahoo.co.in	31.12.2024
C)	EOT Cranes				
1)	Shree Abhay Cranes	EOT, HOT , Wire rope, Hoist, C.P.B	**M/s. Shree Abhay Cranes Pvt. Ltd. Survey No. 335 Khamgaon Road,** Shegaon, Dist- Buldhana, Ph. 07265-252401	M/s. Shree Abhay Cranes Pvt. Ltd. Shegaon Buldhana. Ph. No. 07265-252401 /254200	31.07.2025
2)	JAPS	Upto 30 MT	M/s.JAPS Project, 565, Phasse-II, Opp. Vatva Railway Station, GIDC,	**Mr. Gaurang Shah** Mob. 9978900589/ 9825019138 Email Id : sales.japs@gmail.com/	31.12.2024

			Vatva Ahmedabad-382445. (Gujarat)	japspro@yahoo.co.in	
D) Grit Removing Mechanism (Hydraulic Operated)					
1)	**JAPS**	**Upto 25 MLD STP**	M/s.JAPS Project, 565, Phasse-II, Opp. Vatva Railway Station, GIDC, Vatva Ahmedabad-382445. (Gujarat)	**Mr. Gaurang Shah** Mob. 9978900589/ 9825019138 Email Id : sales.japs@gmail .com/ jap-spro@yahoo.co.in	**30.06.2023**
E) Bar Screen (Trash Rack)					
1)	**JAPS**	**Upto 5 Mtr.x 2 Mtr**	M/s.JAPS Project, 565, Phasse-II, Opp. Vatva Railway Station, GIDC, Vatva Ahmeda-bad-382445. (Gujarat)	**Mr. Gaurang Shah** Mob. 9978900589/ 9825019138 Email Id : sales.japs@gmail.com/ japspro@yahoo.co.in	**30.06.2023**
9)	**Motors**				
A)	**Horizontal / Verticle VHS/VSS Foot Mounted Motors (3 Phase Energy Efficient Low Voltage)**				
1	**Hem Industries**	**Upto 315 kW**	**M/s. Hem Industries,** Survey - 738/1, Somnath, Dabhel, Daman - 396210(U.T.)	**Mr. O. V. Keswani** Mobile No. 9967178830 022-42500500 okeswani@hindmotors.com	**29.02.2023**

2)	**Lhp**	**No Limit**	**M/s. Laxmi Hydraulics Pvt.Ltd,** B - 11 & B -16, MIDC Chincholi, Solapur-413255 Ph. No. 0217-2357001 lhpindia@lhpmotor.com	**Mr. Aditya Thakre, Director,**Mobile No:- 9922111524 aditya.thakre@lhpmotor.com **Mr. Atish Deo** Mobile No:- 9011048143 atish.deo@lhpmotor.com	**31.08.2024**
3)	**Kirloskar**	**Upto 315 kW**	**M/s. Karad Projects &Motors Ltd.** Plot No. B-67 / 68, Karad Industrial Area, MIDC, Tasawade Dist. Satara - 415109.	**Mr. Amit Deshpande** Mobile No:- 9850983352 **amit.deshpande@kpml.co.inMr. Ramesh Prasannawar** Mobile No :-7888010397	**31.07.2024**
4)	**JSL**	**No limit**	**M/s. JSL industriesLtd,** N. H. No. 8, Mogar-388340,Tal. & Dist. Anand Gujarat. Phone No. 02692-280224, 280254, 280316 .	**Mr. D. B. Dave** Vice President Marketing-Mobile No: 9687626893 vp@jslmogar.com **Mr. Gaurang P. Patel** Mobile No: 9879944157 gppatel@jslmogar.com	**31.12.2024**
5)	**Havells**	Vertical Hallow/Solid Shaft Hortizantal foot maunted upto 225 kw	M/s. Havells India Ltd., 904, 9th floor, Surya Kiran Building, K.G.. Marg, Connaught Place, New Delhi-110001.	Mr. Anil Rai Gupta Mob. 70456602 46 9987760432 amey.koli@havells. com	**31.05.2023**

B)	H.T. Motors				
1)	Jeumont	Upto 1675 HP, Voltage Level upto 6.6 kV	M/s. Jeumont Electric India Pvt. Ltd.,22 km Stone, Vadodara – Halol Express Highway, 328/13,Jarod, Vadodara – 391510. Ph.No. 02668 – 671009	Mr. Ankit Raj Kulshrestha Mobile No: 8007074786 / 9766451782 ankit.kulshrestha@jeumontelectric.com india@jeumontelectric.com	30.09.2024
2)	Marathon	Upto 2000 HP, Volatge level upto 6.6 kV	M/s. Marathon Electrics Motors India Ltd. R tala Rd, Kolkatta. 700 024., Ph. 033 4403 0500 / 2469 8530.	Mr. Anand Jadhav Mobile No. 9766623158 anand.jadhav@marathone.com	30.06.2023
3)	JYOTI	Upto 2000 HP, Volatge level upto 6.6 kV	M/s. Jyoti Ltd., Nanubhai Amin Marg, PO Chemical Industrial,Vadodara-390003.	Ph.No.0265-3054444 Mob.No.92417 4649/ 9324028701	31.07.2025
10)	LT & HT Control Panels				
A)	L. T. Control Panel (MCC, APFC, Feeder Piller Distribution)				
1)	Chandra	No limit	M/s. Chandra Electrical & Electronics, Plot No. L - 11 /6, MIDC, Waluj, Aurangabad – 431136	Mr. Narayan Pawar Mobile No: 9225313111 Mr. Samir Nimbalkar Mobile No: 9561321163 chandraelec1@gmail.com Ph. No. 0240-2984151	31.10.2024
2)	JSL	No limit	M/s. JSL industries Ltd, N. H. No. 8, Mogar-388340,Tal. & Dist. Anand Guja-	Mr. D. B. Dave Vice President Marketing- Mobile No: 9687626893 vp@jslmogar.com Mr. Gaurang P. Patel Mobile No: 9879944157	31.12.2022

			rat. Phone No. 02692-280224, 280254, 280316 .	gppatel@jslmogar.com	
3)	**Success Engineers**	No limit	**M/s. Success Engineers,** EL-60, EL-Block, MIDC Bhosari, Pune - 411026. Ph. no. 020 - 27119384	**Mr. Rajeev Chhetry** Mobile No: 7710052279**Mr. Sushil Nagare** Mobile No: 9766631722 successquotation@gmail.com contactus@successengineers.in	**31.05.2024**
B)	**LT Switchgears**				
1)	**JSL**	No limit	**M/s. JSL industries Ltd,** N. H. No. 8, Mogar-388340,Tal. & Dist. Anand Gujarat. Phone No. 02692-280224, 280254, 280316 .	**Mr. D. B. Dave** Vice President MarketingMobile No:9687626893 vp@jslmogar.com **Mr. Gaurang P. Patel** Mobile No: 9879944157 gppatel@jslmogar.com	**31.12.2022**
C)	**VFD Drives**				
1)	**Fuji Electric**	All type	**M/s. Fuji Electric India Pvt. Ltd.,**I - 6, Survey No. 79,Sumeet Logistics,Village - Kukse, Near Shangrila Resort, Off. Mumbai Nashik Hway,Bhiwandi Thane421302	**Mr. Pankaj Wankhade,** SeniorSalesEngineer, Mobile No.: 9987221588 /9920664308 Phone No. 022 / 42524850 pankajwankhade@fujielectric.com	**30.11.2023**
D)	**Vacuum Circuit Breaker**				

1)	**Megawin**	**Upto 33 kV**	**M/s. Megawin Switchgear Pvt. Ltd.** Perumal, Malai Post Salem, Tamilnadu industries@megawin.co.in	Ph. No. 0427 - 2330288 / 498 Mobile No. 9823063772 /9790014085 Email id - utilities@megawin.co.in	**30.09.2023**
11)	**Transformers**				
1)	**Urja**	**Upto 10 MVA & Voltage Level upto 33 kV**	**M/s. Urja Techniques (India) Pvt. Ltd.** R- 653,TTC, MIDC, Thane - Belapur Road, Rabale, Navi Mumbai-400701	**Mr. Pradeep Dixit,** Mobile No: 9820401606 / 9820081474 Other Contacts :- +91-9820081474 /9930430606 response@urjatransformers.com	**30.11.2023**
2)	**Trinity**	**Upto 5000 kVA, Voltage level upto 33 kV**	**M/s. Trinity ElectricalIndustries,** Banglore -560091	Ph. No. 080 - 28361413 / 7074 Email id - trinityelectricals@gmail.com	**31.12.2022**
3)	**Transdelta**	**Upto 2500 kVA, Voltage level upto 33 kV**	**M/s. Transdelta Transformers Pvt. Ltd.,** B - 8 & 9, MIDC Area, Chikhalthana, Aurangabad-431006	**Mr. Prashant Nankar** Mobile No. :- 9822611379 Email id :- transdelta@rediffmail.com	**31.08.2024**
4	**Digvijay**	**Upto 1000 kVA, Voltage level upto 33 kV**	**M/S. Digvijay Industries, plot No. H - 44, MIDC, Aurangabad 431006**	Mobile No. :- 9765820904,9765492330 Email id :- transdigvijay@yahoo.com	**30.09.2025**

5)	MSC	Upto 2000 kVA, Voltage level upto 22 kV	M/s. MSC Trans-formersPvt. Ltd., Plot No. E - 18 / 2, MIDC, Jejuri, Pune - 412303 msc.transformers@gmail .com	Mr. Sandesh Mahadev ChavanMobileNo: 9960655777 Mrs. Snehal Chavan Mobile No: 9960633777, 9975444666	30.06.2024
6)	JDS	Upto 630 kVA, Voltage level upto 11 kV	M/s. JDS TransformersPvt. Ltd., Plot No. 33 / 34 & Partof 32 & 26, AKVN, Boregaon, Sausar, Dist. Chhindwara (MP) - 480106.	Mr. Riyaj Sheikh, Manager Marketing Mobile No. 8805088835	31.08.2024
7)	Voltamp	Upto 6.5 mVA & Volt-age Level upto33 kV	M/s. Voltamp Transformers Ltd. Makarpura, Vadoda-ra -390014	Mr. P. N. Jibi Mobile No. :- 9325401171 Mr. Amit Brande Mobile No. :- 9960700805 or-der_pune@voltamptransformers.com	30.06.2024
8)	Rohitra India pvt. Ltd.	Upto 1000 KVA & Voltage Level 11 kV	Rohitra India pvt. Ltd., Gat. No. 156 & others, Plot No.67, Sanaswadi Road, Sanaswadi Tal. Shrirur, Dist-Pune	Mr. Sachin Hi-warkarMo No. 7219617700 rohitraindia@gmail.com www.rohitraindia.com	31.05.2025
12)	PVC / XLPE Cables				
A)	PVC / XLPE Submersible (Copper Conductor) Cable				
1)	Ajanta	Upto 6 sqmm size	M/s.Ajanta Industries, Kishan gate, 3, Behind Sahyog Complex, Plot No. G-413 GIDC Metoda, Rajkot-21.	Mr. Ritesh Patel Mobile No. - 9825215350Mr. Kam-lesh Patel Mobile No. - 9727681901 /8866010555 in-fo@ajantaindustries.co	31.03.2024

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2)	Falcon & Fab-con Brand	Upto 35 sqmm size	M/s. Fabtech CabelsPvt Ltd. Vavdi, Rajkot, 360 004.	Ph No. 0281- 2921307 info@fabtechcables.com	30.06.2023
3)	C.R.I. Pumps	Sub-mersible Ca-ble	C.R.I. Pumps Pvt. Ltd.,No.7/51, A, keranatham Road, sarvanam pat-ti.coimbtore-641035	M/s. Jaipal ShettyMo. 9022202905 mum-bai@cripumps.com www.crigroups.com	31.05.2023
B)	1.1 kV Allum. & Copper Cable				
1)	Vishal	Multico-reUp to 400 sqmm& single core1000 sq m m	M/s. Vishal Cables Pvt. Ltd. Plot No. E-41, Anand Nagar, Addi-tionalAmbernath MIDC,Ambernath East Dist Thane – 421506.	Mr. Hirasing Ailsinghani Mobile No:- 9049777777 /7841078410 Mr. Dilipsingh Ailsinghani Mobile No:- 9766442288 sales@vishalcables.com	31.03.2024
13)	Water Treatment Plant Equipments				
A)	Air Blowers Twin & Tri Lobo & Turbo				
1)	Kay Inter-national	No Limit	M/s. Kay Interna-tionalPvt. Ltd., 302, Lusa Tower, Azadpur Commer-cial Complex, Delhi – 110033.	Mr. Anil Suri Con-tact No:- 8572899504 a.suri@kayblowers.com Mr. Saurabh Deshmukh ContactNo :- 9996940489 pune@kayblowers.com	31.03.2024

B)	**Chlorination System**				
1)	**Achala**	Gas Chlorination System, Vacuum Operated (Fully Automatic &Manual), Pressure feed Chlorinators & Chlorine Handling equipment		**M/s Achala Engineering and Electronics,** Kalva,Thane **Mr. Anant Padigudri** Mobile No. 7498070219 / 8652270219 achalaee@gmail.com, anantpadubidri@gmail.com	**31.05. 2025**
2)	**Toshcon**	Gas chlorination System Vaccum operated gas Chlorinators, Residual Chlorine anylesar.	Add : Toshcon Jasco India GegalIndia area, Ajmer-305023.	**Mr. Ashok Rathore Mob. 9351497757** info@toshcon.com **metering@tushcon.com**	**30.11. 2024**
3)	**"Chlorojeevan " plus**	**Sodium Dichlorois ocyanurate Dosing Potable water Chlorinatio n system**	**M/s. Bhavani Enviro Technologies Pvt. Ltd.** Unit No. 6 & 7, Globe estate, Pot No. C - 9, Phase 1, MIDC, New Kalyan Road, Dombivli (East), Thane - 421203	**Mr. Deepak Deshpande** Contact No: - 9167023869**Mr. Dilip Nar** Contact No:- 9324630332 admin@bhavanienviro. comin-fo@bhavanienviro.c om Ph. 0251 / 2423393 / 2423392	**31.01. 2024**
4)	**SM Polymer**	**Gas Chlorination System, Vacuum Operated (Fully Automatic & Manual) Chlorinato**	**M/s. S.M. Polymers,** Plot no. 27 , Shree GuruGajanan Industrial Area, Ambad - Vilholi Link Road, Vilholi, Nashik - 422010. Ph. No. 0253 - 2975576	**Mr. Rahul M. Patil** ContactNo:- 9869116003**Mr. Raj Patil** Contact No :- 9021125576 **Mr. Manoj Patil** ContactNo:- 9869010571 smpoly-	**31.03. 2024**

				mer@gmail.com sales@smpolymers.com	
5)	Toshcon	Gas Chlorination System, Vacuum Operated (Fully Automatic & Manual) Chlorinators & Chlorine Handling equipment & Residual Chlorine Analyser		**M/s. Toshcon Jesco (India) Pvt. Ltd.,** 401, Manish Chamber, Sonawala Cross Lane,Goregaon (E) Mumbai 63 **Mr. Ashok Rathore** Contact No:-09351497757**Mr. Uday Kulkarni** Contact No:-9372417787	**30.11.2024**
14)	STP Accessories				
1)	**Positive Metering Pumps**	Chemical dosing Pumps	**M/s. Positive Metering pumps (India) Pvt. Ltd.** M-8, MIDC, Ambad, Nashik - 422010 Phone-0253 - 6613206	**Mrs. Chetana Surywanshi** Mobile No - 9552590845 chetanak@positivemetering.com **Mr. Priyal Sirsath** Mobile No. 9922507046 sales@positivemeteri ng.com	**29.02.2025**
2)	**Positive Metering Pumps**	**Electronic Dosing Pump, Screw Pump, Dosing System & Agitator**	**M/s. Positive Metering pumps (India) Pvt. Ltd.** M-8, MIDC, Ambad, Nashik - 422010 Phone-0253 - 6613206	**Mrs. Chetana Surywanshi** Mobile No - 9552590845 chetanak@positivemetering.com**Mr. Priyal Sirsath** Mobile No. 9922507046 sales@positivemetering.com	**29.02.2023**
15)	SCADA & Automation			--	

A)	**SCADA and Automation System**				
1)	**Fuji Electric**	**PLC, SCADA**	**M/s. Fuji Electric India Pvt. Ltd.**,I - 6, Survey No. 79,Sumeet Logistics, Village - Kukse, Near Shangrila Resort, Off. Mumbai Nashik Highway, BhiwandiThane - 302	**Mr. Pankaj Wankhade,** SeniorSales Engineer, Mobile No.: 9987221588 /9920664308 Phone No. 022 / 42524850 pankaj-wankhade@fujielectric.com	**30.11.2023**
2)	**Axis Solutions**	**PLC, SCADA**	M/s.Axis Solutions Pvt.Ltd., Plot No.324, Road No.5, G.I.D.C. Kathwada, Ahmedabad-382430Gujrat, India	Mr. Purthik Gajjar. Tel. No.079-22900860/1 Mobile No. 9909906354/ 9925001633 Email.Id: axis@axisindia.in/ info@axisindia.in	**31.07.2025**
B)	**Transmitters Level, Pressure, Temperature**				
1)	**Endress +Hauser**	**All type**	**M/s. Endress + Hauser (India) Pvt. Ltd.,** M 171-176, Walunj Industrial Estate, MIDC, Aurangabad - 431136.	**Mr. Sunil Bhor** Mobile No:9930306449 sunil.bhor@endress.com Phno. 0240 / 2563695 info@in.endress.com	**31.08.2024**
2)	**Techtrol**	Level Switch, Radar Level Transmitter, Ultrasonic LevelTransmitter	M/S. Pune TechtrolPvt. Ltd., 18, MIDC, Bhosari, Pune-411026.	Mr. Sudhakar Badiger,Mo. 9922438205, ho@punetechtrol.comPh. 020/66342900 www.punetechtrol.com	**31.07.2025**
3)	**R.L.Tech**	Level Transmitter,Pressure Transmitter, Liquid Analyzer	M/s. R.L.T. Instrumentation Pvt. Ltd., Chennai, No.2, Factory Road, Attur, Chengalpattu,	Mr. G.P.Tirumurgon Mo.	**31.05.2025**

			Chennai-603101.	9566039869	

Contractor No of Correction Executive Engineer SMKC

4)	Fuji Electric	All type	M/s. Fuji Electric India Pvt. Ltd.,I - 6, Survey No. 79,Sumeet Logistics,Village Kukse, Near Shangrila Re-sort, Off. Mumbai Nashik High-way, Bhiwandi, Thane – 421302	Mr. Pankaj Wankhade, SeniorSalesEngineer, Mobile No.: 9987221588 / 9920664308 Phone No. 022 / 42524850pankaj-wankhade@fujielectric.com	30.11.2023
C)	Turbidity, pH, Conductivity, DO, ORP,TDS, Cl2,TSS, COD, BOD Analyzers				
1)	En-dress + Hause r	All	M/s. Endress + Hauser(In-dia) Pvt. Ltd., M 171-176, Walunj Industrial Estate, MIDC, Aurangabad – 431136	Mr. Sunil Bhor ContactNo: 9930306449 sunil.bhor@endress.comPh no.0240 / 2563695 info@in.endress.com	31.08.2024
2)	Toshcon	All	M/s. Toshniwal Instru-ments Mfg. Pvt.Ltd., 401, Manish Chambers, Sonawala Cross Lane, Goregaon(E), Mumbai - 400063	Mr. Abhishek Tosh-niwalMobileNo. 9414006717 pur-chase2@toshcon.comMr.Uday Kul-karni Mobile No. 9372417787 pu-ne@toshcon.com	29.02.2025
3)	R.L.Tech	All	M/s. R.L.T. Instrumentation Pvt. Ltd., Chennai, No.2, Factory Road, Attur, Chengalpat-tu, Chennai-603101.	Mr. G.P.T. Tirumurgon Mo. 9566039869	31.05.2025
D)	Web based Pump & Multi Pumps monitoring Solution				
	CENSEO		M/s. Secure Meters	Mr. Piyush Ghosh	

1)	meter along with tem-paratur e & pressure Probes	All types of pum ps with No Limit	Ltd., E- class, Pratap-nagar ind. Area, Udai-pur-313003. Phone No. 0294-2492300-05 mktg@securemeters.com	Mobile No: 9930360842 pi-joush.ghosh@securemeters.com Mr. Rahul Joshi Mobile No:- 9920132039 ra-hul.joshi@securemeters.com	31.12.2024
16)	Water Meters				
A)	ISI Marked Domestic Water Meters as per IS:779:1994				
1)	Chambal	Sin-gle Jet upto 15 mm dia, Multi Jet upto 50 mm dia	M/s. N. B. Industries (Meters) Pvt. Ltd., 12-B, Laxmibai Nagar, Indore - 452006 Madhya Pradesh	Mrs. Jaya Sama-se MobileNo. 9229182344Mr. Prashant Ladda MobileNo. 9372255553 Ph No 0731 - 2415277 / cham-bal-meters@gmail.com	30.09.2023
2)	Everest	Single Jet upto 15 mm dia, Multi Jet upto 50 mm dia	M/s. Everest Sanitation (india), B-55, Wazirpur Group ind. Area, Delhi-110052 Phone No. 011-47551158	Mr. Pawankumar Gupta Mobile No. :- 9810076158 everestme-ter@hotmail.com Mr. Sanjaykumar S. AgrawalMobileNo: 9422163412 / 8793390473 sanjaykumar-my@gmail. Com	31.12.2024
		Single Jet upto 15	M/s. Aman Engineering Works, C	Ph. No. 0181 - 2603614 / 15 / 16 Mobile No.	

3)	Kranti	mm, Multi Jet upto 50 mm dia	54-55, Focal Point Extension, Jalandhar, Punjab - 144004	9815544438krantimeters@gmail.com info@krantimeters.com	31.10.2023
4)	Zeener Aquament	Single Jet upto 15 mm, Multi Jet upto 40 mm	**M/s. Zenner Aquamet India Pvt Ltd,** Faridabad - 121003., Ph. No. 0129-4042040 / 2276077	Mobile No. 9818201440, info@zenneraquament.comopcngp@gmail.com	31.01.2023
5)	Rahul	Single Jet upto 15 mm, Multi Jet upto 40 mm	M/s. Rajastan Industrial & Scientific Corporation, 40, Industrial Area, Jhotwara, Jaipur-302012, Ph. 0141-2340272.	**Mr. Abhishek Shinde Mo.7798356666** rahulmeters@gmail.com abhishek@ferroton.com **www.rahulmeters.com**	31.07.2025
6)	Belanto	Domstic Water meter upto 50 mm dia	M/s. B.M. Watermeters, Village, Salempur, Musalmana, Near H.P. Petrol pump, Randhawa,Masandan Road, Jalandhar-144004.	M/s. Kushal SharmaMo. 9876110500 / 9501200231 sales@bmwatermeters.com	31.05.2024
B)	**Domestic Multi Jet Water Meters OIML / MID certified AMR / AMR Compatible as perISO -4064**				

1)	Baylan	Upto 40 mm	**M/s. Aquameas Instruments Pvt. Ltd.** 3, Gangadip Appts, Opp. Post office, ModelColony, Shivajinagar, Pune 46	**Mr. Avinash Jape** Mobile No: 9822057521 avinash.jape@aquameas.com sales@aquameas.com	**30.09.2024**
2)	TEKSAN	Upto 20 mm dia	**M/s. Accumeasure Systems Pvt. Ltd.** Survey No. 84, Katraj Shop No. 26, Manik MotiComplex, Bldg - A / 2, Pune - 411046	**Mr. Abhishek Shinde** Mobile No: 7798356666 abhishek.accumeasure@gmail.com	**31.01.2024**
C)	**Bulk Woltman Type Water Meters OIML / MID certified AMR / AMR Compatible Multi Jet as per ISO - 4064**				
1)	Baylan	Upto 200 mm dia	**M/s. Aquameas Instruments Pvt. Ltd.** 3, Gangadip Apprtments, Opp. Post office, Model Colony, Shivajinagar, Pune – 411046	**Mr. Avinash Jape** Mobile No: 9822057521 avinash.jape@aquameas.com sales@aquameas.com	**30.09.2024**
D)	**Bulk Woltman Type Water Meters Multi Jet as per ISO - 4064**				
1)	Zeener Aquament	Upto 300 mm dia	**M/s. Zenner Aquamet India Pvt Ltd,** Faridabad - 121003.,	Mobile No. 9818201440, info@zenneraquament.co mopcngp@gmail.com Ph. No. 0129-4042040 /2276077	**31.01.2023**
2)	Belanto	Upto 300 mm dia	M/s. B.M. Watermeters, Village, Salempur, Musalmana, Near H.P. Petrol pump, Randhawa, Masandan Road, Jalandhar-144004.	M/s. Kushal SharmaMo. 9876110500 / 9501200231 sales@bmwatermeters.com	**31.05.2024**
E)	**Ultrasonic AMR Domestic Water Meters**				

1)	Kam-strup	Upto 40 mm dia	**M/s. Kamstrup Meter-ingSolution Pvt. Ltd.,** 214, Orion Busi-nessPark, Kapurbawdi, Ghodbunder Road,Thane - 400610.	**Mr. Subodh Vaidya Country Manager, India** Mobile No. 9822496763 subv@kamstrup.com **Mr. Upendra Borate Sales Manager - India** Mobile No. 9702015903 upb@kamstrup.com	**31.12.2024**
2)	Adept	Upto 40 mm Dia	**M/s. Adept Fluidyne Pvt. Ltd**, Plot 4, S. No. 17 / 1-B, Kothrud Industrial Estate, Kothrud, Pune 411038.	**Mr. Vinayak Gadre,** Mobile No. 98814 78230	**31.05.2023**
F)	**Electromagnetic Domestic AMR / AMI Water meter.**				
1)	Sen-sus, a Xylem brand	Upto 20 mm dia	**M/s. Xylem Water Solutions India Pvt. Ltd,** Plot No 731, GIDCSavli, Savli - Manjusar Road, Vadodara - 391775	**Mr. Ajit Magar** Mobile No. 9819338303 Ph No 02667-265800 / 615800 ajit.magar@xyleminc.com	**31.10.2023**
G)	**Ultrasonic AMR Bulk Water Meters**				
1)	Adept	Upto 300 mm Dia	**M/s. Adept Fluidyne Pvt. Ltd,** Plot 4, S. No. 17 / 1-B, Kothrud Industrial Estate, Kothrud, Pune 38.	**Mr. Vinayak Gadre, Director** Mobile No.: 9881478230 in-fo@adeptfluidyne.com	**30.11.2023**

H)	**Ultrasonic Flow Meters (Insertion, Portable & Clamp on Fixed Type)**				
1)	**ADD-MAS**	**No Limit**	**M/s. Instronix Process Controls,** Plot No E-148,Phase-2, Bol GIDC, Opp. GEB Sub- Station, Rasulpur, Village :- Bol, Tal:- Sanand, Ahmedabad-382481	**Mr. Divyang Patel** Mob. 9879007526 / 7486892642 / ad-min@addmas.in, sales@addmas.in , divyangkp@hotmail.com	**28.02.2024**
2)	**Adept**	**No Limit**	**M/s. Adept Fluidyne Pvt. Ltd**, Plot 4, S. No. 17 / 1-B, Ko-thrudIndustrial Estate, Kothrud, Pune 38.	**Mr. Vinayak Ga-dre, Director**Mo-bile No.: 9881478230 info@adeptfluidyne.com	**30.11.2023**
3)	**R.L.Tec h**	Ultra-sonic Flow-meter	M/s. R.L.T. Instrumenta-tion Pvt. Ltd.,Chennai, No.2, Factory Road, At-tur, Chengalpattu, Chennai-603101.	Mr. G.P.T. Tiru-murgonMo. 9566039869	**31.05.2023**
4)	**Manas**	**No limit**	**M/s. Manas Microsystem Pvt. Ltd.,** EL 54, Elec-tronic Zone, JBlock, MIDC Bhosari, Pune - 411026. md@manasmicro.com	**Mr. Shrikant Sa-hasrabuddhe**Manag-ing Director Contact No: 9860792277 md@manasmicro.com **Mr. Pavan Patil** Mobile No. 8530006258	**31.12.2022**
I)	**Full Bore Electromagnetic Flowmeter AC & Battery Operated**				
1)	**Eureka**	**Upto 1500 mm dia**	M/s. Eureka Industrial Eqnipements Pvt. Ltd. 17-12, Royal Chambers Paud Road, Pune-411038.	Mr. Ashish Shaha, Mo. 9370469464 sales@eurekaflow.com www.eurekaflow.com	**31.05.2025**
2)	**R.L.Tech**	Up-to 1200	M/s. R.L.T. Instrumenta-tion Pvt. Ltd., Chennai, No.2, Factory Road, At-tur, Chengalpattu, Chennai- 603101.	Mr. G.P.T. Tirumurgon	**31.05.2025**

		mm		Mo. 9566039869	
3)	**En-dress+ Hauser**	Up-to 1200 mm	M/s. Endress+ Hauser (India) Pvt. Ltd., M171-176, Walunji Industrial Estate, MIDC, Auranga-bad-411009	Mr. Sunil Bhor Mob.9930306449 Ph.No.0240/2563695 sunil.bhor@endress.comin-fo@in.endress.com	**31.08.2024**
4)	**ADDMAS**	**Upto 1000 mm**	**M/s. Instronix Process Controls,** Plot No E-148, Phase-2, Bol GIDC, Opp. GEB Sub- Station, Rasul-pur, Village :- Bol, Tal:- Sanand, Ahmedabad-382481	**Mr. Divyang Patel** Contact No:9879007526 / 7486892642 / 8733807526 ad-min@addmas.in, sales@addmas.in, divyangkp@hotmail.com	**28.02.2024**
5)	**Elec-tronet (Pune)**	**Upto 1000 mm dia**	**M/s. Electronet Equipments Pvt. Ltd.,** Plot No. 84 to 86, Tiny Ind. Estate, Pisoli Road, Kondwa (Bk.), Pune - 48	**Mr. Rajendra Na-gavkar,** Managing Di-rector Contact No: 9822015256rmn@eeplindia.com**Mr. Tushar Patil** Contact No: 8275518875	**31.05.2024**
6)	**Adept**	**Upto 900 mm dia**	**M/s. Adept Fluidyne Pvt. Ltd,**Plot 4, S. No. 17 / 1-B, Kothrud Industrial Estate, Kothrud, Pune 38.	**Mr. Vinayak Gadre, Director**Mobile No.: 9881478230 in-fo@adeptfluidyne.com	**30.11.2023**
7)	**AAROHI**	**Upto 900 mm dia**	M/s. Aarohi Embedded systems Pvt. Ltd., Plot No.G/1004,1008/A, G.I.D.C. Metoda, Rajkot-360021	Mr. Ravi Bhardava, Mob-9512999942 . info@aarohies.com	**31.05.2025**

8)	**Manas**	**Upto 800 mm dia**	**M/s. Manas Microsystem Pvt. Ltd.,** EL 54, Electronic Zone, JBlock, MIDC Bhosari, Pune - 411026. md@manasmicro.com	**Mr. Shrikant Sahasrabuddhe** Managing Director Contact No: 9860792277 md@manasmicro.com **Mr. Pavan Patil** Mobile No. 8530006258	**31.12.2024**
9)	**Flowtech**	**Upto 600mm dia**	**M/s. flowtech Measuring Instruments Pvt. Ltd.,** 900/2/B, GIDC, Aurangabad.390010	**Mr. Tushar Patil** No: 9824049988 , 8275518875 **Email Id** tushar@flowtech-instrument.com , **info@flowtech-instruments.com**	**30.10.2023**
10)	**Nivo**	**Up to 350 mm dia**	**M/s. NIVO ControlsPvt.Ltd.** 104-115 Electronic Complex, Indore – 452010. 0731 / 4081305 / 07	**Mrs. Suwarna Karwade**Sr. Engineer Marketing Mobile No:- 9584132258 sales@nivocontrols.com	**30.06.2024**

Note : If any make of the product is not mentioned in the above approved list then the same shall be got approved from Superintending Engineer (M) Thane/Nagpur.

Detail Technical Specifications for Wet well Pumping Stations and Sewage Treatment Plant

Technical Specifications

A. Raw Sewage Pumping Station of MLD Capacity

Design data Description	Ahilyanagar wet well with PS & Panel RM	Tulajainagar wet well with PS & Panel RM	Kumbhar Mala wet well with PS & Panel RM	Jagruti wet well only
Wet well Gross capacity including inlet and screen chamber capacities	266000Lit	730000Lit.	1570000Lit.	56000 Lit.
Average flow	5.55MLD	22.02MLD	47.06MLD	27.57MLD
Peak Factor	2.25	2.25	2.25	2.25
Design Peak Flow	12.5MLD	49.55MLD	105.9MLD	62.05MLD
Dia.& Material Of incoming sewer	500 mm RCC	500 mm and 800 mm RCC	1200 mm RCC	350 mm and 700 mm DI K9
Average Ground level	561	555.809	547.70	568.8
Incoming sewer IL	557.172	551.267	540.997	571
Detention time	30 min.	30 min.	30 min.	5 min.
Free board below IL (over design capacity)	0.5	0.5	0.5	0.5
Plinth level	563.75	557	548.75	571.5
Min. Side Water depth below IL	4 m	4 m	5.5 m	2.5 m

Receiving Chamber

The deep gravity outfall sewers will discharge the raw sewage into a Receiving chamber. The function of the Receiving chamber is to distribute the flow for process units. The Receiving Chamber shall be designed for ultimate peak flow. The

Receiving chamber shall consist of sluice gates on upstream for flow regulation. In the sidewall of the Receiving chamber, sluice gates shall be installed such that it is possible to operate them manually, inspection as well as operation by standing on a platform constructed at a suitable elevation adjoining and circumventing the receiving chamber. The receiving chamber shall be of adequate size to meet the requirements of workability inside it. The receiving chamber shall be open to sky and shall be water tight to prevent seepage of the sewage out of the receiving chamber. The entire construction is in M30 grade concrete and as per IS 3370. RCC access platform minimum 1000 mm wide with railing as per specifications shall be provided on one side of the chamber:

Ultimate Average flow	:	MLD
Peak factor	:	2.25
Ultimate Peak Flow	:	MLD
Number of Units	:	1 (One)
Detention period	:	30 Sec at Peak Flow
Min Free board	:	0.50 m above FGL

Coarse Screen Channels

One mechanical screen working and one manual screen standby of 20 mm clear spacing and each screen shall be provided of 100% peak flow capacity.

The mechanical and manual bar screens shall be made of 10 mm thick Stainless Steel (SS 304) flats respectively. The mechanical coarse screens shall be of Inclined Rake Type of 20 mm opening as per the specifications detailed elsewhere in the tender. Bin and chute arrangement shall be provided to take the screenings to the screenings dropped from chute will be collected in a wheel burrow. Manually operated CI gates are provided at the upstream and downstream ends to regulate the flow.

Adequate RCC Platforms shall be provided at the upper level to enable operation. Railings shall be provided around the entire periphery of the platform. The entire structure is to be M30 concrete and as per IS 3370 including the platform. RCC staircase 1000 mm wide shall be provided for access from the ground level to the top of the unit & to the operating platform.

Ultimate Average flow : MLD

Peak factor	:	2.25
Ultimate Peak Flow	:	MLD
Number of Units	:	1 Mechanical (Working)+ 1 Manual(Standby) each of 100% Peak Flow capacity
Approach Velocity at Average Flow (m/sec)	:	0.3
Velocity through Screen at Average Flow	:	0.6 maximum (m/sec)
Velocity through Screen at Peak Flow (m/sec)	:	1.2 maximum
Min Free board	:	0.50 m above FGL
Wheeled Trolley	:	1 No.

All other accessories, whether specified or not, but required for completeness of contract shall be in contractor's scope.

Raw Sewage Pumping Station

3.1 Sump and Pumps

Sewage enters into wet well of the pumping station after screening. The wet well shall be circular/rectangular in shape and shall be designed for an ultimate average flow of as stated in the table. The capacity of the wet well should be kept such that the detention time in the wet well shall be minimum 5 minutes of ultimate peak flow and the maximum detention time shall not exceed 30 minutes at ultimate average flow. The entire structure is to be M30 concrete and as per IS 3370 including the platform. Following criteria shall be considered to size the sump:

1. That the pump of the minimum duty/ capacity would run for at least 5 minutes considering no inflow or
2. The capacity of the sump is to be so kept that with any combination of inflow and pumping the operating cycle for any pump will not be less than 5 minutes and
3. The arrangement of the submersible pumps as per pump manufacturer's data i.e. spacing between pumps, minimum space between pump and wall etc.
4. The side water depth (live liquid depth) shall be minimum 1.5 meter. In addition to the above liquid depth an additional depression shall be provided to ensure adequate submergence of the pump as per the manufactures recommendations Pumping station should have a room adequate for

installing electrical panels. Suitable arrangement should be provided for lifting of pumps.

5. The effective liquid volume shall be provided below the invert level of the screen chamber after leaving provision for a minimum of 0.1 m.

   Necessary bypass arrangement shall be provided to be used during the shutdown of the plant.

IS: 3370 and IS: 4111 (part 4) shall be followed for the design and construction of wet well.

Bidder shall note that, the civil works for raw sewage pumping station shall be carried out for ultimate average flow whereas, electro-mechanical works for pumping station shall be carried out for intermediate average flow). Hence, Pumping machinery shall be designed for present ……. MLD (as stated in the table) average flow and a peak factor of …...(as stated in the table) Adequate space shall be provided for the pumps that need to be installed in the wet well for future …….MLD(as stated in the table) average flow and peak factor of ……..(as stated in the table) The pumps shall be Submersible raw sewage pumps with centrifugal, non-clog type design. The speed of pump shall not be more than 1500 rpm. The impeller should be of a non-clog design with smooth passage and solid handling capability of 100 mm size. The pumps will have automatic coupling arrangement at discharge end for removal and a guide pipe and chain in SS 304 will be provided for removal and lowering of pumps. Pump shall run smooth without undue noise and vibration. Vibration shall be limited as per BS 4675 Part I. The motor shall be squirrel cage type, suitable for three phase supply continuous duty with class 'F' insulation. Motor shall have integral cable parts and the cable entries shall be sealed. Complete rotor shall be balanced dynamically.

Design Flow (Ultimate Avg. flow)	:	MLD
Minimum Retention Time	:	5 minutes minimum at peak flow.
No. of Pumps for present Flow	:	MLD with Suitable Head (2W+1S)
Type of Pumps	:	Submersible type non-clog design
Solid passage size	:	100 mm max.

Through Pumps

Insulation	:	Class F
Protection	:	IP-68

Wet well Specific Requirement, Material of Construction and Accessories:

i. Number of Units : (1) One designed for peak flow
ii. Pumping Station Material of Construction RCC
Wet well / Sump

The size of the sump shall be suitable to accommodate the number of pumps required for operation with easy maneuverability. Electrical panel of the Pump House shall be placed in such a manner to avoid corrosion from gases. Either, it can be clubbed with MCC panel or necessary protection can be given.

Raw Sewage Sump shall be provided with following:

Electrical Hoist - comprising of I-Girder and a 1½ ton or more chain pulley (the chain pulley block capacity to be 1½ Ton or 1.5 times the maximum single unit/ weight that may be required to be removed for maintenance) with horizontal travel on the I-beam.

Pumps Configuration	:	As mentioned above
Liquid	:	Raw Sewage
Specific gravity	:	1.05
Temperature	:	Min. 20° C
Efficiency	:	more than 70%
Installation	:	Fixed.
Casing	:	Cast Iron IS 210 Gr. FG 260
Impeller	:	Cast Iron IS 210 Gr. FG 260
Shaft	:	AISI 410
Cable gland	:	Cast Iron IS 210 Gr. FG 260
Motor Body	:	Cast Iron IS 210 Gr. FG 260
Seal cover	:	Cast Iron IS 210 Gr. FG 260
Automatic Coupling	:	CI
Duck foot bend	:	CI
Guide Pipe	:	SS 304

Lifting chain	:	SS 304
Fasteners	:	MS with GI coating

Testing of Pumps at Manufacturers Premises:

a) Hydrostatic Testing: All pressure parts of pumps prior to assembly, shall be subjected to hydrostatic tests to the satisfaction of Executive Engineer at 1.5 times the maximum pressure obtained with the delivery valve closed and suction pressure at maximum, or twice the working pressure whichever is higher for a duration of 10 minutes.

b) Balancing Test: Impeller and pump rotating assembly shall be dynamically balanced.

c) Performance Test: Each pump shall be tested for full operating range individually to BS: 5316: Part 2. Test shall be carried out for performance at rated speed with minimum NPSH as available at site.

d) Pump performance shall be within the tolerance limits specified in BS: 5316: Part 2.

3.2 A suitable plant bypass shall be provided from the pumping station to divert sewage in case of emergency.

BRIEF SCOPE OF WORK For Wet well Pumping Stations

The scope of the work for all pumping stations i.e. PS1, PS2 shall include but not be limited to the following:

1. Design construction, supplying, erection, testing and commissioning of PS-1, PS-2, PS-3 with their corresponding rising mains as specified in the tender document.

2. Preparation of process, hydraulic, structural, electrical, mechanical and piping design. Preparation all civil, mechanical, electrical and piping drawings including architectural, construction and as built drawings.

3. Construction of civil engineering works for all the units plus all the ancillary structures as detailed in the tender document.

4. 1.2 m wide plinth protection along the periphery of all SPS units shall be provided as per technical specifications or as directed by the Engineer in Charge.

5. Providing bypass / overflow/Gates/Screen arrangement to each pumping station up to the nearest disposal point as directed.

6. Supply, erection testing & commissioning of all the mechanical equipment as detailed in Mechanical and Electrical Specifications mentioned separately in the tender document.

7. Supply, erection testing & commissioning of all the Electrical & Instrumentation equipment as detailed in Mechanical and Electrical Specifications mentioned separately in the tender document.

8. Supply, erection testing & commissioning of all the Instrumentation equipment as detailed in specifications mentioned separately in the tender document.

9. Supply, erection testing & commissioning of all the piping & valves as detailed in specifications mentioned separately in the tender document.

10. Construction of internal roads, pathway, storm water drain, boundary walls and MS gates and MS arch.

11. Defect liability period of 60 months after getting completion certificate.

12. Construction of HT substation, installation of transformers along with providing and laying LT cable from transformer to pump etc complete. Main electrical panel shall be designed for proposed mechanical components mentioned in scope of work.

13. Supply of all documentation for the plant such as As-Built drawings, Operation & Maintenance manuals (6 sets), list of fast wearing spares and list of two years normal operation spares to maintain.

14. Waterproof acrylic painting of approved shade to all civil units and oil painting with anti corrosive treatment to railing and all MS, CI and GI works.

15. Subsoil testing and investigation for water table and safe allowable bearing capacity to be carried out by the contractor at four SPS locations through a reputed and specialist firm approved by Engineer-in-Charge.

16. Bidders are advised to visit SPS and STP sites and inspect the location before quoting for the proposed for SPS & STP.

17. Any other items of work which have not been specifically mentioned in the specifications but are necessary for construction of the plant as per good engineering practice and safety norms and operation and guaranteed performance of the entire plant shall be deemed to be included within the scope of work of this specifications and shall be provided by the contractor without any extra cost to the employer.

18. All the above said pumping stations, treatment units shall be designed as per earthquake resisting structure.

SEWAGE PUMPING STATIONS
DETAILED SCOPE OF WORK

- Three Sewage Pumping Stations shall have following units.
- Separate Inlet , Screen Chamber and Grit Chamber Unit
- Raw Sewage Sump & Pump House Unit
- Raw Sewage Pumps (Separately specified in tender document)
- Rising Main (Separately specified in tender document)
- HOT
- Flow Measuring Unit
- Valves
- Electrical Works
- Automization unit.
- DG Set with room (Panel Room as specified in tender)
- Miscellaneous Works
- Operation & Maintenance

PROPOSED TREATMENT SCHEME

A) RAW SEWAGE PUMPING STATION

1. Receiving of Raw Sewage

The deep gravity outfall sewer shall discharge into receiving chamber of pumping station. From Receiving Chamber it will be taken into downstream screens. The function of the Receiving Chamber is to reduce the incoming velocity. Receiving Chamber shall be of adequate size to meet the requirements of workability inside it. The Receiving Chamber shall be water tight to prevent seepage of the sewage out of the Receiving Chamber.

2. Coarse Screening

Coarse screens are to be provided up stream of Wet well for removal of floating and oversized material coming with the sewage. The coarse screens should be capable to screen out most of the medium & large floating and oversized material such as plastic rags, debris, weeds, paper, cloth, rags etc. which could clog the waste water pump impellers. The coarse screen shall be inclined bar screen (Single or multi rake). It should be of sturdy design to take care of all sorts of materials envisaged in the gravity sewer. The screenings shall be dropped in bin above the top of the screen channel. The screening material as collected will drop into a wheelbarrows for its disposal.

3. Raw Sewage Pumping Station

Screened sewage after coarse screening enters into wet well of the pumping station. The capacity of the wet well should be kept such that adequate detention time is available during average and peak flow conditions. The effective liquid volume shall be provided below the invert level of the incoming sewer after leaving provision for freeboard. The capacity of the sump is to be so kept that with any combination of inflow and pumping the operating cycle for any pump will not be less than 5 minutes. In addition to the above liquid depth, an additional depression shall be provided to ensure adequate submergence of the pump as per the manufacturer's recommendations.

Suitable combination of submersible pumps is to be provided in the sumps to cater the pumping requirements at average and peak flow conditions. Based on incoming flow conditions, adequate no. of pumps shall operate automatically to cater the pumping requirements.

Suitable arrangement should be provided for lifting of pumps. Electrical panel of the Pump House shall be placed in such a manner to avoid corrosion from gases. Either, it can be clubbed with MCC panel or necessary protection can be given.

The pumped flow from the pumping station shall be taken to the elevated head works Inlet chamber of the STP from where sewage will gravitate to fine screen channels.

B) SEWAGE TREATMENT PLANT

4. Inlet Chamber

Inlet Chamber of STP shall receive the average flow from Raw Sewage Pumping Station through rising main in STP area. From Inlet Chamber it will be taken into downstream Fine Screen Channels. The function of the Inlet Chamber is to reduce the incoming velocity. It shall be of adequate size to meet the requirements of workability inside it. It shall be water tight to prevent seepage of the sewage outside.

2.2.5 Fine Screening

Fine Screens Channels shall be provided upstream of Grit Removal Units. Fine Screens should be capable to screen out most of the small floating materials above 6 mm size. It shall be of Mat type. The screenings shall be dropped in the bin installed at the top of the Fine Screens Channels. The screening material as collected will drop automatically into wheel Barrows for its disposal.

2.2.6 De-gritting

Screened sewage shall gravitate to Grit Separator Tanks for removal of grit and small inorganic particulate matter of specific gravity above 2.65 and particle size above 150 microns. The Grit Separator Tanks shall be of RCC complete with Detritus Mechanism comprising Scraper, Classifier and Organic Return Pumps. The grit separated shall be properly collected and transferred for disposal.

2.2.7 Flow Measurement

Flow measurement shall be done online using an ultrasonic flow meter on the both rising mains from raw sewage pumping station at STP area.

2.2.8 Sequential Batch Reactor (SBR) Units

Primarily treated sewage shall be fed into the Sequential Batch Reactor (SBR) Process Basins for biological treatment to remove BOD, COD, Suspended Solids, Biological Nitrogen and Phosphorous. Sequential Batch Reactor (SBR) shall work in Cyclic / Batch mode in single step. It shall perform biological Organic Removal, Nitrification, De-nitrification and Biological Phosphorous Removal and shall be capable of simultaneous sludge stabilization. The oxygen required shall be supplied through fixed type Fine Bubble Diffused Aeration System with auto control of oxygen level in the Basins. The system shall have a SVI < 120 for higher settling rates and should be designed in such a way that growth of filamentous bacteria is restricted. The complete operation including Filling of Sewage, Aeration, Sludge Recirculation, Decanting and Wasting of Excess Sludge shall be controlled by PLC. Treated sewage from Sequential Batch Reactor (SBR) Units shall be collected in Chlorine Contact Tank for its further treatment.

2.2.9 Chlorination Tank

Treated sewage from SBR basins shall be collected in a Chlorination Tank where disinfectant will be added for disinfection at suitable dosing rate. Baffle walls shall be provided in the Tank to facilitate hydraulic mixing of treated sewage. Adequate reaction time shall be provided to ensure proper disinfection of treated sewage. The capacity of the Chlorination tank should be kept such that adequate detention time is available during peak / decant flow condition. Treated Sewage from Chlorination Tank shall be discharged into the nearby River.

2.2.10 Sludge Dewatering Units

Excess Sludge from SBR Basins shall be withdrawn through Sludge Withdrawal System and collected in the Sludge Sump. Sludge Sump shall be equipped with suitable submersible mixers to ensure homogeneous mixing.

The sludge shall be then pumped to centrifuge for dewatering using positive

displacement type Screw Pumps. Dewatering Polyelectrolyte Dosing System comprising one Solution Preparation and One Solution Dosing Tank equipped with slow speed Agitator and mechanically actuated diaphragm type Metering Pumps shall be provided to dose Dewatering Polyelectrolyte Solution online.

The dewatered sludge in the form of wet cake from Centrifuge shall be collected whereas Centrate shall be transferred back to the Raw Sewage Sump.

Interconnection of various Units shall be made through DI K-9 pipe or RCC Channels. RCC Pipes shall be preferred over RCC Channels wherever possible but the Executive Engineer reserves the right to select any option.

Indicative Hydraulic Flow Diagram, Process & Instrumentation Diagram and Equipment Layout for the proposed STP are attached at the end of Volume – I. These Drawings are indicative and for tendering purpose only. Bidders need to develop their own drawings based on his design and site conditions, conforming to the specifications given in the Tender documents.

The process selected is a well-established process for treatment of sewage. The Bidders are to adopt the same nomenclature used for various Treatment Units in their design documents as used in the Tender documents. Also the Bidders are required to fill up/complete the Technical Schedules presented in Technical Bid as a part of Tender submission. Any Bid without filled in Technical Schedules shall be considered as non-responsive and will be summarily rejected. Bidder shall also note that, the Layout & Hydraulic Flow diagram shall be planned in such a way that necessary space provision shall be made after SBR basins so that suitable filtration system can be added in future, if required.

2. DETAILED SCOPE OF WORK

The scope of the work will include the following components

1. Providing Designing, Construction, hydraulic testing and commissioning and giving satisfactory trials with Cyclic activated sludge process technology Sewage Treatment Plant of 27 MLD average capacity with all civil, electrical and Mechanical components
2. Preparation of process, hydraulic, structural, electrical, mechanical and piping design.
3. Preparation all civil, mechanical, electrical and piping drawings including

architectural, Construction and as built drawings

4. Construction of civil engineering works for all the units plus all the ancillary structures as mentioned in detailed Specification.
5. 1.2 m wide plinth protection along the periphery of all SPS and STP units shall be provided as directed by the Engineer in Charge
6. Construction of internal roads, pathway, storm water drain.
7. Drain arrangement with necessary valve and piping (min 200 mm dia) to all units of STP.
8. Providing bypass / overflow arrangement to each sump at Sewage pumping station up to the nearest disposal point as directed.
9. Supply, erection testing & commissioning of all the mechanical equipment as per detailed Specification.
10. Supply, erection testing & commissioning of all the Electrical & Instrumentation equipment as per detailed Specification.
11. Supply, erection testing & commissioning of all the Instrumentation equipment as per detailed Specification.
12. Supply, erection testing & commissioning of all the piping & valves as per detailed Specification.
13. Construction of internal roads, pathway, storm water drain, boundary walls and MS gates and MS arch.
14. Defect liability period of 60 months from the date of the successful completion of the performance run.
15. Construction of HT substation, installation of transformers (1W+ 1S),DG set. Laying LT cable from transformer to pump etc complete. Main electrical panel shall be designed for proposed mechanical components mentioned in scope of work.
16. Supply of all documentation for the plant such as As-Built drawings, Operation & Maintenance manuals (6 sets), list of fast wearing spares and list of two years normal operation spares to maintain.
17. Water proof cement painting of approved shade to all civil units and oil painting with anti corrosive treatment to railing and all MS, CI and GI works.
18. Subsoil testing and investigation for water table and safe allowable bearing capacity to be carried out by the contractor at all units of STP, SPS locations through a reputed and specialist firm approved by Engineer-in-Charge. Landscaping and gardening for the entire open area of the existing and new treatment plant site.
19. Contractors are advised to visit SPS, STP sites and inspect the location before quoting for the proposed for SPS & STP.
20. Any other items of work which have not been specifically mentioned in the specifications but are necessary for construction of the plant as per good engineering practice and safety norms and operation and guaranteed performance of the entire plant shall be deemed to be included within the scope of work of this specifications and shall be provided by the Contractor without any extra cost to the employer.

It includes,

1. Design Basis:

Sr. No.	Design Parameters	Capacity
A	**RAW SEWAGE PUMPING STATION**	AS Stated in Earlier Table
1	Average Flow	
2	Peak Factor	
3	Peak Flow	
B	**SEWAGE TREATMENT PLANT**	
1	Average Flow	27 MLD
2	Peak Factor	2.25
3	Peak Flow	60.75 MLD
4	Dia. of Incoming Gravity Sewer Line (RCC Pipe)	1200 mm
5	Invert Level of Incoming Sewer at pumping station proposed at STP area at Site	540.997
6	Natural Ground Level (NGL) at Site	547.70
7	Finished Ground Level (FGL) at Site	548
8	HFL of nearby River	544
9	Approximate min. length of Disposal Pipe	1000 m
10	Ground Water Table	Bidder has to verify on his own before bidding.
11	Net Safe Bearing Capacity (T/m2)	Avg.5 t/m2 at 1.5 m below GL Avg.15 t/m2 below 6 m below GL
Note: The bidder has to make his own assessment of ground water table & safe bearing capacity while quoting their commercial bid.		

Note: Bidder to carry out necessary soil investigation to ascertain the type of foundation. The same shall be approved by Engineer in charge/consultant.

2 Raw Sewage Quality:

An abstract of Raw Sewage Characteristics is indicated in the following Table:

Sr. No.	Parameters	Values	UOM
1	pH	6-8	

2	Biochemical Oxygen Demand (BOD_5)	150-300	mg/l
3	Chemical Oxygen Demand (COD)	300-400	mg/l
4	Total Suspended Solids (TSS)	250-400	mg/l
5	Total Kjeldahl Nitrogen (TKN)	35-50	mg/l
6	Total Phosphorous (TP)	5-10	mg/l
7	Oil & Grease	15-35	mg/l
8	Fecal Coliform	>1000	MPN/100 ml
9	Total Coliform	>1000	MPN/100 ml

The Bidder shall carry out the sampling tests of raw sewage by themselves to ascertain the raw sewage quality for treatment process. The Employer will not be responsible for the above and no relaxation will be given to the guarantee conditions of desired treated sewage quality. For design purposes the lower parameters than the above mentioned parameter will not be allowed.

3 Treated Sewage Quality:

The Contractor shall design the process in such a way that the treated sewage quality attains the following limits or even better:

Treated Sewage Quality:

Sr. No.	*Parameters / Pollutants*		**Values after treatment**
1	pH	:	5.5 to 9.0
2	Biochemical Oxygen Demand (BOD_5)	:	≤ 10 mg/l
3	Chemical Oxygen Demand (COD)	:	≤ 50 mg/l
4	Total Suspended Solids (TSS)	:	≤ 10 mg/l
5	Total Phosphorous (TP)	:	≤ 2 mg/l
6	Total Nitrogen (TN)	:	≤ 10 mg/l
7	Ammonical Nitrogen (NH3-N)	:	≤ 2 mg/l
8	Fecal Coliform	:	≤ 230 MPN/ 100 ml

3. Technical Specifications

A. Raw Sewage Pumping Station

1. Receiving Chamber

The deep gravity outfall sewers will discharge the raw sewage into a Receiving chamber. The function of the Receiving chamber is to distribute the flow for process units. The Receiving Chamber shall be designed for peak flow. The Receiving chamber shall consist of sluice gates on upstream for flow regulation. In the sidewall of the Receiving chamber, sluice gates shall be installed such that it is possible to operate them manually, inspection as well as operation by standing on a platform constructed at a suitable elevation adjoining and circumventing the receiving chamber. The receiving chamber shall be of adequate size to meet the requirements of workability inside it. The receiving chamber shall be open to sky and shall be water tight to prevent seepage of the sewage out of the receiving chamber. The entire construction is in M30 grade concrete and as per IS 3370. RCC access platform minimum 1200 mm wide with SS 304 pipe railing as per specifications shall be provided on one side of the chamber:

Number of Units	:	1 (One)
Detention period	:	30 Sec at Peak Flow
Min Free board	:	0.50 m above FGL

2. **Coarse Screen Channels**

One mechanical screen working and one manual screen standby of 20 mm clear spacing and each screen shall be provided of 100% peak flow capacity.

The mechanical and manual bar screens shall be made of 10 mm thick Stainless Steel (SS 304) flats respectively. The mechanical coarse screens shall be of Inclined Rake Type of 20 mm opening as per the specifications detailed elsewhere in the tender. Bin and chute arrangement shall be provided to take the screenings to the screenings dropped from chute will be collected in a wheel burrow. Manually operated CI gates are provided at the upstream and downstream ends to regulate the flow.

Adequate RCC Platforms shall be provided at the upper level to enable operation. Railings shall be provided around the entire periphery of the platform. The entire structure is to be M30 concrete and as per IS 3370 including the platform. RCC

staircase 1200 mm wide shall be provided for access from the ground level to the top of the unit & to the operating platform.

Number of Units	:	Min.1 Mechanical (Working) + 1 Manual (Standby) each of 100% Peak Flow capacity
Approach Velocity at Average Flow (m/sec)	:	0.3
Velocity through Screen at Average Flow (m/sec)	:	0.6 maximum
Velocity through Screen at Peak Flow (m/sec)	:	1.2 maximum
Min Free board	:	0.50 m above FGL
Wheeled Trolley	:	1 No.

All other accessories, whether specified or not, but required for completeness of contract shall be in contractor's scope.

3. Raw Sewage Pumping Station

3.1 Sump and Pumps

Sewage enters into wet well of the pumping station after screening. The wet well shall be circular in shape and shall be designed for average flow. The capacity of the wet well should be kept such that the detention time in the wet well shall be minimum 5 minutes of peak flow and the maximum detention time shall not exceed 30 minutes at average flow. The entire structure is to be M30 concrete and as per IS 3370 including the platform. Following criteria shall be considered to size the sump:

1. That the pump of the minimum duty/ capacity would run for at least 5 minutes considering no inflow or

2. The capacity of the sump is to be so kept that with any combination of inflow and pumping the operating cycle for any pump will not be less than 5 minutes and

3. The arrangement of the submersible pumps as per pump manufacturer's data i.e. spacing between pumps, minimum space between pump and wall etc.

4. The side water depth (live liquid depth) shall be minimum 1.5 meter. In addition to the above liquid depth an additional depression shall be provided to ensure adequate submergence of the pump as per the manufactures recommendations Pumping station should have a room adequate for installing electrical panels. Suitable arrangement should be provided for lifting of pumps.

5. The effective liquid volume shall be provided below the invert level of the screen chamber after leaving provision for a minimum of 0.1 m.

Necessary bypass arrangement shall be provided to be used during the shutdown of the plant.

IS: 3370 and IS: 4111 (part 4) shall be followed for the design and construction of wet well.

The pumps shall be Submersible raw sewage pumps with centrifugal, non-clog type design. The speed of pump shall not be more than 1500 rpm. The impeller should be of a non-clog design with smooth passage and solid handling capability of 100 mm size.

The pumps will have automatic coupling arrangement at discharge end for removal and a guide pipe and chain in SS 304 will be provided for removal and lowering of pumps. Pump shall run smooth without undue noise and vibration. Vibration shall be limited as per BS 4675 Part I.

The motor shall be squirrel cage type, suitable for three phase supply continuous duty with class 'F' insulation. Motor shall have integral cable parts and the cable entries shall be sealed. Complete rotor shall be balanced dynamically.

Minimum Retention Time	:	5 minutes minimum at peak flow.
No. of Pumps for present Flow	:	Capacity with Suitable Head (2W+1S)
Type of Pumps	:	Submersible type non-clog design
Solid passage size Through Pumps	:	100 mm max.
Insulation	:	Class F
Protection	:	IP-68

Wet well Specific Requirement, Material of Construction and Accessories:

i. Number of Units : (1) One designed for peak flow

ii. Pumping Station Material of Construction RCC

Wet well / Sump

iii. Raw Sewage Pump House: RCC above the Wet well .

It shall be RCC (M25) Frame and Brick Masonry Structure equipped with Doors, Windows/Ventilators, etc. complete. Also, it shall be provided with Flooring, Internal and External Plaster with Painting.

The size of the sump shall be suitable to accommodate the number of pumps required for operation with easy maneuverability.

Raw Sewage Sump shall be provided with following:

i. Electrical Hoist – comprising of I-Girder and a 1½ ton or more chain pulley (the chain pulley block capacity to be 1½ Ton or 1.5 times the maximum single unit/ weight that may be required to be removed for maintenance) with horizontal travel on the I-beam.

Pumps Configuration	:	As mentioned above
Liquid	:	Raw Sewage
Specific gravity	:	1.05
Temperature	:	Min. 20° C
Efficiency	:	more than 70%
Installation	:	Fixed.
Casing	:	Cast Iron IS 210 Gr. FG 260
Impeller	:	Cast Iron IS 210 Gr. FG 260
Shaft	:	AISI 410
Cable gland	:	Cast Iron IS 210 Gr. FG 260
Motor Body	:	Cast Iron IS 210 Gr. FG 260
Seal cover	:	Cast Iron IS 210 Gr. FG 260
Automatic Coupling	:	CI

Duck foot bend	:	CI
Guide Pipe	:	SS 304
Lifting chain	:	SS 304
Fasteners	:	MS with GI coating

Testing of Pumps at Manufacturers Premises:

a) Hydrostatic Testing: All pressure parts of pumps prior to assembly, shall be subjected to hydrostatic tests to the satisfaction of Executive Engineer at 1.5 times the maximum pressure obtained with the delivery valve closed and suction pressure at maximum, or twice the working pressure whichever is higher for a duration of 10 minutes.

b) Balancing Test: Impeller and pump rotating assembly shall be dynamically balanced.

c) Performance Test: Each pump shall be tested for full operating range individually to BS: 5316: Part 2. Test shall be carried out for performance at rated speed with minimum NPSH as available at site.

d) Pump performance shall be within the tolerance limits specified in BS: 5316: Part 2.

4. Rising Main

The pumped flow from the pumping station to the elevated head works inlet chamber of the plant shall be taken through a DI – K-9 pipeline including all specials, valves, air valves, thrust block of M-20 grade if required etc. The rising main shall be designed for average flow with peak flow.

(a) The pipeline shall be adequately sized to have a minimum velocity of at least 1.2 m/s at minimum flow conditions and not more than 2.5 m/sec at pumped peak flow.

(b) The pump head shall be adequately sized to give a residual discharge head as per CPHEEO manual.

A suitable plant bypass shall be provided from the pumping station to divert sewage in case of emergency.

B. Sewage Treatment Plant

1.0 Primary Treatment Units

Primary Treatment Units comprising Inlet Chamber, Fine Screen Channels and Grit Chambers shall be designed for Peak Flow.

1.1 Inlet Chamber

Inlet Chamber of STP shall receive the flow from raw sewage pumping station located within STP area. Inlet Chamber shall be designed for Peak Flow. The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370. RCC Platform/Walkway, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided. RCC Staircase, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided for access from Finished Ground Level to the top of the Unit & to the Operating Platform/Walkway.

Number of Units	:	1 No.
Hydraulic Retention Time	:	30 Sec at Peak Flow
Free Board	:	0.50 m min.

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

1.2 Mechanical & Manual Fine Screen Channels

Min. 1 Mechanical Fine Screens (Working) and one Manual Fine Screen (Standby) shall be provided in Fine Screen Channels. Each Fine Screen Channel shall be designed for 100% of Peak Flow.

The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370. RCC Platform/Walkway, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided. RCC Staircase, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided for access from Finished Ground Level to the top of the Unit & to the Operating Platform/Walkway.

The clear opening shall be 6 mm for Mechanical Fine Screen and 10 mm for Manual Fine Screen. The Mechanical and Manual Screens shall be made of SS 304 flats (3

mm for Mechanical and 10 mm for Manual Screen). Bin and Chute arrangement shall be provided to take the screenings. Screenings dropped from Chute shall be collected in a wheel Burrow. Manually operated CI Sluice Gates shall be provided at the upstream and downstream ends to regulate the flow.

Number of Units	:	1 Mechanical (Working) + 1 Manual Stand by) each of 100% of Peak Flow capacity.
Approach Velocity at Average Flow	:	0.30 m/s
Velocity through Screen at Average Flow	:	0.60 m/s max.
Velocity through Screen at Peak Flow	:	1.20 m/s max.
Free Board	:	0.30 m min.
Wheel Barrow	:	1 No. min.

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

1.3 Grit Chambers

Two Mechanical Grit Chamber (Working) along with one Manual Bypass Channel (Standby) shall be provided after Fine Screen Channels. The Grit Chamber shall be designed for 50% of Peak Flow and the Bypass Channel shall be designed for 50% of Peak Flow.

The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370. RCC Platform/Walkway, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided. RCC Staircase, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided for access from Finished Ground Level to the top of the Unit & to the Operating Platform/Walkway.

Each Grit Chamber shall have the following features:

- One tapered Inlet Channel running along one side with adjustable Influent Deflectors for entry of sewage into the Grit Chamber.
- One tapered Outlet Channel for collecting the de-gritted sewage, which

overflow over a adjustable Weir into the Outlet Channel. It shall be designed in such a way that no settling takes place in it.

- One sloping Grit Classifying Channel in to which the collected grit shall be classified.
- The grit from Classifier shall be collected in a Wheeled Trolley.
- A Grit Scraping Mechanism.
- Screw Classifier or Reciprocating Rake Mechanism to remove the grit.
- One Organic Matter Return Pump

Manually operated CI Sluice Gates shall be provided at entrance of the Inlet Channel of the Grit Chambers as well as Bypass Channel to regulate the flow.

No. of Units capacity	:	2 Mechanical (Working) of 50% of Peak Flow
Type	:	Mechanical
Size of grit particle	:	0.15 mm
Specific gravity of grit	:	2.65
Maximum Surface Overflow Rate	:	960 m3/m2/day
Free Board	:	0.30 m min.
Side Water Depth	:	0.90 m min.
Wheel Barrow	:	1 No. minimum

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

Flow Measurement

Flow measurement shall be done online using an ultrasonic flow meter on the rising mains from raw sewage pumping stations located at STP area.

2.0 Sequential Batch Reactor (SBR) Units

2.1 General

The Sequential Batch Reactor (SBR) Process shall be an advanced activated sludge process with in-built nitrification, de-nitrification and biological phosphorous

removal. The process shall utilize a Fill-and-Draw Reactor with complete-mix regime and operating in true-batch mode. The complete process shall be divided into Cycles with each Cycle is of duration of 2 – 4 hours. All the subsequent treatment Steps – Fill/Aeration, Settling and Decanting must take place sequentially and independently without overlapping. During Fill/Aeration phase, the sewage shall be filled into SBR Basins and part of the treated sewage along with activated sludge shall be recycled with the help of Recycle Pumps. Air shall be supplied for aeration with the help of Air Blowers. During settling phase, the Filling/Aeration shall be stopped and the mixed content shall be allowed to settle under perfect settling conditions. During Decanting phase, the supernatant shall be removed form top with the help of Decanters and excess sludge shall be wasted with the help of Waste Pumps.

The Bidder shall provide the most advanced and proven SBR technology being in successful operation for at least 5 years as on date and meeting Standards of the Treated Sewage / Sewage Quality as mentioned vide Clause 2.3.3 above in Indian conditions. The performance of the same shall be demonstrated by providing necessary Authenticated Certificates issued by the competent authority.

2.2 Process Design

- Sequential Batch Reactor (SBR) Units shall be installed and equipped for average flow.
- The SBR Process shall have following independent steps without overlapping each other:
  - Fill & Aeration
  - Settling (Sedimentation/Clarification)
  - Decanting (Draw)
- Filling, during Settling or Decanting will not be acceptable.
- The complete biological system shall be designed for handling peak flow.
- Suitable Nos. of SBR Basins with adequate volume shall be provided. In addition, 0.50 m Free Board shall be provided to each Basin.

- The entire construction shall be in **M30** grade reinforced cement concrete and as per IS 3370. RCC Platform/Walkway, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided. RCC Staircase, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided for access from Finished Ground Level to the top of the Unit & to the Operating Platform/Walkway. Plinth protection along periphery shall be provided as per technical specifications.
- The system should work on a gravity influent condition. No influent / sewage Equalization Tanks or flash filling is accepted.
- The system should be designed for maximum F/M ratio of 0.18 Kg BOD/Kg MLSS day.
- MLSS maintained in the Basin should range from 3500 to 5000 mg/l.
- Cycle times shall be selected adequately by the Bidder considering min. 12 hrs. /day Basin of aeration and not exceeding decanting of 2.40 m liquid depth at any time with preferred cycle times containing max. 50% not aerated portion.
- The excess sludge produced shall be fully digested. Sludge production (including percipients) rate shall be about 0.60 – 1.20 Kg / Kg of BOD removed.
- A minimum total SRT of 10 days shall be maintained to ensure digested sludge.

2.3 Decanting Device

- The Decanting Device shall be Moving Weir Arm Device of SS 304 with top mounted Gear Box, Electric Drive, Scum Guard, Down comers, Collection Pipe, Bearings. The maximum design travel rate shall be 60 mm/min with proven hydraulic discharge capacity of the decanter proportional to the selected Basin area.
- There should be maximum one (1) Decanter per Basin.
- The hydraulic design based on design flow rate as given above shall not exceed flow speed of 1.30 m/s.
- Flexible rubber hose kind of decanter Sealing is not acceptable.

- One or more decanters shall be provided in each basin which functions under a controlled lowering rate to withdraw treated water out of SBR / Cyclic Activated Sludge Process Basins.
- The decanting mechanism shall be designed for a variable speed mode of operation. Decanter shall be capable to travel at varying speeds. The rate of travel of the decanter shall be adjustable during its travel in air and into the liquid surface, at which point the rate of travel of the decanter shall be automatically adjusted to a calculated rate of operation. The maximum design travel rate shall be restricted to 60 mm/min. Rope driven or fixed subsurface arrangements will not be acceptable.
- The rate of operation shall be calculated for each cycle and shall be determined by the volume of treated effluent to be discharged per cycle. The calculation of decanter travel shall ensure that the volume of treated effluent shall be discharged throughout the designated decant phase of the process cycle. The travel of the decanter shall be limited and controlled by limit switches which shall communicate with the PLC. Upon reaching the designated BWL, the decanter shall return to its parked position.
- During non-decanting cycles, the decanter collection weir shall be parked above the top water level of the basin during aeration and settling phases, thereby eliminating any possibility of solids carryover during these phases. Therefore weirs or entry ports of the Decanters shall not be submerged below the top water level of the basin during non-decant phase. Each decanter shall be fitted with a scum retention mechanism to prevent surface scums and floatables from exiting with the treated effluent.
- In addition, at park position, the decanter shall also provide fail safe overflow protection in the event of a power failure by allowing clear supernatant to flow via gravity, under the scum guard, over the weir, and into the decanters and out of the basins.
- If more than one decanter is provided per basin, operation of all decanters

shall be synchronized precisely using synchronization panel to achieve even distribution of flow through each decanter.

- Weir loading for each decanter shall not exceed 140 m3/hr/m of the inlet weir. During Decanting Phase, decanter weir shall always be visible from the basin walkway to provide the operator with a visual check of the effluent quality. Maximum velocity down comer shall not exceed 1.0m/sec. at the designed decant flow.
- All components of the decanter except seals and bearings shall be constructed of stainless steel 304. The decanter seals and bearings shall be constructed of maintenance free, synthetic materials for longest possible service life. All seals and bearings shall be shipped factory assembled, simplifying installation. All fasteners shall be constructed of 304 stainless. Site fabrication of decanters shall not be allowed.
- Drive mechanism or actuator shall be equipped with variable frequency drive connected to PLC to facilitate its operation at varying flow rates to ensure controlled and seamless operation at varying flow rates. Complete Drive Mechanism shall be mounted on the walkway to provide easy access for maintenance and service purposes.
- All critical decanter components that may require routine inspection or maintenance shall be easily accessible from an access platform at basin coping level without taking a basin out of service or draining or partially draining the basin. It shall be possible to carry out decanter maintenance activities without interrupting normal operation of the basin while the decanter is at its parked position during non-decant phases of the process cycle.
- The SBR blowers, Automatic Air supply Valves, RAS Pumps/Mixers, switching mechanism shall be interlocked with the decanter controls so that aeration/mixing is prevented in a basin which is settling or decanting.

2.4 Aeration System

- The aeration facility shall be installed for average flow.

- Only Fine Bubble Type, PU Membrane Diffusers shall be acceptable with minimum Membrane Diffusers to Floor Coverage Area of 5%. Combination of aeration techniques using Aerators/Submersible Mixers etc. is not acceptable. Diffusers shall be submerged, fine bubble / fine pore, high transfer efficiency, low maintenance and non-buoyant type. Diffusers shall be panel / tubular type. In case tubular type Diffusers are used, only top half surface area of the Diffuser shall be considered for supply of air. Material of construction for entire under water system including accessories shall be of non-corrosive. Complete Diffuser as a unit shall be assembled at the manufacturing factory level. The grid supports shall of adjustable type made of SS 304.

- The Air Blower Arrangement shall be capable of handling Total Water Level and Bottom Water Level operation conditions controlled by process sensors such as DO, Temperature and Level.

- Each set of Air Blowers shall have dedicated standby. Minimum one working Air Blower in each set shall operate via VFD while others may be operating at a fixed constant speed on soft starter configuration.

- The Air Blowers shall be positive displacement (Roots) type and head for Air Blowers shall be decided on the basis of S.O.R. of Diffusers and maximum Liquid Depth in Basin duly considering the losses governing point of delivery (Diffusers) and the Air Blowers. Air Blowers shall be complete with Motor and accessories like Base Frame, Anti Vibratory Pad, Reactive Silencer, Non Return Valve, Air Filter etc. as per requirements. Further, Air Blowers shall have acoustic enclosure to ensure that the noise level at 2.00 m from Air Blowers is below 85 db. The Air Blower House shall have Rolling Shutter, Windows, Exhaust Fans, and Safety Equipment's with sufficient Ventilation, Lighting and Working Space. It shall be equipped with sufficient capacity Electrical Hoist with Travelling Trolley (Min. 3 Ton or 1.5 times the weight of Air Blower whichever is more) to facilitate removal of Air Blower / other Accessory for repairs.

- The operation of Aeration System shall include PLC based control. The operation and speed of Air Blowers shall be automatically adjusted using parameters like Oxygen Uptake Rate, Dissolved Oxygen and Temperature and Liquid Level in the Basin such that the DO is supplied as per demand and power utilisation for operation of Air Blowers is optimised.

- The main Air Header/Ring Main shall be in MS as per relevant IS Code, painted with corrosion resistant paint as per Manufacture's recommendations. The Air Header/Ring Main shall be supported on saddles at suitable intervals or shall be protected against external corrosion in case laid below ground. The Sub-header shall have Auto Valves to facilitate switch over of Aeration Cycle from one Basin to other by PLC. The Sub-header shall supply air to Fixed Type Diffuser Grids at various locations through vertical Air Supply Pipes. These Air Supply Pipes above water level shall be in MS, painted with corrosion resistant paint and below water shall be in SS 304. All under water Lateral Pipes shall be of UPVC. Junctions between horizontal Sub-header and vertical Air Supply Pipes shall be suitably protected against corrosion due to dissimilar materials.

