

TENDER NOTIFICATION

Ref: JDS:ENG:2021:/NO...../JABALPUR/Dt.....

Jabalpur Sahakari Dugdh Sangh Maryadit, Jabalpur, invites online tenders from adequate experienced manufacturers/ suppliers /agencies having valid registration of CPWD/ State PWD/MES/Govt/ Semi Govt. organization including valid licensees from the technology owners for design, supply and labour job for civil construction work, installation, testing, commissioning and successful trial run of 2400 KGS Bio-CNG/ day capacity production plant from buffalo/ cow dung to be installed at Imaliya village, Panagar Tehsil, Jabalpur district for Jabalpur Sahakari Dugdh Sangh Maryadit on turnkey basis on the following responsibility sharing basis between Jabalpur Sahakari Dugdh Sangh Maryadit, successful bidder and system integrator:

1. JSDS will provide land for setting up the Bio-CNG plant.
2. The JSDS will provide upfront cost for setting up the Bio-CNG plant.
3. The system integrator will set up Bio-CNG plant in the land provided by the JSDS within a period of 8 months.
4. The system integrator shall carry out the operations and maintenance activities including purchase and transport of the raw materials from generation point to the CNG unit.
5. The system integrator shall bear the cost of O&M, manpower, electricity and other recurring expenses.
6. The system integrator will arrange sale of the CNG, prom and or organic manure produced or any other output.
7. The system integrator will pay a fixed amount on yearly basis (to be offered in price bid apart from bid cost for supply and installation) to JSDS from the date of satisfactory commissioning and for a project period of 5 years which shall be extendable to further 3 years on mutual consent basis.
8. The bidding parameters of the tender (quality cost based system -50:50) and fixed revenue share by system integrator to the JSDS

Tender document is available & can be downloaded from the website www.mpe-tender.gov.in up to 5.00 PM of date 23/05/2022.

The C.E.O, J.S.D.S. reserves the right to accept or reject any or all the tenders without assigning any reasons.

**Chief Executive Officer
Jabalpur Sahakari Dugdh Sangh Maryadit,
Jabalpur (M.P.)**

SECTION-1

Notice Inviting e-Tenders

Jabalpur Sahakari Dugdh Sangh Maryadit Jabalpur

Design, supply installation, construction, testing and commission of 2400 KGPD capacity Bio-CNG plant for treatment of 150 TONS animal dung with 5 Years of operation maintenance and sales

Ref: NO - 0244/ PROJECT: JSDSM: 2021:JABALPUR / Date . 13-05-2022

Online rate bids for the following work are invited from manufacturer contractors and firms fulfilling registration criteria:- Tenders are required to produce attested copies of valid registration of CPWD / State PWD / Railway / MES / BSNL / Govt. / Semi Govt. organization /valid licensees /agreement from reputed technology owners for application of said Technology, valid GST registration, PAN, EPF registration, and similar work completion certificate along with the technical bid.

S. No./Pkg/ Code	Name of Work	Description	Probable Amount (Rs. in lakh)	Completion Period (months)
1	Design, supply installation, construction, testing and commission of 2400 KGPD capacity Bio-CNG plant capable producing PROM/ organic manure for treatment of 150 TONS animal dung daily	KarondaNalla Imaliya Jabalpur	----	8 Months (excluding rainy season).
2	Operation maintenance and sales of above plant output for 5 years which can be extended further for 3 years for Jabalpur Sahakari Dugdh Sangh Maryadit, Jabalpur	Yearly Revenue	----	5 Years Extended mutually for next 3 years

1. The interested bidders may view the Detailed Notice Inviting Tender on website <http://www.mp-tenders.gov.in>. from 23/05/2022
2. The bid documents can be purchased online from 12:00 Noon of 23/05/2022 to 3:00 PM of 03/06/2022.
3. Amendments to this NIT will be published on website only, and not in newspapers.
4. Bid Evolution will be base on QCBS 50:50 System as per the lowest construction cost & highest yearly revenue bidder.

Chief Executive Officer
Jabalpur Sahakari Dugdh Sangh Maryadit,
Jabalpur (M.P.)

System Integrator

1. O&M of the Bio CNG Plant:
 - a. Manpower and Electricity Expenses.
 - b. Sale of the CNG, PROM and Organic Manure produced.
2. Bidding Parameter of the Tender (QCBS -50:50)
3. Fixed Revenue Share by the System integrator to the JSDSM.
4. The Bidders will quote upfront "Annual Premium" which will be paid by the System Integrator to the JSDSM every year throughout the Project Duration.
5. Time period of the project will be 5 years, extendable by mutual agreement of JSDSM & system integrator for another 3 years upon mutual consent and satisfactory performance. The period of agreement will commence from the date of completion of the setting up of infrastructure.
6. Setting up of plant to be done in 8 months.
7. System Integrator bound for submission of requisite design/ drawings to statutory bodies and legal clearances and be responsible for getting permission from all statutory bodies.
8. The system integrator/ bidder shall obtain all the necessary clearances of Petroleum and Explosives Safety Organization (PESO), NOC from the Fire Department, Environmental Clearance from Pollution Control Board, and License for PROM manufacturing and any other mandatory clearance/approvals during execution. However, all such prescribed fees shall be initially paid by the system integrator/bidder and will be reimbursed by the JSDSM.

Chief Executive Officer
Jabalpur Sahakari Dugdh Sangh Maryadit,
Jabalpur (M.P.)

General Information

1.Name of Work	Design, supply and labour job for civil construction work, installation, testing, commissioning and successful trial run of 2400 kgs bio CNG per day capacity production plant from buffalo / cow dung to be installed at imaliya village, panagar tehsil, jabalpur district for jabalpur sahakari dugdha sangh maryadit, jabalpur on turn-key basis on the revenue sharing basis between jabalpur sahakari dugdha sangh maryadit, successful bidder cum system integrator.
2. Period	08 months
3. Contact Person	Mr Anand Chouksey , GMPO Mob. : 8770873191
4. Last Date & time for Tender Document purchase online	03/06/2022 up to 2:00 pm
5. Last date and time for on-line submission of bid .	03/06/2022 up to 3:00 P.M
6. Date and time of on-line opening of EMD. documents.	03/06/2022 up to 3:00 P.M
7. Date and time of on-line opening of technical bid documents.	3/06/2022 at 3:00 P.M.
08. Date and time of opening of on line price bid.	Shall be communicated separately
09. Place of pre bid meeting of Physically	Meeting hall of admin block of JSDS
12.Cost of Tender Document	Rs. 3000/-
13. Earnest money deposit (EMD.)	Rs. 30,00,000/- (RS. Thirty Lakh)
14.Address for Communication.	Jabalpur Sahakari Dugdh Sangh Maryadit Dairy plant . Karonda Nala, Imaliya, Jabalpur

Chief Executive Officer
Jabalpur SahakariDugdhSanghMaryadit,
Jabalpur (M.P.)

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Section I Part -I
General Conditions of Contract

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INSTRUCTIONS TO BIDDERS

TENDERS ARE INVITED FOR :

DESIGN, SUPPLY AND LABOUR JOB FOR CIVIL CONSTRUCTION WORK, INSTALLATION, TESTING, COMMISSIONING AND SUCCESSFUL TRIAL RUN OF 2400 KGS BIO CNG/ DAY CAPACITY PLANT AT IMALIYA VILLAGE, PANAGAR TEHSIL, JABALPUR DISTRICT FOR JABALPUR SAHAKARI DUGDHA SANGH MARYADIT, JABALPUR ON TURN KEY BASIS.

The Tenders are requested to through the tender document's instructions and various terms and conditions contained their in. It may be noted that no conditions or stipulations to the contrary or which are inconsistent will be accepted. Tenders are requested to ensure that all such schedules along with questionnaire (duly filled-in), are submitted along with their offer. The Tenders should also note that in absence of any of the schedules, their offer is likely to be rejected.

All the details to be filled as per tender document format and tenders should read all instructions for compliance before submitting his tender.

1.METHOD OF SUBMISSION OF TENDERS AND THEIR OPENING:

The tender to be submitted in two parts as explained below: -

(a) Part –A : This part is fulfilling the requirement of deposit towards Earnest Money and Technical Bid along with duly filled questionnaire (scanned copies of Both EMD and Technical bid documents should be uploaded as per schedule of submission mentioned in General Information online on the website www.mpe-tender.gov.in

(b) Part -B : -This part shall contain duly filled Price Bid as per the price bid format and to be uploaded on line on website.www.mpe-tender.gov.in

Pl. note that all the above documents are to be uploaded online only and not to be submitted physically or else bid will be rejected without opening technical bid.

(a). Part-A and part-B shall be uploaded as under:-

1. Blank format for the particulars of the firm/ organization (sub section-11in tender document) to be filled by the bidder and attach required document of the organization and profile if wish to add.
2. Copy of tender document to be signed with stamp/ Seal of the organization as token of acceptance of all the terms and conditions of the tender.
3. Copy of documents for the eligibility of the bidder for supply of Bio-Gas as mentioned in the clause no.2 for the ELIGIBILITY CRITERIA/ BASIC QUALIFICATION OF TENDER. The document should be specific to the requirement such as copies of purchase order and performance report of buyers for supply and installation during last 5 years i.e. 17-18, 18-19, 19-20, 20-21 and 21-22 only be attached. No other documents are to be attached.
4. In sub section-7 reg. deviations from technical requirement, in case of any equaling or better options the bidder, he may propose along with providing supporting document on technical specifications ground and purchase order from cooperative/ reputed organizations in support of evidence. No other deviations in scope of supply, technical specifications, general terms and conditions including payment terms are acceptable or else bid will not be considered.

2. BASIC QUALIFICATION OF TENDER

- 1). The bidder should have a Company or a body incorporated in India under the Companies Act, 1956 or 2013 including any amendment thereto or registered proprietary/partnership firm/NGO's/Firm.
The bidder should have minimum 7 years' experience in the related field like/supply/installation/Erection & commissioning of bio- CNG plant and should have executed at least 02 Nos of similar capacity bio-CNG\Bio-Gas plant during last five years (2017 to 2022)
- 2). Annual Sales turn over should be not less than 5 cores during any one of the financial year 2017 - 18, 18-19, 19-20. 20-21 and 21-22.
- 3). The bidder should have adequate experience in successful supply & installation of bio CNG / Bio-Gas plant.
- 4). The bidder should furnish the supply / commissioning certificate from the client.
Documentary evidence shall be provided for successful completion of the work in support of above point. Documents Establishing Bidders' Eligibility and Qualifications.

3. Special Eligibility Criteria

The bidder exempted of the turnover as per mentioned below in special eligibility criteria

1. The system integrator/bidder is recognized as a start-up by the Department for Promotion of Industry and Internal trade. The start-up working in 'Green Technology' Industry and 'Waste Management' sector.
2. The system integrator/Bidders having experience in the construction of such project i.e., 2400 kg Bio-CNG or /and having rendered consultancy service to such projects.
- 3.Startup companies recognized by other Department of Industrial Policy & Promotion (DIPP) exempted turn over criteria and valid registration of CPWB / State PWD / Railway/ MES/Govt./Semi Govt.
4. The start-up companies should furnish the start up registration certificate, GST registration certificate and latest income tax return certified by chartered account

The Bidder shall furnish, as part of its bid, documents establishing the bidder's eligibility to bid and its qualifications to perform the contract if its bid is accepted. The bidder should also give information in the format attached to the Bid document.

The documentary evidence of the Bidder's qualification to perform the contract if its bid is accepted, shall establish to the JSDS'S satisfaction:

- i) That, in the case of a bidder offering to supply goods under the contract which the bidder did not manufacture or otherwise produce, the Bidder has been duly authorized by the goods' manufacturer or producer to supply the goods.
- ii) That the bidder has the financial, technical and production capability necessary to perform the contract. To this end, all bids submitted shall include the following information :
 - a) Copies of original documents defining the constitution or legal status, place of registration and
 - b) Principal place of business of the company or firm or partnership etc.
 - c) Details of experience and past performance of the bidder on equipment offered and on those of similar nature within the past 3 years and details of current contracts in hand and other commitments;
 - d) Major items of plant and equipment available/ installed in the Bidder's factory premises;
 - d) Qualification and experience of key personnel for successful execution of the contract;
 - e) Reports on financial standing of the bidder such as profit and loss statements, balance sheets and

- auditor's report of the past three years, bankers certificates etc.
- F) Information regarding any current litigation in which the bidder is involved.
- g). The farm must have valid GST Certificate issued by Govt. authority and other statutory licenses related to labor laws, EPF registration and from local bodies.

Documents Establishing Goods' Eligibility and Conformity to Bidding Documents

The bidder shall furnish, as part of its bid, documents establishing the eligibility and conformity to the Bidding Documents of all goods and services, which the bidder proposes to supply under the contract.

The documentary evidence of the goods and services conformity to the bidding documents may be in the form of literature, drawing and data, and shall furnish:

- (a) A detailed description of the goods' essential technical and performance characteristics.
- (b) A list giving full particulars, including available sources and current prices, of all spare parts, special tools, etc. necessary for the proper and continuing functioning of the goods for a period of two years.
- (c) A clause-by-clause commentary on the JSDS'S technical specification demonstrating the goods' and services' substantial responsiveness to those specifications or a statement of deviations and exceptions to the provisions of the technical specification.

3. EARNEST MONEY

The supplier shall deposit the Earnest Money amount (EMD) on line as mentioned in point no.4-a . In case, the supplier withdraws his offer during the validity period, after placement of order, the EMD amount shall be forfeited.

4. RETURN OF EARNEST MONEY TO TENDER

EMD shall be returned to the un-successful Tender, as soon as possible, after the tender is decided and on execution of agreement with successful tender. No interest shall be paid on EMD amounts.

5.TAXES AND DUTIES

All taxes (CGST/SGST/) and duties/ any other taxes should be included in the prices quoted. Any kind of taxes and duties shall not be paid extra. However, the breakup of taxes & duties must be indicated separately.

6. AMENDMENT IN SPECIFICATIONS

The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-.may revise or amend the specification and drawing, prior to the date notified for opening of Bid of tender. Such revision/ amendment, if any, will be communicated to all those who have bought the tender documents online and uploaded on our web site.MPe-Tender.gov.in

7.DELAYED/ LATE SUBMISSION OF TENDERS

The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. shall not assume any responsibility for any delays either for the late receipt of documents by supplier or late receipt of tenders by the JSDS. No Extension in time shall be granted on such grounds.

8.ALTERNATIVE TENDERS

Tender should be submitted as per intent of tender documents; any alternative offers are liable for rejection.

9.MISTAKES IN TENDERS

Rates should be quoted in both, figures, and words. In case of ambiguity between rates in figures and words, lower of the two/beneficial to the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR shall be considered. Such offers can also be rejected on recommendation of committee. Documents to be submitted with the technical bid

Copy of Registration Certificate of the Firm / Organization (Tender) Copies of purchase orders last three years .

Copies Income Tax and GST returns & copy of Permanent Account Number (PAN) and GST

Clint list

Completion/Performance certificates

10. ALTERATIONS/CORRECTIONS IN TENDERS

Any alteration/correction in the tender document should be counter-signed. Further, no post tender alteration/correction shall be entertained.

11. INCOMPLETE TENDERS

Tender which is incomplete or obscure in any form is liable for rejection.

12. ACCEPTANCE OF PART/WHOLE TENDERS & NEGOTIATION OVER TENDERS

RIGHTS THERE OF

Chief Executive Officer, Jabalpur Sahakari. Dugdha Sangh Mydt, may Negotiate with Lowest Tender On The Tender Date Or Any Suitable Date decided thereof.

JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. reserves the right to accept/ reject wholly or partly any tender without assigning any reason what so ever.

The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. in this regard shall not entertain any correspondence.

13 AMBIGUITIES IN CONDITIONS OF TENDERS

In case of ambiguous or self-contradictory terms/conditions mentioned in the tender, interpretation as may be advantageous to the Jabalpur Sahakari Dugdha Sangha Maryadit, Jabalpur shall be taken without any reference to the tender.

14. DIS-QUALIFICATION OF TENDERS

Tender which gets opened before the due date because of improper indication having been given on the document uploaded to indicate that it is a tender, will be disqualified Tender will not be permitted to change the substance of his tender on post interpretation/improper understanding grounds. This includes post tender price changes/ modifications etc. after opening of Price Bid. In such events, otherwise, that is, when a supplier does not comply, tender will be rejected.

15. DEVIATIONS FROM TERMS & CONDITIONS

Offers with deviations in the terms of payment, liquidated damages, EMD and performance guarantee are liable to be rejected out rightly.

16. SUBMISSION OF TENDERS.

The tender shall be submitted in two (A and B) parts: -

Part- A shall contain "EARNEST MONEY DEPOSIT"&" TECHNICAL BID".

Part-B shall contain "PRICE BID", in the Price Schedule. The supplier shall ensure that the prices/rates are filled in accordance with the Performa for "Price and Quantity."

It may please be noted that the due date/ time of opening can be altered, extended if felt necessary by the purchaser, without assigning any reason thereof However, due intimation shall be communicated in such a case.

17.OPENING OF E.M.D. & TECHNICAL BID

Mandatory documents to be submitted as per S.No.8 above shall be part of Technical Bid. The concerned tender committee of JSDS shall first open the Part —A of all the Tender and verify the Earnest Money Deposit and Technical Bid submitted by the Tender. Committee shall check for the validity of Earnest Money Deposit as required. In case, the requirements are incomplete in EMD and Technical Bid another part-II of Price Bid of the concerned Tender shall not be opened. The requirement for EMD and Technical Bid shall be verified and thereafter, the second part, i.e., Price Bid submitted by the Tender shall be opened on the same date or as may be fixed by JDS in respect of eligible Tender.

18.VALIDITY OF TENDERS

The offers shall be valid for 90 days. Validity of the offer shall be counted from the date of opening of tenders. Those who do not agree for a validity of 90 days will do so at their own risk and their offers are liable to be rejected.

19. AUTHORISATION/LOCAL REPRESENTATIVE

Only authorized representative, possessing necessary authority letter from the supplier who have participated in the tender shall be allowed to attend the tender opening.

20. ACCEPTANCE OF TENDER

- i) The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. may reject any or all tenders or to accept any tender considering advantageous to JABALPUR SAHAKARI DUGDHSANGHA MARYADIT, JABALPUR-. Whether it is the lowest offer or not.
- ii) The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. may split the quantities against the tender on more than one supplier for the same item. The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. shall assign no reasons for this and the same will be binding on the Tender.
- iii) JSDS will award the contract to the successful bidder whose bid has been determined to be the lowest- evaluated responsive bid as per the eligibility Criterion mentioned. The Cost for the said calculation shall be taken as the all-inclusive cost quoted by bidder in price bid.

21. PAYMENT TERMS AND PERFORMANCE BANK GAURANTEEE: -

Payment shall be made by A/c payee Cheque or RTGS only. The Schedule of Payment shall be as follows:

A). JDS will pay to the contractor 70% of the approved bid price of respective items (Civil construction work, equipment, accessories and installation work as applicable) from time to time as and when supply of equipment/ accessories in accordance with contract & to the satisfaction of JDS Engineer/ consultant after verification.

- B). Out of remaining 30% of the respective executed work, JDS shall pay 20% after successful testing and commissioning.
- C). Remaining 10% amount shall be paid by JDS after 03 months from the date of successful trial on submission of satisfactory report by JDS engineer/ consultant and also on submission of performance bank guarantee of the equal amount of 10% of bid value at end of the completion of the project. Performance bank guarantee shall be for one year from the date of successful commissioning and trial shall be released on the satisfactory report of JDS engineer/ consultant when there is no defect liability or else if such liability is due/ recoverable, it shall be adjusted from contractor's performance bank guarantee amount by initiating action from concerned bank.
- D). **ADVANCE PAYMENT:** 20% advance on supply value shall be payable against bank guarantee of 110% of advance amount valid till scheduled date of delivery/ actual delivery of material on submission of BG (as per attached format-for bank guarantee).

22. PRICES AND STATUTORY LEVIES

The Tender should quote price F.O.R. destination/ erection site including Erection, Installation, Commissioning, and trial run charges on turnkey basis. However, break up of Following elements may be indicated separately: -

Unit Ex-works/Ex-go down rate including packing and forwarding.

GST/ any other Duty applicable on Ex-works price as on date of Tender.

Tax :GST

Freight charges

Any other levy/tax

NA

No revision on any account shall be allowed during execution of the order.

Prices offered by the Tender should be firm and free from all escalations. The prices offered should be valid at least for a period of 90 days from the date of tender opening. Rate approval shall be communicated within 30 days from the date of tender opening.

The Material to be supplied shall be dispatched to site by Road transport under intimation to the purchaser and consignee. Depending upon the type of material, the supplier shall have to carry out proper packing/crating to avoid damage/breakage during transit. Road permit/any other document for dispatch of material if required will be sent by JSDS on written request from supplier.

After rate approval, the party shall have to execute an agreement on a non—judicial stamp paper worth Rs. 1000/- to be executed with Jabalpur Sahakari Dugdh Sangha Maryadit, Jabalpur.

23. TRANSIT RISK

Responsibility regarding covering of risks during transit of material shall entirely be on the supplier. The JABALPUR SAHAKARI DUGDH SANGHA

MARYADIT, JABALPUR-. shall, in any case, not bear the transit risks/ transit insurance charges. Insurance shall be arranged by the supplier at his own.

24. SUBMISSION OF DRAWING AND LITERATURE

All the relevant drawings, layouts shall be submitted along with supply of machines.

One set of drawing, Descriptive Literature and instructions Manual for Erection, Commissioning, and maintenance of the equipment's ordered, shall be supplied.

25. **DELIVERY:** Supply, Erection, Installation & Commissioning shall be commenced within

3 months (including rainy season) from the date of receipt and acceptance confirmation of order or from the date of contract agreement whichever is applicable. In case of any delay due to assembling or any other technical reasons, supplier will have to communicate in advance in written to the CEO, Jabalpur Sahakari Dugdh Sangha Maryadit ,Jabalpur.

26. FORCE MAJEURE

Force majeure condition is herein defined as:-

Natural phenomena, such as floods, draughts, earth-quakes and epidemics.

Act of any Government Authority, domestic or foreign, such as war, quarantines, embargoes, licensing control or production or distribution restrictions. Accident and disruptions such as fires, explosions, increase in power cut with respect to date of tender opening, break-down of essential machinery or equipment's etc. Strikes slow down, lockouts continuing for more than three (3) weeks.

Failure or delay in the supplier's source of supply due to force majeure causes enumerated at (a) to (d) above, provided the supplier produces documentary evidence to show that there were no other alternative sources of supply available to him or if available, the lead time required was likely to be longer than the duration of the Force Majeure at the normal source of supply.

Any cause which is beyond the reasonable control of the supplier or purchaser as the case may be. All the provisions of this clause shall apply whether the disrupting cause is total or partial in its effect upon the ability of the supplier to perform.

27. Forwarding bills/invoice

The original bills should be forwarded to the paying authority and should be marked "ORIGINAL". The bill should indicate GST registration Number and date allotted to him under commercial Tax Act. The invoice in triplicate with relevant documents such as Material Receipt in good condition etc. should be submitted to JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR.

28. PERFORMANCE GUARANTEE

28.1. If during 18 months subsequent to the date of receipt of consignment or 12 months from the date of commissioning whichever is earlier (wherever applicable) any of the goods found to be defective in materials or workmanship or develops defects during service, they will have to be replaced by the supplier, free of all charges. All necessary arrangements on these accounts will be made by the supplier.

28.2. The said material if required to be replaced, shall be collected by the supplier/ firm from Area Stores/ work site at their own cost and at their own responsibility. These materials will likewise be returned duly repaired/ replaced and tested subsequently by the supplier to the destination indicated on "FREIGHT PAID BASIS" at their cost in a reasonable time of 30 days from the date of intimation. The guarantee period as stipulated in clause 32.1 above shall also be applicable for repaired/replaced material, which shall however be counted afresh from the date of its delivery in our stores/site.

28.3. Further, it is clarified that all the charges towards supply of fabrication materials including packing, forwarding, loading, unloading shall be borne by the supplier. The amount deposited under security deposit clause shall also cover the performance guarantee of the material.

All equipment/ line materials reported failed within the specified guarantee period may be replaced free of cost by the supplier.

28.4. Actual cost of dismantling and replacement of these' equipments/ materials with the new ones may be charged to the supplier's account. 34.5 To and fro transportation cost of such failed equipment may also be borne by the supplier/ supplier.

28.6 In the event of the supplier's inability to adhere to the aforesaid provisions, suitable penal action will be taken, which may include blacklisting of the firm for future business with the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. for a certain period.

29. COMPLETENESS OF EQUIPMENTS

The equipment/material shall be completed in every respect with all minor fittings and accessories, even though these may not be specifically mentioned in the purchaser's specifications or the tender's offer. The supplier shall not be eligible for any extra price in respect of such minor fitting and accessories which can be considered as an essential part of the basic equipment even though not specifically mentioned in the specification or in the offer.

30. EXTENSION ORDER

The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-.Reserves right to place an extension order for any additional quantity to the extent of 100% quantity of the original order on the same rates, terms and conditions within six months from the date of order.

31.RECOVERIES FOR LIABILITIES AGAINST OTHER CONTRACTS

All amount recoverable from the successful Tender against earlier contracts including orders on sister concern with the Jabalpur Sahakari Dugdh Sangha Maryadit, Jabalpur.will be adjusted from payment due against the contract that may be awarded under this specification.

32. COMPLIANCE OF REGULATIONS

The supplier should execute and deliver such documents, as may be needed, by the purchaser in evidence of compliance. All laws, Rules and Regulations are required to be incorporated in this reference. Any liability arising out of contravention of any of the laws shall be the sole responsibility of the supplier and the purchaser shall not be responsible in any manner whatsoever.

33. CANCELLATION OF ORDER

33.1 The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. May upon written notice of default, terminate contract in the circumstances detailed here under: -

If in the opinion of the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR, the supplier fails to deliver the material within the time specified or during the period for which extension has been granted by the JSDS.

If in the opinion of the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR, the supplier fails to comply with any of the other provisions of this contract or material is found not in accordance with prescribed specifications and or the approved samples

As a result of stage inspection, if applicable, it is revealed that material and/ or, workmanship is substandard which is likely to affect the performance of the finished product, a notice would be served' by the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. to the supplier to suspend further activities and to take urgent steps towards corrective measures, failing which the entire order would be cancelled.