- All other accessories, whether specified or not, but required for completeness shall form part of Contractors scope.

2.5 Return Sludge and Excess Sludge Pumps

Dedicated Return Sludge and Excess Sludge Pumps shall be provided in each SBR Basin. The Pumps shall be of submersible / horizontal centrifugal type suitable for handling biological sludge of 0.8 – 1% solids consistency. Capacity and Heads shall be decided based on process requirements. Each Basin shall be provided with suitable lifting arrangements to facilitate lifting of these Pumps if required for maintenance.

Return Sludge Pumps

Capacity and Head	:	As per requirements
Type	:	Submersible / Horizontal Centrifugal
Liquid	:	Biological Sludge of 0.8 – 1% solids consistency
Specific gravity	:	1.05

Solid size	:	40 mm (Maximum)
Temperature	:	Min. 25° C
Efficiency	:	more than 50%
Quantity	:	1 No. per Basin + 1 No. Store Standby

b. Excess Sludge Pumps

Capacity and Head	:	As per requirements
Type	:	Submersible / Horizontal Centrifugal
Liquid	:	Biological Sludge of 0.8 – 1% solids consistency
Specific gravity	:	1.05
Solid size	:	40 mm (Maximum)
Temperature	:	Min. 25° C
Efficiency	:	more than 50%
Quantity	:	1 No. per Basin + 1 No. Store Standby

2.6 Automation and Control

- PLC based Automation System with application software based on Rockwell or equivalent to control SBR System including all Gates, Air Blowers, Pumps, Valves and Decanters as per Bidder's/Technology Provider's own design including I/Os with 20 % Spares and UPS.

- HMI Panel shall comprise latest Personal Computer with 22" LCD Monitor, Multi Media Kit, Printer, Internet Connection, RS-View, RS-Links (Gateway Version), Process and Operator Software with dynamic Flow Charts, Pictures, Screens, Alarms, Historical Trends, Reports etc.

- SCADA based Automation System to monitor the following parameters continuously in each SBR Basins:

  - Fill Volume
  - Discharge Volume
  - Temperature
  - DO Level
  - Oxygen Uptake Rate

- Air Blower Speed
- Decanter Speed

3.0 Disinfection (Chlorination) Units

Disinfection (Chlorination) Units including Chlorination Tank and Chlorinator cum Chlorine Tonner House shall be designed for Average Flow or Decant Flow whichever is higher.

3.1 Chlorination Tank and Chlorinator cum Chlorine Tonner House

Treated sewage from SBR basins unit shall be taken to Chlorination Tank by RCC Channel/RCC NP-III pipe. Gas Chlorine shall be added for disinfection at suitable dosing rate. Baffle walls shall be provided in the Tank to facilitate hydraulic mixing of treated sewage. The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370.

Design Flow	:	Average Flow or Decant Flow whichever is more
Number of Units	:	1 No.
Hydraulic Retention Time	:	30 Minutes (excluding Outlet Channel after Weir)
Free Board	:	0.50 m min.

A Chlorinator cum Chlorine Tonner House shall be provided above/near Chlorination Tank to house Chlorination Systems. It shall be RCC (M25) Frame cum Brick Masonry Structure with Rolling Shutter, Windows & Ventilators, Electrical Hoist with Electrical Travelling Trolley of minimum 3 Ton capacity or 1.5 times the weight of the single Unit whichever is more to lift the Pumps/Chlorine Tonners and Safety Equipment's including Sand Buckets, Fire Extinguishers and Fire Alarms etc. Also it shall be provided with IPS Flooring, Internal & External Plaster and Internal & External Painting. Plinth Protection shall be provided along the periphery as per specifications.

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

3.2 Chlorination System

Gas Chlorination System comprising Vacuum Chlorinators (2 Nos.), Water Feed

Pumps (2 Nos.), Interconnecting Piping and Appurtenances, Chlorine Gas Detector, Empty Chlorine Tonners (Suitable for 30 days' Storage) with Trunions, Lifting Device and Suspended Weighing Scale, Residual Chlorine Test Kit, Safety Equipment (e.g. Exhaust Fan, Canisters, Gasmasks etc.), Mandatory Spares, Chlorine Leak Detection and Chlorine Leak Absorption System including FRP Half Hoods, Caustic Solution Tank, Caustic Recirculation Pump, Centrifugal Fan, Interconnecting Piping and Ducts complete and other required ancillary shall be provided.

Design Flow	:	Average Flow or Decant Flow whichever is more
Type	:	Vacuum Type
Chlorine Dosing	:	5 ppm (min.)
Quantity of Chlorinator	:	2 Nos. (1Working + 1Standby)

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

4.0 Sludge Dewatering Units

Sludge Dewatering Units comprising Sludge Sump and Pump House, Centrifuge House and Dewatering Polymer Dosing System shall be designed for Average Flow.

4.1 Sludge Sump & Pump House

A Sludge Sump shall be provided to hold excess sludge from SBR Basins. It shall be equipped with a submersible mixer to facilitate mixing of its contents on continuous basis. It shall be constructed in M30 grade reinforced cement concrete and as per IS 3370.

Number of Units	:	1 No.
Hydraulic Retention Time	:	6 hrs. min. of Average Daily Sludge Production
Free Board	:	0.50 m min.

A Pump House shall be provided near Sludge Sump to house Sludge Transfer Pumps (Centrifuge Feed Pumps). It shall be RCC (M25) Frame cum Brick Masonry Structure with Rolling Shutter, Windows & Ventilators and Electrical Hoist with Electrical Travelling Trolley of minimum 1 Ton capacity or 1.5 times the weight of the single Unit whichever is more to lift the Pump and Safety Equipment including Sand

Buckets, Fire Extinguishers etc. Also it shall be provided with IPS Flooring, Internal & External Plaster and Internal & External Painting. Plinth Protection shall be provided along the periphery as per specifications.

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

4.2 Sludge Sump Mixers & Sludge Transfer (Centrifuge Feed) Pumps

Submersible mixer (<500 rpm) shall be provided inside the sludge sump to keep the sludge in suspension. The material of construction of the mixer shall be SS304 along with lifting device with SS 304 square tube.

All other accessories, whether specified or not, but required for completion of Contract shall form the part of Bidder's Scope.

Sludge Transfer (Centrifuge Feed) Pumps shall be of positive displacement type Screw Pumps suitable for handling biological sludge of 0.8 – 1% solids consistency.

Type	:	Positive Displacement Type Screw Pump
Liquid	:	Biological Sludge of 0.8 – 1% Solids Consistency
Specific gravity	:	1.05
Solid size	:	40 mm (Maximum)
Temperature	:	Min. 25° C
Efficiency	:	more than 30%
Quantity	:	As per requirement + 1 Standby Min.

All other accessories, whether specified or not, but required for complete shall form part of contractors scope.

4.3 Mechanical Sludge Dewatering Device (Centrifuge) and Centrifuge Platform

The Mechanical Sludge Dewatering Device shall be solid bowl type Centrifuges designed for 100% trouble free operation at all times and provided as per the following guidelines.

- The device shall be so located that the dewatered sludge can be loaded into

Trucks/ Trolleys / Containers directly. Preferably the device shall be so located that the dewatered sludge falls into the Trucks/ Trolleys / Containers without requirement of another Material Handling Unit.

- The dewatered sludge shall have a minimum solids concentration of 20% or more (measured as dry solids w/w basis) so that it can disposed by open body Trucks/Trolleys.

The Centrifuge shall be solid bowl type of co-current/counter current design, as decided by the Bidder. It shall have sufficient clarifying length so that separation of solids is effective. The Centrifuge and its accessories shall be mounted on a common Base Frame so that the entire assembly can be installed on an elevated structure. Suitable Drive with V-Belt arrangement and Turbo Coupling shall be provided along with Overload Protection Device.

Differential speed and Bowl speed shall be adjusted by changing the Pulleys. Differential speed may be adjustable by use of epicyclical gears. The Bowl shall be protected with flexible connections so that vibrations are not transmitted to other Equipment's. The Base Frame shall be provided with anti-vibration Pads. The Drive Motor shall be of 1,450 RPM. The noise level shall be 85 dB (A) measured at 2.00 m distance under dry run. The vibration level shall be below 50 micron measured at Pillow Blocks under dry run condition.

Operating Hours	:	18 hrs per day maximum
Type	:	Solid Bowl Type
Liquid	:	Biological Sludge of 0.8 – 1% Solids Consistency
Specific gravity	:	1.05
Quantity	:	As per requirement + 1 Standby Min.

All other accessories, whether specified or not, but required for complete shall form part of contractors scope.

A Centrifuge Platform shall be provided near Centrifuge Feed Pump House to house Centrifuges. It shall be a G(Stilt) + 1 type RCC (M25) Frame Structure. Centrifuges shall be installed at First Floor whereas Trucks/Trolleys/Containers shall be parked

at Ground Floor. An Electrical Hoist with Electrical Travelling Trolley of minimum 3 Ton capacity or 1.5 times the weight of the single Unit whichever is more and Safety Equipment including Sand Buckets, Fire Extinguishers etc. shall be provided. Also it shall be provided with Anti-Skid Tile Flooring, Internal & External Plaster and Internal & External Painting. Plinth Protection shall be provided along the periphery as per specifications.

4.4 Polyelectrolyte Dosing System

Polyelectrolyte shall be dosed online at the inlet of Centrifuge. Minimum dosage of polyelectrolyte shall be 1.50 – 2.50 Kg/Ton of dry solids in sludge at 0.1% solution strength. There shall one Solution Preparation Tank and one Solution Dosing Tank, each suitable for minimum 8 hrs. of operation and quipped with slow speed Mixer (100 RPM). The entire construction shall be in M30 grade reinforced cement concrete and as per IS 3370. RCC Platform/Walkway, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided. RCC Staircase, minimum 1.20 m wide with SS 304 Hand Railing as per specifications shall be provided for access from Finished Ground Level to the top of the Unit & to the Operating Platform/Walkway.

Number of Units	:	2 Nos.
Hydraulic Retention Time	:	Suitable for min. 8 hours of Operation
Free Board	:	0.50 m min.

The solution will be dosed using mechanically actuated diaphragm type Metering Pumps. Dedicated Dosing Pumps shall be provided and shall be interlocked with Centrifuge in such a way that they Start/Stop along with Centrifuge.

Type	:	Mechanically Actuated Diaphragm Type Metering Pump
Liquid	:	Polyelectrolyte Solution of 0.1% Strength
Quantity	:	As per requirement + 1 Standby Min.

5.0 Plant Utilities

5.1 SBR Air Blower cum Administrative cum MCC & PLC/Control Building

The SBR Air Blower cum Administrative cum PLC/Control Building (min. 120 sqm on

each floor) shall be G+1 type RCC (M25) Frame and Brick Masonry Structure. SBR Air Blower House, Workshop & Tool Room shall be constructed at ground floor whereas Administration Block (comprising Office, Conference Hall and Laboratory), PLC/Control Room shall be placed at first floor.

PMCC, HT Substation shall be placed in separate Structure.

SBR Air Blower House shall house Air Blowers for SBR Basins. It shall be equipped with Rolling Shutters, UPVC Windows/Ventilators, Exhaust Fans and Electrical Hoist with Travelling Trolley (Min. 3 Ton or 1.5 times the weight of Air Blower whichever is more) to facilitate removal of Air Blower / other Accessory for repairs. Similarly, PLC/Control Room shall be designed.

Laboratory shall be fully equipped with all necessary Equipments, Instruments, Chemicals, Reagents, Glassware and Furniture.

Adequate number of Toilets and Washbasins shall be provided separately for Men & Women at each floor. A covered Overhead Tank of capacity 5 m^3 shall be provided along with an Underground Water Tank of capacity 10 m^3 to cater to the water requirements of the Building.

In addition, the Building shall be provided with Porch, Staircase, Passages, Wooden/Aluminium/Glass Doors / Windows / Ventilators and Safety Equipment including Sand Buckets, Fire Extinguishers and Fire Alarms etc. Adequate Flooring shall be provided in various Rooms/Areas as per requirement or as per instructions of the Engineer-in-charge. Internal & External Plaster with Painting shall be done as per instructions of the Engineer-in-charge. Plinth Protection shall be provided along the periphery as per specifications.

The Building shall be provided with the following:

Sr. No.	**Item of work**	**Work**
1	Personal Computer in PLC/Control Room	2 Nos. of latest version & configuration complete.
2	Printer in PLC/Control Room	1 No. of A3 Size Laser Wifi all in one Printer of latest version & configuration complete.
3	Telecommunication	Min. 1 No Telephone Line with a Broad Band

	Facility	facility. The chargers will be born by the Contractor up to the O & M Period.
4	Plant Model	• 1 No. Wall Mounted Process Model (Electronic Plant Display Model) with Flow Diagram (Minimum size 3 m x 1.5 m) • 1 No. 3D Model with display of flow direction and lighting.
5	Air Conditioner	Adequate nos. of Air conditioners shall be provided as directed by Executive Engineer.

5.2 Electrical HT Substation

The Electrical HT Substation (min. 150 sqm) shall be provided to house HT Components comprising Metering Kiosk, HT Panel and Power Control Centres. It shall be RCC (M25) Frame and Brick Masonry Structure equipped with Rolling Shutters, Windows/Ventilators, Exhaust Fans and Safety Equipment including Sand Buckets, Fire Extinguishers and Fire Alarms etc. complete.Also, it shall be provided with IPS Flooring, Internal and External Plaster with Painting and Plinth Protection along the periphery as per specifications.

5.3 DG House

The DG house (min. 50 sqm) shall be provided to house DG Set of adequate rating capable of running the entire STP and pumping station located in STP area at Peak Flow including AMF Panel, Fuel Tank and other Accessories. It shall be RCC (M25) Frame and Brick Masonry Structure equipped with Rolling Shutters, Windows/Ventilators, Exhaust Fans and Safety Equipment including Sand Buckets, Fire Extinguishers and Fire Alarms etc. complete. Also it shall be provided with IPS Flooring, Internal and External Plaster with Painting and Plinth Protection along the periphery as per specifications.

5.4 Security Cabins

Security Cabin of size 3.00 m x 3.00 m shall be provided at entry Gate of the Plant. It shall be RCC (M25) Frame and Brick Masonry Structure equipped with Doors, Windows/Ventilators, etc. complete. Also, it shall be provided with Flooring, Internal and External Plaster with Painting and Plinth Protection along the

periphery as per specifications.

5.5 Schedule of Finishes

Sr. No.	Unit	Flooring	Doors	Windows / Ventilators
1	Administrative Block, Laboratory, MCC Room, PLC & Control Room, Security Cabins	Marbonite flooring of approved make. The size of Marbonite tiles shall be min 600 mm x 600 mm & thickness min 10 – 12 mm	Solid Core Flush Door with heavy duty Brass Fittings of approved make	Aluminium of approved make
2	SBR Air Blower House, Workshop & Tool Room, Chlorinator cum Chlorine Tonner House, Sludge Pump Houses, Electrical HT Substation, DG House	IPS Flooring with Abrasion Resistant Additives of approved make	MS Rolling Shutter (See Through Type) of approved make	Aluminium of approved make
3	Centrifuge Platform	Anti-Skid Tile Flooring of approved make	---	---
4	Vehicle Parking Area	Coloured Pre-cast Heavy Duty Paving Blocks with Lacquer Finish	---	---
5	Toilet Blocks	Coloured Glazed Tiles	UPVC of approved make	UPVC of approved make
6	Staircase: Inside Building	Grey Granite Flooring of approved make	---	---

5.6 Roads, Pathways & Vehicular Parking Area

All internal Roads (min. 400 m long) shall be provided with Drainage and constructed to prevent standing water. All Roads shall be minimum 5.0 m wide WBM road of thickness 0.225 m compacted excluding casing grade-I GSB of 0.15 m thick and grade-II GSB of 0.075 m thick including spreading in uniform thickness, hand packing to proper grade and camber, applying and brooming requisite type screening/binding material to fill up the interstices coarse aggregate, watering and compacting with power roller complete, with hard murum casing of thickness 0.30 m compacted. BM shall be 75 mm thick (4% bitumen content) and AC shall be 40 mm thick with (6.25% bitumen content) as directed by Engineer-In-Charge.

Pathways shall be constructed interconnect the entire Plant with Roads. Minimum width of pathways shall be 2.00 m. Pathways shall be in coloured Pre-cast Heavy Duty Paving Blocks of 60 mm thick of M-20 grade with Lacquer Finish including the sub base of 0.23 m thick soling and as directed by Engineer-In-Charge.

Vehicle Parking Area shall be shall be provided to permit the parking of Vehicles in coloured Pre-cast Heavy Duty Paving Blocks with Lacquer Finish.

The entire system of Roads, Pathways and Vehicle Parking Area shall be designed such that Vehicles involved in the delivery of Materials, Chemicals, Consumables and Residual Disposal can continuous route through the Works and get out again.

5.7 Storm Water Drainage

Adequate Storm Water Drainage shall be provided adjacent to the Internal Roads considering local rainfall intensity with 100% runoff. It shall be in RCC Class NP 3 pipe of min 600 mm dia. with necessary Chambers at appropriate locations. These Chambers shall be covered with RCC chambers. This Storm Water Drainage shall be connected to the nearby Storm Water Drain or Channel of City Network.

5.8 Boundary Wall with Gate

Boundary Wall shall be constructed all around the STP plot (min 810 m length). Boundary Wall having architectural and elegant view shall be provided along entire periphery of the Plot. Height of boundary wall should not be less than 2.0 m from finished ground level. The boundary wall shall be RCC footing & columns and

ground beam of M-20 grade including brick masonry in CM 1:4 with wall thickness of 0.23m thick including sand faced plaster on both side with coping of 0.15m thick in M-20 grade with acrylic cement paint, etc. complete as directed by Engineer-In-Charge. It should be able to bear wind pressure up to 80 Km/hr. At least two MS grill gate of 3.60 m wide with frame having weight of gate 30 kg/sqm including hinges, pivot blocks locking arrangement welding riveting and 3 coats of oil painting shall be provided. Each Entry Gate shall be provided with a Wicket Gate.

5.9 Internal Water Supply and Water Supply for Gardening

Proper water facility shall be provided at STP. Rate of water supply may be kept as 150 liter per capita per day for a population of 20 people. Storage should not be less than 3000 liters. Water supply for gardening purpose may be from treated final sewage in sufficient quantity.

5.10 Disposal of Plant Residuals & Treated Sewage

The treated sewage from STP shall be disposed off by the contractor to nearby river. Dewatered sludge from centrifuge shall be a property of employer. However, Disposal of grit and screening shall be done by contractor.

5.11 Landscaping

Landscaping involves beautification of Sewage Treatment Plant site by cultivating lands, plants and trees of environmental value and suitably modifying the appearance of STP site. It shall add scenic value to the STP site to obtain maximum visual impact. Contractor has to develop proper landscaping in the STP site from professional landscaper approved by Employer.

6.0 Interconnecting Piping and Valves

All interconnecting Piping, Gates, Valves, Specials and other appurtenances, auxiliaries and accessories required as per Process Design and Scope of Work. In case of Rising Mains, thrust blocks shall be provided wherever required. In case of buried Pipes, warning tapes shall be provided of the appropriate colours. The material of construction for major interconnecting Piping shall be as follows:

Piping: Guide Line for Velocity

Sr. No.	Service	Design Velocity m/s	Limitations
1	Gravity Lines for Sewage & Water	0.6 – 1.2 Designed as pipe line flowing full.	Min. Velocity shall not be less than 0.6 m/sec. Max. Velocity up to 1.2 m/sec is allowable at Peak Flow.
2	Pressure Lines for Sewage & Water	0.6 – 2.5	Min. Velocity shall not be less than 0.6 m/sec. Max. Velocity up to 2.5 m/sec is allowable at Peak Flow.
3	Air (Pressurized Lines)	18 – 22	Max. Velocity shall not be more than 25 m/sec in any section.
4	Scum & Sludge Lines	0.6 – 1.5	Irrespective of flow, Diameter shall not be less than 150 mm for Gravity Lines.
5	Chemical Feed Lines	0.6 – 1.5	Irrespective of flow, Diameter shall not less than 20 mm.

Notwithstanding the above, the Bidder shall submit a Pipe Line Schedule with Tag No., Flow, Size, Type, Material of Construction etc. with detailed P & ID for approval of the Engineer-in-charge prior to any further engineering or procurement/fabrication and installation.

Generally, the Material of Construction shall be selected based on the following guide lines. The Bidder can make suitable selection depending on Service, Type of Flow (i.e. Gravity or Pressurized) and Diameter of Pipe.

Piping: Guide Lines for MOC

Sr. No.	Service	Type of Flow	MOC
1	Waste Water / Sludge	Gravity	RCC NP-3 Class

Sr. No.	Service	Type of Flow	MOC
2	Waste Water / Sludge	Gravity/ Pressurized	CI Class "LA" / DI K-9
3	Service Water	Gravity / Pressurized	GI "C" Class
4	Air Lines: Headers, Vertical Down-comers	Pressurized	**Above Water:** MS Sand/Shot Blasted, Epoxy Painted **Under Water:** SS 304
5a	Air Grid Piping: Aeration Zone	Pressurized	UPVC Schedule 40
5b	Air Grid Piping: Selector Zone	Pressurized	SS 304
6	Chemicals	Gravity / Pressurized	SS 304 except Chlorine & FeCl3
7	Chlorine & $FeCl_3$	Gravity / Pressurized	Schedule 40 UPVC

Valve: Guide Line

Sr. No.	Service	Type	MOC	End Connection
A	**Sewage / Sludge**			
1	Gravity / Pressurized	Knife Gate	CI Body & SS 304 Gate & SS 410 Spindle	Flanged/ Wafer
2	Delivery of Pump	Swing Check	CS Body & SS 304 Internals	Wafer
3	Suction & Delivery of Pump	Knife Gate	CI Body & SS 304 Gate & SS 410 Spindle	Flanged/ Wafer
B	**Service Water**			
1	Gravity / Pressurized	Ball	CS Body & SS 304 Internals	Flanged/ Screwed
2	Delivery of Pump	Swing Check	CS Body & SS 304 Internals	Wafer
3	Suction & Delivery	Butterfly	CI Body & SS 304	Wafer

	of Pump		Internals	
C	**Air**			
1	Pressurized	Ball	CS Body & SS 304 Internals	Flanged/ Screwed
2	Delivery of Blower	Swing Check	CS Body & SS 304 Internals	Wafer
3	Suction & Delivery of Blower	Butterfly	CI Body & SS 304 Internals	Flanged
D	**Chemicals**			
1a	Gravity / Pressurized	Ball	As per Chemical Compatibility Chart	Flanged
1b	Gravity / Pressurized	Diaphragm	As per Chemical Compatibility Chart	Flanged
1c	Gravity / Pressurized	Plug	As per Chemical Compatibility Chart	Flanged

Notwithstanding the above, the Bidder shall submit a Valve Schedule with Tag No., Flow, Size, Type, and Material of Construction, End Connection etc. with detailed P & ID for approval of the Engineer-in-charge prior to any further engineering or procurement/fabrication and installation.

7.0 Electrical & Instrumentation Works

It shall be the Contractor's responsibility to obtain adequate incoming HT power from State Electricity Authority based on the maximum demand load. The Employer will pay the charges for obtaining the above connection whereas necessary liasoning for the same shall be done by the Contractor in consultation with Engineer-in-charge.

Two nos. of Transformers (1W + 1SB) for full load of the STP and pumping station at STP area with 10% overload shall be provided. These shall be step down Transformers suitable for indoor installation manufactured in accordance with IS 2062/1962 and as modified from time to time. They shall be supplied with all accessories and mounting as per IS 2062 and shall also have Dial Thermometer, Bucholz Relay, Rollers and Explosion Vent. Each Transformer shall be provided with off load tap changer for ± 2.5%. The windings shall be of connections as per vector

group DY II. The efficiency of the Transformer at 100%, 75% and 50% loading should also be indicated separately. The Transformer should be tested as per I.E. Rules & Regulations. Suitable cable boxes for H.T. and bus ducting for L.T. side be provided.

The entire Plant shall be operated on 415 V, 3-Phase, 50 Hz, 4-Wire system. The Contractor's Scope of Work shall include the following:

- Obtaining incoming HT Power from State Electricity Authority including necessary liasonoing, documentation etc. complete.
- HT Cable with Termination Kit from "Source" to the Electrical HT Substation located at the Sewage Treatment Plant.
- HT Substation including 4-Pole Structure, Metering Kiosk, HT Panel, Transformers, Power Control Centre etc. complete.
- Motor Control Centres.
- Cabling including Power, Control and Instrumentation Cables.
- Earthling for Electrical equipments as well as Instruments.
- Internal Lighting in Buildings.
- External Lighting.
- Local Push Button Stations near respective Drives.
- Any other item / accessories required for successful completion of the Project.

The Contractor shall design/execute the System as per standard specifications, I.E. Rules and Regulations, requirements of State Electricity Board and other local Authorities and actual site conditions.

Also, the Contractor shall provide adequate automation for fully automatic operation of the entire Sewage Treatment Plant including Primary Treatment Units, Biological Treatment Units based on SBR technology, Chlorination Tank, Sludge Dewatering Units through a one Programmable Logic Centre (PLC) and Supervisory Control and Data Acquisition (SCADA) with Man-Machine Interface (MMI). Provision shall also be made to operate each Unit of the Plant manually, if required.

8.0 PLC/PC/SCADA BASED AUTOMATION SYSTEM FOR ENTIRE PLANT

The complete Plant shall be designed for automatic operation through Programmable Logic Control (PLC) and Supervisory Control and Data Acquisition (SCADA). This shall be achieved by either individual equipment PLCs with SCADA/HMI or single PLC and SCADA for entire Sewage Treatment including pumping stations. These shall be located at control room of the STP.

The plant shall have provision for operations in following modes -

1. Automatic – **Auto operation through PLC/digital controller.**
2. Manual – **Operator intervention through SCADA/HMI.**
3. Local – **Local operation through local control panel located near equipment.**

Audio Visual Alarms –

Audio visual alarms shall be initiated under emergency or equipment trip conditions, other than usual service alarms. Salient features of the proposed control system shall be as follows:

- Dynamic display of all Units, equipment and drives shall be available on SCADA screen.
- It shall Acquire, process and manage the processed data.
- It shall safeguard the process by means of interlocks and alarms.
- Auto/Manual operation of each drive shall be made by selecting a soft switch on SCADA/HMI screen.
- In Auto mode, each drive shall operate based on pre-set sequence and interlock. Also automatic change over from working to standby drive shall happen after a drive reaches pre-set hours of operation.
- In Manual mode, each drive shall be operated in Local/Remote mode by selecting a soft switch on SCADA/HMI screen. In Local mode, each drive shall be

operated from the Local Push Button Station (LPBS) located nearby. In Remote mode, operation from LPBS shall be disabled and each drive shall be operated manually from PLC. Also provision for working/standby selection of drives by selecting a soft switch on SCADA screen shall be provided.

- Run/Trip indication of all drives shall be displayed on SCADA/HMI screen.
- Open/Close indication of all Auto Sluice Gates and Auto Valves shall be displayed on SCADA/HMI screen.
- Annunciation & Alarm facility shall be available in PLC/HMI/SCADA. In the event of a Fault, the symbol representing the equipment/drive shall continue flashing on SCADA/HMI screen with equipment/drive description appearing at bottom of the SCADA/HMI screen and electric Hooter shall continue blowing until the Fault Alarm is acknowledged.
- Data logging of Running Hours of each drive, Alarms, Historical Trends of monitored Parameters, etc. shall be envisaged in SCADA.
- Report generation for plant performance.

The process system must have pre-configured software packages which can be adapted to the process by parameterization.

The monitor images must be designed to be user-friendly by hierarchical breakdown with the possibility of selective display and optimum selection possibilities.

Changing of parameters and other software units must be possible "online", i.e. with the system running.

Different alarms colors provide information on their priorities.

For the system engineering offered, the Contractor must take measures, e.g. by the installation of surge voltage arresters or surge voltage filters, to ensure that internal and external surge voltages do not impair the function of his parts of the system.

The programs and data entered must be backed up in a non-volatile read-only memory.

A limit value and plausibility check must be provided in the software of the process station for the measured values and messages. Exceeding of limit values or deviations detected by the above checks must trigger an event and cause a message to be sent.

Further demanded features of the process system:

- Integrated, detailed error message and fault detection concept with display on the HMI/SCADA for quick localization of faults. The system operator must be able to identify the fault from the error.
- Essentially maintenance-free
- Robust against external interferences of all kinds
- Proven design and solder-free connection technique
- Protection of the equipment against surge voltages
- Automatic fault detection and quick troubleshooting in the PLC system by integrated, hierarchically structured diagnostic devices
- Power supply in wide admissible voltage range
- Simple function-oriented operation

The process system (PLC, HMI/SCADA) shall be protected against power failure by an uninterruptible power supply (UPS). When the critical charge state of the UPS is reached, the process system is automatically shut down.

Mode selector switch

A mode selector switch is to be installed on the MCC or distribution board. It serves for pre-selection between Automatic mode and Manual/Local mode.

The following switching functions must be provided:

Automatic – Manual/Local

- Automatic: In this position, only automatic operation is possible; the local switches have no function (Except emergency stop).

- Local: Automatic mode cannot be started. The drives can be operated individually without interlock with the local switches.

Local switches (LPBS)

Each drive must be equipped with a local switch positioned in such a location that the corresponding machine or conveyor can be switched on in Manual/Local mode and can be monitored visually at all times.

The local switch must have the following switching functions:

START – STOP (for drives with one direction of rotation) or

FORWARD – STOP - REVERSE (for reversible drives)

- If a unit has several drives (e.g. conveyor belt drive and travel drive), the local switches should be installed if possible in one switch box or at least installed next to one another.

- Each local switch must be adequately labeled in plain text so that no operator errors can occur.

PLC

The automatic start-up of the whole system, sequential operations and the automatic shutdown, allowing for external control influences, e.g. EMERGENCY STOP, etc., is performed by programmable logic controller (PLC).

This performs not only the control of the system, but also the display of the operating state in the HMI/SCADA.

The interlocks of the individual process groups and their signaling must be performed by the PLC.

A system must be selected which is sufficiently protected against external interference in the supply, control and signaling lines. The aim is that the program can continue to run without fault signals in the event of transient earth faults in

the supply grid. In the event of prolonged power failures, on the other hand, a controlled restart must be triggered (under-voltage trip of the non-automatic circuit breaker).

PLC Specifications: Technical

- The PLC shall be non-redundant.
- PLC of individual equipment shall be selected to carry out necessary operations without overloading the PLC memory.
- The PLC shall have adequate I/O per card.
- There shall be 15% spare I/O of each type.
- The CPU shall not be loaded more than 60% of its capacity.
- Retentively shall be 100% to save the recorded data and saving the programd logic, other attributes connected with system for power & system failure.
- Change in program / modifications to program shall be possible by a portable laptop.
- It is preferred to have all PLC's in the plant from same manufacturer.

HMI/SCADA system

The HMI system shall be designed as a minimum 6", color, and touch-screen on the panel. Whereas SCADA system must be computer based.

All displays must be designed by the Contractor with graphic sophistication and all texts in the visualization system must be displayed in English.

A sub-menu for each operating mode and further menus for editing the system parameters, fault archive, etc., must be developed. It must be as simple as possible to switch between the various menus and to edit the system parameters.

When designing the user interface or the assignment of the function keys, attention must be paid that the function key assignment remains the same in all sub-menus so that it is possible to jump to another menu without first having to jump back to the main menu.

It must be possible to edit the following parameters at the touch-panel and SCADA:

- Operating mode
- Changes in the speeds of frequency converter-controlled equipment
- Start-up times
- Shutdown times
- Duration of the operation of warning devices
- Limit values for sensors, etc.

Faults, level messages, pressed EMERGENCY STOP buttons, etc., must also be clearly displayed at the bottom of the screen, irrespective of the selected screen page or sub-menu.

It must be possible to output all important menu items to the printer. The corresponding interfaces must be provided.

The display of the function plans, images, etc. is affected in direct dialog with the system by means of the mouse and keyboard.

The central SCADA shall generate various reports to analyze plant performance. The process is documented via the laser printer.

Computer hardware and software

All programs required for operation of the system must be correspondingly compatible. The corresponding licenses must be supplied for the standard programs. The operating systems must be agreed upon with the Client. Minimum requirements shall meet:

CPU		
1.	Processor	Intel i5 or higher
2.	Processor speed	2 GHz or higher
3.	Configuration	Tower
4.	Architecture	32 bit
5.	System memory	8 GB
6.	Hard disk	320 GB or higher
7.	DVD Drive	Combo (Read/Write)
8.	Operating system	Microsoft Windows 7 professional
9.	Communication	USB – 4Nos., Ethernet – 1Nos.
10.	Graphic	1 GB

11.	Power supply	240V, 50Hz, 1Phase
12.	Keyboard	Internet Keyboard (with USB interface)
13.	Mouse	Optical, 3 buttons (with USB interface)
Monitor		
14.	Type	Full HD LED color monitor
15.	Screen size	22" or higher
16.	Resolution	1920 x 1080
17.	Power supply	240V, 50Hz, 1Phase

Complete Project shall operate in auto mode. As a minimum, following controls must be considered in Bidder's Control Philosophy:

1. Coarse screens

Each mechanical coarse screen shall be installed with ultrasonic differential level transmitter / level switch, across it; the same shall be operated on the basis of set differential level in SCADA. Also if differential level is not reached for certain time period, the screen shall be operated on the basis set time in SCADA.

The selection of Auto/Manual and Working/Stand-by shall be made available in SCADA. In manual mode the screen operation will be done from SCADA screen. Physical switch over of screens in plant will be done by operator using manual gates.

Necessary interlocks, controls, alarms, report generation, etc. shall be considered in PLC for auto operation of coarse screen.

2. Raw Sewage Sump and Pumps

The sump will employ an Ultrasonic level transmitter to measure level. The combined operation of Raw Sewage Pumps will be dependent on rate of change of level with reference to time. The selection of Auto/Manual and Working/Stand-by shall be made available in SCADA. In manual mode the pump Start/Stop will be done through SCADA screen.

A clamp on type Ultrasonic or Electromagnetic flow transmitter shall be provided at

common header of pumps for measurement of flow to sewage treatment plant. PLC shall calculate instantaneous flow as well as cumulative flow, both shall be displayed on SCADA.

Necessary interlocks, controls, alarms, report generation, etc. shall be considered in PLC for auto operation of Raw Sewage Pumps.

3. Inlet chamber

A clamp on type Ultrasonic flow transmitter shall be provided on rising main of inlet chamber for measurement of flow coming to Sewage Treatment Plant. PLC shall calculate instantaneous flow as well as cumulative flow, both shall be displayed on SCADA.

4. Fine screens

Each mechanical fine screen shall be installed with ultrasonic differential level transmitter / level switch, across it; the same shall be operated on the basis of set level in SCADA. Also if level is not reached for certain time period, the screen shall be operated on the basis set time in SCADA.

The selection of Auto/Manual and Working/Stand-by shall be made available in SCADA. In manual mode the screen operation will be done from SCADA screen. Physical switch over of screens in plant will be done by operator using manual gates.

Necessary interlocks, controls, alarms, report generation, etc. shall be considered in PLC for auto operation of fine screen.

5. Grit Chambers

Each grit chamber will consist of Detroiter (1No.), Organic Return Pump (1No.) and Screw Conveyor for grit removal (1No.). As such Detroiter, Organic Return Pump and Screw Conveyor will not have auto operation; these will be started and stopped from SCADA screen as required.

Necessary interlocks, alarms, report generation, etc. shall be considered in PLC for

operation of Grit chamber equipment.

6. SBR Basin

Complete operation and control of SBR plant will be done through a separate PLC and SCADA. However it shall have necessary inputs and generate required outputs to operate in co-ordination upstream and downstream units of balance plant.

Alternatively contractor may provide single PLC and SCADA for entire Sewage Treatment Plant.

Necessary interlocks, controls, alarms, report generation, etc. shall be considered in SBR PLC for auto operation SBR basin.

Each SBR basins shall be equipped with Level Transmitter, DO Transmitter for monitoring and recording of critical operation parameters through SCADA.

7. Sludge sump and pump

An ultrasonic type level transmitter shall be used for measurement of level in sludge sump.

Screw pumps will be used to feed sludge to Centrifuge. These will operate as per level in sludge sump.

The selection of Auto/Manual and Working/Stand-by shall be made available in SCADA for sludge pumps. In manual mode the Start/Stop of pump will be done from SCADA screen.

Necessary interlocks, alarms, report generation, etc. shall be considered in PLC for operation of chlorination system.

8. Chlorination tank

The selection of Auto/Manual and Working/Stand-by shall be made available in SCADA for booster pumps. In manual mode the Start/Stop of pump will be done from SCADA screen. Though chlorinator will have standalone operation, feedback for the equipment shall be taken to PLC and displayed SCADA for monitoring

purpose.

Necessary interlocks, alarms, report generation, etc. shall be considered in PLC for operation of chlorination system.

9. Centrifuge

The drives and instruments of centrifuge shall be connected to PLC for its auto operation. Starting of dewatering system will be a manual process.

Necessary interlocks, alarms, report generation, etc. shall be considered in PLC for auto operation of centrifuges.

2.4 Technical Specifications – Civil Works

a) Survey Work

The Contractor shall carry out detailed survey work and submit both soft and hard copies of contour drawings with spot levels with 10 m x 10 m grid to the Employer. Necessary information such as reference to the location as proposed for the treatment plant by him with respect to site boundary.

b) Geotechnical Investigation

The Contractor shall carry our Geotechnical Investigation work at the proposed location of treatment plant. The no. of bore holes to be taken, depth of boring etc. shall be decided in consultation with the Engineer In-charge. The Contractor has to provide the hard and soft copies of the test reports. If the bearing capacity of the soil found lower than that is mentioned in the soil report provided with the Tender document, the lower of the two values shall be considered for design.

c) Process / Hydraulics Design

- The Contractor shall provide his own design system and equipment based on Sequential Batch Reaction process to treat the raw sewage up to the sewage quality as said in Clause 3 or even better.
- Bidder shall design the plant in such a way that in case of non-availability of sufficient sewage at the time of commissioning, plant can be commissioned with a minimum quantity of sewage equal to 30% of the average capacity.

d) Treatment Objective

Considering the raw sewage quality and the required treated sewage quality, the Contractor shall furnish a process train to achieve the following objectives –

- To achieve guaranteed treated sewage quality or even better.
- To ensure that the offered treatment process is the most appropriate and state of the art in terms of both efficacy of treatment and cost (the Contractor shall have to produce the performance records with the same treatment systems applied elsewhere.)
- To ensure that the process is cost effective from both capital and running costs consideration.
- To ensure that the sludge produced is dewatered to a "spreadable" or "open body transportable" consistency – so that it can be easily disposed off.
- The process preferably should be free from utilization of chemical/any organic chemicals except for sludge removal process. No toxic chemical shall be used by the Contractor. He will submit the toxicity test report from any govt. recognized laboratory at his own cost before using such chemical.
- Oils/lubes/fuels/media/chemicals etc. to be used will be defined by Bidder.
- The final treated sewage is to be disinfected through chlorination before its disposal.

e) Structural Design

The Contractor shall have to do the structural design considering the survey details and geotechnical investigation details like safe bearing capacity, seismic forces, depth of water table and hydraulic flow diagram. Rock anchoring shall be carried if required wherever uplift is considered. The design of plant units and Buildings – if any, shall be submitted by the Contractor in soft and hard copies, with General Arrangements and detail RCC drawings. The design of units shall be finalized in consultation with the Engineer – in – Charge. The design of units shall be as per relevant BIS or other Indian/international standards in absence of BIS or sound engineering practice. The requirements to be fulfilled by the Contractor are

described in detail in the general civil specifications and particular specifications for civil work for sewage treatment plant. Pressure releasing valve to release sub soil water pressure shall be allowed at appropriate locations.

f) Construction Works

The Contractor shall construct the civil units of the plant (including intermediate process pumping stations wherever required) to accommodate the mechanical units to fulfill the requirement of process design. There shall be adequate working space, accessibility considerations like RCC staircase or ladders, walkway with proper width, hand railing, etc wherever needed. For Buildings, there shall be additional items like ventilation and lighting requirements, flooring and finishing (hard flooring like granite for machine bearing floors) etc. The civil units shall be constructed such that there is proper accessibility for repair or replacement of mechanical equipment's. Any concreting shall be done only after approval of Engineer – in – charge. All construction work shall be carried out as per the provision of CPWD specifications unless otherwise mentioned in the document.

g) Equivalency of Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national or related to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In fee event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the Bid Documents.

h) Board

The Contractor at his own cost, shall provide sign boards at approved locations, in English and Hindi at the site of the Works of approved size and design which provides

(i) The name of the Project,

(ii) The name and addresses of the Employer, the Contractor and the Consultant;

(iii) The name and short description of the Project and

(iv) The starting and completion dates. Contractor shall take care of signboard and re-do it in case of loss, damage, theft etc., as desired by the Engineer In-charge.

i) Assurance Program/Sample Tests

Contractor shall be responsible to develop a quality control program and to all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the under the Contractor. Without limiting the generality of the foregoing, the actor shall either (i) establish a testing laboratory at the site of Works which be adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the Tender document specifications provide all field equipment and apparatus as necessary to conduct all in-situ tests and/or any Tests on Completion, or (ii) arrange for routine sampling, testing and reporting, as required, through a certified independent laboratory acceptable to the Engineer In-charge. The Contractor shall obtain the approval of the Engineer In-charge for the quality control program developed by him and incorporate any modifications suggested by the Engineer In-charge at no extra cost.

All costs of such sampling, testing and reporting of test results will be borne the Contractor, and the Contractor shall include sufficient provisions in his; tendered rates to allow for independent sampling and laboratory testing under the direction of the Engineer In-charge. The Contractor shall furnish certified copies of all test reports to the Engineer In-charge within 3 days of completion of the specified tests.

The Contractor shall, within 14 days after the date of the issue of Letter of Acceptance, submit to the Engineer In-charge for his consent a detailed description of the arrangements for conducting the quality control program during execution of the Work, including details of his testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer In-charge that the Contractor's quality control program is not adequate to ensure the quality of the Works, the Contractor shall produce a revised program, as desired by the! Engineer In-charge, which will be adequate to ensure satisfactory quality control, in case of the Contractor will fail to ensure quality control program the action deem fit will be taken against the Contractor. The Employer shall carry out supervision and quality control and monitoring the progress of works.

j) Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities concerning utility lines such as water supply, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead) etc., and determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required and shall not make any claim for extra work or extra time that may be required to protect or facilitate relocating such utilities. If any major shifting realignment of water supply, sewers, gas pipes, electric and telephone lines is necessary due to their interference with the proposed Works, the same may done by the Contractor. The cost of such relocations will be borne by the Contractor.

k) Erection

Bidders have to note that various major items shall be procured / executed under this Contract subject to inspection by the Employer or their authorized representatives at manufacturer’s premises. Cost of inspection shall be borne by Contractor

l) Testing of Concrete

Testing of Concrete shall be carried out as per IS4926: 1976. The contractors shall send three flexural beams to the laboratory for every ten slabs, or part thereof, for testing flexural strength. The admixture used shall conform to IS 9103-1979 reaffirmed on 1990 or AS1 C-494 of 92.

All taxes/duties etc. will be borne by the contractors and not by the Employer. No extra payment will be made for the use of admixtures.

2.5 Mechanical Equipments for STP

The Contractor shall have to design, supply, erect and commission the mechanical equipments as proposed by him in the treatment train to achieve the required parameters. The design, material of construction and type of various mechanical equipments shall confirm to the standards laid in various sections of Tender document.

2.6 Electrical and Instrumentation / Automation System

The Contractor shall design, shop test, supply, transport, storing at site, erecting, testing and commissioning all electrical equipment and instruments required for the plant as per general specifications, specific specifications for electrical works, typical power distribution scheme and typical control system architecture.

2.7 Disposal of Sludge/Screenings/Debris

The screenings/debris/dried sludge from the Sludge Handling Unit shall be disposed off by the Contractor to a suitable location, which is away from the residential area. The place of sludge disposal shall be as per the decision of the Engineer In-charge, within a radius of 20 kms from the plant. The responsibility of sludge withdrawal and disposing off lies with the Contractor within the operation and maintenance period. The Contractor should explore the possibility promoting it as manure.

2.8 Disposal of Excavated Stuff

It will be the responsibility of Contractor to dispose all the excavated stuff within

the Employer limits as directed by Engineer In-charge.

2.9 General Utilities

For the proper functioning of the proposed works of sewage treatment plant, connection for rising mains, sewage channel, the other general utilities necessary for the proper functioning of the proposed works which shall be included under this Contract are :

- Internal & outdoor lighting, plant water supply and sanitation, waste disposal, etc.
- Electric substations and distribution of power supply to all necessary points
- Street and yard lighting and fire hydrant system for the STP.

2.10 Safety Equipment:

Safety Equipments should be provided at STP as per the recommendation of Inspector of Industries. Contractor shall also take care of safety compliance as applicable from time to time as per safety rules/Factory act/Indian Electricity regulations/manuals/manufacturer's special instructions.

2.11 Model of the Project:

A 3D Model of the Plant shall also be submitted by the Contractor. The size of the Model shall not be less than 1.5 m x 2.5 m. The Model shall be within a wooden Box having glass on its top and kept over a Table fir display.

2.12 Scope of Work for Operation & Maintenance

The Bidder shall operate and maintain the Raw Sewage Pumping Stations, Sewage Treatment Plant and all other allied works under this Contract for a period of 60 months, including defect liability period of 60 months. For this period, the scope of work shall include, but not be limited to the Operation and Maintenance of the following:

- Raw Sewage Pumping Station and Sewage Treatment Plant including all the Civil Units and Electro-Mechanical Equipments as per the Bidder's Proposal to ensure that all the output guarantees are met.

- General Facilities and Utility Services.
- PLC/SCADA based Automation system.
- All other in-plant facilities listed in the detailed Scope of Work

The Bidder shall also dispose-off the sludge, screenings, grit and any other material, as per specifications and to the satisfaction of the Engineer In-charge. It is to be noted that all costs during the O&M period excluding cost of power and diesel for DG is to be borne by the Contractor. Within his quoted cost, the Bidder is to ensure that the following guarantees are maintained:

- Guarantee for Quality of Treated Sewage.
- Guarantee for Power Consumption.
- Guarantee for Automation System.

The Bidder shall provide on job training to the Employer staff as per specifications.

The Bidder shall, at no extra cost to the Employer, repair and re-condition all the required mechanical equipment in the concluding year of the O & M period and Hand over the facility to the Employer in proper & fully working condition.

2.13 Operation and Maintenance Cost

All the cost for Operation and Maintenance of the Plant such as Chemicals and Consumables, Disposal of Screenings, Grit and Dewatered Sludge, Manpower, Spares, Repair and Maintenance of Civil, Mechanical, Electrical, Instrumentation Items including all other major/minor repairs, breakdowns, replacements etc. **excluding Cost of Electricity and Diesel for DG** shall be in the scope of the Bidder. **No extra payment other than whatever has been quoted in Price Schedule will be entertained by the Employer.**

The Bidders are to quote O&M Cost and provide Functional Guarantee based on the design parameters given in the tender which shall be used for technical evaluation of qualifying Bids:

2.14 Contract Period

The total Contract Period shall be as follows :

Construction Period : 18 Months (Including Monsoon)

Performance Run : 3 Months

O&M Period : 60 Months including 60 months defect liability period

Payment Breakup for Pumping Station Wet wells & Screen chamber:

S.N	Brief Description of Unit	% of Total Cost Civil Work
1	Approval of Process Design	**5%**
2	Approval of RCC Design and Drawing	**2%**
3	Excavation work	**15%**
4	PCC	**2%**
5	Concreting of Raft foundation	**25%**
6	Concreting of walls ½ Ht	**15%**
7	Concreting of walls full Ht	**15%**
8	Balance Civil work	**11%**
9	Hydraulic testing and trial	**10%**
	total	**100%**

Payment Breakup for STP:

S.N	Brief Description of Unit	% of Total Cost	
		Civil Work	Electro Mechanical work
1	Screen Chamber, Degritting tank	**2%**	**7%**
2	SBR System (CASP Basins)	**30%**	**31%**
3	Sludge thickener/Sludge sump	**1%**	**1%**
4	Centrifuge System	**2%**	**5%**
5	Chlorination System	**2%**	**1%**
6	Administrative Building MCC & Blower Room	**5%**	**0**
7	Misc. Civil Work, roads and landscaping	**3%**	**0**
8	Interconnecting Piping	**0**	**3%**
9	Electric works	**0**	**2%**
10	Electric Substation	**0**	**4%**
11	Instrumentation	**0**	**1%**
	Subtotal	**45%**	**55%**
	Total	**100%**	

Note: 10% of Each Civil Item percentage (as mentioned above) will be held up for successful hydraulic testing and trial run.

S.N	Brief Description of Unit	% of Total Cost E&M Work
1	Approval of Process Design	**5%**
2	Approval of Design and Drawing	**2%**
3	On receipt of Equipment\Material	**60%**
4	Erection & Installation	**17%**
5	Testing and Successful commisioning	**15%**
	total	**100%**

Cost of DG set, Automation with SCADA And Mechanical and Manual screen required for STP are already included in the cost of STP Subwork.

TESTING & COMMISSIONING

TEST ON COMPLETION

General

Prior to the commencement of Tests on Completion the Contractor shall submit for approval the following:

• Site Acceptance Test Documents for STP & SPS.

• As-Built Drawings STP & both SPS.

• Operation & Maintenance Manuals STP & SPS.

Tests on Completion shall not be commenced until the aforementioned documents are approved.

The initial charges necessary for Tests on Completion shall be provided by the Contractor.

Electricity required for Tests on Completion will be provided by EMPLOYER free of charge for a period not exceeding 30 days. In case the test on completion period exceeds 30 days, the cost of power till start of performance run shall be borne by contractor.

The cost of any consumables and chemicals required for the Tests on Completion shall be borne by the Contractor.

Dry Test Requirements

General

As a minimum requirement, the following dry tests shall be carried out as a general requirement:

• a general inspection to check for correct assembly and quality of workmanship, a check on adequacy and security of Plant fixing arrangements

• a general check to ensure that all covers, access ladders, water-proofing, guard railingstc. are in place,

• a check on damp proofing, rust proofing and vermin proofing and particularly the sealing of aperture between building structure , chambers, etc. and the outside.

Civil and Building Works

As a minimum requirement the following dry tests shall be carried out on the civil engineering and building works:

Check for the presence of foreign bodies in pipe work and structures.

Mechanical Works

As a minimum requirement the following dry tests shall be carried out on the mechanical systems:

• Carry out preliminary running checks as far is permitted by circumstances in order to ensure smooth operation of Plant.

Check for the presence of foreign bodies in wet well, delivery pipe and rising main.

Electrical Works

As a minimum requirement the following dry tests shall be carried out on the electrical systems:

• Check phasing and polarity

• Carry out point to point check on all cables;

• Check on security of cable terminations

• Check on completeness and adequacy of earthing systems;

• Check setting on protection relays, sizes of fuses and motor overload settings;

• Carry out checks on cabling systems in accordance with the requirements of the relevant tandards;

• Check operation of main circuit breakers by secondary injection methods;

• Check rotational direction of plant;

• Check instrument loop integrity, functionality and calibration;

• Check operation of standby generator installation and mains/generator changeover

Procedures; a 4 hrs load test (using the normal load of the Works) shall be carried out on the generator when the load is available;

• Check plant functionality

• Check functionality of the central MMI and its power supply;

Process STP & SPS Item / Equipment

All process plant items/equipment shall be tested to ensure they meet the Employer's

Requirements for quality of workmanship, construction and performance.

Hydraulic Wet Test Requirement

Hydraulic wet tests shall be carried out on completion of dry tests.

Potable water shall be used for hydraulic wet tests. The purposes of the tests is to prove as far as is practical the hydraulic performance of the Works. In order to demonstrate this Contractor shall ensure that each part of the Works is hydraulically loaded to its maximum rated load throughout for a period of at least seven days at twenty-four hours intervals.

In order to ensure a sufficient supply of potable water to carry out these tests the Contractor shall provide facilities for the disposal off site in an approved manner.

In order to remove doubt the following tests inter alia shall be carried out.

• Pressure testing of all piped systems laid direct in ground in accordance with the relevant standards;

• Fill all structures and check for leaks as per IS: 3370;

• Running of all pumped systems in order to check for

• Correct functionality

• Absence of leaks

• Correct running temperatures

• Smoothness of running and the absence of undue vibration or stress;

• Check drive running currents

• Carry out calibration of instruments where appropriate

• Carry out valving, diversion etc. to fully hydraulically load each process element (or WHERE THERE IS A REQUIREMENT TO WITHSTAND AN OVER LOAD), OVERLOAD EACH PROCESS ELEMENT;

• Demonstrate correct functionality of electrical, control and instrumentation systems.

The Contractor shall simulate where practical the conditions that will prevail when operating as a process in order to demonstrate the correct functionality of process control loop etc.

During these tests a check on the performance of Plant shall be made, as far as site facilities will allow, to compare its site performance with the factory test data and to identify and constraints on performance due to site conditions.

Process Wet Test

On approval by the EMPLOYER the Contractor shall carry out process wet tests.

Raw water shall be used as the primary feed stock for process wet tests. These tests shall be carried out to demonstrate the process performance of the Works. In order to demonstrate this, the Contractor shall ensure that each part of the Works is located to its rated through put (including a period of overload if required in order to demonstrate compliance with the Employer's Requirements) for continuous stable operating period of not less than 48 hours. The Contractor shall provide facilities for the disposal off site in an approved manner.

The following tests inter alia shall be carried out;

• Check and rectify leakage on civil structures, pumps and pipework;

• Running of all pumped systems in order to check for;

• Correct functionality,

• Absence of leaks,

• Correct running temperatures,

• Smoothness of running and the absence of undue vibration or stress,

• Check drive running currents where the solution pumped is different from that pumped during hydraulic wet tests;

• Carry out calibration of instruments;

• Carry out valving, diversion etc to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element;

• Demonstrate correct functionality of electrical, control and instrumentation systems not checked during dry or hydraulic wet tests or which may have changed as a result of the different operating conditions now prevailing.

• On completion of process wet test on the various parts of the works the Contractor shall run the plant as a whole in order to demonstrate the full functionality and performance of the Works at various throughput rates for a continuous period of not less than 7 days. In this period power utilized by the contractor shall be compared with the guaranteed power consumption given by the contractor. This shall be considered as completion of 'Test on Completion' and shall be certified by EMPLOYER.

PERFORMANCE RUN AFTER START UP

General

On successful completion of 'Test on Completion' i.e. start up and commissioning, certified by EMPLOYER, Contractor should start the performance run of the plant for 3 months.

The Contractor is to carryout Operation & Maintenance (O&M) of the whole plant including civil works for 3 (three) months under performance run. EMPLOYER shall

monitor the operation and maintenance by the Contractor.

During performance run period, the Contractor shall provide following as minimum for round the clock operation.

Sr. Personnel	No.	Total Experience	Main Task of the Personnel
1 Plant in Charge (BE Civil/Environment)	1	5 years	Coordination of activities for satisfactory performance of the STP & pumping station and Reporting to the Engineer-in-charge and responsible for the proper functioning & maintenance, data collection of STP & pumping station.
2 Operators (Diploma, ITI Qualified)	6	3 years	Responsible for overall operation for STP and pumping station.
4 Electrician (ITI Qualified)	1	3 years	Responsible for maintenance of electrical equipment.
5 Fitter (Mech.) (Diploma, ITI Qualified)	1	3 years	Responsible for maintenance of mechanical equipment.
6 Helpers	6	1 years	Responsible for keeping the STP premises clean and neat. Also they will assist operators in day to day activities.
6 Security Guards	4	1 year	To protect the plant from the trespassers, animals etc.
7 Gardener	1	5 years	To maintain the garden/landscaping of the plant
8 Sweeper	1	5 years	Assisting in day to day activities in office, keeping office clean & neat

Spares: As required for replacement during performance run period. The spares

used from the spare supplied under the contract shall be replaced by the Contractor.

EMPLOYER shall supply power and water during Performance Run period free of cost. All other material such as chemicals, consumables, lubricants, tools & plants, spares etc. shall be provided by the contractor. The contractor, if required, shall provide activated sludge or any other material for the stabilization of the plant.

The Contractor shall provide operators for various units/plants for three shifts and other staff/supporting personnel in general shift.

The Contractor shall submit a weekly report to the Employer, about the operation and maintenance indicating the manpower, electric power, chemicals and other consumables consumed and also problems faced and rectified.

During this period, the Contractor shall ensure that the design treated sewage quality standards are met in accordance with the specification within the rate of power and chemical consumption as committed by the Contractor. The raw and treated sewage analysis pH, SS, BOD and oil & grease shall be carried out on daily basis from the day of commissioning at a reputed laboratory as approved by Engineer-in-Charge. 90% of the treated sewage samples should fall within prescribed limits of the treated sewage. The sampling location for raw sewage shall be at raw sewage sump and that of treated sewage shall be at outlet of chlorine contact tank. The analysis of sewage for the above parameters at different locations such as outlet of secondary clarifier shall also be carried out on weekly basis. The Contractor shall take immediate steps to correct the operation of the plant to meet the guaranteed performance. The charges for analysis at the laboratory are to be borne by the Contractor.

The Contractor's responsibility includes the safety and security of the works/plants during the course of performance run of three month.

The Contractor shall provide the key personnel for performance run with the minimum qualification and experience as given below.

Sr.	**Category**	**Qualification and Experience**
1.	Plant in charge	Graduate in Engineering/Technology (Civil/ Environmental Engineering) having 5 years of experience in O & M/ Maintenance of water /wastewater treatment plant.
2.	Plant Operator	Diploma in Engineering/Technology (Civil/ Environmental/Chemical Engineering) having 3 years of experience in Operation/ Commissioning of

	water/wastewater treatment plants.
3. Chemist	Graduate in Environmental Science/ Chemistry having 5 years of experience in sampling/ analysis in water / wastewater treatment plants.
4. Electrician / Fitter	Diploma in respective field with 5 years of experience in erection, commissioning and O&M of M&E equipment in water/ wastewater treatment plants.

PERFORMANCE RUN CERTIFICATE

The conditions for issuance of a Performance Run Certificate as detailed in the Conditions of

Contract shall comprise:

• The completion of the three months operation and maintenance under performance run of the treatment plant to the satisfaction of EMPLOYER.

• 90% of the treated sewage samples fall within the prescribed limits of the treated sewage as mentioned in the tender document.

• The O & M Manuals have been updated following three month's operational experience and approved by EMPLOYER.

• All defects identified during the three months operation of the works have been rectified

• EMPLOYER shall issue a Completion Certificate for "Performance Run of Plant" after successful completion of Performance Run of plant for 90 consecutive days by Contractor to the satisfaction of EMPLOYER.

SCOPE OF WORK – OPERATION & MAINTENANCE

1.0 General Obligations

The Bidder shall during the O&M Period, undertake all services relating to operation and maintenance of the Project Facilities in conformity with O&M Requirements.

a. The Bidder shall submit to the Engineer-in-charge a plan for operation and maintenance of the Project Facilities ("O&M Plan") in conformity with the Construction Requirements, O&M Requirements and Performance Standards as set out in Tender Document after the completion of the construction period.

b. The O&M Plan shall set out in detail the standards, schedules, procedures, type, periodicity and other details of the operation and maintenance activities to be carried out for the Project during the O & M Period so as to meet the O&M Requirements as well as details of the management information system to be incorporated, reports to be submitted and procedure for reviews, including developing a mechanism for corrective actions.

c. Engineer-in-charge shall review the same and convey its comments/observations to the Bidder on the O&M Plan, including the need, if any, to modify the same. If the comments/observations of the Engineer-in-charge require the O&M Plan to be modified, the Bidder shall suitably modify the O&M Plan. The O&M Plan shall be finalized with mutual consent.

d. Notwithstanding any review or failure to review by the Engineer-in-charge or the comments/ observations of the Engineer-in-charge, the Bidder shall be solely responsible for the adequacy of the O&M Plan and the conformity thereof with the Performance Standards, Construction Requirements and O&M Requirements and shall not be relieved or absolved in any manner whatsoever of any of its obligations hereunder.

e. The Bidder shall inform engineer-in-charge details of its key personnel responsible for O&M and subsequent changes, if any, from time to time. However minimum manpower as given in the tender document shall be provided for the Operation and Maintenance of the project at all times.

f. The Bidder shall undertake operations and maintenance of the Project Facilities by itself or through Contractor possessing requisite technical/financial/managerial expertise/ capability, but in either case, the Bidder shall remain solely responsible to meet the O&M Requirements.

g. The Bidder shall incorporate good management practices and appropriate technologies required for meeting the Performance Standards.

h. The Bidder shall, during the Agreement Period;

(i) have requisite organization and designate and appoint suitable officers / representatives as it may deem appropriate to supervise the Project, to deal with the Engineer-in-charge and to be responsible for all necessary exchange of information required pursuant to the tender provisions; Minimum Manpower as required for the plant operation and maintenance as per the Tender Document shall be provided at all times.

(ii) for the purposes of determining that the Project Facilities are being maintained in accordance with the Construction Requirements and O&M Requirements, the Bidder shall with due diligence carry out all necessary and periodical Tests in accordance with the instructions and under the supervision of the Engineer-in charge Bidder shall maintain proper record of such Tests and the remedial measures taken to cure the defects or deficiencies, if any, indicated by the Test results.

(iii) conduct all Tests / guaranteed trial runs to ascertain compliance with Construction Requirements and O&M Requirements.

(iv) suspend forthwith the whole or any part of the O&M activities upon receiving a written notice from the Engineer-in-charge who may require the Bidder to suspend the activities in whole or part if in the reasonable opinion of the Engineer-in-charge, the operations are being carried on in a manner that is not in conformity with the O&M Requirements.

(v) be responsible for the security of the Project facilities and comply with all applicable laws, statutory requirements as may be applicable from time to time.

(vi) be responsible for the routine as well as any capital replacement that maybe required either to meet the agreed specifications and performance of the Project facilities.

(vii) The Bidder shall as per pre agreed format record the system performance and periodically provide the same to Engineer-in-charge.

1.1 Other Obligations during O&M stage

The Bidder shall:

a. from the Date of commissioning, undertake all services relating to Development, operation and maintenance of the plant in conformity with O&M Requirements.

b. and shall meet its Performance Standards as per the Tender Document and all statutory laws as applicable.

c. From the Date of commissioning, carry out the following activities in the Project Area:

- Ensure that treated sewage is recycled and used within the plant battery limits for various non-human consumption activities to the extent possible.
- Obtain the desired Performance parameters from the plant, such that it is necessary that each unit's treatment process is operated and maintained to function at optimum level and the process parameters to be maintained at each unit of treatment plant is closely monitored.

d. The Bidder shall Operate & Maintain the Project facilities with the following scope of work:

1. For a period of 60 (Sixty) months from the date commissioning.

2. Treat Raw Sewage to desired treatment standards and with the treatment process specified in the Tender Document.

3. Supply of necessary chemicals and consumables as required for treatment specified in the Tender Document under functions and responsibility of the Bidder.

4. Provide the qualified staff required including security for watch and ward, necessary skilled and trained men for preventive and breakdown maintenance of all the equipment's and components of the Project facility.

5. Cost of all repairs i.e., major and minor to all the equipment's, plant and machinery, electrical and mechanical equipment's, instrumentation and civil works etc.

6. Cost of all spares/replacements to all the equipment's, plant and machinery, electrical and mechanical equipment's, instrumentation and civil works etc.

7. Cost of all labour, materials, special tools and ordinary tools and parts required for maintenance of all equipment's.
8. Supply of engine oil, lubricants, necessary spare parts.
9. Cost towards salary of staff, guidance and training of staff, monitory of the treatment process by Public health engineer as specified.
10. Carrying out Raw and Treated sampling, testing, according to the standard test procedures.
11. Cost of necessary chemicals reagents, and glass ware for testing the samples by the chemist employed including monitoring and control of treatment process and ensuring that the raw sewage is treated in accordance to the performance standards prescribed in Schedule - 7.
12. Maintaining log books/ registers for daily inputs and outputs , flow rates, quality test results , chemicals consumed , energy used, staff attendance , preventive and break down maintenance works done for each equipment and other plant O & M data etc.
13. Maintaining gardens, trees, roads and drains in the plant premises and keep the Project Facility / Project Area and equipment's in good working conditions conforming to all the requirements set out under this Agreement.
14. Any other item left out and necessary as per guidelines of statutory agencies will be carried out within scope of above work.
15. Take necessary action as may be appropriate and in accordance with Prudent Utility Practices in the event of an emergency or risk of danger or damage to persons or property (including the Project Facilities).

1.2 O&M Cost Obligations

The Bidder rate quoted by him in the Price Bid shall include following O&M Cost obligation with other contractual obligation within the Project Area.

a. Water usage cost
b. Establishment cost
c. Chemicals & other consumables cost
d. Manpower for Plant operation

e. Maintenance & repairs / replacement of Project facility.
f. O&M obligation under this Contract unless excluded by this Contract.
g. All expenses towards Statutory permissions
h. Any other expense required for upkeep and smooth operation of the Project Facility.

1.3 General activities during O & M period

During O & M Period of 60 months, contractor shall perform, not limited but including, following general activities:

1. Operations

a. Daily Operations of Facility

The Contractor shall carry out all facility operation and waste water conveyance, treatment & disposal operations indicated below; in accordance with Good Operating Practices, as set out in this Contract. The Facility operation and waste water disposal operations shall include, but not be limited to the following:

- Operating & Maintaining Raw Sewage Pumping Station.
- Operating & Maintaining Sewage Treatment Plant to maintain the quality of treated sewage within the standards prescribed in the Tender, operate electrical equipment during power failures by operating generators and operate Sludge Handling units.
- Carrying out continuous flow measurements of treated & untreated sewage and recording the same online / offline.
- Collecting samples of influent and effluent and analyzing them daily to determine the quality of sewage and performance of the treatment plant and providing security for facilities and system at all times.

b. Contingency Plan

Developing and implementing contingency plans in respect of responses to natural disasters, periods of power failure, storm water inflow into sewers during monsoon,

de-silting of units of treatment plants, constraint operations or other similar emergencies to maintain the quality of treated sewage.

c. Energy Audit

The Operator shall take all necessary measures to minimize the power consumption in carrying out its operations. The energy audit operations shall include, but not be limited to the following.

- Reducing electricity consumption by regulating equipment operation through suitable modifications to the operating schedules.
- Maintaining power factor and demand to avoid penalty
- Installing more efficient pumping equipment and following better maintenance practices for electrical installation.

d. Repairs and Maintenance

The Contractor shall carry out preventive, routing maintenance and break down maintenance Operations for proper upkeep of plant in accordance with good operating practices. The following items shall be included in such maintenances.

i) Machinery and Treatment Plant Equipment

- Dewatering and de-silting of sludge Sump, chlorination Tank, chemical dosing tanks at least twice a year as per approved programs and disposal of silt.
- Cleaning and maintaining all rising mains/sewers in the plant area at least four times a year.
- Repairing and replacing damaged pipes, fittings and valves for suction and delivery pipe.
- Repairing and replacing pump impellers, body, bearings shafts column pipes.
- Repairing and replacing motors
- Repairing and replacing starters, circuit breakers, capacitors
- Repairing and replacing vanes and/or gears of agitators
- Repairing and replacing transformer.
- Repairing of blowers, decanter, diffusers, chlorinator, and chemical dosing equipment's & Centrifuges.

ii) Building and Civil Structures

- Water proofing leaking roofs of the Buildings.

- The preventive and routine maintenance shall include all repairs and provision of spares material and tools required for these repairs. The Contractors shall also carry out breakdown maintenance and repairs. The labour, tools and plant, spares shall be arranged by the Contractor. The following spares shall be the respective responsibility of the Contractor and the Employer during preventive routing and breakdown maintenance.

2. Advice Early Warning:

The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the operations or the condition of the facilities and / or system. The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstances can be avoided or reduced and in carrying out any resulting instruction of the Engineer

The Contractor shall also advise the Employer from time to time, on improving the quality of operations, reduction in water / energy losses and betterment practices.

3. Reporting

The Contractor shall utilize the office space, provided by the Employer to establish its monitoring and reporting office along with computer and peripherals. It shall also obtain a telephone connection and maintain the same through the Contract period. All data transfers and updates made to the Employer shall be affected through the said telecommunications medium.

The Contractor shall carry out all reporting indicated below and as set out in this Contract. The reporting shall include, but not be limited to the following.

- Daily summary of Operations at Sewage Treatment Plant – A daily report of operation of the diffuses, agitators, decanter and other equipment at the sewage

treatment plants providing information on the quantity of sewage treated, hours of operation of equipment, energy consumed and use of chemicals.

- Sewage Quality Monitoring – A daily report monitoring the quality of raw and treated sewage through the analysis of samples.
- Sewer / Storm Water Drains / wet well & other units etc. Monthly cleaning report sewer / storm water drain de-silted and record of silt disposed at disposal sites.
- Continuous flow measurements of Raw & Treated Sewage and recording the same.

4. General Responsibilities

The Contractor shall maintain properly and keep intact all assets / works/facilities / system of the Employer throughout the Contract period and shall hand over the same in good working condition at the end of the Contract. The Contractor shall not modify or alter any operations regarding the facilities and / or system without prior written permission of the Employer or its representative.

The Contractor shall procure all spare parts required for the maintenance of equipment excluding those to be supplied by the Employer. The Contractor shall warrant to the effect that all the spares shall be procured from the authorized sources and be of the best quality and fit for the purpose for which it is being used.

The Contractor is expected to carry out the work in such a manner as not because any damage to public property on account of negligence or otherwise. The Contractor shall be fully responsible for making good the damages so caused by him entirely at his own cost.

The assets / works / facilities / systems of the Employer shall be at the risk and in the sole charge of the Contractor and it shall be responsible for making good any loss or damage there to arising from any cause whatever including that due to a theft or robbery.

The Contractor shall provide adequate engineering equipment, maintenance staff, inventories plant and machinery and all other things, whether of a temporary or permanent nature required for carrying out operations under the Contract.

The Contractor shall carry out its Operations, so far as compliance with the requirement of the Contract permits, so as not to interfere unnecessarily or improperly with:

- The convenience of the public
- The access to use and occupation of public or private roads and footpaths to or of properties.

Permissions: The Contractor shall obtain all required permissions, sanctions clearances and permits for carrying out its Operations, including Contractors clearances and shall be fully responsible for carrying out the operations in a safe and secure manner, consistent with the law of the land, laws and regulations regarding such facilities and / or System and directives of any Authority and planning permissions.

Safety: The Contractor shall be responsible for the safety of all activities on the site and shall be absolutely and solely responsible for any and all kinds of injuries or damages to persons and property of any description whatever may be caused by or result from the operations carried out, whether these may have been carried out skilfully and carefully and strictly in conformity with the provision of the specifications or not.

Discoveries: All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent its workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Employer instructions for dealing with the same.

The Contractor shall be responsible for payment of reinstatement charges for roads, footpaths and land as per the Employer's rates.

The Contractor shall take full responsibility for the adequacy stability and safety of all Site operations.

5. Staff & Labour:

A. Engagement of Staff & Labour

The Contractor shall employ skilled, semi-skilled and unskilled labour in sufficient numbers to carry out its operations at the required rate of progress and of quality to ensure workmanship of the degree specified in the Contract for timely fulfilling of the Contractor's obligations under the Contract and to the satisfaction of the Employer.

The Contractor shall not employ in connection with the operations any child who has not completed his/her fifteenth year of age. It shall also not employ an adolescent who has not completed his / her eighteenth year unless he/she is certified fit for carrying out operations as an adult as prescribed under clause b) of such section (2)(of Section 69 of the factories Act 1948.

The Contractor shall provide its staff, a minimum of two sets of uniforms with the titles the Employer inscribed on the back and subject to approval of the Employer. Each worker on duty shall wear a clean uniform whenever on duty.

The Contractor shall be required by the Engineer deliver to it, to such forms and at such intervals as the Engineer may prescribed a return showing the numbers of the several classes of staff employed by the Contractor on the site and such other information as the Engineer may require.

If the Employer asked the Contractor to remove a person who is a member of the Contractor's staff stating the reasons, the Contractor shall ensure that the person leave the site within seven (7) days and has no further connection with operations under the Contract.

At all times during continuance of the Contract, the Contractor and its sub-contractors shall abide by all existing and future labour enactment and rules made there under, regulations, notifications and bye-laws of the Central, State or Local Government. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by any Authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments.

If the Employer is caused to pay or reimburse such amounts as may be necessary to carry or observe, or for non-observance of the provisions stipulated in the notifications/bye-laws/acts/rules/regulations including amendments if any, on the part of the Contractor and in connection with labour enactment, the Engineer shall have the right to deduct any money due to the Contractor including its amount of security deposit. The Engineer shall also have the right to recover from the Contractor, any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

B. Contractor's Superintendence

The Contractor shall provide all necessary superintendence while carrying out its operations and as long thereafter as the Employer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor shall nominate a competent and authorized representative (Contractor Representative) approved of by the Engineer which approval may at any time be withdrawn. The Contractor's Representative shall give its whole time to the superintendence of the operations. The Contractor's Representative shall receive, on behalf of the Contractor, instructions from the Engineer which shall be deemed received by the Contractor.

6. Repairs and Maintenance Schedules

1. Sewage Treatment Plant Complex:

As per indicated period checking the operation, correcting defects, attending to calibration and setting is required attending to minor repairs and proper up keeping) such as cleaning and painting) required for the following :

i. Monthly

- Roof and surroundings and
- Lightning arrestors.

ii. Annual

- Leakages in structures
- Ladders
- Railings
- Structural damages to the wet and dry well and
- Overflow drain.

2. Pumping Machinery and Treatment Plant Equipment:

As per indicated period checking the operation, correcting defects attending to calibration and setting is required attending to minor repairs and proper up keeping) such as cleaning and painting) required for the following:

i. Daily

- Screens/ Grit Channels
- Moving parts of screens and grit removal equipment, Blowers /Agitators / Pumps/ Agitators /Return Sludge pumps/ Chemical mixer/Centrifuge/Decanter
- Stuffing box
- Bearing and
- Cable insulation near the lugs.
- Panels Breaker and Starter
- Contacts of relay and circuit breaker and
- Setting of over-current relay, no-volt coil and tripping mechanism and off in the dash pot relay.

- Transformer Sub-station
- Ground Operated Dis-connectors (GOD)
- Contacts of GOD and of Over Current (OC) relays
- Radiators and Earth pit

ii. Monthly

- Screens and Grit channels
- Chains in mechanically operated components
- Screens performance
- Transformer
- Relay alarm circuit
- Load (Amperes) and
- Voltage

iii. Quarterly

- Transformer
- Bushing and
- Dehydrating breathers

iv. Half -Yearly

- Pumps / Blowers /Agitators / Compressor /Decanters/Centrifuge
- Gland of stuffing box
- Gland bolts
- Gland packing
- Alignment of pump aerator and drive and
- Oil lubricated bearings
- Motors
- Tripping elements for motor protection
- Contact points and
- Fuse ratings

v. Annual

- Paint screens, grit removal mechanism, scrapers, scrapers , motors, pipes,

- Valves, fittings agitators and inlet/outlet weirs with two coats of anticorrosive paints.
- Replace worn out parts of mechanical equipment in sewage treatment plant.

3. Buildings and Civil Structures:

Carry out routine maintenance and minor repairs including cleaning, repairs to plaster, doors, windows and painting.

i. Daily

- Sweep the premises
- Clean the floors and parts inside the Building
- Clear the cobwebs and other biological growth
- Maintenance of horticulture
- Disposal and transportation of dewatered sludge

ii. Half - Yearly

- Repair damaged floor, plaster, roof, leakages and
- Repair damaged doors, windows and other fixtures.