33.2 In the event of such termination, JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR shall exercise its discretionary power as :- a) To recover from the supplier the agreed liquidated damages. OR b) To purchase from elsewhere after giving due notice to the supplier on account and at the risk of the supplier such stores/ material not so delivered or others of similar description in respect of consignment not yet delivered. OR c) To cancel the contract reserving JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-'s right to recover damages.

33.3 Notwithstanding that the powers under clause (a, b & c) referred to above, are in addition to the rights and remedy available to the JABALPUR SAHAKARI DUGDH SANGHAMARYADIT, JABALPUR under the general law of India relating to Contract.

33.4 In the event of risk purchase of stores of similar description, the opinion of the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR shall be final. In the event of action taken under clause 39.2(a) or (b) above, the supplier shall be liable to pay for any loss, which the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT JABALPUR. may sustain on that account but the supplier shall not be entitled to any saving on such purchases made against the default.

33.5 The decision of the Chairman, JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. shall be final regarding the acceptability of the stores supplied by supplier and the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. shall not be required to give any reason in writing or otherwise at any time for the rejection of the stores/ material. 39.6 In the event, JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-. does not terminate the order as provided in clauses above, the supplier shall continue execution of order, in which case he shall be liable to the JABALPUR SAHAKARI DUGDH SANGHA MARYADIT, JABALPUR-.

34. ARBITRATION

In case of any dispute ,if arises between the parties relating to any terms and conditions of the Tender / Agreement and or regarding the agreement /tender before or after the filling of tender and /or execution of the agreement, any party may refer the dispute to a sole arbitrator who will be the Chairman of Jabalpur Sahakari Dugdh Sangha Maryadit ,Jabalpur or a person nominated by him whose decision and award shall be final and binding to both the parties. The arbitration proceedings shall be under and accordance with provision of Arbitration and Conciliation Act 1996. Supplies under the Contract shall be continued by the supplier during the arbitration proceedings, unless otherwise, directed in writing by the Purchaser or unless the matter is such that the work cannot possibly be continued until the decision of the arbitrators or of the Umpire is issued.

35. JURISDICTION

Any dispute or difference, arising under, out of, or in connection with this tender/ contract order shall be subject to exclusive jurisdiction of competent court at Jabalpur only.

36. RANDOM TESTING-

Inspection of material after receipt or waiver of inspection will not relieve the supplier from his responsibility to supply the material strictly in accordance with the specification. The JABALPUR SAHAKARI DUGDH SANGHA MARYADIT,

JABALPUR In case, the samples fail to withstand the required test, the entire lot will be liable to be rejected (i.e. unused material so supplied) and the supplier will have to refund the amount paid, including all taxes and duties, as well as the test charges thereof, after inspection. Such quantities or rejected material as identified, shall be removed by the supplier and replaced in full at his own cost

37. CORRESPONDANCE : -

Copies of all important correspondence on subject should be sent to "CEO, Jabalpur Sahakari Dugdh Sangh Maryadit, Jabalpur".

38. CONSEQUENCES OF BREACH OF AGREEMENT

If the authorized person of the unit or a partner in the contract/tendering firm commit breach of any of the conditions of agreement it shall be lawful for the Chief Executive Officer, Jabalpur Sahakari. Dugdha Sangh Mydt, to cancel the contract and purchase or authorize to purchase stores at the risk and costs of the unit.

39.0 DISPUTE ARBITRATION & FINAL AUTHORITY

39.1 It should be clearly understood that in the event of any dispute between suppliers and purchaser due to deviation from any terms and conditions of work order & contract agreement, the decision of the Chairman, Jabalpur Sahakari Dugdha Sangh Mydt., in this respect will be final and binding on both supplier and purchaser.

39.2 For matters of dispute, relating to the interpretation of the above clause, the decision of the Chief Executive Officer, Jabalpur Sahakari. Dugdha Sangh Mydt, shall be final and binding on all the concerned.

40. LIQUIDATED DAMAGES

If the supplier fails to deliver any or all of the Goods or perform the Services within the time period(s) specified in the contract, the purchaser shall, with out prejudice to its other remedies under the contract, deduct from the contract price, as liquidated damages, a sum equivalent to:

Up to 15 days 1% of the contracted value in between 16 to 30 days 2% of the contracted value.

Beyond 30 days 5 % of the contracted vale JSDS reserves the rights to either to cancel the order and make alternative purchase from other sources at the risk and cost of the of defaulting supplier.

(Section I - Part-II)

Special Conditions of Contract for General Erection & Commissioning

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Table 1 List of Drawings required Submission Sufficiency of Tender

The Bidder/Supplier by bidding shall be deemed to have satisfied himself as to all the conditions and circumstances affecting the Contract Price, as to the possibility of executing the works as shown and described in the Contract, as to the general circumstances at the site of the works, as to the general labor position at site and to have determined the prices accordingly.

Programmed of Installation & Commissioning

As soon as practicable after the acceptance of the bid, the Bidder/Supplier shall submit to the Purchaser for his approval a comprehensive programmed in the form of bar chart showing the sequence of order in which the Bidder/Supplier proposes to carry out the works including the design, manufacture, delivery to site, erection and commissioning thereof. After submission to and approval by the Purchaser of such programmed, the Bidder/Supplier shall adhere to the sequence of order and method stated therein. The submission to and approval by the Purchaser of such programmed shall not relieve the Bidder/Supplier of any of his duties or responsibilities under the Contract. The programmed approved by the Purchaser shall form the basis of evaluating the pace of all works to be performed by the Bidder/Supplier. The Bidder/Supplier shall update the PERT Network every month, submit it to the Purchaser and shall inform the Purchaser the progress on all the activities falling on schedule for the next reporting date.

Preparation of Drawings for Approval

The Bidder/Supplier should visit the site to acquaint himself in respect of existing site conditions and to know the details/information required for understanding the nature and type of works involved in the project. The Bidder/Supplier shall submit to the Purchaser for approval:

. Within the time given in the specification or in the program, such drawings, samples, patterns and models as may be called for therein, and in numbers therein required.

During the progress of works and within such reasonable times as the Purchaser may require such drawings of the general arrangement and details of the works as the Purchaser may require. During the progress of works and before the start of the erection activities, Supplier to submit the intelligent 3D for entire plant in the freeware software format for the approval to the Purchaser/Consultant. Wherever necessary, the Bidder/Supplier would be provided with a set of drawings where the erection works would be carried out and also the equipment details/ drawings of various equipment's handed over to the Bidder/Supplier by the Purchaser. The specifications/ conditions concerning the submission of drawings by the Bidder/Supplier are detailed as under:

Bidder/Supplier shall furnish a list of all necessary drawings, which the Bidder/Supplier shall submit for approval, identifying each drawing by a serial number and descriptive title and expected date of submission. A brief list of drawings is given in Table 1. This list shall be revised and extended if necessary, during the progress of work depending on the nature of the contract also.

The Purchaser shall signify his approval or disapproval of all drawings or such drawings that would affect progress of the contract as per the agreed programmed.

The purchaser shall issue, within four weeks of time in all circumstances, any drawing requested by the Bidder/Supplier and required to be provided by us. If the Bidder/Supplier suffers delay and/ or incurs costs due to delay on purchaser's part in this regard, then the Purchaser shall take such delay into account in determining any extension of time to which the Bidder/Supplier is entitled under Clause 15 hereof and the Bidder/Supplier shall be paid the amount of such cost as shall be reasonable. P&I Drawings, Plant Layout and GA Drawings submitted for approval shall be designed by responsible representative of Bidder/Supplier and shall be to any one of the following sizes in accordance with Indian Standards: " A0, A1, A2, A3 and A4"

All drawings shall show the following particulars in the lower right hand corner in addition

to Bidder/Supplier's name	:
Name of the Purchaser	:
Date of drawing	:
Project Title	:
Drawing number	:
Title of drawing	:
Space for drawing number	:
Scale Drawing Revision Number	:

In addition to the information provided on drawings, each drawing shall carry a revision number, date of revision and brief description of revision carried out. Whenever any revision is carried out, correspondingly revision number must be updated.

All dimensions on drawings shall be in metric units.

Drawings (three sets) submitted by the Bidder/Supplier for approval will be checked, reviewed by the Purchaser, and comments, if any, on the same will be conveyed to the Bidder/Supplier. It is the responsibility of the Bidder/Supplier to incorporate correctly all the comments conveyed by the Purchaser on the Bidder/Supplier's drawings. The drawings, which are approved with comments, are to be re-submitted to the Purchaser for purpose of records. Such drawings will not be checked / reviewed by the Purchaser to verify whether the Bidder/Supplier has incorporated all the comments. If the Bidder/Supplier is unable to incorporate any comments in the revised drawings, Bidder/Supplier shall clearly state in his forwarding letter such non-compliance along with the valid reasons.

Drawings prepared by the Bidder/Supplier and approved by the Purchaser shall be considered as a part of the specifications. However, the examination of the drawings by the Purchaser shall not relieve the Bidder/Supplier of his responsibility for engineering design, workmanship, and quality of materials, warranty obligations and satisfactory performance on installation covered under the contract.

If at any time before completion of the work, changes are made necessitating revision of approved drawings, the Bidder/Supplier shall make such revisions and proceed in the same routine as for the original approval.

Date of submission: In the event, the drawings submitted for approval require many revisions amounting to redrawing of the same, and then the date of submission of the revised drawings would be considered as the date of submission for approval.

The Bidder/Supplier shall furnish to the Purchaser before the works are taken over, Operating and Maintenance instructions together with Drawings of the

works as completed, in sufficient detail to enable the Purchaser to maintain, dismantle, reassemble and adjust all parts of the works. Unless otherwise agreed, the works shall not be considered completed for the purposes of taking over until such instructions and drawings have been supplied to the Purchaser.

Superintendence, Team And Conduct

The Bidder/Supplier shall employ one or more competent representatives, whose name or names shall have previously been communicated in writing to the Purchaser by the Bidder/Supplier, to superintend the carrying out of the works on the site. The said representative or if more than one shall be employed, then one of such representatives shall be present on the site during all times, and any orders or instructions which the Purchaser may give to the said representative of the Bidder/Supplier shall be deemed to have given to the Bidder/Supplier. The said representative shall have full technical capabilities and complete administrative and financial powers to expeditiously and efficiently execute the work under the contract.

The Bidder/Supplier shall, execute the works with due care and diligence within the time for completion and employ Bidder/Supplier's team comprising qualified and experienced engineers together with adequate skilled, semi-skilled and unskilled workmen in the site for carrying out the works. The Bidder/Supplier shall ensure adequate workforce to keep the required pace at all times as per the schedule of completion. Bidder/Supplier shall also ensure availability of competent engineers during commissioning/start up, trial runs, Operation of the plant/equipment till handing over of the plant.

The Bidder/Supplier shall furnish the details of qualifications and experience of their senior supervisors and engineers assigned to the work site, including their experience in supervising erection and commissioning of plant and equipment of comparable capacity.

When the Bidder/Supplier or Bidder/Supplier's representative is not present on any part of the work where it may be desired to give directions in the event of emergencies, orders may be given by the Purchaser and shall be received and observed by the supervisors or foremen who may have charge of the particular part of the work in reference to which orders are given. Any such instructions, directions or notices given by the Purchaser shall be deemed given to the Bidder/Supplier.

The Bidder/Supplier shall furnish to the Purchaser a fortnightly labor force report showing by classifications the number of employees engaged in the work. The Bidder/Supplier's employment records shall include any reasonable information as may be required by the Purchaser. The Bidder/Supplier should also display necessary information as may be required by statutory regulations.

None of the Bidder/Supplier's supervisors, engineers, or laborers may be withdrawn from the work without notice to the Purchaser and further no such withdrawals shall be made if in the opinion of the Purchaser, it will adversely affect the required pace of progress and/or the successful completion of the work.

The Purchaser shall be at liberty to object to any representative or person, skilled, semi-skilled or unskilled worker employed by the Bidder/Supplier in the execution of or otherwise about the works who shall, in the opinion of the Purchaser, misconduct himself or be incompetent, or negligent or unsuitable, and the Bidder/Supplier shall remove the person so objected to, upon receipt of notice in writing from the Purchaser and shall provide in that place a competent representative at Bidder/Supplier's own expense within a reasonable time.

In the execution of the works no persons other than the Bidder/Supplier, sub-Bidder/Supplier and their employees shall be allowed on the site except by the written permission of the Purchaser.

Purchaser's Instructions

The Purchaser may, in his absolute discretion, issue from time to time drawings and/ or instructions, directions and clarifications, which are collectively referred to as Purchaser's instructions in regard to:

- Any additional drawing and clarifications to exhibit or illustrate details.
Variations or modifications of the design, quality or quantity of work or the additions or omissions or substitution of any work.
- Any discrepancy in the drawings or between the schedule of quantities and/or specifications.
- Removal from the site of any material brought there by the Bidder/Supplier, which are unacceptable to the Purchaser and the substitution of any other material thereof.
- Removal and/or re execution of any work effected by the Bidder/Supplier, which are unacceptable to the Purchaser.
- Dismissal from the work of any persons employed there upon who shall in the opinion of the Purchaser, misconduct him, or be incompetent or negligent.
- Opening up for inspection of any work which is covered up.
- Amending and making good of any defects.

Right of The Purchaser

Right to direct works

The Purchaser shall have the right to direct the manner in which all works under this contract shall be conducted, in so far as it may be necessary to secure the safe and proper progress and specified quality of

the works. All work shall be done and all materials shall be furnished to the satisfaction and approval of the Purchaser.

Whenever in the opinion of the Purchaser, the Bidder/Supplier has made marked departures from the schedule of completion or when circumstances or requirement force such a departure from the said schedule, the Purchaser, in order to ensure compliance with the schedule, shall direct the order, pace and method of conducting the work, which shall be adhered to by the Bidder/Supplier.

If in the judgment of the Purchaser, it becomes necessary at any time to accelerate the overall pace of the plant erection work, the Bidder/Supplier, when directed by Purchaser, shall cease work at any particular point and transfer Bidder/Supplier's men to such other point or points and execute such works, as may be directed by the Purchaser and at the discretion of the Purchaser.

Right to order modifications of methods and equipment

If at any time the Bidder/Supplier's methods, materials or equipment appear to the Purchaser to be unsafe, inefficient or inadequate for securing the safety of work men or the public, the quality of work or the rate of progress required, the Purchaser may direct the Bidder/Supplier to ensure safety, and increase their efficiency and adequacy and the Bidder/Supplier shall promptly comply with such directives. If at any time the Bidder/Supplier's working force and equipment are inadequate in the opinion of the Purchaser, for securing the necessary progress as stipulated, the Bidder/Supplier shall if so directed, increase the working force and equipment to such an extent as to give reasonable assurance of compliance with the schedule of completion. The absence of such demands from the Purchaser shall not relieve the Bidder/Supplier of Bidder/Supplier's obligations to secure the quality, the safe conducting of the work and the rate of progress required by the contract. The Bidder/Supplier alone shall be and remain liable and responsible for the safety, efficiency and adequacy of Bidder/Supplier's methods, materials, working force and equipment, irrespective of whether or not the Bidder/Supplier makes any changes as a result of any order or orders received from the Purchaser.

Right to inspect the work

The Purchaser's representative shall be given full assistance in the form of the necessary tools, instruments, equipment and qualified operators to facilitate inspection. The Purchaser reserves the right to call for the original test certificates for all the materials used in the erection work. In the event the Purchaser's inspection reveals poor quality of work/materials, the Purchaser shall be at liberty to specify additional inspection procedures if required, to ascertain Bidder/Supplier's compliance with the specifications of erection work. Even though inspection is carried out by the Purchaser or Purchaser's representatives, such inspection shall not, however, relieve the Bidder/ Supplier of any or all responsibilities as per the contract, nor prejudice any claim, right or privilege which the Purchaser may have because of the use of defective or unsatisfactory materials or bad work man ship. Bidder/Supplier's Functions

The Bidder/Supplier shall provide everything necessary for proper execution of the works, according to the drawings, schedule of quantities and specification stake together whether the same may or may not be particularly shown or described therein, provided that the same can reasonably be inferred there from and if the Bidder/Supplier finds any discrepancy therein, Bidder/Supplier shall immediately refer the same to the Purchaser whose decision shall be final and binding on the Bidder/Supplier.

The Bidder/Supplier shall proceed with the work to be performed under this contract in the best and workman like manner by engaging qualified and efficient workers and finish the work in strict conformance with the drawings and specifications and any changes/modifications thereof made by the Purchaser. Variations

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

- .Increase or decrease the quantity of any work included in the contract,
- .Omit any such work,
- .Change the character or quality or kind of any such work,
- .Change the levels, lines, position and dimensions of any part of the works
- .Execute additional work of any kind necessary for the completion of the works and no such variation shall in any way vitiate or invalidate the contract, but the value, if any, of all such variations shall be taken into account in ascertaining the amount of the Contract price.

The Bidder/Supplier shall make no such variations without an order in writing of the Purchaser. Provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an order given under this clause, but is the result of the quantities exceeding or being less than those stated in the Contract/Bill of Quantities. Provided also that if for any reason the Purchaser shall consider it desirable to give any such order verbally, the Bidder/Supplier shall comply with such order and any confirmation in writing of such verbal order given by the Purchaser, whether before or after the carrying out of the order, shall be deemed to be an order in writing within the meaning of this clause. Provided further that if the Bidder/Supplier shall within seven days confirm in writing to the Purchaser and the Purchaser shall not contradict such confirmation in writing within 14 days, it shall be deemed to be an order in writing by the Purchaser.

All extra or additional work done or work omitted by order of the Purchaser shall be valued at the rates and prices set out in the contract if in the opinion of the Purchaser, the same shall be applicable. If the contract does not contain any Rates or prices applicable to the extra or additional work, then suitable rates or prices shall be agreed upon between the Purchaser and the Bidder/Supplier. Any Extra Work, carried out by the Bidder/Supplier would be at mutually agreed cost (Landed cost + 15% service charge).

Provided that if the nature or amount of any omission or addition relative to the nature or amount of the whole of the works or to any part thereof shall be such that, in the opinion of the Purchaser, the rate or price contained in the contract for any item of the works is, by reason of such omission or addition, rendered unreasonable or inapplicable, then a suitable rate or price shall be agreed upon between the Purchaser and the Bidder/Supplier. In the event of disagreement the Purchaser shall fix such other rate or price as shall, in his opinion, be reasonable and proper having regard to the circumstances.

Provided also that no increase or decrease mentioned above or variation of rate or price shall be made unless, as soon after the date of the order as is practicable and, in the case of extra or additional work, before the commencement of the work or as soon thereafter as is practicable, notice shall have been given in writing:

- . By the Bidder/Supplier to the Purchaser of his intention to claim extra payment or a varied rate or price,
- or
- . By the Purchaser to the Bidder/Supplier of his intention to vary a rate or price

If, on certified completion of the whole of the works, it shall be found that reduction or increase greater than 15 per cent of the sum named in the Letter of Acceptance results from the aggregate effect of all Variation Orders but not from any other cause, the amount of the contract price shall be adjusted by such sum as may be agreed between the Bidder/Supplier and the Purchaser or, failing agreement, fixed by the Purchaser having regard to all material and relevant factors, including the Bidder/Supplier's site and general overhead costs of the contract.

The Bidder/Supplier shall send to the Purchaser's representative once in every month an account giving particulars, as full and detailed as possible, of all claims for any additional payment to which the Bidder/Supplier may consider himself entitled and of all extra or additional work ordered by the Purchaser which he has executed during the preceding month.

No final or interim claim for payment for any such work or expense will be considered which has not been included in such particulars. Provided always that the Purchaser shall be entitled to authorize payment to be made for any such work or expense, notwithstanding the Bidder/Supplier's failure to comply with this condition, if the Bidder/Supplier has, at the earliest practicable opportunity, notified the Purchaser in writing that he intends to make a claim for such work.

The work shall be carried out as approved by the Purchaser or his authorized representative/s from time to time, keeping in view the overall schedule of completion of the project. The Bidder/Supplier's job schedule must not disturb or interfere with Purchaser's or the other Bidder/Supplier's schedules of day-to-day work. The Purchaser will provide all reasonable assistance for carrying out the jobs.

Night work will be permitted only with prior approval of the Purchaser. The Purchaser may also direct the Bidder/Supplier to operate extra shifts over and above normal day shift to ensure completion of contract as per schedule. Adequate lighting wherever required should be provided by the Bidder/Supplier at no extra cost. The Bidder/Supplier should employ qualified electricians and wire-men for these facilities. In case of Bidder/Supplier's failure to provide these facilities and personnel, the Purchaser has the right to arrange such facilities and personnel and to charge the cost thereof to the Bidder/Supplier.

In order to enable the Purchaser to arrange for insurance of all items received at the site including the items of supply covered under this contract, the Bidder/Supplier shall furnish necessary details of all the equipment immediately on its receipt at site, to the Purchaser. Any default on the part of the Bidder/Supplier due to which any item does not get covered under the insurance of the Purchaser; the cost of such equipment shall be charged to the Bidder/Supplier.

The Purchaser shall not be liable for or in respect of any damages or compensation payable at law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Bidder/Supplier or any sub-Bidder/Supplier, save and except an accident or injury resulting from any act or default of the Purchaser, his agents, or servants. The Bidder/Supplier shall indemnify and keep indemnified the Purchaser against all such damages and compensation, save and except as aforesaid and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto. Purchaser shall be liable for and shall indemnify Bidder/Supplier against all losses, expenses or claims in respect of loss of or damage to any physical property or of death or personal injury whenever occurring, to the extent caused by any negligence or breach of statutory duty of Purchaser or its employees, contractors or agents.

The Bidder/Supplier shall ensure against such liability with an insurer approved by the Purchaser, which approval shall not be unreasonably withheld, and shall continue such insurance during the whole of the time that any persons are employed by him on the works shall, when required, produce to the Purchaser or Purchaser's representative such policy of insurance and the receipt for payment of the current premium.

Provided always that, in respect of any persons employed by any sub-Bidder/Supplier, the Bidder/Supplier's obligations to ensure as aforesaid under this sub-clause shall be satisfied if the sub-Bidder/Supplier shall have insured against the liability in respect of such person in such manner that the Purchaser is indemnified under the policy, but the Bidder/Supplier shall require such sub-Bidder/Supplier to produce to the Purchaser or Purchaser's representative, when required such policy of insurance and the receipt for the payment of the current premium.

Whenever proper execution of the work under the contract depends on the jobs carried out by some other Bidder/Supplier, the Bidder/Supplier should inspect all such erection and installation jobs and report to the

Purchaser regarding any defects or discrepancies. The Bidder/Supplier's failure to do so shall constitute as acceptance of the other Bidder/Supplier's installation/jobs as fit and proper for reception of Bidder/Supplier's works except those defects which may develop after execution. Bidder/Supplier should also report any discrepancy between the executed work and the drawings. The Bidder/Supplier shall extend all necessary help/cooperation to other Bidder/Suppliers working at the site in the interest of the work.

Bidder/Supplier shall carryout final adjustments of foundations, level ling and dressing of foundation surfaces, bedding and grouting of anchor bolts, bed plates etc. required for seating of equipment in proper position. The Bidder/Supplier shall be responsible for the reference lines and proper alignment of the equipment. However, all civil works like making cut-outs in walls, floors and ceilings for pipelines shall be done by the purchaser. Adjustment & level ling are to be carried out by the Bidder/Supplier at no extra cost. The Purchaser shall arrange the necessary refilling/repairs of these cut-outs and pockets. The Bidder/Supplier should arrange for laying the supports, cut-outs, grouting of bolts, etc. When the civil works are in progress, so as to avoid refilling/repair works The Purchaser at Bidder/Supplier's costs shall make the damages occurring to civil and other works good. For fixing of piping/equipment support son wall/beams/roof floor etc., preferably anchor bolts shall be used by the Bidder/Supplier. Drilling of holes for fixing anchor bolts & supply of anchor bolts is in the scope of Bidder/Supplier without any extra cost. The Bidder/Supplier shall keep a check on deliveries of the equipment covered in the scope of erection work and shall advise the Purchaser well in advance regarding possible hold-up in Bidder/Supplier's work due to the likely delay in delivery of such equipment/components to enable him to take remedial actions.

Duties of the Bidder/Supplier Vis-à-Vis the Purchaser

The equipment and the items, if any, to be supplied by the Purchaser for erection, testing and commissioning shall be as listed in the contract.

Besides the utilities/ services as specified in battery limits, Purchaser shall also provide the following assistance/ facilities to the Bidder/Supplier for carrying out the installation work:

Plant building ready for installation of equipment/ items.

Necessary temporary water for carrying out the installation shall be supplied at only one point within the project site by the Purchaser free of charge. All necessary distribution tapings from this point onwards shall be the Bidder/Supplier's responsibility.

Necessary temporary power for carrying out the installation shall be arranged by the Bidder/Supplier at Bidder/Supplier's own cost. The Purchaser on written request by the Bidder/Supplier will issue the necessary authorization letter.

The details of temporary water and power requirements shall be furnished one month in advance by the Bidder/Supplier to enable the Purchaser to make timely arrangement.

If the Bidder/Supplier suffers delay and/or incurs costs from failure on the part of the purchaser to give possession of the civil works in accordance with the mutually agreed schedule, the purchaser shall determine.

Any extension of time to which the Bidder/ supplier is entitled due to delay caused by Purchaser.

Any extension of time to which the Bidder/ Supplier is entitled under clause20 of GCC (General Conditions of Contract).

Supply of Tools, Tackles And Materials

The Bidder/Supplier shall, at his own expense, provide all the necessary equipment, tools and tackles, haulage power, consumables necessary for effective execution and completion of the works during erection and commissioning.

Protection Of Plant

The Purchaser shall not be responsible or held liable for any damage to person or property consequent upon the use, misuse or failure of any erection tools and equipment used by the Bidder/Supplier or any of Bidder/Supplier's Sub-Bidder/Suppliers even though such tools and equipment may be furnished, rented or loaned to the Bidder/Supplier or any of Bidder/Supplier's Sub-Bidder/Suppliers. The acceptance and/or use of any such tools and equipment by the Bidder/Supplier or Bidder/Supplier's Sub-Bidder/Supplier shall be construed to mean that the Bidder/Supplier accepts all responsibility for and agrees to indemnify and save the Purchaser from any and all claims for said damage resulting from the said use, misuse or failure of such tools and equipment's.

The Bidder/Supplier and Bidder/Supplier's Sub-Bidder/Supplier shall be responsible, during the works, for protection of work, which has been completed by other Bidder/Suppliers. Necessary care must be taken to see that the Bidder/Supplier's men cause no damage to the same during the course of execution of the work.

All other works completed or in progress as well as machinery and equipment that are liable to be damaged by the Bidder/Supplier's work shall be protected by the Bidder/Supplier and protection shall remain and be maintained until the Purchaser directs its removal.

The Bidder/Supplier shall effectively protect from the effects of weather and from damages or defacement and shall cover appropriately, wherever required, all the works for their complete protection.

The Bidder/Supplier shall carry out the work without damage to any work and property adjacent to the area of Bidder/Supplier's work to whomsoever it may belong and without interference with the operation of existing machines or equipment.

Adequate lighting, guarding and watching at and near all the storage handling, fabrication, pre-assembly and erection sites for properly carrying out the work and for safety and security shall be provided by the Bidder/Supplier at Bidder/Supplier's cost. The Bidder/Supplier should adequately light the work area during nighttime also. The Bidder/Supplier should also engage adequate electricians/wiremen, helper etc to carry out and maintain these lighting facilities. If the Bidder/Supplier fails in this regard, the Purchaser may provide lighting facilities as he may deem necessary and charge the cost thereof to the Bidder/Supplier

The Bidder/Supplier shall take full responsibility for the care of the works or any section or portions thereof until the date stated in the taking over certificate issued in respect thereof and in case any damage or loss shall happen to any portion of the works not taken over as aforesaid, from any cause what so ever, the same shall be made good by and at the sole cost of the Bidder/Supplier and to the satisfaction of the Purchaser. The Bidder/Supplier shall also be liable for any loss of or damage to the works occasioned by the Bidder/Supplier or the Bidder/Supplier's Sub-Bidder/Supplier in the course of any operations carried out by the Bidder/Supplier or by the Bidder/Supplier's Sub-Bidder/Suppliers for the purpose of completing any outstanding work or complying with the Bidder/Supplier's obligations.

Unloading, Transportation And Inspection

The Bidder/Supplier shall be required to unload all the materials/equipment from the carriers, those received at site after Bidder/Supplier's team arrives at site. Bidder/Supplier shall be paid extra for unloading of the equipment being supplied by the purchaser whereas no extra payment for unloading of the

equipment/piping shall be paid to Bidder/Supplier for the equipment being supplied by the Bidder/Supplier. The Bidder/Supplier shall plan in advance, based on the information received from the Purchaser, Bidder/Supplier's requirement of various tools, tackles, jacks, cranes, sleepers etc. required to unload the material/equipment promptly and efficiently. The Bidder/Supplier shall ensure that adequate and all measures necessary to avoid any damage whatsoever to the equipment at the time of unloading are taken.

Any demurrage/detention charges incurred due to the delay in unloading the material/equipment and releasing the carriers shall be charged to the Bidder/Supplier's account.

The Bidder/Supplier shall be responsible for the reception on site of all plant and Bidder/Supplier's equipment delivered for the purposes of the contract.

The Bidder/Supplier shall safely transport/shift the unloaded materials/equipment by the Bidder/Supplier to the storage area.

All the materials/equipment received by the Purchaser prior to arrival of the Bidder/Supplier at site shall be handed over to the Bidder/Supplier and thereupon the Bidder/Supplier shall inspect the same and furnish the receipt to the Purchaser. The manner in which the inspection shall be carried out is enumerated below:

The materials/equipment would be carefully unpacked by opening the wooden cases/other modes of pickings as the case may be.

Detailed inventory of various items would be prepared clearly listing out the shortages, breakage/damages after checking the contents with respect to the Bidder/Supplier's packing list, the Purchaser's purchase order and approved equipment drawings. The Bidder/Supplier shall also check each & every equipment for any shortage/shortcoming that may eventually create difficulty at the time of installation or commissioning.

All the information and observations by the Bidder/Supplier shall be furnished in the form of 'INSPECTION REPORT' to the Purchaser with specific mention/suggestions which in the opinion of the Bidder/Supplier should be given due consideration and immediate necessary actions, to enable the Purchaser to arrange repair or replacement well in time and avoid delays due to non-availability of equipment and parts at the time of their actual need.

The inspection for all the equipment handed over to the Bidder/Supplier shall be completed within three week's period.

The protection, safety and security of the materials so taken over from the Purchaser shall be the responsibility of the Bidder/Supplier, until they are handed over to the Purchaser after erection, commissioning and testing as per the terms of the Contract.

Storage of Equipment

The Bidder/Supplier shall be responsible for the proper storage and maintenance of all materials/equipment under Bidder/Supplier's custody. However purchaser to provide with covered lockable area which can be used by Bidder/Supplier as site office or storage area for small costly items. Bidder/Supplier shall take all required steps to carry out frequent inspection of equipment/materials stored as well as erected equipment until the same are taken over by the Purchaser. The following procedure shall apply for the same.

The Bidder/Supplier's inspector shall check stored and installed equipment/materials to observe signs of corrosion, damage to protective coating to parts, open ends in pipes, vessels and equipment, insulation resistance of electrical equipment etc. The Bidder/Supplier shall immediately arrange a coat of protective painting whenever required. A record of all observations made on equipment, defects noticed shall be promptly communicated to the Purchaser and Purchaser's advice taken regarding the repairs/ rectification. The Bidder/Supplier shall there upon carry out such repairs/ rectification at Bidder/Supplier's own cost In case the Bidder/Supplier is not competent to carry out such repairs/ rectification, the Purchaser reserves the right to get this done by other competent agencies at the Bidder/Supplier's responsibility and risk and the entire cost for the same shall be recovered from the Bidder/Supplier's bills.

The Bidder/Supplier's inspector shall also inspect and provide lubrication to the assembled equipment. The shafts of such equipment shall be periodically rotated to prevent rusting as well as to check freeness of the same.

The Inspector shall check for any signs of moisture or rusting in any equipment.

If the commissioning of equipment is delayed after installation of the equipment, the Bidder/Supplier shall carry out all protective measures suggested by the Purchaser during such period.

Adequate security measures shall be taken by the Bidder/Supplier to prevent theft and loss of materials handed over to the Bidder/Supplier by the Purchaser. The Bidder/Supplier shall carry out periodical inventory checks of the materials received, stored and installed by the Bidder/Supplier and any loss noticed shall be immediately reported to the Purchaser. The Bidder/Supplier shall maintain a proper record of these inventories. The Bidder/Supplier should not sell, assign, mortgage, hypothecate or remove equipment or materials which has been installed or which may be necessary for completion of the work without the written consent of the Purchaser.

Suitable grease recommended for protection of surfaces against rusting (refined from petroleum oil with lanolin minimum (70 OC) and water in traces) shall be applied over all equipment as required once in every six months.

All equipment shall be stored inside a closed shed or in the open depending upon whether they are of indoor or outdoor design. The space heaters where provided in to the electrical equipment shall be kept connected with power supply irrespective of their type of storage. Where space heaters are not provided adequate heating with bulb is recommended. For transformers heating of oil shall be done by giving 440 V supply and short-circuiting the LT terminals. Frequent checks on insulation resistance are essential for all electrical equipment and record of the inspection reports and mugger readings shall be maintained equipment wise. Such records shall be presented to the Purchaser whenever demanded.

All the necessary items/goods required for the Bidder/Supplier as described above shall arrange protection and such cost shall be included in the Contract price.

Approvals

The Bidder/Supplier shall obtain the necessary approvals of the Electrical Inspector, Weights & Measures Inspector, Explosive Inspector and another state and local authorities as may be required and the cost of obtaining such approvals shall be included in the contract price.

The Bidder/Supplier will furnish all the necessary details, drawings, and submission of application and proofreads to the Purchaser for verification/signature. The Bidder/Supplier on behalf of the Purchaser shall submit the necessary application duly filled-in, together with the prescribed fees to the appropriate authorities. However all the actual statutory prescribed fees paid by the Bidder/Supplier shall be reimbursed by the Purchaser upon production of the receipt/vouchers.

The bidder shall arrange for approval from concerned statutory authority on behalf of the JDS and the statutory fees shall be reimbursed by the JDS at actual on production of receipts.

Bidder/Supplier shall provide all necessary documents/details to the Purchaser for obtaining the necessary approval of concerned authority and related area.

Review & Co-Ordination of Erection Work

The Bidder/Supplier shall depute senior and competent personnel to attend the site co-ordination meetings that would generally be held at the site every month or at such frequency as the purchaser may decide from time to time. The Bidder/Supplier shall take necessary action to implement the decisions arrived at such meetings and shall also update the erection schedule.

Extension of Time for Completion

Should the amount of extra or additional work of any kind or any cause of delay referred to in these conditions, or exceptional adverse climatic conditions, or other special circumstances of any kind whatsoever which may occur, other than through a default of the Bidder/Supplier, be such as fairly to entitle the Bidder/Supplier to an extension of time for the completion of the works, the Purchaser shall determine the amount of such extension and shall notify the Bidder/Supplier accordingly. Provided that the Purchaser is not bound to take into account any extra or additional work or other special circumstances unless the Bidder/Supplier has within twenty eight days after such work has been commenced, or such circumstances have arisen, or as soon thereafter as is practicable, submitted to the Purchaser full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

Part - III
Special conditions of counteract for civil construction work

Architectural Concepts and Designs

An Architectural Design Basis Report will be submitted to the engineer including proposals for the following scheme components: shape, form, color, and basic materials for interior and exterior architecture along with an appropriate landscaping scheme. All schemes will be supported by architectural statement explaining the factors considered in the design.

Architecture work shall include walls, roof, flooring and floor finish, roof water proofing, down water pipes, windows, ventilators, doors, glazing, equipment access doors, painting and other ornamental works. The contractor shall get all Architectural, Structural and RCC drawings and design calculations, etc approved by engineer prior to construction of works at site.

Structural Designs

The Contractor shall on its own carryout Soil investigation i.e. Geo technical investigation and prepare Structural drawings vetted by Government College or Institute

Design Submissions

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. The Contractor shall also take care to check the stability of partly completed or existing structures associated with the proposed SWM System.

Complete detailed design calculations of foundations and superstructure together with general arrangement drawings and explanatory sketches shall be submitted to the Engineer. 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. The contractor shall be responsible for the safety of structures, structural strength, stability, soundness, water tightness and accuracy, adequacy of design, workability and performance even after the approval of the same by the Engineer. During the job execution, if any deficiency or alteration is required, firm shall attend to the same within the contractual provisions and nothing extra shall be claimed/ paid to the firm.

Approval conveyed to the firm will neither relieve the firm of its contractual obligations and its responsibility for the correctness of the dimensions, material, of the construction, weights, quantities, design perimeters, dimensions, assembly its, performance, particulars, conformity of the supplies with Indian statutory laws as may applicable nor will it limit the DJBs rights under the contract.

Design Loadings

All buildings and structures shall be designed to resist the worst combination of the loads/stresses during testing and under working conditions and shall be as per IS:875. The loads considered shall include dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials, dynamic loads and uplift pressure.

Dead Load

This shall comprise all permanent construction including foundations, walls, floors, columns, roofs, partitions, stairways, fixed service equipment's and other items of machinery. In estimating the loads of process equipment all fixtures and attached piping shall be included. The following minimum loads shall be considered in design of structures:

GENERAL SPECIFICATIONS FOR CIVIL WORKS (GS)

GS 1 Sand and Metal

Sand and coarse aggregate (metal) shall be stored separately on site on hard ground so as to keep them free from foreign materials such as soils, clay, glass etc. In case of machined crushed metal separate depot shall be prepared for different sizes of metal and suitable proportion to form dense mix as directed by the Officer In-Charge shall be taken from these different sizes of metal.

GS 2 Form Work

A The wooden shuttering planks shall be not less than 40 mm thick or such other thickness as may be allowed by the Executive Engineer / authorized person /authorized person for a particular job. The entire form work, whether of steel, plywood or wooden planks, shall be very strongly proposed and braced with sufficiently strong vertical and horizontal members and the entire Servicing structure shall be of sufficiently horizontal members and sufficiently strong to take up the load of concrete and all stresses it may be subjected to, without any deflection. The Contractor shall be wholly and fully responsible for any defects in the entire form work and its Servicing structure.

The form work shall be very smooth and entirely free from any dust particles direct and its inner surface shall be oiled for the easy facility of form removal and shall be watertight.

GS 3 Reinforcement

The Contractor has to procure it from open Market at his cost. The bars shall be scrapped thoroughly for removing any scales, rust, etc. before use in work. Bars that may be found defective in any way shall not be allowed to be used. The reinforcement is to be fabricated and placed in position as per the Officer InCharge or contractors design to be intimated to the Contractor during execution from time to time. The hooks, laps, anchors, cover, etc. shall be as per IS code. The Contractor has to place in position the reinforcement as directed and to secure it by binding wire to be provided at Contractors cost. Any additional reinforcement provided by contractor in addition to approved design and direction shall not be measured and paid for.

To ensure that the minimum cover require for slabs, beams, etc. is provided. Separators of precast or cast in situ CC block with wires embedded shall be used and shall be tied to the reinforcement with wires. Between 2 or more layers of reinforcement, separators, of 200 mm or 25 mm size bars as directed shall be used duly tied. The separators of M.S. bar piece shall not be admissible for payment. The GI binding wire shall not be admissible for payment.

When Contractor has to bring steel then it shall be only tested one and Contractor shall produce the manufacturers rolling mills test certificate without which it shall not be accepted. Further the Contractor shall arrange to get tested any samples from steel brought at site in a laboratory at his cost, and result should be submitted to Officer In-Charge. Defective steel shall be rejected.

GS 4 Mixing

Good clean water shall only be used for mixing. Arrangements for bringing such water shall be done by the Contractor at his cost. The amount of water to be used shall be as directed by the Engineer-in-charge. On the bases of correct water cement ratio. The water measuring apparatus shall be provided by the Contractor at his cost.

For R.C.C. reservoirs and for other works which in the opinion of the Executive Engineer / authorized person / authorized person are important the concrete shall be only machine mixed. The mixing shall be continued for at least 8 minutes after all materials and water are placed in the drum which shall revolve for 14 to 18 revolutions or as specified by the manufacturers. The mixer for this purpose shall be brought by Contractor at his cost and the Officer In-Charge does not take any responsibility for supply of mixer if as a result of

breakdown of mixer during concreting, hand mixing has to be resorted to temporarily. Only such work which is considered absolute essential by the Executive Engineer / authorized person / authorized person shall be allowed to be done by hand mixing and the entire operation of hand mixing and precaution thereof shall be taken as directed by the Engineer-in-charge. For hand mixture mixing shall be done for sufficient time till it is of uniform color. The required quantity of aggregate shall then be added and the mixture again turned over for at least 14 to 18 times. The required quantity of water shall then be added gradually through rose pieces attached to the can until process of turning is in progress and till is of uniform consistency where such hand mixing is allowed as a result of area requirement and no extra payment for this excess cement shall be admissible.

For works other than mentioned in above Para, hand mixing will be allowed and in such cases, cement to be used shall be as per standard requirement only.

Normally the standard cement consumption will be as under: for one cum of concrete 1:2:4 (M-150) 1:1.1/2:3 (M-200) 1:3:6 (M-100) 5.90 bags 6.90 bags 4.42 bags For any other mix the cement consumption shall be as decided by the Executive Engineer / authorized person/ authorized person. The consumption as mentioned above shall be for the gross RCC column actually cast.

GS 5 Concrete Laying

The forms shall first be lightly moistened before laying concrete. The concrete shall be placed in position within 20 minutes after adding water to the mix and shall be slowly deposited in its place and not thrown or dumped from a height shall be placed in uniform layers. For vertical walls or water retaining structure, water stoppers shall be provided.

For columns the concrete shall be laid in maximum 1.2 M height at a time. For vertical walls of reservoir it shall be laid in maximum 0.6 M height only at a time.

GS 6 Tamping, Ramming and Consolidating

For all RCC structures and other works which are considered by the Engineer / authorized person / authorized person to be important mechanical vibrators shall invariably be used by the Contractor at his cost. The Contractor shall provide at least 2 vibrators in good working condition, so as to have one as a standby and to prevent interruption in work. The concrete being laid shall be vigorously vibrated laying and also loaded by bars where vibrator cannot reach so that dense and complete filling is assured. The Contractor shall make his own arrangements for procuring vibrators at his cost and the OFFICER IN-CHARGE does not guarantee that they will be supplied on hire.

For all other works consolidation and tamping shall be manual labor by Roding vigorously by M.S. bars, throughout for a sufficient time and in such manner as directed by the Engineer-in-charge. Adequate number of laborers shall be set apart specifically for tamping and ramming with relieves.

The efficiency of tamping and consolidation shall be judged by absence of any air pockets and absence of honey combing any defective consolidation and tamping shall be entirely on Contractor's risk and costing will have to be entirely pulled down if so directed and redone properly entirely at the cost of the Contractor.

GS 7 Curing

All RCC work will be watered and kept constantly wet for 28 days after initial set casting by means of wet gunny bags and pounding as directed by the Engineer-in-charge. This operation shall start immediately after initial set of the concrete. Should the Contractor fail to water the concrete - continuously, it will be done immediately at Contractor's cost.

Removal of Form It shall be generally as under, subject to the written approval and modification by the Engineer-in-charge. Column and Beam Sides 3 Days Vertical Walls 6 Days Bottom of Slab and Domes 10 Days Bottom of Beams 14 Days Bottom of Beams of Span 4.5 M and above 21 Days

GS 8 Inspection

The work of each category of operation i.e. completion of form work placing reinforcement, concreting, removal of form, etc. must be got inspected by the Junior Engineer before commencing and succeeding operation in case of RCC works and major RCC jobs. In all cases, however, before the concrete is laid it must be got inspected and approved by the Deputy Engineer to concreting shall be commenced with approval of the Deputy Engineer. In case of RCC structures and other major works concreting must be done in presence of Deputy Engineer himself. In other case, it shall be done in presence of Junior Engineer. In case of failure to comply with above specifications, the work is liable to be pulled down if directed for any work which is done contrary to specification and no payment thereof shall be admissible.

GS 9 Finish and Quality of Concrete

The RCC work cast shall be of dense mix, homogenous without any honey combing true in size alignment and shape. Any defective work shall not be entitled for full tendered rates for payment and if the defects are major no measurements and payment are admissible and Contractor shall have to pull down such defective work and redo at his cost. The decision of the Executive Engineer / authorized person / authorized person regarding such defective work and the decision, viz. pulling it down or reducing rates as may be necessary shall be final and binding on the contractor.

All RCC work shall be finished as directed by the Executive Engineer / authorized person/ authorized person. It should be clearly understood that the finishing is not meant to cover the casting defects but only to give a smooth appearance. In case of RCC reservoirs and other major RCC works Contractor shall not commence finishing unless and until Engineer-in-charge has inspected the casting of concrete after removal of form and has satisfied about its quality failing which it shall be regarded that casting was defective and action deemed fit as per clause (11) 1 above will be taken since finishing has to commence immediately after removal of forms. The forms removal in RCC reservoirs and other major work shall be done in presence of Deputy Engineer. 28 days test : 1:2:4 1:1.1/2:3 1:1.5:1 150 Kg/cm² 200 Kg/cm² 300 Kg/cm² Cube casting acceptance of concrete will be as specified in IS 456 - 1964 and relevant ISS. Unacceptable quality concrete shall be demolished and redone without any extra cost by the contractor. The Executive Engineer / authorized person/ authorized person at his discretion consider substandard work at a suitable reduced rate, provided such weak concrete is restricted to such members and in such quantities, which in the opinion of the Executive Engineer / authorized person / authorized person will not endanger the safety of the structures. Executive Engineer / authorized person's/ authorized person's decision in such cases shall be final and binding on the contractor. 9.3 Surfaces not in contact with form work and not subject to any plaster shall be finished by a float to present a smooth and uniform appearance. Surfaces which are in contact of form work but for which no plastering is provided as per plan and estimate shall also be finished smooth, and sand faced as directed. Surfaces for which plastering is to be done, as per separate provision of plastering plans and estimates, shall immediately on removal of forms, be roughened for bond by a pointed tamping tool.

9.4 In case, whether would be specified in the tender item or not the finish shall be such as to match with the rest of the structure to present a harmonious appearance. It shall consist of 3 coats of cement, rendering, plastering float finished faced, etc. as per to the requirement at site and as directed by the Executive Engineer / authorized person / authorized person and Contractor shall have to do it at his own cost. Failure to do proper finishing as directed shall result in payment at reduced rates only to the Contractor and the decision of the Executive Engineer / authorized person / authorized person in this respect shall be final and binding on the Contractor.

GS 10 Testing

All structure meant to hold water shall be tested for water tightness test at Contractor's cost, by filling them to their desired level. The water tightness test shall be considered satisfactory when the fall in water level after the container is filled to the FSL is not more than 6mm in 48 hours and there is no sweating from outside or bottom whatsoever.

Contractor has to make his own arrangements for water for testing at his cost and these arrangements shall be such that immediately after initial setting of plaster, the containers are filled with water. After the satisfactory water tightness test the container shall be kept constantly filled with water at Contractor's cost till the completion of work.

Till satisfactory water tightness test is given by the Contractor, at his cost, to the satisfaction of the Officer In-Charge. Only 90% tendered rates shall be admissible for payment for RCC concrete items.

In case of major RCC works from batches or concrete mix actually being laid, testing cubes shall be cast periodically as directed by the Officer In-Charge, in presence of the Deputy Engineer-in-charge and these cubes shall be got tested after they have attained their full strength, from a suitable testing laboratory. The Officer In-Charge representative shall arrange for taking test cubes, sending them to laboratory and obtaining test results, at full cost of Contractor. The charges of this viz. moulds, labour for casting, materials, conveyance charges to and from the laboratory including TA of staff members and laboratory test charges, etc. are included in the tender rates and they shall be recovered from Contractor's bills. The ultimate compressive stress as revealed from these tests shall not be less than 28 days test : 1:2:4 1:1.1/2:3 150 Kg/cm² 200 Kg/cm² Cube casting acceptance of concrete will be as specified in IS 456-1964 and relevant ISS. Unacceptable quality concrete shall be demolished and redone without any extra cost by the Contractor. The Executive Engineer / authorized person at his discretion consider substandard work at a suitable reduced rate, provided such weak concrete is restricted to such members and in such quantities, which in the opinion of the Executive Engineer / authorized person will not endanger the safety of the structure. Executive Engineer / authorized persons decision in such cases shall be final and binding on the Contractor.

GS 11-Successfull Bidder shall provide a break up of BOQ, unit price and cost considered for the assessment of bid quote for the entire civil construction work including labor and materials as per scope of work mentioned in respective clause of tender. This is required for measurement of work at any stage of work in order to work out the cost involved in progressive work for stage wise payment of running bills as per MB (measurement book) which will be adjusted against approved bid quote for civil work. The details of cost so provided should be nearer to the prevailing price of the respective items of works/ SOR rate of MPPWD/CPPWD and shall be subject to approval of CEO JSDS. However, the total cost of the same shall be at par with the approved bid quote.

GS 12 Specification for Masonry viz. UCR/CR, Brick Masonry Khandki Facing, etc.

The masonry shall be either UCR/CR Khandki facing, BB Masonry, etc. as required.

For stone masonry either UCR/CR or Khandki facing, with 1:5 proportion cement mortar, which has to retain, the percentage of mortar shall be between 40% to 45% of the gross built-up masonry and in no case less than 40%. The cement to be used in masonry shall be on the basis of this percentage. If the masonry is constructed with less percentage of the mortar than specified above and if in the opinion of Executive Engineer / authorized person it is not suitable retain water pressure, it shall have to be dismantled and redone at Contractor's cost with correct percentage of mortar.

For all other masonries viz. UCR/CR/BB, etc. the percentage of mortar shall be as per P.W.D.

Hand Book Specifications and cement to be used shall be based on these percentage.

For CR Masonry, khandki facing masonry etc all courses shall be of equal height, to be specified by the Engineer-in-charge and only one row of khandkies shall be allowed in one course.

Tender rates of masonry item, unless otherwise mentioned specifically in the tender items, shall include scaffolding, watering, curing and cement pointing in CM 1:2 to the exposed faces, where necessary and as directed.

For masonries meant for retaining structures, the Contractor shall give a satisfactory water tightness test at his cost to the satisfaction of OFFICER IN-CHARGE Till such a satisfactory water tightness test is given, only part rates (90%), as directed by the Executive Engineer / authorized person shall be admissible for payment and the decision for such part regarding reduced rates, shall be final and binding on the Contractor. It shall be Contractor's responsibility to give the water tightness test and he may use standard waterproofing compounds at his cost in the mortar.

In all other items viz. materials like sand, stones, joints, headers, khandkies, etc. the PWD Hand Book Specification (latest edition) and specifications given in standard specification Book (Red Book) shall apply.

The wall of masonry should be truly vertical on both faces or should be truly as specified grade.

The height of masonry should not be raised at more than 1 M per day.

GS 13 Doors, Windows CCTW Doors, Windows, Cupboards, etc.

Sizes shown on drawing are clear opening in masonry and not the shutter's size. these sizes shown on drawings are, therefore, inclusive of required frame sizes and doors, windows, etc. and shall be manufactured, accordingly. If sizes bigger than shown in drawing are manufactured, as instructed specifically in writing they shall be measured and paid for accordingly.

The work shall be executed as per the size of frame thickness of shutter type viz. plain planked paneled, glazed, etc. and fixture, etc. as described in tender item. Iron bars for windows ventilators are to be provided if specifically mentioned in the tender item at Contractor's cost. Specifications in PW standard specifications shall be applicable.

The design shutters and quality of wood shall be got approved from the Engineer-in- charge before manufacture. The CCTW to be used for wood work shall be uniform in substance straight, free from large deed knots, flows flanks. The work shall be done as per specification of P.W.D. hand books latest edition. The joints shall be perfect.

Parts of wood embedded in masonry shall be painted with the tar. The frames of doors, windows, ventilators, etc. shall have proper holdfasts embedded in masonry.