DESCRIPTION OF STAFFING

Details of minimum staff required to be employed for the operation and maintenance of the

Sewage treatment plant for 60 months is given below. However, additional staff, if required for proper operation and maintenance of STP, will be provided by the contractor without any

Additional charges.

Sr. Personnel	No.	Total Experience	Main Task of the Personnel
1 Plant in Charge (BE Civil/Environment)	1	5 years	Coordination of activities for satisfactory performance of the STP & pumping station and Reporting to the Engineer-in-charge and responsible for the proper functioning &

			maintenance, data collection of STP & pumping station.
2 Operators (Diploma, ITI Qualified)	6	3 years	Responsible for overall operation for STP and pumping station.
4 Electrician (ITI Qualified)	1	3 years	Responsible for maintenance of electrical equipment.
5 Fitter (Mech.) (Diploma, ITI Qualified)	1	3 years	Responsible for maintenance of mechanical equipment.
6 Helpers	6	1 years	Responsible for keeping the STP premises clean and neat. Also they will assist operators in day to day activities.
6 Security Guards	4	1 year	To protect the plant from the trespassers, animals etc.
7 Gardener	1	5 years	To maintain the garden/landscaping of the plant
8 Sweeper	1	5 years	Assisting in day to day activities in office, keeping office clean & neat

GENERAL SPECIFICATIONS

TECHNICAL SPECIFICATIONS – E & M WORKS

1.1 GENERAL

All the E&M works shall be carried out as per latest CPWD Electrical Specifications Part – I (Internal) – 1994, Part – II (External)-1995, Part-IV (Sub-Station) – 1982, Part – VI (Fire Alarm System) – 1988 & Air Conditioning - 1997 with up to date corrections slips issued up to the date of submission of bid. In case the CPWD specifications are not found applicable and adequate than the relevant BIS specifications shall be used. Further in case, any of these are not applicable to particular tools, Equipments and machinery, then the manufacturer's specifications or their relevant instructions shall be followed.

1.1.1 Lighting System

1.1.1 Drawings and Data

a) The contractor shall furnish relevant descriptive and illustrative literature on lighting fixtures and accessories dimensioned drawings/ data for the respective lighting fixtures with manufacturer's catalogue numbers.

b) It shall be the responsibility of the contractor to work out a detailed layouts in order to provide the level of installations as indicated under Design Criteria and shall be furnished for the approval of the Engineer In-charge before commencement of installation

1.1.1.2 General Requirements

The Lighting system includes the following items:

(i) Lighting fixtures complete with Lamps and accessories

(ii) Lighting system equipment

- Light control switches, receptacle units with control switch units, lighting wires, conduits and other similar items necessary to complete lighting system
- Lighting fixture supports and street lighting poles

- Lighting main distribution board, lighting panels.

c) Multi core cables for street, boundary and flood lighting

1.1.2.3 Design Requirements

It shall be responsibility of the contractor to work out a detailed layout for different units/areas in order to provide the levels of illumination as indicated in the design requirement above. The contractor shall be responsible for measuring the levels of illumination after installation and establish compliance with the specification.

The design, manufacture and performance of equipment shall conform to the latest amended Indian standard and following design and general criterion is given in Volume – I, Section – 2.0 Scope of Work above.

Mechanical Equipments:

Ambient Air Temp	:	Max. 45°C
		Min. 2°C
Relative humidity	:	Max. 85%
		Min. 15%

Electrical Equipments:

Ambient Air Temp	:	Max. 45°C
		Min. 2°C
Relative humidity	:	Max. 85%
		Min. 15%

Nominal system supply

1.	Incoming power	:	11KV, 3Ø, 3W, 50Hz
2.	Power distribution	:	11KV/ 415V, 3Ø, 4W,50Hz, AC
3.	Lighting & space heating	:	240V, 1Ø, 2W, 50HzAC
4.	D.C. Controlling	:	30V and 24V D.C
5.	A.C. Control	:	240V A.C
6.	P T Secondary	:	110V, 3 Phase, 50 Hz A.C

7. Variation

Voltage	:	± 10%,
Frequency	:	± 5%
Combined Voltage and Frequency	:	± 10%,

8. System Earthing:

a)	11KV System	:	Wherever generation is taking place at 11 KV, this will be earth through resistance.
b)	415V system	:	Neutral solidly earthed
c)	240V Single Phase	:	Neutral solidly earthed
d)	30V D,C, System	:	Unearthed

1.2 Inspection, Pre-Despatch Inspections and Testing by the Employer

i) Employer reserves the right for pre- dispatch inspection of Equipment at the manufacturer's place in India or abroad by the representatives of the Employer and Consultants along with Contractor or his/their representatives. The total cost of to & fro by Air or any other better conveyance charges, wherever the air routes are not available, boarding and lodging etc., shall be borne by the Contractor. In case the equipments are not found suitable for dispatch or whatsoever the defects may be and another inspection is required that visit also shall be arranged and borne by the contractor. The Employer shall not entertain any request on this account; even such inspection may be one or more, as may be required, before the dispatch of the Equipments. The discrepancies of such equipments as pointed out by the representatives of the Employer and the Consultants shall be rectified at the cost of the Contractor or the Manufacturer and the Employer shall not hold any liability on this account, what so ever may be.

ii) A mutually agreed quality assurance plan will be developed which provides for inspection and certification by the Employer at specified times during the manufacture and fabrication of such items. All costs for independent inspection or testing will be borne by the Contractor, and the Contractor shall be fully

responsible to ensure that adequate provisions are made in his tendered rates to cover independent inspections and testing for the following equipments and machineries to be incorporated in the Permanent Works:

Sl. No	Name of the Equipment	Stages of inspection		
1.	Pumps	1	Review of material test certificate for pump casing, bowls, shaft, impeller bearings, columns pipe etc.	
		2	Review of heat treatment certificate if any	
		3	Dynamic balancing or rotating parts / impeller	
		4	Examination of the shaft	
		5	Hydro test of casing.	
		6	Performance test at 49Hz and 50Hz frequency including vibration measurement covering following tests	
			i)	Capacity in LPM / LPS
			ii)	Delivery Head in mtrs.
			iii)	Efficiency at the specified duty.
			iv)	Power absorbed by the pump at the specified duty.
			v)	N.P.S.H required.
			vi)	Maximum power required by the pump.
			vii)	Shut off Head of the pump.
			viii)	Discharge of the pump when only on pump is operated in the system.
			ix)	Delivery pressure when only on pump is operated in the system.
			x)	Power absorbed by the pump when only one pump is operated in the system.
			xi)	Efficiency of the pump when only one pump is operated in the system
			xii)	Visual and dimensional check.
			xiii)	Strip test.
			xiv)	Speed test at 49 Hz and 50 Hz frequency
2.	Motors	1.	Dynamic balancing of rotor and visual examination of rotor assembly.	
		2.	Visual inspection and testing of stator assembly	
		3.	Review of Test Certificate for conductor, Stator Coils, shaft Bearings etc.	

Sl. No	Name of the Equipment	Stages of inspection	
		4.	Routine test no load x load test vibration measurement as per IS
		5.	Verification of type test report.
		6.	Visual and dimensional check.
3.	Switch Gear and Electrical Panels	1. 2.	Visual and dimensional check. Verification of bill of materials.
		3.	Functional Test.
		4.	H.V / I.R. Test.
		5.	Verification of type test reports.
		6.	Voltage ratio, burden class, induced high voltage, applied high voltage test for potential transformers
		7.	Current ratio, burden, class of accuracy, test for current transformers.
		8.	Rate symmetrical breaking capacity, rated making capacity, rated short time current, auxiliary voltage for release coils, Impulse with Standard voltage test for Switch Gear panels.
		9.	Test results of Relay provided.
4.	Transformer	□Visual inspection, dimensional check and verification of bill of materials. □Iron losses and Copper losses test at 90% of the rated voltage, 100% rated voltage and 110% of the rated voltage. □Resistance voltage test at HV side and L.V side. □Routine tests as per IS:2026. □Verification of type results, temperature rise test, Impulse test, Insulting oil test etc.	
5.	Capacitor	All routine and type test as per IS:2834 such as sealing test, test for output / capacitance, Insulation resistance test between terminals. Containers and loss angle measurements, test for efficiency of discharge divide, test for dielectric loss angle, thermal stability test, self healing test, voltage test between terminals.	
6.	Cables	1. Visual Inspection and dimensional check. 2. Routine test as per IS: 1554. 3. Insulation test, resistance test, current rating test, star reactance test, star capacitance test, short circuit current test, voltage drop test.	
7.	Valves	• Visual and dimensional check. • Review of material test certificate for Valve body and internal parts. • Operational smoothness. • Hydrostatic test / leakage test as per applicable code.	

Sl. No	Name of the Equipment	Stages of inspection
8.	Pipes & Specials	1. Visual and dimensional check. 2. Review of chemical and physical test certificates as per the relevant Indian Standard specifications. 3. Hydrostatic pressure test as per the relevant Indian Standard specifications. 4. Ultrasonic testing of welded joints for MS pipes 5. Checking the integrity of epoxy lining for MS pipes at joints after laying and jointing pipes.
9.	Penstock Gate	1. Visual and dimensional check. 2. Review of chemical and physical test certificates as per the relevant Indian Standard specifications. 3. Hydrostatic pressure test as per the relevant Indian Standard specifications. 4. Checking the integrity of epoxy lining
10.	Screening Equipment	1. Visual and dimensional checkup. 2. All the manufactures test certificates shall be submitted. If the Employer desires any test, contractor shall arrange to perform the same at no extra cost.
11	Aeration Equipment/Diffuser	1. Visual checkup. 2. Oxygen transfer capacity.
12	Thickening/ Dewatering Equipment	1. Visual and dimensional checkup. 2. All the manufactures test certificates shall be submitted. If the Employer desires any test, contractor shall arrange to perform the same at no extra cost.
13.	Sedimentation Units	1. Visual and dimensional checkup. 2. All the manufactures test certificates shall be submitted. If the Employer desires any test, contractor shall arrange to perform the same at no extra cost.
14.	EOT Crane	1. Visual and dimensional check. 2. Load test at 25% in excess of rated load. 3. Test for Deflection 4. Test for lifting speed.
15.	Actuators	1. Visual and dimensional check. 2. Speed for actuation 3. All the manufactures test certificates shall be submitted. If the Employer desires any test, contractor shall arrange to perform the same at no extra cost.
16.	Motors and	1. Visual and dimensional checkup.

Sl. No	Name of the Equipment	Stages of inspection
	Reduction Gears	2. Test for speed 3. All the manufactures test certificates shall be submitted. If the Employer desires any test, contractor shall arrange to perform the same at no extra cost.
17.	PLC, Automation, Field equipment	1. Visual and dimensional check-up. 2. Checking for suitability in terms of connecting, fitting, auxiliary voltage, necessary change over contracts. 3. Test certificate of all equipment and performance of equipment after connecting all controllers at local level and at remote level through controller. 4. Display in terms of appropriate units and satisfactory calibration. Any error shall be removed. 5. Coding and addresses of all inputs and outputs. 6. Graphical representation alarm generation.

In addition to these the contractor shall carry out test of the other equipment in the presence of the third party agency with Employer engineers and shall submit test certificates for approval.

1.3 Guarantee

i) The Contractor shall guarantee all plant and machinery and their equipments supplied under the Contract, including erection and commissioning works, to be suitable for the application for which it is designed, and against defects due to manufacture or poor workmanship for a period of 12 months from the date of satisfactory completion of the stipulated trial run period. The Contractor shall be responsible to replace, free of cost, the whole equipment or parts thereof which may be found defective during this period, and to ensure the proper working of the equipment during the guarantee period. In case the Contractor fails to repair or replace any defective Equipment & machinery and equipment or part(s) thereof within 30 days from the date of intimation of any defects by the Engineer In-charge , the same will be done by the Employer/Engineer In-charge at the Contractor's cost.

ii) If it becomes necessary for the Contractor to replace or renew any defective portion of the plant or equipment under this Sub-Clause, the plant and equipment, so replaced and the work so renewed shall be guaranteed for a further period of 6

months from the date of replacement or renewal. Only genuine spare parts are to be used under the supervision and with approval of Engineer-in-Charge.

1.4 Certificates and Drawings for Electrical Installations

The Contractor shall furnish all the necessary data, drawings, layouts and test certificates, etc., as may be required by the power distribution agency and the Electrical Inspectorate Authorities in respect of all electrical installations, and shall obtain any required approvals or clearances. Necessary assistance will be given by the Employer in this respect. It would be obligatory on the part of the Contractor to obtain such sanctions and approval of the electrical load from the concerned authorities

1.5 Suitability of Equipment for Indian Tropical Conditions

All plant and equipment supplied under the Contract shall be suitable for operation under the climatic and operating conditions prevailing at the Site. All parts, surfaces and sealants which are subject to corrosion shall be made of such materials, and shall be provided with such protective finishes, as are appropriate to protect the installed equipment from deterioration or injury due to the climatic conditions or operating environment. All electrical and auxiliary equipment shall be specially treated for Indian tropical conditions especially in city of Kota.

1.6 Display Panels

The Contractor shall provide such charts and drawings as are appropriate to clearly illustrate the process, operation and maintenance requirements of the plant and facilities provided under the Contract. Such charts and drawings shall be mounted on a panel, protected with a glass cover, and affixed on to the wall(s) of the plant/pump house/control room, as the case may be, and shall include, as appropriate, the following:

- General arrangement drawings.
- Wiring diagrams and detailed drawings of all electrical and mechanical installations.
- Assembly drawings for electrical and mechanical equipment.

- Charts indicating operations and maintenance details and schedules for electrical and mechanical equipment.
- Lists of commonly used spare parts and tools

1.7 Installation of Plants & Machineries

In case of all Electrical & Mechanical Equipment, plant & Machinery and fittings etc., the tendered rate shall include the costs of supplying, installation/erection, fixing in position, testing and commissioning etc. at the site of work. No extra charges shall be payable on this account by the Employer. 6 sets of completion drawings, complete set of equipment brochures, dimensional details, approved drawings, installation manuals, pre commissioning tests, commissioning tests required to be carried out, shall be kept & made available at site for inspection of the Employer's officers. These sets will be given to Engineer-in-charge before commencement of supple/erection of equipment.

SPECIAL TECHNICAL SPECIFICATION FOR ELECTRO – MECHANICAL WORK (SEWAGE TREATMENT PLANT)

1.8 General Requirements

1.8.1 Material

All materials incorporated in the Work shall be the most suitable for the service conditions and duty concerned. They shall be new and of reputed make / approved quality, free from imperfections and selected for long life and minimum maintenance. Non–destructive tests, if called for in the Specification, shall be carried out. All submerged moving parts of the Plant, or shafts and spindles or faces etc. in contact with them shall be of corrosion resistant materials. All parts in direct contact with various chemicals, shall be completely resistant to corrosion, or abrasion by these chemicals, and shall maintain their properties without aging due to the passages of time, exposure to light or any other cause. All materials shall conform to the material standards as per BIS or any equivalent standard.

1.8.2 Workmanship

Workmanship and general finish shall be of first class quality and in accordance with best workshop practice. All welds shall be as per IS, BS, ASME standards. All tolerances and clearances shall be as per good and sound engineering practices. Should the Employer's representative not consider any material acceptable, it shall be replaced.

1.8.3 Design Features

As far as practicable, all designs shall be as per latest concept and practices. The equipment shall be new, of robust design for a long reliable operating life. These shall be capable of 24 hours per day continuous operation for prolonged period in the climatic and working conditions prevailing at the site and with a minimum of maintenance. Particular attention shall be given to extra temperature and the rating of electrical and mechanical equipment, cooling systems and the choice of lubricants shall be for the temperatures as specified.

Paints used shall be the manufacturers' standard and shall be suitable for duty as described. The equipment shall be designed to provide easy access to and replacement of component parts which are subject to wear without the need to replace whole units. All parts in contact with water shall have a life from new to replacement for 5 years minimum and new to repair of not less than five years.

Design features shall include the protection of equipment against damage caused by vermin, dirt, dust and dampness and to reduce risk of fire. Equipment shall operate without undue vibration. Noise reduction measures shall be adopted such that levels of 75 dB (A) at 3 meters are not exceeded. Parts shall be designed to withstand the maximum stresses under the most severe conditions of normal service. Materials shall have a high resistance to change in their properties due to the passage of time, exposure to light, temperature and any other cause which may have a detrimental effect upon the performance or life of the Plant.

All rotating elements shall be dynamically and statically balanced.

All equipment shall have name plates specifying the makes, model, rating and other pertinent information.

1.8.4 Lubrication

The equipment shall be lubricated by long life lubricants such that working life is not less than 3000 operation hours or as recommended by equipment manufacturer.

A complete schedule of recommended oils and other lubricants shall be furnished by the Contractor. The number of different types of lubricants shall be kept to a minimum. The schedule and the name of the supplier of the lubricants shall be submitted to the Employer's representative for approval.

Lubricants shall be oil and grease. The Contractor shall indicate indigenously available equivalent lubricants, with complete specification.

Where the lubricant is grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Preferably, life lubricated grease packed bearings shall be used.

Where more than one special grease is required, a grease gun for each special type shall be supplied and permanently labelled.

1.8.5 Name Plates

Each equipment of the Plant shall have permanently attached to it a nameplate and rating plate in a conspicuous position, Upon these shall be engraved or stamped, the manufacturers name, type and serial number of the equipment, details of the loading and duty at which the equipment has been designed to operate, and such diagrams as may be required by the Employer's representative. All indicating and operating devices shall have securely attached to them or marked upon them designations as to their functions and proper manner of use.

1.8.6 Painting At Manufacturer's Works:

The Contractor shall be responsible for the cleaning, preparation for painting, and priming or otherwise protecting, as specified, all parts of the Plant/ Equipment at the place of manufacture prior to packing.

Parts may be cleaned but surface defects may not be filled in before testing at the

manufacturer's works. Parts subject to hydraulic test shall be tested before any surface treatment. After testing, all surfaces shall be thoroughly cleaned and dried out, if necessary by washing with an approved de-watering fluid prior to surface treatment. Except where the specification provides to the contrary, all painting materials shall be applied in strict accordance with the paint manufacturer's instructions.

Steel and cast iron parts shall be sand blasted to near white cleaning before painting. Edges, sharp corners etc. shall be ground to a curve before sand blasting. A primer coat of a zinc rich epoxy resin based coating with at least 75 microns dry film thickness is to be provided. In addition, the parts for wet duty are to be provided with an adequate number of coats of coal tar epoxy polyamine coating to a dry film thickness of 175 microns excluding primer coating.

At Site:

Immediately on arrival at the site, all items of Plant shall be examined for damage to the paint coat applied at the manufacturer's works. Any damaged portions shall be cleaned down to the bare metal, all rust removed, and the paint coat made good with similar paint.

After erection, such equipment/ items which are not finish painted shall be done so. Items that have been finish painted at the manufacturer's works shall be touched up for any damaged paint work. For finish painting, two coats of synthetic enamel conforming to IS: 2932 shall be applied. Dry film thickness of each coat shall be at least 25 microns.

The dry paint film thickness shall be measured by Elcometer or other instruments approved by the Employer's representative. In order to obtain the dry film thickness specified, the Contractor shall ensure that the coverage rate given by the paint manufacturer will enable this thickness to be obtained. Strength of adhesion shall be measured with an adhesion tester and this value shall not be less than 10 kg/cm2. Painted fabricated steel work which is to be stored prior to erection shall be kept clear of the ground and shall be laid out or stacked in an orderly manner

that will ensure that no water or dirt can accumulate on the surface. Suitable packing shall be laid between the stacked materials. Where cover is provided, it shall be ventilated.

Acceptable Makes: - Berger/ Shalimar/Asian/Woodlas/Neroalc

1.8.7 Galvanising

Wherever galvanizing has been specified the hot dip process shall be used And electro-galvanized parts, equipment shall not be permitted. The galvanized coating shall be of uniform thickness. Weight of zinc coatings for various applications shall not be less than those indicated below:

a) Fabricated steel : 460 gms/sq. m

b) Fasteners : 300 gms/ sq. m

Galvanising shall be carried out, after all drilling, punching, cutting, bending and welding operations have been carried out. Burrs shall be removed before galvanizing. Any site modification of galvanized parts should be covered well by zinc rich primer and aluminium paint.

1.8.8 Supports for Pipe Work & Valves

All necessary supports, saddles, slings, fixing bolts & foundation bolts shall be provided to support the pipe work. Valve and other equipment mounted in the pipe work shall be supported independently of the pipes to which they connect.

All valves to be installed in straight lines shall be installed between the flanges with a dismantling joint or SS expansion bellow at one side of the valve. The dismantling joint must allow a minimum clearance of 20 mm. The pressure rating of the dismantling joint / expansion below shall be same as that of the valve.

1.8.9.1 Mechanical & Manual Coarse Screens

1. Purpose & Scope:

a. Mechanized screens (multi rake type) should be suitable for installation in Sewage pumping stations for removal of floating wastes coming along with

sewage. These screens should be capable to screen out most of the medium and large floating material such as plastic bags, floating debris, weeds, paper wastes, clothes and rags etc. which are generally clogging the impellers of the pumps installed downstream of the screens.

b. The operation of the screen shall be automatic. An ultrasonic type differential level controller shall be provided to sense the head loss through the bar and give the signal to the traveling raking mechanism to start its operation. The sensor will signal the raking mechanism to operate continuously till the head loss is reduced to a preset level.

c. A complete electrical control system shall be supplied with each screen and shall be mounted independently near to the screen installation. The system shall provide for total automatic operation of the screen with the feedback from the level controller.

2. General Material And Equipment Requirements:

a. Fabrication and design features:

(i) Use power grinder to dull and produce smooth edges.

(ii) Use bolted field connections. Field welding will not be allowed.

(iii) Design all components for continuous 24 hours per day service.

b. The screen shall be so constructed so as to mechanically remove the waste from the bottom most portion of the bar portion using a traveling type raking mechanism without shutting the water flow through the screen. The raking mechanism shall then travel up to the top of operating platform and automatically discharge the waste through a discharge chute.

c. The screen shall have protection against overload conditions, which might damage the equipment.

d. All screens shall be constructed and shipped as an integrated product comprising of frame structure and guides, rake and rake arm mechanism, dead

plates, cog wheels, sprockets and chains, discharge chute, drive unit and cover apron.

e. The screen shall be supplied factory assembled and duly tested at manufacturer's works before dispatch. This integrated and factory assembled screen shall involve minimum dismantling and assembly at site for erection.

f. Upon receipt at site these shall be installed resting on the channel floor and mechanically or chemically anchored to the parallel sidewalls of the channel (without making grooves in concrete or breaking open the concrete side walls and thereby weakening the civil structure) in a way that there are minimum chances of misalignment.

g. All parts shall be designed to withstand the stresses that will be imposed upon them during handling, shipping, erection and operation.

h. All stainless steel fabricated materials will be pickled and passivated before dispatch to remove ferrous contamination, if any.

3. Specifications:

- **Material of construction:**

All parts of screen including fixed bars, raking mechanism, screen frame and guide rails, dead plate and discharge chute shall be constructed from stainless steel material SS304 for long life in aggressive sewage environment. Suitable measures should be taken to ensure long life of parts like bearing, chains, sprocket and cogwheels etc, which are not made from stainless steel material.

- **Drawings & Documents:**

Drawings for the following shall be submitted for approval before taking up manufacturing of Screens:

General Arrangement drawing of screens.

Bill of Materials (BoM) & Wiring diagram of control panels.

Quality Assurance Plan.

All drawings shall be submitted in 3 copies of which one will be returned duly commented /approved.

Approval of manufacturer's drawings shall not relieve the manufacturer of his responsibility for supplying equipment confirming to the Technical Specification laid herein for any mistakes, errors or omissions in his drawings.

- **Screen Construction:**

- The bars shall be designed to have a tear drop profile so that they are wider on the upstream side and narrower on the downstream side. This is required to ensure that choking of bars due to stones and other hard material does not take place. The tear drop profile shall be 12 mm wide in the front and 10mm wide at the back and the depth of bars should be at least 60 mm.

- The bar rack shall be firmly anchored to the channel floor and supported by a dead plate at the top.

- The face of bars towards the incoming water should be half round (dia 12 mm) to ensure minimum resistance to the flow and avoid turbulence and also to offer guide and support to the rake (single/ multi rake) during its travel.

- The rake shall be made of Ultra High Molecular Weight Poly Ethylene (UHMWPE) so as to avoid the Galling between rake and bars. Further to this the rake should be provided with rounded off cavity to match the bars with a view to avoid sharp corner contact between the rake and bars thereby minimizing wear and tear.

- The rake arm shall ride on a cogwheel / roller in a single guide channel (min. thickness 5 mm in stainless steel) on each side of the rake and will be lifted away from the dead plate on the downward travel direction. Upon reaching the bottom of its travel the rake would be rotated/ swung into the bar screen to remove the collected debris.

- To effectively remove the debris from the bottom most part of the bar screen, the rake should engage with the bars from the start of its inwards rotating motion. To achieve this, he fixed bars should be curved at the bottom and

taken forward so as to enable the rake to engage from the start of its inwards rotating motion.

- The rake arrangement shall be spring loaded to ensure that the rake is always pushed on to the dead plate.

- The dead plate shall be minimum 3 mm thick in stainless steel shall be suitably braced to ensure rigidity and prevent caving / bending due to increased water flow in monsoon.

- The sprocket for screen chains shall have chilled tooth bearing surfaces and the chain and sprocket shall be of the same material.

- The cogwheel and chains should be so located that these generally remain out of the flow of water during normal plant operation. An exception to this would be allowed only in case when water depth is greater than 2 m.

- The screen should have integrated scraper for discharging the screenings to discharge

Chute. The scraper / wiper shall be cushioned during travel to the rest position by a shock absorber.

- The rake mechanism should be operated by an Electro brake motor and be suitable for automatic operation controlled by a level sensor and electric control cabinet. Torque switch should be provided to protect the screen from damages resulting from excessive torque.

- The screen shall be provided with non-corrosive apron and enclosure at the top above the Platform.

- After fabrication and assembly the stainless steel parts and all welded joints are to be further cleaned by acid pickling and after that they should be passivated to remove any ferrous contamination that might have taken place during manufacturing / handling / movement of raw and fabricated material.

- **Level controller**

The level controller shall be of ultrasonic differential type / level switch.

- **Electrical motor**

The motor shall be of TEFC type with IP 55 protection and suitable for operation on 415V±

10% and frequency of 50 Hz ± 5%.

- **Control Panel**

The control panel shall have IP 65 protection, painted with epoxy paint and shall be comprising of

- Mushroom head emergency stop.
- Overload relays for motor protection.
- Circuitry to operate the screen with ultrasonic level sensor.
- Selector switch to operate the screen in Auto, off and JOG mode.
- Provision to run the screen on timer in case of failure of level sensor.

- **Shop Testing**

The screen should be completely manufactured and offered for inspection at the plant of the manufacture confirming the above mentioned eligibility criteria. A screen assembled by a vendor and offered for inspection at the plant of a vendor / sub-contractor shall not be accepted. The screen shall be subjected to following tests at manufacturer's premises by third party inspection and / or Municipal Corporation representative(s):

- **Dimensional Check:** The overall dimension of the screen shall be conforming to the approved drawings.

- **Operational Test:** The complete screen including its carriage, rake, drive system and brake motor shall be mechanically operated and tested to verify interference free movement and satisfactory operation.

5.0 Miscellaneous:

Any type of work, either supply and or erection of material / equipment which have not been specifically mentioned in this specification, but are necessary to

complete the works for trouble free and efficient operation and guaranteed performance of the entire plant system and equipment offered shall be deemed as included within the scope of this specification and shall be provided by tenderer without any extra price to purchaser.

The installation and commissioning of screens has to be done in the presence of manufacturer's representative(s) so as to avoid any possibility of misalignment and faulty installation. Minimum two (2) working days of training has to be imparted to the concerned Municipal Corporation people by the manufacturer's representative(s). Packing of screens and allied accessories shall be transit worthy to avoid any possibility of damage during the transportation to the site(s).

Manual Bar screen

The manual bar screen will be of opening not more than 20 mm for coarse screen and 10 mm for Fine screen and inclination about 55^0 with respect to horizontal. Specifications for Manually raked screen shall be as under.

The trash screen shall be rectangular in shape. The screen shall be fabricated out of stainless steel SS 304 of not less than 10mm thick and 50 mm wide in section. The screen shall be rigidly fixed to the frame and provided with 2 sets of cleaning rakes.

1.8.9.1.1 Mechanical fine Screens

1. General :

- Mechanically operated step Screen completely made of Stainless Steel having 6 mm clear spacing between the bars shall be provided in inlet screen channel for screening out floating materials such as plastic pouches, bags, rags, floating debris, weeds, paper wastes and other floating materials from the raw sewage coming from the pumping station / gravity mains.

- The screen shall include discharge chute as required to discharge the screenings on the bin without employing any external mechanism / rake mechanism.

- The screen shall be factory assembled & movement tested at plant before dispatch to site & shall only be installed at the site in factory assembled condition thereby avoiding chances of misalignments.

2. Scope :

Design, Supply, Installation, Testing & Commissioning of screening equipment consisting of following:

(a) Mechanized step screen having 6mm spacing between bars and suitable for installation at an inclination of 40 degrees in channel.

(b) Level sensing instrument connected to control panel for automatic operation of screen mechanism and allied accessories.

(c) Local control panel installed near screen.

(d) To discharge the screened material of the screen to the waste bin.

3. Specification

- **Material of construction**:

The fixed as well as movable bars, mechanism, support frame, fixings discharge chute shall be manufactured from stainless steel for long life in the aggressive sewage environment. No component of the screen assembly shall be made of carbon steel or any other material, which can get corroded in sewage environment.

- **Screen Construction**

- The step screen shall be a complete unit comprising of main frame with an integral mechanism containing movable bars located in between fixed bars without engagement of external mechanism / rake mechanism for pulling out the screened material ensuring minimum movement of the mechanism.

- The mechanism comprising of movable bars located between fixed bars shall gradually move the screened material upward in the form of a mat and deliver on the up to the discharge chute.

- The fixed as well as movable bars shall contain a series of steps to prevent the screenings from falling back into the main flow.

- The mechanism shall be mechanically operated by Electro-motor or hydraulic system and shall be suitable for automatic operation controlled by a level sensor.

- The screen shall operate automatically when the upstream water level of the screen increases beyond a pre-set limit and it shall stop when the upstream level decreases to a preset low level due to upward travel of screened material.

- The fine bar screen shall be capable of being tilted out of the sewage flow up to horizontal position for the purpose of cleaning & maintenance.

- The base of the screen shall be fitted with a specially profiled stainless steel plate to direct any grit that may be present towards the screen and taken out along with other screened material thus reducing the possibility of building up of grit in front of the screen.

- **Level Controller**

The level controller shall be differential type Ultrasonic level transmitter / level switch.

- **Electrical Motor**

The motor shall be TEFC type with IP 55 protection and shall be suitable for operation on 415V $\pm$ 10% and frequency of 50Hz $\pm$ 5%.

- **Control Panel**

The Control Panel shall have IP 55 protection, painted with Epoxy paint and shall be comprising of

- Mushroom Head Emergency stop
- Overload relays for motor protection
- MCB's, HRC Fuses and Glass Fuses

- Circuitry to operate the screen with level sensors.
- Selector Switch to operate the screen on JOG mode

1. Shop Testing

The screen should be completely manufactured and offered for inspection at the plant of the manufacture confirming the above mentioned eligibility criteria. A screen assembled by a vendor and offered for inspection at the plant of a vendor / sub-contractor shall not be accepted. The screen shall be subjected to following tests at manufacturer's premises by third party inspection and / or NDA representative(s):

- **Dimensional Check:** The overall dimension of the screen shall be conforming to the approved drawings.

- **Operational Test:** The complete screen including its carriage, rake, drive system and brake motor shall be mechanically operated and tested to verify interference free movement and satisfactory operation.

1.8.10 Mechanical grit separator

The grit separator shall be square in size and twin unit construction. A Central drive mechanism of worm reduction type driven through helical gear and motor or by geared motor shall be mounted on the RCC platform spanning the tank. All exposed steel parts shall be sand blasted and painted with epoxy. All wetted parts shall be in stain steel 304. The drive shall be provided with electro-mechanical device, torque indicating arrangement and mechanical trip contacts with electrical overload relays. Flow regulating vanes shall be provided at the inlet side of the collection chamber and shall be of FRP. The vanes shall be adjusted as per the flow requirement. The weirs at the outlet of grit chamber shall be SS 304 with minimum 3-mm thickness or FRP with minimum thickness of 6 mm. The spacing of anchor bolts of SS 304 for the fixing of the weir shall not be more than 450 mm.

The classifier mechanism shall comprise of a screw driven by a suitable motor. The material of construction of the mechanism shall be SS 304 of suitable dia. The length of screw shall be such that the grit can be elevated up to the discharge end.

SS puddle pipe shall be provided in the concrete trough at the discharge point of wet grit. An organic return pump with wetted parts in SS304 shall be provided.

1.8.11 Air blowers for Oxygenation

The blowers shall be provided for providing adequate oxygen into the reactor tank for aeration. The air requirements shall be calculated for summer and winter as well as for mixing power the higher duty shall be installed. The summer sewage temperature shall be taken as 35 degrees C and that in winter at 10 degrees C.

The blowers shall be capable of developing the required total pressure at the rated capacity for continuous operation. The blowers shall be Tri lobe or Twin lobe type. The blowers shall be provided with suction air filter, reactive silencer, dead weight pressure relief valve and pressure gauge and the air delivered shall be clean, dry and oil free. The blower noise level and velocity of vibration shall be within 85 dB (A) at a distance of 2 m respectively. Blower shall be provided with soundproof canopy as per standards. The blower must be V-belt driven by squirrel cage induction motor.

The speed of the blowers shall be below 1,500 rpm. The power rating of motor shall be at least 10% above the maximum power requirement by the blower. The kW of single blower shall not exceed 250 kW. The blowers shall be mounted at a level necessary to avoid back flow or siphoning of sewage into the blower.

Material of construction:

Casing : C I conforming to IS: 210 Gr FG 260

Rotor : Alloy steel

Shaft : Carbon steel C40/EN 24/19

Timing gear : Cast alloy steel

Pulley and gear side plates and cover: CI conforming to IS 210 Gr FG 260

Sr. No.	Tests	Specs
1	Hydrostatic tests	Twice the maximum working

		pressure
2	Performance test	As per BS : 1571
3	Strip test	Clearances with tolerance limit
4	Mechanical balancing	ISO 1940 Gr. 6.3 or better
5	Visual Inspection	Before painting

- **Tests**

1.8.12 Diffused Aeration System

This comprises piping to diffusers and the diffusers.

- **Type of diffuser system**

A fine bubble diffused aeration system shall be applied to aeration tank for oxygenation. The number of diffuser elements can be varied by the bidder depending on the manufacturer selected, subject to the condition that sufficient design calculations are attached along with it and the manufacturer is a standard one having supplied the diffusers to various waste water treatment plants of similar nature.

- **Diffuser Elements**

The diffuser elements shall be of PU tubular membrane type and resistant to such ingredients as hydrocarbons, oil and grease. This shall afford a high oxygen transfer rate coupled with a minimal pressure drop besides permitting simple erection onto the horizontal air manifold. They shall have self-cleaning properties while in action. The diffuser unit shall be of corrosion resistant material. The membrane diffusers shall permit connection to the air manifolds of circular or square cross section and the entire lot of diffusers shall be capable of discharging designed flow of air at an average flow (maximum of summer and winter requirement) when installed in the said SBR tanks.

The diffuser grid shall be of fixed type. The headers onto which the diffusers are fixed shall be of standard Imported PVC/UPVC pipe sections of suitable inner bore and shape with custom fixtures of the diffuser elements as directed by the membrane manufacturers. Alternative pipe materials shall be acceptable provided the same are a mandatory part of the diffuser supplier and

have been in the supplier's line of supply as original equipment. The headers shall also be procured from the equipment manufacturers who are the suppliers of the membrane diffusers. These headers shall have enough counterweight or alternative arrangement to surmount any buoyancy lift from the floor during air charging.

- **Air Supply Piping**

The air piping from the blower to the basin header (above water) shall be of MS epoxy painted material and pressure rated for the sewage depth plus frictional losses etc. Each air header shall travel downward from the air piping by aligning itself onto the sidewall of the aeration tank and thereafter travel horizontally onto the tank floor. These shall be fixed securely to the concrete surfaces in the horizontal plane and vertical plane so that they are not clamped horizontally onto vertical sides of the walls. The clamping shall be so designed as to permit "in-situ" screw driven fittings. Breaking open concrete surfaces shall not be permitted.

1.8.13 Specifications for Epoxy Painting

Zinc rich epoxy primer and epoxy paint of approved quality shall be used for external and internal painting. No primer shall be applied without prior approval from the Employer's Representative. The max of zinc rich epoxy primer shall be prepared at work site not earlier then 15 minutes before applying the same on pipes and special surfaces. One coat of zinc rich epoxy primer of DFT 75 micron shall be applied along with two coats of epoxy paint DFT 40 micron and DFT 30 micron respectively. No thinner shall be added to ready mix paint without previous approval of the Employers' representative and the finishing coats on top of the primer coat shall only be applied after allowing the film to cure for at-least 48hrs.

After application of zinc rich epoxy primer the surface should be cleaned by duster and inspected. If during inspection any portion is found rusting the same shall be removed by emery paper and coated with zinc rich epoxy primer.

Mixed paint should be used within 3 to 4 hrs. Of mixing and fresh mixing shall be done for every new application. Every successive coat of paint shall be given only

after 48 hrs. Of previous coat. Before applying the next coat the surface should be properly cleaned by duster.

1.8.14 Specifications for Decanting Drive

The decanting device shall be rotating moving arm devices of Stainless Steel with top mounted gear box, drive, scum guard, down comers, collection pipe, bearings. The maximum design travel rate shall be 60 mm/min. with proven hydraulic discharge capacity of the decanter proportional to the selected basin area.

- There should be Maximum 1 decanter per basin.
- The hydraulic design based on design flow rates as given above shall not exceed flow speeds of 1.3 m/s.
- Flexible rubber hose kind of decanter sealing is not acceptable.
- One or more decanters shall be provided in each basin which functions under a controlled lowering rate to withdraw treated water out of SBR / Cyclic Activated Sludge Process Basins.
- The decanting mechanism shall be designed for a variable speed mode of operation. Decanter shall be capable to travel at varying speeds. The rate of travel of the decanter shall be adjustable during its travel in air and into the liquid surface, at which point the rate of travel of the decanter shall be automatically adjusted to a calculated rate of operation. The maximum design travel rate shall be restricted to 60 mm/min. Rope driven or fixed subsurface arrangements will not be acceptable.
- The rate of operation shall be calculated for each cycle and shall be determined by the volume of treated effluent to be discharged per cycle. The calculation of decanter travel shall ensure that the volume of treated effluent shall be discharged throughout the designated decant phase of the process cycle. The travel of the decanter shall be limited and controlled by limit switches which shall communicate with the PLC. Upon reaching the designated BWL, the decanter shall return to its parked position.

- During non-decanting cycles, the decanter collection weir shall be parked above the top water level of the basin during aeration and settling phases, thereby eliminating any possibility of solids carryover during these phases. Therefore weirs or entry ports of the Decanters shall not be submerged below the top water level of the basin during non-decant phase. Each decanter shall be fitted with a scum retention mechanism to prevent surface scums and floatables from exiting with the treated effluent.

- In addition, at park position, the decanter shall also provide fail safe overflow protection in the event of a power failure by allowing clear supernatant to flow via gravity, under the scum guard, over the weir, and into the decanters and out of the basins.

- If more than one decanter is provided per basin, operation of all decanters shall be synchronized precisely using synchronization panel to achieve even distribution of flow through each decanter.

- Weir loading for each decanter shall not exceed 140 m3/hr/m of the inlet weir. During Decanting Phase, decanter weir shall always be visible from the basin walkway to provide the operator with a visual check of the effluent quality. Maximum velocity down comer shall not exceed 1.0m/sec. at the designed decant flow.

- All components of the decanter except seals and bearings shall be constructed of stainless steel 304. The decanter seals and bearings shall be constructed of maintenance free, synthetic materials for longest possible service life. All seals and bearings shall be shipped factory assembled, simplifying installation. All fasteners shall be constructed of 304 stainless. Site fabrication of decanters shall not be allowed.

- Drive mechanism or actuator shall be equipped with variable frequency drive connected to PLC to facilitate its operation at varying flow rates to ensure controlled and seamless operation at varying flow rates. Complete Drive Mechanism shall be mounted on the walkway to provide easy access for maintenance and

service purposes.

- All critical decanter components that may require routine inspection or maintenance shall be easily accessible from an access platform at basin coping level without taking a basin out of service or draining or partially draining the basin. It shall be possible to carry out decanter maintenance activities without interrupting normal operation of the basin while the decanter is at its parked position during non-decant phases of the process cycle.

- The SBR blowers, Automatic Air supply Valves, RAS Pumps/Mixers, switching mechanism shall be interlocked with the decanter controls so that aeration/mixing is prevented in a basin which is settling or decanting.

1.8.15 Submersible Pumps for Return and Excess sludge

Raw sewage pumps shall pump sewage from wet well at sewage pumping station to inlet chamber of STP. Return sludge pumps shall pump the return sludge from the sump to the aeration tank. Pumps shall be submersible type of non –clog design. They shall be suitable for pumping soft solids normally present in raw sewage. Raw sewage pumps with maximum 960 rpm shall be provided. In addition to this, the pumps shall be fitted with a special tearing system on the suction side for tearing soft solid material. The impeller shall be of a non-clog design with smooth passage and desired solid handling capability. Maintenance-free anti- friction bearing, deep grooved permanently greased filled ball bearings shall be provided to take care of all the axial and radial forces at any point of operation. The pump installation design shall be such as to facilitate automatic installation and removal of the pumps without having to enter into the sewage pit. The motor shall be squirrel cage type, suitable for three phase supply continuous duty with class ‘F’ insulation. Motor shall have integral cable parts and the cable entries shall be sealed. The cables must be leak tight with respect to liquids and firmly attached to the terminal block. The motor shall be designed for non-overloading characteristics. There shall be thermal protection against overheating of the motor winding. The pump design shall ensure that seal does not come directly in contact with the liquid being pumped as well as cooling / lubrication by oil is provided. The

moisture sensor of the tripping unit shall be located inside the oil chamber.

The pump unit shall be supplied along with the special duck foot bend, flanged elbow, lifting chain with shackles, enough guide wire / pipe, sufficient tough rubber sheeted water proof cable, as well as stainless steel foundation bolts and nuts. Alternatively pump unit can be with SS wire rope guiding system and pedestal cart integrated with the discharge head.

- **Reverse Rotation**

The pump shall be designed to operate safely in the reverse direction of rotation, due to wastewater returning through the pump.

- **Pump Construction**

Refer Section – 2.0 Scope of Work of the tender.

- **Pump Bearings**

Pump bearings shall be of the antifriction type. The bearings shall be able to take normal axial thrust loads due to unbalanced hydraulic loads on the impellers plus the weight of all rotating parts of the pumps. Pump bearings shall be designed with a minimum life of 40,000 hours. The bearings shall be grease lubricated for life and shall be maintenance free

- **Mechanical Seals:**

A double mechanical seal of approved type shall be provided to prevent pumped liquid entering into the motor winding. The seals shall be running in oil bath. The oil bath shall have moisture sensors to sense water leakage. The sensors shall be used for tripping the pump and also for alarm.

- **Pump Balance:**

All rotating parts shall be accurately machined and shall be in rotational balance. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case the amplitude of vibration as

measured at any point on the pumping unit shall not exceed the limits set forth in the latest edition of Indian Standards. At the operating speed, the ratio of relative speed to the critical speed of the unit or its components shall be less than 0.8 or more than 1.3.

- **Lifting chain**

Each pump shall be provided with galvanized steel lifting chain of suitable capacity. One end of the chain shall be attached to the pump and the other end fixed near the upper bracket for guide rail / wire rope assembly, by means of GI D shackle. The chain shall have GI rings fixed at an interval of about 1 meter for engaging the hook of the chain pulley block.

- **Submersible Cable**

Each pump shall be provided with submersible cables of equal length for power and control so that the pump positions can be interchanged with each other. The cable shall be terminated in a common weatherproof junction box.

- **Moisture Sensor**

The moisture sensor shall be provided in the oil chamber to detect the failure of the mechanical seal.

- **Motor**

The motor shall be integral part of the pump. The enclosure for motor shall be IP-68. Each phase of the motors shall be provided with thermostat. The motor winding shall be suitable for star delta/soft starter. The motor shall be designed for minimum 10 starts/stops per hour, irrespective of whether it is DOL start or otherwise. For other requirements refer subsection VI. The motor shall operate satisfactorily at all operating levels in wet well.

- **Protective Coating:**

The pumps shall be epoxy painted.

1.8.16 Other Sludge Pumps

These pumps shall be of screw type used for pumping sludge to centrifuge. The pumps shall be designed to operate satisfactorily without detrimental surges, vibration, noise, or dynamic imbalance. Over the required head range, the head-capacity curve of the pump shall have a continuously rising head characteristic with decreasing capacity over the whole range of total head. The pump shall have the maximum efficiency at the specified duty point. The unit shall be designed to operate safely at the maximum speed attainable in the reverse direction of rotation due to sewage returning thro the pump at times when power supply of the motor is interrupted.

All rotating parts shall be statically and dynamically balanced as per ISO standards.

A stationary coupling guard shall be provided for the coupling conforming to all relevant safety codes and regulations. Guards shall be designed for easy installation and removal. They shall be complete with necessary support accessories and fastener.

The pumping unit shall be provided with a common base plate. The base plate shall be of sufficient size and rigidity to maintain the pump and motor in proper alignment and position.

The pump design shall be as per IS 6595 and pump performance shall be as per IS 9137. The power rating of the pump motor shall be the larger of following

(i) 115 % of power required by the pump at the duty point

(ii) 110 % of maximum power required by the pump from zero discharge to the runoff point total head.

- **Material of Construction & Specifications**

Type Screw

MOC Alloy Steel

Base plate CI / MS Epoxy painted

Fastener SS AISI 304

Pump speed	960 rpm (maximum)
Ball passing size	25 mm minimum

Applicable code

Design	IS 6595
Performance	IS 9137

- **Testing**

Material test certificate	Casing, Impeller, Shaft
Hydrostatic test	1.5 times shutoff head or twice the rated discharge head whichever is greater
Performance test	IS 5120 and IS 9137 at full speed
Mechanical balancing	As per ISO 1940, Gr. 6.3 or better
Visual inspection	Pump shall be offered for visual inspection before shipment. The pump components shall not be painted before inspection
Field Tests	Field performance tests required for satisfactory operation

1.8.17 Dosing Tank Agitators

The equipment shall include drive motor, coupling, turbine impeller assembly, intermediate bearings, basket, walkway with handrails and such other fittings, devices or appurtenances necessary for a complete operating installation.

- **Mounting Arrangement**

The civil tank for the sludge storage will be provided with a minimum freeboard of 300 mm. The agitator drive unit shall be mounted on RCC platform spanning the tank. These shall be mounted above the freeboard elevation over a RCC bridge walkway with necessary cut out for agitator shaft. The walkway will be provided with hand railing in SS 304 and steel ladder with handrails. A portal shall

be provided permanently in the platform required for the maintenance work of the agitator components.

- **Drive Motor**

The drive motor shall not exceed an rpm of 1500 and shall be directly coupled with the gear reducer. It shall be wired for 415 volts, 50 cycles, and three-phase service. It shall be totally enclosed, fan cooled, and rated for severe chemical duty with a minimum service factor of 1: 1.15.

- **Rotary Speed**

The rotary speed of the impeller shall not exceed 100 rpm so that the solids are not sheared.

- **Direct Coupling & Torque**

The drive motor output shaft and the impeller rotary shaft shall be connected by a direct coupling using such couplings as “Lovejoy” type to avoid cumbersome erections and de-erections. The coupling shall be able to withstand continuous duty with occasional upward thrusts. The drive assembly for each agitator shall consist of a suitable drive motor, directly coupled to a helical gearbox. The gear reducer shall be of heavy duty, high efficiency type with a rugged housing and shall have a minimum service factor of 2.0 and suitable for 24 hours continuous service. The gear reducer shall have oil bath lubrication and dry well construction on the vertical out put shaft to prevent leakage of lubricant. The casing of the gear reducer shall be of CI and the gears shall be hardened and ground for precision.

- **Impeller Elements**

The circulating element of the each agitator will consist of a single, axial flow design, 4 inclined impeller having SS304 blades

- **Fasteners & Anchor bolts**

All fasteners and anchor bolts shall be of such metallurgy that shall be compatible with the duty conditions shall be used.

1.8.18 Dosing Pumps

The dosing solution from the preparation tanks shall be pumped by the use of dosing pumps. The pipe and the pipe fittings shall be HDPE and valves shall be Polypropylene.

These pumps shall be capable of pumping the up to 0.5 % Polyelectrolyte solution. Dosing pumps shall be of the diaphragm type hydraulically operated. These shall permit flow control at both sides of the chosen median duty point for the duty already stated herein. The construction shall be totally enclosed and corrosion proof. The liquid end shall be in SS 304.

1.8.19 Centrifuge

The centrifuge shall be solid bowl centrifuge of co-current/counter current design, as decided by the bidder. The centrifuge shall have sufficient clarifying length so that separation of solids is effective. The centrifuge and its accessories shall be mounted on a common base frame so that entire assembly can be installed on an elevated structure.

Suitable drive with V- belt arrangement and turbo-coupling shall be provided along with overload protection device. Centrifuge shall be with SS304 wetted parts.

Differential speed and bowl speed should be adjusted by changing the pulleys; differential speed may be adjustable by use of epicyclical-gear. The bowl shall be protected with flexible connections so that vibrations are not transmitted to other equipment. The base frame shall be in epoxy painted steel construction and provided with anti-vibration pads. All steps necessary to prevent transmission of structure borne noise shall be taken. The drive motor shall be of 1450 rpm. The noise level shall be 85 dB (A) measured at 2 m distance under dry run. The vibration level shall be below 50 micron measured at pillow blocks under dry run condition. Adequate sound proof shall be carried out for the housing the centrifuges to ensure that the noise level at 5 m distance from the enclosure is less than 75 dB (A).

Centrifuge shall be capable of handling sludge consisting of minimum 0.8% solids by weight. The dewatered cake shall be based on minimum consistency of 20% by weight dry solids.

1.8.20 Disinfection System

Shall include:

1.8.20.1 Chlorination System

- **Chlorinators**

(a) Vacuum type chlorinators shall be supplied with one duty and one stand by unit.

(b) Chlorinators shall be free-standing, floor-mounted, and shall have a turn down ratio of 10:1 over the full range of works operation.

(c) The dosing rate shall be manually set and each chlorinator shall be equipped with a 0 to 10mg/l scale and a manual dose setter over the complete range.

(d) Mal-operation of the duty chlorination system shall be indicated in the chlorination room and the central MMI. The change to the standby system shall be carried out automatically in the event of duty chlorinator failure.

- **Dosing Pumps**

a) Dosing pumps (1 working + 1 standby) shall be installed.

b) The dosing pumps shall draw their supply from treated sewage line.

c) The pumps shall be placed inside the chlorination room and shall be made from material resistant to corrosion by chlorine.

- **Injectors**

Two injectors shall be provided, each serving a duty /standby pair of chlorinators. The injectors shall be located in the chlorination room.

- **Chlorine**

Chlorine shall be supplied as liquid from nominal 1 tonne chlorine toner.

1.8.20.2 The Toner Room

(a) Storage shall be provided for chlorine tonners, sufficient for at least 15 day's usage at normal rate of withdrawal.

(b) The system shall be designed to prevent freezing of the liquid chlorine at the maximum rate of withdrawal.

(c) Tonners on line, tonners on standby and full and empty tonners shall be stored separately in the tonner room. Three sets of tonner rollers shall be provided. Tonners not in use shall be stored on concrete cradles.

(d) The container lifting beam shall be specifically designed for handling chlorine containers and equipped with necessary shackles and hooks.

(e) Operation of crane system shall be from the floor level using independent push button pendent controls operating at a 230 volt 50Hz AC supply.

(f) Two lifting beams shall be provided (a duty and a spare) and a one tonner weighed to be suspended from the crane hoist.

(g) When the pressure in the duty chlorine tonner falls to less than 1.00 Kg/cm^2, the automatic change over device shall operate to isolate the empty tonner and to bring the full standby tonner on line.

(h) A chlorine leak absorption system shall be provided to contain and neutralize chlorine in the event of leak. The system shall comprise FRP Half Hoods, NaOH Storage Tank, NaOH Re-circulation Pump, Centrifugal Pumps and interconnecting ducting/piping.

(i) Special consideration shall be given to any floor drainage system in the tonner building; adequate shall be provided to ensure that chlorine gas cannot escape. All leader tubes carrying cables or pipes out of the building shall be sealed at either end to prevent any chlorine gas leaking out.

1.8.20.3 Chlorination Room

(a) The chlorination room shall be constructed adjacent to the tonner room but with no interconnecting door or other form of access.

(b) Gas lines from the tonner room into the chlorination room shall run in ducts to be sealed after installation and prior to commissioning.

1.8.20.4 Chlorine Leak Detectors

Chlorine gas leak detectors shall be provided each, with a single detector cell. At least two sensors shall be located in the chlorine tonner storage room and at least one sensor in the chlorination room.

The chlorine leak detectors in the tonner room shall be mounted at each end of the tonner room.

The chlorine leak detectors shall initiate a local audible and visual alarm. Statutory warning notices relating to the storage and handling of chlorine shall be provided. The signs shall be pictorial and provided in Hindi and English.

1.8.20.5 Ventilation System

a) Each area where chlorine is stored or used as gas or liquid shall be provided with a forced ventilation system.

b) Air intakes shall be sized to allow uniform ventilation and positioned to prevent possible recirculation.

c) An air change rate of four per hour under normal condition and a minimum of twenty changes of air per hour under shall be used in the event that a chlorine leak is detected.

d) Exhaust fans shall be heavy duty industrial pattern manufactured from chlorine resistant materials.

1.8.20.6 Safety Equipment

(a) Materials and equipment necessary to ensure the safety of personnel operating the chlorination plant and others shall be provided.

(b) The equipment shall include:

(i) two sets of approved self-contained breathing apparatus, each comprising an air set, carrying harness, face mask and valves and ancillary equipment . Each set shall be provided with three 1200 liter capacity, 140mm diameter, air tonners.

(ii) Two 'instant action' resuscitators;

(v) Four sets of safety clothing in various sizes, each comprising PVC overalls, Wellington boots with steel toe caps, goggles, gloves and safety helmets.

(c) Each set of safety equipment shall be mounted in a glass-fronted, non-locking PVC coated steel cabinet in approved locations on the outside of the building.

(d) Two emergency showers shall be provided and shall be installed outside on either side of the tonner room.

(e) Each shower shall be operated automatically by a quick acting hand or foot valve.

(f) Four eyebaths shall be supplied. Two eyebaths shall be adjacent to each of the showers.

(g) Water for showers, etc. shall be drawn from the service water supply.

(h) A telephone will be provided close by outside the building for emergencies.

1.8.21 Valves

1.8.21.1 General

Valves shall be as per internationally recognized standards. Flanges shall be machined on faces and edges to ISO 7005, IS 6392. Valves shall be flanged type. For sluice / gate calves, back seat arrangement shall be provided. Valves buried or installed in underground chambers, where access to a hand wheel would be impracticable, shall be operated by means of an extension spindle and / or keys. Valves shall be suitable for frequent operation as well as operation after long periods of idleness in either the open or closed position. The valve stem, thrust washers, screws, nuts and all other components exposed to the water shall be of a

corrosion resistant grade of stainless steel. All valves parts shall be in general of the material of construction best suited for the proposed application. The inspection category is detailed in subsection VII.

1.8.21.2 Sluice Valves

The gate face rings shall be securely pegged over their full circumference. Valves of 450 mm and above shall be provided with a thrust bearing arrangement for ease of operation. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5mm. Alternatively, valve of diameter 450mm and above may be provided with a gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and gearing shall be such as to permit manual operation in a reasonable time and not to exceed a required rim pull of 80 N. All hand wheels shall be arranged to turn in a clockwise direction for opening and counter clockwise for closing. These directions shall be indicated on the hand wheels. All valves shall be rated for not less than PN 1.0.

All valve doors when fully closed will ensure door faces are riding on body seat ring by at least 50% of width of seat ring providing sufficient allowance for wear. Valves of diameter 450 mm and above shall be provided with a drain and air plug.

Material of Construction

Body, Bonnet, Wedge	CI conforming to IS 210 Gr FG 260 Spindle
Drain and Air Plug	IS 318 Gr LTBZ
Seat Ring, Wedge Ring	SS 304
Back seat Bush	Bronze IS: 318 Gr LTB 2
Gland Packing	Graphite Asbestos

Parameters

Type	Rising spindle

Nominal pressure	2 times working pressure in pipeline
Nature of operation	Horizontal / vertical
Applicable code	IS 14846
Test	Acceptance tests as per IS 14846

1.8.21.3 Knife Gate Valves

Knife gate valves shall be suitable for use at suction and delivery side of pumps in a sewage pumping station. The valve should be provided with gate made of stainless steel and the gate should have bevelled knife edge at the bottom to cut through and easily enter in the solids settled in the bottom and ensure positive shut-off / closure in sewage environment. The valve should be bonnet-less and suitable for face to face flange connections in between pipelines. It should be suitable for uni-directional application.

The valve body should be of Cast Iron Gr. FG 260. The body shall be designed to withstand 6 bar pressure.

The valve shall be provided with replaceable type flexible sealing seals to offer drop tight shut off. The seals should be made of EPDM rubber and should be held in place by an easily removable type seal retainer ring. The seal retainer ring should be designed in a manner so that the flow of the fluid should be away from the sealing perimeter and towards the centre of the valve.

The valve housing should have integral as cast tapered lugs provided for pushing the gate towards the flexible rubber seal only at the verge of closure with a view to avoid seal wear and achieve drop tight shut off. The surface of the gate coming in contact with the seal should be polished & buffed.

The valve shall be provided with sufficient ply of stuffing seals in the in built stuffing box to seal the rear opening. The stuffing box should have internal tappers for pushing the seals on to the gate. The seals should be of non-asbestos PTFE to reduce the friction and offer higher life. Provision shall be made to enable tighten the stuffing seals by means of a pusher arrangement to minimize the leakage

through the back of the valve. Replacement of stuffing seals should be done in installed condition of the valve.

The spindle should be double start threaded and non-rising type for compact & safe operation. The gate movement area should be covered by protection shields. Gate opening indicating arrangement should be provided to find out the extent of gate opening /closing.

Flange drilling suitable to mount between flanges as per IS 1538 -1993.

- Body: Cast Iron FG 260 as per IS 210
- Knife gate: AISI:304 Gr. ASTM A240
- Retainer ring: SS:304 ASTM A351 Gr. CF:8
- Inlet Seal: EPDM
- Spindle: AISI:410 Gr. ASTM A276
- Spindle Nut: Cast Iron Gr. FG 200 as per IS 210
- Stuffing plate: Cast Steel ASTM A216 Gr. WCB
- Stuffing seal: Synthetic yarn with PTFE

1.8.21.4 Reflux Valves

Reflux valve shall possess high speed closing characteristics and be designed for minimum slam conditions while closing. External counterweights are not acceptable. Check valves shall conform to API 594 and API 598. They shall have metal to metal sealing. The pressure drop in the valve at design flow shall be limited to 0.4 mWC.

Material of construction

Body	CI conforming IS 210 Gr FG 220
Plate	SS AISI 316
Spring	SS AISI 316
Seal	SS AISI 304

Parameters

Nominal pressure	Twice the pressure in pipeline
Nature of operation	Automatic
Closure characteristic	Non slamming
Applicable code	API 594
Tests	Acceptance tests as per API 598

1.8.22 Pipe Work

The pipe works for the plant involves procuring, supply, laying and jointing of suitable size electrically welded steel, cast iron, ductile iron, UPVC, RCC and PSCC pipes along with matching specials etc. as required. All pipe work and fittings shall be a class rating in excess of the maximum pressure attained in service including any surge pressure. The pipe work installation shall be so arranged to offer ease of dismantling and removal of pumps or major items of equipment. All pipe work shall be adequately supported with purpose-made fittings, wherever necessary. Flange adapters and union shall be fitted in pipe work runs, wherever necessary, to permit the simple disconnection of flanges, valves and equipment. The Contractor shall be responsible for ensuring that the internal surfaces of all pipe work are thoroughly cleaned before and during erection and commissioning. Cleaning shall include removal of dirt, rust, scale and welding slag due to site welding. Before dispatch from manufacturers works, the ends of the pipe, branch pipes etc., shall be suitably removed until immediately prior to connections adjacent pipes, valves or pumps. All small-bore pipes shall be blown through with compressed air before connection is made to instruments and other equipment. No point of passage of pipes through floors or walls shall be used as a point of support, except with the approval of the Employer's representative. All underground-buried mild steel piping unless found otherwise necessary, shall be protected by the application of hot coal tar enamel and fibreglass wrapping. The coating shall consist of one coal` tar primer one coat, wrapping of fibre glass one more coat of enamel and the final wrap of enamel impregnated fibre glass. However, all water supply plumbing

pipelines shall be of GI class B and either anchored externally with SS AISI fasteners or appropriately buried below the ground with a sand cushion of 20 cm all round. All sanitary piping shall be of UPVC class 4 suitably buried below the ground with a sand cushion of 20 cm all round. Changes in direction on the ground shall be achieved with inspection chambers of 45 cm x 45 cm and heavy-duty CI/Steel reinforced fibreglass chamber covers.

1.8.22.1 C I Pipes

The C I pipes and specials their laying and jointing and their dimensions shall conform to IS 1536, IS 1538 and IS 3114 with their latest revisions. The quality of cast iron shall meet grade 15 of IS 210 and be free from flaws, air bubbles, cracks, sand holes and other defects and shall be truly cylindrical and of uniform thickness. The methods for sampling of C.I. pipes and fittings shall conform to IS 11606. Pipe work outside the buildings shall use Tyton ring joints and inside, double flanged joints. All underground pipes shall be provided with granular bedding. Thrust blocks wherever required in the opinion of the Employer's representative shall be provided in accordance with relevant specifications of the BIS

- **Tests:**

Following tests shall be carried out on the C.I. pipes:

(i) Mechanical Tests

as specified in I.S. 1536 during manufacture of the pipes.

(ii) Hydrostatic tests at works

The pipes shall be tested hydrostatically at the pressure specified in Table 1 for spigot and socket pipe and as per Table 2.0 for flanged pipes of IS 1536. The pressure shall be applied internally and shall be steadily maintained for a period of minimum 10 seconds and the pipes shall be moderately struck with a 700 gm hammer. The pipes shall withstand the pressure test and shall not show any sign of leakage, sweating, cracks or fracturing or other defects.

(iii) Testing at site

The following site tests shall be carried out after a new pipe is laid, jointed and partially backfilled.

(a) Pressure test

The pressure test at a field test pressure specified in clause 7.2.1 of IS 3114 shall be carried out. Pipes and joints shall be absolutely water tight under the test. The procedure for testing shall be as per clause 7.2.1 of IS 3114.

(b) Leakage test

The leakage test shall be conducted as per clause 7.3 of IS 3114 and the leakage should be within the specified allowance as calculated using formula given in clause 7.3.2 of IS 3114.

(c) Water required for any type of testing shall be arranged by the Contractor, at his own cost.

(d) Markings:

The following markings on the pipe shall be cast, stamped or indelibly painted-

1. Manufacturer's name or identification mark
2. The nominal diameter
3. Class reference
4. Mass of pipe
5. The I.S. Code reference
6. The year of manufacture

The marking shall be done outside the socket or towards the end of barrels of the pipe. The coating on the pipes, both internally and externally shall be provided as per clause 15.0 of IS 1536.

1.8.22.2 Galvanized Iron pipe

The procurement, supplying, laying, jointing and testing at works and site of Galvanized Iron (G.I.) pipes and fittings shall be in accordance with IS 1239 (Part I

and II) and its latest revisions. The general requirements relating to the supply of mild steel tubes shall conform to IS 1387. The sulphur and phosphorus requirements in steel shall not exceed 0.05 percent each. The galvanizing of the pipes shall be as specified in IS 4736. The zinc coating shall be uniform adherent, reasonably smooth and free from imperfections. The pipes shall be galvanized before screwing. All screwed pipes and sockets shall have pipe threads conforming to the requirements of IS 554. Gauging in accordance with IS 8999 shall be considered as an adequate test for conformity of threads of IS 554. Screwed tubes shall have taper threads while the sockets shall have parallel threads. The specifications for G.I. pipes shall be generally in accordance with Clause 15.4 of standard specifications. The tolerances on the length of pipes shall follow clause 11.0 of IS 1239 (Part I). The fittings for G.I. pipes shall be of mild steel tubular or wrought steel fittings conforming to I.S. 1239 (Part II). The laying of G.I. pipes and fittings shall follow the relevant I S code of practice. These pipes shall be used for drinking water supply for the office and laboratory buildings. The pipes shall be painted with two coats of anticorrosive bitumen paint.

- **Testing of G.I. pipes**

  Hydrostatic test shall be carried out at works at a pressure of 5 M Pa, maintained for at least 3 sec and shall not show any leakage in the pipe. The tensile strength of length or strip cut from selected tubes, when tested in accordance with IS 1894 shall be at least 320 N / mm2. The elongation percentage shall be as per clause 14.1.1 of IS 1239 (Part I). The bend test shall also be carried out as per clause 14.2 of IS 1239. The G.I. pipes and fittings shall be tested at site, after they are laid and jointed as per clause 15.4.11 of standard specifications.

1.8.22.3 LDPE Pipes: (Low Density Poly Ethylene Pipe)

The International standard specifies the required properties of pipes made from poly ethylene (PE) confirming to ISO 4427:1996.

- **Dimensions**

  The dimensions of pipes shall be measured in accordance with ISO 3126.

The tolerances on the outside diameters shall be in accordance with ISO 11922-1 as

Grade A for normal tolerance (NT pipes)

Grade B for close tolerance (CT pipes)

- **Length of pipe.**

  The length of straight pipes & coils shall be not less than that agreed between supplier and user.

- **Finishes**

  All internal surfaces of the pipes should be regular and smooth. The shape of the finished ends should be fixed by the manufacturer to suit the type of joint used.

- **Specials**

  The specials should be manufactured from LDPE/Hard plastic, polyacetal split rings for positive grip and should sustain maximum working pressure 16 bar at 20° C. should be available in sizes 20mm (1/2"), 25 mm (3/4").

  The fittings should also be supplied by the manufacturer of the pipes. They should preferably be manufacturer by the manufacturer of the pipes. In case they are not, it will be the responsibility of the manufacturer of the pipes to have them manufactured from a suitable manufacturer under its own supervision and have it tested at his / sub contractor's premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products.

1.8.22.4 Ductile Iron Pipes

The DI pipes shall be centrifugally cast (spun) for Water and Sewage and confirming to IS 8329-2000. The pipes used shall be both gasket joints and flanged joints. The minimum class of pipe to be used shall be class K-9 conforming to IS 8329. In general, pipes inside the buildings and below the structures shall be jointed as double-flanged pipes and those outside the building can be either EPDM gasket in accordance with IS 5382 and manufactured by the pipe manufacturer only. The pipes shall be supplied in standard lengths of 5.5m and 6.00m length with suitably

rounded chamfered ends. Any change in the stipulated lengths will be approved by the Engineer's representative. The flanged joints shall confirm to the Clause 6.2 of IS 8329. The pipe supply will also include one rubber gasket for each flange.

Pump delivery piping & specials shall be double flanged type.

- **Inspection and Testing:**

The pipes shall be subjected to following tests for acceptance:

(i) Visual and dimensional check as per clause 13 and 15 of IS 8329.

(ii) Mechanical tests as per clause 10 of IS 8329.

(iii) Hydrostatic test as per clause 11 of IS 8329.

(iv) The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5382 and in accordance to clause 3.8

The sampling shall be as per the provisions of the IS 8329.

- **Markings**

All pipes shall be marked as per clause 18 of IS 8329 and shown as below:

(i) Manufacturer name / stamp

(ii) Nominal diameter

(iii) Class reference

(iv) A white ring line showing length of insertion at spigot end.

- **Packing and Transport**

The pipes should be preferably transported by road from the factory and stored as per the manufacturer's specifications to protect them from damage.

- **Specials for DI Pipes**

The DI specials shall be manufactured and tested in accordance with IS 9523 or BS 4772. The mechanical test and hydrostatic test shall confirm to clause 9 and clause 10 respectively of IS 9523. The tolerances on dimensions shall be as per IS 9523. The manufacturer of the pipes shall supply the fittings.

All the DI fittings shall be supplied with rubber rings for each socket. The rubber ring shall conform to IS 12820 and IS 5382. Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

1.8.23 Sluice Gates

The construction of sluice gates shall be in accordance with the specification and generally as per AWWA C 501 or IS 13349. The sluice gates shall be capable of performing the duties set in the specification without undue wear or deterioration. They shall be constructed so that maintenance is kept to a minimum. All parts of sluice gate, including mechanism components shall be designed for the heads specified with a minimum safety factor of five. All sluice gates shall be of the raising spindle type.

All sluice gates shall be manually operated. Motorized gates, if provided by the Contractor, the actuator specs be got approved from the Employer's representative.

- **Constructional features**

The sluice gates shall be standard design of manufacturer's and of robust construction. The special features shall be as follows.

- **Frame:**

The frames shall be of ample section and cast in one piece. All surface forming joints and bearings shall be machined. The frame shall be of the flange back type and shall be machined on the rear face to bolt directly to the machined face of the wall thimble.

- **Guide:**

The guide shall be bolted to the frame or cast integrally with it and shall be machined on all bearing and contact faces. The length of the guide shall be such that it should support the gate upon the horizontal line of stem nut pocket. Arrangements shall be such that it should support the gate upon the horizontal line of stem nut pocket. Arrangements shall be made to prevent lateral movement of

bolted on guides. They shall be capable of taking the entire thrust produced by water pressure and wedging action. Wedges or wedge facings shall be attached to the guides at point where, in the closed position, they will make full contact with the wedging surface on the slides.

- **Seating Faces**

  The seating faces shall be of full width, solid section. They shall be secured firmly by means of counter sunk fixings in finished grooves in the frame and slide faces in such a way as to ensure that they will remain permanently in place as well as free from distortion and loosening during the life of the sluice gates.

- **Wedging devices**

  Sluice gates shall be equipped with adjustable side, top and bottom wedging devices required providing contact between the slide and frame facing when the gate is closed position. All faces shall be machined accurately to give maximum contact and wedging action. Wedges shall be fully adjustable with suitable adjusting screws and lock nuts and so designed that they will remain in the fixed position after adjustment.

- **Gate slides**

  The slide shall be with strengthening ribs where required and reinforced section to receive the seating faces. The slide shall have tongues on each side extending its full length and tongues shall be machined accurately on contact surfaces. Surfaces of the slide that in come in contact with the seat facing and wedges shall be machined accurately. The maximum allowable clearances between the slide and slide gate shall be 1.6 mm. An integrally cast stem nut pocket with reinforced ribs shall be provided above the central line of the slide.

- **Stem nut and Lift nut**

  A gate shall be provided with lower fixed stem nuts for connecting the stem to the slide and revolving lift nut located in the lifting mechanism in the head stock. They shall be of ample design to endure the thrust developed during gate operating

under maximum gate operating condition loads in opening and closing direction. The stem nut and slide shall be constructed to prevent turning of the stem nut in the pocket in the slide. The stem nut shall be threaded and keyed or threaded and pinned to the stem.

- **Stem**

  The operating stem shall be designed for a tensile strength to withstand 90 kg effort on the crank and for a critical buckling compressive load assuming a 36 kg effort on the crank. The threads of the stem be machine cut or rolled and of the square or acme type. The number of threads per inch shall be such as to work most effectively with the lift mechanism used. The top of the stem be provided with a stop collar. Stem shall be provided with polycarbonate cover fixed to the headstock.

- **Stem coupling**

  The coupling shall be threaded and keyed or threaded and bolted and shall be of greater strength than the stem.

- **Stem guide**

  Stem guides shall be cast, with bushings and mounted on cast brackets. Guides shall be adjustable in two directions and shall be so constructed that when properly spaced they shall hold the stem in alignment. The number of stem guides shall be such that the unsupported length of stem shall not exceed one hundred times its diameter.

- **Lifting Mechanism**

  Sluice gates shall be operated through a suitable lifting mechanism, which shall incorporate gearing if required. The lifting mechanism shall be suitable for operation by one man under all conditions. The lifting mechanism shall incorporate a strong locking device suitable for use with a padlock or padlock and chain. The manual operation shall be of the hand wheel crank operated type and shall have a lift nut threaded to fit the operating stem. The crank shall be removable. Ball or

roller thrust bearings shall be provided above and below flange on the lift nut to take the load developed in opening and closing the gate with torque of 14 kg-m on the crank. Fittings shall be provided to lubricate gears and bearing. The design of the lift mechanism of the hand operated gates shall be such that the slide can be operated with torque is not more than 7 kg-m on the operator after the slide is unseated from wedges based on the operating head. The maximum crank radius shall be 380 mm.

- **Gears and bearings**

  All gears and bearings shall be enclosed in cast iron housing with labyrinth seals. The lifting mechanism shall be of cast iron pedestal, machined and drilled to receive the gear housing and suitable for bolting to the operating floor. The gates shall close with clockwise rotation of the crank. The direction of rotation to close the gates shall be indicated on the lift mechanism. A suitable means shall be provided for lubricating the stem threads directly adjacent to the lift nut. An inspection cover shall be provided to access the lift nut and gearing.

- **Fasteners**

  All anchor bolts, assembly bolts, screw, nuts etc., shall be of ample section to safely withstand the forces created by the operation of the gate.

- **Wall thimbles**

  The wall thimbles shall be made of cast iron and shall be supplied along with the gate. The wall thimbles shall provide a rigid mounting and designed to prevent warping of the gate frame during installation. The cross section of the thimble shall have the shape of the letter ‘F’. The front, or mounting flange, shall be machined and shall be attached to the thimble with bolts and studs. The depth of the wall thimbles shall not be less than 300mm. To permit entrapped air to escape as the thimbles are being encased in the concrete, holes not less than 35 mm diameter at not more than 600 mm span, shall be cast or drilled in each entrapment zone formed by the reinforcing ribs or flange and water stop.

- **Material of Construction**

Frame, Guide, Thimble, Stem	C I conforming to IS 210 Gr 260
Guide Bracket, Wedges,	
Door Sealing faces	Bronze conforming to IS 318 Gr LTB 2
Spindle	SS AISI 431
Flush bottom resilient seal	Natural or synthetic rubber conforming to IS: 1855
Anchor bolts	SS conforming to IS 6603
Hand wheel	Cast iron
Stem cover	Polycarbonate transparent tube.

Parameters

Type	Rectangular rising spindle
Size	As per requirement
Applicable code	IS 13349
Class	1
Maximum seating head	As per contractors design
Unseating head	As per contractors design
Maximum distances between gates	As per contractors design.
Center line and operating platform	

Tests Seat clearance check, moving tests, leakage tests and Hydrostatic tests as per IS 13349/ AWWA C 501 shall be conducted at Manufacturer's works in accordance with the Inspection category.

1.8.24 Open channel Gates

The manufacture of open channel gates shall be in accordance with the manufacturer's standard. All open channel gates shall be of the rising spindle type. All open channel gates shall be manually operated or motorized as per process

requirements. Open channel gates shall be tested as per manufacturer's standard. The open channel gates for pumping stations shall be CI sluice gates. The material of construction shall be as follows.