Whenever iron bar is to be provided as per tender item the rate thereof is included in tender item. The painting shall be done as prescribed in tender item. No painting, however, shall be permitted till the wood work is approved by the Engineer-in-charge.

Any substandard work not confirming to the specifications shall be paid at reduced rates only and also liable to the outright rejected and Executive Engineer / authorized person's decision in such cases shall be final and binding on the Contractor.

GS 14 Steel doors, windows and ventilators

General The specification lays down the requirements of providing the steel doors, windows and ventilators shall confirm to I.S. 1038 - 1975 its latest revision.

Material's Rolled Steel Sections: They shall be manufactured from steel conforming to I.S. 1977-1962 specifications its latest revision for structural steel. They shall be free from rolling defects and shall be suitable for punching and welding. Coupling Sections for Non-modular Opening: They shall be manufactured from mild steel plate 1.6 mm in thickness conforming to the dimensions as given in figure 84 or IS 1038 -1975 its latest revision as specified in the Item 1 Glass Panels: Glass panels shall weigh at least 7.5 kg/sqm. and shall be free from flaws, specks and bubbles. All glass panels shall have properly squared corners and straight edges. The size of glass panels shall be as specified in the item. Workmanship: The doors windows and ventilators shall be fixed in true line and level, to the entire satisfaction of the Engineer-in-charge. The damaged works shall be made good to the level of original works. Screws: Screws threads of machine screws used in manufacture of steel doors, windows and ventilators shall conform to the requirements of I.S. 7362-1962.

d) Painting the steel sections and portion of the doors windows and ventilators with three coats of synthetic enamel paint of approved quality and shade.

GS 15 Plastering

12 mm, 20 mm and 25 mm cement either plain or waterproof. The plastering items shall be executed in thickness and cement mortar of proportions as detailed in respective tender items. Similarly, the plastering shall be either ordinary or waterproof as specified in tender item.

In case of waterproof plaster, standard and approved waterproofing compounding shall be mixed in cement mortar in required percentage as directed and then the plaster is applied. Unless and until the water tightness test is given by the Contractor to the satisfaction of the Officer In-Charge only part rates shall be paid.

The finishing shall be either smooth or rough cast as may be directed by the Officer In- Charge unless otherwise specifically mentioned in the tender item.

Neeru finish wherever directed by the Officer In-Charge shall be done from inside at no extra cost.

Specification given for this item in Standard Specifications Book (Red Book) published by B and C Department shall be followed

Curing and watering shall be done as directed and plaster shall be in alignment and level. Any substandard work is liable to be rejected and shall have to be redone at Contractor's cost. Sand to be used shall be of approved quality only.

Cost of all scaffolding is including in the tender rate.

GS 16 Flooring - IPS Flooring

1.1/2" thick cement concrete 1:2:4 shall be provided for IPS flooring. The size of metal shall not be more than 1/2" and it shall be properly graded. A thin coat of very fine plaster shall be provided on top to give it a smooth finish. The marking of false grooves to surfaces as directed includes the cost of labour.

GS 17 Shahabad Stone Flooring

Stone shall be specified in tender item. The Shahabad stones shall be square with suitable dimensions and of approved quality only. All stones shall be of the same size. They shall be either rough Shahabad or polished Shahabad as mentioned in tender item. If there is no such mention, they shall be rough shahabad only.

These shall be set in 1:2:4 CC and joints properly finished in CM 1:1 pointing. The CC bedding below 10 cm thickness (M-100) is included in the item.

All other specifications of P.W.D. Hand Book latest edition and specifications given in Standard Specification Book (Red Book) published by B and C Department shall apply to the above flooring items.

GS 18 Painting

The work shall be carried out as per the description of the tender item and as directed by Engineer-incharge. It shall be whitewashing, distemping and / or snowcap painting. Shade and make shall be as directed by the Officer In-Charge and for decorative purpose, Officer In- Charge 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 to the Officer In-Charge 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.

GS 19 Providing and Fixing M.S. Ladder

Ladder shall be manufactured as per the details provided in the tender item. All the materials and labour required for executing the item are to be provided by the Contractor at his cost. The Ladder shall be properly fixed at site as directed and the bottom and top shall be properly embedded in 1:2:4 CC block as directed at Contractor's cost. In order to have stiffness to the ladder, cross Services or stiffeners at suitable intervals as directed, shall be provided of suitable

M.S. flats duly embedded in walls or welded to the ladder. The specifications for this item as given in the Standard Specification Book (Red Book) published by B and C Department shall be followed.

GS 20 GI Hand Railing

The item shall be executed as specified in the tender item and as shown on drawing. The vertical SERVICES shall be properly fixed at base either in masonry or concrete by nuts and bolts duly embedded in the form, right anchorage holes in the vertical Services to pass GI piping in it or welding to fix the GI pipes to Services together with MS cleats, etc. are included in this item. The GI piping shall be provided along with required specials, fixtures, fastenings, etc. and GI collars or welded as per necessity. The diameter of GI piping, number of rows, size and type to vertical posts together with its center to center distance height, etc. shall be as specified in the tender item in absence thereof as per the Officer In-Charge type design in force. The rate shall also include 2 coats of approved shade oil paint. Cost of all the materials which shall be procured by the Contractor, labor involved for executing this item is including in tender item. The measurements and the payment shall be on the basis of lengths in running meters occupied by the completed railing assembly in plan.

GS 21 Providing, Fixing RSJ and Other Structural Steel Works

This item covers fixing MS/RS girders, MS angle, channel, flats base plates, gusset plates, clear, 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 at site with necessary riveted or welded joints, fixtures with nuts and bolts, etc. wherever necessary 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 material and labor thereof are included in the tender item. The measurement and payment shall be on the weight 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 cleats, packing pieces actually 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 specification for this item given in Standard Specification (Red Book) published by B and C Department will be followed.

GS 22 Murum filling, Bedding etc.

When tender item provides that murum available from excavation is to be used free of cost, whatever murum that is available and suitable from excavated stuff shall be used by the contractor shall be used by the contractor free of cost.

The murum filling or bedding is to be done in 15 cm to 20 cm thick layers, watered and duly consolidated by hand rammers as directed.

GS 23 Rubble Filling - Providing and Packing Rubble Filling, etc.

The rubble shall be properly hand packed with murum bindage in 20 cm thick layers as directed. Unless otherwise specifically mentioned in the tender item of the cost of rubble is included in this item, and if rubble is available from excavation, the same shall be used by the contractor after getting approved the quality of rubble selected from the excavated stuff by the Engineer-in-charge. This rubble is considered to be issued free of cost for use on the work only.

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.

GS 24 Specifications for Embankment

Scope of work: The item shall include deposition and spreading the available material from excavation in final position and consolidation as specified

Clearance of site: Before commencing the work on the embankment, the site should be cleared of stones and vegetation without any charges. The soil available from excavation and to be used for embankment work should be free from any deleterious materials and the same shall be carried out by the contractor without any charges.

Material used: All the material to be used shall be free from organic material and shall contain coarse-grained material whose suitability being confirmed by laboratory tests. The material shall not contain stones larger than 3/4th thickness of compacted layer Surplus rubble available at site can be used as casing material as directed by the Engineer-in-charge.

Compaction including watering: All the materials placed in the embankment shall be compacted to attain a dry density which shall not be less than 95% of the modified proctor density of the material under consideration. The required amount of water to be sprinkled for a specific quantity of soil shall be first calculated when water is proposed to be added at the dam. This water should be thoroughly mixed with the soil and then rolling should be started. Rolling should be done by wheeled power rollers of 10 Tonne capacity. For the portions where compaction is permitted by the Executive Engineer / authorized person to be done by non- mechanical means, the compaction shall be done by stone or iron rollers of such a size and weight that they will give a pressure of 15 Tonne per meter length of the roller. There should be at least 2 field density tests per day for ascertaining the dry density of the soil. Also the field tests shall be done forever 300 cum of embankment compacted.

Tamping. In those part of the structure in accessible to the specified rolling equipment's, around and in contact with the structure and in proximity to structures where the rolling equipment will not be permitted to operate, compaction shall be either accomplished either with hand or mechanical tampers of approved

type. Rollers will not be permitted to operate within one meter of structures and this distance shall be tamped by mechanical tamper. All materials to be tamped shall be exercised to obtain a good contact and bond with surface of structures.

GS25 Specifications for Stone Pitching Scope of Work

The slopes of the embankment to receive the pitching shall be first prepared and the pitching laid upon the bank work

Material: Stones should be large and placed vertically so as to interlock with each other and the chips used for filling the interstices and wedging may be in pieces. The stone should be large enough so as not to be disturbed by wave action. Also the flat surface of the pitching should face the embankment. The remaining interstices being filled in with chips, spauls properly hammered in so that the entire mass becomes firm and cannot be disturbed by hand

Laying of Pitching: The stones used for pitching shall be perfectly sound and as regular as possible. 60% of the stones shall not weigh less than 40Kg each. The stones should be interlocked and keyed together with minimum voids. High irregular points shall be knocked off and the finished pitching shall present a neat and reasonably smooth and uniform surface free of loose stones.

GS 26 Providing H.D.P.E. Pipes

This Indian Standard lays down requirements for high density polyethylene pipes from 16mm to 1000mm nominal diameter of pressure rating from 0.25 MPa to 1.6 MPa in material grades of PE63, PE 80, PE 100, for use for buried water, sewerage mains and services conforming to IS 4984/14151/12786/13488 latest version 1.1

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

IS No.	Title
2530 : 1963	Methods of test for polyethylene molding materials and polyethylene compounds.
4905 : 1968	Methods for random sampling.
7328 : 1991	High density polyethylene materials for molding and extrusion (First revision).
9845 : 1968	Method of analysis for the determination of constituents of plastics materials and articles intended to come into contact with foodstuffs (First revision)
10141 : 1982	Positive list of constituents of polyethylene in contact with foodstuffs, pharmaceuticals and drinking water.

10146 : 1982	Polyethylene for its safe use in contact with foodstuff, pharmaceuticals and drinking water.
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Designation

Pipes shall be designated according to the grade of material followed by pressure rating and nominal diameter for example, PE 63, PN 10, DN,200 indicates a pipe pertaining to material grade 63, pressure rating 1.0 MPa and outside nominal diameter 200 mm. in blue colour. These stripes shall be executed during pipe manufacturing and shall not be more than 0.2 mm in depth. The material of the stripes shall be of the same type of resin, as used in the base compound for the pipe.

Material

The material used for the manufacture of pipes should not constitute toxic hazard, should not services microbial growth and should not give rise to unpleasant taste or odour, cloudiness or discoloration of water. Pipe manufacturers shall obtain a certificate to this effect from the manufacturers of raw material.

High Density Polyethylene. High density polyethylene (HDPE) used for the manufacture of pipes shall conform to designation PEEWA-45-T-006 of IS 7328:1991. HDPE conforming to designation PEEWA-45-T012 of IS 7328 m: 1992 may also be used with the exception that melt flow rating (MFR) shall not exceed 1.10 Kg / 10 minutes. In addition the material shall also conform 5.6.2 of IS 7328:1992 (See A-1) 1.6.3 The specified base density shall be between 9405 Kg / m³ and 946.4 kg / m³ (both inclusive) when determined at 27°C according to procedure prescribed in Annex A of IS 7328: 1992. The value of the density shall also not differ from the nominal value by more than 3 Kg / m³ as per 5.2.1.1 of IS 7328:1992.

1.6.4 The MFR of the material shall be between 0.41 and 1.10 (both inclusive) when tested at 1900 with nominal load of 5 Kgf as determined by method prescribed in 7 of IS 2530:1993. The MFR of the material shall also be within – 20 percent of the value declared by the manufacturer.

The Resin shall be compounded with carbon black. The carbon black content in the material shall be within 2.5 = 0.5 % and the dispersion of carbon black shall be satisfactory when tested according to the procedure described in IS 2530:1963.

Anti-oxidant The percentage of anti-oxidant used shall not be more than 0.3 percent by mass of finished resin. The anti-oxidant used shall be physiologically harmless and shall be selected from the list given in IS 10141: 1982.

Reworked Material The addition of not more than 10 percent of the manufacturer's own rework material resulting from the manufacture of pipes is permissible. No other reworked or recycled material shall be used.

Dimensions of Pipes

Wall Thickness: The minimum and maximum wall thickness of pipes for the three grades of materials, namely, PE 63, PE 80, and PE 100 shall be as PW IS 4984 / 1995. 1.6.2

Method of Measurement: The outside diameter of the pipe shall be taken as the average of two measurements taken at right angles for pipes up to 110 mm diameter. Alternatively and for high sizes, the diameter shall be measured preferably by using a flexible pit tape or micrometer, having an accuracy of not less than 0.1 mm. The wall thickness shall be measured by a dia. vernier or ball ended micrometer. The resulting dimension shall be expressed to the nearest 0.1 mm.

Notes:

The outside diameter shall be measured at a distance of at least 300 mm from the end of the pipe. In the case of dispute, the dimension of pipes shall be increased after conditioning at room temperature for 4 hours.

Length of Straight Pipe: The length of straight pipe shall not be less than 6.0 m.

Coiling: The pipes supplied in coils shall be coiled on drums of minimum diameter of 25 times the nominal diameter of the pipe ensuring that kinking of pipe is prevented.

Visual Appearance: The internal and external surfaces of the pipes shall be smooth, clean and free from grooving and other longitudinal grooves or irregularities in the wall thickness shall be permissible provided that the wall thickness remains within the permissible limits.

Performance Requirements.

Hydraulic Characteristics. Then subjected to internal pressure creep rupture test in accordance with procedure given in Annexure of IS 4985 / 1995 the pipes under test shall show no signs of localized swelling, leakage or weeping, and shall not burst during the prescribed test duration. The temperatures, duration of test and induced stresses for the test shall conform to those specified in Table as below.

Sr. No.	Test	Test Temp °C	Test Duration (Minimum Holding Time)	Induced Stress, or in MPa for		
				PE 63	PE 80	PE 100
1	2	3	4	5	6	7
i)	Type Test	80	165	3.5	4.6	5.5
ii)	Acceptance test.	48	48	3.8	4.9	5.7

Reversion Test. When tested according to the procedure given at Annex C, IS of 4985 / 1995 the value of the longitudinal reversion shall not be greater than 3 percent.

Overall Migration Test. When tested from a composite sample of minimum 3 pipes as per IS 9845: 1986, the overall migration of constituents shall be within the limits stipulated in IS 10146: 1987.

Density. When tested from a composite sample of minimum three pipes as per Annex A of IS 7328: 199, it shall meet the requirement as given in 5.2. 1 of IS 4985 / 1995.

Melt Flow Rate (MFR). When tested from a composite sample of minimum three pipes as per IS 2530: 1963 at 1900 C with nominal load of 5 kg, MFR shall be between 0.4 to 1.1 kg / 10 minutes and also shall not differ by more than 30% of the MFR of the material used in manufacturing pipes.

Carbon Black Content and Dispersion. When tested from a composite sample of minimum three pipes, in accordance with IS 2530:1963, the carbon black content shall be within 2.5 = 0.5 percent and the dispersion of carbon black shall be satisfactory.

Sampling, Frequency of tests and Criteria for conformity

Type Test. The tests are intended to prove the suitability and performance of a new composition, a new technique or a new size of a pipe. Such tests, therefore, need be applied only when a change is made in polymer composition or method of manufacture, or when a new size of pipe is to be introduced. Even if no change is envisaged type test shall be done at least once in two years on each pressure rating and grade of pipe of the highest size manufactured during the period.

Acceptance Tests. Acceptance tests are carried out on samples selected from a lot for the purpose of a acceptance of the lot.

Lot. All pipes of the same size, same pressure rating and same grade and also manufactured essentially under similar conditions of manufacture, shall constitute a lot. For ascertaining conformity of the lot to the requirements of this specification, samples shall selected in accordance with the provisions.

GS 27 Precautions during Execution

The Contractor shall comply with instructions 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, in all respects. In case of non-compliance the contractor shall be liable to pay liquidated damages for various lapses as indicated below:

Non-installation of boards on either ends of trenches: Rs. 500/- per day till implementation

Non shoring of walls of trenches to prevent collapse of the excavated portion (beyond 1.5 m) and where proper stopping not proved: Rs. 1000/- per day till the shoring is fixed.

Digging of trenches beyond a stretch of 500 meter for Electrical Authority and Employer and otherwise 1000 meter in case of telephone: Rs. 500/- per day till the damage is restored.

Non barricading of trenches of more than 1.5 meter: Rs. 500/- per day till completed.

Excavation of trenches across and along roads during day time (at 8 AM to 8PM) without permission: Rs. 500/- per day.

Non removal of excess earth and other stones etc. which are causing inconvenience to the road users: Rs. 1000/- per day till completed.

Non consolidation of earth while back filling of trenches to the original level: Rs. 500/- per day till completed.

Non adherence to prescribed methodology for reinstatement of trenches: Rs. 500/- per day.

Road cutting without written or oral permission: Rs. 1250/- per day.

Non stacking of materials pipes etc. in an orderly manner during execution causing 98 in convenience to the road users: Rs. 1000/- per day.

The contractor shall have to provide MS sheet barricading or as provided in BOQ 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 sheets must be painted in red & White stripes with fluorescent paint.

Proper supporting of all underground services such as water mains, sewers, cables, drains, and 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.

Imposition of liquidated damages by Employer shall not absolve Contractor from any other civil/ criminal liabilities.

Contractor should maintain first aid box, electric shock recovery devices, safety equipment such as breathing apparatus, safety personal protective equipment and/ or other safety equipment as per NHRC guidelines and/ or factory act. The Engineer-in-Charge shall decide to impose suitable damages

GS 28 Action in Case work Not Done as per Specifications

All work under or in course of execution or executed in pursuance of the Contract shall at all times be open and accessible to the inspection and supervision of the Engineer-in-Charge, his representatives and assistants in charge of the Works and all senior officers, officer of the quality control division of the Employer, third party hired by Employer, and of the chief technical examiner office. The Contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the Contractor, either himself be present to receive orders and instructions or have his responsible agent, present for that purpose.

In the event it appears to the Engineer-in-Charge or his representative in charge of the Works or any nominated officer (as described above in this clause), that any work has been executed with unsound, imperfect, or unskillful workmanship, or is against Good Engineering Practice or with material or articles of a quality inferior to that contracted or otherwise not in accordance with the Contract, the Contractor shall, on demand in writing which shall be made during construction and upto six months after completion of the Works by the Engineer-in- Charge specifying the work, materials or articles complained (notwithstanding that the same may have been passed, certified and paid for forthwith) rectify, or remove and reconstruct the Works so specified in whole or in part, as the case may require, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of failing to do so within a period specified by the Engineer-in- Charge in his demand aforesaid, the Contractor shall be liable to pay compensation at the same rate specified earlier in the Contract (for noncompletion of the Works in time) for this default.

Provided that in such an event the Engineer-in-Charge may not accept the item of Works at the rates applicable under the Contract but may accept such items at reduced rates as the Employer may consider reasonable during the preparation of on-account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the Works outright without any payment and/or get it and other connected and incidental items rectified, or removed and reexecuted at the risk and cost of the Contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same shall be final and binding on the Contractor.

GS 29 Action where there are no Specifications

In the case of any class of work for which there is no such specifications as referred in tender conditions, such work shall be carried out in accordance with the CPWD/ Bureau of Indian Standards Specifications or any other applicable standards specific to the Works. Provided that where there is no such specification in CPWD/ Bureau of Indian Standards, the Works shall be carried out as per manufacturers' specifications. Provided further that where there are no such specifications as required above, the Works shall be carried out in all respects in accordance with Good Engineering Practice and Site requirements under the instructions and requirements as communicated by the Engineer-in-Charge.

GS 30 Contractor to Supply Tools & Plants etc.

The Contractor shall provide at his own cost all materials (except such special materials If any, as may in accordance with the Contract be supplied from the Employer) stores, plants, tools, appliances, implements, ladders, cordage, tackle, scaffolding and temporary work required for the proper execution of the work,

whether original, altered or substituted and whether included in the specification or other documents forming part of the Contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Engineer-in-Charge. 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 the measurement for examination at any time of the Works or materials. In the event the Contractor fails to supply such requisite number of persons with the means and materials the same may be provided by the Engineer-in-Charge at the expense of the Contractor and the expenses may be deducted, from any money due to the Contractor, under this Contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

30.1 NA

GS 31 General Measurement & Payments

Measurement of work done (Refer GS-11 also)

The Engineer-in-Charge shall, except as otherwise provided, ascertain and determine, by measurement, the value of Works done in accordance with the Contract. Measurement of all items having financial value shall be entered in measurement book and/or level field book so that a complete record is obtained of all Works performed under the Contract. All measurements and levels shall be taken jointly by the Engineering-Charge or his authorized representative and by the Contractor or his responsible agent from time to time during the progress of the Works and such measurements shall be signed and dated by the Engineering-Charge and the Contractor or their representatives as token of their acceptance. If the Contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties.

If for any reason the Contractor or his responsible agent is not available and the work of recording measurements is suspended by the Engineer-in-Charge or his representative, the Engineer-in-Charge and the Employer shall not entertain any claim from Contractor for any loss or damages on this account. If the Contractor or his responsible agent does not remain present at the time of such measurements after the Contractor or his responsible agent has been given a notice in writing three (3) days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Engineer-in-Charge or his representative shall be deemed to have been accepted by the Contractor.

The Contractor shall, without extra charge, provide all assistance with every instrument, labor and other things necessary for measurements and recording levels.

Except where any general or detailed description of the Works expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the technical specifications notwithstanding any provision in the relevant standard method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

If any part of Works shall be covered up or placed beyond the reach of measurements without notice been given to the Engineer-in-Charge or without his consent being obtained in writing, the Works shall be uncovered at Contractor's expense, or in default thereof no payment or allowance shall be made for such Works or the materials with which the same was executed.

Engineer-in-Charge or his authorized representative may cause either themselves or another officer of the Employer to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this Contract that recording of measurements of any item of Works in the measurement book and/or its payment in the interim, on-account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the Contractor from liabilities from any other measurements or defects noticed till completion of the defects liability period.

Payments of Running Bills

The payment of the monthly running bill for the Works shall be released in 90 days from the date of recording of pay order. No excuse for delay in completion of work/prolongation of the Contract shall however be entertained on account of the reason of delay in payment. The bidder therefore, must take into consideration of its financial capability to carry out and to continue the work without any hindrances.

In the event of the failure of Employer to release payment as per clause 8.2.1, the Employer shall be liable to pay interest @ 10% per annum on net payable amount computed for period beyond 90 days. Provided always, that no interest shall be payable on any amount disallowed or disputed by the Engineer-in-Charge or the Employer, even if such amount is later on determined to be payable to the Contractor, as a result of any process resorted to for the settlement of the dispute as per Contract.

It shall be the contractual obligations on the part of the Contractor to submit with each running bill photocopies of the:-

Challans for the main items purchased for the Works like CI/DI/MS/RCC/PSC Pipes, E&M equipment, manhole frame and covers, footrests, sluice valves, fire hydrants and other fixtures and accessories used in the Works;

Guarantee/ warranty certificates, wherever applicable;

Manufacturer's test reports of cement, steel, MS plates, sluice valves etc.

GIS maps of pipelines and other related key components (to be submitted only with the final bill)

Note: Contractor shall solely be responsible for the authenticity of the challans and other documents submitted along with each running and final bills.

The original challans shall be produced before the Engineer-in-Charge for verification, as and when desired by him.

Currency of Payment

Unless specifically provided for in the Contract, all payments shall be in Indian rupees only. Unless specified otherwise, payment, if any, in foreign currencies, shall be made only to the extent and in the manner laid down in the Contract. In case of items of Works requiring payments in foreign exchange, the Contractor shall furnish the details in the Bill of Quantities. For such items, payments will be arranged in Foreign Currency.

Payment of Contractor's bills to Banks Payments due to the Contractor shall be made to his bank instead of direct to him. The Contractor shall submit to the Engineer-in-Charge an authorization in form of a legally valid document such as a power of attorney conferring authority on the bank to receive payments and his own acceptance of the correctness of the amount made out as being due to him by Employer or his signature on the bill or other claim preferred against Employer before settlement by the Engineer-in-Charge of the account or claim by payment to the bank, registered financial, cooperative or thrift societies or recognized financial institutions. While the receipt given by such bank; registered financial, cooperative or thrift societies or recognized financial institutions shall constitute a full and sufficient discharge for the payment, the Contractor shall whenever possible present his bills duly receipted and discharged through his bank, registered financial, cooperative or thrift societies or recognized financial institutions. Nothing herein contained shall operate to create any rights or equities vis-à-vis Employer in favor of the bank.

Payment of Final Bill

(Refer GS-11 also)

The final bill shall be submitted by the Contractor within three months of Completion Date or within one month of the date of issue of Completion Certificate furnished by the Engineer-in-Charge whichever is earlier. In case commissioning is delayed beyond a period of one year from the Physical Completion of the Works, the final bill shall be settled upon completion of the Defect Liability Period, as per various clause or upon successful commissioning whichever is earlier. No further claims shall be made by the Contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in-Charge, will, as far as possible be made within the period specified herein under, the period being reckoned from the date of receipt of the bill by the Engineer-in-Charge or his representative, complete with account of materials issued by the Employer and dismantled materials.

Note: *Recognition of delivery challan against the material and supplies at the time of their receipt at the project site should not be understood in any case, that the contractor can procure any quantity of material which is way beyond the quantity to be consumed (estimated using the common business prudence) and the shelf life of the material expires before it being used. Accordingly, material and supplies should be procured based on the progressive use of material and supplies/ equipments and the same shall correspond with the approved/ released design & drawing, and BOQ. Further, Employer shall not be responsible in any manner to recognize the billing for any excess consumption of material and supplies/ equipments by the Contractor beyond the quantities worked out as per Para 2 above, subject to permissible variation allowed under clause 9.3. [Clause to be inserted in Pure Supply and E&M Contracts]*

31.10.6 Works Contract TDS: The Contractor shall produce before the Employer a copy of his registration certificate under the GST Act/s and the lower TDS rate certificate (if any) issued in terms of the provisions made under the GST Act / Rules, hereof, failing which the Employer will deduct tax at source (TDS) on full value of the Contract at the standard rate prescribed under the GST Act.

GS 32 Alterations, Additions & Omissions

Deviations / Variation Extent and Pricing

The Engineer-in-Charge shall have power:

to make alteration , omissions , additions , or substitutions in the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and to omit a part of the Works in case of non-availability of a portion of the Site or for any Other reasons.

The Contractor shall be bound to carry out the Works in accordance with any instructions given to him in writing signed by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the Contract as if originally provided therein. Any altered, additional or substituted Works which the Contractor may be directed to do in the manner specified above as part of the Works, shall be carried out by the Contractor on the same conditions in all respects including price on which he agreed to do the Works except as hereafter provided. Instructions for any variations shall be communicated to the Contractor by the Engineer-in-Charge in writing with a copy to the Employer.

In case of reduction of scope due to action under clause 9.1.1, the reduction in payments shall be calculated based on schedule of rates for the Contract.

Foreclosure of Contract due to abandonment or reductions in scope of work

If at any time after issuance of Work Order, the Employer decides to abandon or reduce the scope of the Works for any reason whatsoever and hence not require the whole or any part of the Works to be carried out, the Engineer-in-Charge shall give notice in writing to that effect to the Contractor and the Contractor shall act accordingly in the matter. The Contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the Works in full but which he did not derive in consequence of the fore closure of the whole or part of the Works.

The Contractor shall be paid at Contract rates full amount for Works executed at Site and, in addition, a reasonable amount as certified by the Engineer-in-Charge for the items hereunder mentioned which could not be utilized on the Works to the full extent in view of the foreclosure:

Architectural Concepts and Designs

An Architectural Design Basis Report will be submitted to the engineer including proposals for the following scheme components: shape, form, color, and basic materials for interior and exterior architecture along with an appropriate landscaping scheme. All schemes will be supported by architectural statement explaining the factors considered in the design.

Architecture work shall include walls, roof, flooring and floor finish, roof water proofing, down water pipes, windows, ventilators, doors, glazing, equipment access doors, painting and other ornamental works. The contractor shall get all Architectural, Structural and RCC drawings and design calculations, etc approved by engineer prior to construction of works at site.

Structural Designs

The Contractor shall on its own carryout Soil investigation i.e. Geo technical investigation and prepare Structural drawings vetted by Government College or Institute

Design Submissions

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. The Contractor shall also take care to check the stability of partly completed or existing structures associated with the proposed SWM System.

Complete detailed design calculations of foundations and superstructure together with general arrangement drawings and explanatory sketches shall be submitted to the Engineer. 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. The contractor shall be responsible for the safety of structures, structural strength, stability, soundness, water tightness and accuracy, adequacy of design, workability and performance even after the approval of the same by the Engineer. During the job execution, if any deficiency or alteration is required, firm shall attend to the same within the contractual provisions and nothing extra shall be claimed/paid to the firm.

Approval conveyed to the firm will neither relieve the firm of its contractual obligations and its responsibility for the correctness of the dimensions, material, of the construction, weights, quantities, design perimeters, dimensions, assembly its, performance, particulars, conformity of the supplies with Indian statutory laws as may applicable nor will it limit the DJBs rights under the contract.

Design Loadings

All buildings and structures shall be designed to resist the worst combination of the loads/stresses during testing and under working conditions and shall be as per IS:875. The loads considered shall include dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials, dynamic loads and uplift pressure.

Dead Load

This shall comprise all permanent construction including foundations, walls, floors, columns, roofs, partitions, stairways, fixed service equipments and other items of machinery. In estimating the loads of process equipment all fixtures and attached piping shall be included. The following minimum loads shall be considered in design of structures:

Weight of water	:	10.00 kN/m ³
Weight of saturated soil (irrespective of strata	:	20.00
kN/m ³ available at site and type of soil used for filling etc).		
However, for checking stability against uplift, actual weight of soil as determined by field test shall be considered.		
Weight of plain concrete	:	24.00 kN/m ³
Weight of reinforced concrete	:	25.00 kN/m ³
Weight of brickwork (exclusive of plaster)	:	22.00 N/m ² per mm thickness of brickwork
Weight of plaster to masonry surface	:	18.00 N/m ² per mm thickness
Weight of granolithic terrazzo finish or	:	24.00 N/m ²
per rendering screed, etc. mm thickness		
Weight of sand (filter media)	:	26.0 kN/m ³

Live Load

The following minimum loads shall be considered in the design of structures:

Live Load on Roofs : 1.50 kN/m² Live Load
on Dome : 2.50 kN/m²

Live Load on floors supporting equipment such as pumps, blowers, compressors, valves etc

Live load on all other floors walkways, stairways and platforms

Toilet : 2.00 kN/m²

In the absence of any suitable provisions for live loads in I.S. Codes or as given above for any particular type of floor or structure, assumptions made must receive the approval of the Engineer prior to starting of 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/construction shall be considered and shall be partial or full whichever causes the most critical condition. Any such loading condition must be incorporated in design calculations with supporting documentation for approval. Wind Load

Wind loads shall be conforming to I.S. 875.

Earthquake Load

Earthquake loads shall be conforming to I.S. 1893 considering seismic zone for the location of project.

Dynamic Load

Dynamic loads due to working of plant items such as pumps, blowers, compressors, switch gears, travelling cranes, etc. shall be considered in the design of structures.

Vehicular Load

IRC Class AA (wheeled vehicle) loading shall be considered for design of structures under or by the side of roads.

Joints

Movement joints such as expansion joints, complete / partial contraction joints and sliding joints shall be designed to suit the structure requirements. Position and design of construction joints should be predetermined keeping in view the convenience in construction. All joints should be tested for water tightness and must be leak proof. The material used in the joints like joint filers, water bars, sealing compounds and other such materials should be resistant to chemical and biological action and require approval of Engineer and nothing extra is payable.

Water stops

Water stops shall be of PVC/Neoprene as applicable (material shall be suitable for sewage/acidic liquid storage). To be supplied from approved manufacture. Samples and the test certificate shall be got approved by the Engineer – in – charge before procurement for incorporation in the works. Water stops shall be either of the bar type, serrated with centre bulb and end gips for use within the concrete elements or of the surface (kicker) type for external use. nothing extra is payable.

Completely / Partly Underground Liquid Retaining Structures

All underground or partly underground liquid retaining structures shall be designed for the following conditions:

Structure filled with liquid: Liquid depth up to full height of wall, irrespective of the actual height of liquid in the structure: no relief due to soil pressure from outside to be considered;

Structure empty: full earth pressure and surcharge pressure, as 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; Structures shall be designed for uplift in empty conditions with the water table indicated by the Contractor's own investigation or approved by Engineer prior to design, whichever is maximum. No reduction Factor for the uplift forces shall be considered.

The dead weight of the empty structure should provide a safety factor of not less than 1.2 against uplift pressures during construction and in service;

Walls shall be designed under operating conditions to resist earthquake forces from earth pressure mobilization and dynamic water loads;

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 from below to base slab.

Foundations

The minimum depth of foundations for all structures, equipment, buildings and frame foundations and load bearing walls shall be conforming to IS 1904. All foundations shall extend to a depth below virgin ground level as per the Geotechnical Report. The foundations shall be placed on virgin soil and not on backfilled soil. The earth fill above virgin ground level till formation level shall be taken as a surcharge load and shall be added in the loads coming on foundations appropriately.

Maximum safe bearing capacity of soil strata shall be taken as indicated in geotechnical reports by contractor's. For the foundation depths and types of footings other than those mentioned in the geotechnical reports, the maximum safe bearing capacity shall be appropriately computed from the parameters given in the geotechnical reports and got reviewed and approved by the

Engineer.

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.

Plinth level of all structures shall be at least 500 mm above formation level. If pile foundations are used, the bidder shall conduct the initial routine test as per IS 2911 at his own cost, to determine the safe load bearing capacity of piles.

Design Requirements

The Civil & Structural design shall be carried out in accordance with BIS:456, and BIS:3370 and other relevant Indian Standard Codes. For the seismic forces, the structure should be designed as per IS: 1893 and all the factors as applicable for Zone.

The following are the design requirements for all reinforced or plain concrete structures:

All blinding and leveling concrete shall be minimum 100 mm thick in concrete grade M15, unless otherwise specified.

All structural reinforced concrete shall be with a maximum 20 mm stone aggregate size.

The minimum grade of concrete shall be M-25 for RCC structures other than liquid retaining structures, for which minimum grade of concrete shall be M 30.

The minimum reinforcements in walls, floors and roofs of liquid retaining structures in each of two directions at right angles shall be 0.3% HYSD bars.

Minimum reinforcement and cover to the reinforcement shall be provided as per relevant IS standards.

Minimum Thicknesses of Reinforced Concrete Members

The following minimum thicknesses shall be used for different reinforced concrete members, irrespective of design thicknesses:

Walls for liquid retaining structures for Launders :	150 (except mm Channels)
Bottom slabs for liquid retaining :	150 structures mm Wall foundation (at junction of base: 250 slab & wall) mm
Roof slabs for liquid retaining	150 structures mm
Launders & Channels – Base Slab & wall	150 MM
Floor slabs including roof slabs, walkways, canopy slabs	75mm
Walls of cables / pipe trenches	100 mm
Precast trench cover :	75 mm
Additional Appointment of Third Party	

The Local Body as and when feels can appoint Third Party as PMC or otherwise to Supervise, Monitor & Verify Performance and/or conduct of Contractor as well as to verify test records, drawings, schedule, QA/QC, treatment process efficiency, etc at extra cost as & when required.

Design Calculations & Drawings Submissions

The Contractor at his own cost shall carryout contour survey & prepare design calculations for the technology, process flow diagram, P&ID, Section drawings, working civil & MEP drawings, Layout on Contour also superimposed on google maps, architectural & structural design calculations & drawings, line diagram, hydraulic drawings, etc. Additionally, contractor shall submit cut sheets & test certificates of MEP, etc.

Section I - Part III

Special Conditions of Contract for Electrical Works

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1.Scope

1.1 The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like panels, power control cables, remote push button stations, motors, earthing network, etc Requirement of a particular project shall be as specified in schedule of quantities/approved drawings or as per the battery limits fixed in the contract. Bidder should note that specifications given under this scope are at broad level, the applicability shall be according to relevant work.

2.0. Standards

2.1 The work shall be carried out in the best workmanship in conformity with this specification, the relevant specification/codes of practice of the Bureau of Indian Standards, approved drawings and the instructions issued by the Engineer-in-charge or his authorized representative, from time to time. Some of the relevant Bureau of Indian Standards is listed in Table 1.

2.2 In addition to these standards, all works shall also confirm to the requirements of the followings:
Indian Electricity Act and Rules framed there under.

Fire Insurance Regulations.

Regulations lay down by the Chief Electrical Inspector of the State/State Electricity Board.

Regulations lay down by the Factory Inspector of the State.

Any other regulations lay down by the local authorities.

Installation & operating manuals of original manufacturers of equipment.

3.0 Equipment and Accessories Specifications

All materials, fittings and appliances to be supplied by the Bidder/Supplier shall be of best quality and shall conform to the BIS specification. The equipment shall be manufactured in accordance with current Bureau of Indian Standard Specifications wherever they exist or with the BS or NEMA specifications, if no such BIS are available. In the absence of any specification, the materials shall be as approved by the Owner or his authorized representative.

4.0 Cable Glands

4.1 These shall be provided at both ends of armoured/ Unarmoured electrical cables. Cable glands to be manufactured as per performance requirements of BS 6121 amended as on date, with BRASS material accurately machined and NICKEL finish. Single compression cable glands to be complete with checkout, gland body, 3 nose metal washers, and outer seal rubber ring and compression nut. Double compression glands to be complete with checkout, gland body, neoprene outer ring, Armour clamping cone, Armour clamping ring, Armour clamping nut, neoprene outer ring, skid washer & outer seal nut. Sample of cable gland to be got approved from the Site In charge before supply For instruments MOC of cable gland shall be polyamide.

5.0 Cable Connectors

5.1 Cable connectors, lugs/sockets, shall be of copper/Aluminum alloy, suitably tinned, soldering less, crimping type. These shall be suitable for the cable being connected and type of function (such as power, control or connection to instruments, etc.)

6.0. Cable Route Markers

6.1 These shall be galvanized Cast Iron plate with marking (LT/HT) diameter 150 mm with 600 mm long 25x25 mm MS. angle riveted/bolted with this plate. Sample to be got approved before use. Cable Indicators

6.2 Individual symbols / numbers printed on yellow strips of glossy PVC should be used for cable indicator.

7.0. Pipes for Cables

7.1 For lying of cables under floor, G.I. class 'A' pipes shall be used. MS. conduits are acceptable for this purpose. For laying cable in air whereas cable trays are not being used, MS 'B' class pipe shall be used. Size of pipe shall depend upon the over all diameter of cable to be drawn through pipe. To determine the size of pipe, assume that 40% area of pipe shall be free after drawing of cable. In dairy's process area wherever required SS-304 pipe, 1.6 mm thick shall be used.

8.0 Motor Isolators

8.1 These shall be in Aluminum cast housing, completely dust, vermin and weather proof(IP 55), suitable for 30/25 A, 415 volts, 50 Hz with rotary type switch complete with cable gland for incoming and outgoing cables. For dairy's process area SS-304 motor isolator shall be used. Final finish of housing to be buffer mirror for SS and powder coated gray for Aluminum housing. Sample to be got approved before supply.

9.0 Control Junction Box

9.1 These shall be in Aluminum cast housing, completely dust, vermin and weather proof(IP 55). For dairy's process area SS-304 junction box shall be used. Final finish of housing to be buffer mirror for SS and powder coated gray for Aluminum housing. Sample to be got approved before use.

10.0 Remote Push Button Stations

10.1 These shall be used for remote OFF for motors, away from MCC. These shall be suitable for surface/structure mounting in Cast Aluminum housing having IP-55 class of protection i.e. completely weather proof. For dairy's process area SS-304 push button shall be used. Final finish of housing to be buffer mirror for SS and powder coated gray for Aluminum housing. Sample to be got approved before supply.

10.2 Riveted type bio-color plastic nameplate to be provided for each feeder.

10.3 For outdoor installation suitable canopy to be provided.

11.0 Erection of Equipment

The cases containing the equipment (being supplied by the purchaser shall be handed over to the Bidder/Supplier. The Bidder/Supplier shall make his own arrangements for safe transportation of all the items to the erection site and also carry out complete loading/unloading during transportation. Equipment shall not be removed from packing cases unless the floor has been made ready for installing them. The cases shall be opened in presence of the Engineer-in-charge or his authorized representative. These empty packing cases shall be returned to the storage space identified by engineer in charge and any document if found with the equipment shall be handed over to the Engineer-in-charge. Any damage or shortage noticed shall be reported to the Engineer-in-charge in writing immediately after opening of packing cases.

12.0 Erection and Testing of Motors

Erection and coupling of motors with machines will be done under the mechanical erection. However, earthing, cable termination, testing and commissioning are covered under this section. Before starting, the alignment and coupling of motors with machines and the insulation resistance of the motors will be measured and recorded by the Bidder/Supplier. The direction of the rotation of the motor shall also be checked before the driven equipment is finally coupled. Motor bearings are to be checked and rectified including supply and changing of grease if required, checking of fans coupling with bodies etc. The Bidder/Supplier shall take adequate precaution and care while executing the work. For all damage due to negligence etc. the Bidder/Supplier shall be responsible to replace/repair at his own cost.

Before connecting power cables to motors the insulation resistance of all motor windings shall be measured. Measurement shall be repeated after power cable terminations are completed and before first charging.

1. Motors shall be operationally tested together with the starting gear and auxiliary apparatus such as push button stations, the contractors, level and pressure controls, signal and alarm apparatus, power and control circuits etc.
2. Check the anti-condensation heater and its circuit (if installed).
3. Check the setting of the thermal overload protection / single phase prevent or. Testing of these devices is
4. to be done wherever required as per the instructions of the Engineer-in-charge.
5. Run all motors uncoupled for a maximum period of 4 hours before the driven equipment is placed in regular service. Fill up Test Certificate as per Table 3.
6. All outdoor-installed motors must be shrouded with cover made out of 14 gauge GI sheet with lifting hook and louvers as per norms

13.0 Installation of Cable Network

Cable network shall include power, control and lighting cables which shall be laid in underground trenches, home pipes, open trenches, cable trays, GI pipes, or on building structure surfaces as detailed in the relevant drawings, cable schedules or as per the Engineer-in-charge's instructions. Supply and installation of cable trays, GI pipes/ conduits, cable gland sockets at both ends, isolators, junction boxes, remote push buttons stations, etc shall be under the scope of the Bidder/Supplier. For selection of cable size please refer to Table 5.

14.0. General Requirements for Handling of Cables

Before laying cables, these shall be tested for physical damage, continuity absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500/1000 volt Muggger.

The cables shall be supplied at site, wound on wooden drum as far as possible. For smaller length and sizes, cables in properly coiled form can be accepted. The cables shall lie by mounting the drum of the cable on drum carriage. Where the b carriage is not available, the drum shall be mounted on a properly support enable, and the cable laid out from the top of the drum. In no case the cable will be rolled on, as it produces kinks, which may damage the conductor.

Sharp bending and kinking of cables shall be avoided. The bending radius for PVC insulated and sheath armored cable shall not be less than $10 D$ Where 'D' is overall diameter of the cable.

While drawing cables through GI pipes, conduits, RCC pipe, ensure that size of pipe is such that, after drawing cables, 40 % area is free. After drawing cable, the end of pipe shall be sealed with cotton/bituminous compound High voltage (11 kV and above), medium voltage (230 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes/trays.

Armored cables shall never be concealed in walls/floors/roads without GI pipes, conduits RCC pipes. Joints in the cable throughout its length of lying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If all owed, proper straight through epoxy resin type joint shall be made, without any additional cost. A minimum loop of 3 M shall be provided on both ends of the cable, or after every 50 M of uncounted length of cable and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and lying.

Cable shall be neatly arranged in the trenches/trays in such a manner so that crises crossing are avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be the responsibility of the Bidder/Supplier.

All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings are indicative only and the same may be rechecked with the Engineer-in-charge before cutting of cables. While selecting cable routes, interference with structures, foundations, pipeline, future expansion of buildings, etc. should be avoided.

All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead allo

Wherever cable rises from underground/concrete trenches to motors/switchgears/push buttons, these shall be taken in G.I./MS pipes of suitable size, for mechanical protection upto 300 mm distance of concerned cable gland or as instructed by the Engineer-in-charge.

Where cables pass through foundation/walls of other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures the electrical Bidder/Supplier shall determine their location and obtain approval of the Engineer-in-charge before cutting is done.

15.0 Laying of Cables (Underground System)

Cables shall be so laid in ground that these will not interfere with other underground structures. All water pipes, sewage lines or other structures, which become exposed by excavation, shall be properly supported and protection from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded diverted as directed by the Owner.

Cables shall be laid at minimum depth of 750 mm in case of LT & 1200 mm in case of HT, from ground level. Excavation will be generally in ordinary alluvial soil. The width of the trench shall be sufficient for lying of required number of cables.

Sand bedding 75 mm thick shall be made below and above the cables. A layer of bricks (full size) shall be laid on the edge, above sand bedding on the sides of cables and a flat brick to cover cable completely. More than one cable can be laid in the same trench by providing a brick on edge between two cables. How ever the relating location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction to the Engineer-in-charge.

For all underground cables, route markers should be used

Separate cable route markers should be used for LT, HT and telephone cables.

Route markers should be grounded in ground with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm.

Cable markers should be installed at an interval not exceeding 50 M along the straight routes of cables at a distance of 0.5 M away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

RCC Hume pipe for crossing road in cable laying shall be provided by Owner. No deduction shall be made for cable lying in home pipe for not providing bricks, sand and excavation. RCC home pipe at the ends shall be sealed by bituminous compound after laying and testing of cable by electrical Bidder/Supplier without any extra charge.

16.0 Laying of Cables under Floors

GI class a pipe shall be used for lying of outgoing cables under floors from distribution boards to motors, isolators/junction boxes of motors, starter of motors and push button stations. Preferably one cable shall be drawn through one pipe. Size of pipe shall be such that after drawing of cable 40 % area is free. If length of pipe is more than 30 M, free area may be increased to 50 %.

Use of elbows is not allowed at all and number of bends shall be kept minimum. Instead of using bends with sockets, pipe-bending machine shall be used for making long smooth bends at site.

Ends of pipe shall be sealed temporarily while laying with cotton/ jute/ rubber stopper etc to avoid entry of building material.

Exact location of equipment motor/ isolator/ push buttons etc shall be ascertained prior to lying of pipe.

Laying of Cable in Masonry Trenches

Masonry/ concrete trenches for lying of cable shall be provided by Owner. However steel members such as MS angles/ flats etc shall be provided & grouted by electrical Bidder/Supplier to support the cables without any extra charge. Cables shall be clamped to these supports with Aluminum saddles/ clamps. More than one tier of cables can be provided in the same trench if the number of cables is more. If required cable trays can also be provided in trenches. Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

17.0 Laying of Cables in Cable Trays

Cable trays and supporting steel members such as MS angle/ channel/ flats etc shall be provided and fixed by the Bidder/Supplier.

Cables shall be fixed in cable trays in single tier formation and cables shall be clamped with Aluminum flat clamps and galvanized bolts/unit.

Earthling flat/ wire can also be laid in cable tray along with cables.

After lying of cables minimum 20 % area shall be spare.

Laying of Cables on Building Surface/ Structure

Such type of cable lying shall be avoided as far as possible and will be allowed only for individual cables or small group of cables, which run along structure.

Cables shall be rigidly supported on structural steel/masonry using individual cast/malleable iron galvanized saddles and these supports shall be approximately 400 to 500 mm for cables upto 25 mm overall diameter and maximum 1000 mm for cables larger than 25 mm. Unsightly sagging of cables shall be revenged. Only/GI clamps with GI bolts/nuts shall be used.

If drilling of steel structure must be resorted to, approval must be secured from the Engineer-in-charge and steel must be drilled where the minimum weakening of the structure will result.

18.0 Termination & Jointing of Cables

Use of Glands: All PVC cable upto 1.1 kV grade, armoured or Unarmoured shall be terminated at the equipment/junction box/ isolators/push buttons/ control accessories, etc. by means of suitable size single/double compression type cable glands. Armour of cable shall be connected to earth

point. The Bidder/Supplier shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanized threaded reducing bushing shall be used for approved type

In case of termination of cables at the bottom of the panel over a cable trench having no access from the bottom, close fit holes should be drilled in the bottom plate for all the cables in one Line, then bottom plate should be split in two parts along the centre line of holes. After installation of Bottom plate and cables with glands, it shall be sealed with cold sealing compound.

Use of Lugs/ Sockets: All cable leads shall be terminated at the equipment terminals, by means of crimped type solder less connectors unless the terminals at the equipment ends are suitable for direct connecting without lugs/sockets.

The following is the recommended procedure for crimped joints and the same shall be followed: Strip off the insulation of the cable end with every precaution, not to sever or damage any strand. All insulation to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

The cable should be kept clean as far as possible before assembling it with the terminal/socket. For pre Ingress of moisture and possibility of re-oxidation after crimping of the aluminum conductors, the socket should be fitted with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket. Correct size and type of socket/ ferrule/ lug should be selected depending on size of conductor and type of connection to be made. Make the crimped joint by suitable crimping tool. If after crimping the conductor in sock lug, some portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.

19.0 Dressing of Cable inside the Equipment

After fixing of cable glands, the individual cores of cable shall be dressed and taken along the cableways (if provided) or shall be fixed to the panels with polyethylene straps. Cable shall be dressed in such a manner that small loop of each core is available inside the panel.

For motors of 20 HP and above, terminal box if found not suitable for proper dressing of Aluminum cables, the Bidder/Supplier shall modify the same without any additional cost. Cables inside the equipment shall be measured and paid for.

20.0 Identification of Cables/ Wires/ Cores

Power cables shall be identified with red, yellow & blue PVC tapes for trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear/control panels and control switches.

In case of control cables all cores shall be identified at both ends by their wire numbers by means of PVC ferrules or self-sticking cable markers, wire numbers shall be as per schematic/connection drawing. For power circuit also wire numbers shall be provided if required as per the drawings of switchgear manufacturer.

Cable between Isolators/ Junction box & Motors/ Controls

Wherever possible Copper cables with glands shall be used between isolator/junction box (installed near motor/controls) and motors/controls. If terminal box of the motor or control switch is not suitable for accepting armored cable or it is difficult to lay, copper conductor, multi-core, Unarmoured flexible cable in PVC flexible conduit steel (reinforced) with flexible conduit glands shall be used.

21.0 Testing of Cables

Before energizing, the insulation resistance of every circuit shall be measured from phase to phase and from phase to ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits.

Where splices or terminations are required in circuits rated above 650 volts, measure insulation resistance of each length of cable before splicing and/or terminating. Report measurements after splices and/or terminations are complete.

DC High Voltage test shall be made after installation on all 1100 Volts grade cables in which straight through joints have been made and all cables above 1100 V grade.

For record purposes test data shall include the measured values of leakage current versus time. The DC High Voltage test shall be performed as detailed below:

Cables shall be installed in final position with the entire straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear, transformer etc are not subjected to test voltage.

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution. Fill up the Test Certificate as per Table 4.

Earthing Network

The entire earthing installation shall be done in accordance with the earthing drawings, specification and instructions of the Engineer-in-charge. The entire earthing system shall fully comply with the Indian Electricity Act and Rules framed there under.

The Bidder/Supplier shall carry out any changes desired by the electrical inspector or the Owner in order to make the installation conform to the Indian Electricity Rules, at no extra cost. The exact location of the earth pits, earth electrode and conductors and earthing points of the equipments shall be determined at site, in consultation with the Engineer-in charge. Any change in the methods, routing, size of conductor etc. shall be subject to approval of the owner/engineer-in charge before execution.

22.0 Earth Pit with Electrode

Plate or pipe type earth electrode with earth pit shall be provided for this work unless otherwise advised by the Engineer-in-charge due to typical site conditions. Earthing electrode and pit shall be as per IS: 30431966 (code of practices for Earthing). All earth electrodes shall preferably be driven to a sufficient depth to reach permanent moist soil.