Components	Material	Specification	Grades
Gate frame, shutter, Headstock, Flush bottom seal support bar, Stop nut.	Cast Iron	IS: 210 – 1993	FG: 260
Sealing faces/ Seat facings	Stainless Steel	ASTM A276	AISI: 304, 316
Resilient rubber seal	Natural Rubber EPDM Rubber Neoprene Rubber		
Seal retainer bar	Stainless Steel	ASTM A276	AISI: 304, 316
Stem / Spindle	Stainless Steel	ASTM A276	AISI: 304, 316
Operating Nut/ Stem Nut	Leaded Tin Bronze	IS: 318 – 1981	LTB 1, LTB 2
Fasteners	Stainless Steel	ASTM A276	AISI: 304, 316
Anchor Bolts	Stainless Steel	ASTM A276	AISI: 304, 316
Yoke	Mild Steel	IS: 2062 – 1992	Grade A

1.8.25 Chain Pulley Blocks

Geared Chain Pulley Blocks shall be adopted. The monorail and trolley and the chain pulley block shall be provided for lifting the blowers and submersible pumps. The trolley and chain pulley block shall be hand driven. The capacity of the trolley and the chain pulley block shall be for the maximum weight to be lifted during erection and maintenance of the equipment but should not be less than 1 ton. The travelling trolley shall run on the lower flange of the rolled steel joist. The trolley shall have two wheels on both sides of the joist web. The trolley wheels shall be single flanged with treads machined to match the flange of the beam. The wheels shall be of carbon steel casting conforming to IS 1030. The trolley shall have an arrangement for the fixing chain pulley block and sling. Pushing the load shall move the trolley. Suitable arrangement shall be provided on the joist to prevent over travelling. The chain pulley block shall have frame housing gears load sheave, brake unit, hand chain wheel and load chain wheel shall have hooks on both sides,

one fixed with traveling and other for the load. The frame shall be of welded construction.

The gears shall be of spur type incorporating high grade hardened carbon steel pinion and heat treated carbon steel wheels. The width of the gear shall be adequately sized for long life. The driving pinion shall be integrated with the driving shaft. The load hook (bottom hook) shall rotate on the ball bearing. The chain shall be electrically welded, accurately calibrated, pitched and polished. The length of the load chain shall be sufficient for taking out the blower/pumps from their location. The hand chain wheel shall be provided with roller type guarding to prevent slipping the chain. The hand chain wheel shall hang to cleat of the hook. The braking shall be automatic, the screw and friction disc type and shall offer no resistance. The load shall be sustained in any position of lift when effort for hoisting or lowering is removed. Each chain pulley block shall be supplied with one set of 1 ton sling with galvanized D- shackles and clamps. The slings shall be about 3 m long. The monorail shall be 'I' section. The exposed mild steel surfaces shall be enamel painted. The fasteners shall be GI or Cadmium plated. The chain pulley block shall be tested for 150% overload through a length of lift which will be ensure that every part of the block mechanism and every teeth of gears come under load.

1.8.26 Valve Actuators

All actuators shall be motorized type and local controls shall be protected by a lockable cover.

Each actuator shall be adequately sized to suit the application and be continuously rated to suit the modulating control required. The gearbox shall be oil or grease filled, and capable of installation in any position. All operating spindles, gears and head stocks shall be provided with adequate points for lubrication. The valve actuator shall be capable of producing not less than 1½ times the required valve torque considering valve spindle jamming and shall be suitable for at least 5 continuous operations.

The actuator starters shall be integrally housed with the actuator in robustly

constructed and totally enclosed weatherproof housing. The motor starter shall be capable of starting the motor under the most severe conditions.

The starter housing shall be fitted with contacts and terminals for power supply, remote control and remote positional indication, and shall also be fitted with internal heaters so as to provide protection against damage due to condensation. Heaters shall be suitable for single phase operation. The heaters shall be switched "ON" when the starters are "OFF" and shall be switched "OFF" when the starters are "ON".

Each actuator shall be equipped as follows:

(a) AC electric motor with engage/disengage clutch mechanism of the dry type.

(b) Reduction gear unit (with thrust bearing if required)

(c) Torque switch mechanism

(d) Limit switch mechanism

(e) Geared hand wheel for manual operation of valve.

(f) Valve position indicator – open/closed

(g) Auto-Manual lever with suitable locking arrangement

(h) Reversing contactor starter complete with overload relays of suitable range and adequately rated control fuses

(i) Actuator shall have selection between local/remote operation

(j) Local control switch/push buttons

(k) 415 V/110 V AC control transformer

(l) A white lamp for supervision of main supply to be provided locally.

(m) A potential free contact shall be provided to annunciate over-load trip/main supply failure on remote panel

(n) Provision for local as well as remote operation

1.8.27 Laboratory Equipment

Laboratory equipments shall be provided as mentioned below (each location):

Sr. No	Item Description	Unit	Qty
A	**Laboratory Instruments**		
1	Digital Spectrophotometer	No.	1
2	Cuvette 50mm	No.	1
3	Cuvette 10mm	No.	2
4	Digital Nephelometer	No.	1
5	T D S meter	No.	1
6	Magnetic Stirrer	No.	1
7	Hot Plate with regulator	No.	1
8	Autoclave portable	No.	1
9	Digital pH meter	No.	1
10	Distilled water plant	No.	1
11	Vacuum Desiccator	No.	1
12	Vacuum Pump	No.	1
13	Centrifuge	No.	1
14	Microscope	No.	1
15	Digital Colony Counter	No.	1
17	Water Bath Thermostatic	No.	1
18	Digital Muffle Furnace	No.	1
19	Lab. Oven	No.	1
20	Bacteriological Incubator	No.	2
21	B.O.D. Incubator, made by Refrigerator	No.	2
22	Single Pan Balance	No.	1
23	Inoculation Chamber	No.	1
24	Gas stripping Apparatus	No.	1
25	Membrane filter Assembly	No.	1
26	Membrane filter Disc	No.	1
27	Heating Mantle	No.	1
28	Fume Hood	No.	1
29	Thermometer with calibration	No.	1
30	Kjeldahl Distillation Assembly	No.	1
31	Flow Meter	No.	1
32	Reduction Column	No.	1
33	Activated Carbon Column	No.	1
34	ERTL Approved calibration Certificate	No.	10
B	**Laboratory Glassware**		
1	Amber coloured bottle, 1000ml	No.	4
2	Amber coloured bottle, 500ml	No.	10
3	Amber coloured bottle, 250ml	No.	12
4	Amber coloured bottle, 125ml	No.	6
5	Plain wide mouth bottle, 1000ml	No.	1

6	Plain bottle, 1000ml	No.	4
7	Plain bottle, 500ml	No.	10
8	Plain bottle, 250ml	No.	52
9	Plain bottle, 125ml	No.	6
10	Beaker, 1000ml	No.	2
11	Beaker, 500ml	No.	4
12	Beaker, 250ml	No.	4
13	Beaker, 100ml	No.	4
14	Beaker, 50ml	No.	2
15	Plastic Beaker, 500ml	No.	3
16	Plastic Beaker, 250ml	No.	3
17	Measuring Cylinder, 500ml	No.	3
18	Measuring Cylinder, 250ml	No.	2
19	Measuring Cylinder, 100ml	No.	1
20	Volumetric flask, 500ml	No.	4
21	Volumetric flask, 250ml	No.	4
22	Volumetric flask, 100ml	No.	8
23	Grouch crucible G-4	No.	1
24	Grouch crucible G-3	No.	1
25	Silica dish	No.	1
26	Filter funnel	No.	4
27	Screw capped tube, 50ml	No.	12
28	Screw capped tube, 30ml	No.	12
29	Nesslers Cylinder, 100ml	No.	8
30	Durham's tube	No.	3
31	Test tube, 20ml	No.	60
32	Test tube, 10ml	No.	15
33	Round bottom flask, 500ml	No.	1
34	Round bottom flask, 100ml	No.	3
35	Flat bottom flask, 500ml	No.	1
36	Flat bottom flask, 250ml	No.	3
38	Separating funnel, 500ml	No.	2
39	Separating funnel, 125ml	No.	4
40	Separating funnel, 1000ml with Teflon	No.	1
41	Dropper	No.	4
42	Glass rod	No.	10
43	Graduated pipette, 25ml	No.	3
44	Graduated pipette, 2ml	No.	2
45	Petri plate 4"	No.	60
46	Conical flask, 500ml	No.	3
47	Conical flask, 250ml	No.	3
48	Iodine flask, 250ml	No.	2
49	Condenser	No.	2
50	Burette, 50ml	No.	3

51	Boiling Beads	Kg	0.5
52	Watch Glass	No.	2
53	Cover Slip	No.	2
54	PP Measuring Cylinder, 100ml	No.	2
55	PP Conical flask, 250ml	No.	2
56	PP bottle 250 ml	No.	6
57	Tripod Stand	No.	2
58	Wire gauge	No.	10
59	Watman filter paper No. 1/2	No.	1
60	Watman filter paper No. 40/42	No.	1
61	Test tube stand	No.	1
62	Pipette stand round	No.	1
63	Burette Stand	No.	1
64	Non absorbent cotton	No.	2
65	SS Spatula	No.	2
66	SS Tong	No.	2
67	Test tine	No.	2
68	Tissue role	No.	2
69	Gas burner	No.	2
C	**Laboratory Chemicals**		
1	Ammonia buffer soln.	ml	500ml
2	Activated charcoal	gm	500gm
3	Ammonium Dichromate	gm	500gm
4	Ammonium acetate	gm	500gm
5	Ammonium chloride	gm	500gm
6	Ammonium hydroxide	gm	500ml
7	Antimony metal powder	gm	500gm
8	Azomethane H	gm	2gm
9	Acetic acid Glacial	ml	500ml
10	Ammonium oxalate	gm	500gm
11	Aluminium potassium sulphate	gm	500gm
12	Ammonium carbonate	gm	500gm
13	4 - Aminino antipyrine	gm	25gm
14	Acetone	ml	500ml
15	Ascorbic acid L	gm	100gm
16	Buffer tbt 4.0	tbt	10tbt
17	Buffer tbt 7.0	tbt	10tbt
18	Bensene	ml	500ml
19	Boric acid	gm	500gm
20	Barium chloride	gm	500gm
21	Barium hydroxide	gm	500gm
22	Calcium chloride	gm	500gm
23	Cobaltous chloride	gm	100gm
24	Chlorotex Reagent	ml	100ml

25	Citric acid	gm	500gm
26	Cyclohexanone	ml	500ml
27	Calcium hydroxide	gm	500gm
28	Copper metal powder	gm	500gm
29	Chloroform	ml	500ml
30	Cupric sulphate	gm	500gm
31	Chromotropic acid	gm	25gm
32	Dodecyl benzene sulphonic acid	gm	500gm
33	Di ammonium hydrogen orthophosphate	gm	500gm
34	Ethyl acetate	ml	500ml
35	Ethanol	ml	500ml
36	E D T A	gm	100gm
37	Erichrome Cyanine R	gm	5gm
38	Ferric chloride	gm	500gm
39	Ferric citrate	gm	500gm
40	Ferrous ammo sulphate	gm	500gm
41	Formaldehyde	ml	500ml
42	Gelatin powder	gm	500gm
43	Glycerine	ml	500ml
44	Hydrazine sulphate	gm	100gm
45	Hexamethylene tetramine	gm	500gm
46	Hydrochloric acid	ml	500ml
47	Hydrogen peroxide	ltr	1ltr.
48	Hydroxylamine Hydrochloride	gm	100gm
49	Iodine resublimed	gm	100gm
50	Iso Propyl alcohol	ml	500ml
51	Methanol	ml	500ml
52	Mercuric chloride	gm	250gm
53	Neocuprone (2, 9 dimethyl 1, 10 (N1-napthyl) ethylene dihydrochloride	gm	1gm
54	NED dihydrochloride		5gm
55	Nitric acid	ml	500ml
56	N,N dimethyl - P - Phenylene diamine oxalate	gm	5gm
57	Orthophosphoric acid	ml	500ml
58	Potassium chloroplatinate	gm	1gm
59	Potassium iodine	gm	250gm
60	Perchloric acid	ml	500ml
1	Potassium dichromate	gm	500gm
62	Potassium chromate	gm	500gm
63	Potassium nitrate	gm	500gm
64	Potassium permangate	gm	500gm
65	Patton & Reeders indicator	gm	5gm
66	Potassium cyanide	gm	5gm
67	Phenol crystal	gm	500gm

68	Potassium bromate	gm	500gm
69	Potassium bromide	gm	500gm
70	Potassium dihydrogen phosphate	gm	500gm
71	Potassium ferricyanide	gm	100gm
72	Potassium chloride	gm	500gm
73	Potassium metaperiodate	gm	100gm
74	1, 10 Phenanthroline	gm	5gm
75	Potassium hydroxide	gm	500gm
76	Rhodamine B	gm	25gm
77	Sodium acetate	gm	500gm
78	Sodium hydroxide	gm	500gm
79	Sodium chloride	gm	500gm
80	Sodium thiosulphate	gm	500gm
81	Sulphuric acid	gm	500ml
82	Sodium hydrogen carbonate	gm	500gm
83	Sodium carbonate	gm	500gm
84	Sodium sulphate	gm	500gm
85	Starch soluble	gm	500gm
86	Silver nitrate	gm	25gm
87	Sodium sulphite anhydrous	gm	500gm
88	Sodium ascorbate	gm	100gm
89	Sulphur dioxide solution	gm	500ml
90	Sodium fluoride	gm	500gm
91	Sodium mete bisulphate	gm	500gm
92	Sodium nitrite	gm	500gm
93	Sodium oxalate	gm	500gm
94	Sucrose	gm	500gm
95	Sulpha nil amide	gm	500gm
96	Tri sodium citrate	gm	500gm
97	Tri ethanol amine	gm	500ml
98	1, 1, 2 trichloro trifluoro ethane	gm	250ml
99	Urea	gm	500gm
100	Zinc dust	gm	500gm
101	Zincon	gm	1gm
102	Zinc sulphate hepata hydrate	gm	500gm
103	Zinc acetate	gm	500gm
D	**List Of Media**		
1	Aspergine praline broth	gm	100gm
2	Andrede peptone water	gm	100gm
3	Brillient green bile broth 2%	gm	100gm
4	Chloramphenicol yeast glucose agar	gm	100gm
5	Differential reinforced clostridial medium	gm	100gm
6	EMB Agar	gm	100gm
7	Lactose broth	gm	100gm

8	MacConkey's broth	gm	100gm
9	MacConkey's agar	gm	100gm
10	Milk agar with cetrimide (Twin)	gm	100gm
11	MR-VP Medium	gm	100gm
12	Nutrient broth	gm	100gm
13	Nutrient agar No. 2	gm	100gm
14	Peptone water	gm	100gm
15	Plate count agar	gm	100gm
16	Simmon's Citrate agar	gm	100gm
17	Tergitol - 7 agar base	gm	100gm
18	Violet red bile agar	gm	100gm
E	**list of Indicators**		
1	Brilliant green	gm	25gm
2	Bromocresol purple indicator	ml	125ml
3	Bromocresol green	ml	125ml
4	Crystal violet	ml	125ml
5	Eosin	ml	125ml
6	Methyl orange	ml	125ml
7	Methyl red	ml	125ml
8	Methylene blue	ml	125ml
9	Muraxide (Ammo Purpurte)	gm	5gm
10	Neutral red indicator	ml	125ml
11	Phenol phthalein indicator	ml	125ml
12	Erichrome black T	gm	25gm
13	Universal indicator	ml	125ml
14	Phenol red	ml	125ml
15	Gram iodine stain	ml	125ml
16	Bromothymol blue	ml	125ml
F	**Providing Furniture for The Laboratory**		**Qty.**
1	Providing, manufacturing & supplying Working table of approx. size 1200mm X 600mm & 750mm height with 4 Drawers of 300 mm width, in marine plywood finish with inside the drawers including all hardware etc. complete		3 Nos.
2	Providing, manufacturing and supplying Side table of specifications same as working table but along wall.		4 Nos.
3	Providing, manufacturing and supplying Running table of specifications same as side table but along wall and 450 mm deep.		2 Nos.
4	Providing, manufacturing, supplying and fixing Storage unit above the running table in marine plywood of approx. 450mm deep and 600mm height with shelves, shutters including all hardware, 1.5mm thick laminate on External face & wax polish internally.		2 Nos.
5	Office Chairs		4 Nos.
6	Steel Almirah		2 Nos.

TECHNICAL SPECIFICATIONS: ELECTRICAL & INSTRUMANTATION WORKS – PART A

1.1 TRANSFORMERS

1.1.1 General

a) **Standard Specification of Electrical Works**

Transformer

The specifications given below refers to the design, manufacture, testing and supplying of step down core resin impregnated **dry type** indoor transformer.

Standards:

a) The design, manufacture and performance of equipment shall comply with all currently applicable standards, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be constructed to relieve the Vendor of this responsibility.

b) Unless otherwise specified equipment shall conform to the following latest applicable Indian Standards.

IS:11171	-	Transformer
IS:3639	-	Fittings and Accessories for Power Transformer
IS:2099	-	High Voltage Porcelain Bushings
IS:3637	-	Specification for Gas Operated Relays

System of Supply: 11 KV, 3 phase, 50 cycle solidity earthed system.
Rating: Suitable for operation at peak load for continuous rating
No Load voltage: 11000 Volts on H.V. side and 433 Volts on L.V.side, 11000/433 Volts.

- Winding shall be subjected to shrinking and seasoning process, that, no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.

- Materials used in the insulation and assembly of the windings shall have high tensile and dielectric strength. These shall not soften or otherwise get affected under the operating conditions.
- In case of Dy-11 transformers, neutral shall be brought out in open for solid earthing on the secondary side.
- The windings shall be copper wound.

Enclosure:

Steel enclosure with screens of metal at top for indoor type transformer shall be provided. For outdoor type transformer, hermetically sealed unit should be used.

Impregnation:

- Coils to be impregnated with cycloaliphatic epoxy resin by vacuum pressure impregnation process to ensure void free impregnation.
- The process shall consist of but not limited to preheating, vacuum drying, under vacuum entry of resin, vacuum submersion, pressurization, draining, transfer to oven and curing.
- Class of Insulation: Type “H”

Tapings:

Off load tap changing arrangement on H.V. side, The tapings to be provided for variation of H.V. voltage from +5% to -7.5% in steps of 2.5%, with arrangement to lock with pad including 2 sets of keys.

Temperature Rise:

Continuously rated for full load, temperature rise not to exceed 115^0C over ambient.

Cooling:

Natural air cooling.

Fittings:

The following accessories and fittings shall bee provided with the transformers:

a) <u>Inspection covers:</u>

Inspection cover on top of the transformer shall be provided.

b) <u>Lifting lungs:</u>

The arrangement of lifting the active part of the transformer along with the cover of the tank by means of lifting lungs without disturbing the connections. Also complete transformer lifting lungs shall be provided. Lifting arrangement for core and coils shall also be provided.

c) Jacking pads:

Jacking pads shall be provided on the transformer.

d) Earthing pads:

Two nos. earthing pads shall be provided of copper of non-corrosive material on transformer enclosure and suitable earthing terminals on cable boxes.

e) Diagram and rating plate:

One diagram and rating plate indicating the details of transformer, connecting diagram vector group, tap changing diagram etc. shall be provided.

f) Rollers:

4 Nos. bi-directional type roller shall be provided to the transformers on cross channels to facilitate the movement of transformers in both the directions.

g) Temperature Indicator:

Winding temperature indicator with contacts for operating trip circuits as well as for alarm shall be provide.

Cable End Boxes:

a) On H.V. Side:

Cable end box suitable for 11 KV, 3c x 120 sq.mm (minimum) XLPE cable. The size of box should be sufficient for termination using cable jointing kit.

b) On L.V. Side:

On L.V. side cable end box shall be providing suitable to accept the following size cables.

8 Nos. XLPE insulated and overall sheathed armoured, aluminium conductor cables of size 1 c x 400 Sq. mm. (minimum)

The cable terminal box shall be provided with suitable cable glands of proper size and number of lungs shall be provided on the terminal for all cables.

Testing:

The transformer shall be subjected to the following tests at the factory before

dispatching the same and test certificates, in quadruplicate, shall be furnished:

a) Measurement of winding resistance.

b) Ratio polarity and phase relationship

c) Impedance Voltage

d) Load Losses.

e) No load loss and no load current

f) Insulation resistance

g) Induced over voltage withstand

h) Separate source voltage withstand

i) Temperature rise by no load plus short circuit method

Instruction Manual:

The contractor shall submit six copies of manual of complete instructions for the installation, operation, maintenance and repairs, circuit diagram and foundation details shall be provided with the transformers.

Drawings:

a)Four sets of drawings of the transformers being supplied shall be furnished within two or three weeks of placement of order for approval.

The routine and other tests to be performed as per IS: 11171-1985 and IS:2026-1977.

b) It shall have HV cable box. For Transformer of 1000 KVA and above, bus duct shall be used in LT side whereas for transformer below 1000 KVA, cable box shall be provided in the LT side. Radiators shall also be detachable type along with HT cable boxes and disconnecting chamber on HT side.

c) Transformers shall employ copper conductor windings.

d) Transformers in clause (b) above shall have a separate bushing brought out on the transformer tank for earthing of neutral. Transformers designed for HV cable connections shall incorporate disconnecting chambers.

e) Transformers in clause (a) above shall have off load tap changing gears with auto / manual operating features. The tap changer range shall be –10% to + 5% in steps of 2.5%. The voltage profile of the transformer shall confirm to the voltage profile of power distribution agency. Transformers in clause (b) above shall have off load

tap changers.

f) The Transformer KVA rating shall be designed considering maximum 80% loading on the transformer at full load with a power factor of 0.8. No. Of transformers shall be 2 nos each of 100% of total plant load.

1.2 REQUIREMENT FOR OTHER ELECTRICAL ITMES:

1.2.1 Painting:

a) Rust in the sheet steel, structural steel used for fabrication shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly hot water and drying. A lightweight zinc coating to class C as per relevant IS shall be applied. After phosphating thorough rinsing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and drying.After pre treatment, powder coats of thickness not less than 50 microns shall be applied.

b) Paint shade for all electrical equipment shall be 692 (smoke grey shade) and 631 (admiralty grey) for indoor and outdoor equipment respectively. Unless specifically instructed interior portions of all housings shall be painted with while colour. Paint shade references are as per relevant IS.

1.2.2. Sheet Metal Work:

Sheet steel used for fabrication of these or similar items shall be cold rolled sheet of 2 mm or hot rolled sheet of 2.5 mm.All cubicles, panels, cabinets, kiosks and boards shall comprise rigid welded structural frames made of pressed and formed sheet steel thickness of not less than 2 mm cold rolled or 2.5 mm hot rolled. The frames shall be enclosed by steel sheets thickness of at least 2 mm cold rolled or 2.5 mm hot rolled, smoothly finished and free from flaws. Stiffeners shall be provided wherever necessary.All doors, panels, removable covers, gland plates, etc. shall be gasketed all round the perimeter. Locking arrangement for doors / removable covers/ panels shall be hand operated type requiring no tools for locking or unlocking. Padlocking facilities where required shall be provided in addition to above along with padlocks and duplicate keys.

All doors shall be removable and supported by strong hinges of the disappearing or

internal type and braced in such a manner as to ensure freedom from sagging, bending and general discretion of panel of hinged parts. The hinges should be in such a fashion that door once hooked in upper hinge automatically slides in the bottom hinge. Suitable compartment shall be made for mounting switchgear and compartment shall be fully isolated from other compartment.

1.2.3. Switchgears:

1.2.3.1. LV Switchgears:

415 V switchgear shall comprise separate, segregated modules for each circuit in compartmentalized fashion for PCC and MCC with starters capacity > 50 HP. More than one module may not be arranged in the same compartmentalized section. Medium voltage switchgear circuits controlled by circuit breakers shall be of draw out type. It shall not be possible to obtain access to an adjacent cubicle when any door is opened. Each door shall be interlocked and all line terminals, bus bar chambers & back covers must be shrouded between each vertical riser and there should be proper barriers. Not more than one air circuit breaker shall be mounted in one vertical bay Bus bars and cableways in 415 V switchgear shall run in separate segregated compartments and again these should be isolated from equipment chamber making minimum form 3B construction.Instruments, relays and control devices shall be mounted flush on hinged door of the metering compartment located in the front portion of the cubicles.

1.2.3.2. Circuit Breakers:

a. General:

The circuit breaker shall be air break type with draw out design confirming to the relevant Indian standards. All the circuit breakers of the panel will be mounted in separate cubicles and will be of same make to maintain the uniformity.

The breakers will be draw out type and will be mounted on a rigid steel frame moving on horizontal ball, telescopic slides offering minimum of friction. The system will have horizontal, self-aligning, isolating pairs of moving and stationary power and control contacts. The unit will have three horizontal positions

corresponding to:

b. Plugged In Position:

Here both the Power and control contacts are in make position and the breaker gets mechanically locked in this position. The breaker can go in ON position only after being locked in this position.

c. Test Position:

Here the power contacts get isolated where as the control contacts can be kept in make status. The breaker can be mechanically locked in this position and make ON and OFF for testing purposes.

d. Withdrawn Position:

In this position the power and control connections are in isolated status and the moving portion of the breaker can be dismantled from the panel. An isolating shutter or set of shutters is to be provided for the automatic coverage of live power and control fixed isolating contacts in the withdrawn position.

All the breakers with remote closing arrangement will have a spring charging motor of single phase 230 V and a closing coil. In case of power failure the spring charging can be done manually with the help of button or lever. The circuit breaker should switch on only when the spring is charged fully which should be able to store energy for one closing and one tripping operation. The spring will also get fully charged when the breaker is in closed position. In this case the spring should store enough energy to make first tripping, one re-closing and the second tripping.

The breaker will have quick making trip free closing mechanism. The operation of the mechanism will be independent of the speed of the closing lever or the duration of the closing signal.

The breaker will have following indications distinctly notable from outside.

- Electrical indication of breaker ON status.
- Electrical indication of breaker OFF status.
- Electrical indication of trip circuit healthy.

All breakers will have switching ON and OFF time of less than 4 cycles and will have

the following interlocks for the safe operation of the equipment:

- Breaker to ON only when mechanically locked in any of the three horizontal isolation position.
- When the Breaker is in "Plugged in" position it will go to ON position only with the front door closed.

The breakers will be provided with 6 Nos each of type NO and NC auxiliary contacts rated for 10 Amps AC at 415 V and 6 Amps DC at 48 V. These contacts are in addition to the ones already in use for the operation of the breaker and will be required for subsequent interlocks incorporated in near future.

Whenever requested mechanical positive interlocks will be provided between the operation of different breakers with the help of individually unique and suitable Castle Key Locks.

1.2.3.3. Isolators Switches, Fuse Units & Fuses:

These items shall conform to the latest IS13947 and following specifications:

a. The isolators and switch fuse units (SFU) will be three pole or four pole air break double isolating type capable of making and breaking the current as detailed below without any abnormal deterioration in the life of equipment and without endangering the safety of the operators. Wherever isolable neutral is specified, neutral is terminated / isolated separately. Wherever switched neutral is specified, four pole switches will be used. All switches will be fully shrouded and a proper barrier plate will be used between phases.

b. In case of isolator/SFU supplying heater, lighting loads etc., the current is of 125% of full load current connected.

c. In case where the switch is supplying current to a group of motors this capacity of the isolator/SFU will be equal to full load current of all motors plus the locked rotor stator current of the largest motor of the group.

d. In case of the load being capacitors this capacity of the isolator/SFU is equal to 225% of the capacitor current.

e. In case of the DB's, SFU panel etc. the isolator/SFU will be mounted on the component plate of the module and the operating handle will be brought out

for front access to enable the operation. The operation of the isolator/SFU will be interlocked with the isolator/ SFU in ON and OFF positions will be provided. Clear indications of ON and OFF positions of the handle will be shown on the front door for confusion free evaluation of the status of the isolator/SFU.

f. The operating mechanism of the isolator/SFU will be quick make, quick break type and it's speed of operations will be independent of the speed of the operating handle.

g. The isolator/SFU will be able to carry short-circuit current 1for 10 cycles before the fault is cleared by the local/ remote fuses/breaker.

h. The SFU will have three fuses one in each phase to provide safety against high currents.The fuses will be only High rupturing capacity (HRC) type. The fuses should be capable of clearing the fault current on short circuited without damaging the isolator/ switch and without endangering the safety of the operator and the adjacent equipment.

i. All the control fuses and the power fuses will be HRC type with current rupturing capacity of more than 41 KA at 440 V AC. No wire fuses or any other kind of fuses shall be used in the supply of electrical equipments for this project.

j. Shall have very high mechanical life e.g. 10000 operations for 800A.

k. Manufacturer to confirm that equipments have been tested as per IS13947.

1.2.3.4. Contactor Type Motor Starters:

Motor starter / contactor shall be of the electromagnetic type rated for uninterrupted duty. Contactors of DOL and star / delta starters shall be suitable for class AC 3 utilization category and contactor for reversing starters shall be of AC 4 category. Contactors used for star / delta and forward / reverse shall be electrically interlocked. Main contacts of the contactors shall be silver faced. Operating coils shall be suitable for operation on 230V, 1 Phase, 50 Hz supply. Each contactor shall have minimum 2 Nos + 2 NC auxiliary contacts for interlocking and control circuits. Contactors shall have very high electrical & mechanical life and

size shall confirm to only type II coordination. At least one spare 1 NO + 1 NC shall be provided for future use after using all control contacts for interlocking, control circuit in PLC/ DDC logics, indication and controls.

1.2.3.5. Overload Relay:

All the Over load relays used for the protection of three phase induction / synchronous motors will be three elements, ambient temperature compensated, positive acting, manual reset, as well as auto reset from panel front, heavy duty, separately mounted, bimetallic thermal type relays with one change over contact rated for 6 amps at 415 V AC. The resetting of the relay will be done by a push button located on the front door with the help of movement transfer by a flexible shaft in flexible cable outer between the push actuator and the relay reset point. The relay shall have single phasing prevention feature and shall be as per latest amended relevant IS. If due to PLC logic, more changeover NO/NC contacts are required then either relay shall have more changeover contacts or basic changeover (along with the relay) shall be multiplied to obtain extra contacts. The rating of these contacts should be rated for at least 2 times the current requirement.

For the equipment having higher inertia special arrangements will be made to short circuit the relay with or without resistance, with the help of a contactor and a timer. The shorting contactor will open after laps of a preset time (Set on the timer) after the starting.

The adjustment range of the over load relay shall cover 70% and 110% of the full load currents of the motor it is protecting.

All motors of 100 H.P. and above shall have additional protection of earth leakage through core balance current transformers and winding temperatures shall be displayed. For these motors of 100 H.P. and above, the numeric type micro-processor based relays shall be used in place of conventional thermostatic overload relays.

1.2.3.6. Moulded Case Circuit Breaker

Molded Case Circuit Breakers shall comply with IS-13947 and have a category of duty P2. They shall be of the low energy let through type incorporating positive ion quenching in order to ensure rapid arc quenching i.e. shall be of extra current limiting feature. It shall have provision of adding either one-shunt trip or under voltage along with two changeover contacts at any stage.

The operating faceplate shall have three positive positions 'ON', 'OFF' and 'TRIPPED' and this shall be used with front extended rotary handle. All contacts shall have phase barrier and extended links for aluminum suitability.

Tripping characteristic shall be of ambient temperature compensated and selected according to application, i.e. distribution, generation or motor duty. The size of MCCB shall be selected after taking necessary de-rating into account inside panel compartment. It shall have variable over current setting and variable short circuit setting.

1.2.3.7. Miniature Circuit Breaker:

Miniature circuit breaker (MCB) shall have 10 KA breaking capacity. If fault withstand capacity of MCB is less than that of the switchboard, backup HRC fuse or motor protection circuit breaker shall be fitted. MCB shall confirm to latest IS 8828 : 1996 and shall have lower watt losses and shall be rated for 10 KA and type 'C' Curve shall be used.

1.2.3.8. Residual Current Circuit Breaker

Residual current circuit breaker shall be current operated and comply with IS 12640 or BS 4293. The tripping current shall be selected dependent on location within the supply network and the calculated loop impedances. It shall operate to trip all phases including the neutral. **Unless otherwise specified the following sensitivities shall be applied:**

- Individual ring mains, ring main group or socket outlets 30mA
- Small consumer boards incorporating no other RCCB protection 30mA
- Small consumer boards incorporating RCCB protection on outgoing way100mA

- Large consumer board incoming RCCB shall be at least 300 mA

The residual current circuit breaker shall be capable of withstanding the likely fault current at the point of installation.

1.2.4 Bus Bars:

Switchgears shall be provided with three phase or three phase and neutral bus bars. Bus bars shall be of aluminum and shall be insulated with close fitting fiber reinforced plastic sleeve. PVC sleeve shall be acceptable for LV switchgear. Insulating sleeves shall have R, Y, B, colour bands at suitable intervals for identification of phases and shall withstand 90 ^{o} C temperature. Bus bar used shall be Al 91E with minimum 55% conductivity. Bus bar will be designed for 500V with neutral bus bar size shall be half of phase. Bus bar sizes will be uniform throughout horizontal run and again uniform on the vertical run. No reduction of bus bar size is permissible either in horizontal or vertical run and uniform life of busbar shall be adopted.

All bus bar joints and bus tap joints shall be plated. Bus bar joints shall be of the bolted type and shall be insulated with moulded caps. To provide a tight seal between adjacent cubicles, bus bars shall be taken through seal off bushings or insulating blocks.

Bus bars shall be adequately supported on insulators capable of withstanding dynamic stresses due to short circuit. The short circuit rating of bus bars shall not be less than that of the associated switchgear and bus bar ratings shall be worked out after taking deratings of ambient temperature and enclosure. Bus bar temperature shall not rise beyond 85^{0} C. Bus bar temperature rise calculations, short circuit calculations along with the Employer support distance shall be submitted at detailed engineering stage for approval alongwith temperature rise and minimum size of busbar selected. Similar calculations must be submitted for earth bus.

1.2.5 Interlocks:

Interlocks for LV circuit breakers shall comply with the following requirements:

a) It shall not be possible to plug in or isolate a closed circuit breaker. Attempted isolation of a closed circuit breaker from switchgear cubicle / module shall trip the circuit breaker.

b) It shall not be possible to close a circuit breaker unless it is in “service”, “test”, or “isolated” position.

c) Isolating devices, if provided shall be interlocked with breakers to prevent their making or breaking current.

d). It shall not be possible to close the circuit breaker in service position, without completing the auxiliary circuits between fixed and moving portions.

e) Where key interlocking is employed tripping of a closed circuit breaker shall occur if any attempt is made to remove the trapped key from the mechanism.

1.2.6 Test Operation Facilities:

A separate test position of the breaker shall be provided in the cubicle / module. It shall be possible to test the breaker in this position with all interlocks in the circuit.

1.2.7 Safety Shutters:

Switchgear cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage to cover the stationary isolated contacts when the breaker is withdrawn.

1.2.8. Switchgear Control Components, Devices and Other Features:

All individual components of control equipment associated with any item of pumping station shall be contained in a single control cubicle or panel.

All instruments, relays, switches, lamps, push buttons and the like shall be arranged on the cubical in a neat, functional and logical manner. The arrangement shall be subject to the Employer approval.

Similar items shall be of the same type, style pattern or appearance throughout. Control and changeover selection switches for various functions shall be of the same type but with a handle of different shape for each specific function.

Instruments, control devices and relays mounted on different panel sections but having similar functions shall be located in a physically similar position. Such equipment shall be mounted at a operating height not exceeding 1800 mm and not less than 300 mm operating height above floor level.

1.2.8.1. Indicating Meters:

All indicating meters shall be digital type complete with inter-facing devices.

a)	Display	: 4-1/2 Digits, 7 segments red coloured LED
b)	Accuracy	: ± 1%
c)	Inputs	: From current transformer /voltage transformer as required.
d)	Dimension of digits	: 12.5 mm (Minimum)
e)	Sampling rate	: 4 samples / sec

1.2.8.2. Indicating Lights:

Indicator lights shall be not less than 20mm diameter and shall be panel mounted types with metal bodies adequately fastened so that the lamps shall be capable of replacement from the apparatus without disturbance to the lamp holder or panel wiring. Lamp holders shall be keyed into panels to prevent rotation. Lens colours shall comply with BS EN 60037 as follows:

- Power on White*
- Running Green
- Tripped/ alarm Red
- Status (open, closed, etc) Blue
- Ready to start Blue
- Warning (no imminent danger) Amber

Note: *white may be used where doubt as to which other colour to use.

The Lights shall be under-run to give long life either by use of a resistor to limit voltage to 90% normal value or by using higher voltage lamps. The indicating lamps on control panel shall be cluster of LED's.

1.2.8.3. Push buttons:

Colours of push buttons shall generally comply with IS 6875, BSEN 60947, 60037 or IEC 60073 and in particular shall be as follows:

- Stop, emergency stop Red
- Start Green
- Jogging/ inching Black
- Reset (when not also acting as a stop) Blue
- Lamp test Blue
- Override/ alarm accept Yellow

1.2.8.4. Control Transformers:

Unless otherwise specified all control circuit supplies for contractor starters shall be obtained from a 230V, 50 Hz integral control transformer contained in the breaker or starter cubicle. In the case of motor control centers and composite boards comprising circuit breakers and starters one or more master control circuit transformers shall be provided for each section of busbars in the switchgear to feed a group of outgoing starters and / or outgoing breakers via bus wires in the board. Each control transformer shall be busbar connected and be provided with isolation facilities, and primary and secondary HRC fuses. Transformers shall be of the double wound pattern and be provided with earth screen between primary and secondary windings. One end of the secondary winding shall be earthed through a link. Each control transformer will have 100% standby and a manual change over arrangement between two control transformers.

1.2.8.5. L.T Current Transformers (CTs):

The current transformers to be used in the L.T. Electrical panels shall be low tension, ring/ rectangular type resin cast current transformer with the requisite currents ratio having secondary of the current transformers. For guidance the protective current transformers shall have an accuracy class 5P and an accuracy limit factor greater than 10. Low reactance current transformer shall be used for protection. Selection will be based on the following information:

a) For energy measuring : 1.0 class of accuracy.

b) For other metering : 1.5 class of accuracy.

c) For protection : 5P10 class of accuracy.

The current transformers to be selected for this panel will have at least 20% extra VA capacity available over the normal conventional meter capacity based on the following details:

- For ammeters conventional : 3 VA.
- For current coils of KW & KWH : 5 VA
- For current coils of PF.KVAR meters : 5 VA
- For all recorders conventional : 5 VA
- For normal wiring : 2 VA
- For current coil of protection relays : 10 VA.

The VA rating shall be calculated keeping 30% spare capacity and under no circumstances the VA rating of the CT's will be less than 15 VA. In case of low currents a primary wound CT will be chosen or a higher size ring type CT with 2 or 3 or 4 or 5 turns of primary conductor may be used to get the VA rating at required current ratio.

1.2.8.6. Terminal Blocks:

Terminal boards or block shall be of barrier pattern, stud type having covers of transparent insulating material.

All terminals shall bear a permanent identification number of letter. Terminal blocks shall be of 650 V grades, 10A rated.

Dropping type shorting links shall be provided on terminal block for CT secondary shorting. Terminals used in conjunction with current transformer shall have facilities for shorting out of the output to enable removal of instrumentation.

Terminal blocks shall be of the screw clamp, rail mounted type to IS: 13947, VDE 0611 : Part 1 for connection of copper conductors up to 1000V.

The terminals used shall be suitable for the type of wire to be terminated and current carrying capacity.

Each terminal rail and each individual terminal shall be indelibly marked with a

unique number corresponding to the schematic numbering system.

No more than two cables shall be terminated per clamp. Cross connections shall be used to link adjacent terminals where multiple wire connections are required.

Earth terminals shall be coloured green/yellow and shall clamp to the fixing rail in order to provide earth continuity.
Terminals of different sizes and for different voltage terminations shall be partitioned.

Where un-isolated external voltages may be present, terminals shall be screened and a warning label fitted.

Terminals used in conjunction with current transformers shall have facilities for shorting out of the output to enable removal of instrumentation.

In any terminal arrangement adequate space shall be provided for the neat and logical termination of the incoming wiring. Terminal rails shall have provision for the installation of at least 10% additional terminals.

Terminals within cubicles and enclosures shall not be obscured and shall be easily accessed for installation and testing purposes, without removal of equipment.

1.2.8.7. Anti Condensation Heaters/ Panel Internal Illumination:

Each vertical section of MV switchgear shall incorporate wiring for supplies to anti condensation heaters. The wires will be energized from a single phase supply obtained from a separate distribution board. The heater circuit shall be controlled by a rotary type ON/ OFF switch, HRC fuse or MCB mounted inside the panel and adjustable type thermostat. Multitier cubicles shall have cubicle heater and thermostat for reach vertical panel section.
The heaters shall be located in cable alleys where such alleys are available or shall be located in the bottom portion.

Panels / panel sections shall be provided with fluorescent lamp lighting fixtures of 20W rating protected by HRC fuse and a switch or a MCB located inside the panel.

1.2.8.8. Safety Arrangements:

All terminals, connections, relays and other components which may be “Live” when front access doors are open shall be adequately screened / shrouded.

1.2.8.9. Auxiliary Switches:

Auxiliary switches/ devices shall be supplied as required for indication, protection, metering, controls, interlocking and supervisory purposes. They shall be readily accessible and enclosed in transparent dust proof cover.

1.2.8.10. Panel Internal Wiring:

Inside switchgears, motor control centers, annunciation panels, etc. the wiring for control, signaling, protection and instruments shall be done with PVC insulated copper conductors of minimum 1.5 sq. mm size. Wiring for CT circuits shall be with 2.5 sq.mm copper conductor. The insulation grade for these control wires shall be 1100 V. Inter panel wiring shall be enclosed in PVC wire ducts. Wiring for three phase circuits shall be colour coded red, yellow and blue for identification of relevant phases. For single phase AC circuits white coloured wires shall be used for phase conductor and black coloured for neutral conductor. Grey coloured wires shall be used for DC circuits and green coloured wires for earth connections. Circuits in which the operating voltage exceeds 110V shall be physically segregated from all other wiring. All wiring shall be neatly and securely fixed by insulated cleats or run in insulated wiring troughs. Wiring shall be so arranged that access to any apparatus or connection point is not impeded. Wiring carrying low-level DC signals shall be segregated from AC circuits and screened if recommended by the manufacture of associated equipment/ instruments. Spare contacts available on relays / devices etc. shall be wired up to terminal blocks. Wires shall be joined or tied between terminal points.

Each wire shall be identified at both ends by yellow colour PVC ferrules marked with black letters/ numbers. The letters/ numbers used for marking on ferrules shall correspond with the appropriate wiring diagram. Trip circuit wires shall be distinguished by an additional red colour. Ferrules of other colours, if used, shall be subject to the Employer approval.

Wiring termination shall be made with solder less crimping type tinned copper lugs.

Insulated sleeves shall be provided at all termination.

1.2.9 Main and Auxiliary Bus Bars:

Bus bars shall be of uniform cross section throughout the length and made of high conductivity hard drawn conforming to IS 613.

1.2.9.1. Safety

Access to any enclosure shall be possible only when the circuit isolator is open and unless connections within the enclosure are isolated or fully shrouded against accidental contact.

Where a test facility exists for use with the enclosure door open all live contacts shall be shrouded to prevent accidental contact.

Isolators shall be pad lockable in the 'OFF' position. It shall not be possible to open the assembly door when the isolator is in the 'ON' position.

1.2.9.2. Short Circuit

The short circuit rating of the assemblies shall be suitable for the point of installation in the system. Where possible short circuit protective devices shall be coordinated to ensure that a fault in any outgoing branch does not operate the assembly incoming protection device.

1.2.9.3. Earthing

Assemblies shall be provided with earthing facilities as follows.

For small single compartment assemblies an earth stud shall be provided.

For large single compartment or multi-compartment assemblies a clearly marked continuous Alum./ GI earth bar of minimum 40mm x 5mm shall run the entire length of the assembly and shall be provided with terminals for connections to the metal cladding or armoring of all incoming and outgoing cables. The earth bus size shall be generally 10% of phase size subjected to meeting short circuit conditions and minimum size for any panel shall be 40x5mm.

The temperature rise of the bus bar and connections under fault conditions shall not cause damage to the connections of any equipment to which they may be

connected. The earth fault calculations shall be submitted along with detailed engineering.

No earth terminal bolts or studs shall be less than 8mm diameter.

An earth bond of minimum size 4 sq.mm. Shall be made to all enclosure doors.

1.2.9.4. Labels

The assembly as a whole and each compartment shall be clearly and unambiguously identified.

The labels shall be engraved letters and numbers filled black on a white background.

Warning labels shall be engraved and filled black on a yellow background.

Labels shall be affixed with non-corrodible rivets or screws.

Internal labels shall be used to identify all components and terminal strips. They shall be of plastic in constructions and shall be affixed adjacent to the component to which they appertain.

1.2.10 Internal Wiring Arrangement:

1.2.10.1. Internal Power Distribution

The internal power distribution arrangement for each assembly shall comprise an MCB distribution board arrangement for each voltage present. Separate switches on this board shall be dedicated to individual circuits in order to ease fault finding and to localize faults.

Separate MCB's shall typically be provided for supplies to :

For 240 V AC : Power supplies
: CPU and input modules
: PLC output modules
: Transformers
: Rectifiers
: Each instrumentation loop
: Panel Lighting

: Panel cooling

: Anti-condensation heating

: Internal socket outlets

For 24V DC : DDC input/ Output circuit and modules

Where specified auxiliary contacts shall be fitted to each MCB to indicate a trip.The power supply for PLC & PC to be tapped from true Online UPS providing immunity from mains voltage disturbances.

The 24V DC power shall be derived from a regulated reliable voltage power supply.

1.2.10.2. Arrangement of Internal Components

Internal components shall be laid out in a logical manner in order to provide freedom of access to terminations and to allow removal of any component without interference to adjacent components.

Particular attention shall be paid to the location of heat dissipating equipment such as power supplies etc. in order that they do not have a detrimental effect on adjacent cabling or components.

Where necessary forced ventilation shall be provided by extraction fans mounted in the sides or access doors of the assembly as appropriate. Unless otherwise specified disposable filters shall be provided at the inlet grills. These shall be externally serviceable without affecting the operation of the assembly.
An over-temperature alarm signal shall be provided by the volt free contacts.

1.2.10.3. Terminal Arrangements

Cable entering and leaving an assembly shall do so via suitably positioned terminals.

Terminals shall be arranged in function groups as follows:

- Supply outputs to field devices
- Signal inputs from field devices
- Control output to starter section
- Signal inputs from starter sections
- Signal inputs to telemetry

- Signal outputs form telemetry

  Within each group terminal shall be arranged in subgroups as follows:
- Voltage
- Energized with panel door open
- De-energized with panel door open
- Digital signal
- Analogue signal

Terminals for circuits at voltages greater than 24V that are not de-energized when the assembly door is open shall be screened and labeled accordingly. Wiring for different voltage like A.C. And D.C. shall be carried out by different colour and in case any components/voltage is live even if incomer of the panel is off then it should be labeled along with warning sign and orange colour wire should be used for this type of wiring.

Incoming and outgoing cables to intrinsically safe barriers shall connect to the barriers via knife terminals.

1.2.10.4 Lighting:

Each cubicle of an assembly shall be provided with an internal switched fluorescent luminaire. It shall be positioned to illuminate all internal areas of the assembly cubicle.

1.2.11 Motor Control Gear and Control Panel Assembly Control Facilities

Unless otherwise specified assemblies shall contain dedicated sections for motor drive, starters, common control, instrumentation, lamp test.

1.2.11.1 Motor Drive Starters

All starter modules shall be self-contained. The drives shall have manual and automatic control features selectable by manually positioning a starter mounted automatic/ off/ manual selector switch.

Facilities may also be provided for manual control to be carried out locally or remotely. If this facility is provided a remote/ local selector switch shall be

provided on the starter. In this instance a remote start/ stop station is located adjacent to the drive. This station is only active when the starter is selected 'manual' and 'remote'.

Control in manual mode shall comprise safety controls only.

Control in automatic mode shall comprise safety controls and process controls.

a. Safety controls shall comprise controls necessary for the safe operation and protection of the drive in order to protect the drive itself and/ or personnel. Typically these shall comprise flow check switches, run dry protection, overrun devices, torque switches, overload, over temperature, high pressure, emergency stop devices etc. These devices shall be hard wired direct to the starter and shall be independent of any PLC/ DDC controls that may exist.

b. Process controls typically interact with the drive via a PLC/ DDC or hard wired logic. Typically these shall comprise controls for duty rotation, auto standby, level and flow control, sequencing, start up/ shut down procedures, scheduling etc.

Section of manual control shall enable local drive start/ stop controls at the starter itself or remote manual controls if fitted. In this mode the starter shall operate independent of process controls. All safety controls shall be operative.

Selection of automatic control shall deactivate local and remote manual controls. In this mode the starter shall respond to the dictates of process and safety controls.

For starters module of motors rated for 100 H.P. and above, they shall have (besides above protection) numeric type microprocessor relay along with temperature scanner for windings. There should be minimum two thermocouples /PT 100 devices for each winding. These should be wired from motor to starter.

1.2.11.2 Common Control Section

This section shall house:

Safety controls which are related to drive groups rather than specific drives.

Typically these shall comprise run dry protection (when used in a common sump), group emergency stop control, etc.

Process controls facilities. These facilities shall typically be provided by a PLC. However, unless otherwise specified, hard wired logic will be acceptable for simple control schemes comprising less than twenty control relays.

Lightning protection barriers, if fitted, shall be installed at the base of the section adequately segregated from all other unrelated devices.
The common controls section may also provide facilities for the marshalling of starter module status, alarm and remote control signals in order to facilitate the use of multi core cable connections to remote locations.

The interior of the common control section shall be accessible without isolation of any drive or circuit. Therefore all voltages in excess of 24V shall be screened to prevent access.

Each circuit shall be individually protected by an MCB such that maintenance work can be carried out with the minimum of interference to running pumping station.

The front face of the common control section shall typically be fitted with pumping station controls, status indication and alarm annunciation facilities.

Alarm annunciation facilities shall show drive group faults, non-drive related faults and drive common fault alarms, Specific drive related faults shall be indicated at the drive module itself i.e. the common controls fault annunciator may indicate a fault on drive A but starter module A shall indicate precisely what the fault is.

1.2.11.3 Instrumentation

This section shall house equipment associated with field and panel mounted instrumentation. Lighting protection barriers, if fitted, shall be installed at the base of the section adequately, segregated from all other unrelated devices.

Each circuit shall be protected by an MCB such that maintenance work can be carried out with the minimum of interference to running pumping station.

1.2.11.4 Lamp Test

Facilities shall be provided to test all lamps on an assembly. This shall comprise

a common lamp test section. Operation of the lamp test circuit shall energize a relay in each section of the assembly in order to light each lamp and annunciator. The lamp test circuit shall pass through auxiliary contacts on section isolators if fitted. A short time delay shall ensure that the lamp test supply is retained to allow visual checking of all lamps.

On small assemblies, less than ten starters, individual lamp test buttons on each section shall be acceptable unless otherwise specified.

1.2.11.5 Emergency Stop Circuitry

Each drive or group of drives shall provide with an emergency stop facility which shall comprise a red coloured, mushroom headed, stay-put-twist to release push button.The emergency stop device shall be located adjacent to the drive or drive group to which it relates and shall be clearly labeled.Individual drive emergency stop devices shall be wired directly into the drive starter contactor circuit.

1.2.11.6 Local Control Station

These shall be of heavy duty construction and with the smaller sizes designed for mounting on or near the pumping station to be controlled.The bottom face shall be arranged to accept with adequate space for the use of spanners, gland terminations for the number of cables required. Cables shall enter from the top generally.Terminals provided for interconnections shall be easily accessible and marked with identification numbers/ letters corresponding with the associated diagrams.Indicator lamps shall be not less than 20mm diameter and have projecting lenses with a wide angle of vision.

Pushbuttons and selector switches shall be of heavy duty, oil tight type of matching design. Legend plates shall be provided to identify equipment to be controlled and the purpose of each operating or indicating device.Pendant type control for cranes, hoists, etc. shall be of molded neoprene or equivalent heavy flexible, high impact strength materials, with a long molded-in cable strengthening sleeve, to minimize the possibility of cable fracture at the bending point. The enclosure shall be colored in safety yellow.

1.2.12 HV Switchgear Components:

1.2.12.1. Circuit Breakers:

Circuit breakers shall be vacuum / SF 6 type and of the drawout pattern. SF 6 circuit breakers shall be puffer type or self extinguishing type with rotating arc of dead tank and single pressure design. SF 6 pressure/ destiny monitoring switch/ contacts shall be provided. The short circuit fault level of HT Panel shall be obtained from nearest power distribution agency grid station and shall be taken as minimum 350 MVA. Vacuum breakers shall have completely sealed interrupting units for interruption of arc inside the vacuum. All breakers shall be provided with contact wear guage and we should be able to measure snatch gap below the interruptible vacuum bottle. It shall be possible to isolate easily the vacuum interrupted unit from the breaker operating mechanism for testing of the interrupter.Circuit breakers shall be complete with surge arrestors (if the breaker design necessities the same) to provide protection to the equipment controlled by the breaker, against switching surges. However for motor starting application surge suppressors shall be provided.Circuit breakers shall be fully rated for the specified ambient conditions.

1.2.12.2 Operating Mechanism for Circuit breakers:

The circuit breakers shall be operated by a motor operator spring charging type mechanism. The motor operated spring charges mechanism shall be completed with motor, opening spring, closing spring and all accessories to make the mechanism a complete operating unit. The tripping spring shall be charged by the closing action to enable quick tripping. Closing of the circuit breaker shall automatically initiate recharging of the spring to enable the mechanism to be ready for the next closing stroke. It shall be possible to manually charge the springs in an emergency. Transfer from motor to manual charging shall automatically disconnect the charging motor. The charging mechanism shall be provided with mechanical indicators to show ‘charged’ and ‘discharged ‘conditions of the spring. Failure of any spring, vibration or mechanical shock shall not cause tripping or closing of the circuit breaker. The operating mechanism shall be designed to release the spring to close the circuit breaker only by a deliberate action.Only one closing operation of the circuit

breaker mechanism shall result from each closing impulse (manual / electrical), even though the breaker trips while the control device (manual / electrical) is being held in the 'close' position. The circuit breaker mechanism shall make one complete closing operation, once the control switch has been operated and the first device in the control circuit has responded, even though the control switch is released before the closing operation is complete, subject to the condition that there is no counter- impulse for tripping.Spring of motor operated spring charged mechanisms should not discharge until they are fully charged, and the charging means are disconnected. All switch gear compartment like circuit breaker compartment busbar chamber, CT& cable box compartment should be provided with pressure relief flap. Metallic safety shutters should be provided for busbar spouts and circuit spouts be interlinked with movement of circuit breakers.

All operating mechanisms shall be provided with ON/OFF mechanical indicators.

A local manual trip device shall be provided on the operating indicators.

1.2.12.3. Isolators & earth switches:

Unless otherwise specified isolators and earth switches shall be off-load and fixed type. For vertical isolation type switch gear integral earthing facility for busbar side (for incomer breaker) or circuit side (for outgoing breaker) shall be provided by breaker transfer position principle. For horigontal isolation type switch gear earthing should be provided by integral earthing switch or earthing truck for busbar and circuit side. Mechanical and electrical interlocks shall be provided where applicable to ensure that the isolators cannot be operated unless the associated breakers are open.

1.2.12.4. Circuit Earthing Facility:

It shall be possible to connect each circuit of the switchgear to earth, either through earthing switches or though trunk mounted earthing devices.

Earthing switches shall be mechanically interlocked with the associated breaker/isolator to prevent earthing of live circuit. Necessary NO and NC auxiliary contacts shall be provided on each earth switch for interlocking with the respective

circuit breaker.

1.2.12.5. Relays:

All relays shall be numeric type microprocessor type. Relays shall be equipped with operation indicator LED's for visual indication. On three phase relays with separate phase elements, each phase element shall have separate indicator with phase identification clearly marked. Output elements of over current, earth fault & other relays shall operate through master tripping electro-mechanical relay.

All relays shall be suitable for flush mounting, with only the dust tight covers projecting from the front of the panel. All relays shall be accessible for setting and resetting from the front. Access to setting devices shall be possible only after the front covers of the relays are removed. Resetting facilities shall however be accessible external to the relay case.

All protective relays except auxiliary relays shall be of the drawout type. Where it is not possible to provide protective relays of the drawout pattern due to non manufacturing range, fixed type relays with facilities for plugging in a portable test plug shall be provided. Necessary test plugs shall be furnished along with the relays.All relays shall be provided with positive action flag indicators visible from the front.No control relay except under voltage relays, which would trip a circuit breaker when de-energized, shall be used.Auxiliary relays shall be rated to operate satisfactorily between 80% and 110% of the rated voltage. Tripping relays shall be rated to operate satisfactorily between 50% and 110% of the rated voltage. The successful bidder shall prepare coordination chart of all relays with the help of graphic chart and shall submit it for approval. The successful bidder has to ensure that only immediate relay trips first.

1.2.12.6. Current Transformers (CTs)

All current transformers shall have a short time current rating of not less than that of the switchgear in which they are incorporated. CTs shall be resin cast type and shall have class 1.0. Rating of CT's shall be worked out in such a way that 30% spare VA capacity is available.

Duplicate rating labels shall be fitted on the exterior of the mounting chambers

suitably located to enable reading without the removal of cover or metal sheeting forming part of the structure of the switchboards.

1.2.12.7. Voltage Transformers (VTs):

Voltage transformers shall be supplied where required. They shall have a winding ratio to give voltage between lines of 110V on the secondary. They shall have a rated burden, at the stated accuracy, in accordance with the requirements of all connected instruments, meters and relays and of any instruments or meter to which they may be connected via test blocks.

The primary circuit shall be protected by HRC fuses having a short circuit rating of not less than that of the Switchgear. The connection between the fuses and the switchgear primary conductors shall be capable of withstanding the short time current of the switchgear.

The secondary circuit shall be protected by HRC fuses mounted as closely as possible to the secondary terminals. The fuses shall have safe access for replacement without the necessity for complete isolation of the switchgear.

Windings for metering circuit shall have accuracy class 1.0 and those for protective circuits shall have accuracy class 5 P10.
VT shall shave continuous over voltage factor of 1.2 and short time over voltage factor 1.5 for 30 seconds for effectively earthed system and in case of resistively earthed system or non- effectively earthed system, the short time over voltage factor shall be 1.9 for 30 secs.

1.2.13. Switch Tripping Unit (Batteries, Battery Chargers and DC Distribution Boards)

1.2.13.1. General

Switch tripping unit shall comprise battery, charger and DC distribution board housed in a common sheet steel enclosure. The enclosure shall be of cold rolled cold annealed (CRCA) and thickness shall not be less than 2mm. Enclosure shall be of indoor, floor standing, totally enclosed, dust, damp and vermin proof of adequate strength and rigidity. Degree of protection shall be IP-42.The equipment

shall be so housed in the cabinet as to facilitate easy inspection and maintenance. To prevent accident all live parts inside the cabinet shall as far as possible be adequately insulated to avoid contact during maintenance.All external fasteners shall be cadmium plated/ zinc passivated to withstand the atmosphere conditions. The cabinet shall be complete with all necessary wiring, cable glands and sockets for incoming and outgoing circuits and suitable circuit label/inscriptions made of non-rusting metal, 3 ply lamicoid or engraved PVC. Two earthing terminals shall be provided to earth the cabinet.All the steel works of the cabinet shall be painted after suitable pretreatment with anti-rust paint and special finishing paint. The internal surface shall be painted in white and the external surface in dark admiralty gray colour.

1.2.13.2. Battery

Batteries shall be of high performance 30V DC lead acid SMF conforming to relevant IS. The battery calculations shall be attached with the bid.Batteries shall be suitably sized to supply the control requirements of HT and LT breakers and Annunciations wherever required.Batteries shall have cells housed in translucent, high impact plastic containers. The containers shall be fitted with vented filler pumps. High and low electrolyte levels shall be permanently marked on the container.Cell terminals shall be of bolted type. The terminal polarity shall be permanently marked.Battery cells shall be arranged so that each is accessible for test and inspection. Cells shall be arranged in single steps, double tier rack formation and shall be not less than 300mm above floor level.Batteries shall be supplied complete with all necessary connections. The connections between tiers and cells and disconnection links and fuses shall be of the multi-stranded plastic insulated type.The battery rack shall be made of mild steel painted with alkali resistant paints and shall be supplied in knocked down condition which could be bolted and assembled at site. The batteries shall rest on treated wooden planks inside battery racks.

1.2.13.3. Battery Charger

Battery Charger shall conform to relevant and IS code. The charger shall be a float

cum boost charger suitable for rating lead acid cells upto 1.85V per cell and also capable of quick charging the battery upto 2.2V / cell. The charger should be able to supply continuous DC load during boost charging with 10% margin.

1.2.13.4. Terminal Arrangement

The Battery and Battery Charger shall have terminals suitable for connecting PVC insulated, armoured aluminum cables. Approved type of terminal lugs and screwed type glands for the entry of cables in the panels shall be provided.

1.2.13.5. Accessories

Each battery shall be complete with all accessories and devices including but not limited to the following:

i. Battery stands

ii. Set of inter-cell, inter-row and inter-bank connectors and number plates as required for the complete installation.

One number each of the following accessories shall be supplied with each battery unit.

i. I-centre zero cell testing voltmeter to IS: 1248 scaled 3-0-3 volts/

ii. Plastic filling bottle

iii. Insulated box spanner

iv. Insulated tommy bar

v. End lugs

vi. Bellavee washers

vii. Lugged inter row cable

viii. Vent caps

Battery Charger and DCDB shall be provided with the following Components.

I. Double pole rotary switch for AC input

II. HRC fuses with fittings for the above

III. Pilot lamp to indicate the equipment ON condition

IV. Variance to give step less control of DC output voltage from 0-48V.

V. Double wound, impregnated, naturally air cooled single phase mains

transformer with taps.

VI. Single phase, full wave bridge connected, silicon controlled rectifiers. Stack with RC net work for each SCR for surge suppression.

VII. Filter circuit to reduce the ripple content to 3% RMS

VIII. Moving coil ammeter of suitable range and size to measure the DC output current

IX. Moving coil voltmeter of suitable range and size to measure the DC output voltage.

X. HRC fuses with fittings for DC output

XI. Voltage dropping diode with selector switch and contactor

XII. Cable connection from battery to charger

XIII. Cubicle internal light operated form a 240V, single phase, AC system with on-off switch.

XIV. Battery earth leakage relay comprising of solid state sensing/ triggering circuit with electromagnetic relay with center zero millimeter isolating switch and fuse.

XV. Space heater suitable for operation on 240V, 1 phase, 50 hz, A.C system with ON-OFF switch.

XVI. Local auto/visual annunciations for the following faulty conditions shall be provided for:

a. Mains fuse failure

b. Rectifier fuse failure

c. Capacitor fuse failure

d. D.C output overload

e. Rectifier control supply failure

1.2.13.6. DC Power Supply:

The Power supplies will operate from 240V AC, and produce a 24V and 48V DC output voltage at full load current

Voltage regulation : 0.02% for ± 10% mains voltage variation

Load regulation : 0.3% form zero to full load conditions

Triple at full load : <1 mV rms

The power supply shall incorporate an over voltage protection circuit, the components of which shall be independent of the voltage regulating circuit.
The protection circuit shall operate within 50ms of an over voltage occurring and shall cause rupturing of the mains input or output fuses.

Automatic reset of the over voltage protection circuit is not permitted.

1.2.14. Harmonic Filter

Harmonics generated in electrical systems shall be limited to directives of IEEE519. If harmonics are exceeding than limits specified in IEEE519; necessary harmonic filters (Active or Passive) shall be provide to control them within specified limit.

1.2.15 Motors

The bidder shall strictly adhere to following condition while selection of motor:

i. Motors of 3000 rpm are not acceptable. In turn the bidder shall not consider pumps/ drives of 3000 rpm/ 2900 rpm. 2 pole motor shall not be considered anywhere in the project.

ii. Bidder shall take in general 15% additional safety factor while selecting the motor's KW. Bidder while selecting motor size shall take 25% safety margin for motors upto 5 KW and 15% safety margin for motors rated above 5 KW. Safety margin is defined as safety on top of EKW required by pump plus efficiency of motor.

iii. All the motor shall be provided with class F insulation and with temperature rise limit of B class above ambient temperature when operating at full load.

iv. All the motors shall have overloading capacity as per latest revision of IS.

v. The noise level during the operation of the pump sets/ drive shall not exceed 85 dBA at a distance of 1.86 m from the pump/drive.

vi. The mechanical vibration limits shall be as required by BS 4675: Part 1 to class

III, subclass B or better. Vibration measurements on the drive and non drive end of motor bearing, pump bearing housing and base plates shall not exceed 2.8 mm/sec. RMS within ± 10% rated head, while the limit is 4.5 mm/sec RMS for balanced portion from shut off to maximum flow. The above indicated vibrations shall be measured at the manufacturer's works during testing. For the purpose of guarantees the site tests shall govern.

vii. All motor shall be on LT system. However, the motors above 75 KW shall be of slip ring type.

1.2.16. Lighting Fixtures:

1.2.16.1. Luminaries

a. Luminaries shall be designed for continuous trouble-free operation without reduction in lamp life or without deterioration of materials and internal wiring. Outdoor fitting shall be weather-proof and rain proof type confirming to minimum IP-54 protection.

b. The luminaries shall be designed so as to facilitate easy maintenance. Including cleaning, replacement of lamps/ starters etc.

c. Connections between different components shall be made in such a way that they will not work loose by small vibration.

d. All luminaries shall be supplied complete with lamps suitable for operation on a supply voltage and the variation in supply voltage and frequency indicated in the Employer's Requirement.

e. Fluorescent type, metal halide and sodium vapour type luminaries shall be complete with accessories like lamps, ballasts, power factor improvement capacitors, starters, re-wireable fuse and fuse base. These shall be mounted as for as possible in the luminaire housing only. If these cannot be accommodated integral with the Luminaires then a separate metal enclosed control gear box shall be included to accommodate the control accessories together with a terminal block suitable for loop-in, loop-out connections. Outdoor type fixtures shall be provided with outdoor type weather-proof box. No mercury vapour

lamps shall be used indoor & outdoor. Mainly sodium vapour lamps shall be used outdoor.

f. Fluorescent type Luminaires with single or double lamp shall be provided with electronic ballasts and these luminaire shall be used upto maximum height of five meters..

g. Each luminaire shall have a terminal block suitable for loop-in loop-out and T-off connection by 250/ 400V, 1 core, PVC insulated copper/ aluminum conductor wires up to 4 sq.mm. in size. In outdoor areas the termination at the luminaire shall be suitable for 1100V, PVC insulated, copper/ aluminum conductor, armoured cables of sizes upto 6 sq.mm. alum. conductor or suitably sizes cable as per design. Terminals shall be of stud of clamp type. The internal wiring shall be by means of insulated copper wire of minimum 1.5 sq.mm. size and terminated on the terminal block. Terminal blocks shall be mounted with minimum two fixing screws.

h. Mounted facility and conduit knock-outs for the luminaries shall be provided.

i. Earthing

1. Each Luminaire and control gear box shall be provided with an earthing terminal.

2. All metal or metal enclosed parts of the luminaire/ control gear box shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity

j. Painting/ Finish

- All surfaces of the luminaire control gear housing accessories shall be thoroughly cleared and degreased. It shall be free from scale, rust, sharp, edges and burrs.
- The luminaire housing shall be stove-enameled/ epoxy stove-enameled - vitreous enameled or Anodized as indicated under various types of fittings.

1.2.16.2. Decorative Luminaire

Fluorescent Luminaires shall be provided as per following guide lines :

a. These luminaries shall be generally indoor type provided with cold rolled cold annealed (CRCA) sheet steel channel/ rail cum reflector housing complete with all electrical control accessories mounted on it. The finish shall be stove enameled.
b. Decorative fluorescent type luminaries shall be provided with aluminum louvers providing minimum glare at work station.
c. Luminaires shall be suitable for the number of lamps of specified wattage, direct mounting on ceiling/ wall/ column pendant mounting or for recess mounting in false ceiling.
d. Decorative luminaries with mirror optic reflectors shall be of the wide angle dispersion type. Where these luminaries are mounted in control rooms and computer rooms, clip-on type adjustable reflectors which can be attached onto the tube shall be provided to direct the light output in the desired direction. This is mainly to reduce reflection of the light source form TV/ monitor screens.
e. Luminaires mounted recessed in false ceiling shall be with reflector housing and spring loaded fixing arrangement for the diffuser/ louver frame. It shall be possible to have access to the lamp and other accessories from below.

1.2.16.3 Industrial Luminaires

Fluorescent Luminaires shall be provided as per following guidelines:

a. The luminaire shall be provided with CRCA sheet steel mounting rail with reflector of minimum 22 SWG thickness and complete with all control accessories mounted on it. The finish shall be vitreous enameled.
b. Luminaires shall be suitable for the number of lamps of specified wattage, direct mounting on ceiling/ wall/ column/ pendent mounting.
c. The distribution of light shall be such that at least 80% of the total luminous flux from the luminaire shall be in the lower hemisphere.
d. The luminous output of the luminaire with reflector shall hot be less than 75% irrespective of type of reflector used.
E. Luminaires for use in areas where chlorine is stored or dosed shall be fully enclosed to IP-65 and have a luminaire body constructed of GRP or some

other non-metallic material resistant to attack by chlorine.

1.2.16.4. Incandescent/ Metal Halide / Sodium Vapour Luminaires

1.2.16.4.1. Bulk head Luminare

- The Luminare shall be robust construction, with cast aluminum/ vitreous enamelled housing, heat and shock resistant prismatic or clear glass cover fixed with neoprene gaskets for sealing. For mechanical protection to the glass cover, round steel wire guard with vitreous enameled finish shall be provided.

- The Luminare shall be suitable for incandescent lamp up to 150 watts, for direct mounting to ceiling/ walls/ column and used for general purpose indoor lighting.

1.2.16.4.2. High and Medium Bay Luminaires

High medium bay luminaries shall be with cast aluminum housing, anodized aluminum mirror polished reflector canopy with eye bolt for suspension, cooling fins and glass cover.

- The luminaire shall be suitable for metal halide up to 1000W and sodium vapour lamps up to 400 watts. The control gear accessories shall be mounted integral with the luminaire.

- High bay luminaries shall be used when the mounting height is above 8 meters while medium bay luminaries shall be used when the mounting height is around 5 to 8 meters.

1.2.16.4.3. Flood Light Luminaries

a. General purpose flood Light Luminaries

10. Flood Light luminaries shall be of weather proof construction with cast aluminum housing, anodized aluminum mirror polished reflector, heat resistant, toughened glass cover and necessary neoprene gaskets to prevent ingress of dust. The housing shall be supported on a cast iron base and capable of being swiveled in both horizontal and vertical directions and locked in any desired position.For focusing purposes, knobs, shall be provided along with sector plate indicating the angle in degrees between 0-90 degrees, in vertical

direction.The Luminaries shall be suitable for single and dual metal halide or sodium vapour lamps up to 400 watts. When metal halide or sodium vapour lamp specified, the same shall be mounted in a separate sheet metal enclosed/ cast aluminum weather proof control gear box. The luminaries shall be provided with cable gland on the canopy in down ward direction for cable connection. It shall be possible to adjust the lamp position to achieve wide beam, medium beam or marrow beam. It shall be possible to replace the lamp from the canopy without opening the front glass.

b. Outdoor Lantern Luminaires Post top Lantern

- Post top lantern Luminaires shall be generally outdoor weather proof type of illumination of walkways, gate posts, gardens or in front of office area only.
- The luminare shall have cast aluminum spigot of 50/60 diameter finished with corrosion proof paint for mounting, opal acrylic or high density polyethylene (HDP) diffuser bowl, complete with integral mounted control gear, neoprene gaskets, earthing terminal etc.

1.2.16.4.4. Street Lighting Luminaires

a. Fluorescent Luminaries:

- Street lighting fluorescent luminaire shall be outdoor weather proof type for illumination of secondary roads, walkways, peripheral lighting of buildings etc.
- The luminaire shall be of semi-cut off or non-cut off type, CRCA sheet steel housing, vitreous enamelled, plain or corrugated clear acrylic cover, complete with integral mounted control gear, neoprene gaskets, side pipe entry or top suspension type.
- The outdoor luminaire shall have IP 55 enclosure.

b. Sodium vapour luminaries

- Street light sodium vapour luminaries shall be outdoor weather proof type for illumination of main roads, traffic islands etc.
- The Luminaire shall be of semi-cut off with cast aluminum housing, acrylic or prismatic cover, polished aluminum reflectors, complete with integral mounted control gear, neoprene gaskets and with near pipe entry.

- The luminaire shall be suitable for 1 x 150W/ 1 x 250W/ 2 x 150W / 2 x 250W sodium vapour lamp and for mounting heights up to 9 meters from natural ground level.

c. Emergency Light Luminaires

- Emergency light of installite luminaire shall be indoor type for providing emergency light during failure of normal AC supply.
- The luminaire shall be with CRCA sheet steel enclosure, complete with metallised mirror reflector, leak proof re-chargeable battery rated for two hour discharge, battery charger, charger-on lamp, push button switches, automatic changeover switch/ relay, two meter length cord with plug, mounting pads and other accessories required for satisfactory operation of the luminaire.
- The luminaire shall be suitable for connection to 240V, 50 Hz single phase supply. On failure of normal A.C supply the luminaire shall pick-up automatically and on restoration of A.C supply the luminaire shall switch off automatically. The luminaire shall be suitable for incandescent lamp up to 40W or flurescent lamp up to 20 watts.

1.2.16.4.5. Accessories for Luminaires

a. Reflector

- The reflectors shall be made of CRCA sheet/ aluminum/ silvered glass/ chromium plated sheet copper as indicated for above mentioned luminaries.
- The thickness of steel/ aluminum shall comply with relevant standards. Reflectors made of steel shall have vitreous enameled finished. Aluminum used for reflector shall be anodized/ epoxy stove enameled/ mirror polished. The finish for the reflector shall be as indicated for above mentioned fittings.
- Reflectors shall be free from scratches or blisters and shall have smooth and glossy surface.
- Reflectors shall be readily removable from the housing for cleaning and maintenance without disturbing the lamps and without the use of tools. They shall be securely fixed to the housing by means of positive fastening device of captive type.

b. Lamp/ Starter Holders

- Lamp holders shall have low contact resistance, shall be resistant to wear and shall be suitable for operation at the specified temperature without deterioration in insulation value. They shall hold the lamps in position under normal condition of shock and vibration met wit under normal installation and use.
- Lamp holders for the fluorescent lamps shall be of the spring loaded bi-pin rotor type. Live parts of the lamps holder shall not be exposed during insertion or removal of lamp or after the lamp has been taken out. The lamp holder contacts shall provide adequate pressure on the lamp cap pins when the lamp is in working position.
- Lamp holders for incandescent, mercury vapour and sodium vapur lamps shall be of Edison Screw (E.S.) type.
- The starter holder shall be so designed that they are mechanically robust and free from any operational difficulties. They shall be capable of withstanding the shocks met within normal transit, installation and use.

c. Ballasts (Electronic)

- The ballasts shall be designed to have a long service life, low power loss & high power factor.
- Ballasts shall be mounted using self-locking, anti-vibration fixings and shall be easy to remove without demounting the fittings. They shall be in dust tight, noncombustible enclosures.
- Separate electronic ballast for each lamp shall be provided in case of multi lamp luminaries, except in the case of 2 x 20W luminaries.
- Electronic ballast shall have very high power factor (more than 0.95) and harmonic distortion shall be less than 10%.
- Voltage variation of ballast shall be between 140-320V.

d. Lamps

<u>Incandescent lamp</u>

- General Lighting Service (GLS shall be tungsten filament incandescent type. The filament shall be coiled coil type rated for 230/250V, single phase A.C.

- Lamps shall be with Edison Screw type metal lamp caps.
- Lamps shall milky white for diffused, soft, glare free lighting and rated up to 100 watts.

Fluorescent Lamps

- Fluorescent lamps shall be low pressure metal halide type with low wattage consumption and high efficiency and longer burning life (above 2500 hours).
- Lamps shall be of white light type suitable for operation on 240V, single phase A.C in standard lengths of 2, 4 and 5 feet and ratings upto 65 watts.
- Lamps shall be provided with features to avoid blackening of lamp ends.

High intensity discharge lamp

These lamps include high pressure metal halide lamps and high pressure sodium vapour lamps.

- High pressure metal halide lamp shall be with quartz discharge tube, internal coated shall, quick restrike time (of within 8 minutes) and with burning life (above 10000 hours) in standard ratings up to 400 watts.
- High pressure sodium vapour lamp shall be with polycrystalline translucent, coated discharge tube, coated shell, quick restrike time (of within 5 minutes) and with burning life (above 10,000 hours) in standard rating up to 400 watts.

1.2.16.5. Lighting System Equipment - Main Lighting Distribution Boards and Lighting Panels (AC & DC)

Construction Features

Boards and panels shall be sheet steel enclosed and shall be fully dust and vermin proof, providing a degree of protection of IP-52. Outdoor panels shall in addition be completely weather-proof with a sloping canopy for protection against rain and providing a degree of protection of IP-55. The sheet steel used for frame shall be cold rolled of 2.0mm thick or 2.5 mm hot rolled and all frame enclosures, doors, covers along with partitions will be of same thickness.

All boards and panels shall be provided with hinged doors for access to equipment. Doors shall be gasketted all round with neoprene gaskets. For the main floor mounted distribution boards with the switch fuse units arranged in tier formation,

the hinged door of each unit shall be interlocked so as to prevent opening of the door when the switch is ON and to prevent closing of the switch with door not fully closed. However, a device for by-passing the door interlock shall be provided to enable the operation of the switch with the door open, when necessary, for examination/ maintenance. For wall mounting 1- phase ways lighting panels wherever provided with MCBs, arranged latched front door shall be provided with key-locking facility and slotted bakelite sheet shall be provided inside. Only the MCBs operating knobs or the fuse cap covers shall project out of the bakelite sheet slots for safe operation and neat appearance. Incomer to lighting panels shall be provided with TPN MCB with RCCB. Lighting panels shall be manufactured with 1.6 mm cold rolled sheet.

All accessible live connections/ metals shall be shrouded and it shall be possible to change individual fuses, switches, MCBs from the front of the board panels without danger contact with live metal.For floor mounting type distribution boards, adequately sized mounting channel shall be supplied and for wall/ column/ structure mounting type panels suitable mounting straps shall be provided.Adequate interior cabling space and suitable removable cable entry plates shall be provided for top/ bottom entry of cables through glands and or conduits as required. Necessary number of glands to suit the specified cable sizes shall be provided. Cable glands shall be screwed on type and made of brass.

Two earthing terminals shall be provided.All sheet steel parts shall be undergo rust-proofing process which should include degrading de-scaling and a recognized phosphating process. The steel works shall be then painted with two coats of Zinc-chromate primer and two coats of final stove-enameled finish paint of specified colours.

1.2.16.6. 415V, 3 Phase Switch Socket Outlets (Receptacles):

Switch socket outlets shall be suitable for operation on 3 phase, 4 wire, 50 Hz supply system. The switches and sockets shall conform to relevant standards. These units shall be housed in epoxy painted sheet steel boxes and shall be suitable for outdoor installation. The units shall be fed from power distribution boards /

switchgear etc. located in relevant areas

1.2.16.7. Receptacles (Lighting and Small Power) :

Decorative and industrial type receptacle (receptacle means a combination of a socket and a switch) units of approved make with switches shall be supplied. The units shall be suitable for mounting flush or within painted sheet steel boxes. Decorative receptacles shall be 5A / 15A rated with 5 pin sockets and 15A switches. Industrial receptacles shall be of 20A rating along with MCB.

1.2.17. Ceiling Fans & Exhaust Fans:

Ceiling fans shall be provided in areas such as offices, stores etc. Adequate ventilation arrangements shall be made for enclosed areas where ceilings fans are not proposed to be installed or cannot be provided.

Power supply for the ceiling fans shall be derived from lighting circuits. Ceiling fans shall be complete with all accessories. Regulators shall be electronic type. Heavy duty exhaust fans shall be installed in plant rooms as to achieve a 20 air changes per hour.

1.2.18. Diesel Generator:

The Scope of Work covers the design, Manufacturer; testing supply of suitable capacity D.G. set which including the following:

a) Alternator along with its excitation system auxiliaries, circuits, control panel, metering and protection circuits.

b) Diesel engine along with its accessories and starting system.

c) Flexible / semi flexible couplings.

d) Common heavy-duty channel for base frame supported by anti-vibration damper at bottom.

e) Cooling arrangements etc.

f) Exhaust piping with heavy-duty residential type silencer, insulation of exhaust piping and etc height of piping as per pollution control regulation.

g) Starting lead Acid batteries with battery charger having trickle and boost

charging arrangements complete with Ammeter with switch and voltmeter with fuse and switch to read battery voltage, starting motor, fuel oil, service tank, fuel oil piping etc.

h) All control and power wiring between D.G. set, control panel batteries, safety controls, pumps and AMF panel etc.

i) First fill of fuel oil, lubricating oil; etc including cleaning and flushing out of the system after the test at manufacture facility.

j) Fuel and oil for testing, trials runs and up to commissioning

k) Obtaining all licenses, approval from local authorities including but not limited to any or all of the following:

1) Electric Supply Utility.

2) Electrical Inspector of Govt. of Maharashtra.

3) Pollution Control Board.

4) Fire Department of the local Fire Brigade.

5) Traffic Advisory Committee.

6) Municipal Corporation.

All requirement offered shall be provide design and reliable in operation. Diesel Generator set capacity specified is at site condition.

The Tenderer shall specify in detail all equipment offered including auxiliaries, associated piping, cabling based on typical layout

DG set with individual Auto Transfer starting facilities is required to provide electric power to the essential loads in the events of failure of normal power supply or when normal supply is switched off under abnormal conditions like fire. When normal power fails or is tripped manually, the D.G. set should start automatically and restore electrical supply for essential loads. It should have provision to start all the equipments one by one so as to reduce higher starting current. The DG set shall also run continuously to supply power to the loads till restoration of normal power supply.

The starting time of the DG set should be as less as possible, but not exceeding 15 sec. to come on load. In case the first starting operation is not successful, two

more attempts with preset time intervals should be attempts; the particular set should be locked out. When an engine speeds up and alternator develops desired voltage in frequency, generator circuit breakers will be switched on.

Both the engine and Generator shall be rated for continuous duty at full load and have an overload capacity of 10% for an hour in 12 hours operation. The excitation system shall be designed to maintain the rated voltage constant even if a load of 150% of rated load is imposed on to the Generator for duration of 15 secs. Tenderer shall indicate power consumed by auxiliaries along with the Tender document.The diesel engine shall be indoors type, multi cylinder, totally enclosed, continuous duty, direct fuel injection, series Turbo charged compression ignition, complete with its self-contained lubricating system. The lube oil system shall be provided with Engine Driven Lube Oil Pump only.

The Contractor shall carry out the installation of the DG sets including but not limited to the following:

a) Installation of the DG Set, testing, commissioning, alignment, mounting along with AVM pads on ready floor, foundation to be made by the Contractor and the cost shall be included in the rate for supply and installation of the D.G. set.

b) Installation of fuel oil system complete with day tank and Lube oil system with necessary piping, valves, fittings, supports, etc.

c) Installation of air intake system, exhaust gas system complete with residential type silencer, expansion bellows, etc. and necessary piping, valve, fitting. Supports etc.

d) Installation of Auto Transfer Switch and any other electrical panel.

e) The Contractor to supply and install the required 8" dia MS exhaust pipe upto the required height (as stipulated by Pollution Control Board Authorities) above the building in which the D.G. set are housed. The scope also includes providing insulation.

f) Installation and charging of battery along with leads, battery stand, etc.

The fuel used for the DG set shall be High-speed diesel (HSD) only. The day tank

shall be filled manually by operating Hand pump. In order to transfer fuel from day tank to engine has to be done through fuel transfer pump which should be engine driven only. The fuel oil day tank shall be provided with gauge glass, filling, drainage and vent connections with valves. Radiator shall be offered by the Contractor to cool the water received from the engine or any other cooling system as specified by Engineer-in-charge.Manual Electrical starting arrangements of the engine in case of power failure shall be provided. The system will consist of DC starter motor mounted on turning gear will receive power from the set of 24V DC Batteries.The generator shall also conform to 15 4722 or equivalent.

Tests

1. Equipment shall be tested to conform to the appropriate standard and the following tests shall be conducted in the presence of purchasers.
2. Functional tests, continuity tests and high voltage test on control panel to establish the performance called for in the specification.
3. Power frequency voltage test on switchgear and mechanical / electrical operation check.
4. Routine test for alternator as per IS 4722.
5. Over speed test (1.2 times the rated speed for 2 minutes)
6. Transient response tests for sudden application and rejection of loads of 25°/0/ 50%, 75%, and 100% of rated capacity.
7. Wave from test (type test result are acceptable).
8. Please sequence test.
9. Vibration test.
10. Noise level test
11. Dimensional and alignment.

1.2.19. Samples:

Contractor shall be required to obtain the Employer approval for samples of items such as lighting fixtures of each type, ceiling fans, switch socket outlets of each type and rating, light/fan control switch of each type and rating, push buttons, conduits of various sizes, junction boxes, cable trays, wires and earthing

conductor to be used for lighting system etc. before commencement of installation work.

1.3. DRAWINGS:

Following minimum data / information shall be made available on contractors drawing:

a). Single line diagrams for AC and DC system.

i). All equipment with rating.

ii). Cable details for all circuits.

iii). Details of relays and major components related associated with each circuit.

iv). Bus bar details makes of equipment/ components.

v). Relevant reference drawings.

b). General arrangement drawings (equipment, cabling, earthing, lighting, lightning protection etc.).

i). Dimensional layout drawing composite layout of these items.

ii). Plans and sections as required to show access space/ clearances etc.

iii). Civil foundation details, details of cutouts, openings, supporting/ mounting details etc.

iv). Bill of material, identification of components / rooms / area etc.

1.4. INSPECTION OF EQUIPMENT:

a) All equipment shall be offered for inspection by the contractor. Inspections shall be carried out at the works of relevant manufacturers in the presence of the Employer's representative. Routine type and acceptance tests as applicable shall be carried out during inspection. Tests and test procedures detailed in relevant standards shall be adopted.

b) All measuring/ test instruments used for such tests shall be calibrated and certified by an approved independent testing authority. Supporting calibration certificates shall be provided. The Employer representative reserves the right to impound any instrument immediately after test for independent testing. A certificate shall be provided by the contractor prior to carrying out every test showing the readings obtained, calculations and full of the calibration certificates

referred to. On the day of testing, calibration validity shall not have expired.

c). Items of equipment/system not covered by standards shall be tested in accordance with the details and programd agreed between the employer and contractor.

d). If during or after testing any item of equipment/systems fails to achieve its intended duty or otherwise prove defective it shall be modified or altered as necessary, retested and reinspected as required by the Employer.

e). No equipment / system is to be delivered to site without inspection having been carried out or officially waived in writing by Employer representative.

1.5. INSTALLATION WORK:

Equipment shall be installed in a neat, workman like manner so that it is level, plumb, square and properly aligned and oriented. Tolerance shall be as established in the manufactures drawing or as stipulated by Employer. No equipment shall be permanently bolted down to foundation of structure until the alignment has been checked and found acceptable by Employer.Manufacturer's drawings, instructions and recommendation shall be correctly followed in handling, setting, testing and commissioning of equipment.Contractor shall be required to obtain approval of Employer in respect of sample installations at commencement of any installation activity, these may include but be not limited to activities such as mounting of lighting fixtures/switch socket/switches/junction boxes etc., cable terminations, fixing of supports for cables/conduits etc., alignment/routes of cable/conduits/cable trays etc. More details in this regard shall be finalized with the contractor at site.

1.6. INSTRUMENTATION

1.6.1 Flow Measuring System

Flow measuring system shall consist of flow sensor/ transducers, flow computer and flow transmitter.

Flow transducers shall be rugged in construction and shall be suitable for continuous operation. Flow transducers shall have waterproof construction and

shall be suitable for installation in underground/ above ground pipeline.To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow sensor shall be provided in accordance with the requirements of the flow meter manufacturer.The flow transmitter shall be suitable for field or panel mounting and shall accept an input from the flow sensor. It shall process the input signal and provide 4-20 mA dc output proportional to flow rate. The flow range shall be adjustable.A zero span adjustment facility shall be provided for flow transmitter and indicator.Flow measurement shall not be affected by physical properties of sewage viz., temperature, pressure, viscosity, density etc., within given limits. Contractor shall provide compensating electronic circuits if required. The overall accuracy of flow measuring systems shall be at least ±1.0% of the measured value unless otherwise stated.

1.6.1.1. Electromagnetic Flow meter

Full bore electromagnetic flow meter shall consist of flow sensors (i.e. flow tube), transmitter and remote flow indicator cum integrator.The flow meter shall have flanged connection and shall be inserted in the sludge line.The flow computer/ transmitter shall be microprocessor based and shall have diagnosis facility.Remote flow indicator cum integrator shall be provided on the control panel.

To ensure full electromagnetic compatibility the flow tube flanges and transmitter housing shall be connected earth.

1.6.1.2. Open Channel Flow Meter

Open channel flow measuring system shall consist of level transducer, flow computer and flow transmitter. The level of the fluid in the flume shall be measured by the ultrasonic level transducer. The level measured shall be used along with the physical characteristics of the flume to compute the flow rate.

The level transducer shall be suitable for flange or bracket mounting as required and shall be environmentally protected as per IP65. it shall have ambient temperature compensation and adjustable datum setting facilities.The design and

application of ultrasonic level meter shall take into account the channel construction, the material size, shape, environment, process fluid or material, the presence of foam granules, size etc.The installation shall avoid any degradation of performance from spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuation, specific gravity changes and condensation. For application where spurious reflections are unavoidable the control unit shall be provided with facilities for spurious reflection rejection.The structure required for supporting the level sensor, platform, railings etc. shall be in the Contractor's scope.

1.6.2 Level Measuring System

1.6.2.1. Ultrasonic Level Meters

Ultrasonic level measuring devices applied for liquid level measurement shall comprise a transducer, control unit and remote indicator.

The transducer shall be suitable for flange or bracket mounting as required and shall be environmentally protected to IP 65.

The design and application of ultrasonic level meters shall take into account the vessel or channel construction, the material, size, shape, environment, process fluid or material, the presence of foam granules, size etc.

The installation shall avoid any degradation of performance from spurious reflections, absorption, sound velocity variations, sensor detection area, temperature fluctuations, specific gravity changes and condensation. For applications where spurious reflections are unavoidable the control unit shall be provided with facilities for spurious reflection rejection.

If turbulence exists, shielding, stilling tubes or other measures shall be provided to avoid effects on the measurement.

1.6.2.2. Conductivity Level Switches

The electrodes used for conductivity level switches shall be stainless steel. Single electrode systems (one electrode per holder) shall be used (except where their use is impractical) with insulated electrodes such that only the tip of each electrode is

exposed to the liquid at the operating level.Relay or control units operating with level electrodes shall have adjustable sensitivity. Electrodes for use in fluids of low or variable conductivity shall be fitted with conductivity discs.Where relay or control units are not mounted in control panel, they shall be provided with surface mounting enclosures with a degree of protection to IP-54 for indoor locations or IP 65 for outdoor location.

1.6.2.3. Ultrasonic Differential Level Measuring System

The ultrasonic type differential level measuring system shall consist of ultrasonic type level sensors on upstream and downstream of screens, differential level computer / transmitter and indicator.The flow computer / transmitter shall be microprocessor based and shall have facility for programming (i.e. adjustment of set points).The ultrasonic transducer shall be suitable for flange or bracket mounting as required and shall be environmentally protected as per IP-65. It shall have ambient temperature compensation and adjustable datum setting facilities.

1.6.3. Pressure Gauges

Pressure gauges shall comply with BS 1780. Snubber shall be provided where the gauge is subjected to pressure pulsations and / or vibrations. The internal parts of pressure guage shall be of stainless steel material. In chlorine applications the diaphragm shall be silver or tantalum for other fluids an appropriate diaphragm material shall be used. The pressure gauges shall be provided with diaphragm seal arrangement.The minimum diameter for round pressure gauges shall be 150mm unless specified otherwise or where the gauge forms part of a standard item of equipment.The accuracy of pressure gauges shall be ±1% over the operating range.The zero and span of pressure gauges shall not change by more than ±0.1% of the span per __^{O}C changes in ambient temperature.

1.6.4. Surge Protection Devices

Surge protection devices (SPDs) shall be suitable for withstanding the surge arising out of high energy static discharge / lighting strikes and protect the instrument to which it is connected against damage. SPDs shall provide protection through the

use of quick acting semi conductors like Tranzorb, zener diodes, varistors and an automatic disconnect and reset circuit. SPDs shall be passive and shall require negligible power for operation. During the occurrence of a surge it shall clamp on the allowable voltage and pass the excess voltage to the ground. The SPD shall be self resetting to minimize the down time of the measurement loop.SPDs shall be provided to protect devices transmitting and receiving analogue and digital signals derived from field devices located outdoors.

The surge protection device shall be rated for surge rating of 10kA.

1.6.5. Cabinets for Field Instruments

Wall mounted cabinets shall be provided for enclosing transducer unit and associated accessories which are mounted outside the main control panel. The cabinet shall be of die-cast aluminum, field provided not less than IP-55 protection and shall be lockable. The cabinet shall have facilities for earthing. A steel plate shall be provided inside the cabinet for mounting instrument and accessories.

1.6.6. Alarm System

Alarms shall be initiated by the opening or closing of volt-free contacts which shall remain unchanged throughout the periods in which the alarm conditions exit. Alarm Circuits shall be cable of conversion from open-healthy to open-alarm or vice versa by a simple modification after installation requiring no additional parts or special equipment.Each alarm shall initiate the operation of both visual and audible devices.Audible devices in the same room or area shall have distinguishable sounds and adjustable sound levels.

1.6.7. Matrix Type alarm Annunciators

The alarm annunciator shall be microprocessor based, modular, split type unit with alarm windows mounted on the front door and electronic modules inside the panel. The weather protection class for alarm annunciator shall be IP-54 of IS 13947, Part-I.Each alarm shall initiate a visible and audible indication of the specified condition. Unless otherwise specified, alarm indicators shall be grouped together in annunciator units each having at least 20% spare ways. Alarm indicator lamps

(Cluster LED type) and shall have transparent screens engraved with legends approved by the employer's Representative. The legend area of each indication shall not exceed 40mm high and 75mm wide.When any alarm condition occurs, a condition device common to an alarm annunciator system shall sound and the appropriate indicator shall flash on an off. The flashing rate shall not be less than 2 Hz and shall not exceed 5 Hz. On pressing an accept pushbutton, the audible device shall be silenced and the flashing light shall become steady. The alarm indicator shall remain illuminated until the alarm condition ceases and a reset pushbutton has been operated.The operation or acceptance of one alarm shall not inhibit the operation of the audible device or the flashing of the appropriate alarm indicator if a further alarm condition occurs. At unmanned locations alarms operated on two or more annunciators shall require acceptance at each annuciator.Alarms shall be accepted automatically and the appropriate audible device silenced after an adjustable period of 1 to 5 minutes.An integral 'test' pushbutton shall be provided to illuminate each lamp in the appropriate group and to operate the audible device but shall not cause a spurious alarm condition on any other annunciator.

Alarm circuitry shall be arranged so that spurious or transient alarm states persisting for less than 0.5 seconds do not initiate any action.Alarm annunciator / indicator legends or labels shall be arranged with three lines of text as follows:

- Topline Location
- Middle Line Parameter
- Bottom Line Status

e.g. reservoir 1

level high & level low

1.6.8 Uninterruptible Power Supply (UPS)

The UPS shall be floor mounted; self-contained and metal clad and shall be suitable for operating on a non-linear load.It shall be front door accessible. The UPS system shall be true ON-Line.The ON LINE UPS shall be incorporating a six-pulse rectifier and pulse width modulation inverter technology with 100% microprocessor control

with built in static and manual bypass switch. The UPS shall incorporate a DC under voltage trip circuit to electrically trip the UPS in order to protect the battery.The noise level of the unit shall not exceed 60dB (A) at 1m from the UPS cabinet.The output of the inverter shall be a sine wave having less than 5% THD for linear loads and less than 4% to 50% non-linear load. It shall be suitable for load power factor 0.8 lag.The unit shall have dynamic response such that a 100% step load causes an output voltage transient of less than ±4% with a recovery time of less than 4 ms.
For three phase output units the output voltage shall not very by more than ±1% for an unbalance for 10%.The load crest factor shall not be less than 3:1.The efficiency at full load and 0.8 power factor shall be greater than 88%.Indicators to indicate

- UPS status
- UPS alarm conditions

The UPS shall provide a volt free contact output to indicate:

- Warning. i.e low battery capacity
- Fault
- Static bypass in use.

The UPS shall have an overload capacity of 150% for 30 seconds and shall be protected in the event of a short circuit of the output.The batteries shall be housed, either within the UPS enclosure or within a separate matching battery cubicle suitable for location adjacent to the UPS.The batteries shall be maintenance free lead acid type sealed for life.

Terminals shall be shrouded to prevent accidental contact. The battery enclosure shall be corrosion resistant and ventilated to prevent the buildup of gases.Warning notices shall be provided for wall mounting to warn of the presence of charge gases.The battery supply of the UPS shall be via a fused load break switch dis-connecter circuit breaker.The battery recharge time to 90% of full charge shall be approximately ten times the discharge time at full load. The UPS battery shall have a backup of 120 minutes at full load and supported with inverter of suitable capacity.

1.6.9 Air Conditioning / Air Handling / Cooling and Ventilation / Exhaust:

The bidder shall design and provide AC / Air cooling / Ventilation and exhaust system as per the norms, regulations, statutory and process design requirement. The control room shall be provided with air conditioning of required capacity. All plant rooms shall be provided with push pull ventilation with air intake through a fan filter unit and exhaust with propeller fans. The design of supply air capacity should be based on 20 air changes per hour or heat load with inside temperature limited to a maximum of 5º C above ambient temperature. The equipment shall comprise of air intake louver, panel type filter, centrifugal air supply fan, GI ducting, Grills, propeller fans and their gravity louvers.

1.6.10 Testing / Inspection:

1.6.10.1. Tests on cables

Check details are in accordance with the specifications

Check for physical damage

Continuity Check, meggar test for insulation

Connections

No dark visible marks of armouring onto external surface

1.6.10.2. Tests on electrical installation

Check all closing, tripping, supervision and interlocking of control devices.Check operation of all alarm circuits.

Check CT polarities, give primary & secondary injection.

Carry out relay calibration

1.6.10.3. Test on complete control system

On completion, the functioning of the complete system shall be tested to demonstrate its correct operation in accordance with the Specification.For control system testing, the contractor may provide temporary means to simulate operating conditions, but the system will not be finally accepted until correct operation has

been demonstrated to the satisfaction of the Engineer when all the pumps are operating.The system shall be shown to operate correctly whatever the selection of duty and standby equipment may be.

Conditions to be tested shall include:

- Normal automatic operation.
- Normal manual operation
- Emergency manual operation

1.6.10.4. Commissioning Tests

Correct operation of controllers shall be verified by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point. All logic sequences shall be verified to operate in accordance with the specifications.All defects and malfunctions disclosed by test shall be corrected immediately. New parts and materials shall be used as required and approved and tests shall be repeated.A report certifying completion of validation of each instrument system indicating calibration values, verification that the system performs as per requirements and any provisional settings made to devices shall be provided. A format for commissioning checklist to be provided for approval before performing the commissioning tests.

1.6.10.5. Final Operational Testing and Acceptance

Upon completion of instrument calibration and system validation, all systems shall be tested under process conditions.The testing shall include, but not limited to all specified operational modes, taking process variables to their limits (simulated or process) to verify all alarms, failures, interlocks and operational interlocks between systems and/ or mechanical equipment.Any defects or malfunctions shall be immediately corrected using approved methods and materials and the tests shall then be repeated.Upon completion of final operational testing, a report shall be submitted, indicating that the total control system provided meets all the functional requirements specified herein. This report shall be made in the format approved by the Engineer. The Engineer shall certify this report and it shall constitute final acceptance of the control system.

1.7. COMMISSIONING:

After completion of installation works the contractor shall arrange to carry out following checks/tests in the presence of Employer representative / Engineer – in – charge.

1.7.1 Tests on Transformers:

a). Mechanical Completion Checks:

(i) Compare name plate details with the specification.

(ii) Check for any physical damage, in particular of bushings and cleanliness of bushing.

(iii) Check for tightness of all bolts, clamps and connecting terminals.

(iv) Check for oil leakage and oil level.

(v) Breather condition, check whether breathing line is free, silica gel is reactivated, oil is available at the bottom.

(vi) Check for clearances.

(vii) Water tightness of terminal boxes.

(viii) Earthing of transformer tank and neutral.

(ix) Ensure that all cooler and header valves are open

(x) Check that the transformer is correctly installed with reference to it phasing.

b). Commissioning Test:

- Test oil for dielectric strength as per IS.
- Insulation resistance test of windings.
- Test the transformer for the following.
- Voltage/ turns ratio at all the taps.
- Winding resistance at all the taps.
- Short circuit impedance (at low voltage)
- Magnetic balance
- Core loss at normal tap at low voltage.
- IR and PI.
- Vector group test.

- Phase sequence test.
- Test the current transformers for following.
- Continuity test.
- Polarity test.
- Insulation resistance test.
- Magnetization characteristics.
- Rough ratio test (if bushing CTs provided prior to mounting of busing)
- Measurement of secondary winding resistance.
- Line connection as per phasing diagram.
- Winding resistance.
- Insulation resistance of control wiring.
- Buchholz relay operation (for alarm and trip)
- OLTC control indicating and alarm circuit. (if used)
- Operation test of all protective devices (electrical and mechanical) and interlocks.
- Calibration of temperature indications (oil and winding) and temperature relays.

1.7.2 Tests of Motors:

a). Mechanical Completion Checks:

i). Compare name plate details with the specification.

ii). Check for tightness of all bolts, clamps and connecting terminals.

iii). Check ground connection.

iv). Bearing lubrication.

v). Check clearance inside terminal box.

vi). Megger testing of motor winding and cables.

vii). Motor winding, control and power cables continuity checks.

viii). Resistance of motor winding.

ix). Check / calibration if RTDs, BTDs for bigger motors, flow switches (in case of water cooled motors) and if any other instrument mounted.

b). Commissioning Test:

i). Controls and interlocks.

ii). Ready test and settings.

iii). Phase sequence and rotation.

iv). Starting and no load currents.

v). No load operation (observe variation, noise level, temperature of bearing and windings of motor, check speed of motor).

vi). On load operation, starting and running currents operation (observe variations, noise level, temperature of bearing and windings of motor, check speed of motors), vibrations.

vii). In case of closed loop arrangement for cooling the windings of motor, inlet and outlet temperature of the cooling air / water.

1.7.3 Test on Control Panels and Switchboards:

a). Mechanical Completion Checks:

i). Check name plate details of every associated equipment according to specification.

ii). Check for physical damage.

Iii). Check for tightness of all bolts, clamps and connecting terminals.

iv). Check earthing.

v). Switch developments.

vi). each wire shall be traced by continuity tests and it should be made sure that the wiring is as per relevant drawings. All interconnections between panels/equipment shall be similarly checked.

vii). All the wires should be maggered to earth.

b). Commissioning Test:

i). Checks on relays, functioning of relays, simulation of fault for testing.

ii). Checks on motors.

Iii). Setting of relays, other alarm, tripping devices and interlocks as per scheme.

iv). Phase angle checks, measurement of magnitude and phase angle of current transformer secondary currents and potential transformer secondary voltage.

v). Functional checking of all power and control circuits e.g. closing, tripping, control, interlock, supervision and arm circuits including proper functioning of the components equipment. If inter locks are provided with other equipment, it shall be thoroughly tested.

1.7.4 Test of Relays:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for any physical damage.

iii). Check internal wiring.

iv). Megger all terminals to body.

v). Megger AC to DC terminals.

b). Commissioning Test:

i). Check operating characteristics over the entire range by secondary injection.

ii). Check minimum pick up voltage.

iii). Check operation of electrical /. Mechanical targets.

iv). Relay settings to be checked by injecting different values of current.

v). Setting of relays as per discrimination chart

1.7.5 Test for Meters:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for any physical damage.

b). Commissioning Checks:

i). Check calibration.

ii). Megger all insulated portions.

iii). Check CT and VT connection with particular reference to their polarities for relevant meters.

1.7.6 Tests for Circuit Breakers:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for nay physical damage.

iii). Check for tightness of all bolts, clamps and connecting terminals.

iv). Check oil level, air pressure and leakage (wherever applicable).

v). Check earth connection

vi). Check cleanliness of insulators and bushings.

vii). Check all moving parts are properly lubricated.

viii). Check heaters provided.

v) Check alignment of breaker trucks for free movement, check operation of shutters.

b). Commissioning Checks:

i). Check control wiring for correctness of connections, continuity and IR values.

ii). Manual operation of breaker.

iii). Power closing / operating manually and electrically.

iv). Breaker tripping and closing time.

v). Trip free and anti-pumping operation.

vi). IR values, resistance and minimum pick up voltage.

vii). Contact resistance.

viii). Simultaneous closing and mechanical interlocks provided.

ix). Check electrical and mechanical interlocks provided.

x). Checks on spring charging motor, correct operation of limit switch and time of charging.

xi). Checks on CTs.

xii). All functional tests.

1.7.7 Tests for Voltage Transformers:

a). Mechanical Completion Checks:

i). Check name plate details.

ii). Check for nay physical damage.

iii). Check cleanliness of insulators.

iv). Check for tightness of all bolts, clamps and connecting terminals.

v). Check earthing connections.

b). Commissioning Checks:

i). Insulation resistance test.

ii). Polarity test.

iii). Ratio test on all cores.

iv). Line connections are per connection diagram.

v). Open delta test with low voltage, wherever required.

vi). Measure core loss from LT side.

1.7.8. Tests for Current Transformers:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for any physical damage.

iii). Check cleanliness of insulators and bushings.

iv). Check for tightness of al bolts, clamps and connecting terminals.

v). Check for oil level and leakage.

vi). Check connections.

b). Commissioning Checks:

i). Megger between windings, winding terminals and body.

ii). Polarity test.

iii). Ratio identification checking of all ratios on all cores by primary injection of current.

iv). Magnetisation characteristics, secondary winding resistance.

v). Capacitance and tan delta test.

vi). Dielectric test of oil (wherever applicable).

1.7.9 Tests for Isolators:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for any physical damage.

iii). Check cleanliness of insulators.

iv). Check for tightness of all bolts, clamps and connecting terminal.

v). Insulation resistance of each pole.

b). Commissioning Checks:

i). Manual and electric operation and interlocks.

ii). Correctness of connections, continuity and insulation resistance values of control circuits.

iii). Contact resistance of each pole / gap between male and female contacts.

iv). Earth connections of structures and operating handle.

v). Clearance in open and closed position.

vi). Simultaneous closing of all phases.

1.7.10 Tests for Cables:

a). Mechanical Completion Checks:

i). Check name plate details according to specification, check internal /outer dia. of cores, cross sectional area of conductor.

ii). Check for any physical damage.

iii). Megger test between each core and armour/sheet.

iv). Continuity check.

v). Connections.

1.7.11 Test for Battery:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for any physical damage.

iii). Dimensional check of plates (before assembly)

b). Commissioning Checks:

i). Specific gravity test.

ii). Cell voltage test.

iii). Capacity test.

iv). Initial charging cycle.

1.7.12Tests for Battery Charger:

a). Mechanical Completion Checks:

i). Check name plate details according to specification.

ii). Check for any physical damage.

iii). Check Connections.

b). Commissioning Checks:

i). Functional check of auxiliary devices, such as alarms, indicating lamp etc.

ii). Insulation test of all circuits.

iii). Measurement of voltage regulation.

iv). No load current and voltage (AC) and voltage and current both AC and DC) at different points.

v). Voltage at tap cell (While boost charging).

1.7.13 Test for Electrical Installation:

a). Mechanical Completion Checks:

i). Check all closing, tripping, supervision and interlock of control devices.

ii). Check operation of all alarm circuits.

iii). Earthing:

- Measure resistance of each earth electrode by isolating the same from station grid as well as from other earth electrodes.
- Check continuity of grid conductors and wires.

b). Commissioning Checks:

i). Cable Testing.

All 3.3 kV, 6.6 KV, 11 KV cables to be high voltage tested.

ii). In addition to above, any other tests specified by manufacturer shall be carried out as per manufacturer's instruction.

iii). Measure voltage across bearing pedestal insulation and between rotor shaft and bearing.

1.7.14 Miscellaneous:

Mechanical completion checks and commissioning tests on items not covered

above, shall be carried out by the contractor as per the instructions of Employer representative./ Engineer - in – charge.

1.8 DIESEL GENERATOR SET

1.8.1 GENERAL

1. It will be complete responsibility of successful agency to carry out following Work without any extra cost. If any minor Work other than the considered items in required being carried out without any extra cost, which may please be noted.
2. The successful agency will be responsible to operate the D.G. Set after testing and commissioning for the period of five year including defects liability period of two years from the date of completion of Work. The agency is to deploy one operator and one helper with required minor materials and tools round the clock and should take care of the required operation and maintenance of D.G. set during power failures in coordination with regular maintenance and repair agency or as specified by Engineer-in-charge.
3. The agency is required to provide Diesel for the D.G. Set as per the requirements. The diesel tank should be full/90% capacity at all times. No laps on any accounts shall be tolerated. The payment of the same will be paid as per actual after producing required documents such as diesel consumption/cash memo etc.
4. The manual operation required for the D.G. Set is also included in this scope. The successful agency will have to operate the D.G. Set in coordination with the EMPLOYER's other Electrical departments and existing electrical M&R agency Maharashtra State Electricity Department supply is to be used as a standby supply during that period.
5. The agency is to bring adequate diesel required for the DG Set. They should operate the D.G. Set at least 10 minutes in a day and keep the D.G. set in full working condition at all times.
6. The D.G. Set provided is fully automatically operative condition. However, in case of any emergency, if the D.G. Set is not operating in its automatic mode,

then the operator should be in a position to operate the D.G. Set in manual mode.

7. The agency should provide the manpower during the three shifts or as specified by Engineer-in-charge from time to time.
8. It will be the responsibility of the successful agency to obtain the necessary approval/sanctions from concerned authorities like Maharashtra State Electricity Department, Electrical Inspector, PWD, Pollution Control Board etc. before commissioning of the D.G. Set and same shall be submitted to Engineer-in-charge within the stipulated Contract period.
9. Successful agency will also be responsibility for carrying out comprehensive maintenance of total installation under Contract in addition to operation for a period of Five year including defect liability period of two year. This also included the replacement/ repairs of any defective parts and fuel and oil required, so as to ensure the required operation schedule.
10. In case if any breakdown/ power failure is notice due to negligence in operating the D.G. set during the emergency/during the required period, 2% of the total deposited amount against operation of D.G. set for the period of one year will be deducted as penalty for every incident.
11. Before quoting the Tenderer should inspect the present location where the D.G. set is to be kept and also visit the site to collect the data for Work.
12. The successfully agency will have to design the scheme matching with existing system and Work will be started only after due approval to the scheme from Engineer-in- change.

1.8.2 SPECIAL REQUIREMENT

1.0 <u>GENERAL</u>

1.1 The entire electrical Work shall be carried out in accordance with specification without any extra cost. The Work shall conform to relevant Indian standard, Indian Electrical Acts and requirements of local electricity board.

1.2 For supervision, Contractor must depute qualified electrical engineer with

sufficient experience for similar type of Work.

1.3 The Contractor shall employ only experience and licensed electrical / wiremen for the Work. Only licensed electrical Contractor are allowed to Work.

1.4 When the electrical installation is complete, the same shall be tested as per I.S. code, i.e. Regulations in front of Engineer-in-Charge and result are to be submitted in four sets.

1.5 The Contractor shall carry out all minor civil works connected with electrical Work. The Contractor shall repair and make good damage caused to the civil structure while carrying out the electrical works.

1.6 The foundation for panel board grouting of frames in wall etc is required to be carried out by the agency.

2.0 SCOPE

2.1 Supply, installation, testing and commissioning of D.G. set of desired rating, Auto transfer panel and power and control cabling Work and sound proof Enclosure (Acoustic canopy). DG set shall be provided for critical process requirement only i.e. to for load requirement of SBR air blowers, plant lighting & raw sewage transfer pumps.

2.2 The scope of Work also including the operation and maintenance of the D.G. set for the period of two year including the defect liability period of one year. It also including and breakdown maintenance / replacement of defective parts and providing require manpower for daily operation of same round the clock or completely as per the requirement of Engineer-in-charge.

2.3 DRAWING & SPECIFICATION

Drawing and specification shall be followed and if any deviation from the same is necessary to make the Work conform to the requirement, the same shall be called to the attention of the Engineer. If any discrepancy between specification, Drawing and BOQ is noticed the same shall be informed to the Engineer-in-charge before execution of the Work and higher standard amount the three will take precedence.

3.0 SHOP DRAWINGS

3.1 The Contractor prepares detailed shop drawing and submits for the approval of the Engineer before commencing the Work. The shop drawings showing all setting out details and physical dimensions of all complements in the system like conduits and cable, routes, location if HT & LT pane's, D.G. sets AMF panels, sound proof canopy and fixing details. Works shall not be comments without the approval from the Engineer for each working drawings. The drawing should include circuit diagram of the AMF panel.

4.0 BROCHURE AND DATA

4.1 The Contractor shall submit to the Engineer four copies of all brochures, Manufacturer description data and similar literature. One copy will be returned to the Contractor after approval.

5.0 SCALE

5.1 Electrical layout plans shall be drawn to scale as established on drawings and shall indicate the size and location of all equipment and accessories herein. The Contractor shall obtain all dimensions preferably at the building and check those plans for interference with the building structure and other plans for interference with the building structure and other equipment.

6.0 APPROVAL

6.1 The engineers approval of such drawings, schedule, brochures, etc. will be an approval of general details and arrangements onlyand shall not relive the Contractor from responsibility for deviation from drawings or specifications unless he had, in writing, called the Engineer attention to such deviations at the time of submission, nor shall it relieve the Contractor from responsibility for errors or commissions of any kind in the shop drawings when approved.

7.0 STORAGE

7.1 All materials and requirements shall be stored properly to the satisfaction of the Engineer so that physical handling and climatic conditions do not affect the equipment.

8.0 CUTTING & PATCHING

8.1 Cutting, patching and reading shall be kept to the minimum. Whenever this is required, advance approval of the Engineer shall be obtained before cutting and patching Work is taken up during the installation of Work. Those shall be subsequently finished properly to the satisfaction of the Engineer. Care shall be taken to prevent spreading of dust and debris and for protection of equipment and finishes.

9.0 PROTECTION

9.1 All Work equipment and material shall be protected at all times to prevent obstruction, damage or breakage. All equipment shall be covered and protected against water, dustand sand as well as chemical and/or mechanical damage. At the completion of the Work, all equipment shall be thoroughly cleaned and delivered in a perfect unblemished and working condition.

10.0 TESTING & COMMISSIONING

Testing and commissioning of complete electrical, accessories/equipment/ installations shall be carried out in the presence of Engineer-in-charge/ Maharashtra State Electricity Department officials as per the required norms/ directives at Manufacturers place and at site.

11.0 The Contractor shall furnish all labour and materials called for in this specification and accompanying drawings and shall install the system complete in every respect. Only license approved electrical Contractor/Sub Contractor are permitted to execute the Work.

12.0 GUARANTEE

The Contractor shall furnish one-year guarantee on all equipment and appliances. This shall include guarantee against defects in workmanship or material in any part or accessory. If any higher period is implied elsewhere in this Contract, the same shall hold a Govern. If any defects are found during the guarantee period, the Contractor at no additional cost shall replace the defective part or Work.

13.0 HANDING OVER OF INSTALLATION

13.1 The Contractor shall handover the complete installations to the Corporation in a clean, brand new and perfect working condition. Any area in which the Contractor has worked, shall be thoroughly cleaned of all debrisand unwanted materials cleaned and handed over in a perfectly finished, ready to use condition.

14.0 DEVIATION & ORDERING MATERIAL

14.1 The Contractor must quote exactly as per specification bill of quantities and drawing.

14.2 The bill of quantities shall not be used as a basis for ordering materials and the Contractor shall be responsible for assessing the quantities of material to be ordered.

15.0 AS BUILT DRAWINGS

15.1 On completion of Work, the Contractor shall submit to the Engineer, a reproducible and five copies of "As Built" drawing showing:

1) LT Cable layout wherever required.
2) Single line diagram and complete electrical layout.

15.2 Contractor shall prepare operation and maintenance manual for the complete electric system under this Contract and submit the same in four sets.

16.0 MANUFACTURE TEST

The Contractor shall specifically perform all test such as routine test, type test on all equipment in the presence of EMPLOYER & Maharashtra State Electricity Department officials. All cost incidental to such test shall be deemed to have been included in the specific items of that equipment and no extra charge will be payable.

1.8.3 GENERAL SPECIFICATION

1. INTENT OF SPECIFICATION

This specification is intended to cover the design engineering manufacturing, fabrication. Assembly, testing at Manufacturer Work/delivery

properly packed for transport, transportation up to site, erection, testing and commissioning at site suitable design capacity of D.G. Set. The D.G. Set shall run with HSD oil and shall be supplied complete with all the accessories described below for safe and trouble free commercial operation, in manner accepted to EMPLOYER Ltd.

2. CODES & STANDARD

The design, manufacture, shop testing, erection and commissioning of compression ignition diesel Engines and accessories shall conform to the following particular standard and codes, with latest revisions in addition to the relevant standards and manufactures own standards.

3. SCOPE OF WORK

The scope of Work includes design, manufacture, supply, transport to project site, handing erection testing and commissioning of Diesel Engine driven Generating sets in conformity with the specification given herein and the schedule of quantities.The scope of Work covers the design, Manufacturer; testing supply of suitable capacity D.G. set which including the following:

a) Alternator along with its excitation system auxiliaries, circuits, control panel, metering and protection circuits.
b) Diesel engine along with its accessories and starting system.
c) Flexible / semi flexible couplings.
d) Common heavy-duty channel for base frame supported by anti-vibration damper at bottom.
e) Cooling arrangements etc.
f) Exhaust piping with heavy-duty residential type silencer, insulation of exhaust piping and etc height of piping as per pollution control regulation.
g) Starting lead Acid batteries with battery charger having trickle and boost charging arrangements complete with Ammeter with switch and voltmeter with fuse and switch to read battery voltage, starting motor, fuel oil, service tank, fuel oil piping etc.
h) All control and power wiring between D.G. set, control panel batteries,

safety controls, pumps and AMF panel etc.

i) First fill of fuel oil, lubricating oil; etc including cleaning and flushing out of the system after the test at manufacture facility.

j) Fuel and oil for testing, trials runs and up to commissioning

k) Obtaining all licenses, approval from local authorities including but not limited to any or all of the following:

1) Electric Supply Utility.

2) Electrical Inspector of Govt. of Maharashtra State.

3) Pollution Control Board.

4) Fire Department of the local Fire Brigade.

5) Traffic Advisory Committee.

6) Municipal Corporation.

Installation and commissioning of the above D.G. Set is also including in the scope.

All requirement offered shall be provide design and reliable in operation. Diesel Generator set capacity specified is at site condition. Generator shall be rated for critical process requirements only. The excitation system shall be designed to maintain the rated voltage constant even if a load of 150% of rated load is imposed on the Generator for duration of 15 Sec. Tendered to indicate power consumed by auxiliaries along with quotation. The Tenderer shall specify in detail all equipment offered including auxiliaries, associated piping, cabling based on typical layout

PAINTING, PACKING AND TRANSPORT

All metal surfaces shall be thoroughly cleaned of scale, rust and grease, etc. prior to painting. Cleaned Surface shall be given two coats of primer and prepared for final painting. Final finish shall be free from all sorts of blemishes. The equipment shall be shipped to site suitably packed to present any damage. Each package shall have labels to show purchaser name, purchase order and equipment number, suitable lifting lugs, etc. shall be provided and lifting points shall be clearly marked on the package. Packing shall be suitable for storage at site for a minimum period.

TEST AND INSPECTION

The owner or his authorized representative may visit the works during manufacture or equipment to assess the progress of Work as well as to ascertain that only quality raw materials are used for the same. He shall be given all assistance to carry out the inspection.Detailed test procedure along with the facilities available at Contractor works shall be furnished as and when called for. Owner representative shall be given minimum four-week advance notice for witnessing the final testing. The Contractor shall furnish test certificate including test records and performances curves, etc.The Contractor shall prepare and submit detailed shop drawing depicting the general arrangement of D.G. Sets, connected accessories, fuel tank, fuel oil piping, pumps, control panels, single line electrical diagrams for power and controls, exhaust piping, chimney, foundation details, etc. within 10 days of award of Work.

LOCAL REGULATION, BYELAWS, I.E.R. ETC

The D.G. Set installation will be generally governed by the following Regulations:

i) Indian Electricity Rules (1956 and latest revisions).
ii) Local regulations.
iii) Pollution Control Rules (State/Union Govt. Rules)
iv) Electrical Utility Co.
v) Fire Brigade.
vi) Electrical Inspector Approval.
vii) Tariff Advisory Committee.

OPERATION & MAINTENANCE MANUALS SPARE PARTS, TOOLS ETC.

The Contractor shall furnish operation and maintenance manuals in triplicate after installation of the D.G. Set. One set of special tools required shall be supplied at the time of handing over of the set to the Corporation. The price of these special tool set is deemed to be included in the rates quoted by the Tenderer. The bid letter shall list out such tools that will be handed over to the Corporation.

OPERATION OF THE SET AFTER INSTALLATION

The Contractor shall arrange to depute, free of charge, a Senior Operator to the site of works to operate the D.G. Set for a minimum period of four weeks after successful installation and approval of the installation by the local authorities. The operator shall impart training to the owners operator/technicians in proper up-keep of the DG set.

COMPLETION DRAWING

On successful completion of the installation and before issuance of the certificate of virtual completion, the Contractor shall prepare and submit to the owner "as built completion". Drawings of the entire installation.

The completion drawings shall include:

a) Layout of D.G. St and accessories.
b) Exhaust piping arrangement.
c) Fuel oil tank and piping.
d) Electrical single line diagram, control wiring single line diagram, cable layout, panel GA drawings, etc.
e) Location of earth pits and Earth conductor with sizes.

TESTING

1. The following test shall be conducted on each alternator and D.G. Set.

2. Factory Test

i) Routine Tests.
ii) High Voltage Test.
iii) Short circuit Current Test.
iv) Instantaneous short-circuit withstand test.
v) Insulation resistance test.

These tests shall be conducted as per the requirements of the original test certificates shall be furnished to the EMPLOYER.

3. Site Tests

After the erection and wiring and earthing for DG set, the following tests

shall be conducted:

i) Insulation resistance of the generator.

ii) Speed, no load voltage and full load voltage regulation.

iii) Frequency at no load, half load and full load.

The readings shall be observed with calibrated meters. Only one meter shall be used for the tests. The reading shall properly tabulated and submitted in triplicate to the Engineer-in-charge.

4. Testing of Controls

All the safety controls and protective devices of the DG set shall be tested for correct calibration and operation. The result of the tests shall be tabulated and submitted in triplicate.

OPERATION

DG set with individual Auto Transfer starting facilities is required to provide electric power to the essential loads in the events of failure of normal power supply or when normal supply is switched off under abnormal conditions like fire. When normal power fails or is tripped manually, the D.G. set should start automatically and restore electrical supply for essential loads. It should have provision to start all the equipments one by one so as to reduce higher starting current. The DG set shall also run continuously to supply power to the loads till restoration of normal power supply.A pottential free Contract (NO) closing on under voltage will be made available by means of a suitable control cable at the Auto Transfer control panel to indicate failure or absence of normal supply. The DG set shall start on receipt of this signal with an adjustable time delay of 0.5 secs, the time shall be of self - reset type.

The starting time of each of the DG set should be as less as possible, but not exceeding 15 sec. to come on load. In case the first starting operation is not successful, two more attempts with preset time intervals should be attempts; the particular set should be locked out. When an engine speeds up and alternator develops desired voltage in frequency, generator circuit breakers will be switched on.

INSTALLATION

The Contractor shall carry out the installation of the DG sets including but not limited to the following:

a) Installation of the DG Set, testing, commissioning, alignment, mounting along with AVM pads on ready floor, foundation to be made by the Contractor and the cost shall be included in the rate for supply and installation of the D.G. set.

b) Installation of fuel oil system complete with day tank and Lube oil system with necessary piping, valves, fittings, supports, etc.

c) Installation of air intake system, exhaust gas system complete with residential type silencer, expansion bellows, etc. and necessary piping, valve, fitting. Supports etc.

d) Installation of Auto Transfer Switch and any other electrical panel.

e) The Contractor to supply and install the required 8" dia MS exhaust pipe upto the required height (as stipulated by Pollution Control Board Authorities) above the building in which the D.G. set are housed. The scope also includes providing insulation.

f) Installation and charging of battery along with leads, battery stand, etc.

CAPACITIES

The capacity of each of the D.G. set shall be suitale as per design of STP. Both the engine and Generator shall be rated for critical process requirements only. The excitation system shall be designed to maintain the rated voltage constant even if a load of 150% of rated load is imposed on to the Generator for duration of 15 secs. Tenderer shall indicate power consumed by auxiliaries along with the Tender document.

DIESEL ENGINE

The engine shall be suitable for continuous operation to develop design capacity of dg set at site conditions as mentioned above.The diesel engine shall be indoors type, multi cylinder, totally enclosed, continuous duty, direct fuel injection, series Turbo charged compression ignition, complete with its self-contained lubricating

system. The lube oil system shall be provided with Engine Driven Lube Oil Pump only.

Following accessories shall be supplied with the engine and the quoted rate for supply and installation of DG set shall be deemed to have included for the accessories described below:

a) Air filter Air restriction gauge.
b) Lube oil filter.
c) Fuel oil filter.
d) Coupling.
e) Day service Tank.
f) Fly wheel with Guard.
g) Corrosion Resister.
h) Scroll type fuel injection system.
i) Residential type silencer.
j) Electronic governor.
k) Starter motor.
l) Instrument panel.
m) Laid Acid Battery.
n) Exhaust Bellows.
o) First fill of lube oil

DAY FUEL TANK

The fuel oil day tank shall be provided with gauge glass, filling, drainage and vent connections with valves. Fuel Transformer pump between Engine & Day tank should by engine driven only.

LUBRICATING OIL SYSTEM

The Lubricating oil for engine lubrication shall be collected in the oil pan located at the bottom of the cylinder block. From oil pan, the lubricating oil shall be let off to a separate lube oil sump, if required. From the oil pan or from the oil sump the lubricating oil shall be drawn by engine driven lubricating oil pump through foot strainer (in the oil sump) and then Through oil filter of suitable capacity . The lube

oil pump shall be of Gear type and Engine driven only and the entire assembly should be filter inside the sump. All the inter connecting oil piping together with valves, fittings, hangers, supports, etc. shall be provided by Contractor.

AIR / EXHAUST SYSTEM

Exhaust gas Driven Turbocharger shall be fitted to each bank and each turbocharger shall have its own self-contained lubricating oil system. Ai shall be normally supplied and ducted to the turbo-charger of low & high pressure one. Air from the Turbocharger compressor passes to the after cooler and then to the engine manifolds. The cooler shall be of Tabular constructed with aluminium bronze MS and cat-Iron water Boxes. An Engine Drive water ump shall cool it.The engine turbo charging system including exhaust and intake Manifolds, valve timing and arrangement of the cylinder Head shall be designed for optimum performance at High boost pressure with subsequent high specific Engine Power output.

GOVERNING SYSTEM

Electronic governing system shall be provided with the necessary sensors. The governor shall be suitable for operating without external power supply ad shall be provided with adequate speed control system.

FLYWHEEL

The Contractor shall be responsible for determining and providing the necessary flywheel effect. The flywheel shall be both statically and dynamically balanced and capable of rotating at 125% of rated speed without injury. Flywheel guards shall be furnished.

ENGINE COOLING SYSTEM

Radiator shall be offered by the Contractor to cool the water received from the engine or any other cooling system as specified by Engineer-in-charge.

ENGINE STARTING SYSTEM

Manual Electrical starting arrangements of the engine in case of power failure shall be provided. The system will consist of DC starter motor mounted on turning gear

will receive power from the set of 24V DC Batteries.

FUEL OIL SYSTEM

The fuel used for the DG set shall be High-speed diesel (HSD) only. The day tank shall be filled manually by operating Hand pump. In order to transfer fuel from day tank to engine has to be done through fuel transfer pump which should be engine driven only.

ALTERNATOR

The generator shall be driven by the diesel engine as described in this specification and shall match the same in all respects. The generator shall also conform to 15 4722 or equivalent.

TESTS

1. Equipment shall be tested to conform to the appropriate standard and the following tests ` shall be conducted in the presence of purchasers.
2. Functional tests, continuity tests and high voltage test on control panel to establish the performance called for in the specification.
3. Power frequency voltage test on switchgear and mechanical / electrical operation check.
4. Routine test for alternator as per IS 4722.
5. Over speed test (1.2 times the rated speed for 2 minutes)
6. Transient response tests for sudden application and rejection of loads of 25°/0/ 50%, 75%, and 100% of rated capacity.
7. Wave from test (type test result are acceptable).
8. Please sequence test.
9. Vibration test.
10. Noise level test
11. Dimensional and alignment.

DG AUTO TRANSFER SWITCH CONTROL PANEL

DG set shall be supplied with automatic transfer switch control panel. This panel shall be floor mounting, free standing, dust tight, vermin proof/ sheet metal

enclosed, cubicle type. Cable entry to the ATS control panel shall be from the top or bottom (depending upon site condition) for power and control cable, outgoing cable, of auxiliary equipment and outgoing cable to power center.

1. The panel shall be free standing, fabrication from 14/16SWG CRCA sheet metal enclosed, dust and vermin proof type with a hinged door and having a degree of protection IP 52 as per IS 2147 unless otherwise specified. The panel shall be powder coated with Siemens gray color shade after completing 7-tank pre-treatment process. Curing shall be by baking. Finish shall be structural finish (70-80 microns). Power and control equipment shall be segregated inside the Panel as far as practicable. The maximum height of the operation handle / switches shall not exceed 1000 mm and the minimum height sha'l not below 300 mm. All hardware shall be made corrosion resistant and bolts, nuts and washer shall be made of galvanized zinc passivated cadmium plated high quality steel. Unless otherwise specified the panel shall be suitable for bottom cable entry. Necessary glands shall be provided with panel.

All auxiliary devices for control, indication, measurement and alarm such as push buttons control/selector switches, indicating lamps, metering instruments, annunciation, etc. shall be mounted on the front door of the panel. Adequate number of potential free contact shall be provided in the control panel for any remote control, monitoring of the generator set.

2. All switches shall be load-break, heavy-duty type. All fuses shall be non-deteriorating HRC cartridge pressure filtered, link type. The Contractor shall be air break type having AO3 duty rating. Thermal overload relays shall be three elements, positive acting, ambient temperature compensated type with adjustable setting range and built in protection feature against single phasing. All control/selector switches shall be rotary back connected type having cam operated contact mechanism with knob type handle 'STOP' push buttons shall be stay put type.

3. Wiring for power, control and signaling circuits shall be done with PVC insulated copper conductors having 1100V grade insulation. Minimum size of control

wires shall be 2.5 mm. "ELEMEX" type terminals shall be acceptable for wires upto 10 sq mm size and for conductors larger than 10 sq mm bolted type terminals with crimping lugs shall be provided. A minimum of 10% spare terminals shall be provided on each terminal block.

4. An adequately sized earth bus shall be provided in the panel for connection to the main earth grid. All non-current carrying metallic parts of the mounted equipment's shall be earthed. Doors and movable parts shall be earthed using flexible copper connections.

5. Engraved nameplates shall be provided for all devices mounted on the front of the panel. Nameplate or polyester adhesive stickers shall be provided for ach equipment mounted inside the panel.

The AMF control panel shall be provided with, but not limited to the following devices:

AUTO MAINS FAILURE CONTROL PANEL:

The AMF Panel shall have provision such that on switching over to DG supply; it shall not put all the drives into operation on load at a time. But the same shall be put into operation one by one with suitable time lag. The panel shall be Cubical type, floor mounted, dust and vermin proof control panel with hinged doors, CAM type doorknob, undrilled bottom gland plate, load manager each fitted with:

> Suitable rating Amps 4 phase 36KA MCCB - Similar to MD's make Cat No.25606 with frame size of DPX 630, S-l, Electronic type - 2 NOS.

> Shunt Release 220V A.C coil similar to MDs make, Cat No.26164 & frame size of DPX-630 - 2 Nos.

> Remote control front operated, motor operated similar to MDs make - Cat No.26144 & frame size of DPX-630 - 2 Nos.

> Auxiliary contacts similar to MDs make Cat No.26160 & frame size of DPX-630 - 2 Nos.

> Spreader lines similar to MDs make Cat No.625008 & frame size of DPX-630 - 4 Sets.

- Electronic control unit automatic supply inverter similar to MDs make of Cat No.26196 & frame size DPX-630 - 1 No.
- Automatic transfer switch fixed version supply inverter mounting phase suitable for suitable rating Amps similar to MDS make, Cat No.26509 & frame size DPX-630 - 1 No.
- Digital Ammeter of adequate rating with selector switch & CTs - 1 No.
- 0 - 500V digital voltmeter with selector switch & CTs. - 1 Set
- RYB indicating lamp - 2 sets.
- MCCB ON/OFF indicating lamp - 2 sets.
- 2 No. + NC Auxiliary contactor 220V ac - 2 Nos.
- Frequency meter.
- Digital hourly running meter.
- KW meter, Digital.
- KWH meter, Digital.
- Current transformers of suitable ratio of class 1 for metering.
- 3 Nos. current transformers of suitable ratio of Class-I for metering.
- 4 Pole ALB Microprocessor based EDO type contact operated by charging motor and incorporated with shutter Assembly, shunt release etc.
- Micro switch for service position, Test service, 3 indicators for DG ON/OFF/TRIP.
- CT for above ACB's
- Copper Bus Bar (TPN) of adequate rating.

  Mains supply Monitor to identify low voltage/complete failure and initiate necessary single for operation of automatic control gear.
- 1 Set Window Annunciation's with audio visual alarm & Trips for:

i) High Water Temp.
ii) Low lubes Oil pressure.
iii) Over speed stop
iv) Set fails to start.

- 1 No. Electronic Hooter.
- 1 Set push button hooter accept/fault clear.
- 1 No. Control switch (ON/OFF - for DG Manual control)

> 1 No. Mode Selector Switch (AUTO/MANUAL/aEST/OFF)

> 1 Set Indicating Lamps for ˢ Load on Set', ' Load on Mains' etc.

> 1 No. Battery Charger consisting of:

i) Transformer

ii) Rectifier

iii) D.C. ammeter

iv) D.C. voltmeter

v) Charger selector switch (TRICKLE/BOOST/OFF)

vi) Lamp for battery charging indication.

> 1 Set Instrument fuses.

> 1 Set Bus bars of adequate capacity.

> 1 No. of Automatic Transfer Switch fixed version (750 Amps).

CABLES

1. The specification covers the design, manufacture, performance, inspection at the Manufacturer's works and delivery to site of 1100V grade cables.
2. The design, manufacture of performance of the cable should confirm to the latest applicable standards of Bureau of Indian Standards.
3. All cable shall be XLPE and shall comply with the following requirements:

a) Annealed copper conductor, class 2 as per 15:8130 or aluminium.

b) Colour coding shall be provided.

c) Inner sheath shall be extruded type and shall be compatible with the insulation for the cables. The inner sheath shall be with PVC compound type "A'.

d) Armouring for all the cables shall comprise G.I. strips/wires.

e) The outer sheath shall be of an extruded layer of type ST-1 compatible with the specified ambient and operating temperature of the cables. The sheath shall be resistant to water, ultra violet radiation, fungus, termite and rodent attacks. The outer sheath shall be of black colour.

f) Cables shall be subjected to routine and acceptance tests in accordance with 15:1554 and other relevant standards.

4. General Conditions

a) The quantities given in the schedule are subject to change to suit site

conditions.

b) The Manufacturer should have in house testing facilities as per IS.

5. Specifications for Installing LT cables and Control Cables

The method of installing cable shall be broadly classified into four main categories:

Laid in prepared trenches/Hume pipes

All cables laid inside the substation building shall be laid in prepared trenches. For easy identification all cables laid shall have cable marker tied to it by means of steel wire and showing the size and name of panels embossed on it.

Laid Underground

The procedure stated in technical specification shall be followed. However, before laying all precautionary procedure shall be adopted by the Contractor. Layer of sand then cables and then layer of sand again with half round RCC pipe shall be laid.

Fixed on walls etc.

If cables are to be fixed on walls, etc. then the same shall be done by using MS galvanized spacers and GI saddles using screws, etc.

Laid on cable trays

Generally cables laid on trays shall be fixed on the rungs of the trays using nylon lockable cable ties of approved make. As far as possible, cables shall not cross each other unnecessarily on tray, so that a neat and easily identifiable cable system is achieved.

INSPECTION

All cables shall be inspected by the Contractor upon receipt at site and checked for any damage during transit.

JOINT IN CABLE

The Contractor shall take care to see all the cables received at site are

apportioned to various location in such a manner as to ensure maximum utilization and avoidance of jointing cables. The apportioning shall be got approved by the owner before the cables are cut to length. Straight joints are prohibited unless specifically allowed in the schedule of quantities.

EXCAVTION AND BACKFILL

All excavation and backfill including timbering, shorting and pumping required for the installation of the cables shall be carried out by the Contractor in accordance with the drawings and requirements laid down elsewhere. Trenches shall be dug true to line and grades. Backfill for trenches shall be filled in layer not exceeding 150 mm. Each layer shall be properly rammed and consolidated before laying the next layer. The Contractor shall restore all surface, roadways, sidewalks, curbs walls or other works by excavation to their original condition, satisfactory to the EMPLOYER. Back filling shall be done with soft earth only.

TERMINATION OF CABLES & JOINTS

a) For termination of cables of size 16 sq.mm. and above, suitable copper cable sockets of appropriate size and capacity shall be provided at terminal ends. This condition is applicable to single PVC insulated wires of 16 sq. mm. and above also.

b) Generally reducer/spade type sockets shall be used where grub screw/clamp type fixing arrangement is available at the terminating end. Tubular sockets shall be used where bolt and nut arrangement is available at terminating end.

c) The cable socket shall generally be fixed to the cable cores by crimping process.

d) Irrespective of the size of the cable and the method of termination, the core end shall be cleaned and immediately covered with an oxide inhibiting/corrosion inhibiting compound before termination.

e) The tail end wire shall be finished in an appropriate colour by using PVC insulating tape.

1.8.4 TESTING, MANUFACTURER TESTS, PRE-COMMISSIONING TESTS AND

COMPLETE COMMISSIONING

The general intent of this specification is to mention the relevant tests to be done and furnished to the client by the Contractor. These are guidelines. However, the Contractor shall carry out all such tests and complete all formalities as per relevant Indian Standard Specifications, Tariff Advisory Committee's rules and fire Insurance Requirements and or Electricity Rules and Regulations as per Govt. Gazette and Publications.

Testing of Equipment

All equipment before installing on the site Work shall be tested and at such results produced to the Engineer in charge nothing shall absolve the Contractor from re-performing any tests that the Contractor may be called upon specifically by the consultant/EMPLOYER or Supply Company or electrical inspector. All equipment shall be tested jointly with the Consultants/EMPLOYER as required by various sections of the specifications and test data shall be furnished as required at Manufacturers Work before dispatch of material at site.

Pre Commissioning Test

All rules, regulations and requirements of Maharashtra State Electricity Department, Govt. and local authorities and of Indian Standard specifications and/or Rules and regulations stated in Indian Electricity Act shall be strictly complied. On completion of erection the Contractor shall clean all the equipment thoroughly and inspect the entire installation for correctness and shall furnish a report of completion to the consultants, pre-commissioning tests shall commence only on approval of this report by the consultants. All tests and the certification thereof shall only be carried out by those authorized. Skilled, experienced and certified permit holders of the supervisor category of state government Industries and Labour Department. No unauthorized personnel shall ever carry out any such tests as stated herein under.

1) Phantom load tests for protective relays.
2) Insulation tests at the following points by 1000 Volts and or 500 Volts megger.

3) Mechanical operation tests for all movable parts of switchgears breakers tripping devices, etc.

4) Phase sequence test at all the relevant points for connecting correct R, Y and B as per the supply authorities positions.

5) All panels to be tested for interlocks, control tripping and breakers to be tested for sequential tripping.

6) Capacitors banks shall be tested for all residual voltages on the terminal of the units and it should not exceed 50V after one minute.

7) Continuity tests shall be done for noting any short circuits and or earthing of phases.

Commissioning

a) Prior to commencement of installation Work the Contractor shall obtain the approval of the substation drawings, if any and electrical layout prepared by him from the electrical inspector. The time involved in this is included in the overall completion period of the Contract.

b) The Contractor shall obtain the written permission and sanction of commissioning the equipment and substation from electrical inspector and form consultants/PMC.

c) All costs incidental to obtaining such sanctions shall be to the Contractor account.

d) Contractor shall furnish all the necessary tests and test reports to the Electrical supply authorities and complete all formalities required to comply as per the Rules and regulations laid down for release of Electric supply. If called on, the Contractor shall carry out all such tests and prove the results to the entire satisfaction of the local and electric supply authorities.

All costs and expenses incidental to the release of electric supply shall be to the Contractor account and no demand whatsoever shall be to the employer, except for any security deposits that the supply authorities would deem necessary for charging of the line, except as may be provided for in the schedule of quantities.All such documents forwarded and or letter and or

correspondence exchanged in this regard shall be made available for inspecting and the Contractor shall furnish 3 sets of documents and drawings for the employer records.After release of electric supply to employer premises, the Contractor shall furnish six sets of all tests declared to the supply Co. authorities and shall furnish all such documents, officially exchanged.Contractor shall also obtain and furnish the relevant completion certificate from the Electrical Inspector, Fire Officer and/or any other Authority thereof whichever may be applicable.

1.8.5 TECHNICAL SPECIFICATION:

ENGINE

Engine shall be water cooled tube charger with water cooler, under NTP condition of BS: 5514 with at overload capacity of 10% for one hour in any 12 continuous hrs Operation.

The engine shall complete with following accessories:

a) Radiator with blower fan or Heat Exchanger.
b) Corrosion inhibitor coolant.
c) Paper element filter-fuel, lube oil and by-pass.
d) Flywheel housing and flywheel to suit double bearing alternator.
e) Spider flexible coupling.
f) Dry type air cleaners and vacuum indicators.
g) Residential Silencers.
h) Stainless Steel exhausts flexible bellow.
i) Motor driven primping pump.
j) Electric Starter.
k) Battery charging alternator.
j) Solid-state potentiometer.

ELECTRONIC CONTROL PANEL (Displaying the following)

- **Battery voltage**
- **Coolant water temperature.**

- **Lubricating oil pressure.**
- **Engine speed.**
- **Safety Control: High water temperature (HWT)**
- **(Trip & Indication): Low lube oil pressure (LLOP)**
- **Over speed stop.**

ALTERNATOR

Approved make, standard design alternator, suitably rated at 600 W/ required rating at 0.8 p.f.(lag), 415, 3 phase, 4 wire, 50 cycles/ sec. 1500 RPM, self excited and self regulated with brush less excitation, bank of voltage regulation + 2.5% of rated voltage, from no load to full load. Insulation class "H". the alternator generally conforms to BS: 5000/15:4722.

BASE FRAME

Sturdy, fabricated, welded construction, channel iron base frame for mounting the Engine and Alternator.

FUEL TANK

Fuel tank of suitable storage capacity sufficient to run the DG Set for minimum 8 hours, with mounting brackets, complete with level indicator fuel inlet and outlet air vent, drain plug, inlet arrangement for direct filling with pumping arrangement of suitable rating and capacity and set of 5 fit or as per the requirement of site long fuel hoses.

BATTERY SET

Set of Batteries: 12 Volts, 27 plates, dry, uncharged batteries with leads and / terminals.

CABLING WORKS

All cables from D.G. Set to AMF panel and from AMF panel to existing control panel and transformers of suitable rating as per the D.G. Set rating should be provided. The Tenderer should inspect the site before quoting the offer.

AUTO MAINS FAILURE CONTROL PANEL

Floor mounting, cubicle type, Automatic Mains failure panel, compressing of:

- TPN motorized Air Circuit Breaker for Mains for 2 Nos. of transformers and
- Nos. outgoing to control panel.
- TPN 4 Pole motorized Microprocessor based Air Circuit Breaker.
- TPN 4 pole motorized Air Circuit Breaker for Alternator.
- Natural Contractors for Main & Alternator.
- Voltmeter with selector switches for MAINS & ALTERNATOR.
- Ammeter with selector switch.
- Current transformer.
- Frequency meter.
- KWH Meter.
- KW Meter.
- Battery charger consisting of Transformer/Rectifier with surge protection.
- Selector switch for current adjust.
- Mains supply failure monitor (voltage sensing).
- Supply failure timer.
- Restoration timer.
- Control unit incorporating 3 impulse Automatic Engine Start/ Stop and "Failure to Start" lockout.
- Impulse counter with locking and reset facility.
- OFF/manual/Auto Test Selector switch.
- Control circuit ON/OFF switch.

LAMP INDICATION & TRIP ANNUNCIATION SCHEME

Mains ON	Yes	-
Generator ON	Yes	-
Load on MAINS	Yes	-
Load on Generator	Yes	
Low Lube Oil Pressure	Yes	Yes
High water	Yes	Yes

temperature		
Set/Fails to Start (with Alarm)	Yes	
Mains ON	Yes	-

Push Buttons/Switches for :

> Engine Start/Stop

> Alternator breaker ON/OFF

> MAINS Breaker OFF

> AMF Test

WORKING OF THE PANEL

a) Auto Mode

When the mains supply fail, the "Mains supply failure Monitor" operates after a preset time of approx. 10 Sec. This actuates the "3 impulse Engine Start" control. We do not recommend plug type relays. The control unit gives three starting impulses with an interval of 1-5 sec. If the engine starts at the first impulse, the unit shuts off. If not, it gives further two impulses, during which time, if the engine, does not start, the unit shuts off, activating the audio-visual alarm for "Set fails to Start".

b) Test Mode

By operating the "AMF Test" Push Button, the conditions of Mains Failure are stimulated as explained in Auto Model above, without disturbing the supply through Mains switchgear.

ENGINE INSTRUMENT PANEL

a) Starting switch with key.

b) Lube oil pressure gauge.

c) Battery charging ammeter.

d) Charge regulator.

e) Set of documents comprising spares part book maintenance.

Mains supply monitor to identify low voltage/complete failure and initiate necessary single for operation of automatic control gear.

a) 1 set window Annunciation's with audio visual alarm and trips for:

a) High Water Temp.

b) Low Lube oil pressure.

c) Over speed stop.

d) Set fails to Start.

ii) 1 No. Electronic Hooter.

ii) 1 Set Push Button - Hooter Accept/Fault Clear.

iii) 1 No. control switch (ON/OFF for DG manual Control)

iv) 1 No. mode selector switch (Auto/Manual/Test Off)

v) 1 Set indicating lamps for load on set, load on mains, etc.

vi) 1 No. battery charger cosseting of:

a) Transformer

b) Rectifier

c) D.C. ammeter

d) D.C. Voltmeter

e) Charge range selector switch (Trickle/Boost/off)

f) Lamp for battery charging indication

vii) 1 Set instrument fuses.

viii) 1 Set bus bar of adequate capacity.

SOUND PROOF ENCLOSURE

Sound proof enclosure of DG set shall be fabricated out of M.S. 16 gauge sheet steel and special type of sandwich material shall be used for sound absorption. DG set can be operated without any duration.The DG set shall be suitable for direct mounting inside MS fabricated container with proper clamping, mounting and supporting arrangement. M.S. sheet metal enclosure with hinged/sliding type doors shall be provided for protection from sound, dust and rain.

The Salient features of outdoor D.G. Set Canopies (for noise control) are as under:

> Enough space to house DG Set pane! and fuel tank outside canopy.

> Provision of Air-Intake and Air-Exhaust Silencer(S) for preventing leakage of sound.

> Openable Doors for easy access to virtually every part of DG set for comfortable.

> Maintenance Doors are double wall all steel insulated SOUND REDUCTIN DOORS.

> Provision of additional screen and hoods for multi medium noise suppression.

> Two layers of sound - suppressing elements:

a) Non-Ferrous sheet sound barrier.

b) Rock-Wool 48 Kg/cu. M. 100 thick.

c) Total thickness of panel - 100 mm.

> High performance most comfortable sound - reduction level to 70 db at a distance of 3 meters.

> Provision for forced ventilating hot air coming out of engine.

> It can be dismantled completely & engine is accessible from all the sides.

SPECIFICATION OF ACCOUSTIC ENCLOSURE CANOPY

The D.G. Set is mounted on anti mounts and placed on firm ground. A specially designed transportable acoustic chamber encloses the generator set. The acoustic chamber attenuates the noise of the generator set. The weather proof acoustic chamber is designed to reduce the noise level to an average of 70 ±_5 db (A) at three meter away from the enclosure as measured in free field condition. The enclosure shall be designed to the following requirement:

a) Modular type weather proof design so that this can be installed in open space (No engine room is required).

b) Sufficient space around the genset to meet the day to day maintenance of engine, alternator, batteries etc.

c) Suitable grills for air suction for engine cooling/aspiration, outlets for hot exhaust gases, air for ventilation, air inlet and outlet without affecting the engine performance etc.

d) Frame Work made out of heavy gauge steel sections and suitably reinforced.

e) Proper forced ventilation arrangement to maintain enclosure temperature within permissible limits.

f) Electric points, illumination lights, blower fans etc, inside the chamber.

The external surface of the enclosure is cladded with CRCA steel sheets and treated with anticorrosive paints. The interior is lined with fire proof, vermin proof sound absorbing material suitably retained in position using perforated sheets/galvanized wire mesh.The acoustic enclosure is designed and fabricated to meet the specification and shall Work at the optimum condition and maximum efficiency with proper fresh air blowers.Adequate number of doors with lockable arrangements are provided for easy access. All the doors are provided with rubber gaskets for weather and sound proofing. The bolted structure of the enclosure facilitates it easy shifting from one place to another if required. The acoustic chamber shall be painted as per the customer colour choice.

MATERIAL USED FOR CONSTRUCTION

A) The outer cover for the acoustic enclosure shall be made out of ribbed type 1.6 thick CRCA steel sheet. Size of the rib shall be 80 mm x 20 mm.

B) All perforated sheets used shall 1 mm thick galvanized iron sheets with 3 mm hole dia and 5 mm diagonal pitch.