33.2 Prior approval of the engineer-in-charge shall be taken for selecting type of earth electrode (pipe or plate).

Earth pit centre shall be at a minimum distance of 2 m from nearest building, unless otherwise advised. The minimum 3 m distance shall be maintained between centre's of 2 earth pits.

23.0 Earth Bus, Earthing Lead & Earth Wire/ Strip

All electrical equipment is to be doubly earthed by connecting two-earth strip/wire conductor from the frame of the equipment to an earthing pit/ main earthing ring. The earthing ring will be connected via links to several earth electrodes. The cable armoured will be earthed through the cable glands. Conductor size for connection to various equipments shall be as specified in the drawing or as instructed by the Engineer in-charge. However, the length of the branch leads from equipment to earthing grid/ ring shall not be more than 10 to 15 meters.

All hardware for earthing installation shall be hot dip galvanized. Spring washers shall be used for all earthing connections of equipment having vibrations.

Size of earthing lead/ wire shall be as specified in schedule of quantities/ drawings.

When earthing wire is to be drawn under floor/in underground, Aluminum wire 10 mm dia. With PVC insulation shall be used. Instead of GI wire, PVC insulated copper conductor wires can also be used.

However, while deciding type & size of earth lead, the resistance between the earthing system and the general mass of the earth shall be as per IS code of practice. The earth loop impedance to any point in the electrical system shall not be in excess of 1.0 ohms in order to ensure satisfactory operation of protective devices.

G.I. wire/ Aluminum wire shall be connected to the equipment by providing crimping type socket/ lug. Wherever earthing strip to be provided in cable tray, it shall be suitably bolted on cable tray and electrically bonded to the cable tray at regular interval.

Excavating & refilling of earth, necessary for laying underground earth bus loops shall be the responsibility of the Bidder/Supplier.

Wherever earth leads/ strips/ wire are laid in cable trenches, these shall be firmly and suitably cleared to the walls/ supporting steel structure on which cable is clamped.

The neutral of the transformer shall be connected to earth pit independently and earth pit shall have copper earth plate.

Long runs of GI strip shall be connected at each end with lap type welding to ensure continuity.

Erection Procedure Guidelines of Instrumentation & Control System

The erection of Instrumentation & Control System shall be carried out generally conforming to General Technical Standards as described herein. However, the Bidder shall select and adopt methods and procedures for equipment erection to suit the nature of equipment and erection work, involved according to the best modern practice and his own experience. Shop tests as well as Site tests shall be performed to ensure that all equipment / sub-systems / systems furnished are manufactured and tested conforming to the requirements of the specification and approved Quality Assurance Program. All assembly and erection procedures adopted by the supplier shall be open for inspection and approval by the Client. Acceptance of erection procedures shall not in any way relieve the supplier of his responsibility for proper erection of the equipment.

Transmitters, converters and pressure & temperature switches shall generally be installed on Instrument Stands made of 2" SS pipes located at convenient points. Level transmitters shall normally be flanged for direct mounting in the tank / equipment.

Temperature / Pressure Stub on equipment and pipelines shall preferably be of same material or higher grade of material Suitable Root Valves shall be provided with every tap-off point.

Installation of Pressure and Differential Pressure Transmitter shall be as per standard engineering practice incorporating Drain Valves, Isolation Valves, 2/3-Valve Manifold, Syphon etc. as applicable.

For instrument air, SS. Pipe shall be used for air distribution from Battery Limit to the designated point of use. Take-off connections to instruments /actuators shall be with suitable size nipples and shut-off valves. Individual air supply shall be provided by 6 mm OD PU tube through an isolating needle valve and air filter regulator.

Perforated Aluminum Trays (minimum 2 mm thick) shall be utilized for routing of signal tubing / cables in field. All cables / tubes in the supporting trays / channels shall be tagged properly. The loading of the cable trays shall not exceed 60 % of the available space. Proper gap between the electrical trays, as per the voltage level, shall be maintained in the cable tray layout. Tray numbers shall be provided at suitable intervals.

Rigid and flexible conduits along with necessary fittings shall be used for cable laying from instrument to JB or instrument to trays etc.

Bureau Indian Standards (BIS)

SN	Description	BIS
1	PVC insulated cables (light duty) for working voltage upto 1100 volts	694-1977 Part I
2	PVC insulated cables (heavy duty) for voltage upto 1100 volts	1554-1976 Part I
3	-- Do -- for voltage 3.3 kV to 11 kV	1554-1976 Part II
4	Specification for polyethylene insulated PVC sheathed heavy duty electric	5959-1970 Part I
5	-- Do -- voltage 3.3 kV to 11 kV	5959-1970 Part II
6	Guide for marking of insulated conductors	5578-1970
7	Code of practice for installation and maintenance of paper insulated power	1255-1967
8	Code of practice for earthing	3043-1966
9	Guide for safety procedures and practices in electrical work	5216-1969
10	Code of practice for installation and maintenance of AC induction motor	5214-1969
11	Code of practice for installation and maintenance of induction Motors	900-1965
12	Code of practice for installation and maintenance of switchgears	372-1975
13	Code of practice for installation and maintenance of transformers	1886-1967
14	Code of practice for electrical wiring installation, voltage not exceeding 650 V	732-1963
15	Code of practice for electrical wiring installation (system voltage exceeding	2274-1963
16	Guide for testing three phase induction motor	4029-1967

Table 2 Pro forma for PCC, DB, Motor Control Centre's Test		
SN	Test Report	
1. Circuit(Breaker/Bidder/Supplier Module Designation/Bus		
2. Insulation resistance (Contacts open, breaker Racked in position)		
a.	Between each Phase & Bus (Mega Ohm)	
b.	Between each phase and earth (Mega Ohm)	
c.	DC and AC control & auxiliary circuits (Mega Ohm)	
d.	Between each phase of CT/PT and between CT & PT circuit if	
3. CT Checks		
a.	CT ratio	
b.	CT secondary resistance	
c.	CT polarity check	
4 Check for contact alignment and wipe		
5 Check/test all releases/ relays		
6. Check mechanical interlocks		
7 Check electrical interlocks		
8 Check switchgear/control panel wiring		
9 Checking breaker/Bidder/Supplier circuits for		
a.	Closing- local and remote (wherever applicable)	
b.	Tripping-local and remote (wherever applicable)	
10	Opening time of breaker/ contactor	
11	Closing time of breaker/ contactor	
Signature and seal of Engineer-in-charge of JDS, Jabalpur		Signature and seal of Engineer-in- charge of Bidder/Supplier

B	Y Phase Amps	
C	B Phase Amps	
6. Temperature rise after 4 hours run		
A	On no load degree C	
B	On full load degree C	
C	Ambient temperature during test degree C	
7. Operation of thermal overload relay		
A	At normal Full Load current of motor	
B	At twice Full Load current of motor trips in Seconds	
Signature and seal of Engineer-in-charge Of JDS, Jabalpur.		Signature and seal of Engineer-in- charge of Bidder/Supplier

Table 4		
Pro forma for Testing Cables		
Sr. No	Test	Report
1	Date of Test	
2	Drum Number (from which cable is	
3	Cable From -> To	
4	Length of run of this cable (meter)	
5	Insulation resistance test (In Mega Ohm)	
A	Voltage of Megger Volts	
B	Between core-1 to earth	
C	Between core-2 to earth	
D	Between core-3 to earth	
E	Between core-1 to core-2	
F	Between Core-2 to Core-3	
G	Between Core-3 to Core-1	

6	High Voltage Test (Voltage Duration)	
A	Between Cores and Earth	
B	Between Individual Cores	
Signature and seal of Engineer-in-charge of JDS, Jabalpur.		Signature and seal of Engineer- in- charge of Bidder/Supplier

Table 4		
Pro forma for Testing Cables		
Sr No	Test	Report
1	Date of Test	
2	Drum Number (from which cable is	
3	Cable From -> To	
4	Length of run of this cable (meter)	
5	Insulation resistance test (In Mega Ohm)	
A	Voltage of Megger Volts	
B	Between core-1 to earth	
C	Between core-2 to earth	
D	Between core-3 to earth	
E	Between core-1 to core-2	
F	Between Core-2 to Core-3	
G	Between Core-3 to Core-1	
6	High Voltage Test (Voltage Duration)	
A	Between Cores and Earth	
B	Between Individual Cores	
Signature and seal of Engineer-in-charge of JDS, Jabalpur.		Signature and seal of Engineer- in- charge of Bidder/Supplier

Table 5				
Recommended Cables Sizes For Industrial Wiring				
3 ϕ 415 V Motor HP	Aluminum Conductor Cable Size (in mm ²)			
	Rotor Resistance Starter		Star Delta Starter	
	Supply side	Motor Side (2 Cables)	Supply side	Motor Side (2 Cables)
10	6	6	6	4
15	10	10	10	4
20	16	16	16	6
25, 30	25	25	25	10
40	35	35	35	16
50	50	50	50	25
60	70	70	70	35
75	95	95	95	50
100	120	120	120	70
125	150	150	150	95
150	225	225	225	120
180	300	300	300	150
215	300	300	300	185

Table 6		
Sizing of Earthing Lead/ Wire		
Sr No	ITEM	Size
1	Control switches	G.I. wire 14 SWG
2	Motor upto 10 HP	G.I. wire 8 SWG
3	Motor above 10 HP unto 125 HP	G.I. strip 25 x 3 mm
4	Motor above 125 HP	G.I. strip 25 x 6 mm
5	Switch Board	G.I. strip 25 x 6 mm
6	Power control centre/ LT panel of sub-station	G.I. strip 40 x 6 mm

Section-1

SPECIAL CONDITIONS OF CONTRACT FOR MECHANICAL WORKS

PART-IV

CONTENTS

- 1. Mechanical Installation**
- 2. General Installation**
- 3. Service Piping Installation**
- 4. Special Instructions and specifications**
- 5. Insulation of Piping and Equipment**
- 6. Interconnections of Service and**
- 7. Electricals with equipment**
- 8. Guide lines for expansion work**
- 9. Cleanup of Works Site**
- 10. Cleaning chemicals and lubricants**
- 11. Testing, commissioning and start-up**
- 12. Painting**
- 13. Training of personnel**

1.0 MECHANICAL INSTALLATION

The installation work would comprise:

General installation i.e. positioning and installing all the processing, miscellaneous and service equipment as per approved layout drawings and as per the contract.

Supply and installation of structural platforms and tables.

Supply and installation of all service and product piping including ancillary items.

Insulation and cladding of piping and equipment including supply of materials.

Interconnections of services and electrical with equipment.

Guide line for expansion work.

Clean up of work site.

Supply of all cleaning chemicals (except CIP chemicals) and lubricants.

Testing, commissioning and start-up.

Painting including supply of paints as approved by the Owner.

Training of personnel.

GENERAL INSTALLATION

Positioning of Equipment

The work involves preparation of access for moving of the plant and equipment including their fittings from the work site go down or from the place within the site where they have been unloaded, to the place of erection, decorating and placing on the foundation wherever required. All the civil foundations as per the manufacturer/supplier's drawings shall be arranged by the Owner. The Supplier shall place the equipment and carry out final adjustment of the foundations

including alignment and dressing of foundation surface, embedding and grouting of bolts and bed plates. The Supplier shall be responsible for obtaining correct reference lines for purpose of fixing the alignment of various equipment from master benchmarks provided by the Owner.

Tolerances shall be as specified in equipment manufacturers drawings or as stipulated by the Owner's Engineer. No equipment shall be permanently bolted down to foundations or structure until the alignment has been checked by the Supplier and witnessed by the Purchaser. The Supplier shall carry out minor alterations in the anchor bolts, pockets etc., at no extra cost and set the equipment properly as per approved layout, drawings and manufacturer's instructions. The Supplier shall supply all the necessary foundation/anchor bolts and bedplates if required without extra cost.

The Supplier shall supply, fix and maintain, at his own cost, during the erection work, all the necessary centering, scaffolding, staging required not only for proper execution and protection of the said work but also for protection of the surrounding plant and equipment. The Supplier shall take out and remove any or all such centering, scaffolding, staging planking etc., as occasion shall require or when ordered to do so and shall fully rein-state and make good all things disturbed during execution of the work, to the satisfaction of the Owner. The Supplier shall be paid no additional amount for the above.

Structural Platforms, Service Pipe Bridge and Tables

Structural platforms shall be required to provide access for various equipments. Pipe support bridges/gantry shall be required for supporting the pipes from the ground, including road crossings outside the buildings. Tables shall be required for handling milk/milk products. These platforms, bridges/gantry and tables shall be fabricated keeping stability and other functional as well as aesthetic requirements into consideration as approved by the Owner. The payment shall be made on the basis of the actual weight executed and the unit rates agreed upon or as per provisions made in the contract for such items.

The purchaser shall arrange for any civil works required for the above works based on the drawings and load details provided by the bidder. Necessary templates and other accessories required by the civil contractor shall be provided by the bidder.

SERVICE PIPING INSTALLATION

General Guidelines

All piping systems shall comply with the latest editions of the following regulations wherever applicable.

Regulations of explosives inspectorate.

All applicable Indian Standards.

All applicable State Government/Central Government laws/acts.

The successful Tender has to prepare all erection drawings of the proposed plant including equipment positions and service-piping positions (Isometric), spacing between pipes, all other relevant details and submit these drawings to JSDS for approval.

Scope of Supply

The Supplier shall supply all piping materials like pipes, fittings, flanges measuring instruments and all other items as shown in the flow diagram/specifications and schedule of quantities. All the pipes & fittings and insulation material etc. should be of class and make as approved by the Owner. Prior approval of the Owner must be obtained by the Supplier for the class and make of all materials. The Supplier should furnish the details of makes selected by him, in the prescribed proforma.

Scope of Piping Erection

This to be performed by the Supplier as outlined below:

The scope of erection for piping, includes all system covered in the flow diagrams and specifications.

The Supplier's work commences/terminates at the pipe connections with valves or flanges as specified in flow diagrams/battery limits.

The Supplier shall also install necessary pipings and any specialties furnished with or for equipment such as relief valves, built-in-pass and other items of this type.

The Supplier shall install primary elements for flow measurements, control valves and on-line metering equipment.

The Supplier shall perform necessary internal machining of pipes for installing orifices, flow nozzles, control valves etc.

The Supplier shall install all pipes, valves and specialties being procured from other sources.

Testing of Piping

The Supplier shall test all piping systems mentioned below including valves and specialities and instruments as per procedure mentioned under:

1. Steam piping
2. ETP raw water
3. ETP soft water
4. Soft and raw water
5. Air
6. SS Piping
7. Ammonia

All piping shall be internally cleaned and flushed by the Supplier after erection in a manner suited to the service and as directed by the Owner.

For hydrostatic testing and water flushing, the Supplier shall furnish necessary pumps, equipment, instruments and piping etc.

The details of testing pressures for various pipelines are mentioned below:

Sr. No.	Name	Test pressure	Test medium
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All piping shall be suspended, guided and anchored with due regard to general requirements and to avoid interference with other pipes, hangers, electrical conduits and their supports, structural members and equipment and to accommodate insulation and conform to buildings structural limitations. It is the Responsibility to the piping Supplier to avoid all interference while locating hangers and supports.

Anchors and/or guides for pipelines or for other purposes shall be furnished, when specified, for holding the pipeline in position for alignment. Hangers shall be designed fabricated and assembled in such a manner that they cannot become disengaged by any movement of the support pipes.

All piping shall be wire brushed and purged with air blast to remove all rust, mill scale from inner surface. The method of cleaning shall be such that no material is left on the inner or on outer surfaces, which will affect the service-ability of the pipes.

Effective precautions such as capping and sealing shall be taken to protect all pipe ends against ingress of dirt and damage during transit or storage. The outside of the steel pipes (black) shall be painted with two coats of red oxide paint or as directed by the Owner.

All pipes in the corridor shall be supported from the sidewall.

Pipe support shall be of steel, adjustable for height and primers coated with rust preventive paints and finish coated with dark admiral grey of approved shade. Where pipes and clamps are of dis-similar material, gaskets shall be provided in between. Pacing of pipe supports shall not exceed the following:

Pipe size Spacing between supports

Up to 12mm 1.5m 15 to 25mm 2.0m 30 to 150mm 2.0m Over 150mm 2.5m

Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor slab by clamps or collars attached to pipe and with a 15mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at a lower point and air vent at the highest point.

Pipe sleeves at least 3mm thick, 50mm/100mm larger in diameter than the pipes shall be provided wherever pipe passes through walls and slabs. Annular space shall be filled with fiber glass and finished with retainer rings. No extra payment shall be made on account of providing the sleeves.

All piping works shall be carried out in a workman like manner, causing minimum disturbance to the services, buildings, roads and structures. The entire piping work shall be organized, in consultation with other agencies work, so that laying of pipe support, pipes and pressure testing for each area shall be carried out in one stretch.

Cutouts details in the floors and slabs for installing various pipe are to be provided by the contractor immediately after receipt of the purchase order, so as to make the cutouts ready by civil contractor.

The contractor shall make sure that the clamps, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes include expansion joints wherever required.

All pipes shall be accurately cut to the required size in accordance with the relevant BIS code and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matters. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for piping to drain fully. In other locations concentric reducers may be used.

All buried pipes shall be cleaned and coated with zinc chromate primer and bitumen paint, then wrapped with three layers of fiber glass tissue, each layer laid in bitumen.

Auto purge valve shall be provided with all high points in the piping system for venting. Air valve shall be 15mm, pipe size valves with screwed joints. Discharge from the air valves shall be piped through an equal size mild steel, hot galvanised pipe to the nearest drain or sump. These pipes shall be pitched towards drain point.

Tee-off connections shall be through equal or reducing tees. Otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.

SPECIAL INSTRUCTIONS AND SPECIFICATIONS

Steam Piping

Steam piping work can be classified into two categories:

High-pressure steam piping when the working pressure of steam is more than 3.1 kg/sq.cm (50 psi).

Low-pressure steam piping when the working pressure of steam is below 3.1 kg/sq.cm (50 psi).

All the pipes and fittings used for high pressure steam piping work should conform to IBR and they should be IBR certified and also to be identified with number and mark showing that they are tested by the Boiler Inspector and supported with duly authentic certificates to this effect. ALL HIGH PRESSURE STEAM PIPES SHALL BE SEAMLESS TYPE, SCHEDULE 40.

The high pressure steam piping after installation should be hydraulically tested in presence of the Boiler Inspector for his approval.

The high-pressure steam piping work should also include fabrication and installation of pressure reducing stations strictly conforming to IBR.

Chilled Water Piping:

All the piping for chilled water, ammonia, soft and raw water, steam pipes and air shall generally of welded construction. Whenever welding is done for pipes of smaller size special care should be exercised to avoid clogging of flow area with the welding material.

SS Piping;

Generally all SS piping for process and CIP shall be of welded construction. However, SMS unions may be used as per process requirements or as directed by the Engineer-in-charge. The overhead and ground pipe supports for SS piping shall be of SS square sections of suitable wall thickness. The accessories like nipples, clamps, base plates etc. are included in the scope of this package shall be provided by the supplier.

Pipe supports for straight length of SS piping are to be provided at suitable distances as instructed by Engineer-in-charge to avoid any sag or hang in the pipelines.

4.3.2 PROCEDURE TO BE ADOPTED FOR SS WELDING

The SS pipes shall be cut square and joints to be prepared without damage to the electro polishing of the pipes.

The welding shall be done using TIG welding procedure with inert gas masking to prevent oxidation of the joints.

The joints then shall be cleaned using proper abrasive material such as 3M abrasive weld cleaning cloth so that proper polishing is maintained at the weld joints.

Weld penetration of the inner side of the pipe shall be avoided.

INSULATION OF PIPING AND EQUIPMENT

Insulation of Chilled Water and Ammonia Pipeline

All the chilled water pipelines shall be insulated by expanded polystyrene or polyurethane foam or any other high-grade insulation acceptable to the Purchaser. This insulation could be in pre-formed sections or cast in situ. The insulation with pre-formed sections shall be carried out in the following manner.

Before starting insulation work all pipelines shall be tested for 8.5 kg/sq. cm compressor.

The surface of the pipes to be insulated should be properly cleaned.

Hot bitumen of 85/40 or 85/25 conforming to IS 702 should be applied uniformly @ 1.5 kg per sq.m. on the surface of the pipes.

A similar layer of bitumen should be applied on the inner surface and on the edges of the insulation sections.

The sections should then be stuck to the coated pipes with joints staggered. Adjacent sections should be tightly pressed together.

All joints should be properly sealed with bitumen.

A thick vapour seal of hot bitumen @ 2.5 kg/sq. cm should be applied uniformly on the outer surfaces of the pipe sections and allowed to dry.

In case the insulation sweats or the specified/required insulation properties are not attained, the entire insulation in such region shall be redone with fresh material, entirely at the Supplier's cost.

The thickness of insulation may be as per Annexure II.

Note: In situ insulation shall be carried out as per standard procedure.

Insulation of Steam and Hot Water Pipe Lines All the steam and hot water pipelines shall be insulated with mineral wool or equivalent of specified thickness. The insulation shall be carried out in the following manner and should be supplied in the form of properly required sizes.

Clean the surfaces to be insulated. Apply a coat of red oxide primer and fix glass wool/mineral wool of specified thickness, tightly to the pipes, butting all joints and tie with lacing wire.

It should then be covered with GI wire netting of 20 mm x 24 SWG.

In case the insulation does not have the desired insulation properties, the entire insulation will have to be redone at the Supplier's cost to give the desired results.

In case of condensate return piping all the steps mentioned above shall be executed except that thickness of the insulation shall be 25 mm.

Aluminium/GI Cladding

The chilled water, ammonia, water, & hot water lines after insulations shall be covered by Aluminum/GI cladding the payment will be made as per the executed items.

Aluminum cladding will be done with 22-gauge aluminum sheet with proper roves and overlaps and screwed in position with 12 mm. self- tapping parker screws.

GI sheet cladding will be done with 22 gauge sheet with proper grooves and overlaps and screwed in position with 12 mm self tapping parker screw. The GI sheet cladding will finally painted 2 (coats) by approved shade and quality of paint.

All the necessary materials of quantity and make approved by the Owner, equired for carrying out insulation, cladding and other works mentioned above, shall be supplied by the Supplier.

INTER CONNECTIONS OF SERVICE AND ELECTRICALS WITH EQUIPMENT

The Supplier shall lay service piping and provide connections with the equipment complying strictly with the equipment manufacturers' instructions. The Supplier shall also carry out all the interconnecting service piping with the various items of plant/system. The work shall be complete with capillary piping if required and connections with instruments and controls supplied with the equipment.

The Supplier shall also carry out electrical connections for equipment with the control panels including equipment lighting as per the wiring diagrams of the equipment suppliers.

Connection shall be made for small electrically operated devices on equipment installed as accessories to, or assembled with equipment. Connections regarding instruments, float switches, limit switches, pressure switches, thermostats and other miscellaneous equipment shall be done as per manufacturers' drawings & instructions.

GUIDELINES FOR EXPANSION WORK

Shutdowns

Plant shutdown shall be required for making tapping/ interconnections of the new equipment proposed to be installed under expansion with the existing equipment. These shut downs should be planned carefully well in advance to enable the Owner to take suitable actions for ensuring normal Plant operations. The details of shut downs; the numbers and duration should be worked out and intimated to the Owner for approval. The Supplier should ensure completion of all the necessary works well within the allowed time so that no inconvenience is caused in regular operation and working of the existing plant.

Cleanliness

Wherever the Supplier is required to work in existing plant area he should take due care and extra precautions to ensure absolute cleanliness and minimum hindrance for proper working of the existing plant.

Change over

The programmers for change over from existing plant system to new plant system should be prepared by the Supplier and should be got approved by the Owner.

Modifications and rectifications of existing plant and equipment

During expansion work, the Supplier shall be required to carry out modifications, repairs/replacement of the existing equipment. The alterations/modifications not specified in the contract/order and or minor in nature requiring not more than 24man-hours for each item, will be carried out by the Supplier without any extra cost. However, if the modifications are of major nature and if not specified in the Contract/order, the Supplier shall be paid for such works based on man- hour rates.

CLEAN UP OF WORKS SITE

All soils, filth or other matters of an offensive nature taken out of any trench, drain or other places shall not be deposited on the surfaces, but shall at once be carted away by the Supplier from the site of work for proper disposal.

The Supplier shall not store or place the equipment, materials or erection tools on the drive ways and passages and shall take care that his work in no way restricts or impedes traffic or passage of men and materials during erection. The Supplier shall without any additional payment, at all time keep the working and storage area used by him free from accumulation of dust or combustible materials, waste materials rubbish packing, wooden planks to avoid fire hazards and hindrance to other works.

CLEANING CONDITION AND LUBRICANTS

The necessary quantities of cleaning chemicals, lubricants, etc. required for the installation and commissioning, testing and start up of all the equipment till handing over are to be supplied the contractor and nothing extra would be paid for these.

TESTING, COMMISSIONING AND START UP

The contractor shall operate, maintain and give satisfactory trial run of the plant for a period of continuous 30 days (Thirty Days) at the rated output, after satisfactory commissioning and start-up of the plant. All rectification of damages / defects and routine troubleshooting should be carried out by the contractor. The contractor shall incorporate / execute necessary minor modifications during the trial period for maximizing operational efficiency. The contractor should also execute minor modifications as may be suggested by the purchaser. The contractor shall suggest recommended log sheet proformas for recording necessary operating data and pass it on to the JSDS in proof of satisfactory rated output and performance of the equipments / plant.

The commissioning shall also include the following for each equipment:

Field Dis-assembly and assembly.

Clean out of lubrication system including chemical cleaning wherever required.

Circulation of lubricant to check flow.

Clean out and check out of all the service lines.

Check out and commissioning of instruments, equipment and plants, filtering of transformer and other oils so that if deteriorated, they shall attain the required properties/standards, specified tests in this regard must be carried out by approved authorities and their satisfactory reports submitted to the JSDS before start-up.

Recharging or make-up filling of lubricant oil up to the desired level in the lubrication system of individual machine.

Operation in empty condition to check general operation details wherever required and wherever possible.

Closed loop dynamic testing with water wherever required.

Operation under load and gradual load increase to attain maximum rated output.

Trouble shooting during the trial period.

The Contractor shall demonstrate proper working of all mechanical and electrical controls; safety and protective device, in presence of the JSDS's engineer and the same should be duly recorded.