C) The sound absorbing acoustic materials used shall be resin bonded mineral wool/rock wool. It will have a density not less than 65 Kg./Cu.mtr.

1.8.6 SCOPE OF INSTALLATION & COMMISSIONING

For erection of the equipment in the power house, following Work shall be undertaken.

1. DG Room layouts, preparation of detailed engineering drawings for foundation, electrical panels and other accessories etc.
2. Supply and installation of exhaust pipes from the engine, with necessary supports as per our layout and lagging of pipes. To a maximum of 6 mtr. Additional length will be charged extra.
3. Supply and installation of fuel piping form the engine to fuel tank & return.

4. Supply and laying of power cables between alternator & DG panel.
5. Necessary control cabling between DG set and DG panel.
6. Training of your personnel at site.
7. Unloading and positioning of the DG set.
8. The scope of works also includes all types of works to complete the erection and successful commissioning of DG set at site such as:

a) All civil works including mounting on MS frame etc. as per the directives of Engineer-in-charge.
b) Earthing along with earth pits.
c) Outgoing power cables.
d) Obtaining approval from concerned authorities.

1.8.7 ESSENCE OF WORK

Following given points are the essential works of Contract for the subject Work and successful agency will be responsible for completing the same without any extra cost within stipulated Contract period.

1. Even though the technical specification and other details are specified in the Tender document for carrying out the subject Work, the successful agency will be supposed to design the scheme in detail for carrying out the subject Work, matching with the existing system and the scheme prepared should be got approved before starting the execution of Work, the agency should visit the site before quoting the offer to guess the exact quantum of Work.
2. After finalization of the scheme the agency should obtain the required approvals to the various makes of material to be supplied under the Contract before procurement. The D.G. Set and other material to be supplied under this Contract should be got tested at Manufacturers unit in presence of Engineer-in-charge or his representative.
3. The agency should submit the Bar Chart within a period of one week after issue of Work order.
4. It will be the responsibility of the successful agency to complete the statutory requirements from concern authorities for carrying out the subject Work

completely as per the requirement of Engineer-in-charge without any extra cost.

5. Proposed D.G. Set under the present Contract shall be installed at STP. For erection of the same, successful agency will be responsible for carrying out the required foundation work and other connected civil Work also. This foundation work and civil work should be carried out in consultation with concern civil authority completely as per the requirement of Engineer-in-charge.

6. Successful agency will be responsible to provide required connecting cables of appropriate size and length to be connected between transformer, AMF panel and D.G. Set etc. completely as per the scheme approved by Engineer-in-charge. This Work will be included in the total scope and no extra payments will be made against this Work

7. After completion of erection and commissioning Work of proposed rated designed D.G. set, successful agency will be responsible for operating and maintaining the installation for a period of five years (including defects liability period of two year).

8. The agency shall carry out the Work as per ISO 9001-2000 procedure and maintain necessary records completely as per the directives of Engineer-in-charge.

TECHNICAL SPECIFICATIONS: ELECTRICAL & INSTRUMANTATION WORKS – PART B

1.0 Scope

The bidder's /contractor's scope covers the design, shop testing, supply, transport, storing at site, erection, testing and commissioning of all electrical and instruments required for the plant, as per enclosed General Specification, Specific Requirement, typical power distribution scheme and typical control system architecture.

Where there is any contradiction between General Specification and Specific requirements mentioned in this document, the specific requirements will rule the project requirement.

2.0 Design Basis

2.1 The Bidder/ Contractor shall strictly follow the typical power distribution single line diagram, which is to be proposed by him, and approved and accepted by Employer.

The bidder shall visit the site to satisfy himself about availability of voltage level, its condition, its probable route, etc. before quoting. The Employer will provide 11 KV, 50 c/s, 3 phase electrical power up to electrical meter within the premises. From this metering point onwards the successful bidder shall extend 11KV supply up to main substation and further 433 V(step down) supply up to MCC room (Motor Control Centre).

2.2 All the incomers of substations shall be suitably electrically as well as mechanically interlocked as per scheme.

2.3 LT panels shall also have two EDO (Electrical Draw Out), ACB (Air Circuit Breakers) incomers and one no. EDO, ACB bus coupler. All the main pumps/drives and standby pumps shall be distributed between two LT bus section equally so that in case of failure of one bus section, other standby motors should get power supply from other bus section.

2.4 Bidders shall follow the BIS guideline for voltage rating of motors while designing and selection of electrical motors. All motors shall be of squirrel cage type.

2.5 All motors shall be provided with class-F insulation and their temperature rise shall be limited up to Class-B. All motors above 100HP/75KV shall be provided with RTD's (at least two RTD's per winding)earth leakage protection, comprehensive micro process based protection having locked current /over load, negative phase sequence relay, under load, over current, earth fault, start nos., transit currents etc.

2.6 All HT & LT cables shall be designed and selected after considering a minimum de-rating factor of 0.65. Exact de-rating shall be calculated taking into consideration designed ambient temperature, grouping and minimum size as per fault level calculations of synchronised DG with grid). Bidder shall carryout detailed fault level calculation of main generating station and upto all distribution points.

2.7 **Bidder shall carry out the earth resistivity test on his own and based on this result they should design the total earthing system to maintain a overall resistance value less than one ohm.**

2.8 The electrical and instrumentation in gas handling area like compressors etc. shall be flame proof type and strictly adhere to CPCB norms.

2.9 Substation design shall incorporate all safety aspects and shall be provided with power distribution agency metering room, switchgear room, separate fence, gates, internal access roads, lighting, earthing, power factor correction, lightning protection, cable trenches, equipment foundations, transformer oil soak/drain pits, galvanized steel latticed structures/gantries, gravel etc. Two supplies from power distribution agency shall be made available and normally any one source shall supply

power to the entire system.

2.10 Noise level (db levels & insertion level) inside and outside blower room shall be strictly as per latest amended pollution control board norms applicable at installation time. Whatever extra equipments required like scrubber, acoustic shall be provided to meet statutory guide lines as well as building should be able to accommodate all equipments.

2.11 **The Control system and instrumentation for the total plant shall be provided as per typical control system architecture provided with this tender.**

2.12 HT cabling shall be done underground with top of HT cable minimum 1.0 meter below plant ground level. The protection above HT cable shall be provided as per latest revision of IS standard.

LT cable/ control cable/ lighting cable inside the plant shall be done on overhead cable tray mounted on steel structure etc.

2.13 Bidder shall get the short circuit fault level data at 11 kV, from power distribution agency and shall do the fault level calculation and Relay co-ordination scheme for the entire plant accordingly. Bidder shall provide minimum protection on HT side as per standard relay protection scheme enclosed herewith. In case some additional protections other than indicated in drawing, are required; same should be added. Wherever transformer size is 2 MVA or bigger, than differential protection shall be provided.

2.14 Measuring instruments shall be provided by bidder as per standard measurement scheme enclosed herewith.

2.15. LT capacitor bank shall be provided with automatic power factor correction system. Its panel shall incorporate timer circuit to allow capacitor to discharge at minimum 50V before re-energisation of any individual bank.

2.16. Capacitor bank shall consist of many small capacitors so that banks can be in circuit as per system p.f requirement with the help of Automatic Power

Factor Correction relay. Minimum 0.99, preferably unity power factor shall be maintained at power distribution agency meter on H.T. Side. Capacitor bank calculations submitted along with bid shall also take into consideration the transformer impedance. Each capacitor should be able to switch ON either in manual or auto mode independently.

2.17. All the protection relay of 11kV/ 6.6 kV/ 3.3 kV HT panel shall be of microprocessor based except master tripping relay and check supervision relay.

3.0 Bidder's Obligation

Bidder shall provide preliminary details for the sr. items 3.1, 3.6 & 3.33given below during bidding stage. All other remaining details shall be provided during detailing. However, if Empolyer requires any further details during technical bid evaluation stage, the bidder shall provide the same.

3.1 Load list (as per enclosed typical format)

3.2 Maximum demand in KVA with duration (period) of the plant.

3.3 Minimum demand in KVA with duration (period) of the plant

3.4 Normal demand in KVA of the plant.

3.5 Detailed Bill of material for electrical as well as instrumentation scope of work.

3.6 P & I diagram of the total plant.

3.7 Instrument index (as per enclosed typical format)

3.8 Input/ Output List (as per enclosed typical format)

3.9 Instrument Data sheet for each tag No.

3.10 Interlock logic diagram

3.11 Control system architecture.

3.12 Instrument air requirement.

3.13 Uninterrupted power supply (UPS) capacity requirement.

3.14 UPS capacity and it's battery backup calculation sheet.

3.15 Lighting fixture capacity and quantity calculation.

3.16 Single line diagram for HT Power, LT Power. (main panel), L T

distribution boards.

3.17 Single line diagram for lighting and small power.

3.18 Cable schedule of total plant, along with voltage drop calculation and deratings.

3.19 Operating power factor of each equipment.

3.20 Power factor improvement capacitor calculation.

3.21 H.T Panel Board Data Sheets.

3.22 LT Panel board (NDAC, MCC etc) Data Sheets.

3.23 HT Cable, LT cable, control cable, telecommunication cable Data Sheet.

3.24 Transformer Data Sheet.

3.25 UPS Data Sheet.

3.26 Battery and Battery Charger Data Sheet.

3.27 ACSR Conductor Data Sheet.

3.28 Guaranteed Power generation by Gas Engine.

3.29 Bus Duct Data Sheet

3.30 Power mounted Isolator Data Sheet.

3.31 Maximum Power consumption of the plant per day.

3.32 Minimum power consumption of the plant per day.

3.33 Guaranteed power consumption of the plant per day.

3.34 Transformer capacity calculation sheet.

3.35 Battery Charger Capacity Calculation Sheet.

3.36 Battery Capacity Calculation Sheet.

3.37 Motor List (as per typical format enclosed herewith).

3.38 Control Valve sizing calculation sheet.

3.39 DDC sizing calculation sheet.

3.40 GA drawings of all electrical panels like HT panel, Transformer, Diesel Generators, NDAC, MCC, Battery chargers and batteries, AC distribution board, DC distribution Boards, UPS and its batteries, Pole mounted Isolators, Lighting Arrestors etc.

3.44 Typical drawings of earthing station.

3.45 A drawings of all analyzers, control room equipments etc.

3.46 Typical drawing HT cable laying under the ground.

3.47 Typical structural drawing showing LT cable tray for power, control etc in outdoor areas.

3.48 Substation layout for each section, D G layout with appropriate clearances as per IER and

Appropriate clearances for maintenance.

3.49 Control room layout.

3.50 Room size and quantity for total plant electrical and instrumentation work.

3.51 List of Safety Items.

4.0 Indian Standards / Other International Standards

For the benefit of bidders, a few Indian Standards and Codes of practices and other international standards are listed below. Unless otherwise noted, equipment/devices/accessories /installations/ testing etc. shall comply with relevant standards/codes mentioned herein. Where Indian Standards are not available equipment/ devices etc. complying with relevant British or IEC standard or ISO standards shall be proposed. While referring to any standard, the latest revision/edition shall govern. Bidders are advised to include in their bid a list of equipment/devices and corresponding standards to which they conform. Translation in English of standards, which are available in other languages, shall be furnished along with the bid, in such cases the English translation shall govern.

4.1 List Of IS & Other International Codes (For Electrical Equipment / Accessories)

IS 5	Colours for ready mixed paints and enamels
IS 3	Three phase induction motors
IS 374	Electric ceiling type fans and regulators
IS 694	PVC insulated cables for working voltages upped and including 1100V
IS 722	AC electricity meters

IS 1248 Direct acting indicating analogue electrical measuring instruments and their accessories

IS 1271 Thermal evaluation classification of insulating material

IS 1293 Plugs and socket outlets of rated voltage upped and including 250V and rated current upped and including 16A

IS 1364 Hexagon head bolts, screws and nuts of product grades A and B.

IS 1534 Ballast's for fluorescent lamps

IS 1554 PVC insulated (heavy duty) electric cables

IS 1777 Industries luminaries with metal reflectors

IS 1913 General and safety requirements for luminaries

IS 2086 Carrier and bases used in rewire able type electric fuses for voltages upped 650V

IS 2223 Dimensions of flange mounted AC induction motor

IS 2253 Designation for type of construction and mounting arrangement of rotating electrical machines

IS 2254 Dimensions of vertical shaft motors for pumps

IS 2259 Methods of tests for determination of insulation resistance of solid insulating materials

IS 2419 Dimensions for panel mounted indication and recording electrical instrument

IS 2544 Porcelain post insulators for system with nominal voltages greater than 1000V

IS 2551 Danger notice plates

IS 2667 Fitting for rigid steel conduits for electrical wiring

IS 2705 Current transformers

IS 2713 Tubular steel poles for overhead powerlines

IS 2834 Shunt capacitors for power systems

IS 3156 Voltage transformers

IS 3231 electrical relays for power system protection

IS 3725 Resistance wire, tapes and strips for heating elements

IS 3854 Switches for domestic and similar purposes

IS 3961 Recommended current rating for cables

IS 4029 Guide for testing 3 phase induction motors

IS 4691 Degree of protecting provided by enclosure for rotating electrical machinery

IS 4728 Terminal marking and direction rotation for rotating electrical machinery

IS 4889 Method for determination of efficiency of rotating electrical machines

IS 5216 Guide for safety procedures and practices in electrical works

IS 5578 Guide for marking for insulated conductors

IS 6098 Method of measurement of air borne noise emitted by rotating electrical machinery

IS 6875 Control switches (switching devices for control and auxiliary circuits, including contractor relays) for voltage upped and including 1000V AC and 1200 V DC

IS 7098 Cross – linked polyethylene insulated PVC sheathed cables

IS 8623 LV switchgear and control gear assemblies

IS 828 Circuit breakers for over current protection for house hold and similar installations

IS 10322 Luminaries

IS 12729 general requirements of switchgear and controller

IS 13032 MCB boards for voltage upped and including 1000V AC.

IS 13947 Low voltage switcher and controller

IS 732 Code of practice for electrical wiring installations

IS 3043 Code of practice for earthing

IS 3646 Code of practice for interior illumination

IS 10118 Code for practice for selection, installation and maintenance of switchgear and control gear

IS IEC 309 Plugs, socket outlets and couplers for industrial purpose.

IS 2026 Transformers

IS 13118 Vacuum circuit breakers

For all other process equipments and instruments contractor shall follow IS / ISO specifications and submit a copy of the same.

5.0. Clearance from Statutory Authorities

Bidders shall note that the successful bidder shall be responsible for obtaining statutory clearances from all the relevant bodies (such as electrical inspector, Safety, Pollution Control Board, Fire Insurance and Explosive Department Authorities, etc.). Payment in respect of fees, deposit, etc., of such bodies shall be made by successful bidder. Employer shall assist the contractor in obtaining such clearances expeditiously by way of issue of introductory letters to relevant bodies but this will not absolve the Contractor from his responsibility of obtaining in writing clearances mainly from Electrical Inspector, Chief Explosive Officer, Pollution Control Board or any other local/ central authority entirely at his own cost. No extra sum will be paid for these services. However fee deposited to power distribution agency will be reimbursed by Employer.

6.0 Contractors License:

It shall be the responsibility of the contractor to obtain necessary license / authorization / permit for work for his personnel from the licensing board of the state. The persons deputed by the contract's firm should also hold valid permits issued or recognized by licensing board of the state where the work is to be carried out.

7.0 Workmanship:

The contractor shall ensure workmanship of good quality and shall assign qualified supervisor/ engineers and competent labour who are skilled, careful and experienced in carrying out similar works. Empolyer shall reserve the right to reject non-competent person/s employed by the contractor, if the workmanship is found unsatisfactory.

8.0 Power Distribution Philosophy:

The bidder shall design the power distribution scheme for this site on the basis of following guidelines and single line diagram. Voltage drop

from transformer output to last point in electrical distribution shall not be more than 5%. Voltage drop in any cable for installed load or any single circuit for installed load shall not be more than 2%. Only aluminium conductor with PVC insulation armored cables shall be used for size 2.5mm² and above. All power cables upto 2.5mm² shall be copper conductor PVC insulated armored cables.

8.1 An indoor substation shall be planned to house switchgears for incoming and outgoing power supply circuits, metering equipments, communication equipment, control panels, auxiliary power supply distribution boards, DC system equipment etc. The following voltage of load factor and diversity factor shall be considered for calculating the maximum running load. The sizing of transformer shall be included along with the bid.

LOAD FACTOR

Main Pump Motor	**:**	**0.9 (or as per BKW)**
Aux. Loads	**:**	**0.9 (or as per BKW)**
Lighting loads	**:**	**1.0**
Socket outlet, receptacle Diversity Factor	**:**	**0.50**

DIVERSITY

Main pump motor for working loads	**:**	**1.0 (or as per process requirement)**
Lighting Loads	**:**	**1.2**
Socket outlet, receptacle	**:**	**1.2**

8.2 **Main incomer switchgear in various plant/process areas shall be fed by duplicate (two), 100% capacity feeders and outgoing feeders shall be so designed that at least 20% spare subjected to minimum of one feeder of every type shall be available. All control voltage inside switchgear panel shall be at 230V AC for Contactors and control supply. Single line diagram of all panels shall be attached with bid giving cable sizes in single line diagram.**

8.3 DC system equipment (comprising batteries, chargers & DC distribution board) with adequate capacity shall be proposed for protection / control circuits and other vital devices of each substation. Further, in plant areas / substation a few lighting fixtures, suitable for operation on battery voltage shall be proposed in strategic areas. DC system, calculation of DC Battery size, DC battery charger, Voltage should be attached with the bid.

8.4 Following protections for incomer feeders in main MCC location for each process area of the plant. Each MCC shall be provided with 4 Pole two incomers and bus section with draw out ACB/MCCB as incomer. MCC's shall be metal clad floor mounted, with cable entry from bottom (preferred) and environmentally protected to IP-52. MCC shall have fault rating of not less than the applicable fault levels. The two incomer neutral shall completely be isolated by using 4 pole ACB/MCCB.

Mechanical and electrical interlocking shall be provided between the incomers and the bus section ACB/MCCB to prevent parallel operation of main switchgear feeders. MCCs shall be housed within brick built buildings segregated from injurious effects of process fluids/gases are present. The major components of each starter shall comprise:

- **Door interlocked isolator**
- **Fuse gear/ MCCB**
- **Contactor, overload relay with single phasing protection.**
- **Start/ Stop push button.**
- **Local/ remote selector switches (if applicable)**
- **Manual / off/ auto sector switch.**
- **Ammeter as per starter requirement**
- **Indication light for run, trip, emergency stop operated, power On, run dry protection operated (where such tanks are used)**

i) Incomer feeder shall have electrostatic / microprocessor based control releases for over current, short circuit, earth fault with time

delay and these releases shall directly work on tripping mechanism of drawout air circuit breaker. Outgoing feeder up to 630 Amps shall be switch fuse unit / MCCB and beyond 630 Amps shall be air circuit breaker. All Outgoing Air Circuits Breakers will be manual drawout type.

ii) Each motor upto 5 KW shall have DOL starter with O/C, short ckt protection, over load relay with single phasing protection along with ammeter, provision for remote start/stop. Overload relay shall be reset type from front of panel. All starters component shall follow type-II coordination chart of established manufactures with components of same make. Each starter shall have On/Off/Trip indication. All necessary selector switches like auto manual switch and local remote switches shall be installed.

iii) Motors above 5 KW and upto 30 KW shall have Star / Delta starter with O/C, short ckt protection, over load relay with single phasing protection along with ammeter, provision for remote start / stop O/C relay shall be reset from front of panel. All starter components shall follow type-II coordination chart of established manufactures with components of same make. Each starter shall have on/off/trip indication. All necessary selector switches like auto, manual switch and local, remote switches shall be installed.

iv) Motor from 37 KW & above shall have auto transformer or Soft starter (FCMA) type or electronic type start and auto transformer shall have taps at 40%, 60% and 80%. Over load relay shall be reset from front of panel. All starter components shall follow type-II coordination chart of established manufactures with components of same make. Each starter shall have on/off/trip indication. All necessary selector switches like auto, manual switch and local, remote switches shall be installed.

v) Motor from 75KW and above shall have numeric type micro processor based relays along with short circuit protection. Each starter shall have on/off/trip indication. All necessary selector switches like auto

manual switch and local, remote switches shall be installed. Since these motors will be slip ring, necessary either liquid rotor starter or air break contactors in minimum faultages shall be installed.

8.5. Cables proposed shall be suitable for operation on earthed/ unearthed system as applicable. LV cables shall be armoured PVC insulated. Outer sheath of all cables shall be of general purpose PVC and shall be of extruded type meeting latest IS-1554 requirements. The cable shall be designed after taking de-rating factors of ambient, grouping into consideration for its design. Power cables of cross section above 2.5 sq. mm shall be with aluminium conductors. All cables of cross section up to 2.5 sq. mm shall be with copper conductors. Unless otherwise stated all the cables shall be armoured. LV cables shall be of the armoured heavy duty type and of 1100 V grade. Voltage drop on cable for installed current shall not exceed 2% on installed load. Design ambient temperature shall be taken as $47^{O}C$. All cables shall also confirm to the relevant fault level of switch board for one second and supporting calculations must be submitted for fault level.

8.6 Cable Terminations

i) For termination of MV cables, single compression type glands shall be used for indoor locations. Glands shall be of brass, Lugs of Al / Cu or tinned copper shall be used as applicable, lugs shall be properly crimped on conductors. All glands used must be of heavy duty type.

ii) In outdoor areas, except within outdoor sub station area, cables shall be laid directly buried between building entry/exit points. Within buildings, cables shall be laid on cable trays to be supported from building walls columns/ beams/floors / ceilings. In outdoor sub station area, cables shall be laid on cable trays in build up cable trenches. Ladder and perforated type cable trays shall be proposed. Ladder type cable trays widths shall be restricted between 300 mm and 600 mm. Perforated cable trays widths shall be restricted

between 100 mm and 250 mm. Side members of ladder type cable trays shall be fabricated using structural steel angles of at least 6 mm thick. Perforated cable trays shall be of the formed type made from 2 mm thick sheet steel. For supports, structural angles or channels of appropriate strength shall be proposed. Vertical runs of cable trays shall be enclosed using perforated sheets as above. Cable trays, supports and covers shall be painted with epoxy paint of shade acceptable to Employer. Tray width shall be so sized that at least 30% margin is available for addition at later date. This distance between the cables shall be minimum equal to outer dia of cable.

iii) At road crossings hume pipe/s of adequate size shall be provided at a depth of 1000 mm (center line depth) of passage of cables, earthing conductors etc. At building entry points pipe sleeves of GI or PVC shall be provided for the passage of cables and earthing conductors, such sleeves shall have projections on either side to facilitate extension.

9.0 Illumination:

9.1 All internal and external areas shall be provided with lighting. The illumination levels to be achieved shall be as follows:

Office and labs	**:**	**300**	**Lux**
Switchgear Room	**:**	**200**	**Lux**
Control Room	**:**	**300**	**Lux**
Pump House	**:**	**200**	**Lux**
DG set Room	**:**	**200**	**Lux**
Chemical and General Store	**:**	**150**	**Lux**
Chemical Plant Room	**:**	**200**	**Lux**
Other indoor areas	**:**	**100**	**Lux**
Outdoor plant from and walkways		**:50**	**Lux**
Building entrance	**:**	**100**	**Lux**
Indoor Plant Area	**:**	**200**	**Lux**

Outdoor Plant Area	**:**	**50**	**Lux**
Transformer Area	**:**	**100**	**Lux**
Roads	**:**	**10**	**Lux**

Fluorescent luminaries shall be used primarily for internal lighting. High pressure vapour or metal halide type luminaries shall be used in indoor application where their use is appropriate. If mercury or metal halide is used in indoor then they should be supplemented with fluorescent luminaries to assure that minimum illumination levels are maintained following momentary power dips. All other internal areas shall be lit with fluorescent luminaries. Where specific recommendation of lux level are not covered above, illumination level in such areas shall be finalized in consultation with Empolyer. Contractor shall be required to measure levels of illumination after completion of lighting installation work and short fall in illumination level shall be made good by the contractor. Complete set of calculations showing, room, index, copy MF shall be given during detailed engineering.

9.2 Switches / sockets of piano type shall be used in general and in offices of staff, control room, MMI room, decorative modular switches shall be used. Suitable fans shall be provided in rooms/ plant areas as per Empolyer/CPWD standards. For exhaust fans it must be provided in panel rooms, pump rooms, chemical rooms, stores, toilets and at least 20 air changes per hour must be maintained.

9.3 The following type of lighting fixtures shall be proposed:

a) Decorative type 2x36W fixtures for fluorescent luminaries inside office/ administrative buildings and control rooms.

b) Corrosion resistant fixture with canopy made of FRP for fluorescent luminaries for corrosive areas like chlorine handling or chemical store or area with corrosive smell/gases etc.

c) Industrial type vitreous enameled fixture for fluorescent

luminaries inside 415V switchgear, MCC room and pump house.

d) In outdoor process areas, lighting fixtures shall be sodium vapour type subjected to minimum of IP protection class.

e) All outside lights as plant field lights, building outside lights, flood lights etc. which are to be switched on only during night hours should be controlled through photo cell/ clock switch installed at a central place. All lights shall have minimum IP65 protection class.

f) Street lighting wiring shall be through buried underground.

g) All bulb fittings (except fluorescent lamps) will have screw type caps.

h) For outdoor lighting, the lighting feeder shall be operated through a contactor, controlled by photocell/ clock switch and shall also have a manual by pass switch.

9.4 Luminaires shall be installed to permit ease of maintenance i.e. it shall not be necessary to shut down plant in order to carryout maintenance or to access luminaries located over areas of water etc. The contractor shall provide all equipment necessary to carryout maintenance on the lighting installation and demonstrate its operation to the satisfaction of Empolyer.

9.5 Indoor lighting circuit will be arranged in such a way that 50% lighting can be put off in each room through switches. All lighting circuits will be wired with 2.5sq.mm. stranded copper wire or through 2.5 sq.mm. armoured cable laid in cable trays. Sub circuit from switch to fixture could be wired with 1.5 sq.mm. stranded copper wire in MS conduits or armoured copper cable of similar size provided total voltage drop in any lighting distribution board to last lighting point shall not exceed 2%. All lighting circuits will have separate neutral, separate earth from Lighting Distribution Board.

9.6 For illumination of roads, outdoors areas where operation of equipment or units required and substation area, lighting fixtures of

appropriate type (such as street lighting type, flood lighting type, post top lanterns etc.) incorporating high pressure sodium vapour lamps shall be proposed. Street light poles shall not have less than 7500 mm height above the finished road level and the arm shall not project more than 1200 mm along the road width. Poles of bigger heights may also be used if some outdoor areas are to be illuminated. Poles of 4 / 4.5 Mtrs using post top lantern may be used in gate office, walk way or in front of office area. Complete area, streets, lanes, boundary shall be covered with street lighting.

9.7 Receptacles (Lighting & Small Power) :

a. Decorative and industrial type units of above shall be proposed in all plant areas, offices, stores, workshop, plant room and they shall be located at least two numbers in each room. Distance between two receptacles shall not be more than 8 – 10 mtr. All small 5 amps 5 pin lighting & small power sockets shall be wired by multi stranded copper wire of 2.5 sq. mm laid in rigid MS conduits along with earth wire of 1.5 sq.mm flexible copper wire or equivalent size armored cables. All wiring shall be coded with Red, Yellow, Blue & Black as per the phase used. If required, wiring can be done alternatively through armoured copper cables of similar size laid in MS perforated trays of minimum 2.0 mm thick.

b. Three phase power receptacles (convenience outlets) suitable for operation of 415V, 3 Phase 4 wire, 50 Hz power supply shall be proposed. In indoor areas one such unit shall be provided to cover areas of 20 meter radius (or at least one in each room housing plant items) and in outdoors areas on such unit shall be provided at 50 meter interval. Actual requirement of such units shall be finalized by Empolyer during detailed engineering. One three phase receptacle shall be provided near entrance of each building for utilities like welding.

c. Single phase 15 Amp 5 Pin / 6 Pin receptacles will be

provided in each room and in halls they will be provided in such a way that with 15 meter cord we should reach every place in building. These shall be wired with 4 sq. mm copper earth wire in MS rigid conduits along with 2.5 sq. mm earth wire. Not more than two sockets shall be looped in one circuit. Alternatively they can also be connected through armoured cable of 4 sq. mm running in appropriate cable trays.

9.8 Separate lighting panels and lighting distribution boards shall be installed and they shall not take tapping for power from motor control centers or power distribution boards.

10.0. Earthing & Lightning Protection.

10.1 Bidders are advised to carry out soil resistivity measurement for designing the earthing system. Further, bidders are also required to study the guidelines in respect of lightning protection covered in relevant Indian Standards and accordingly include proposals for the same. The bidder shall make sure that earthing resistance value for both neutral conductor & body earthing shall be less than one ohm. All earthing station shall conform to latest amended IS 3043.

10.2 The Contractor shall provide an earthing installation at each site. Protective conductors shall be provided for all electrical installations and associated mechanical plant, exposed steel work and buildings. Protective conductors shall be provided in accordance with the requirements of IS-3043 or equivalent. The earthing system shall be designed for the earth fault current occurring at the point of supply. The neutral point of the 11/0.433 KV transformer secondary windings shall be solidly earthed. The calculation of earthing system and earthing valves must be submitted at detailed engineering stage.

10.3 The electrical installation shall be connected to the general mass of the earth by an earthing electrode. The earth electrode system shall be established adjacent to the transformer compound. GI

plate earth electrodes shall be proposed in earthing system. MS conductors with allowance for corrosion shall be used for conductors to be buried in ground and they shall with stand fault for three seconds. GI conductors for earthing shall be used for above ground installations. Touch and step potentials shall be kept within permissible limits as per IS and this should be supported with earthing calculations. No earthing resistance shall be less than one ohm. Size of earthing conductor shall be arrived as per calculations subjected to minimum rating suggested below:

a. Main switch board and stand bye : 50 x 6mm GI Flat

b. Interconnection to lighting protection system : 50 x 6mm GI Flat

c. Interconnection to MCC's : 50 x 6mm GI Flat

d. Interconnection to control panels : 25 x 3mm GI Flat

e. PF correction panel : 50 x 6mm GI Flat

f. Local push button : 14 SWG GI

g. Lighting distribution boards : 4 SWG GI

h. Lighting & receptacle system : 12 SWG GI

i. Outdoor street lighting : 8 SWG GI

j. Ladder rack and cable tray at suitable points: 25 x 3mm GI

k. Hand rails and metallic structure : 25 x 3mm GI

l. Steel structure comprising storage tanks : 25 x 3mm GI

10.4 The complete plant shall have lighting protection in the form of lighting finials, horizontal earth continuity conductors, verticals risers, inspection links, earthing pits as per IS 3043. As detailed lightning calculations shall be submitted at the detailed engineering stage.

11.0 Communication:

Bidders are required to provide communication facilities at site. The site shall also have facility to communicate with outside agencies through local telephone network. Bids shall take into account the above requirement. Bidders are free to propose means of communication within site; however communication with outside agencies shall be through local telephone network only.

12.0 Instrumentation

12.1 Introduction to Instrumentation

Employer wants to have latest technology with compatible automation system ON LINE to run the plant from a single location. A typical control system architecture is enclosed with bid which is to be strictly followed by bidder/ contractor while designing the control system and instrumentation.

AIM: To provide latest technology for ON LINE monitoring and control of various parameters Employer hopes to achieve following aim:

- **Improvement in effluent quality**
- **Proper monitoring and correction**
- **Low manpower**
- **Generation of all faults and trends**
- **Correct display of input raw material and output treated effluent**
- **Long-term historical storage of process data**
- **Analysis and graphical plots of historical data**
- **Prevention maintenance management**
- **Inventory control**

- **Maintain plant operation summaries**
- **Maintain record of generation of methane gas and consumption.**
- **Improve plant efficiency and increase the plant life.**

Bidder shall provide one centralised control room with PLC based SCADA system based on latest technology with following minimum feature.

- Two nos. of Pentium-IV PC with 22" colour monitors with one no. LaserJet printer.
- All field instruments shall be controlled by centralised control room.
- In case of PC failure, the local control shall be able to control all the field instruments.
- All Analysers / Transmitters shall have local display as well.
- SCADA should have graphics, alarm reports, process trends, history, etc.
- Minimum 15% spare capacity for each analogue and digital I/O's shall be provided in PLC.Instrumentation control system shall have dedicated earthing and shall not be joined with electrical earthing. Control system earthing shall have ideal zero voltage value.
- **On-line flow measurement shall be done at inlet of sewage treatment plant.**
- **All the valves, motors penstock shall be electrically as well as electrically operated except valves on suction line of pumps / blowers / compressors, which shall be manually operated. Scour valves on rising main (s) shall also be manually operated.**
- **A central control room shall be provided with air conditioning. The control room shall be located inside the plant at convenient location.**
- **Contactor shall submit the details of Field Instruments, Panel Instruments, Including Type, Makes, Model No., and Range etc. suitable for above mentioned application.**
- **Bidder shall submit the complete control system architecture including**

type of control, number of analogue/digital I/OS, type of communication bus, retentively level etc.

12.2 Large General Product Description:

The Automation System shall integrate multiple sewage treatment plant functions including equipment supervision and control, alarm management, energy management, information management, and historical data collection and archiving. The automation system shall consist of the following:

1.Programmable Logic Controllers

2.Computer based SCADA

12.3 System Architecture

Processor: Controllers shall be microprocessor-based with a minimum word size of 32 bits and a maximum program scans rate preferably 2-3 msecs but less than 1 second. They shall be multi-tasking, multi-user, and real-time digital control processors. Controller size and capability shall be sufficient to fully meet the requirements of this Specification.

Memory: Each controller shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control.

Hardware Real Time Clock: The controller shall have an integrated, hardware-based, real-time clock.

Communications Ports: The PLC shall provide at least one RS-232 serial data communication ports for operation of operator I/O devices, such as industry-standard printers, operator terminals, modems, and portable operator's terminals. PLC shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or terminals.

Diagnostics: Controller shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The network controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

Power Failure: In the event of the loss of normal power, there shall be an orderly

shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.

Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence. Should a controller memory be lost for any reason, the operator workstation shall automatically reload the program without any intervention by the system operators.

PLC specifications

Point types: Each PLC panel shall support the following types of point inputs and outputs:

Analog inputs shall monitor the following analog signals:

- **4-20 mA Sensors**
- **0-10 VDC Sensors**
- **1000ohm RTDs**

Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input “bouncing.”

Counter inputs shall monitor dry contact pulses with an input resolution of one HZ minimum.

Analog outputs shall provide the following control outputs:

(iii) 4.20 mA – Sink or Source

(iv) 0-10 VDC

Binary outputs shall provide SPDT output contacts rated for 2 amps at 24 VAC.

Operator Interface – Personal computer operator interface

The automation system Contractor shall provide and install a personal computer workstation for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the network controllers to facilitate greater fault tolerance and reliability.

Workstation System Architecture – The architecture of the workstation shall be implemented to conform to industry standard APIs (application programming interfaces), so that it can accommodate applications provided by the automation system Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards. All historical information contained in Time Series Databases and all configuration data contained in relational databases must be accessed via ODBC (utilizing ANSI SQL database query specifications).All real-time, online plant data must be accessible by all applications (including, but not limited to, graphics, reports, etc.) via OPC (OLE for Process Control).All real-time event data (including alarms, change of state events, warning events, etc.) shall be accessible by all applications via OPC (OLE for Process Control).The Automation system Contractor shall provide all necessary OPC servers for communicating to the DDC controllers that are provided as part of this contract. In addition, the system shall accommodate installation and registration of OPC servers provided in the future by other equipment suppliers.

Workstation Operator Applications architecture: Major operator viewing applications shall be implemented utilizing the current Microsoft Model of an Active-X control, to be contained in one or more Active-X compliant containers. Specifically, the graphics application shall be provided as an Active-X control (for example it shall be possible to embed a graphic in a web page and view it in Internet Explorer). Conversely, it shall be possible to embed other Active X controls—such as trends

and other third party available controls—in the real-time graphic application.

12.4 Operating System Software for PC

Windows 10 Professional (OEM)

Complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.

Peripheral Hardware

Alarm printers:

Printer Make	**:**	**HP**
Printing Method	**:**	**Laser**

Workstation Application Components:

Operator Interface

An integrated software package shall be used as the operator interface program.All Inputs, Outputs, Set points and all other parameters as defined or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.The operator workstation software shall provide context-sensitive help menus and instructions for each operation and/or application currently being performed.All controller software operating parameters shall be displayed for the operator to view/modify from the operator workstation. These include set points, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.

The operation of the control system shall be independent of the operator workstation, which shall be used for operator communications only. Systems that rely on the operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

Alarms:

Each workstation shall receive and process alarms sent to it by the control system. The alarm management portion of the operator workstation software shall, at the minimum, provide the following functions: Log date and time of alarm occurrence. Generate a “Pop-Up” window informing an operator that an alarm has been received.Allows an operator, with the appropriate security level, to acknowledge, delete, or disable an alarm.Provide an audit trail for alarms by recording operator acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the operator, the alarm, the action taken on the alarm, and a time/date stamp.Record all alarms received at an operator’s workstation to that workstation’s hard drive.Allow the operators to view/manage the alarm data archived to hard disk. Selection of a single menu item or tool bar button shall allow the user to acknowledge, disable, delete, or print the selected alarm.Alarms shall be generated by the operator workstation for any controller that is “off-line” and is not communicating.Changes made to alarm set points from the Operator Workstation shall directly modify the controller alarm management database.Selection of a single menu item or tool bar button shall print any displayed alarm report on the system printer for use as a building management and diagnostics tool.

Reports

Reports shall be generated and directed to one of the following: workstation displays, printers, or disk. As a minimum, the system shall provide the following reports:

1. All points in the network.
2. All points in a specific controller.
3. A listing of a user-defined group of points in the network. There shall be no limit to the number of user-defined groups
4. All points currently in alarm.
5. All points in hardware override.
6. All disabled points.
7. All weekly schedules.
8. All or selected point attributes, including, but not limited to:

9. Values
10. Set points
11. Alarm Limits
12. Run Times
13. All programd holidays and associated schedules.
14. All disabled alarms.
15. All active, unacknowledged alarms.
16. All active, acknowledged alarms.
17. Any and all other controller operating parameters.

The system shall allow for the creation of custom report point groups that shall be capable of including points from multiple controllers. Systems limiting point report displays to only a single controller's point database shall not be accepted.The number of custom reports or display groups shall be limited by the amount of available system memory.Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report on the system printer for use as a building management and diagnostics tool.Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and database manipulation capabilities as he or she deems appropriate for each user, based on an assigned password.

Each user shall have the following: a user name; a password, and an access level (from 1 - 5). The system shall allow each user to change his or her password at will.When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.A minimum of five levels of access shall be supported as follows:

- **Level 1 = Data Access and Display**

- **Level 2 = Level 1 and Operator Overrides**
- **Level 3 = Level 2 and Database Modification**
- **Level 4 = Level 3 and Database Generation**
- **Level 5 = All privileges, including Password Add/Modify**

A minimum of 100 unique passwords, including user initials, shall be supported.

Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving the operator workstation logged on.Within applications the user shall easily be able to navigate to new information (for example, launch a new graphic within a graphic).

Graphics

The graphics shall be able to display and provide animation based on real-time data that is acquired, calculated, or entered. Multiple graphic applications shall be able to execute at any one time on a single workstation. The Operator shall be able to configure the speed at which data will be updated on the specific graphic. Basic graphical objects: All graphics shall be able to be constructed from the following basic graphical objects:

Single or multi-segment lines of any thickness: Line styles at a minimum shall include: solid, dotted, and dashed.

Rectangles: User may fill with any color or no fill, and may configure the thickness of the outline.

Polygons: User may fill with any color or no fill, and may configure the thickness of the outline. Arcs.

Circles and Ellipses: User may fill with any color or no fill, and may configure the thickness of the outline.

Text boxes: User may configure text boxes with any W98 TrueType font, any foreground color, any background color, and with 8 or more thickness levels.

Animation: Any Basic object, any group of basic objects, or any symbol or group of symbols, shall be capable of being animated in the following manner:

Size: Any object's size shall be able to be animated based on the value of an analog variable.

Movement: Any object can be animated to move either in a straight line, or can follow a configured path of any number of line segments.

Rotation: Any object shall be able to be animated to rotate up 360 degrees.

Visibility: It shall be possible to make any object dynamically appear or disappear based on the true / false result of any boolean equations.

Operation from graphics: It shall be possible to change values (set points) and states in system controlled equipment by any of the following methods of operator interaction:

By selecting the object with either the left, middle, or right mouse button:

- Load a specific graphic.
- Drag/Drop to load a graphic in a selected window.
- Link forward or backward to another graphic.
- Change or toggle the value of an object.
- Launch an executable application.

Slider action: Any object can be defined to be a slider and configured to change a set point or other variables as the user slides an object over a configured geometry.

Dial action: Any object can be configured so that it can change a configured analog value over a range as the object is rotated. This is most often used to represent dials.

Data Entry: A variable is displayed on a graphic. By selecting the variable, the data entry function for the value is enabled and the operator is able to enter a new

value for the variable.

Graphic editing tool: A graphic-editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing all drawing functions, defining all calculations to be executed as part of the graphic, defining all animations, and defining all runtime binding. It is not acceptable for separate programs to be required to do these various functions.

The graphic-editing tool shall in general provide for the creation and positioning of objects by dragging from tool bars and positioning where required. It shall provide the ability to create, at a minimum, all of the object types, all of the animation algorithms, and all of the action types referenced in this section.

In addition, the graphic editing tool shall be able to add additional content to any graphic by importing any Windows metafile (.wmf) or any bitmap file (.bmp).

Historical trending and data collection:

Each Network Controller shall store trend and point history data for all analog and digital inputs and outputs, as follows:

Any point, physical or calculated, may be designated for trending.

Each network controller shall have a dedicated RAM-based buffer for trend data, and shall store 96 samples for each physical point and software variable, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters. Trend and change of value data shall be stored within the controller and then uploaded to the trend database(s). Uploads shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in either Microsoft Access or SQL database format. To enable users to easily access stored data, the system shall provide the capability to store historical data in more than one file system (i.e., removable media, separate hard drives, or a remote network file system).

Trend data viewing and analysis.

Provide a trend viewing utility that shall have access to all database points.

Provide database access through an Open Database Connectivity (ODBC) interface – a standard Application Programming Interface (API) for accessing data from relational databases. Client applications can reside within a Windows 95, Windows 98, Windows NT or other latest windows environment.Graphic displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.It shall be possible to display trend data in histogram (X-Y plots) format as well as area and bar graphs.Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed. This function shall also be operator selectable.The display range shall consist of magnitude and units fields. The units are seconds, minutes, hours, days, and months.

12.5 Instrumentation Design Criteria

The design criteria to be applied to instrumentation system shall be as follows:

- All instruments shall suitable for continuous operation.
- All transmitting instruments shall have a 4-20 mA/0-10VDC linear output.
- All digital outputs shall be volt free.
- Instruments shall be designed for the ambient conditions of temperature and humidity.
- All wetted parts of instrument sensors shall be non-corrosive and suitable for use with sewage.
- All instrumentation system for use out of doors shall be protected to IP 65.
- All analogue displays shall be of the digital type with no moving parts utilizing back lit liquid crystal diode LCD/ LED technology.
- Instrumentation shall utilize solid state electronic technology and avoid the

use where practical of any moving parts.

- Minimum maintenance requirements.
- Instrumentation shall resume operation automatically on the application of power following a power failure.

Analogue instrumentation system shall be provided to monitor the following

- Raw Sewage Flow
- Sump levels
- Clogging of screens through differential level monitoring
- Total Power consumed by Plant.

Digital systems shall be provided as detailed in the Employer's Requirements and as necessary for the efficient and safe operation of the treatment plant.The Contractor shall provide plant to measure any other parameter required for the efficient and safe operation of the treatment plant.Instrumentation sensors shall be suitable for the environment in which they are expected to work. Sensor located in hazardous (flammable) or potentially hazardous atmospheres shall be certified for use in these areas.

12.6 Flow Measurement

Flow metering as specified will be either open channel type or full bore Ultrasonic/electromagnetic type as applicable.

a. Open Channel Flow meter

The open channel flow meter should employ an ultrasonic principle to measure level and level to flow conversion should be inbuilt in the unit. It should provide isolated 4-20mA/0-10VDC outputs based on flow rate. It should have inbuilt LCD display and housed in an IP65 enclosure. It should have inbuilt temperature sensor for automatic compensation for changes in air temperature to ensure measurement accuracy. Maximum error in measurement should be within +/-0.2% m at head change of 3m at 22degC and 40-70%RH. The probe unit should be in corrosive and unaffected by H_2S laden atmosphere.

b. Ultrasonic / Electromagnetic Flow meter

The electromagnetic flow meter should provide isolated 4-20mA/0-10VDC outputs based on flow rate. It should be housed in IP65 enclosure. It should have an accuracy of +/- 0.5% of flow rate at maximum mean velocity of 15m/sec. It should have a non-full pipe detection system inbuilt in it. The lining of material should be polyurethane with transducers. No rubber lining will be allowed.

12.7 Level Measurement

Ultrasonic level type measurement devices shall be used to monitor all tanks. They should be housed in an IP68 enclosure with a integrated display unit. It should have a 4-20mA/0-10VDC output based on level and a resolution of at least 1mm. Measuring range should be at least 0.3 to 8m. The unit should be CE /UL certified

12.8 Instrumentation Cables

All signal cables (Analog/Digital) shall be 660V, PVC insulated with stranded tinned copper conductors and laid up as twisted pairs with approximately one twist per 30mm approx. Each cable shall be overall screened of aluminium-mylar type including drain wire giving coverage of 85%, and overall PVC sheath. The analog signals shall have conductors of .8 sq.mm. All external cables should be armored.

12.9 Control System Protection

Short Circuit

All power supplies to PLCs, instrument power supplies shall be protected against short circuit by the provision of adequate numbers of fuses or miniature circuit breakers.

12.10 Duty/ Standby Drives

The duty pump for each duty drive shall be selected on basis of minimum runtime and will be rotated for runtime equalization.The control logic shall automatically start an 'available' standby in the event of the duty drive failing.

12.11 Uninterruptible Power Supply (UPS)

Complete control instrumentation system should be powered through centralized

UPS. The Network Controllers and Operator workstation should also be powered through online UPS.

Bidder shall provide true ON Line UPS system with rated working load plus 100% standby with parallel redundant in a room. The UPS system shall be provided with necessary by pass arrangement. Each UPS shall have minimum 30 minutes battery backup. The batteries shall be of maintenance free type.

All DC or AC voltage required for instrumentation system shall be derived within the control panels by providing a regulated DC power supply units or transformers. Generators of small capacity sufficient to feed UPS, shall be supplied and installed along with control gear, changeover scheme, and exhaust and earthing.

12.12 Process Plant Control Philosophy

The control system in addition to providing the facilities detailed in the preceding clauses shall provide the following process plant specific requirements. The automation system should automatically on the restoration of power (following a power failure) start the plant operation sequence after expiry of delay timers and follow a startup sequence to prevent the simultaneous startup of various drives. The typical input/ output (I/O) requirements of various drives to be controlled and monitored through DDCs are shown in Table 1.1.

12.13 Intercom System

An intercom system with 3x24 EAPBX shall be provided at all suitable locations especially between the following points within the treatment plant:

- Control room
- All rooms within the Administration and Control Building
- The pump and compressor room with the adjacent main distribution panel room
- The laboratory
- The disinfection house
- Duty Room
- Security Cabin at the entrance of the campus
- 132 KV GSS

TABLE 1.1: TYPICAL I/O SCHEDULE

Sl. No.	Items	DDC I/O.					
		DI	DO	AI	AO	Controls	Alarms
1.	**Tanks and associated Pumps**						
	Tank Level(Through Ultrasonic level transmitter)			x		Level control	High and low
	Pump Start/Stop(2A rated potential free relay contact output)		x			Duty cycling on demand and runtime equalization. Standby to come online in case of duty failure	
	Pump Status	x					Run
	Pump trip status(Through potential free contact of overload relay)	x					Trip alarm
	Pump auto manual switch status(Through auxiliary potential free contact of auto manual switch)	x					Manual mode

Sl. No.	Items	DDC I/O.					
		DI	DO	AI	AO	Controls	Alarms
2.	**All electrical drives (aerators, fans etc.)**						
	Start/Stop(2A rated potential free relay contact output)		x			Duty cycling on demand & runtime equalization. Standby to come online in case of duty failure	
	Status(Through current relay)	x					Run
	Trip status(Through potential free contact of overload relay)	x					Trip alarm
	Auto manual switch status(Through auxiliary potential free contact of auto manual switch)	x					Manual mode
	Control sensors for automatic operation of the drives if required	x		x			High/low value alarm
3.	Power failure	x					Power failure alarm
4.	Power failure restart					Restart plant in sequence	Power failure

Sl. No.	Items	DDC I/O.					
		DI	DO	AI	AO	Controls	Alarms
							restart mode ON

Notes:

i. The I/O schedule detailed is indicative. The Contractor shall provide all the I/Os necessary in order to achieve the complete control and monitoring of the plant.

ii. 15% spare for each type of digital and analogue I/Os shall be provided in each DDC.

INSPECTION, TESTING, ERECTION, COMMISSIONING & PERFORMANCE RUN OF MECHANICAL & ELECTRICAL EQUIPMENTS OF PLANT

1.1 General :

All equipments prior to dispatch for the site shall be tested at works as per relevant IS codes. International codes shall be used wherever Indian standards are not available.

1.1.1. Test Instruments:

The Contractor shall satisfy the Engineer as to the accuracy of all the instruments used for tests and if required shall produce recent calibration tests, or otherwise have them calibrated at his own expense by and independent authority.

1.1.2. Test Certificates:

Copies of certificates of all works, routine tests shall be provided as detailed.

The Contractor shall obtain and submit to the Engineer and to other parties as may be directed, certificates of test of all items, certifying that they have been satisfactorily tested and describing and giving full particulars of such tests.

1.1.3. Manufacturer's Works Inspection Tests and Gaurantees:

All Schedules of Particulars shall be completed and the Guaranteed Particulars and the efficiencies of the equipment offered at the duties specified will be binding and may not be varied expect with the consent in writing of the Engineer.

The Engineer shall be provided with the facility for inspection of all equipment and material and shall be given at least 10 days notice when such equipment and material is ready for inspection at manufacturer or vendors workshops.

Full witness testing to the relevant standards and to prove guarantees given will be required for the following items:

i). **All pumps for performance testing.**

ii). Electric motors for type on routine one motor of each size.

iii). All control panels.

iv). Chlorinator for relevant performance test.

v). All transformers for routine and type test on.

vi) EOT Crane as per relevant standards.

In addition all other items of equipment not subject to witness testing shall be temporarily erected at the manufacturer's works and tested for satisfactory operation and shall be offered for inspection. Copies of manufacturer's test readings shall be submitted to the Engineer, all prior to packing for shipment.

Such inspection, examination, or testing, shall not release the Contractor, manufacturer or supplier of any item from any obligation under the Contract.

Certified copies of manufacturer's test readings of all items shall be submitted to the Engineer within 7 days of the satisfactory completion of the tests.

Whilst the Engineer shall be provided with facilities for witness testing and / or inspection of all items of equipment at the manufacturer's works, he may at his discretion advise that the tests shall proceed in his absence. These tests shall be made as if in his presence, and duly certified copies of test readings shall be submitted.

Where items of equipment are of identical size and duty it may be required, at the Engineer's discretion, that a reduced number of the items be subjected to witness tests; however this shall not relieve the manufacturer from the requirement of carrying out the performance tests on all items prior to offering a witness testing.

If after inspecting, examining or testing any material or equipment, the Engineer shall decide that such items or any pat thereof is defective, or not in accordance with the Specification or performances, he may reject

the said items or part thereof, giving to the manufacturer within a reasonable time, notice in writing of such rejection, stating therein the ground upon which the said decision is based. All re-testing shall be at the Contractor's expense.

1.1.4. Site Testing:

The Contractor shall arrange for the full site testing of all items of equipment and shall include provision of:

a). All skilled and qualified operating and test staff for the testing of all equipment.

b). Provision and disposal of all services, lubricants, and fuels other than electricity.

c). All measuring and testing instruments to demonstrate equipment operates to the fulfillment of the works sheet.

1.1.5. Manufacture's Work Tests

1.1.5.1 Power Transformers

i). **Measurement of winding resistance.**
ii). Ratio polarity and phase relationship.
iii). Impedance voltage.
iv) Load losses.
v). No-load losses and no-load current.
vi). Insulation resistance.
vii). Included over voltage withstand.
viii). Separate source voltage withstand.

1.1.5.2 Type Tests

i). **Impulse voltage withstand both chopped and full wave.**
ii). Temperature rise.

Unless otherwise stated by the Engineer, evidence of type of tests

carried out on identical transformers to those being provided under the contract will be accepted in lieu of actual tests.

1.1.5.3 Circuit Breakers And Control Gear:

i). Routine tests including pressure test, milli-volt drop (Ductor) tests.

ii). To ensure operation of the closing coil and satisfactory closing of the circuit breaker with the voltage on the coil down to 80% of its rated voltage, and that mal-operation does not occur with a voltage on the coil of 120% of its rated voltage.

iii). To ensure the satisfactory trip operation of the circuit breaker at no load conditions with the trip coil energized at 50% of its rated voltage.

iv). Test figures for heat - run tests performed on identical panel types shall be made available.

v). All interlocking, circuit breaker draws in & out operation.

1.1.5.4 Protection and Control Circuits:

Base on the completeness of the circuits in the final manufactured form within the manufacturer's works, the following tests shall be carried out:

i). Primary injection tests to ensure correct operation of the current operated protection relays and direct acting coils over their full range of settings.

ii). Balanced earth fault stability tests by primary current injection. Care must be taken to reproduce accurately the burdens of interconnecting cables. A further test to ensure correct polarity must be made after assembly.With different pilot wire schemes it may not be possible to apply primary injection testing. In this case the circuits shall be proved by secondary injection. Current transformer characteristics and calculations associated with the above tests shall be available for

inspection by the Engineer.

iv) Correct operation of control circuits at normal operating voltage by operating voltage by operation of local control switches, and simulation of operation from remote control positions.

1.1.5.5 Motors:

Motors over 100 KW site rating shall be subject to full performance tests which may be witnessed by the Engineer at the Motor manufacturer's works.Motors of 5.5 KW to 22 KW site rating shall be subject to performance tests but will not be witnessed.Motors under 5.5 KW site rating shall be subject to " type test " standards.

Type test certificates which shall include the following shall be provided for all motors :

i). Manufacture to BS.

ii). Class of Insulation.

iii). Type of cable fittings.

iv). Type of bearing sizes and lubricant.

v). Type and raring of motor heaters.

Motor testing shall be carried our in accordance with the requirements of BS 4999.

1.1.5.6 Instruments And Meters:

Tests to ensure operation of all ammeters, voltmeters and transducers and checks for correct calibration KWH meters shall be checked for correct rotation and creep tests shall be carried out to ensure that the meter is inoperative with voltage along, if the secondary of the current transformer is left connected with the primary current interrupted.

1.1.6. Tests On Cables During Manufacture:

All cables supplied under the Contract shall be subject to routine tests in accordance with the relevant British Standard. Cables will not be accepted on Site for installation until certificates giving proof of

compliance with the Specification and date of tests have been received and approved by the Engineer. A certificate shall be applicable to each drum.

The tests to be carried out on every drum at manufacturer's premises shall include:

a). High voltage A.C insulation pressure test between cores, each core to earth metallic sheath or armour as applicable.

b). Insulation resistance test.

c). Core continuity and identification.

d). Conductor resistance test.

1.1.7. Process Control and Indicating Instruments:

All flow, level and process measurement controllers, transmitters, recorders, indicators, vacuum and pressure gauges shall be subject to routine in accordance with BS 88, BS 1780 and BS 3680.

Test Certificates shall be provided against each item of equipment.

1.1.8. Electrical Measuring Instruments and Meters:

Tests to ensure accurate operation of all meters, voltmeters and kwh meters shall be undertaken in accordance with BS 89 and BS 37.

1.1.9. Alarm Systems:

The Contractor shall be responsible for testing all items of equipment comprising the Works alarm system for correct operation and sequence action.

1.1.10. Site Tests:

Leakage Tests at the test pressure shall be carried out on all erected pipe work and valves immediately after erection and before being built in. The Contractor shall advise the Engineer when these tests are to be carried out.

1.1.11. Tests on Cable During Installation:

During the period of site installation the Engineer will carry out inspection of the Works to ensure the standards of workmanship meet the specification and are to his satisfaction. In the event of any part of the cabling installation failing to meet these requirements the Contractor shall remedy the deficiency to the satisfaction of the Engineer.

After completion of various parts of the installation the Contractor shall provide a test engineer, labour and materials to demonstrate to the Engineer that the cables have been correctly installed.

The Contractor shall inform the Engineer prior to the testing of cables and shall be responsible for liaison with any other contractor to whose equipment the cables may be terminated to ensure all parties concerned are aware of the impending tests, to guarantee safety of personnel and that isolation of any particular equipment has been completed. Any special isolation or preparation required to be carried out before cable testing will be completed by the Contractor responsible for that equipment. All tests shall be carried out by the Contractor to the satisfaction of the Engineer.

1.1.12 Pumps Sets:

Tenderers shall complete the Schedule of Particulars and Guarantees and shall state therein, inter alia, the guaranteed efficiencies of the pumps and motors offered, and the overall guaranteed rates of energy consumption of the complete pump sets at the duties specified.The contractor's guarantees given when tendering in respect both of performance and efficiency shall be binding and considered part of the contract.The fulfillment of these guarantees shall be verified at the test works to be witnessed by Empolyer and at Site trials in accordance with the procedure given in British Standards 5316 and 4999 etc.These site trials shall be carried out under the control of the contractor's staff to

the satisfaction of the Engineer. The Contractor shall provide all the necessary labor and instrumentation to conduct the tests. The discharge from the pumps shall be measured wherever possible by the volume drawn from a sump or delivered to a tank over timed intervals.

1.1.13 Electrical Plant:

After all the deficiencies apparent during the installation inspection have been rectified to the Engineer's satisfaction, the following tests shall be carried out.

1.1.13.1 Circuit Breakers and Control Gear:

Routine tests, including H.V. pressure tests.

1.1.13.2 Protection And Control Circuits:

Tests at 1.5.4 with the addition of satisfactory operation of all inter-tripping circuits in conjunction with other items of plant.

1.1.13.3 Tests on Cables after Installation:

Every cable shall be subject to the following tests after installation:

High voltage pressure tests:

The following D.C. test voltages shall be applied at full valve.

i) PLYSWS 11,000 volt grade cable
Between cores 30,000 volts between any core and armour 17,500 Volts.

ii) XLPESWAPVCC 3,300 volt grade cables.
Between cores 10,000V Between any core and armour 5,800 V

iii) XLPESWAPVC OR
PVCSWAPVC 1,100 volt grade mains cable
Between cores 3,000 V Between any core and armour 3,000V

Witnessed high voltage pressure tests shall not be carried out on PVCSWAPVC control cables, but it shall remain the responsibility of the Contractor to test the insulation of these cables both between cores and between cores and earth during installation with a 'Megger' 5000 volt hand generator.The Contractor shall test all cables after installation to ensure correct phasing out of cores, continuity of cores sheath and armour over the whole length of the cable.

1.1.14. Earthing System Tests:

The Contractor shall demonstrate to The Engineer that the Resistance of the Electrodes to earth and the earth conductor continuity is in accordance with the Specification and IS 3043. The tests shall be made on completion of the installation.The test shall be performed from each major item of plant, by using an "Earth Megger" and auxiliary return conductor. The each earthing station shall be separately tested and value of earthing resistance shall be displaced under manhole cover.

1.1.15. Installation Inspection:

In additional to the progressive supervision and inspection by Employer the Contractor shall offer for inspection to Engineer, the completely created plant/ part of plant on which tests are to be carried out. After such inspection by Engineer, each equipment / sub system shall be tested by the contractor in accordance with the applicable standards in the presence of Engineer. Such tests shall include but not be limited to the tests specified in following clauses.

1.1.16. Pre-commissioning Trials, Tests of Electrical Equipment's.

1.1.16.1 Start Up:

On completion of erection of the equipment and before start-up, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Engineer and the Contractor for correctness, completeness of installation and acceptability for start-up, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be

performed shall be as mutually agreed by the Engineer and Contractor.

1.1.16.2 Initial Operation (Initial Run)

After the pre-commissioning tests are satisfactorily over, the complete plant shall be placed on Initial Operation during which period the complete equipment shall be operated integral with sub-systems and supporting equipments as a complete plant and necessary adjustments made while operating over the full load range enabling the plant to be made ready or commissioning. The period of Initial Operation shall be as mutually agreed by the Engineer and the Contractor. An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during Initial Operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Engineer to enable to latter to accord permission to carry out the commissioning the conduct. Performance and Guarantee Tests on the Plant. However, minor defects which do not endanger the safe operation of the equipment shall not be considered as reasons for withholding the aforesaid permission. The cost of all labour, energy and consumables other than water required for Pre-commissioning, Initial Operation shall be borne by the Contractor. Water required for running the plant will be supplied free by the Employer.

1.1.17. Commissioning:

The plant shall then be commissioned and put on Trial Operation at full load when Performance Guarantee Tests shall be conducted.

During the period of trial operation the Contractor shall

i). Operate the full works on behalf of the Employer.

ii). Supply the labour and materials including consumable required for the operation and maintenance of the works and bear the cost of electrical energy.

iii). Instruct the Employer's operators in the operation and maintenance of the work; a program shall be submitted by the Contractor for the training of operators, both supervisory and subordinate levels. This program shall be submitted to the Engineer three months before the scheduled start of commissioning. The training of the employer's staff shall be carried out with reference to the operation and maintenance manual furnished by the Contractor.

iv). Carry out maintenance repairs of defects immediately.

v). During the period of trial operation of working hours of the Contractors shall be 24 hours daily, 7 days week.

The Contractor shall provide for the expenditure on all the consumables any energy required during the trial operation. All labour and cost of any other materials shall also be met fully by the Contractor. Water for operating the Plant will be supplied free by the Employer.The Trail Operation shall be considered successful, provided that each item of the equipment can operate continuously at the specified characteristics, for the period of Trial Operation and the Performance Guarantees are successfully met.Any special equipment, tools and tackles required for the successful completion of the Performance and Guarantee Tests shall be provided by the Contractor free of cost.The guaranteed performance figures of the equipments shall be provided by the Contractor during the Performance and Guarantee tests. Should the results of these tests show any decrease from the guaranteed values, the Contractor shall modify the equipments as required to enable them to meet the guarantees? In such case, Performance and Guarantee Tests shall be repeated within one month from the date the equipment is ready for re-test and costs for modifications including labour, materials and the cost of additional

testing to prove that the equipment meets the guarantees, shall be borne by the Contractor.Performance and Guarantee Tests shall make allowance for instrumentation errors as may be.

1.1.18. Completion

a) The Works will be certified as virtually completed by the Empolyer only after it has successfully completed trial operation for a continuous period of three months.

b) A Virtual Completion Certificate for plant shall not be issued unless the following documentation are dully compiled and submitted in final formats in duly bound volumes.

i) A Completion of all shop inspection results/ reports of the plant/machinery with due attestation that the plants have been manufactured to specified standards (6 copies)

ii) All erection/construction quality control checks in appropriate approved formats for installation works with attestation that installation has been carried out as per acceptable / stipulated standards (6 copies)

1.2 Start Up and Performance Run

1.2.1 Tests on Completion:

1.2.1.1 General

Prior to the commencement of Tests on Completion the Contractor shall submit the following:

- Site Acceptance Test Documents
- As built drawings
- Operation & Maintenance Manuals

Test on completion shall not be commenced until the aforementioned documents are approved.

The initial charges necessary for Tests on Completion shall be provided by the contractor. Electricity required for Tests on Completion will be provided by Empolyer free of charge for a period not exceeding 30 days. In case the test on

completion period exceeds 30 days, the cost of power till start of performance run shall be borne by the contractor. The cost of any consumables and chemicals required for the tests on shall be borne by the contractor.

1.2.1.2 Dry Test Requirements

1.2.1.2.1 General

As a minimum requirement, the following dry tests shall be carried out as a general requirement:

- A general inspection to check for correct assembly and quality of workmanship
- A check on adequacy and security of Plant fixing arrangements
- A general check to ensure that all covers, access ladders, water-proofing, guard railings etc. are in place,
- A check on damp proofing, rust proofing and vermin proofing and particularly the sealing of aperture between building structure, chambers, etc. and the outside.

1.2.1.2.2 Civil and Building Works

As a minimum requirement the following dry tests shall be carried out on the civil engineering and building works:

- Check for the presence of foreign bodies in pipe work and structures.

1.2.1.2.3 Mechanical Works

As a minimum requirement the following dry tests shall be carried out on the mechanical systems:

- Carry out preliminary running checks as far is permitted by circumstances in order to ensure smooth operation of Plant.

1.2.1.2.4 Electrical Works

As a minimum requirement the following dry tests shall be carried out on the electrical systems:

- Check phasing and polarity

- Carry out point to point check on all cables
- Check on security of cable terminations
- Check on completeness and adequacy of earthing systems;
- Check setting on protection relays, sizes of fuses and motor overload
- Carry out checks on cabling systems in accordance with the requirements the relevant standards
- Check operation of main circuit breakers by secondary injection methods
- Check rotational direction of drives.
- Check instrument loop integrity, functionality and calibration;
- Check operation of standby generator installation and mains/generator changeover procedures; a 4 hrs load test (using the normal load| Works) shall be carried out on the generator when the load is available
- Check plant functionality

1.2.1.3 Process Plants/Equipments

All process plant items/equipments shall be tested to ensure that they meet the Employer's Requirements for quality of workmanship, construction and performance.

1.2.1.4 Hydraulic Wet Test Requirement

Hydraulic wet tests shall be carried out on completion of dry tests.Potable water shall be used for hydraulic wet tests. The purposes of the 1 to prove as far as is practical the hydraulic performance of the Works. In order to demonstrate this Contractor shall ensure that each part of the Works is hydraulically loaded to its maximum rated load throughout for a period of at least seven days at twenty-four hours intervals.In order to ensure a sufficient supply of potable water to carry out these the Contractor shall provide facilities for the disposal off site in an approved manner.In order to remove doubt the following tests inter-alia shall be carried out.

- Pressure testing of all piped systems laid direct in ground in accordance to the relevant standards;
- Fill all structures and check for leaks as per IS: 3370;

- Running of all pumped systems in order to check for
- Correct functionality
- Absence of leaks
- Correct running temperatures
- Smoothness of running and the absence of undue vibration or stress
- Check drive running currents
- Carry out calibration of instruments where appropriate
- Carry out valving, diversion etc. to fully hydraulically load each element (or where there is a requirement to withstand an over overload each process element;
- Demonstrate correct functionality of electrical, control and instrumentation systems.The Contractor shall simulate where practical the conditions that will when operating as a process in order to demonstrate the correct functions process control loop etc.During these tests a check on the performance of Plant shall be made, as far as site facilities will allow, to compare its site performance with the factory test data and to identify and constraints on performance due to site conditions.

1.2.1.5 Process Wet Test

On approval by the Empolyer the Contractor shall carry out process wet tests.Raw water shall be used as the primary feed stock for process wet tests. These tests shall be carried out to demonstrate the process performance of the Works. In order to demonstrate this, the Contractor shall ensure that each part of the Works is located to its rated throughput (including a period of overload if required in order to demonstrate compliance with the Employer's Requirements) for continuous stable operating period of not less than 48 hours.The Contractor shall provide facilities for the disposal off site in an approved manner.

The following tests inter alia shall be carried out;

- Check and rectify leakage on civil structures, pumps and pipe work;
- Running of all pumped systems in order to check for;

- Correct functionality,
- Absence of leaks,
- Correct running temperatures,
- Smoothness of running and the absence of undue vibration or stress,
- Check drive running currents where the solution pumped is different from that pumped during hydraulic wet tests;

- Carry out calibration of instruments;
- Carry out valving, diversion etc to fully hydraulically load each process element (or where there is a requirement to withstand an over load), overload each process element;
- Demonstrate correct functionality of electrical, control and instrumentation systems not checked during dry or hydraulic wet tests or which may have changed as a result of the different operating conditions now prevailing.On completion of process wet test on the various parts of the works the Contractor shall run the plant as a whole in order to demonstrate the full functionality and performance of the Works at various throughput rates for a continuous period of not less than 7 days. This shall be considered as completion of Test on Completion' and shall be certified by Empolyer.

1.2.2 Performance Run After Start Up

1.2.2.1 General

On successful completion of ‘Test on Completion’ i.e. start up and commissioning, certified by Employer, Contractor should start the performance run of the plant for 1 month. During performance run period, the Contractor shall provide following as minimum for round the clock operation.

DESCRIPTION OF STAFFING

Sr.	Personnel	No.	Total Experience	Main Task of the Personnel
1	Plant In Charge (BE Civil/ Environment)	1	5 years	Coordination of activities for satisfactory performance of the STP & pumping station and reporting to the Engineer-in-charge and responsible for the proper functioning & maintenance, data collection of STP & pumping station.
2	Operators (Diploma, ITI Qualified)	6	3 years	Responsible for overall operation for STP and pumping station.
3	Electrician (ITI Qualified)	1	3 years	Responsible for maintenance of electrical equipment.
4	Fitter (Mech.) (Diploma, ITI Qualified)	1	3 years	Responsible for maintenance of mechanical equipment.
5	Helpers	6	1 year	Responsible for keeping the STP premises clean and neat. Also they will assist operators in day to day activities.
6	Security Guards	4	1 year	To protect the plant from the trespassers, animals etc.
7	Gardener	1	5 years	To maintain the garden/landscaping of the plant
8	Sweeper	1	5 years	Assisting in day to day activities in office, keeping office clean & neat.

Spares: As required for replacement during performance run period. The spares used from the spare supplied under the contract shall be rep the Contractor.Empolyer shall supply power and water during Performance Run period free of cost. All other material such as chemicals, consumables, lubricants, tools & plant spares etc. shall be provided by the contractor. The contractor, if required

shall provide activated sludge or any other material for the stabilization of the plant.

The Contractor shall provide operators for various units/plants for three shifts and other staff/supporting personnel in general shift. The Contractor shall submit a weekly report to the Employer, about the operation and maintenance indicating the manpower, electric power, chemicals consumables consumed and also problems faced and rectified. During this period, the Contractor shall ensure that the design treated quality standards are met in accordance with the specification within the rate of power and chemical consumption as committed by the Contractor. The treated sewage analysis pH, SS, BOD and oil & grease shall be carried out on daily basis from the day of commissioning at a reputed laboratory as approved by Engineer-in-Charge. 90% of the treated sewage samples should fall within prescribed limits of the treated sewage. The sampling location for raw shall be at raw sewage sump and that of treated sewage shall be at chlorine contact tank.

The analysis of sewage for the above parameters at different locations outlet of SBR Process basin shall also be carried out on weekly basis Contractor shall take immediate steps to correct the operation of the meet the guaranteed performance. The charges for analysis at the laboratory to be borne by the Contractor.

The Contractor's responsibility includes the safety and security works/plants during the course of performance run of three month.

1.2.3 Performance Run Certificate

The conditions for issuance of a Performance Run Certificate as detailed in the Conditions of Contract shall comprise:

- The completion of the three months operation and maintenance under performance run of the treatment plant to the satisfaction of Employer.
- 90% of treated sewage samples fall within the prescribed limits of the treated sewage mentioned in the tender-document
- The Operation & Maintenance Manual have been updated following three month's operational experience and approved by Employer.
- All defects during the three months operation of the works have been

rectified.

Empolyer shall issue a Completion Certificate for "Performance Run of Plant" after successful completion of Performance Run of plant for 90 consecutive days by contractor to the satisfaction of Empolyer.

Approved MAKES

11. 1 CIVIL ITEMS

SL. NO.	MATERIAL, WORK	SUPPLIER, MANUFACTURER, VENDOR, AGENCY
1	Cement (OPC) 43 Grade / 53 Grade	Ultratech, ACC, Birla Gold
2	Cement (SRC)	ACC, Gujrat Sidhee, Gujrat Ambuja
3	Cement (White)	Birla, JK
4	Cement (PPC)	ACC, Gujrat Sidhee
5	Bricks	Ordinary Burnt Clay Bricks of any brand conforming to IS: 1877 with minimum Crushing Strength of 40 Kg/cm^2 and Water Absorption Ratio restricted to 25% for Bricks used in Panel Walls and 20% for Bricks used in Load Bearing Walls
6	Mild, Tor Steel, CRS Steel	Integrated plant
7	Structural Steel	SAIL, TISCO, Vizag
8	Screws	GKW Nattlefold, Oxidised
9	Dash Bolt Fasteners	Fischer, Hilti
10	Ceramic Tiles	Spartex, Kajaria, Nitco, Johnsons, Somany, Pedder
11	Glazed Tiles (1st Quality)	H & R Johnson, Kajaria, Spartex, Naveen, Rommano, Somani Pilkingtm, ECL
12	Granite Tiles	Bell Granito, Naveen, H & R Johnson, RAK

		Ceramics – Dubai, Restile Ceramic
13	Glass Mosaic Tiles	Bisazza India, Pino Bisazza
14	Paver Blocks	Conwood Prefab, Hindustan Prefab or equivalent
15	Adhesives	Pidilite, Fairmate, Bal Adhesive, MC Bauchemie, Cementone India, Fosrock, Sunanda Speciality Coating
16	MS Door Frames & Shutters (With Galvanising)	Agew, Ferrosteel, Sen Harvic, Weldoors, Yashashri Polyextrusion
17	Door Shutters (Wooden)	Kutty, Anchor, Classic, Goyal, Timber Techniks, Sejpal Doors, Wood Designs, Yashashri Polyextrusion, Anand Wood Crafts, Northern Doors
18	Door Shutters (FRP) & Plastic	Everest fibre glass Industries, Unipals India, Advance Marketing, Yashashri Polyextrusion, Sintex
19	Hardware (Handles, Hinges, Mortice Locks)	Shalimar, Sobeet, Vijayan, Navbharat Brass Works, CIEF, Amarbhoy Dossaji
20	Aluminium Windows	Aluminite, Aluplex, Almech, Indrajit Associates, Aldoweit, Crystal Corporation, Indal, Jindal, Ajit India
21	Night Latch	Godrej, Sobeet, Vijayan, Yale
22	**Paints:**	
	a. Internal	Snowcem, Asian, ICI, British Paints, Shalimar, Nerolac, Burger, Jenson & Nicholson
	b. External	NITCO Paints, Killick Nixon, Hindustan Colours and Chemicals, Supreme, Shalimar, Burger, Jenson & Nicholson, Super Snowcem.