After conducting testing, in case a particular equipment is not working properly or not giving rated output the Contractor will furnish a detailed report to the JSDS stating therein the detailed account on the performance of the equipment with possible reasons for improper or not working of the same in case such equipment is supplied by JSDS.

The JSDS after receipt of report from the Contractor would take up the matter with the manufacturers and if required would invite the representative of original manufacturers. In case the jsds considers that the nonperformance of equipment is only due to in-experience of the Contractor, then the charges incurred for the manufacturer's representative visit would be debited to the Contractor's account.

In case of turnkey contracts, the contractor shall furnish a detailed account of the performance of all the equipments. In case any particular equipment fails to perform properly or at its rated output, then the contractor shall take up the matter with the original manufacturer, under intimation to JSDS. In case JSDS considers it necessary, the contractor shall invite, at his own cost, the technical personnel of the original manufacturer to visit the site & carry out necessary rectification/modifications to get the rated performance. In case the contractor fails to do so within 7 days of receipt of instructions from JSDS, the

JSDS shall take necessary action to invite the representatives of the Original manufacturer to visit the site & the cost of such visit(s) shall be debited to the contractor's account.

Further before commencement of testing of commissioning, the JSDS reserves the right to invite the original manufacturer's representative at the cost of the Contractor for start-up help, assist and guide the Contractor during commissioning in the following cases:

- a) The Contractor has no previous experience of commissioning and start-up of the similar equipment
- b) If the Contractor is not capable to commission and start-up of certain specific equipment.

However, in either of the cases the manufacturer's representatives would be called with prior information to the Contractor and the Contractor will have to extend all co-operation to such representatives in good spirit and in the interest of the work.

After satisfactory commissioning and start-up the Contractor shall keep his representatives under whose supervision the JSDS's staff shall be operating and maintaining the plant and equipment for the trial run period of 30 days. The Contractor's representatives should be present at all times during the running and operation of plant and equipment. During this period the Contractor shall ensure proper working of complete plant and equipment and attend any works required to be done and shall also take complete responsibility for proper operation and maintenance of the complete plant and equipment.

11.0 PAINTING

All the equipment/machineries like motors, pumps, HT / LT panel, transformer, switch boards, starters, junction boxes, isolators, storage tanks, supporting structures, pipe supports and MS / GI pipes and all exposed and visible iron parts included in the scope of erection / commissioning shall be given double coat of paint of approved shade over a double coat of anti-corrosive primer wherever necessary.

Irrespective of the condition of original paint of equipment / machineries / structures / supports. All surfaces wherever required must be properly cleaned from scale, dirt and grease prior to painting. Spray painting must preferably be used on all the equipment / machineries and wherever practicable. Suitable and necessary cleaning / wiping of sight

/ dial glasses, other non-metallic parts, flooring, walls and other surfaces which have been spoiled by paint during painting must also be carried out by the Contractor.

Lettering and other markings, including capacity and flow direction markings, shall also be carried out by the Contractor on the tanks, pipe lines, starter's, motors, isolators and wherever else necessary, as directed and as per the standard practice of installation. ISI colour codes and colour charts as mentioned below must be adhered to. Supply of all paints and all other materials required is included in the scope of supply of the Contractor under this contract/order.

TRAINING OF PERSONNEL

Necessary staff as may be deputed by the JSDS shall be trained by the Contractor for operating the plant. The personnel will be associated for the training during the installation, testing, commissioning, start-up and trial run period and the training tenure shall be extended for a minimum period of one month from the date of commissioning and start-up.

Section II -

- 1. Background .**
- 2. Project introduction and General informations of the project**
- 3. Design basis.**
- 4. Work scope and technical specifications**
- 5. Bill of quantities.**

Sub section-1. Background:

Dairying was hardly known as an organized activity at the time of formation of the State of Madhya Pradesh in 1956. The dairy trade was unorganized and largely under the control of milk traders, middlemen and vendors. Dairying, although a subsidiary activity in relation to agriculture, provides many rural families with their only source of continuous income. Lately, the concept has undergone a lot of change owing to the participative and interactive approach having been organized on proper lines as an integrated and inter-linked activity involving production, processing and, marketing.

The Cooperative Dairy structure has played the role of a development agent and has an important participant in the rural development program initiated by the Government to generate subsidiary employment & alleviate poverty. The Cooperative Dairy structure in the State was created under the Operation Flood(OF) program with the financial support of National Dairy Development Board(NDDDB).

MP State Cooperative Dairy Federation Ltd(MPCDF) is the apex body of the 3 tier dairy cooperative structure in the State of Madhya Pradesh for organized dairy development. The First Tier – Village level Dairy Cooperative Societies – the DCSs, Second Tier – Central Society i.e. Cooperative Milk Unions, and Third Tier – Apex Society i.e. MPCDF has become the mainstay for almost all dairy development activities in the State.

Jabalpur Sahakari Dugdh Sagh Maryadit , Jabalpur

Jabalpur Sahakari Dugdh Sagh Maryadit , Jabalpur affiliated to MP State Co-operative Dairy Federation Ltd, is collecting processing and marketing liquid milk & milk products and covers Jabalpur, Chhindwara, Balaghat, Seoni, Mandla, Narsingpur, Kani, Dindori, Rewa, Satna, Sidhi, Shahadol, Annoppur, Umariya, Singroli and Panna districts, in February 1981, the main Dairy plant located at Adhartal in Jabalpur was commissioned and in 1989 the main Dairy plant shifted at Katni Road in Jabalpur Presently, the infrastructure at Ujjain milk union comprises –

1.00 LLPD capacity Dairy plant at Jabalpur

3 Mini Dairy Plant, 2 Chilling centre and 26 BMC functioning in the 16 districts in the milk shed area.

The milk union aims at strengthening cooperative dairy structure by assisting rural milk producers of the milkshed area in milk production enhancement thereby, offering them competitive purchase prices for their produce at their door-step and, ensuring qualitative milk & milk products and services, to the urban consumers at reasonable rates. The major activities include – Organization of Village level Dairy Cooperative Societies.

Milk collection from Dairy Cooperative Societies. Providing Artificial Insemination, First aid & Veterinary services to rural milk producing members.

Conducting regular motivation & training programs for scientific methods of milk production to milk producer members of DCS.

Provide balanced cattle feed for high yield on low cost.

Provides services for fodder development in the DCS Villages.

Milk Processing , pasteurization & packing governed by PFA norms.

Manufacturing and packing of different types of milk products.

Distribution of fresh Milk & Milk products through distribution network to the rural and urban consumers.

2. PROJECT INTRODUCTION.

Milk production is a major pillar of rural economy of India. The cattle and buffaloes not only produce milk but also produce dung on a daily basis. For a milk producer, there are several avenues to sell the milk such as to dairy cooperatives or in informal market.

However, the avenue to sell and earn from the dung is limited. Cattle and buffalo dung has several well known uses such as in cooking and as fertilizer. But the dung has never been treated as a commodity to be sold for regular income.

Propagation of biogas plants across the country had the potential to make efficient use of dung to convert it into a clear cooking fuel and produce nutrient rich bio slurry for usage in Agriculture fields. But due to limitations of technology, challenges in implementation, the initiative still has not been taken off as

expected. Farmers also do not opt for biogas much as they generally value monetary earnings more than the non-monetary savings.

HIT received a request from Madhya Pradesh State Cooperative Dairy Federation (MPSCDF) dated 08 March 2022 to analyze the feasibility to setup a Bio-CNG plant to be operated with cattle dung as input, at Jabalpur Sahakari Dugdh Sangh Maryadit(Jabalpur Milk Union).

It may be mentioned that there are hundreds of dairy farms in the city and the herd size ranges from 100 to 2000 animals –mostly buffaloes. Since Jabalpur is listed under Smart City Project, as a part of clean city initiative, the Jabalpur Municipal Corporation plans to procure the dung from large dairy farms by Jabalpur Milk Union to produce Bio-CNG. The Bio-CNG generated is proposed to be primarily supplies to the vehicles of Jabalpur

Municipal Corporation. In case of any surplus, the surplus Bio-CNG is planned to be sold in the open market.

Jabalpur Milk Union plans undertake this project in a phased manner. In the first phase, a biogas plant of 50 MT dung handling capacity will be setup in the premises of Jabalpur Milk Union. Based on the experience of the first phase, the project may be expanded to handle 150MT dung per day.

Biogas based power generation

Under the biogas based Bio-CNG generation project at Jabalpur, a biogas plant of 6000 cubic meter capacity is proposed to be setup. This biogas will be purified and compressed to produce Bio-CNG. At full capacity, it will generate about 2400kg Bio-CNG per day.

The proposed plant will use 150 MT of dung per day which shall be aggregated from minimum 4-5 thousand dairy animals (at about 10-20 kg per animal) within radius of about 2-3 km of the dairy plant. The bio slurry produced from the biogas plant shall be separated in to solid and liquid parts through a screw press. The liquid portion shall primarily be recycled in biogas plant and some portion shall be given away as liquid organic fertilizer to farmer as per demand.

About 40 Tones of Organic Manure with PROM is expected to be produced on basis which shall be sold at very reasonable rates covering cost of operations and ensuring long term viability. Large scale propagation of organic fertilizers is expected to reduce dependency on chemical fertilizers and improve soil health in the region.

The milk union has earmarked the land to setup a Bio-CNG station ,which will primarily cater to the vehicles of the Municipal Corporation and also sold to public.

Outcomes of the Project

The project is expected to result in multiple benefits not only limited to satisfying the Bio- CNG needs of the vehicles of Jabalpur Municipal Corporation. This will also help reduce menace of dung in the city area, which is otherwise piled up on roadsides to convert it into dung cake.

This purchased dung while producing biogas, will also produce high quality bio slurry. The organic fertilizer producing from this surry, will be available to farmers at very reasonable rates which will help them reduce their use of chemical fertilizer while significantly increasing yield and improving soil health. While the union presently proposes to limit to production and scale of organic manure and bio slurry liquid only, it may create facilities in future that is required for producing value added fertilizers like Phosphate Rich Organic Manure (PROM) , Micro Nutrient Rich Liquid(MRL) etc.

This project provides a potential that the milk union would be able to cover the operational costs of Bio-CNG generation through the supply of Bio-CNG to the Municipal Corporation and also cover the costs of fertilizer production through the scale of organic fertilizers.

This initiative will help in environment protection as it is aimed to partially replace the use of conventional fossil fuel such as diesel. The benefits of carbon credits shall also be explored at an appropriate stage, which shall further enhance the benefits of the project.

Sub-section-2. General information of the project.

Project Details& Address of the Site:

Name of the Project : Bio CNG Plant
New/Expansion project : New Project

Address:

Site Survey No. : SY. NO. 00056 / 59
Village : Imaliya Village,
Tehsil : Panagal
District : Jabalpur. District.
State : Madhya Pradesh
Pin code : 462010

ACCESSIBILITY TO PROPOSED LOCATION OF THE PROJECT:

S.no.	Particulars	Name	Distance from site Project (km)
1	Nearest Tehsil/Block	Panagal	3
2	Nearest Road Head	Jabalpur-Kotha road	0
3	Nearest Railway station	Jabalpur	10
4	Nearest Air Port	Jabalpur	5
5	Nearest Grid/ sub station	Imaliya	05
6	Local electrified/ non-electrified	Electrified	

5.4 Other Details

Grid Connectivity Captive/ Off-grid : off-grid
Type of output : Bio CNG
Waste Details :Waste Category (Agri Raw Material) : Animal dung
Type of Waste : Solid
Quantity/effluent treated : 20Tons/day in the plant per dayPlant
area (private land) : **2.5 acers**

Technical Details.

Waste energy Process : Bio methanation

Installed capacity/day

Installed capacity of bio gas :6000
plant/digester (m³/day Bio fertilizer/ Manure Production : 20 Tons Liquid Fertilizer
Capacity of bio gas generation (m³/day : 6000Type of
digester : Modified KVIC model digester
No. of digester :2

Bio CNG generation plant details

Proposed capacity of bio CNG : 2400 kg/day
 Bio gas purification technology : water scrubbing/Pressure Swing Adsorption & Membrane Purification System
 Bio CNG Usage : Vehicle fuel

Bio fertilizer generation plant details Production – Dry : 20 tons (tons/day)

Production Liquid(kl/day) : 3300 KL

Source of raw Material : Procurement of dung from the dairy farmers

Sub section-3. Design basis and technical specifications

2400 kg Bio-CNG plant designed based on animal dung to produce Bio-CNG

The gas generation value of 1 Metric Tons of animal dung would be 50 m³ of Biogas in its conversion to Bio-CNG through purification process which could yield 20 kg Bio-CNG. Further proposed to install 2400kg Bio-CNG Project duly collaborating with the surrounding and neighboring dairy farmers anticipating the supply of 150 tons dung every day.

The animal dung material main raw material to the project is being available all over the year i.e., 365 days and Bio-CNG can be used in CNG vehicles in CNG Filling Stations, and also in order to replace LPG wherever required such as hotels, hostels and restaurants etc.

The present proposed Project is near to Jabalpur. The KVIC Digester is preferred for generating required Biogas we will install purification system for the removal of CO₂ to enrich methane content more than 95%. We will install 250 bar compressors could enhance of biogas pressure from about atmospheric to 250 bar. We install required decanter (liquid solid separator) for the recycling of the water from slurry over flow from the outlet of the Digester. The project will function successfully for a period of 15 years supported by proper maintenance.

The site is sufficient and quite enough i.e., more than 2.5 Acre land for taking up the construction of 2400 kg Bio-CNG. The site has sufficient ground water to cater the needs of the proposed project. The probable temperature would be 15° to 42° Celsius throughout the year. To install hot water system to enhance the temperature from 15° to 25° by using recirculation pipes in the digester. We will purchase 250bar cylinders for storage of the purified Bio-CNG and using cascades to carry the cylinders through CNG trucks to the CNG filling station.

Thus, the project could achieve the ambitions as defined in both “Swatch Bharat” and “Waste to Energy” programmed of the Government of India.

Site Location:

Village : Imaliya

Tehsil : Panagal

District : Jabalpur

Graphical Co-ordinates : Latitude:23°18'15" N Longitude: 79°9'86" E

Climate Conditions : Temperature 45.3° C max, 3.1° C Min

Humidity : 36 % max, 30% min Rainfall

: Approx. 1208 mm.

Dairy Farms : 100's of Farms within 5 KM

Raw Material: Abundant availability of the raw material of animal dung can be Collected within 5km from Jabalpur which sufficient the need of feed material to run the plant Testing Report of the cow dung Anxure-III)

Details	Dung
pH	6.37
TS(%)	17.01
VS (%) from TS	76.72
Ash (%)	3.96
Organic Crobon(% from VS)	44.52
Total Nitrogen (%)	1.7
Prosphates	0.54
Potash (as k2o2) %	1.72
Conductivity (Ns/cm)	2398

Animal dung with co-digestion with Energy Plantations (Short Rotation Plants)

The Project designed by combined Raw Material of using Cattle dung, Napier Grass, Vegetable and food waste available in the nearest.

SOURCE OF WATER AND ITS TREATMENT

(A) Water Sourcing

The water requirement for the 150 cum/day Bio gas Plant. 100 cum water shall be collected from milk processing unit ETP Plant.50 cum water from the outlet slurry tank.

Water Testing Report:

The details as per the Water Testing Report are mentioned below.

Sl. No.	Test	Result	Limits	Test Method
1	pH value	7.41	6.5 – 8.5	IS:3025:1983 part -11 RA-2017
2	Chloride (cl)	18.53	Max.250	IS:3025:1988 part (32) RA-2019
3	Sulphate(as SO2)	3.91	Max.200	IS:3025:1986 part (24) RA-2019
4	Total Dissolved Solid	166	Max.500	IS:3025:1984 part (16) RA 2017

2.6. Implementation Schedule

The Plant shall be completed within the time schedule of 8 months.

2.7 PROJECT DETAILS:

Sahakari Dugdh Sangh Maryadit. Affiliated to MP State Co-operative Dairy Federation Ltd Ministry of Non-Conventional Energy Sources is encouraging such “waste-to-energy” projects to promote better waste management techniques and resource recovery.

The project has good revenue potential. The sale of the BIO-CNG generated, bio- fertilizer produced contributes to the project revenue.

Advantages of Location

The project site is located under survey numbers (patwarh halk no / khasara no) 00056/ 59, at Imaliya(V) ,Panagar(Tehsil), Jabalpur(Dist). The total extent of land available is 9.120 hect out of 9.120 hect only 1 hect consider to establish the Bio-CNG unit. The site is suitably placed and is within a radius of 5 km from the dairy farms.

Plant is located at Jabalpur Katni Road Highway route it has proper road facility for transport purpose.

The proposed location offers several advantages in terms of availability of raw material, availability of civic amenities, and availability of ground water.

Location detailed Temperature and Rainfall graphs

Graph I – Average Sun Hours Graph for Jabalpur

Graph II– Average Temperature graph for Jabalpur

PRODUCT & ITS USES

Main products of the project are biogas & Manure. The raw biogas has Methane concentration of 60% - 65%. The gas can be purified and the Methane concentration can be increased up to greater than 91% which can be an alternative of Commercial LPG and can be used as fuel for vehicles.

Bio-Manure will be extracted from the slurry with 25% of Solids and the same can be used as fertilizer .PROM technology adapting for enhance of the prosperous value in the Manure

Glossary & Acronyms

Biogas: A mixture of gases, predominantly methane and carbon dioxide, produced by the process of anaerobic digestion.

Aerobic treatment: Degradation and stabilisation of organic compounds by microorganisms in the presence of oxygen.

Anaerobic Digestion (AD): Degradation and stabilisation of organic compounds by microorganisms in the absence of molecular oxygen (bio-methanisation) leading to production of biogas. This term is also used to describe the whole anaerobic treatment process.

Biodegradable: Material that can be broken down into basic molecules (e.g., carbon dioxide, water) by organic processes carried out by bacteria, fungi, and other microorganisms.

Degradation: A particular type of gradual decomposition of organic matter that usually proceeds in well-defined stages resulting in products with fewer carbon atoms than the original material. The term is often applied to decomposition by microorganisms.

Digestate: The solid and/or liquid material remaining after undergoing anaerobic digestion; often still high in nutrient content (*see effluent*).

Digester: An enclosed tank, cylinder or silo in which anaerobic digestion of organic wastes takes place. In this book, the term reactor is used as synonym for digester.

Carbon dioxide: A colorless, odorless, non-flammable gas and one of the two main constituents of biogas; chemical formula CO_2

Effluent: The liquid that remains after a treatment or separation process; it refers to liquid which has gone through some type of clarification, settling, or biological process, flowing out of the digester.

Feedstock: Organic input material for subsequent treatment by aerobic or anaerobic processes. This material may vary in terms of particle size, moisture content (solid and/ or liquid wastes) and ease of degradability.

Gasholder: A separate structure that receives and stores biogas produced in a digester. The digester and the gasholder are part of the AD system.

Hydraulic Retention Time (HRT): Defines the (average) amount of time that liquid and soluble compounds stay in a reactor. It has the unit of time and is calculated by dividing the volume of the reactor by the flow.

SRT: Solid retention time percentage in the bio gas Digester.

Hydrogen Sulphide: A colorless, odorous and corrosive gas which is found as a minor constituent of biogas; chemical formula H_2S .

Inorganic matter: Material, such as grit, inorganic salts, metals, glass etc., which is not degraded by microorganisms.

Mesophilic: Microbial processes that take place in the moderate temperature range of 20 – 45°.

Methane: A colorless, odorless, flammable, gaseous hydro carbon present in natural gas and formed by the anaerobic decomposition of organic matter; chemical formula CH_4 .

Hydrolysis: The first step. Bacteria starts decomposing the long chains of the complex carbohydrates, proteins and lipids breaking them into small degradable chains of oligosaccharides

Acidogenesis: The second stage of the conversion of large organic molecules to volatile fatty acids.

Acetogenesis: In this third stage both long chain fatty acids and volatile fatty acids and alcohols are transformed by acetogenic bacteria into hydrogen, carbon dioxide and acetic acid.

Methanogenesis: The final conversion stage of acetic acid and hydrogen into biogas.

Municipal Solid Waste (MSW): Wastes generated by settlements, which includes households, commercial and industrial premises, institutions (schools, healthcare centres, prisons, etc.), and public spaces (streets, bus stops, parks and gardens). **Organic Loading Rate (OLR):** The substrate quantity fed into the reactor volume in a given time. The unit is Kg substrate (VS)/m³reactor per day.

Organic matter: Material from animal and vegetable sources which can be degraded by microorganisms.

pH: Measured as concentration of hydrogen ions in a solution and used as an indicator of acidity (pH<7) or alkalinity (pH>7).

Post-treatment: Treatment of the outputs from the anaerobic digestion process (effluent/digestate and/or gas) to further remove pollutants or pathogens.

Pre-treatment: Treatment of feed stock before filling into the digester (size reduction, sorting, etc.,).

Slurry: A semi-liquid mixture of organic material, microorganisms and water (*see effluent*).

Solids Retention Time (SRT): The average length of time solid material remains in a reactor.

SRT and HRT are equal for complete mix and plug flow reactors. Some two-stage reactor concepts decouple HRT from the SRT allowing the solids to have longer contact time with microbes while maintaining smaller reactor volume and higher through put.

Stabilisation: The degradation of organic substances by aerobic and/or anaerobic microbial populations to yield biochemically stable products.

Thermophilic: Microbial activity at a relatively high temperature, in the range of 50–65°C.

Total Solids (TS): When a water or sludge sample is filtered and dried at 105 °C, the residue that remains is referred to as the Total Solids. It is measured in mg/L (mass per volume) or as a percentage of wet weight. Moisture content plus TS (both expressed as percentage of wet weight) equal 100 percent.

Volatile Solids (VS): The organic matter in a sample, usually expressed as a percentage of the Total Solids.

2. List of Acronyms

AD: Anaerobic Digester

CHP: Combined Heat & Power CBG:

Compressed Biogas CNG: Compressed

Natural gas

OMC: Oil Manufacturing Companies DPR:

Detailed Project Report

GDP: Gross domestic Product INR: Indian

National Rupee IRR: Internal rate of
return

IS: Indian Standard

LCV: Light Commercial Vehicle

MNRE: Ministry of New and Renewable energy PESO:

Petroleum & Explosive Safety Organization

SALIENT FEATURES OF THE PROJECT

- Sahakari Dugdh Sangh Maryadit. Affiliated to MP State Co-operative Dairy Federation Ltd for setting up of Compressed Biogas unit with capacity of 24000 Cum raw BioGas per day (Equivalent to 2.4T BioCNG per day) based on cattle dung, and other agro residue etc. in Imaliya(V), Panagar(Tehsil), Jabalpur(Dist), Madhya Pradesh. Implementation Schedule the Plant will be completed within the time schedule of 8 months.

Project Location: -The proposed project is to be set up in the Imaliya village , about

7 km from Jabalpur.

- **Raw Material:** -The Biogas Plant will be designed to animal dung as the potential feedstock.
- **Feedstock Availability:** - About 200 dairy farms in District Jabalpur and output is 9,00 tons dung availability of surplus dung is more than 6 times the feedstock requirement for proposed 2400 cum/day Biogas plant.
- **Biogas & Biomethane:** - Biogas production, through anaerobic digestion of, would range 50 cubic meter/day ton of dung. Biogas production from dung or co-digestion of dung with Agri residues and other bio-waste is commercially proven technology. Compost would be a Co- Product, in all cases.
- **Biogas upgradation:** - involves removal of H₂S (<20 ppm) and CO₂ (<4%) to be suitable for transport application. Methane content would be 95% and Methane losses maintained <0.5%. Upgraded Biogas (95% methane) has heating value, per cu m, close to 0.9 liter of Petrol or 0.8 Kg of LPG. Compressing upgraded Biogas would produce Bio-CNG which could be an effective transport fuel.
- **Technology Selection Criteria:** -Biogas upgradation involves removal of H₂S (<20 ppm) and CO₂ (<4%) to be suitable for transport application. Methane content would be 95% and Methane losses maintained <0.5%.
- Bio CNG Potential in India
- **INDIA – IMPORT DEPENDENCE IN OIL & GAS:** - India's Oil Import dependence, in FY 2018-19, surged to 84%, a totally contrarian trend to target of 67% by 2022 that was set by the Prime Minister. Speaking at the 'Urja Sangam' conference in March 2015, the Prime Minister had said that India needs to bring down its oil import dependence by 10% by 2022 (viz from 77% in 2013-14 to 67%), when India will celebrate its 75th year of independence. Further, the dependence can be cut to half by 2030, he had said.
- **Bio-CNG Potential in India (a) From FARM WASTE:** - Biogas produced from agriculture residues and manure can be upgraded to Bio-CNG and displace Auto LPG & CNG in rural areas. As per Study done by KPMG for Skills Council of Green Jobs (SCGJ), there is significant amount of surplus Farm waste, viz

TRANSPORT APPLICATION PERSPECTIVE: - Established Indian manufacturers of CNG Buses (Tatas & Ashok Leyland) as well as for LCVs (Tatas, Mahindra's) & Cars (Maruti) will pursue Bio-CNG vehicles market, as and when they see visibility of Bio-CNG supplies. Swedish companies (Volvo/ VCEV, Scania) which have established their presence in Indian market, as well as potential entry of US & Chinese companies can further enhance availability of CNG Vehicles in India (which are compatible with Bio-CNG) In summary, CNG Vehicles production is anticipated to scale up with CGD networks spreading to 300 Districts, along with enhancement in CNG retail outlets.

Direct sales: - To Start 'on-site' Bio-CNG Retailing outlet Vehicle filling Station.

6.1. TECHNOLOGY SELECTION

The Proposed Project Designed to Treat 150 MT/day of Dung to produce 2400kg Bio CNG treated by Bio methanation Process (Commonly called Anaerobic Digestion, AD)

Bio methanation

Is the process of conversion of organic matter in waste (liquid or solid) to biogas (rich in methane) by microbial action in the absence of air, known as Bio methanation "anaerobic digestion.