23	Synthetic Plaster Finish	Nitco, Accro, Damani Dye Stuff, Supreme, Renova
24	Waterproofing Works	India Waterproofing Co., Likproof India, Overseas Waterproofing Co.
25	Waterproofing Compound	Accoproof, Pediproof, CICO, Impermo, Vamiplas 302, Vamiproof 101 & 102
26	Glazing	Float Glass of Modi , Asahi , Saint Gobain
27	M.S. Rolling Shutters (With Galvanising)	Swastik, Standard, Shudwar
28	Aluminium Grills	DECO, Alumnigrille
29	Aluminium Joinery	Crystel Corporation, Alumlite, Aluplex, Alm
30	Anti-stripping Agent	Yuva, BE 100
31	Chemical Admixtures and Compounds for RCC and Mortar	MC Bauchemie, Krishna Conchem Products, Sunanda Chemicals, Pidilite, Fairmate, Fosroc, Sika Qualcrete
32	Anti-Corrosive Paint	Krishna Conchem Products, CICO Chemisol Adhesive, Shalimar, Burger
33	Sanitary ware	Hindustan, Parry, Cera, John Gas, Jotisum
34	Flushing Cistern	Flush Line or equivalent Approved ISI Manufacturers
35	Sanitary Fittings and Fixtures	Mark, Jaguar, Gem, Dripless, Kingston, Essco, Metro, Ess Ess
36	Lead for Lead Joints	Approved ISI Manufacturers
37	Rubber Ring	Approved ISI Manufacturers
38	Stainless Steel Sink	Nirali, Tuff, Diamond, Kingston, Neel Kamal
39	SW Gully Trap and Stone ware Pipes	Perfect, Sonya, Girco, Elecon, Rajura

40	Cast Iron Covers	RIFCO, Mohit Steel, Ashok Iron Works, Jayswal Neco
41	Piling Works	Kvaerner, Afcons, Michigan Engineering, Larsen & Toubro, DBM Geotechnics, Meher Foundations, Safe Foundations, Simplex
42	Fire-fighting Works	Monsher, Mather & Platt, Bells Controls, Nitin Fire, Rahul Fire
43	Elevators	Otis, Mitsubishi, Kone, Bharat Bijlee, Schindler
44	Sodium Nitrate	Devica Chemicals or equivalent Approved ISI Manufacturers
45	Sodium Silicate	Devica Chemicals or equivalent Approved ISI Manufacturers
46	Marine Plywood	Anchor, Kitply
47	Neeru	Swastic Instant Neeru or equivalent Approved ISI Manufacturers
48	Lime for Whitewash	As directed by Engineer-in-charge
49	Tarfelt	Shalimar, Lloyds
50	Lightening Conductor	Approved ISI Manufacturers
51	Teak Wood	C.P. Teakwood, First Quality with following Tolerances. Sap Wood to the extent of 25% Wrap to the extent of 10 mm in 3m Knots/meter
52	S.W. Pipes	Burn & Co., Perfect Potteries, Navroji Vakil, Kashimira
53	CI Soil Pipes & Fittings as per	NECO, CENTRI

	IS : 3989/84	
54	G.I. Pipes Class “C”	TATA, Zenith, Jindal, Suryaprakash
55	G.I. Fittings	Approved ISI Manufacturers
56	Gate Valve / Non Return Valve	Sant, Zoloto, Leader
57	S.W. Pipes	Rajura or other Approved ISI Manufacturers
58	Flush Valve	Jaguar , Ess Ess
59	Water Meter	Capstan or other Approved ISI Manufacturers

12. 2 ELECTRICAL ITEMS

SL. NO.	MATERIAL, WORK	SUPPLIER, MANUFACTURER, VENDOR, AGENCY
1	S.F.U., Breakers	L&T, Siemens, GE, Schneider
2	Distribution Boards	MDS, Siemens, Schneider, Hager
3	Indicating Digital Meters	AE, Meco, L&T, Conzerv
4	Crimping Lugs, Glands of Double Compression Type	Dowells, Jainson, Lotus, Braco
5	Jelly filled Telephone Cables	Finolex, Universal, RPG
6	Tag Block with Boxes	Krone
7	Rossets	ITL, Tele Connectors India
8	MCB, RCCB	MDS, Siemens, Schneider, Hager
9	Main L.T Panels, PDB, LDB	Incorporating L&T, Siemens, GEC, Schneider Switchgear Components
10	Switches and Sockets	MDS (Leagrand),Schneider, Anchor, Cona, ROMA
11	PVC Copper Wires (FRLS Grade)	Finolex, RR Kabel, Polycab
12	Motors	Siemens, ABB, Crompton, Kirloskar, Alstom

13	Cable Glands and Lugs	Dowell, Lotus, A.G. Electricals, Siemens
14	Cat-6 Lan Wire	Lucent, LAPP, AMP
15	PVC Pipe	Diamond, Precision (PPI), Asian
16	Lighting Fixtures	Wipro, Phillips, Crompton, Bajaj, Havells
17	Fans & Air-Circulators	Crompton, Bajaj, Almonard, Usha, Orient, Khaitan
18	Distribution Transformer 11 KV, 433V	Crompton, Kirloskar, Voltas, Pactil, Voltamp
19	11 KV VCB Breaker & Panel	ABB, Schneider, Siemens, Alstom, Jyoti, Kirloskar, Crompton
20	Relays	ABB, Siemens, Alstom (AREVA), Schneider, L&T
21	11 KV SF6, Insulated 3-Panel, 4-Panel extensible type RMU	Crompton, ABB, Siemens, Alstom, Schneider, L&T
22	ACB 8-Way, Feeder Pillar 6-Way, 4 Way & Mini Pillars	Popular Brass Metal Works, ABAK, Manish, Fitwell, Super Panel, Control & Switchgear, Chavare Engineering Pvt. Ltd.
23	Fuse Base	Siemens, L & T
24	Control Cables	Polycab, Finolex, KEI
25	Batteries	Amaron, Exide
26	11 KV End Termination & Straight through Joint	Raychem, Xicon, Danson, CCI
27	Measuring Instruments	MECO, IMP, Rishiline (L&T), Conzerv
28	PVC Insulated Cable for Working Voltage up to 1.1 KV as per IS: 694: 1990	Finolex, Polycab, CCI
29	XLPE – LT Cables as per IS:7098 Part – I: 1988	CCI, Finolex, Polycab
30	XLPE – HT Cables as per IS:7098 Part II – 1985	CCI, Finolex, Polycab

31	PVC Insulated (HD) Cable up to 1.1 KV as per IS:1554 Part I – 1988	CCI, Finolex, Polycab
32	Air Conditioners	Samsung, LG, Voltas, Carrier
33	Lamps HPMV,HPSV Metal Hallide Lamps & Accessories	Crompton, Havells, Bajaj, Philips
34	MCB,ELCB,RCCB,HRC	L&T, MDS,Siemens, ABB
35	T. W. Boards & Blocks	Double Folding Polished Board shall be in one Piece. Block up to 8" x 10" shall be in two Pieces
36	T. Switch S.P. or 2-Way S.A. to I.S.A.	Khosla, Keycee, GNE, Modern, Kalki
37	Three Pin Socket: 5A to 15A	Khosla, Keycee, Standard, Ellora
38	Ceiling Rose	**Khosla, Keycee, Ellora, Oshan, Modern**
39	Ring Main Unit, HT, Switch and Fuse Unit	**L&T, Siemens, ABB, Crompton, MEI**
40	C.T. / P.T.	**ABB, Kappa, AE**
41	Auto Transformer Starter	**MEI, Kilburn, JMP, Siemens, Andrew Yule, GEC, KEC**
42	Trivector Meter	**Department approved / MSEDCL approved**
43	Measuring Instrument	**IMP, AE, MECO, Rishiline (L&T), Conzerv**
44	Current Transformer	**AE, Gilbert & Maxwell, IMP, Siemens, SEGC (C.S.), VM Electric or Department approved**
45	PVC Conduits, PVC Pipes, HDPE Pipes	**Garware, Finolex, Prince**
46	GOD Switches and Dropout Fuse Outfit	**Kiran, Pactil, Atlas or Department approved**

47	Chain Pulley Block	**Elephants, Herculas, Morris**
48	Lugs	**Dowels, Lotus, AG Electricals**
49	Motor Protection Relays	**Universal, Thresold, E.E., L&T, Minilac, Siemens, C&S. Telemechanique, Indo-Asian**
50	Feeder Pillar,Mini Pillar	**Popular Brass Metal Works, Anil Electrical Industries or Department approved**
51	MCB & MCB, D.B.	**MDS, Siemens, EE, Telemechanique, Havells, Schneider**
52	ELCB	**Datar, MDS, Standard, GE, Telemechanique, Havells, Schneider**
53	PVC Wires, Copper Aluminium Conductor, Flexible Cables	**Finolex, Polycab, KEI**
54	HRC Fuses	**L&T, Siemens, Havells**
55	Fuse Switches, SW Fuse	**L&T, Siemens, Crompton, Telemechanique, Havells, Schneider**
56	Switches, Sockets	**Kalki, CPL, Anchor, Precision**
57	Cable Glands	**HME, EEW, Conzerv & Department approved,**
58	HC Fuse Distribution Board	**CPL, EE, Ess Ess, Stenly, KEW, Kalki, Standard**
59	Air, Oil Circuit Breakers (HT,LT)	**Siemens, L&T, Crompton, ABB**
60	Energy Meters	**L&T, Enercon, Simco, IMP**
61	Capacitors	**Crompton, L&T, Schneider, EPCOS, (S+M)**
62	Steel Tubular Poles	**Indian Electric Poles, Bombay Tubes, Nityanand, Rajan Tubes or approved ISI Manufacturers**
63	GI Pipes, Poles	**Zenith, Tata, Bharat, Jindal, Suryaprakash**
64	Terminal Box, Bracket, Junction Box, Control Pillar	**ELM, United, DVK or Department approved**
65	Street Lighting Luminaries	**Bajaj, Crompton, Philips, Wipro, Havells**
66	Chokes, Ignitors	**Bajaj, Crompton, Philips**

67	Power Contactors	**L&T, Siemens, Crompton, ABB**
68	Lamps	**Bajaj, Crompton, Philips, Surya**
69	Rotary Selector Switches	**L&T, Siemens, Kaycee, EE, BISONS (ELM), Schneider**
70	Post Top Lantern	**Philips, Crompton, Glolite, Bajaj, Wipro**
71	Street Light Controller, Timer	**L&T, (TSQ 100) 24 hrs. Dial, ELM, GIC**
72	ASCR Conductors	**As per MSEDCL approved**
73	Alternators	**Kirloskar, Caterpiller, Stamford, CG Newage**
74	Diesel Engines	**Kirloskar, Greaves Cotton, Cummins, Cater Piller, Powerica**
75	Cable Jointing Kit	**Raychem, Xicon, Benson, Mahindra (Push on) M Seal**
76	Pole Paint	**Jenson & Nicholson, Asian (S+M), Nerolac**
77	Fluorescent Fixtures	**Bajaj, Crompton, Philips, GEC, Wipro**
78	Analyzers	Forbes Marshall, Endress& Hauser
79	Level Switch, Level Indicator	Forbes Marshall, Endress& Hauser
80	Flow Meter – Magnetic, Ultrasonic	Forbes Marshall, Endress& Hauser
81	Soft Starters	Allen Bradly, Schneider, Innovative Tecno
82	Motors	Crompton, ABB, Siemens, Kirloskar
83	Electrical Panels	Interlec, Positronocs, Jay Switchgear, Chavare Engineering, L&T, Siemens, ABB, Schneider, Crompton, Spark Electro

13.

14.

15. 3 ELETROMECHANICAL & INSTRUMENTATION WORK

SL. NO.	MATERIAL, WORK	SUPPLIER, MANUFACTURER, VENDOR, AGENCY
1	Mechanical Screens– Coarse & Fine	Jash, Johnson, Huber
2	Detritus Mechanism	Voltas, Emco, Geomiller, Shivpad
3	Pumps: Horizontal Centrifugal	Kirloskar, KSB, Grundfos, Mather & Platt, Jyoti
4	Pumps: Submersible	Kishor, Kirloskar, KSB, Grundfos, Aqua, Mather & Platt, Wilo
5	Pumps: Vertical Turbine	Kirloskar Brothers Limited, WPIL, Mather & Platt, Jyoti, Homa, Flowmore
6	Pumps: Screw (Positive Displace / Progressive Cavity Type)	Roto, Flosys, Tushaco, Netzsch
7	Pumps: Chemical Dosing (Positive Displacement Type)	Milton Roy, Shapotools, Roto, Positive Metering Pump
8	Air Blowers	Kay International, Swam, Everest, KPT
10	Air Compressor	Ingersoll Rand, Elgi
11	Fine Bubble Membrane Diffusers	EDI, OTT, Rehau
12	Chlorinators	Metito, Pennwalt, Sumitra, RR Enterprises
13	Submersible Mixers	ABS, Grundfos, ATE, WILO
14	Agitators	Dorr-Oliver, Voltas, Fibre & Fibre, Standard Engineers, Shivpad
15	Centrifuges	Alfa Laval, Hiller, Humbolt, Pennwalt
16	Chain Pulley Block, Electrical Hoist, JIB Crane	Elephant, Hercules, Indef, Brady & Morris
17	**Pipes:**	

	MS / GI Pipes	Tata, Zenith, Indus tubes, Swastic, Jindal
	SS Pipes	Jindal, Lloyds, Zenith, Remi, Prakash
	CI Pipes	Kesoram, ISSCO, RIFKO,SRIF, Electrosteel, Electrotherm
	DI Pipes	Electrosteel, Lanco, Jindal
	PVC Pipes	Prince, Supreme, Reliance, Premium, Kissan, Garware
	UPVC Pipes	George Fisher, Astral
	HDPE Pipes	Hallmark, Vijay, Sangir, Sriram Polymers
	RCC Pipes	Indian Hume Pipes, Premier Prestressed Concrete Product, Patel Hume Pipes
18	Sluice Gate	Voltas, Jash, IVC, Durga
19	Valves: Butterfly, Non-Return, Knife Gate, Gate, Ball, Globe, Diaphragm, Plug	IVC, Jash, Kirloskar, Vaas
20	MCC	Interlec, Positronocs, Jay Switchgear, Chavare Engineering, L&T, Siemens, ABB, Schneider, Crompton, Spark Electro
21	Variable Frequency Drive (VFDs)	ABB, Nord, Mitsubishi
22	PLC	Allen Bradley, Mitsubishi, GE, Siemens, ABB, Honeywell, Schneider
23	SCADA	Allen Bradley, Ellipse, Wonderware
24	Pressure Gauges	H.Guru, Gluck
25	Level Switches, Level Transmitters	Endress & Hauser, Forbes Marshall
26	PH / ORP Meters, Flow Meters, DO Meters etc.	Endress & Hauser, Forbes Marshall
27	TOC, Turbidity, MLSS & other Analysers	Hach, ABB, Forbes Marshall

TECHNICAL SCHEDULES

The schedule formats given on following pages for technical details of the bidders are to be necessarily filled in by the bidders. Bidder must fill these schedules.

However, the bidder, should feel that the formats or items are not sufficient to cover all types of plant, machinery, automation system etc. that are to be provided by him he is free to provide additional formats for the other items. Those formats however must provide all technical details of items supplied, to enable the employer to scrutinize the adequacy or functionality of these items in the plan. However, no financial data or cost is to be indicated in the Technical Proposal as the same are to be indicated in a separate commercial bid.

SCHEDULE – I

DEVIATIONS FROM TECHNICAL SPECIFICATIONS

NIL

We undertake that our bid is strictly as per the technical specifications, where given in the bid document.

SCHEDULE – II
DEVIATIONS FROM CONDITIONS OF CONTRACT

NIL

We undertake that our bid is strictly as per the conditions and requirements of the bid documents.

SCHEDULE – III

DESCRIPTION OF WORK

The bidder shall submit a detailed Description of Work i.e. Technical Write-up, Process & Instrumentation Diagram, Layout, Hydraulic Flow Diagram, Electrical Load List, Power Consumption & Chemical Consumption etc.

SCHEDULE –IV

SEWAGE TREATMENT PLANT - OPERATING DETAILS

SL NO	ITEM	UNIT	VALUE
I.	**Electrical Loads for Raw Sewage Pumping Station**		
1	Total connected load	KVA	
2	Maximum running load	KW	
3	Average running load	KW	
4	Average power factor		
5	Daily average power requirement	KWH/day	
6	Annual average power requirement	KWH/year	
II.	**Electrical Loads STP**		
1	Total connected load	KVA	
2	Maximum running load	KW	
3	Average running load	KW	
4	Average power factor		
5	Daily average power requirement	KWH/day	
6	Annual average power requirement	KWH/year	

SL NO	ITEM	UNIT	VALUE
V.	**Chemical Usage**		
1	Average dose for Chlorine	mg/l	
	Maximum dose for Chlorine	mg/l	
2	Average dose for Dewatering Polyelectrolyte	mg/l	
	Maximum dose for Dewatering Polyelectrolyte	mg/l	

SCHEDULE - V
FUNCTIONAL GUARANTEES

1. **General**

This schedule sets out the functional guarantees required for the calculation of Liquidated Damages for failing O&M performance guarantees.

The Bidder shall provide values of electrical energy and chemical usage for the quantity and quality of raw sewage given in the technical specifications.

2. **Functional Guarantees**

The contractor's guarantee for the performance in the O&M period to be as follows:

2.1 **Quality of Treated Effluent**

The quality of treated effluent shall be as follows:
As specified in "**Volume – I - Scope of Work**".

2.2 **Electrical Energy Usage**

Power requirement of Raw Sewage Pumping Station	Not more than …….Units per month.
Power requirement of STP	Not more than …….Units per month.

SCHEDULE –VI

FORMAT FOR ELECTRICAL LOAD LIST & POWER CONSUMPTION

Sr. No.	Description of Equipment	Motor Rating KW	W	S	T	BKW	Operating Hrs. Hrs./day	Power Consumption (Kw.Hrs./day)
1	Mechanical Coarse Screen							
2	Raw Sewage Transfer Pumps							
3	Mechanical Fine Screen							
4	**Detritus**							
	a. Scraper Mechanism							
	b. Classifier Mechanism							
	c. Organic Return Pumps							
5	Decanters							
6	SBR Air Blowers							
7	RAS Pumps							
8	SAS Pumps							
9	**Chlorination Tank**							
	a. Water Booster Pumps							
	b. NaOH Recirculation Pump							
	c. Air Blower							
10	Sludge Sump Mixers							
11	Centrifuge Feed Pumps							
12	Centrifuge							
13	Agitators for DWPE Dosing Tanks							
14	Dewatering Polymer Dosing Pumps							
15	Service Water Pumps							
16	Auto Valves/Sluice Gates							
17	Plant Area Lighting							
	TOTAL							
	ADD LINE LOSSES & 5% OF ABOVE							

ANNEXURE-I

TECHNOLOGY TIE UP AGREEMENT

(To be made on Rs. 100 stamp paper and notarized to be submitted along with Technical Bid)

This Technology Tie-up Agreement is entered into on …… (Date) by and between …… (Bidder) (Hereinafter referred as **'XXX'**), a company incorporated under the Companies Act 1956 with a Registered Office at …….

……

AND

M/s …….. (Technology Provider) (Hereinafter referred as **'YYY'**), a company incorporated under the Companies Act 1956 with a Registered Office at ……

…….....

.....

WITNESSETH

WHEREAS **'XXX'** is in the business of turnkey execution of Water and Sewage / Wastewater Treatment Plants.

WHEREAS **'YYY'** is in the business of Design, Engineering and Supply of Components for Cyclic Activated Sludge / Sequential batch Reactor (SBR) Technology for Sewage / Wastewater Treatment Plants.

WHEREAS The Commissioner, EMPLOYER (Hereinafter referred as **'EMPLOYER'**) has invited sealed tenders on prescribed proforma from reputed and experienced agencies on turnkey basis for **"……(insert name of work)"**

This Tie-up Agreement is executed specifically for the above mentioned work and cannot be used for any other Works/ Project and this tie-up Agreement does not apply or constitute a Joint Venture.

AND

'XXX' is submitting its bid as lead partner and **'XXX'** has decided to enter into an exclusive Tie-up Agreement with **'YYY'** to engage them exclusively as Technology Provider for the biological treatment section using Cyclic Activated Sludge / SBR Technology as a part of the above mentioned Work for which tenders are invited by **'EMPLOYER'**.

Now, therefore both the parties hereto agree as follows:

1. **'XXX'** is submitting its bid only and exclusively with **'YYY'**.
2. **'YYY'** will be the Technology Provider to **'XXX'** for the Cyclic Activated Sludge / Sequential batch Reactor (SBR) Technology to be used for in the biological treatment section of the STP.

3. **'YYY'** shall provide following Services and Equipments to **'XXX'**:

a. Basic Engineering for the Cyclic Activated Sludge / Sequential batch Reactor (SBR) Technology.

b. Supply of all Equipments and Instruments as part of the Cyclic Activated Sludge / Sequential batch Reactor (SBR) Technology along with back-up guarantee for performance as per the tender requirement. Back-up guarantee for performance shall be applicable and valid only in case all design and documents for the complete STP is in accordance with **'YYY'** design guidelines and all documents and drawings are reviewed, stamped and signed by **'YYY'**.

c. Shall provide supervision assistance during erection, commissioning, performance testing and trial runs of the STP on Cyclic Activated Sludge / Sequential batch Reactor (SBR) Technology.

d. Shall provide supervision assistance during O & M period of the STP for the Cyclic Activated Sludge / Sequential batch Reactor (SBR) Technology Units of the STP if required on a chargeable basis.

4. **'XXX'** will be the main contractor and the authority to sign the agreement with **'EMPLOYER'** and accept responsibility and obligation for the Works will rest with main contractor and shall be responsible to the client viz. **'EM-**

PLOYER'. **'YYY'**, in turn, shall be responsible and liable to **'XXX'** for their scope of work. Further **'XXX'** shall furnish bank guarantees for due Security, Performance and O&M and all other such obligations under the Project as a whole.

5. **'YYY'** shall provide and commit such resources as are necessary to perform their scope of work for the successful completion of the Project. **'YYY'** shall also attend all review meetings over the Project as and when called for by **'EMPLOYER'** till the completion of the Project.
6. **'XXX'** shall make all payments due to **'YYY'** or to their accredited representative as per their Offer.
7. Each Party hereto in relation with the other is solely responsible and liable for their respective scope of work, to be mutually agreed between the Parties and incorporated in a detailed Agreement / Purchase Order to be entered into between the Parties before start of work for the above mentioned Work. Such detailed Agreement / Purchase Order shall deal with technical and financial aspects of the Project.
8. Each Party agrees to and undertakes to indemnify and hold harmless the other Party against any liability, loss, cost, damages or expenses sustained as a result of negligent or improper performance or disturbance caused by itself or by any of its sub-contractors, suppliers or associates in connection with its share of Works as per the Contract. If any third party enforces any claim, which is attributable to the scope of work of a certain party, that Party shall settle such claims. The Parties agree to indemnify each other against all claims made by any third party in respect of any infringements of any rights protected by patents, designs or copyrights or trademarks employed in the Project by any Party.
9. In the course of working as associates, **'XXX'** / **'YYY'** will be sharing information with each other which may be proprietary /confidential information / knowledge acquired by each other. It is hereby agreed that both the parties will maintain complete secrecy regarding such information /

knowledge and will not divulge to any party for any other purpose except for the success of the joint execution of the contract.

10. Disputes if any arising in connection with this agreement shall, at the first place, be referred and settled mutually and amicably between the Parties herein through their respective senior executive without making reference to the arbitration. In the extreme unlikely case, where no reconciliation is reached within sixty (60) days from reference for the dispute to the other party by the dispute raising party, such dispute shall be settled by arbitration in accordance with the provisions of the Arbitration & Conciliation Act, 1996 and/or any statutory amendments thereto. The number of arbitrators shall be three. Each Party shall nominate their respective arbitrators and both the nominated arbitrators shall appoint the third arbitrator who shall act as the Presiding arbitrator. The venue of arbitration shall be **……..(location of employer)** and the language used shall be English. The arbitral award shall be final and binding upon the Parties. Neither Party shall be released from its obligations to comply with any of the provisions of this Agreement, the contract and the detailed agreement as a result of reference of disputes to arbitration or during the course of arbitral proceeding.

11. This Tie-up Agreement shall be effective from the date as mentioned in the first page of the Tie-up Agreement and shall remain valid till the project completion and shall terminate on the happening of any of the following:

a. The bid submitted by **'XXX'** is rejected or **'XXX'** is unsuccessful in the bid.

b. The Contract for the Works has been awarded to other Third Parties.

c. The client notifies the Parties that they will not proceed with the Project.

d. Any of the Parties to the Agreement is declared insolvent by a Court of Competent Jurisdiction.

12. This Tie-up Agreement shall be subject to the laws in India and shall be subject to the jurisdiction of the court at **……..(location of employer)**.

13. For the sake of correspondence, following Addresses and the Persons concerned are to be contacted:

'XXX'	**'YYY'**
Address:	Address:
Tel No. :	Tel No.:
Fax No. :	Fax No.:
Contact Person:	Contact Person:
Designation:	Designation:

For **'XXX'**
(Authorized Signatory)

Name:
Designation:

For **'YYY'**
(Authorized Signatory)

Name:
Designation:

SANGLI MIRAJ KUPWAD MUNICIPAL CORPORATION
Kupwad Underground Drainage Scheme under Central Govt. Programme AMRUT 2.0
Tal.Miraj Dist.Sangli

QUALITY OF INCOMING SEWAGE

Quality of waste-water coming in STP (As mentioned in Specs.& below but contractor must verify its quality on its own without any challenge to the department and any liability to the Department)

Sr. No.	Parameters	Values	UOM
1	pH	6-8	
2	Biochemical Oxygen Demand (BOD_5)	150-300	mg/l
3	Chemical Oxygen Demand (COD)	300-400	mg/l
4	Total Suspended Solids (TSS)	250-400	mg/l
5	Total Kjeldahl Nitrogen (TKN)	35-50	mg/l
6	Total Phosphorous (TP)	5-10	mg/l
7	Oil & Grease	15-35	mg/l
8	Fecal Coliform	>1000	MPN/100 ml
9	Total Coliform	>1000	MPN/100 ml

SANGLI MIRAJ KUPWAD MUNICIPAL CORPORATION
Kupwad Underground Drainage Scheme under Central Govt. Programme AMRUT 2.0
Tal.Miraj Dist.Sangli

QUALITY OF OUTGOING SEWAGE

Quality of waste-water coming out of STP (As mentioned in Specs.)

Sr. No.	*Parameters / Pollutants*		**Values after treatment**
1	pH	:	5.5 to 9.0
2	Biochemical Oxygen Demand (BOD_5)	:	≤ 10 mg/l
3	Chemical Oxygen Demand (COD)	:	≤ 50 mg/l
4	Total Suspended Solids (TSS)	:	≤ 10 mg/l
5	Total Phosphorous (TP)	:	≤ 2 mg/l
6	Total Nitrogen (TN)	:	≤ 10 mg/l
7	Ammonical Nitrogen (NH3-N)	:	≤ 2 mg/l
8	Fecal Coliform	:	≤ 230 MPN/ 100 ml

DRAWINGS

The following drawings has been incorporated in the tender

a) L section of rising main with invert levels of pipeline

b) Phase wise Drawing with Contour map of Kupwad UGD

c) Collection System network Layout

d) Layout plan for Wet well Pumping Stations

e) Contour map of STP/Wet well Pumping Stations

F) Typical Drawing showing various manhole types

G) Wet well Pumping Station

(Note : A typical drawing has been attached of all Wet well Pumping stations for reference .Contractor has to submit his own design, drawings & get it approved from Department.before execution as mentioned in tender specifications.)

Sangli, Miraj & Kupwad City Municiple Corporation

Name of Work: Kupwad Underground Drainage Scheme under Central Govt. Program AMRUT 2.0

BAR CHART

Sr.No	Name of Subwork	1 Month	2 Month	3 Month	4 Month	5 Month	6 Month	7 Month	8 Month	9 Month	10 Month	11 Month	12 Month	13 Month	14 Month	15 Month	16 Month	17 Month	18 Month	19 Month	20 Month	21 Month	22 Month	23 Month	24 Month
	Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	**Working Survey**																								
2	**Collection System**																								
	A) For Zone 1																								
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 500 mm Total Length- 30.44 Kms.																								
	ii)Household Service Connection for Zone 1																								
	iii)Road Reinstating for zone 1																								
	B) For Zone 3B																								
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 1000 mm Total Length- 26.97 Kms.																								
	ii)Household Service Connection for Zone 3B																								
	iii)Road Reinstating for zone 3B																								
	C) For Zone 2A																								
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 450 mm Total Length- 31.61 Kms.																								
	ii)Household Service Connection for Zone 2A																								
	iii)Road Reinstating for zone 2A																								
	D) For Zone 2B																								
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 800 mm Total Length- 100.2 Kms.																								
	ii)Household Service Connection for Zone 2B																								
	iii)Road Reinstating for zone 2B																								
	E) For Zone 3A																								
	i)Trunk Main, Main Branches and Laterals Dia 150 mm to 1200 mm Total Length- 80.9 Kms.																								
	ii)Household Service Connection for Zone 3A																								
	iii)Road Reinstating for zone 3A																								
3	**Wet well and Panel rooms**																								
	A)RCC Wet well and Panel room at Ahilyanagar 5.00 M Dia, Cap.78.5 cum Net and 266 cum Gross																								
	B) RCC Wet well and Panel room at Tuljainagar 9.1 m Dia, Cap. 260 Cum Net and 730 Cum Gross																								
	C) RCC Wet well and Panel room at Kumbhar Mala 11.5 M Dia, cap. 571 Cum Net and 1570 Cum Gross																								
	D) RCC Wet well near Jagruti 5.2 m Dia Cap. 56 Cum																								

Sr.No	Name of Subwork	1 Month	2 Month	3 Month	4 Month	5 Month	6 Month	7 Month	8 Month	9 Month	10 Month	11 Month	12 Month	13 Month	14 Month	15 Month	16 Month	17 Month	18 Month	19 Month	20 Month	21 Month	22 Month	23 Month	24 Month
	Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
4	**Pumping Machinery and allied works**																								
	a)Ahilyanagar Pumping station PS 1																								
	b)Tuljainagar Pumping station PS 2																								
	c)Kumbhar Mala Pumping station PS 3																								
	d) Jetting cum suction Machine																								
5	**Pumping main**																								
	A) Ahilyanagar																								
	i) Rising Main from Ahilyanagar wet well to Wet well near Jagruti, 350 mm Dia D.I. K-9, Length- 4750 M																								
	ii) Road Reinstating for Rising main																								
	B) Tuljainagar																								
	i) Rising Main from Tuljaeenagar Wet well to Wet well near Jagruti. (700 mm ø D.I. K-9, L=1580 m)																								
	ii) Road Reinstating for Rising Main																								
	C) Kumbhar Mala																								
	Rising Main fromKumbhar Mala wet well to STP, 1000 mm Dia D.I. K-9, Length- 150 M																								
6	**S.T.P. Type S.B.R. 27.00 MLD**																								
7	A) RCC Wet Well Storage tank for Treated Water Cap 1.125 ML																								
	B) Disposal arrangement 1200 mm R.C.C. Pipe Length 960 M																								
8	**Miscellaneous**																								
	A) Compound wall for Ahilyanagar Wet well																								
	B) Compound wall for Tulajainagar and Jagruti Wet wells and Compound wall with CLF for S.T.P.																								
	C) i) Repairs to House connection & Water supply pipelines in zone1 & 3B																								
	ii) Repairs to House connection and Water supply pipelines for zones 2A,2B,3A																								
9	**Remaining works of Sangli UGD and Miraj UGD**																								
	A) Sangli UGD																								
	B) Miraj UGD																								

Sr.No	Name of Subwork	1 Month	2 Month	3 Month	4 Month	5 Month	6 Month	7 Month	8 Month	9 Month	10 Month	11 Month	12 Month	13 Month	14 Month	15 Month	16 Month	17 Month	18 Month	19 Month	20 Month	21 Month	22 Month	23 Month	24 Month
	Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Trial Run																								

Note:- Total time period is 24 months including Trial Run for Three month.Progress of each subwork will be moderated & compared to barchart on percentage basis by calculating from average total time duration alloted for subwork.

Sub Divisional Engineer **Divisional Accountant** **Contractor** **Executive Engineer**

Sr. No.	Description	Unit	Rate (in Rs.) 2021-2022	
1	2	3	4	
2.	Providing & Supply of Electro Fusion Fittings in accordance with BS EN12201: Part-3 suitable for drinking water with in black/ blue colour manufactured from compounded PE80/ PE100 virgin polymer and compatible with PE80/PE100 pipes, in pressure rating SDR11 with min PN12.5 rated for water application and shall be inclusive of all cost such as testing, inspection charges, transportation up to store, transit insurance, loading, unloading, stacking excluding GST levied by GOI & GOM in all respect, etc. complete.			
	Couplers 20	No.	87.00	
	Couplers 25	No.	87.00	
	Couplers 32	No.	87.00	
	Couplers 40	No.	151.00	
	Couplers 50	No.	188.00	
	Couplers 63	No.	224.00	
	Couplers 75	No.	379.00	
	Couplers 90	No.	415.00	
	Couplers 110	No.	577.00	
	Couplers 125	No.	588.00	
	Couplers 140	No.	1257.00	
	Couplers 160	No.	1366.00	
	Couplers 180	No.	1960.00	
	Couplers 200	No.	2202.00	
	Couplers 225	No.	2775.00	
	Couplers 250	No.	4325.00	
	Couplers 280	No.	4871.00	
	Couplers 315	No.	5321.00	
	Couplers 355	No.	5818.00	
	Couplers 400	No.	7582.00	
	Couplers 450	No.	13734.00	
	Couplers 500	No.	14448.00	
	Equal Tee			
	Equal Tee 20	No.	183.00	
	Equal Tee 25	No.	183.00	
	Equal Tee 32	No.	183.00	
	Equal Tee 40	No.	404.00	
	Equal Tee 50	No.	412.00	
	Equal Tee 63	No.	674.00	
	Equal Tee 75	No.	988.00	
	Equal Tee 90	No.	1409.00	
	Equal Tee 110	No.	1957.00	
	Equal Tee 125	No.	2700.00	
	Equal Tee 160	No.	4680.00	
	Equal Tee 180	No.	5878.00	
	Equal Tee 200	No.	9422.00	
	Equal Tee 225	No.	10626.00	
	Equal Tee 250	No.	15567.00	
	Equal Tee 315	No.	16906.00	
	Equal Tee 400	No.	23560.00	
	Elbow 90 Deg.			
	Elbow 90 Deg. 20	No.	103.00	
	Elbow 90 Deg. 25	No.	103.00	
	Elbow 90 Deg. 32	No.	104.00	
	Elbow 90 Deg. 40	No.	141.00	
	Elbow 90 Deg. 50	No.	167.00	
	Elbow 90 Deg. 63	No.	232.00	
	Elbow 90 Deg. 75	No.	364.00	
	Elbow 90 Deg. 90	No.	429.00	
	Elbow 90 Deg. 110	No.	590.00	
	Elbow 90 Deg. 125	No.	753.00	

Sr. No.	Description	Unit	Rate (in Rs.) 2021-2022	
1	2	3	4	
	Elbow 90 Deg. 160	No.	1647.00	
	Elbow 90 Deg. 180	No.	1909.00	
	Elbow 90 Deg. 200	No.	2471.00	
	Elbow 90 Deg. 225	No.	5385.00	
	Elbow 90 Deg. 250	No.	10090.00	
	Elbow 90 Deg. 315	No.	10267.00	
	Elbow 90 Deg. 400	No.	13908.00	
	Elbow 45 Deg.			
	Elbow 45 Deg. 32	No.	110.00	
	Elbow 45 Deg. 40	No.	134.00	
	Elbow 45 Deg. 50	No.	159.00	
	Elbow 45 Deg. 63	No.	222.00	
	Elbow 45 Deg. 75	No.	346.00	
	Elbow 45 Deg. 90	No.	408.00	
	Elbow 45 Deg. 110	No.	590.00	
	Elbow 45 Deg. 125	No.	753.00	
	Elbow 45 Deg. 160	No.	1386.00	
	Elbow 45 Deg. 180	No.	1817.00	
	Elbow 45 Deg. 200	No.	1909.00	
	Elbow 45 Deg. 225	No.	2471.00	
	Elbow 45 Deg. 250	No.	5385.00	
	Elbow 45 Deg. 315	No.	10237.00	
	Elbow 45 Deg. 400	No.	13885.00	
	Reducer			
	Reducer 25X20	No.	139.00	
	Reducer 32X20	No.	145.00	
	Reducer 32X25	No.	153.00	
	Reducer 40X32	No.	165.00	
	Reducer 50X32	No.	165.00	
	Reducer 50X40	No.	165.00	
	Reducer 63X32	No.	199.00	
	Reducer 63X40	No.	199.00	
	Reducer 63X50	No.	199.00	
	Reducer 75 x 63	No.	451.00	
	Reducer 90X63	No.	495.00	
	Reducer 90X75	No.	502.00	
	Reducer 110X50	No.	611.00	
	Reducer 110X63	No.	611.00	
	Reducer 110X75	No.	642.00	
	Reducer 110X90	No.	642.00	
	Reducer 125X90	No.	713.00	
	Reducer 160X90	No.	1197.00	
	Reducer 160X110	No.	1262.00	
	Reducer 180X125	No.	1572.00	
	Reducer 200X63	No.	1815.00	
	Reducer 200X90	No.	1938.00	
	Reducer 200X110	No.	2250.00	
	Reducer 200X160	No.	1863.00	
	Reducer 225X160	No.	2725.00	
	Reducer 250X110	No.	3495.00	
	Reducer 250X160	No.	3764.00	
	Reducer 250X200	No.	4116.00	
	Reducer 315 x 200	No.	7822.00	
	Reducer 315 x 250	No.	7930.00	
	Reducer 400 x 200	No.	8424.00	
	Reducer 400 x 315	No.	9047.00	
	End Cap			
	End Cap 20	No.	36.00	
	End Cap 25	No.	36.00	
	End Cap 32	No.	51.00	
	End Cap 40	No.	55.00	
	End Cap 50	No.	58.00	
	End Cap 63	No.	77.00	
	End Cap 75	No.	284.00	

Sr. No.	Description	Unit	Rate (in Rs.) 2021-2022	
1	2	3	4	
	End Cap 90	No.	323.00	
	End Cap 110	No.	454.00	
	End Cap 125	No.	576.00	
	End Cap 140	No.	941.00	
	End Cap 160	No.	1020.00	
	End Cap 180	No.	1118.00	
	End Cap 200	No.	1895.00	
	End Cap 225	No.	3255.00	
	End Cap 250	No.	4195.00	
	End Cap 315	No.	6941.00	
	Ferrule Tapping Tee			
	Ferrule tapping tee 63 x 1/2"	No.	658.00	
	Ferrule tapping tee 63 x 3/4"	No.	658.00	
	Ferrule tapping tee 63 x 1"	No.	658.00	
	Ferrule tapping tee 75 x 1/2"	No.	658.00	
	Ferrule tapping tee 75 x 3/4"	No.	658.00	
	Ferrule tapping tee 75 x 1"	No.	658.00	
	Ferrule tapping tee 90 x 1/2"	No.	658.00	
	Ferrule tapping tee 90 x 3/4"	No.	649.00	
	Ferrule tapping tee 90 x 1"	No.	649.00	
	Ferrule tapping tee 90 x 1%"	No.	855.00	
	Ferrule tapping tee 90 x 1^"	No.	855.00	
	Ferrule tapping tee 90 x 2"	No.	855.00	
	Ferrule tapping tee 110 x 1/2"	No.	658.00	
	Ferrule tapping tee 110 x 3/4"	No.	658.00	
	Ferrule tapping tee 110 x 1"	No.	658.00	
	Ferrule tapping tee 110 x 1 %"	No.	855.00	
	Ferrule tapping tee 100 x 1^"	No.	855.00	
	Ferrule tapping tee 110 x 2"	No.	855.00	
	Ferrule tapping tee 160 x 1/2"	No.	658.00	
	Ferrule tapping tee 160 x 3/4"	No.	658.00	
	Ferrule tapping tee 160 x 1 "	No.	658.00	
	Ferrule tapping tee 160 x 1%"	No.	931.00	
	Ferrule tapping tee 160 x 1^"	No.	931.00	
	Ferrule tapping tee 160 x 2"	No.	931.00	
	Ferrule tapping tee 200 x 1/2"	No.	929.00	
	Ferrule tapping tee 200 x 3/4"	No.	929.00	
	Ferrule tapping tee 200 x 1"	No.	929.00	
	Ferrule tapping tee 200 x 1 %"	No.	1340.00	
	Ferrule tapping tee 200 x 1	No.	1340.00	
	Ferrule tapping tee 200 x 2"	No.	1340.00	
	Ferrule tapping tee 250 x 1/2"	No.	929.00	
	Ferrule tapping tee 250 x 3/4"	No.	929.00	
	Ferrule tapping tee 250 x 1 "	No.	929.00	
	Ferrule tapping tee 250 x 1 %"	No.	1340.00	
	Ferrule tapping tee 250 x 1	No.	1340.00	
	Ferrule tapping tee 250 x 2"	No.	1340.00	
	Ferrule tapping tee 315 x 1/2"	No.	1106.00	
	Ferrule tapping tee 315 x 3/4"	No.	1106.00	
	Ferrule tapping tee 315 x 1 "	No.	1106.00	
	Ferrule tapping tee 315 x 1 %"	No.	1502.00	
	Ferrule tapping tee 315 x 1	No.	1502.00	
	Ferrule tapping tee 315 x 2"	No.	1502.00	
	Electrofusion Reducing Tee			
	Reducing Tee 32 x 32 x 20	No.	153.00	
	Reducing Tee 32 x 32 x 25	No.	153.00	
	Reducing Tee 40 x 40 x 20	No.	344.00	
	Reducing Tee 40 x 40 x 25	No.	348.00	
	Reducing Tee 40 x 40 x 32	No.	373.00	
	Reducing Tee 50 x 50 x 20	No.	383.00	
	Reducing Tee 50 x 50 x 25	No.	393.00	
	Reducing Tee 50 x 50 x 32	No.	407.00	
	Reducing Tee 50 x 50 x 40	No.	427.00	
	Reducing Tee 63 x 63 x 20	No.	614.00	

Sr. No.	Description	Unit	Rate (in Rs.) 2021-2022	
1	2	3	4	
	Reducing Tee 63 x 63 x 25	No.	628.00	
	Reducing Tee 63 x 63 x 32	No.	642.00	
	Reducing Tee 63 x 63 x 40	No.	659.00	
	Reducing Tee 63 x 63 x 50	No.	682.00	
	Reducing Tee 75 x 75 x 40	No.	873.00	
	Reducing Tee 75 x 75 x 50	No.	887.00	
	Reducing Tee 75 x 75 x 63	No.	906.00	
	Reducing Tee 90 x 90 x 50	No.	1271.00	
	Reducing Tee 90 x 90 x 63	No.	1299.00	
	Reducing Tee 90 x 90 x 75	No.	1322.00	
	Reducing Tee 110 x 110 x 50	No.	1756.00	
	Reducing Tee 110 x 110 x 63	No.	1785.00	
	Reducing Tee 110 x 110 x 75	No.	1812.00	
	Reducing Tee 110 x 110 x 90	No.	1844.00	
	Reducing Tee 125 x 125 x 63	No.	2368.00	
	Reducing Tee 125 x 125 x 75	No.	2394.00	
	Reducing Tee 125 x 125 x 90	No.	2425.00	
	Reducing Tee 125 x 125 x 110	No.	2454.00	
	Reducing Tee 160 x 160 x 50	No.	4128.00	
	Reducing Tee 160 x 160 x 63	No.	4146.00	
	Reducing Tee 160 x 160 x 75	No.	4167.00	
	Reducing Tee 160 x 160 x 90	No.	4267.00	
	Reducing Tee 160 x 160 x 110	No.	4362.00	
	Reducing Tee 180 x 180 x 160	No.	5378.00	
	Reducing Tee 200 x 200 x 63	No.	8539.00	
	Reducing Tee 200 x 200 x 75	No.	8581.00	
	Reducing Tee 200 x 200 x 90	No.	8620.00	
	Reducing Tee 200 x 200 x 110	No.	8670.00	
	Reducing Tee 200 x 200 x 160	No.	8717.00	
	Reducing Tee 250 x 250 x 63	No.	13181.00	
	Reducing Tee 250 x 250 x 75	No.	13235.00	
	Reducing Tee 250 x 250 x 90	No.	13277.00	
	Reducing Tee 250 x 250 x 110	No.	13317.00	
	Reducing Tee 250 x 250 x 160	No.	13355.00	
	Reducing Tee 250 x 250 x 200	No.	13412.00	
	Reducing Tee 315 x 315 x 200	No.	17647.00	
	Reducing Tee 315 x 315 x 250	No.	18016.00	
	Reducing Tee 400 x 400 x 110	No.	23037.00	
	Reducing Tee 400 x 400 x 160	No.	23553.00	
	Reducing Tee 400 x 400 x 200	No.	24055.00	
	Reducing Tee 400 x 400 x 250	No.	24417.00	
	Reducing Tee 400 x 400 x 315	No.	24801.00	
	Spigot Long Neck Pipe End (Stub End) for Electro Fusion joint			
	LNPE 63	No.	374.00	
	LNPE 75	No.	421.00	
	LNPE 90	No.	529.00	
	LNPE 110	No.	807.00	
	LNPE 125	No.	1269.00	
	LNPE 140	No.	1445.00	
	LNPE 160	No.	2068.00	
	LNPE 180	No.	2788.00	
	LNPE 200	No.	3279.00	
	LNPE 225	No.	3933.00	
	LNPE 250	No.	4516.00	
	LNPE 280	No.	5055.00	
	LNPE 315	No.	6571.00	

Sr. No.	Description	Unit	Rate (in Rs.) 2021-2022	
1	2	3	4	
3.	**Providing & Supply of Compression fittings,** PN16 rated in conformation to ISO:14236-2000 and shall be tested as per ISO:3459, ISO:3501 & ISO:3503, suitable for drinking water & approved by WRAS, UK/ KIWA etc, in food grade polypropylene and shall be inclusive of all cost such as testing, inspection charges, transportation up to store, transit insurance, loading, unloading, stacking excluding GST levied by GOI & GOM in all respect, etc. complete.			
	Male Adaptor			
	Male Adaptor 20 x 1/2"	No.	57.00	
	Male Adaptor 25 x 3/4"	No.	66.00	
	Male Adaptor 32 x 1"	No.	85.00	
	Male Adaptor 40 x 1 %"	No.	155.00	
	Male Adaptor 50 x /V2"	No.	204.00	
	Male Adaptor 63 x 2"	No.	289.00	
	Female Adaptor			
	Female Adaptor 20 x 1/2"	No.	61.00	
	Female Adaptor 25 x 3/4"	No.	72.00	
	Female Adaptor 32 x 1 "	No.	91.00	
	Female Adaptor 40 x 1 %"	No.	171.00	
	Female Adaptor 50 x m"	No.	217.00	
	Female Adaptor 63 x 2"	No.	307.00	
	Coupling			
	Coupling 20 x 20	No.	59.00	
	Coupling 25 x 25	No.	65.00	
	Coupling 32 x 32	No.	83.00	
	Coupling 40 x 40	No.	148.00	
	Coupling 50 x 50	No.	191.00	
	Coupling 63 x 63	No.	276.00	
	Reducing Coupling			
	Reducing Coupling 25 x 20	No.	102.00	
	Reducing Coupling 32 x 20	No.	135.00	
	Reducing Coupling 32 x 25	No.	135.00	
	Reducing Coupling 40 x 25	No.	230.00	
	Reducing Coupling 40 x 32	No.	230.00	
	Reducing Coupling 50 x 32	No.	297.00	
	Reducing Coupling 50 x 40	No.	297.00	
	Reducing Coupling 63 x 50	No.	422.00	
	90 Deg. Elbow 20	No.	104.00	
	90 Deg. Elbow 25	No.	124.00	
	90 Deg. Elbow 32	No.	151.00	
	90 Deg. Elbow 40	No.	248.00	
	90 Deg. Elbow 50	No.	352.00	
	90 Deg. Elbow 63	No.	477.00	
	90 Deg. Elbow threaded male take off			
	90 Deg. Elbow threaded male off take 20 x 1/2"	No.	66.00	
	90 Deg. Elbow threaded male off take 25 x 3/4"	No.	81.00	
	90 Deg. Elbow threaded male off take 32 x 1"	No.	104.00	
	90 Deg. Elbow threaded male off take 40 x 1/4"	No.	165.00	
	90 Deg. Elbow threaded male off take 50 x 1/2"	No.	227.00	
	90 Deg. Elbow threaded male off take 63 x 2"	No.	315.00	
	90 Deg. Elbow threaded female off take			
	90 Deg. Elbow threaded Female off take 20 x 1/2"	No.	75.00	
	90 Deg. Elbow threaded Female off take 25 x 3/4"	No.	92.00	
	90 Deg. Elbow threaded Female off take 32 x 1"	No.	111.00	
	90 Deg. Elbow threaded Female off take 40 x 1 %"	No.	216.00	

Sr. No.	Description	Unit	Rate (in Rs.) 2021-2022	
1	2	3	4	
	90 Deg. Elbow threaded Female off take 50 x 1 'A"	No.	283.00	
	90 Deg. Elbow threaded Female off take 63 x 2"	No.	373.00	
	Equal Tee			
	Equal Tee 20 x 20 x 20	No.	124.00	
	Equal Tee 25 x 25 x 25	No.	162.00	
	Equal Tee 32 x 32 x 32	No.	209.00	
	Equal Tee 40 x 40 x 40	No.	347.00	
	Equal Tee 50 x 50 x 50	No.	469.00	
	Equal Tee 63 x 63 x 63	No.	667.00	
	End Cap			
	End Cap 20	No.	33.00	
	End Cap 25	No.	33.00	
	End Cap 32	No.	47.00	
	End Cap 40	No.	51.00	
	End Cap 50	No.	53.00	
	End Cap 63	No.	71.00	

SANGLI MIRAJ KUPWAD MUNICIPAL CORPORATION

Name of Work: Kupwad Underground Drainage Scheme under Central Govt. Program AMRUT 2.0 Tal.Miraj Dist.Sangli

SCHEDULE "A"

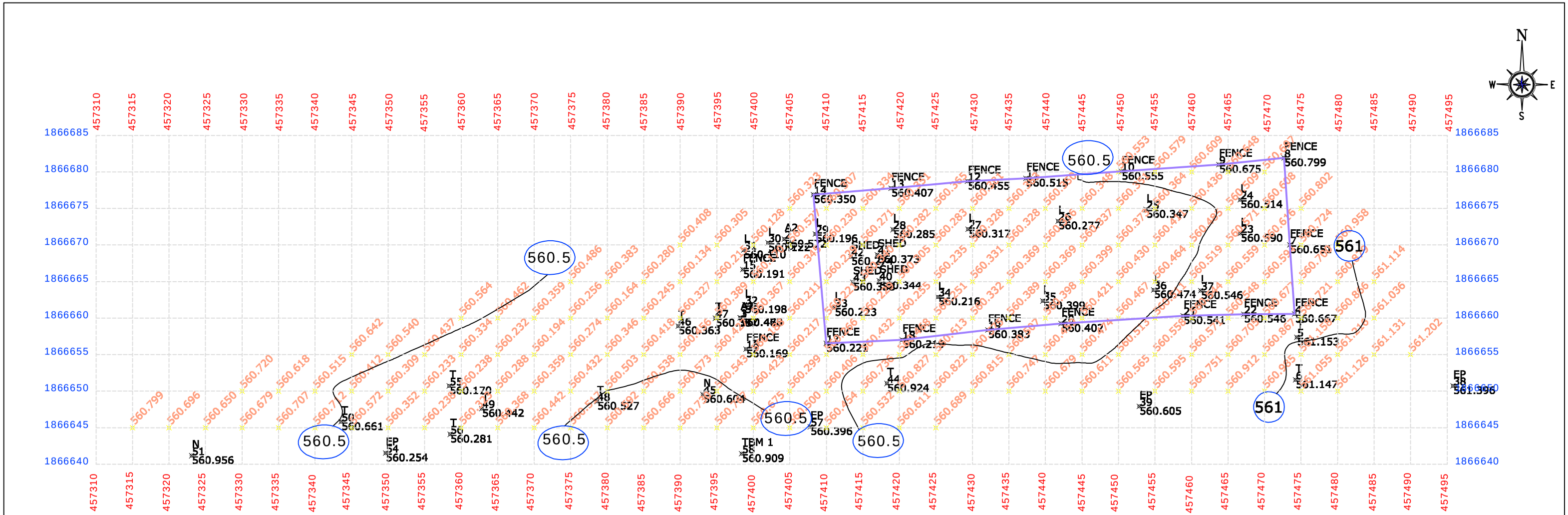
Memorandum showing the approximate quantity to be supplied by the department free of cost for the work.

Sr. No.	Description	Qty.	Unit	Rate	Place of delivery	Note
		NIL				

Contractor

No of Correction

Executive Engineer

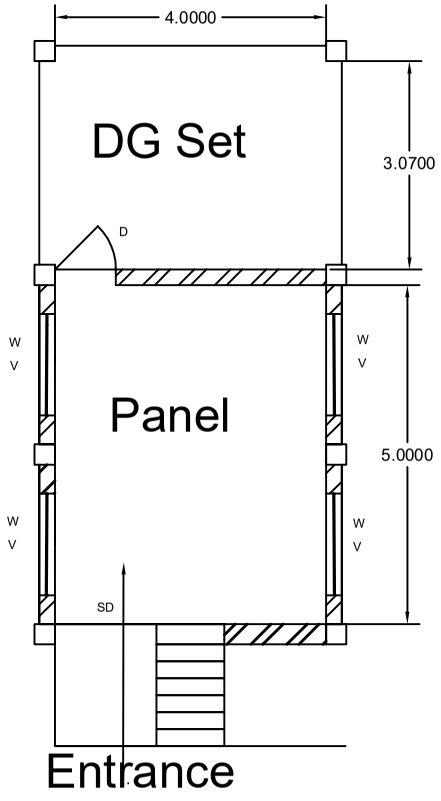


MAHARASHTRA JEEVAN PRADHIKARAN CIRCLE, SANGLI
MAHARASHTRA JEEVAN PRADHIKARAN DIVISION, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN SUB.DIVISION, SANGLI

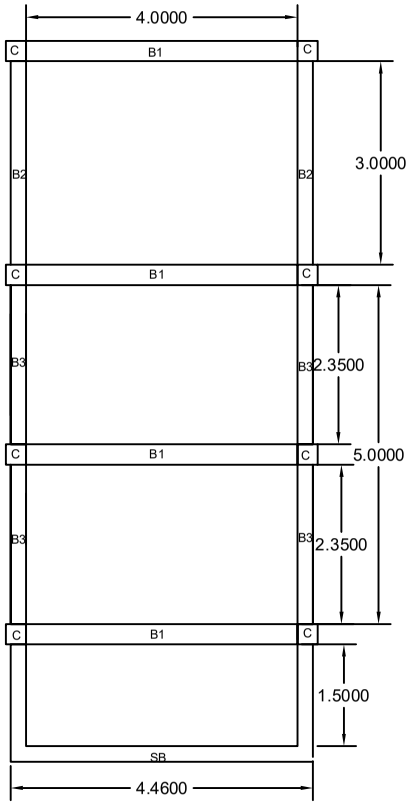
KUPWAD UNDERGROUND DRAINAGE SCHEME TALUKA : MIRAJ, DISTRICT: SANGLI
MAHARASHTRA SUVARNAJAYANTI NAGAROTTHAN MAHAABHIYAN PROGRAMME

CONTOUR LAYOUT FOR SUMP AT AHILYANAGAR

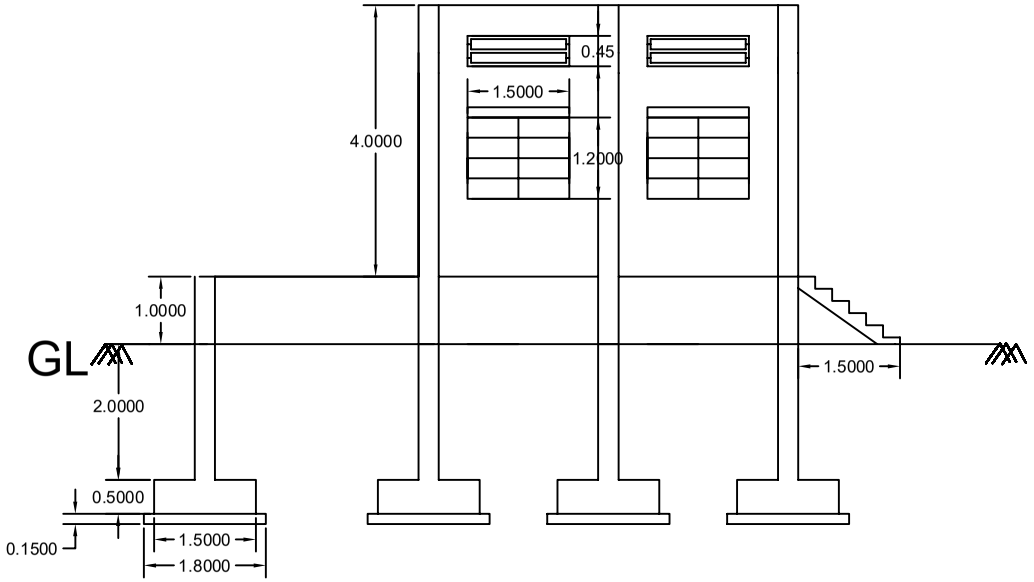
Sec. Engineer	Sub - Div Engineer	Exe. Engineer	Supdt.Engineer



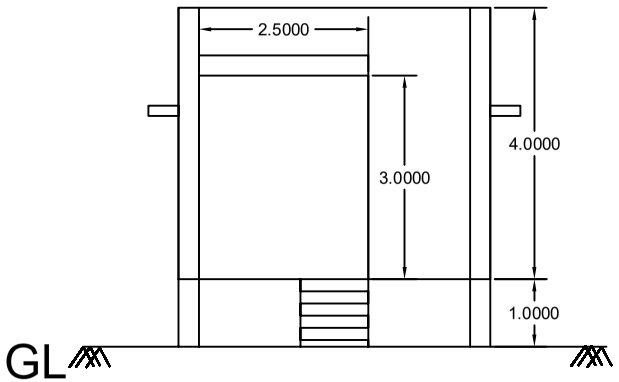
Plan



Plan for Beams Columns



Side Elevation with footing



Front Elevation

Schedule of Beam and Columns

C - Column size 300X300 mm

B1 - Beam size 300 X 450 mm L = 4 m

B2 - Beam size 230 X 450 mm L= 3 m

B3 - Beam size 230 X 450 mm L= 2.35 m

SB - Beam size 230 X 300 mm L = 6.32

Schedule of Doors, Windows and Ventilators

D - Solid core Door size 900 X 2100 mm

SD - Rolling Shutter size 2500 X 3000 mm

W - Steel Window size 1500 X 1200 mm

V - Ventilator 1500 X 450 mm

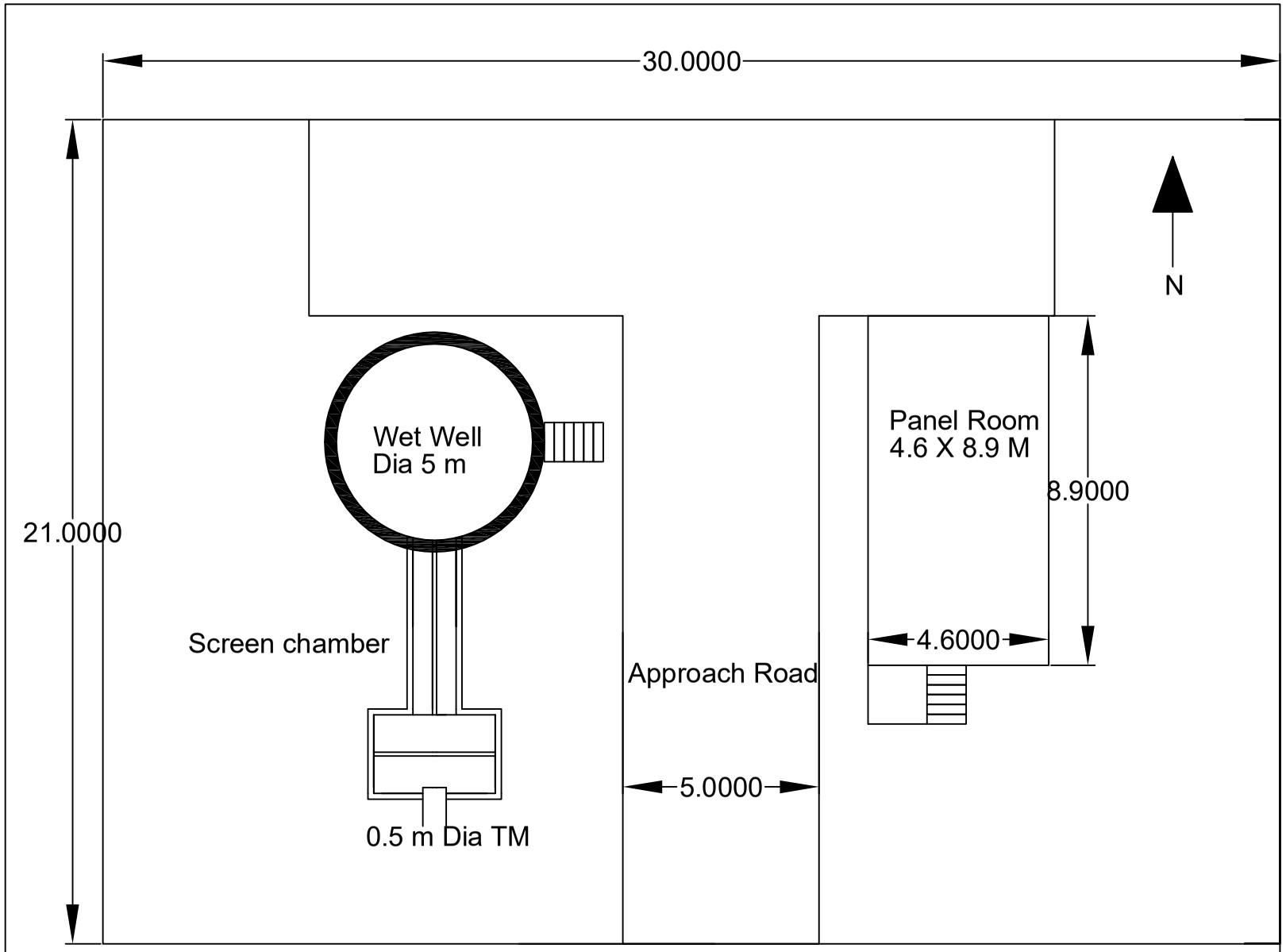
Maharashtra Jeevan Pradhikaran

Name Of Scheme:- Kupwad Underground Drainage Scheme Tal. Miraj Dist. Sangli

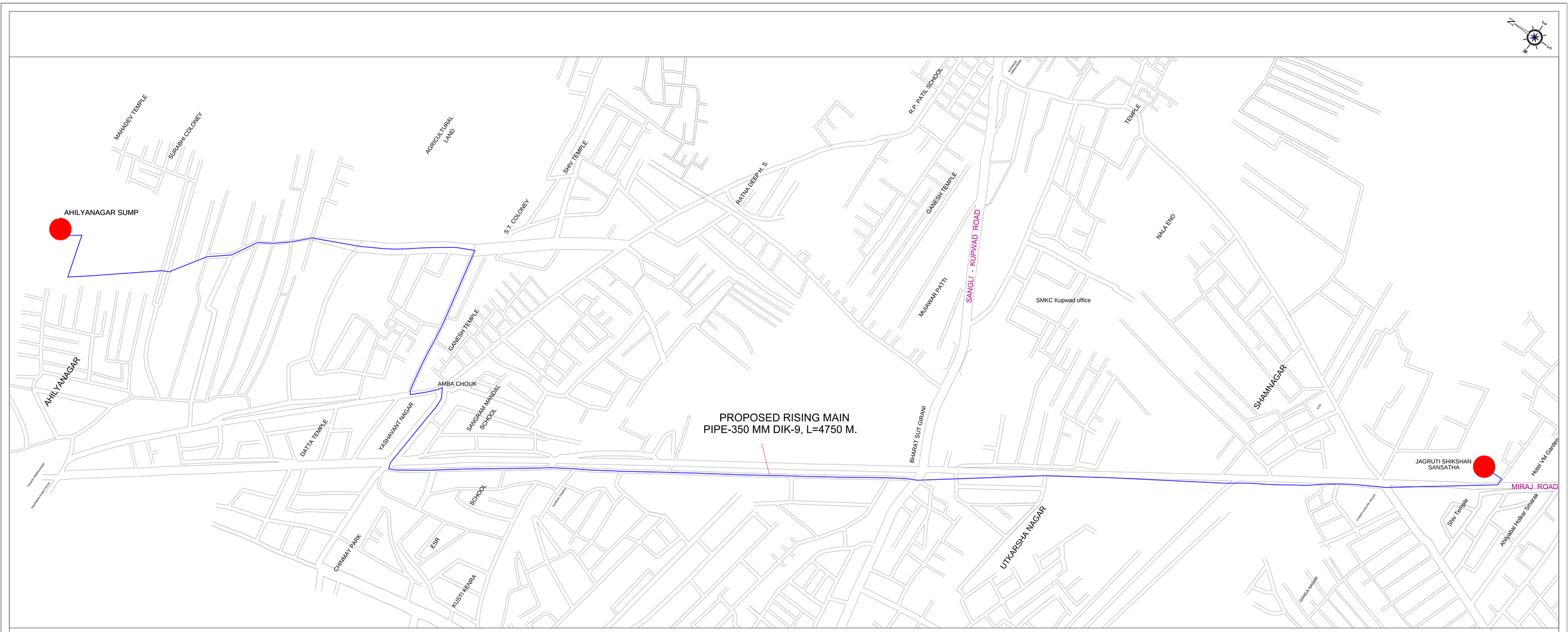
Drawing:- Ahilyanagar Panel Room Drawings

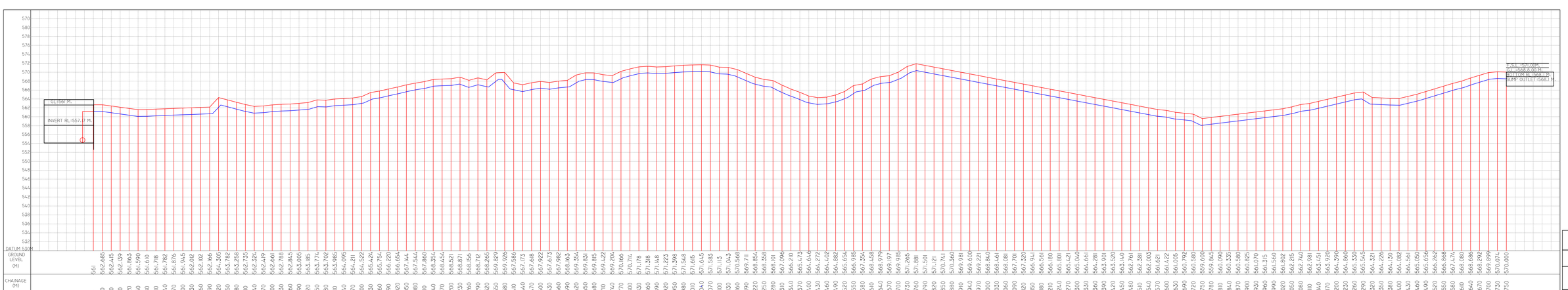
S.D.O.

Executive Engr.



Maharashtra Jeevan Pradhikaran	
Name Of Scheme:- Kupwad Underground Drainage Scheme Tal. Miraj Dist. Sangli	
Drawing:- Key Plan For Ahilyanagar Wet well & Pane Room	
S.D.O.	Executive Engr.





MAHARASHTRA JEEVAN PRADHIKARAN
M.J.P. DIVISION, SANGLI
M.J.P. SUB-DIVISION, SANGLI

KUPAWAD UNDER GROUND DRAINAGE SCHEME, KUPAWAD

L SECTION FOR

PROPOSED RISING MAIN
AHILYANAGAR SUMP TO JAGRUTI SUMP

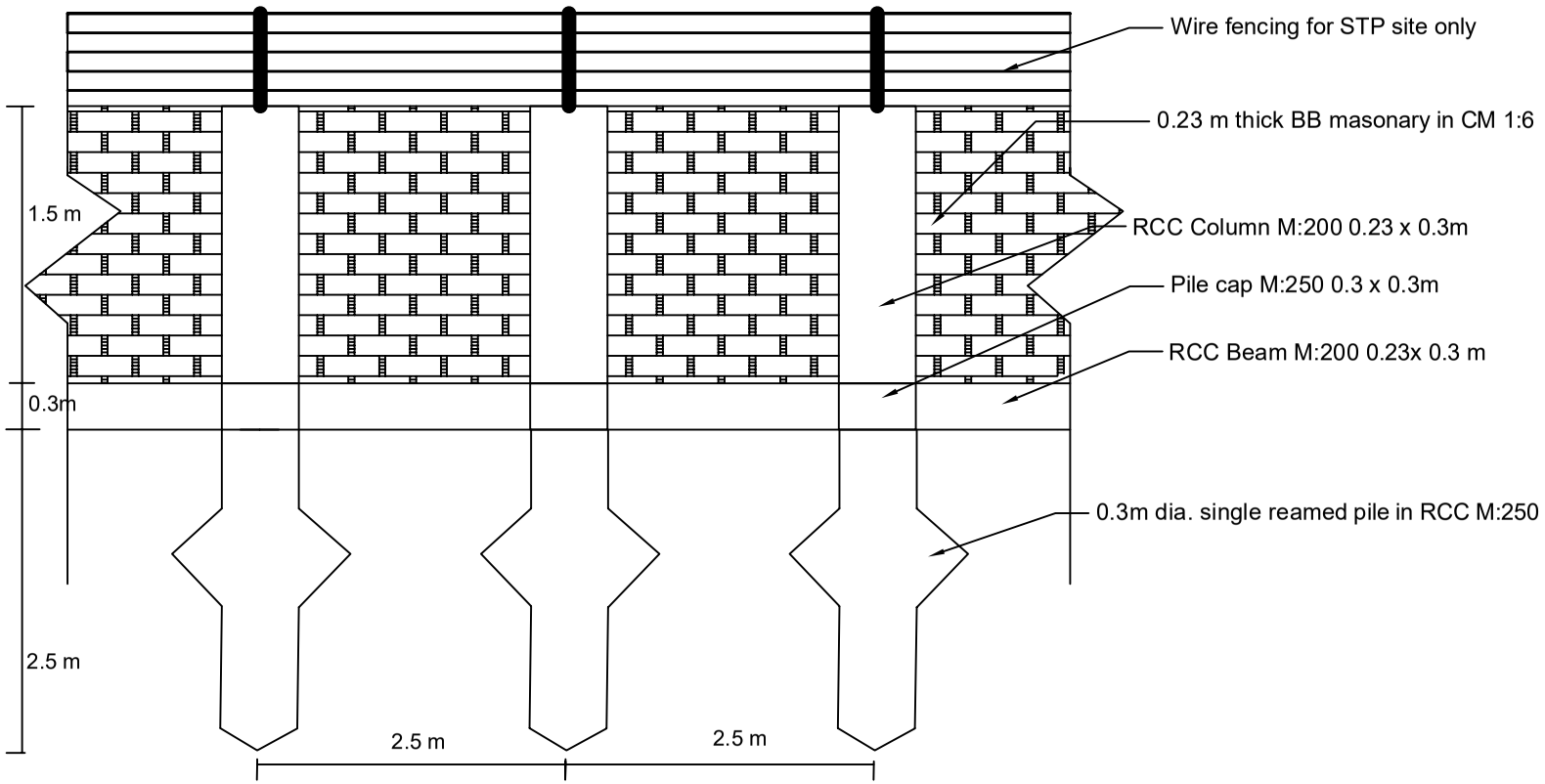
Sec. Engineer	Sub- Divisional Engineer	Executive Engineer

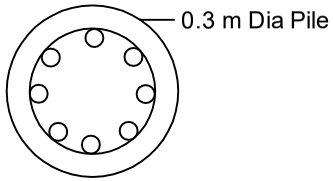
Maharashtra Jeevan Pradhikaran

Name Of Scheme:- Kupwad Underground DrainageScheme
Tal. Miraj Dist. Sangli

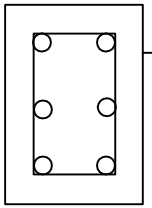
Drawing:- Collection System Layout

S.D.E.	Executive Engr.

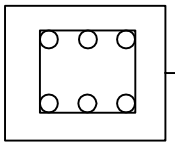




Pile



Beam



Column

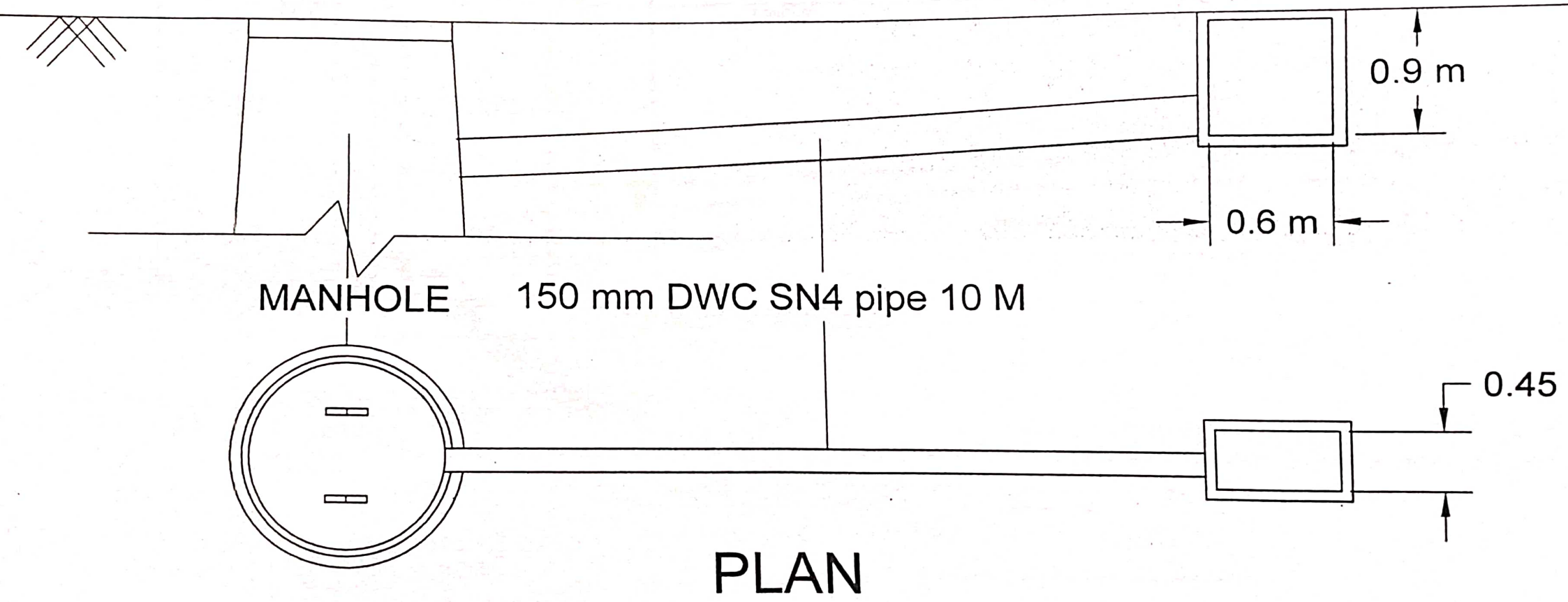
Details Of Compound Wall

Maharashtra Jeevan Pradhikaran	
Name Of Scheme:- Kupwad Underground Drainage Scheme	
Drawing:- Details of Compound Wall	
S.D.O.	Executive Engr.

KUPWAD UNDERGROUND DRAINAGE SCHEME

Household Service Connection

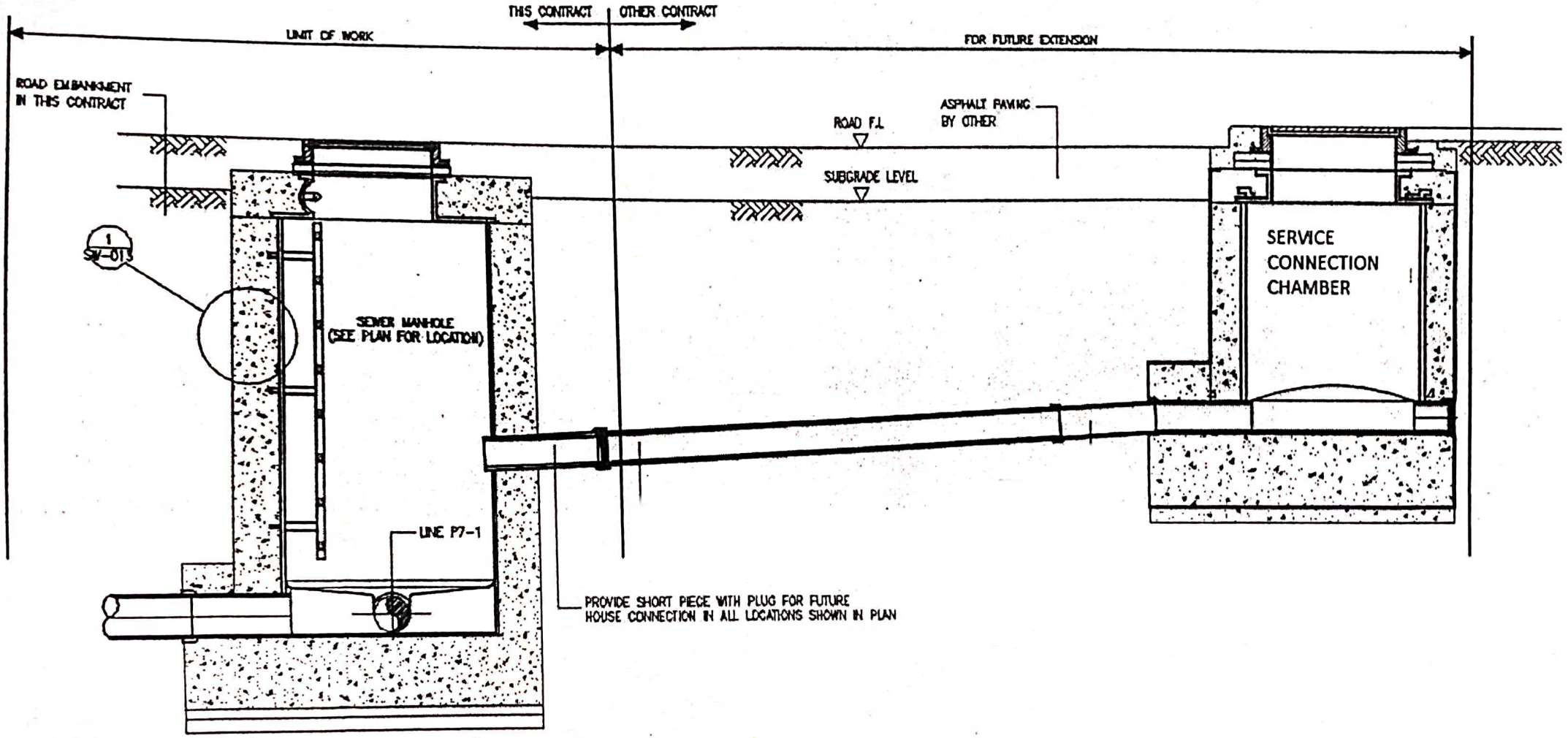
SECTION



PLAN

Sub Divisional Officer
MJP Sub Divisional Sangli

Executive Engineer
MJP Divisional Sangli

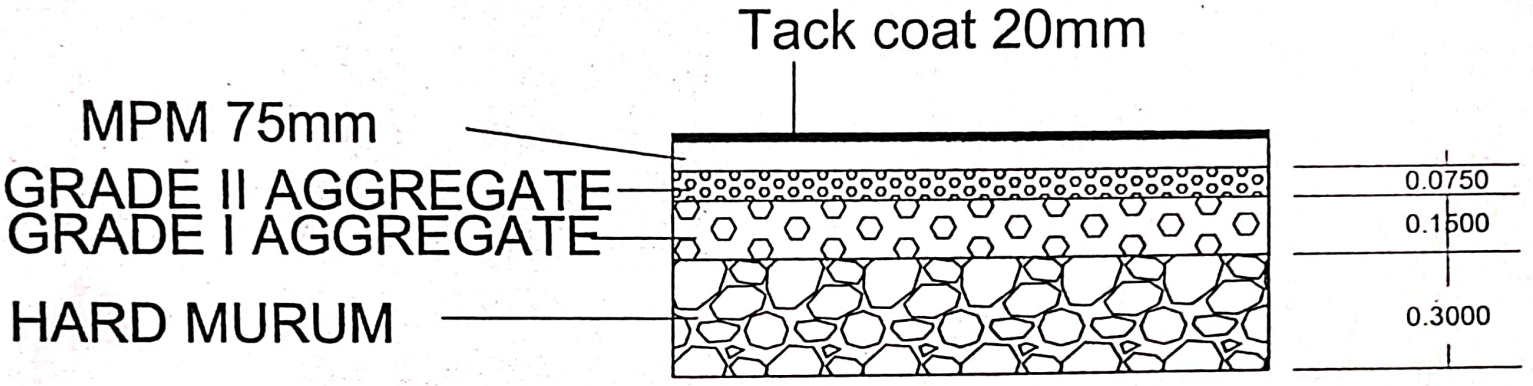


TYPICAL SEWER LINE SECTION SHOWING CONNECTION

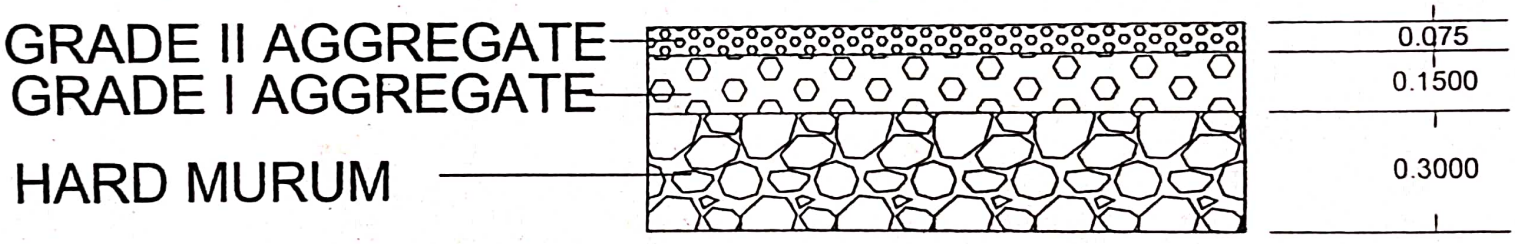
SEWER MANHOLE AND INSPECTION CHAMBER BETWEEN

KUPWAD UNDERGROUND DRAINAGE SCHEME

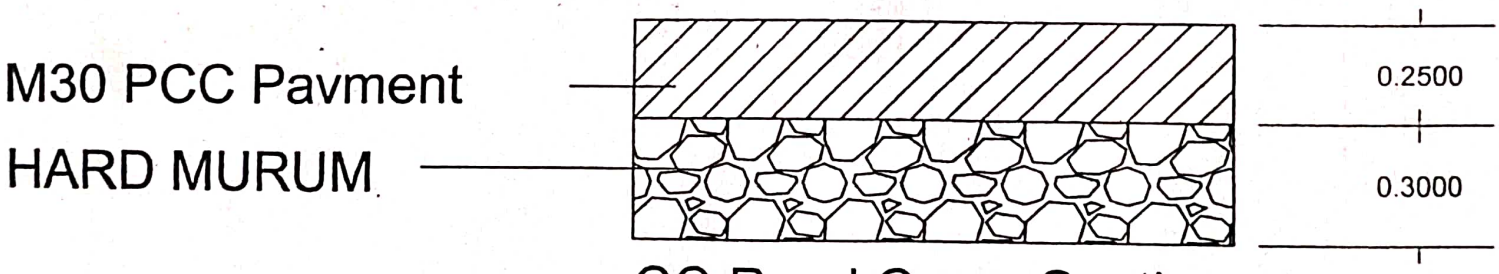
Cross Section For Road Reinstating work



BT Road Cross Section



ŴBM Road Cross Section



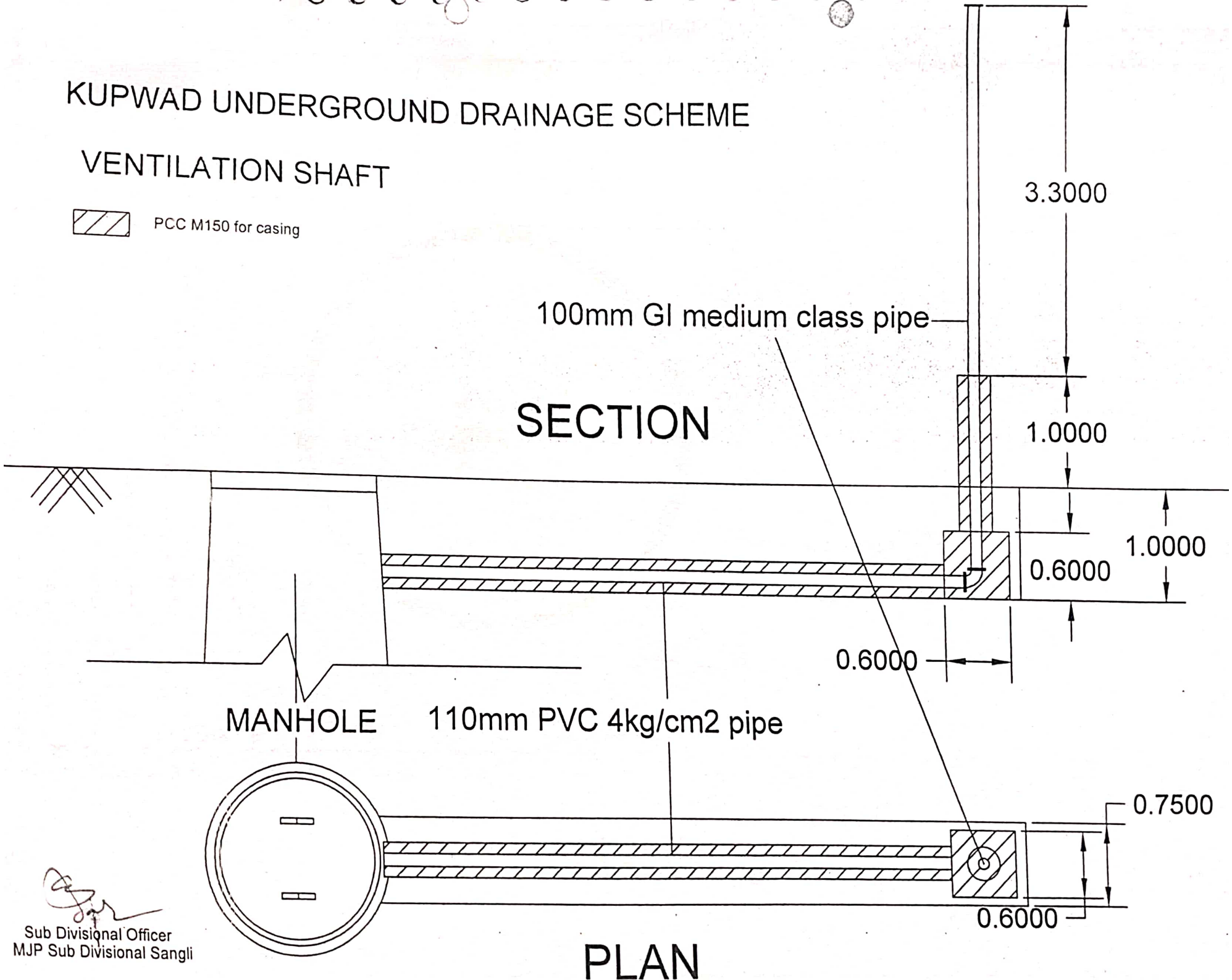
CC Road Cross Section

Sub Divisional Officer
MJP Sub Divisional Sangli

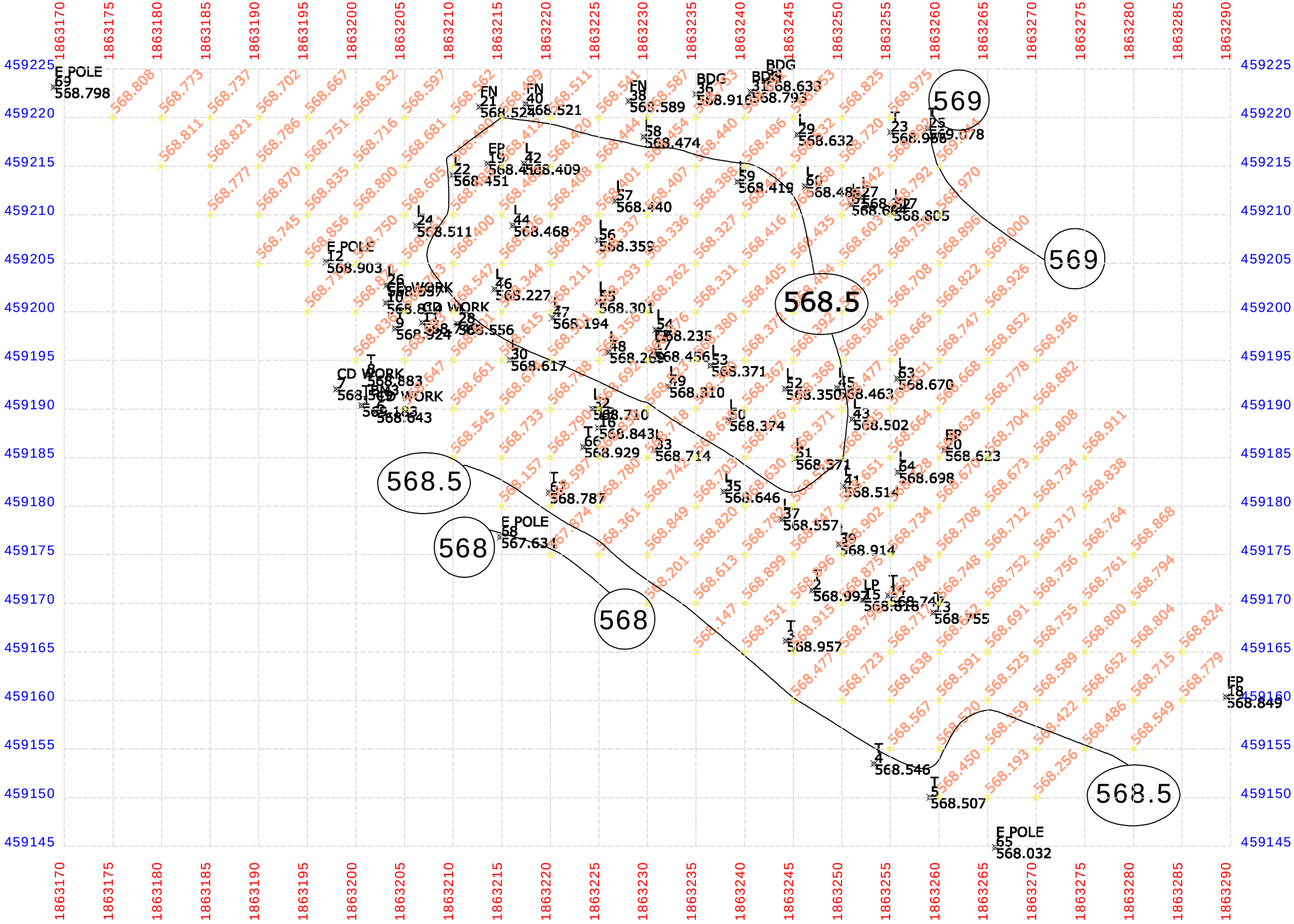
KUPWAD UNDERGROUND DRAINAGE SCHEME

VENTILATION SHAFT

PCC M150 for casing



Sub Divisional Officer
MJP Sub Divisional Sangli



MAHARASHTRA JEEVAN PRADHIKARAN CIRCLE, SANGLI
MAHARASHTRA JEEVAN PRADHIKARAN DIVISION, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN SUB.DIVISION, SANGLI

KUPWAD UNDERGROUND DRAINAGE SCHEME TALUKA : MIRAJ, DISTRICT: SANGLI
MAHARASHTRA SUVARNAJAYANTI NAGAROTTHAN MAHAABHIYAN PROGRAMME

CONTOUR LAYOUT FOR JAGRUTI SUMP

Sec. Engineer	Sub - Div Engineer	Exe. Engineer	Supdt.Enginee

NORTH

AHILYANAGAR WET WELL
PUMP HOUSE - 01

AHILYA NAGAR

KAPASE PLOT

ZONE - 01

DATTA TEMPLE

YASHAVANT NAGAR

AMBA CHOUK

CHINMAY PARK

ESR

SCHOOL

KUSTI KENRA

TO BAMNOLI

BAJRANG NAGAR

IDGAH

P.R. PATIL
SCHOOL

CHURCH

ESR

ASHTA BANK

KUPAWAD
URBAN BANK

GAONTHAN

SHIV TEMPLE

HANUMAN
NAGAR

ZONE - 02 A

ZONE - 02 B

GANESH TEMPLE

SCHOOL

PETROL PUMP

SHARDA HSG.

LAXMI
TEMPLE

HANUMAN
TEMPLE

JAIN
TEMPLE

ALANKAPURI

BOSTAN

POTDAR
SCHOOL

UTKARSHA NAGAR

WAGHMODE
NAGAR

SHAMNAGAR

KUPWAD
PHATA

OLD KUPWAD ROAD

TULAJAINAGAR WET WELL
PUMP HOUSE - 02

GANGA NAGAR

KUMAR
HASURE NAGAR

JAGRUTI
SANSATHA

JAGRUTI WET WELL

AAMANTRAN
HOTEL

ENGLISH SCHOOL

ASHTAVINAYAK NAGAR

WARNALI

VISHRAMBAG
RAILWAY STATION

VINAYAK NAGAR

HANUMAN TEMPLE

PALVI HOTEL

<---- TO SANGLI

WILLINGDAN COLLEGE

CHINTAMANRAO
COLLEGE

WALCHAND
COLLEGE

SANGLI - MIRAJ ROAD

SAINIK NAGAR

TO MIRAJ

ZONE - 03 A

ZONE - 03 B

INC CAPITAL
CORPL

COLLECTOR
OFFICE

COURT
OFFICE

Z.P. SCHOOL

WANLESWADI

BHARATI
HOSPITAL

SHAHU
COLLEGE

RAJMATA D.ED. COLLEGE

HANUMAN
TEMPLE

SFURTI
CHOWK

SHIV TEMPLE

THE VITA
BANK

GOVT. COLONY

JANTA NAGARI
PATSANSTHA

MAHALAXMI CHOUK

MAHALAXMI
TEMPLE

PURVA
GARDEN

SWAPNA NAGARI

VIDHATA COLONY

AARYA
GARDEN

BETHELHEM
NAGAR

CHANDRAMANI PARK - I

VRINDAVAN VILLA

GANRAYA PARK

KUMBHAR MALA

KUMBHAR MALA WET WELL & PUMP
HOUSE - 03

SBR TYPE
S. T. P.27 MLD

Trunk Main

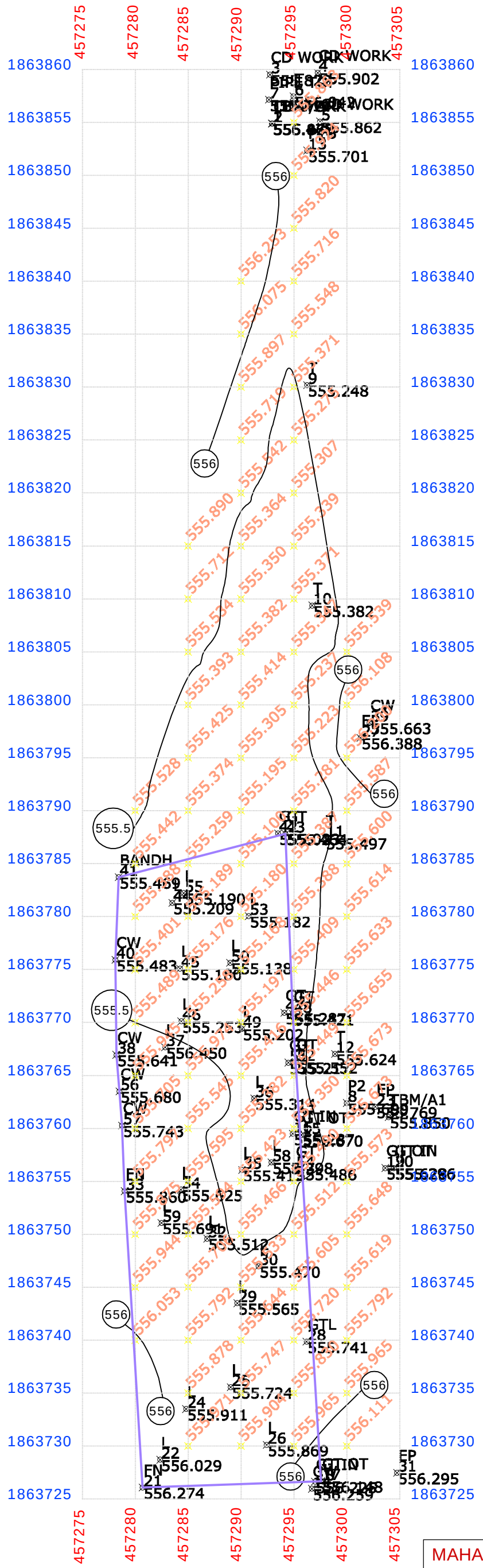
LEGEND -
TRUNK MAIN -
PUMPING MAIN -
SUMP & P. H. -
S.T.P -
WARD BOUNDARY-
ZONE BOUNDARY -
ROAD -
NALA -

MAHARASHTRA JEEVAN PRADHIKARAN CIRCLE, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN DIVISION, SANGLI.

KUPWAD UNDERGROUND DRAINAGE SCHEME TALUKA : MIRAJ, DISTRICT: SANGLI.
MAHARASHTRA SUVARNAJAYANTI NAGAROTTHAN MAHAABHIYAN PROGRAMME

ZONE WISE PLAN WITH CONTOUR

Sec. Engineer	Sub- Divisional Engineer	Executive Engineer	



N

W E

S

MAHARASHTRA JEEVAN PRADHIKARAN CIRCLE, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN DIVISION, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN SUB.DIVISION, SANGLI.

KUPWAD UNDERGROUND DRAINAGE SCHEME TALUKA : MIRAJ, DISTRICT: SANGLI.
MAHARASHTRA SUVARNAJAYANTI NAGAROTTHAN MAHAABHIYAN PROGRAMME

CONTOUR LAYOUT FOR SUMP AT TULJAINAGAR

Sec. Engineer	Sub - Div Engineer	Exe. Engineer	Supdt.Engineer

TULJAEE NAGAR

SANGLI - KUPWAD ROAD

KUPWAD PHATA

SUMP & PUMP
HOUSE - 02

PROPOSED RISING MAIN
PIPE-700 MM DIK-9, L=1580 M.

SHAMNAGAR

ESR

GANGA NAGAR

KUMAR HASURE NAGAR

JAGRUTI
SANSATHA

SUMP 4

Shiv Temple

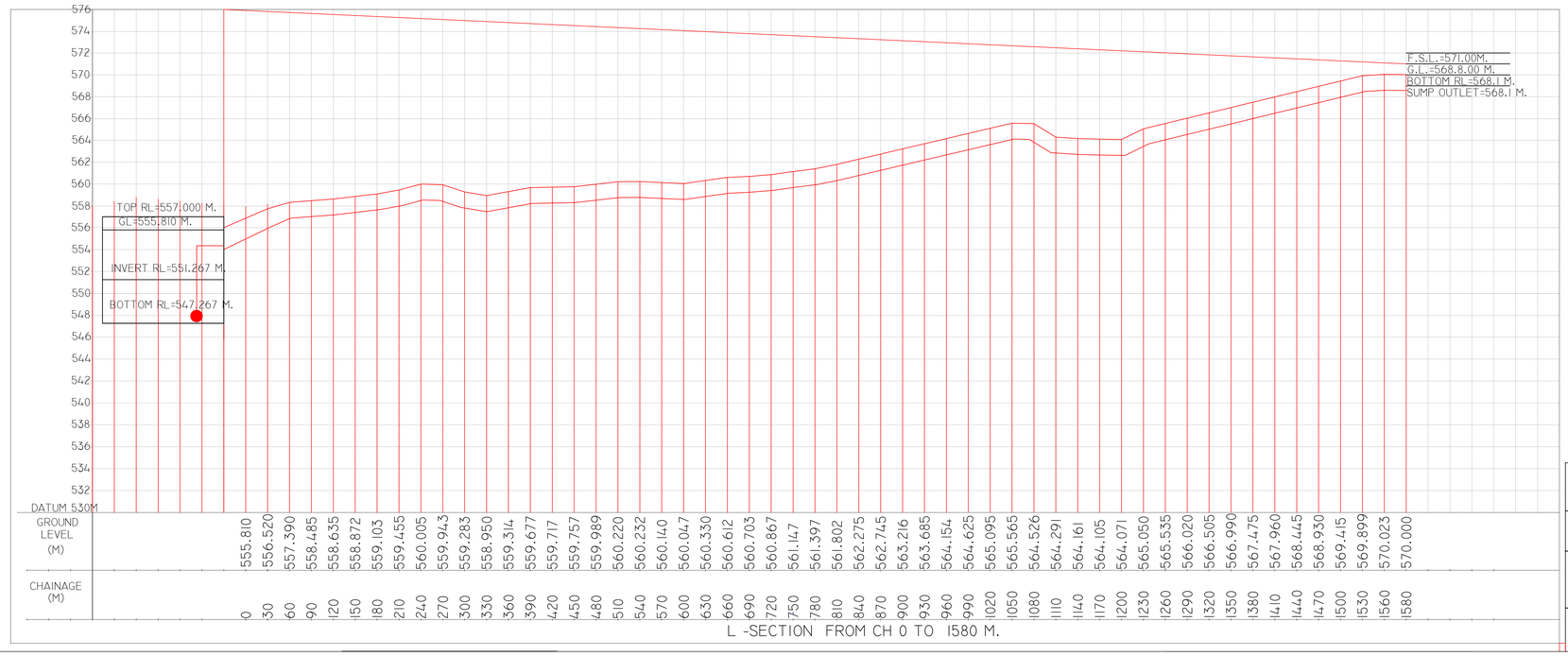
ASHTAVINAYAK NAGAR

Hotel VM Garden

VIKAS COLONY

Ahilyabai Holkar Smarak

N
W E
S



L -SECTION FROM CH 0 TO 1580 M.

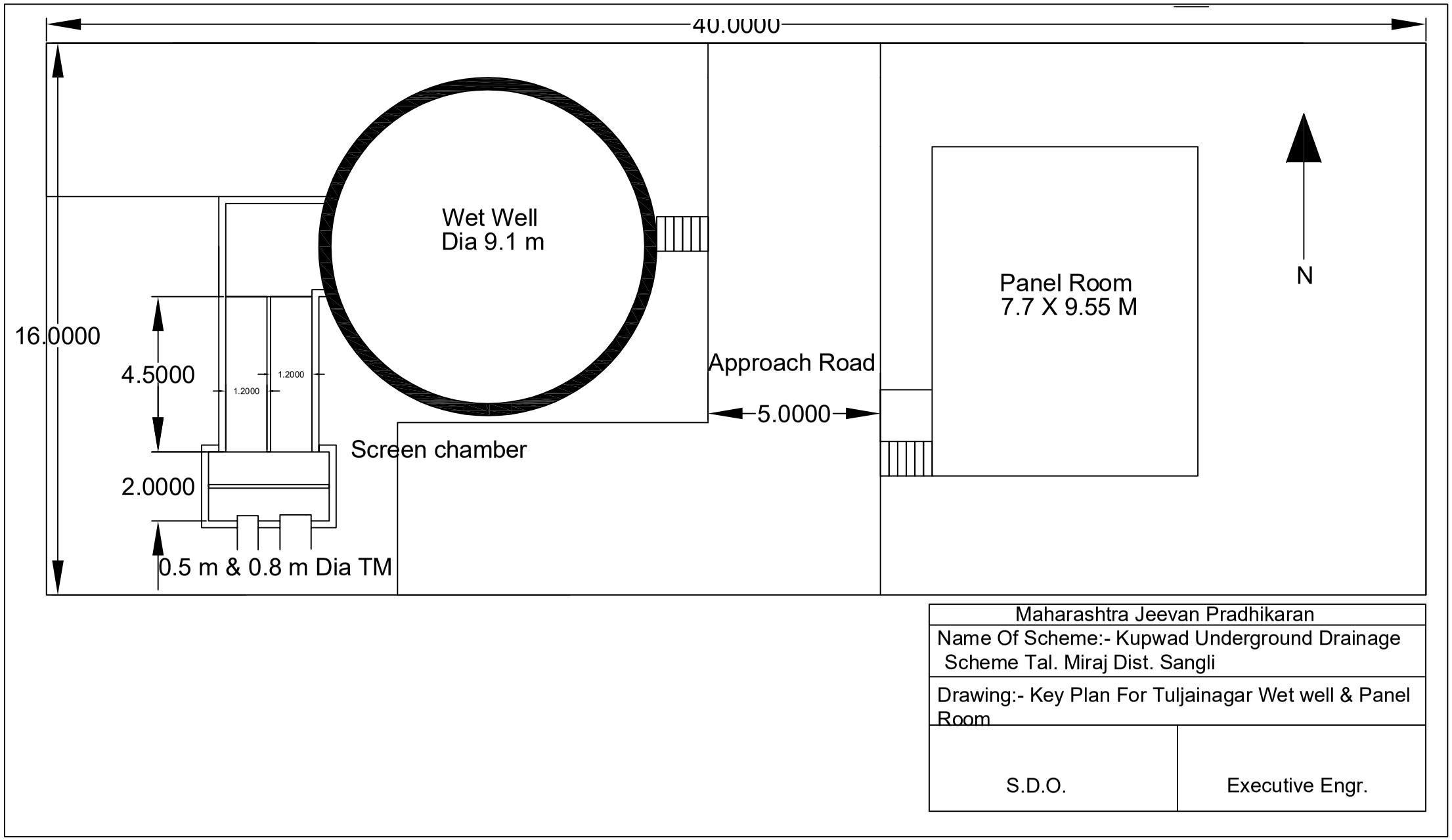
MAHARASHTRA JEEVAN PRADHIKARAN
M.J.P. DIVISION, SANGLI.
M.J.P. SUB-DIVISION, SANGLI.

KUPAWAD UNDER GROUND DRAINAGE SCHEME, KUPAWAD

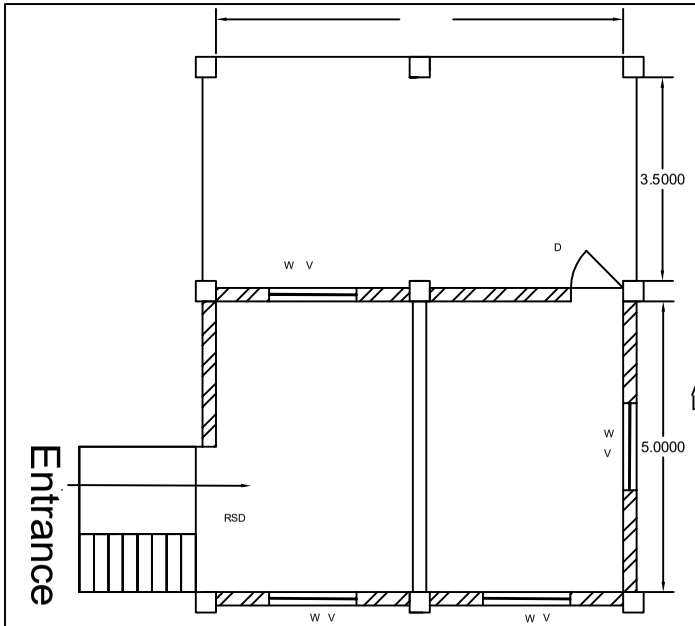
L SECTION FOR

PROPOSED RISING MAIN
TULJAEE NAGAR SUMP TO JAGRUTI SUMP

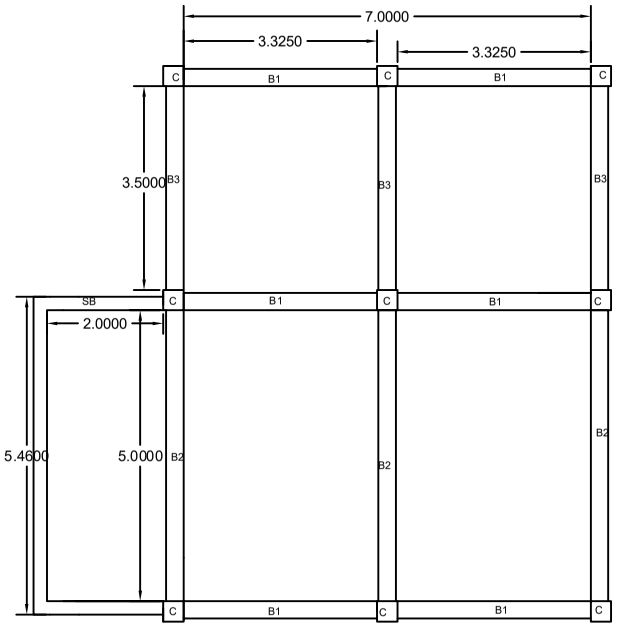
Sec. Engineer	Sub- Divisional Engineer	Executive Engineer



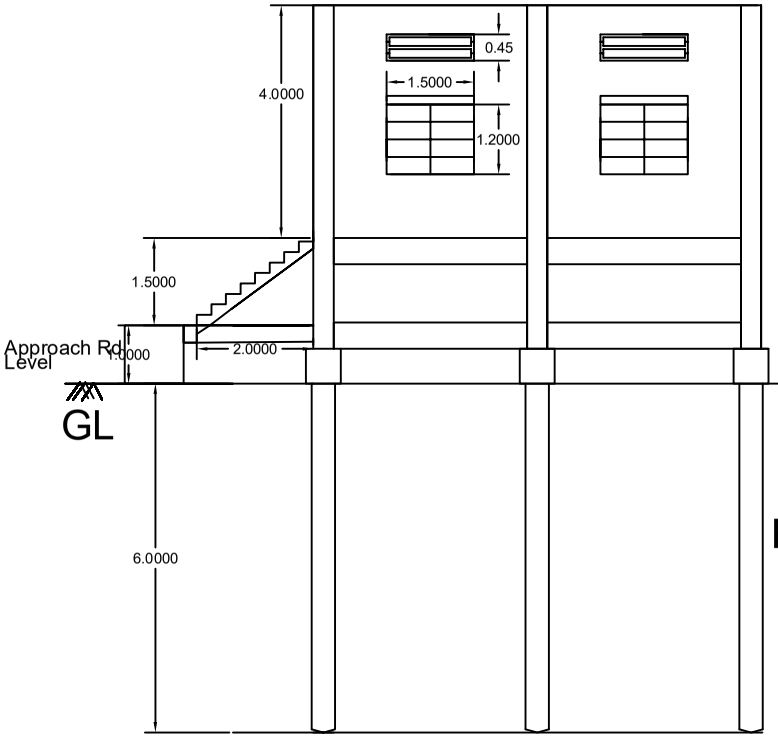
Maharashtra Jeevan Pradhikaran	
Name Of Scheme:- Kupwad Underground Drainage Scheme Tal. Miraj Dist. Sangli	
Drawing:- Key Plan For Tuljainagar Wet well & Panel Room	
S.D.O.	Executive Engr.



Plan

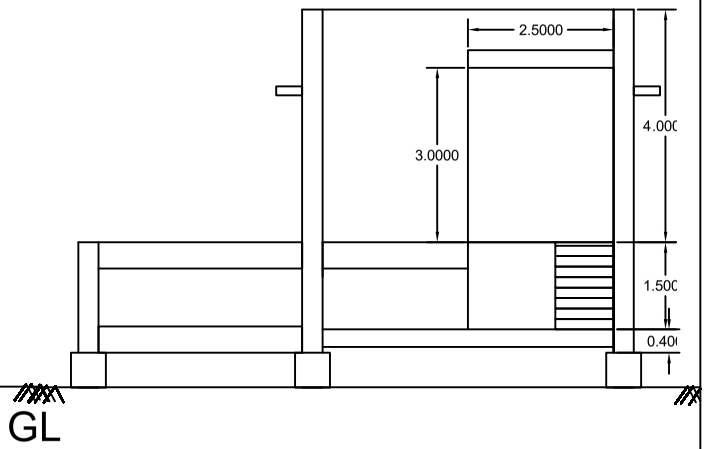


Plan for Beams Columns



Side Elevation with footing

Pille footing

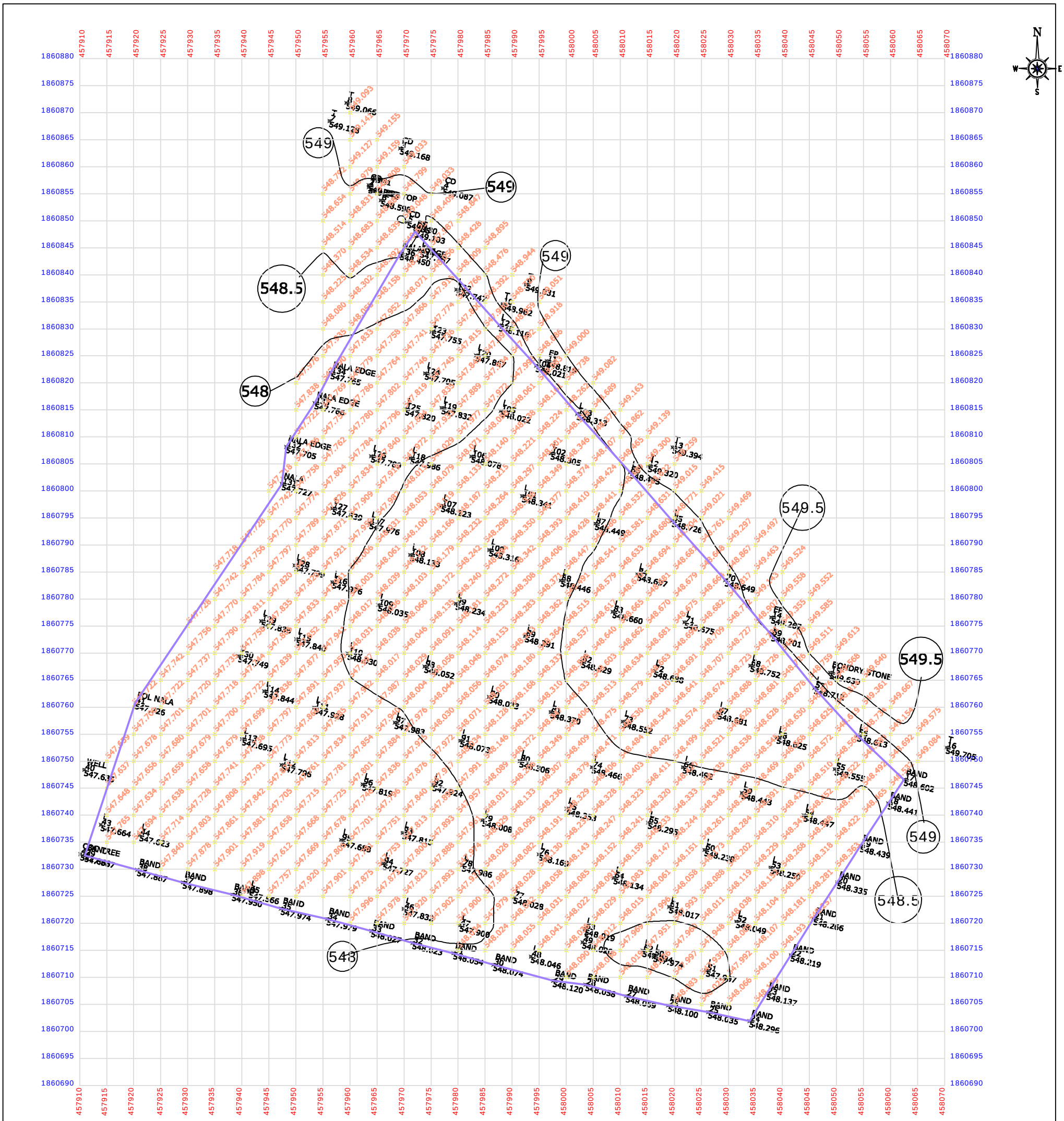


Front Elevation

Schedule of Beam and Columns
C - Column size 350X350 mm
B1 - Beam size 300 X 450 mm L = 3.325 m
B2 - Beam size 300 X 450 mm L= 5 m
B3 - Beam size 300 X 450 mm L= 3.5 m
SB - Beam size 230 X 300 mm L = 8.9 m

Schedule of Doors, Windows and Ventilators
D - Solid core Door size 900 X 2100 mm
RSD - Rolling Shutter size 2500 X 3000 mm
W - Steel Window size 1500 X 1200 mm
V - Ventilator 1500 X 450 mm

Maharashtra Jeevan Pradhikaran	
Name Of Scheme:- Kupwad Underground Drainage Scheme Tal. Miraj Dist. Sangli	
Drawing:- Tuljaiagar Panel Room Drawings	
S.D.O.	Executive Engr.

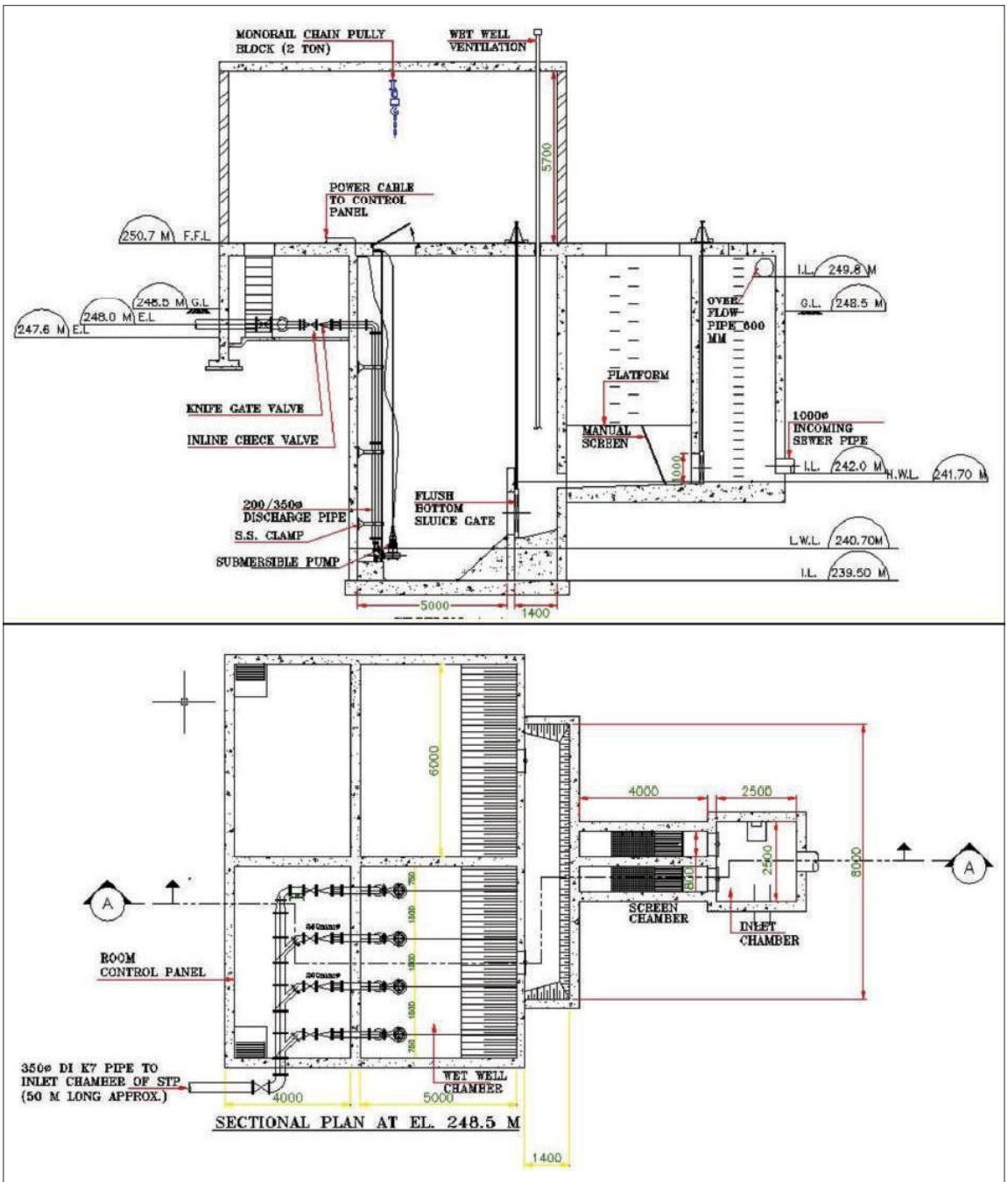


MAHARASHTRA JEEVAN PRADHIKARAN CIRCLE, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN DIVISION, SANGLI.
MAHARASHTRA JEEVAN PRADHIKARAN SUB.DIVISION, SANGLI.

KUPWAD UNDERGROUND DRAINAGE SCHEME TALUKA : MIRAJ, DISTRICT: SANGLI.
MAHARASHTRA SUVARNAJAYANTI NAGAROTTHAN MAHAABHIYAN PROGRAMME

CONTOUR LAYOUT FOR STP AT KUMBHAR MALA

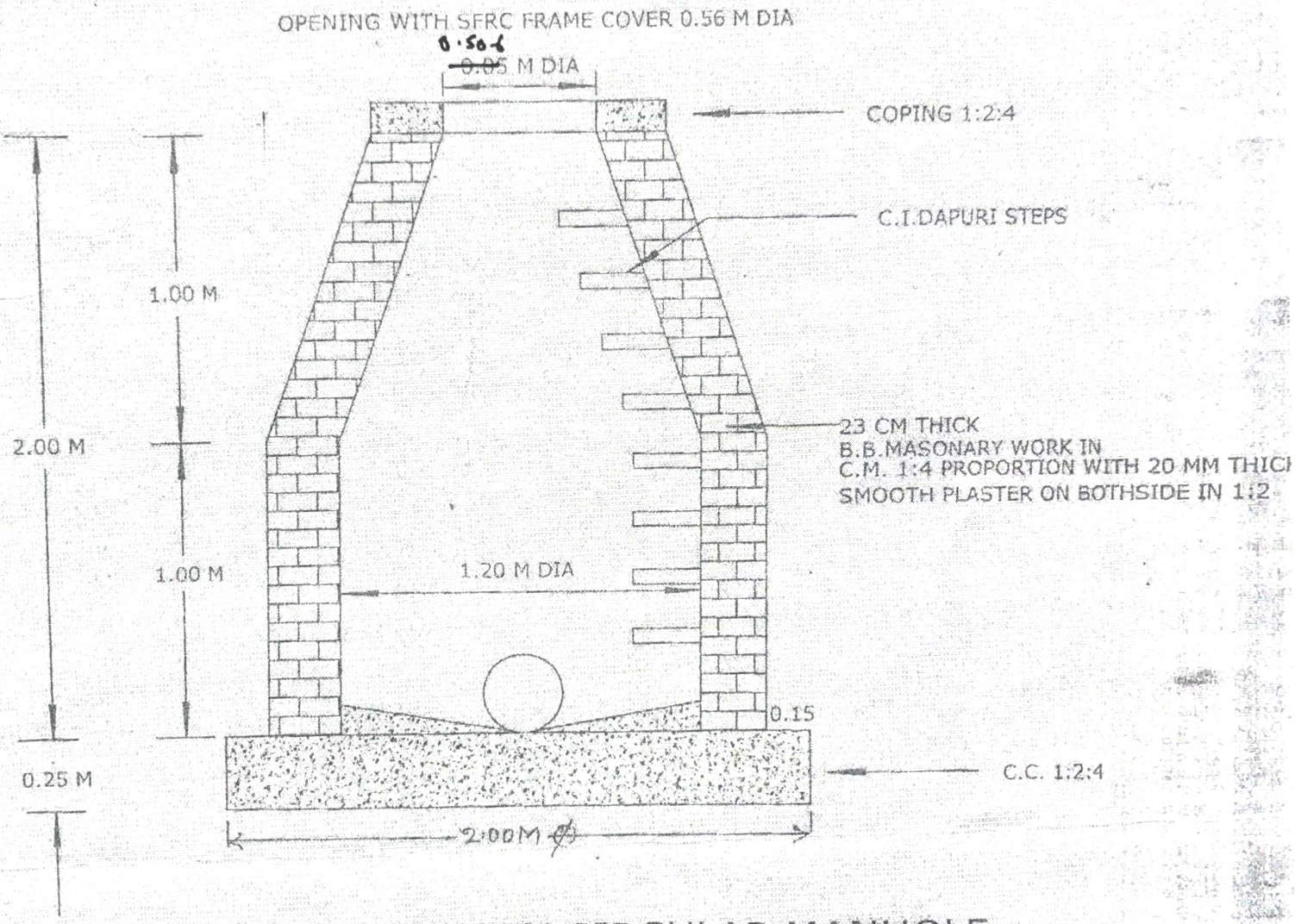
Sec. Engineer	Sub - Div Engineer	Exe. Engineer	Supdt.Engineer



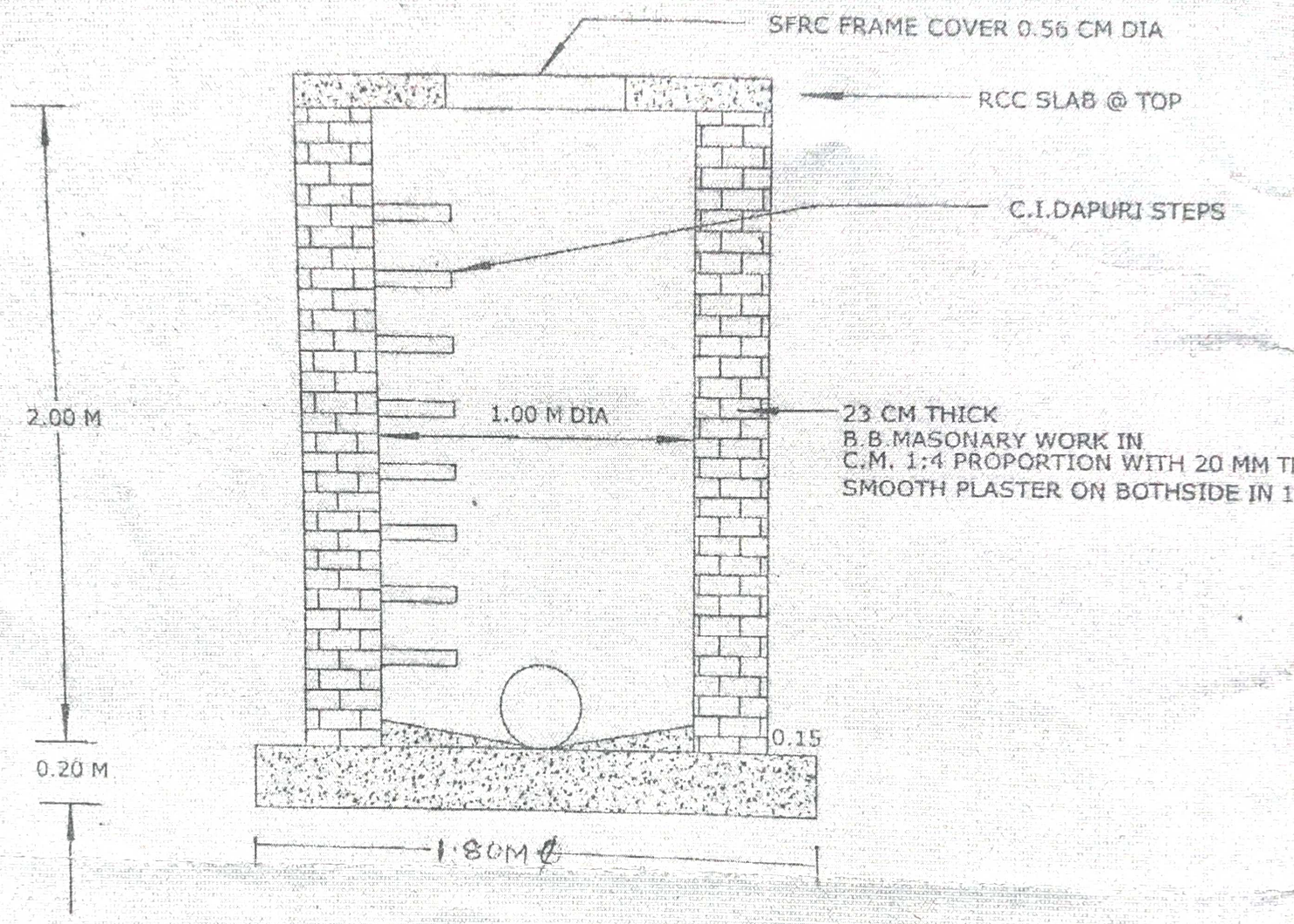
Illustrative wet well design for submersible pump set

The top of the pump set shall not be exposed to the atmosphere and shall be always submerged. The required wet well volume shall be provided preferably between the invert of the sewer and the top of the submersible pump set. This is achieved in this drawing. The wet well volume for large stations can also be compensated by the volume in sewers obtained at 0.8 of diameter and backwater curve.

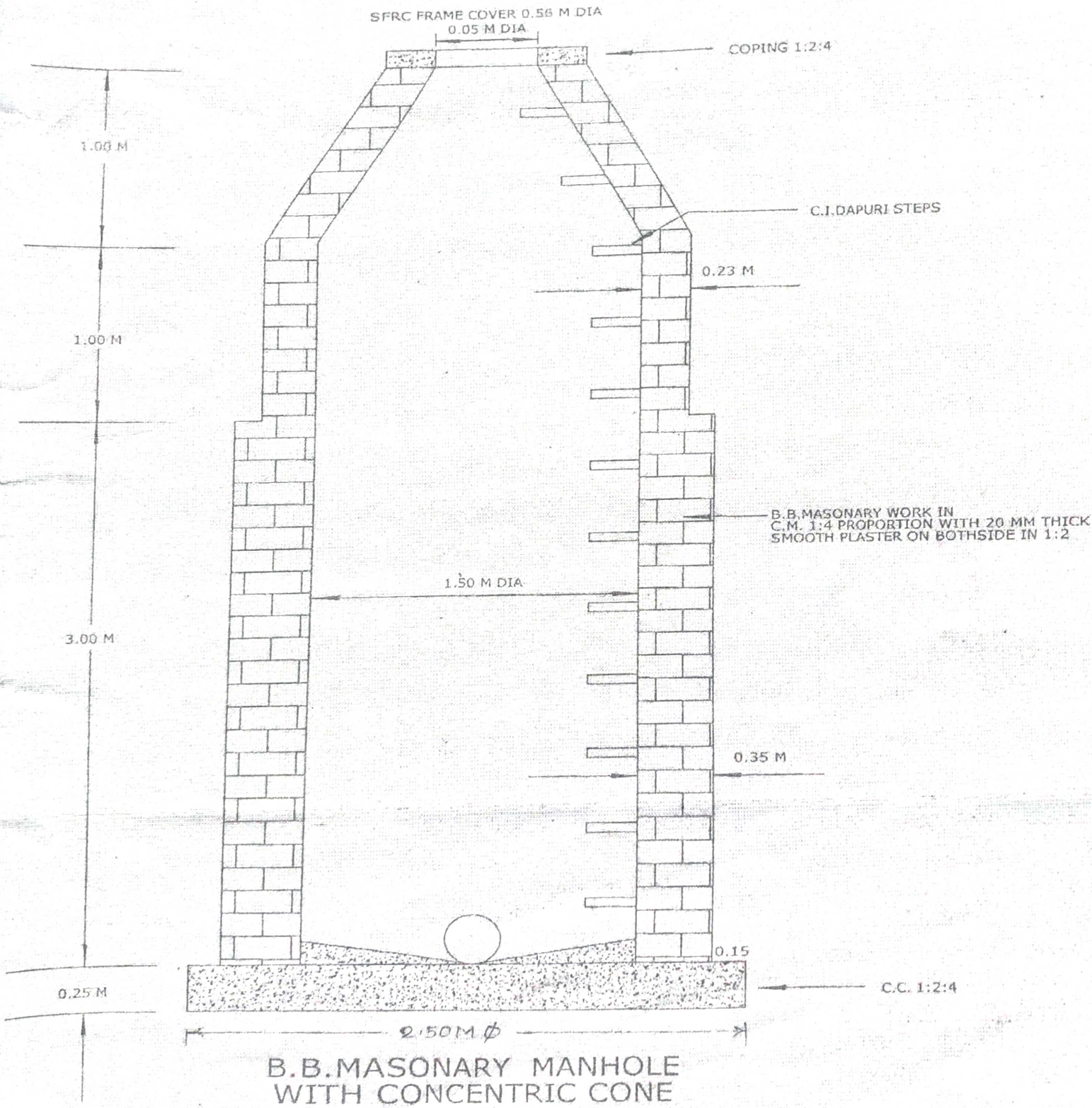
Figure 4.5 Typical arrangements of a submersible pump set wet well



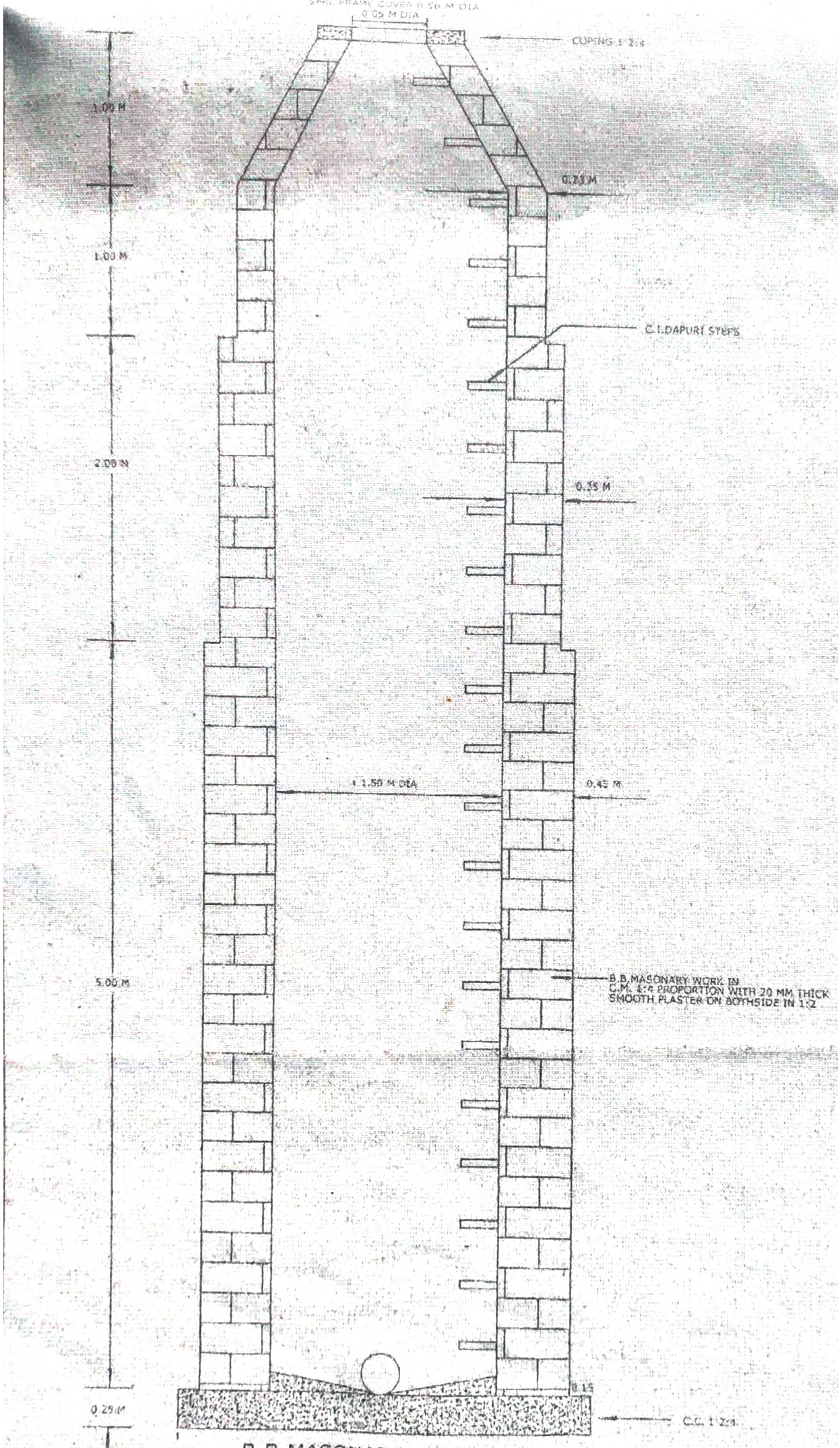
B.B.MASONARY CIRCULAR MANHOLE WITH CONCENTRIC CONE DEPTH UPTO 2.00 M.



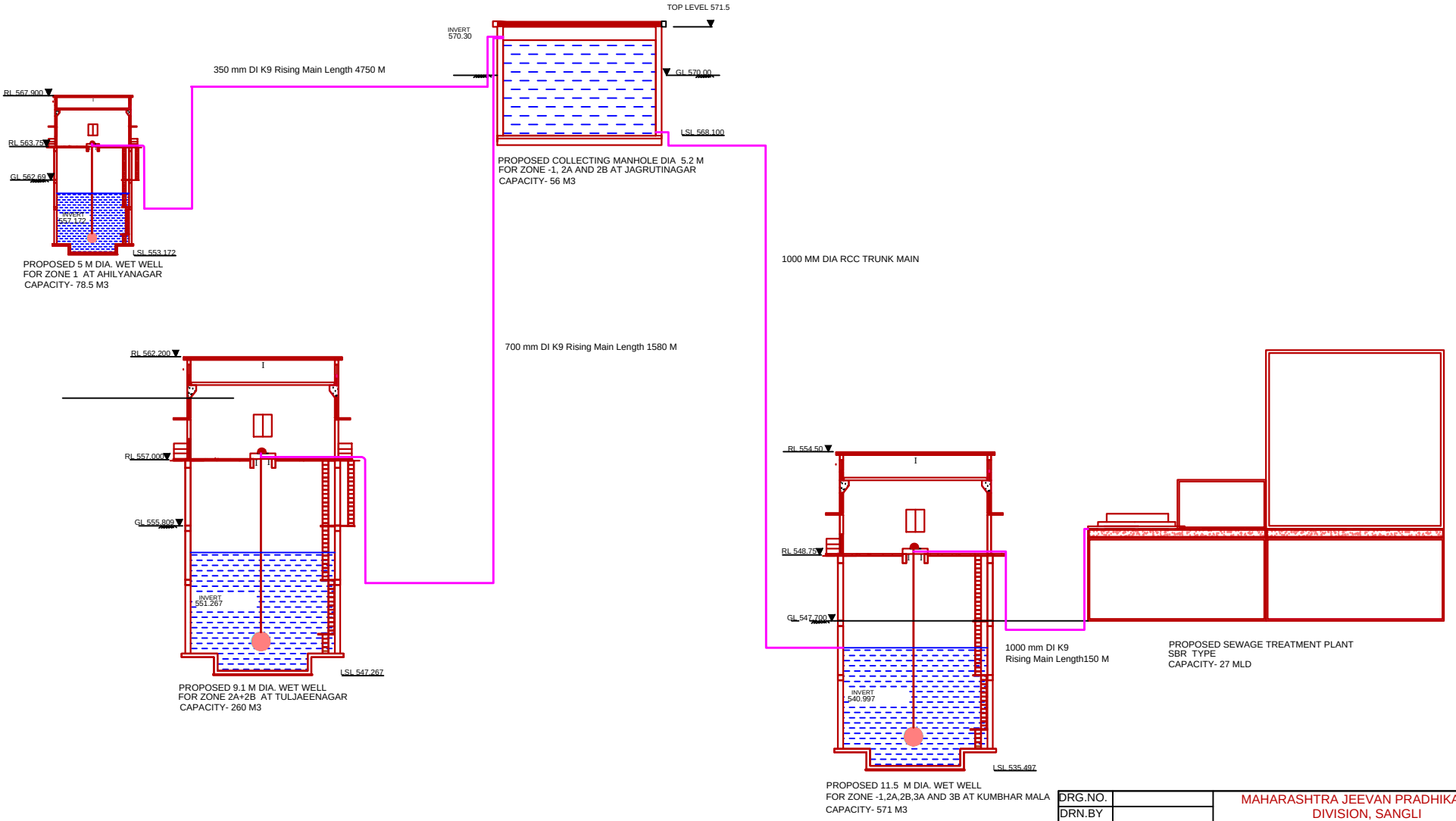
B.B.MASONARY CIRCULAR MANHOLE WITHOUT CONICAL SHAPE DEPTH UPTO 2.00 M.



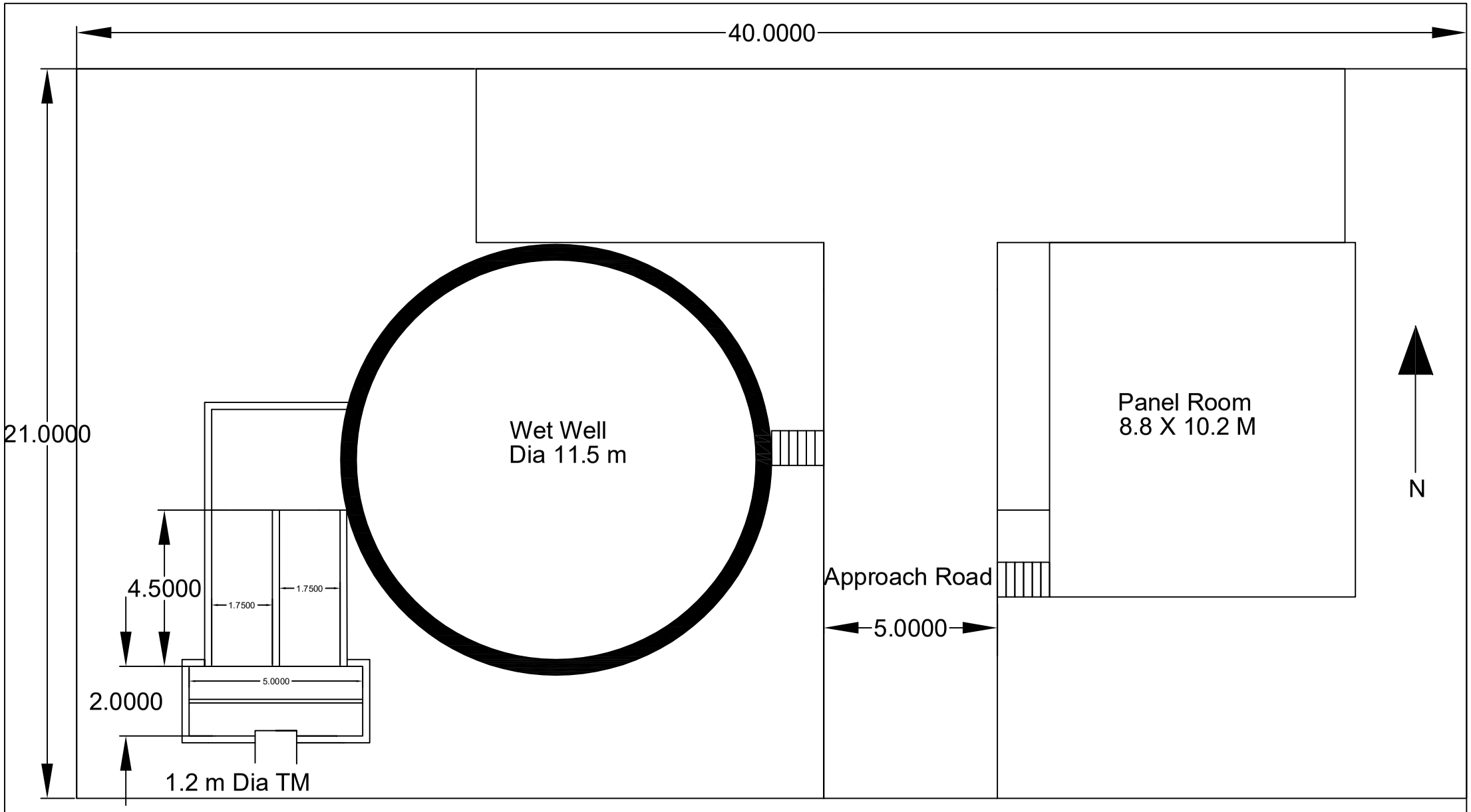
B.B.MASONARY MANHOLE WITH CONCENTRIC CONE DEPTH UPTO 2.00 M.TO 5.00 M.



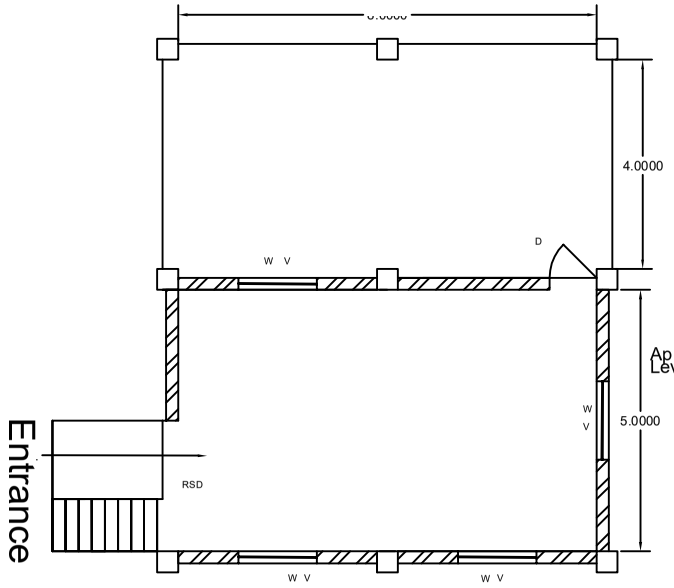
B.B.MASONARY MANHOLE
WITH CONCENTRIC CONE
DEPTH UPTO 5.00 M.TO 9.00 M.



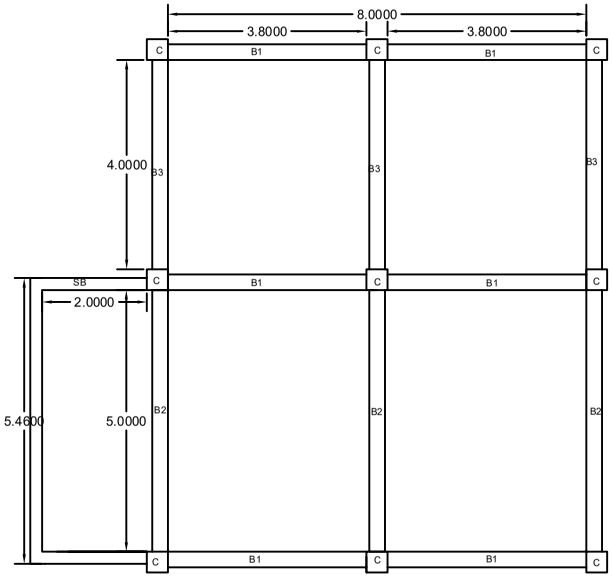
DRG.NO.		MAHARASHTRA JEEVAN PRADHIKARAN DIVISION, SANGLI SUB-DIVISION, SANGLI
DRN.BY CHD.BY		
APPROVED		PROPOSED KUPWAD UNDERGROUND DRAINAGE SCHEME, TAL.-MIRAJ, DIST.- SANGLI.
		FLOW DIAGRAM
DATE	/ / 2021	Sub-Div. Engineer | Executive Engg. | Supdt. Engg.



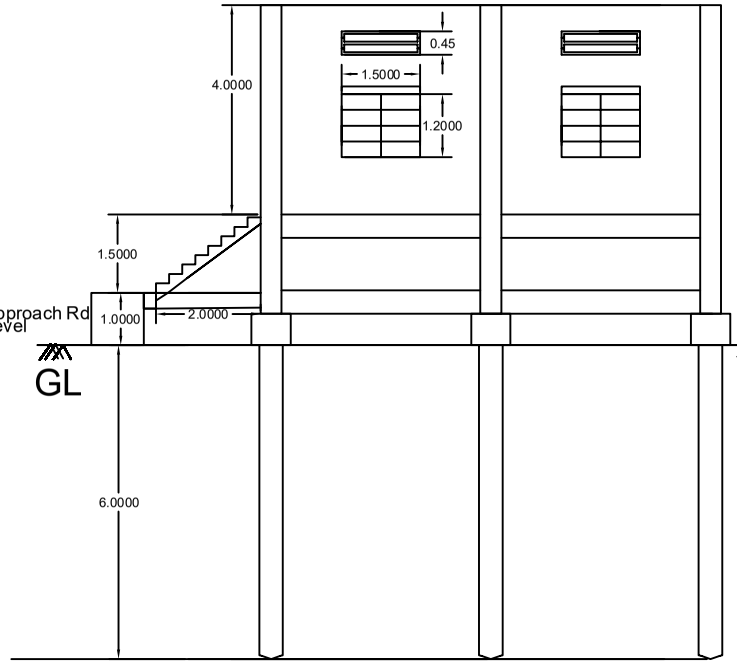
Maharashtra Jeevan Pradhikaran	
Name Of Scheme:- Kupwad Underground Drainage Scheme Tal. Miraj Dist. Sangli	
Drawing:- Key Plan For Kubhar mala Wet well & Pan Room	
S.D.O.	Executive Engr.



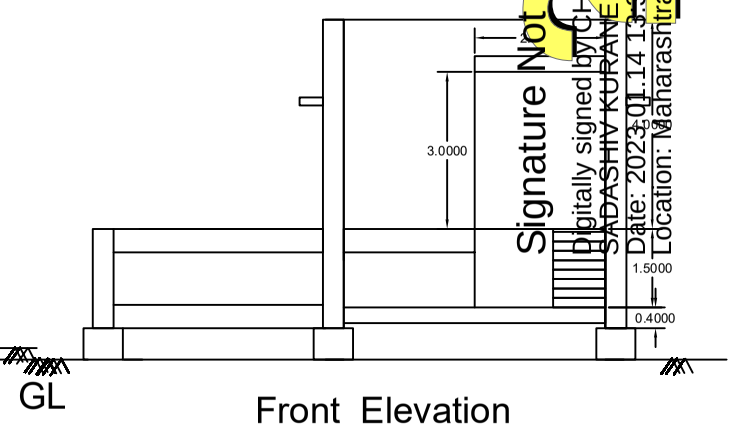
Plan



Plan for Beams Columns



Side Elevation with footing



Front Elevation

Schedule of Beam and Columns
C - Column size 400 X400 mm
B1 - Beam size 300 X 450 mm L = 3.8 m
B2 - Beam size 300 X 750 mm L= 5 m
B3 - Beam size 300 X 450 mm L= 4 m
SB - Beam size 230 X 300 mm L = 8.9 m

Schedule of Doors, Windows and Ventilators
D - Solid core Door size 900 X 2100 mm
RSD - Rolling Shutter size 2500 X 3000 mm
W - Steel Window size 1500 X 1200 mm
V - Ventilator 1500 X 450 mm

Maharashtra Jeevan Pradhikaran	
Name Of Scheme:- Kupwad Underground Drainage Scheme Tal. Miraj Dist. Sangli	
Drawing:- Kumbhar mala Panel Room Drawings	
S.D.O.	Executive Engr.

Signature Not Verified
Digitally signed by CHIDANAND SADASHIV KURANE
Date: 2023.01.14 13:33:22 IST
Location: Maharashtra, MH