Biogas & Bio-methane:

Biogas production, through anaerobic digestion of lingo-cellulosic Agri residues, can now be effectively done, employing advanced Pre-Treatment technologies. The in Biogas, would range between 300 to 350 cubic

meter/day ton of agri residues. Biogas production from Manure or co- digestion of Manure with Agri residues and other bio-waste is commercially proven technology. Compost would be a Co-Product, in all cases. Upgraded Biogas (95% methane) has heating value, per cu m, close to 0.9 litre of Petrol or 0.8 Kg of LPG. Compressing upgraded Biogas would produce Bio-CNG which could be an effective transport fuel. There is also the possibility to establish upgraded Biogas mini grids in rural Districts, with “Piped Upgraded Biogas” effectively displacing Commercial/Auto LPG or up to 80% diesel firing in D.G. Sets. Biogas & Biogas up gradation technologies are commercialized and field proven. Hence, they can be adopted for large scale replication, with potential to make significant contribution to mitigation of environment pollution as well as enhance access to clean gaseous fuels, even in rural Districts.

BIOGAS TECHNOLOGY

The Indian biogas industry is exploring various substrates for the biogas production and these are mainly municipal solid waste, agriculture residue, press mud, cattle dung, chicken litter, spent wash, bagasse, Agriculture residue such as rice straw is a potential cheap renewable energy resource available in northern part of India and can be converted to clean energy ‘Biogas’ to reduce dependence on fossil resources for energy, rice straw is abundantly. Biogas technology is designed for handling and processing the biodegradable waste resource materials mainly municipal solid waste, agriculture residue, press mud, cattle dung, chicken litter, spent wash, bagasse. These biogas plants serve following purposes:

Generation of good amount of clean energy

Environment friendly disposal of biodegradable waste, which is the need of the hour considering mass pollution everywhere.

Generation of high-quality manure, which would be weed less and an excellent soil conditioner

Environmental protection by helping in maintenance of elemental cycles in the nature

TECHNICAL COMPONENTS

BIOGAS GENERATION SCHEME

Biogas generation from Animal Dung shall include the following process components:

Primary Digester

Anaerobic Digester

Recycle Chamber

Biogas Storage,

Organic Manure

AVAILABILITY OF CATTLE DUNG / NON-WOODY FEED MATERIALS / OTHER-STOCKS

1) Identification of raw material - Cattle dung,

PRE-TREATMENT/SLURRY PREPARATION AND HANDLING.

No. of days Pretreatment to be mentioned for each of the feed-material types: 1 day Estimated requirement of each feed-material per cubic meter of raw biogas:

Animal dung (average is 18% Solids): 50cum raw bio-gas per ton

Manure: 130 kgs per 1ton of Raw material (with 25% of moisture).

Possibility of water recycling : Yes

Size reduction : NA

Type : -

Slurry charging : Pumping

Special equipment for size reduction for slurry Shudder : NA

BIOGAS DIGESTER DESIGN AND SIZING SUITABLE FOR MULTI-FEED STOCK

Digester retention time

(Hydraulic retention time (HRT) / Solid retention time (SRT))

Pre-Digesters : 1 Day
 Main Digester : 30 Days
 SRT : 55%

- ii) Type of high-rate bio-methanation digester : KVIC Modal Digester
- iii) Digester Mode : KVIC Modal Digester
- iv) Digester retention time (HRT) : 30Days
- v) Ability to handle different raw materials : Yes
- vi) Special design manufacturing, operation and requirement. : No Maintenance requirement.
- vii) Indigenous availability, import requirement : Indigenous
- viii) Specific design, operation maintenance : No Requirement
- IX) Specific advantages over conventional Design. : Multiple Feed Design.
- X) Handling, Digester Volume advantage : (High SRT against Low HRT)

BIOGAS STORAGE

Inbuilt in digester or separate storage : Separate balloon

Type : PVC fabric

Special material requirement and (Including infrastructural needs) : No and availability

Expected Life time of the storage : 10 years

BIOGAS UPGRADATION / ENRICHMENT TECHNOLOGY

Water scrubbing—using high/low pressure : water scrubbing / PSA Low Pressure / Medium Pressure

Biological scrubbing : Not Applicable

Chemical scrubbing : Not Applicable

Membrane separation : Not Applicable

PSA, Molecular sieves : Yes Applicable

Any other : Not Applicable

Quality of upgraded gas : up 96 % (CH₄)

Utilities, chemicals or any other requirement : No

Availability of technology,

Indian, imported. : Indian

BIOGAS UTILIZATION

Bottling / Cylinder filling, Piped distribution, Balloon, Cooking & heating fuel, Pressure /

Compressed storage, any other. : Cylinder Filling

Power generation for captive utilization : Yes

Boiler fuel : Yes

Vehicle fuel : Yes

Any other (Cooking) : Yes

POST TREATMENT OF DIGESTED SLURRY

Dewatering and recycling system : Yes

Drying, Manure management : in bags

Mechanical, Pneumatic : Mechanical Concentration : Decanter

Composing : Manure with 25% solids Value
addition and packaging : Packing.

7.9. BIOGAS DISTRIBUTION

Pipeline : No

Low pressure cylinder : No

High pressure cylinders / cascade : Yes

7.10 UTILITY REQUIREMENT

i) Power (outside) : 200 kw outside.

iii) Water : 150 KL(Waste Water from ETP-100KL-50 KL (Recycle) iii)Any other

Water : No.

CHEMICALS AND OTHER REQUIREMENTS

Nutrients : No

Flocculants and additives : No

Culture (anaerobic, aerobic) : YES

Chemicals for PSA tech. : No

Any other : No

LAND REQUIREMENT : 2.5 ACERS

OPERATION AND MAINTENANCE REQUIREMENT

Operation and maintenance : Shall be maintained as per Manuals

Spares and tools tackle requirement for maintenance : Shall be provided

Training facility provided : Shall be provided Servicing set up and facility : Provided.

Design Basis Influent characteristics

The substrates' assumed composition and biogas plant load characteristics and are indicated in the tables below

Table 1 : Influent Characteristics per ton: (calculation: - @ 80% production)

Raw Materials	Solids	Bio-Gas output In Cum	Bio-CNG In Kgs
Cow-dung	18%	40	16

Table 2: Bio-CNG Production calculation: - (@ 80% production)

Type of Raw Material	Required Raw material per day in Tons	Bio-Gas Production per day in Cubic Mt	Bio-CNG production per day in Kgs	Manure Production from Bio-CNG plant per day in Tons	Manure production by using PROM technology in Tons
Dung	150	6000	2400	20	40
Total:	150	6000	2400		40

The Project will generate the Following

Bio-Gas : 6000 cubic meters / day

Bio-CNG : 2400 Kgs / day

Organic Manure per day :40 tons per day (20T Organic Manure with using P

Process Design:

Treatment Process : Primary Digester, Secondary Digester, Biogas Biogas up-gradation system & Bottling System and Manure Unit
 Feedstock Load : 150 MT/day
 Primary digester : 1 days
 Secondary digester : 30 days
 Digester characteristics : Civil
 Slurry storage tank : 2 No's

Mechanical components characteristics:

Feed preparation unit : By using mixing equipment dung will be convert into slurry Pumping & Recirculation station : To pass slurry from pre-digester to main-digester

Biogas up gradation system (H2S & CO2 Scrubber) : Bio-Gas will be purified up to 95% purity by using water scrubbing & PSA scrubbing system with 2%-5% losses.

Compressor : Purified Bio-Gas will be bottle By using 250bar compressor

Liquid and Solid manure handling: Manure will be separated with 25-30% moisture by using PROM technology and the same will be packed.

TECHNICAL PARAMETERS

Sl.no	Characteristics	Values	Figures
1	Quantity of Feed stock	Tons/day	150
2	Solid contain in the dung	%	18
3	Solid Loading Ratio	%	10%
4	Total loading quantity per each pre digester per day	Liters	150000
5	Number of Pre-Digesters	Nos	2
6	Dimensions of the pre-digester	M3	6x6
7	Total Volume of each Pre-Digester	m 3	169000
8	Number of Main Digesters	pcs	2
9	Dimensions of the Digester-1	m	27 x 27x 7
10	Digester Volume	m 3	5000
11	Pre-Board in the digester	%	10
12	FRP Dome on digester	No	81
13	Temperature in the Digester	°c	30-40
14	Pressure in the Digester	kPa	0.3
15	Biogas yield for two digesters	m 3 /day	6000
16	Solid Fertilizer yield (25% wet)	Tons/day	20
17	Manure with PROM	Tons/day	40
18	Total Outlet Slurry Water	Lts/day	300000
19	Re-circulation Slurry Water	Lts/day	-
20	Fresh Water	Lts/day	-
21	Liquid Fertilizers (99% wet)	Lts/day	300000
22	Scrubbing System	m3/H	300
23	Compressor	M3/H	150 with 250bar

UPGRADING (PURIFICATION) PLANT DESIGN PARAMETERS.

INLET GAS SPECIFICATION	
B-GAS inlet flow	300 m3/hr
B-GAS inlet pressure	30 m Bar g
B-GAS Pressure by After Blower	0.7 Bar g
B-GAS COMPOSITION	
Methane	55- 58%
Carbon Dioxide	Balance
Hydrogen Sulfide	200 -300 PPM
H2O	Saturated
O2	< 0.3%
N2	Nil
OUTLET GAS SPECIFICATION	
Outlet gas flow (B-CNG)	800T0870 m3/hr
Outlet gas Pressure	0.3 - 0.4 Bar g
B-GAS COMPOSITION as per BIS 16087	
Methane	96% - 97%
Carbon Dioxide	< 3.5%
Hydrogen Sulfide	< 8 PPM (+5 PPM)
H2O	Dew point (-)70 deg C
N2 & O2	Balance

Scope of Work:

The Bio-CNG produced will meet requirements of transport sector i.e., with less than 4% carbon dioxide and the biogas plant effluent would be treated to solids separation to enable production of assured quality compost.

To fix the site boundaries for construction of 2400 kgs. of Bio-CNG plant.

Preparation of Civil designs and drawings for construction of the Digesters and mounting of the machinery.

Preparation of the plans to submit the local authority to get the necessary permissions

Preparation of the structural designs as per Site soil testing report.

Prepared the Plant estimation as per the quotations of mechanical machinery and equipment's as per quotations.

Preparation of technical process flow chart and description of process..

The following are the statutory clearances required for the proposed Biogas/Bio-CNG plant.

Approval for Factory Inspector

Approval for establishing the proposed Biogas/Bio-CNG plant will be obtained from the Chief Inspector of Factories.

Approval for Electrical Inspector

Approval for the electrical installations of Biogas/Bio-CNG Plant as well as Power receiving station etc., shall be obtained from the Chief Electrical Inspector, Government of Punjab.

Approval for Fire Protection systems

Approval from the applicable authorities shall be obtained for the firefighting systems (hydrant system, portable fire extinguishers etc.) proposed to protect the plant & machinery, switchyard, biomass depots, compost yard and other buildings. Appropriate Insurance Policy will be taken.

Approval from Petroleum & Explosives Safety Organization (PESO)

Consent order for establishment from the Petroleum and Explosives Safety Organization (PESO) will be obtained as per Gas Cylinder Rules 2016 under Explosive Act 1884

Consent for Establishment from Pollution Control Board

Consent order for establishment from MP Pollution Control board shall be obtained for air pollution, water pollution and noise pollution. Technology Arrangements

The project designed with a capacity of 6000 m³ Biogas for production of 2400 kgs of the Bio CNG by using 150 tons of the animal dung.

Installation of 2 no's KVIC Model RCC Digesters with 81 compartments to increase surface volume which are covered with FRP Domes system having 3000m³ Biogas generation for each digester.

Installation of VMHR system, (vertical mixing with hot water recirculation system) in two digesters. Where bubble gun units are placed inside of the digester for mixing and Hot Water recirculation system for maintenance of temperature.

Each digester works on bottom mixing system, which has provision of feeding, mixing and |Hot Water Recirculation system for maintenance of temperature.

Working principle of bottom mixing system|: The pre digester slurry is fed into the main digester through bottom mixing system with the help of pressurized pump with continuous mixing and prevention of solids settling. .

Installation of 300m³/hr. Biogas upgrading system by using water scrubbing PSA Technologies.

The scrubbing system is an automatic operation with automatic elements of on-line gas monitoring system to check the gas quality online. For this system we consider gas online analyzes like H₂S, Methane., CO₂ and dew point. (Moisture content)

Installation of 150 cum with 250 bar Gas Compressors.

Installation of PROM Technology to enrich the Manure

Unique Features of Technology

Multi chamber, Multi Domes, Multi Inlets, Multi Outlets Digester to reduce the HRT and increase the SRT

10.1. Material Energy Balance (Theoretical Gas calculations):

Total Raw Material per day – 80 Metric Ton (MT)

150,00,000 kg/day (150 Ton/day) dung will be treated, about 18% (Solids) macerate and mix 1 (one) part dung and 1-part Water (water or recycled water) 150000 litre (considering 82% of moisture in dung) Water to be added to 1,000 kg of dung 1000 ltrs water 2,000 litre total feed to the Digesters – 15000 kg dung + 150000liter after mixing total water 300000 liters

Pre-Digester–

Total feed quantity for pre-Digester– 300000 lt. Retention time within each Pre-Digester– 1 day Number of Pre-Digesters– 2Nos.

Measurements of each Pre-Digester–6m dia 6m ht

Volume of each Pre-Digester– 169 cum (including about 10% pre board)

Main-Digester

Total feed quantity for Main Digester – 3,00,000 lt. (3,00,000 lt. X30 days) Retention time of the Main Digester – 30 days

Number of Main Digesters – 2 Nos

Cube Digesters – 2 Nos.

Measurements of each Digester –27x27X 7 m Height

Volume of each Digester - 500 cum (including 10% Pre board) Effective volume of each Digester - 4500 cum

All (2) Digesters effective volume - 4500 X 2 = 9000 cum Gas Space for 2 main Digester –

Digester 1: FRP Dome size 2.7length,2.7m weight x 2m Height – 14.5 m X162 = 1174 m3 Digester 1&2 Gas storage volume – 2348m3

Feedstock quantity: (considering dung) 15000000 kg X 18% TS = 27,000 kg dry matter @ 75% volatile Solids (VS)

75% VS x 27,000 kg = 20250kg vs/day 300m3 total feed per day = 20250kg vs

Organic Loading Rate (OLR) = Flow rate (m3/day) X concentration (kg vs/m3) / reactor volume m3 = 150 X

75/ 5000 = 2.25kg vs/m3 Biogas yield for organic waste (like cow manure, food & veg waste) = 0.40 m3/kg vs considering VS (mass)

Total amount of gas production will be - 2.25 kg vs/m3 x 0.40 x 9000 = 8,100 m3/day (approx) Expected efficiency of Digester/reactor 80-81% then total gas production - 6480 m3/day

Gas Production per 1 (one) ton of animal dung- 6480m3/ 150 tons = 43.2 m3

Manure production per day

Total solids -27,000 kg

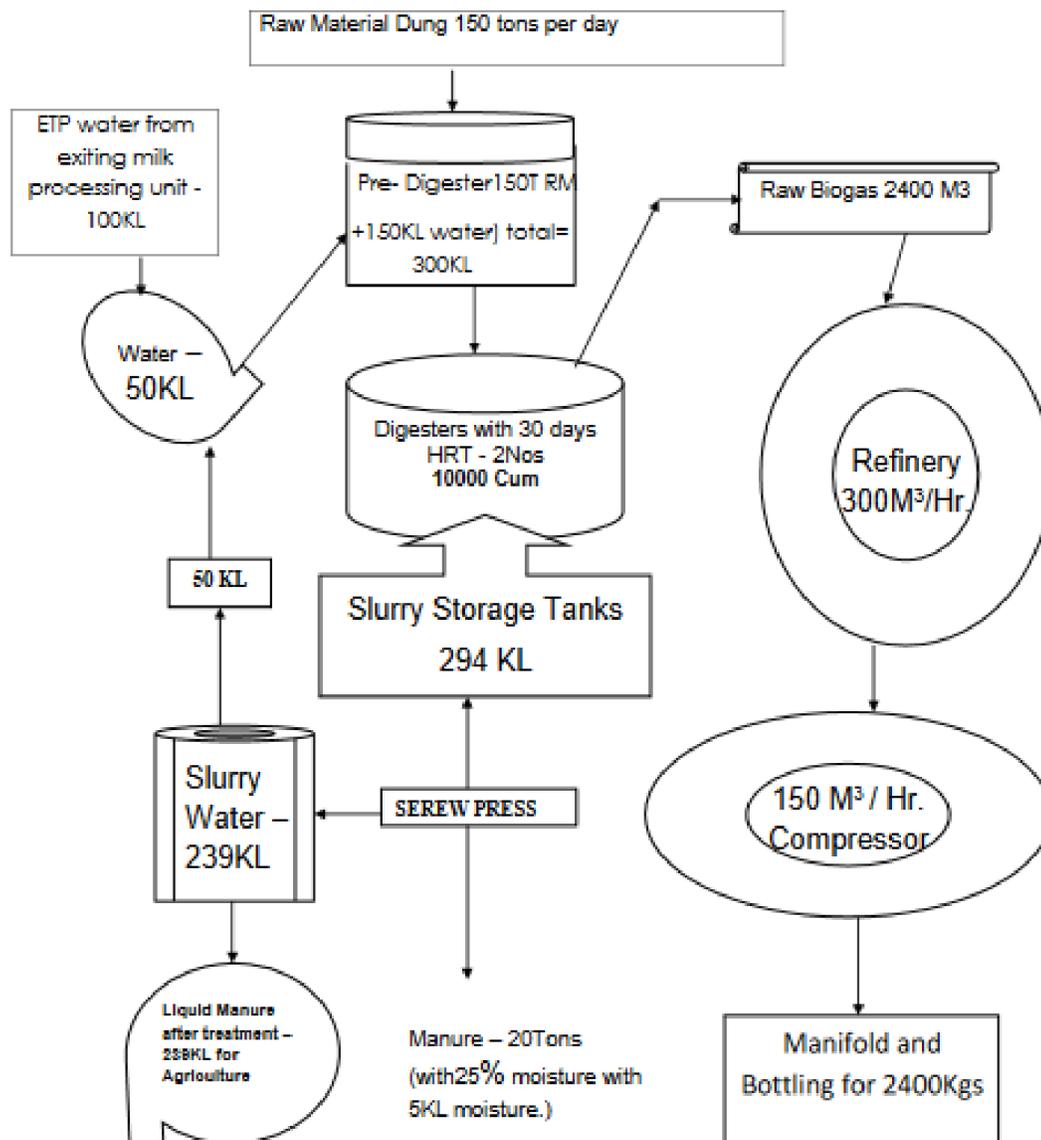
Recovery of Solids by decanter - 80% - 21600kg/21 ton Density of the Raw Biogas - 1.20 kg/m3

Total Biogas produced for day - 6480 m3 Conversion of solids - 6480 x 1.2 = 7776 kg Manure

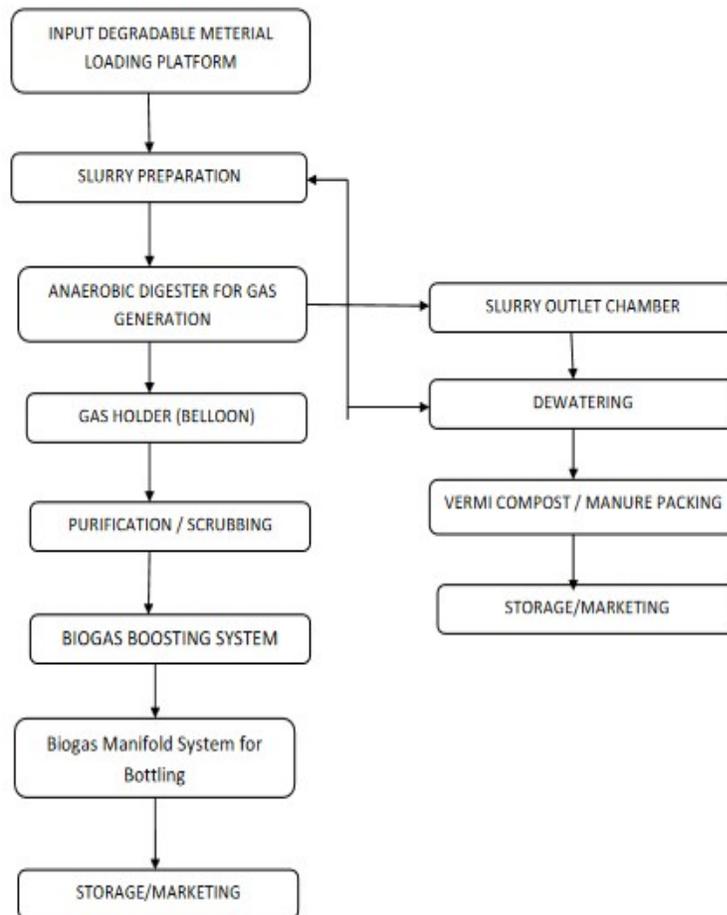
production per day - Net solids - Conversion of solids 21600 - 7776= 13824 kg Considering

30% Moisture - 13824 kg +4147 kg = 17971 kg/18 Tons.

10.2 Material Flow Diagram



Flow Chart-I: INDICATING THE TOTAL PROCESS STEPS



Total Power Required Per Day in KWh (For reference only as per scope of work. However bidder to provide as per his design)

S No	Plant Machinery	Power In KW	Qty	Total Power In KW	Hours of Operation	Power In units – Considering 75%
1	Bore well	3	1	5	2	8
2	Slurry Mixing in Pre-Digester	10	2	20	4	60
3	Slurry Pumping from Pre-Digester to Main-Digester	12	2	24	15	270
6	Slurry outlet Pump	12	2	24	15	270
7	Pre-treatment with H ₂ S Scrubber	3	1	3	20	45
9	CO ₂ Scrubber-300 cum/hr	40	20	40	20	600
10	Compressor- 150 cum/hr	45	1	45	16	540
11	Fans & Lighting	5	-	5	10	37
12	PROM Technology	100		100	14	1400
13	Street Lights	1			10	50
	Total	230				3280

Civil , Equipment & Machinery Items Involved

Civil Items

S No	Description	No's	Unit	Size in m X m X m	Remarks
1	Loading Platform	2	Sqmt	10 m X 10 m	
2	Pre Digesters(169 cum m)	2	Cum	6x6x6m	circular
3	Main Digester	2	Cum	27 m x2 7 m x7m ht	square type digester with internal walls with FRP Domes
4	Slurry Outlet Tank	2	Cum	6x6x6 m	circular
5	Room for Solid liquid separator	1	Cum	4 m X 3 m	Room with RCC slab
6	Shed for Manure Storage	1	Sqmt	50m X 10 X 5 m	Open Shed
7	Shed for Bio-Gas purification, bottling and PLC Control room & office room	1	sqmt	50m X 10 m X 5 m	Open Shed
8	Watchman room & Toilets	1	sqmt	4mx4m with 2 toilets	
9	Office Furniture			Lamsam	
10	Internal Roads		Sqmt	100x6m	Gravel Road

Equipment & Machinery Items Involved

Sl .No.	Equipment's	Description	Details	N of Unit	Capacity y
1	Weigh bridge	To measure the weight of the Dung	MS	1 No	--
2	Agitator in pre digester for Mixing system	To mixing the slurry inside of the pre digester	MS	2	--
3	Pumps	To pump the slurry from the pre digester to main digester through bottom mixing unit	MS	2	80 cum/hr
4	Mixing system in main Digester	To mixing the surly from pre-Digester to main digester through pressure pump	SS	2 Set	
5	Biogas Domes over Main Digester	To store the raw biogas generated within the digester	FRP	162 - Domes for 2 digester s	To cover digester
6	Pumps	To pump the slurry from outlet slurry tank to decanter	MS	2 NO	10 cum/hr
7	Decanter	To separate solids and liquids from the slurry	MS & SS	1 No	10 cum/hr
8	PROM unit for manure	To pack the manure in 25 kg bags	MS	1 NO	5 ton/hr
9	Biogas storage balloon	To store the raw biogas before purification	PVC coated fabric	2 No	500 cum/hr
10	Flare unit	To flare the excess biogas generated or to flare the gas if the up gradation unit is under maintenance	MS & SS	1 unit	300 cum/hr
11	H2S Scrubber with inlet blower	To Scrub the hydrogen Sulfide from the raw biogas	MS & FRP	1	300 Cum/hr
12	CO2 purification system	To Scrub the CO2 from the biogas	MS	2	300 cum/hr
13	High pressure compressor	To compress the clean biogas from 0.3 bar to 250 bars	G.I	1	150M3/hr
14	Manifold for bottling	To transport the clean gas from the high pressure compressor to the empty cascade (cylinders)	SS	1 Set	150 cum/hr

15	Piping for slurry and Gas	piping for the biogas plant slurry and Biogas	UPVC & PVC & SS	1 set	--
16	Gas piping line to the exiting boiler and the exiting Gen set	To convert the boiler from coal to Bio- CNG	MS	1	--
17	Panel boards	To divide an electrical feed into supplementary circuits of the plant and machinery	Wires	1 set	--
18	Electrical cabling	Entire cabling for the biogas plant	confirming to IS: 7098 (Part-II),	1 set	--
19	Electrical line from exiting Genset of the dairy plant to the Bio- CNG unit				
20	Fire Fighting	Firefighting system for the entire plant	MS	1 set	--
21	Cylinders & Cascades (12 nos)	To store the Bio CNG	MS	240 No	15000 kg
22	Operation maintaince	To consider 3 months			
23	Consultancy fee for structural drawings, automation, PESSO license	To consider upto completion of the project and provide training 3 months to the workers			

Process steps for production of 2400kg Bio-CNG and 40 MT Organic Manure

1. Feed Preparation: First the dung will be brought through tractors to waste receiving area
2. Pre-Digester: Dung is dumping to pre-digester and mixed with recycled/slurry water to reduce solids from about 18% to 10%.
3. Anaerobic Digesters: KVIC Model digesters are used for production of 6000 cum Biogas under Microbial process in the absence of air.
4. Gas Balloon: It is used to maintain fluctuation of raw biogas supply to purification/refinery system.
5. Biogas Scrubber: To remove non calorific value gas CO₂ and corrosive gas H₂S from the raw biogas and enrich in CH₄ content more than 95%.
6. Biogas Boosting System: The purified biogas shall be boosted to a pressure of 200 to 250 bar with the help of compressor.
7. Compressed Biogas (CBG) Manifold System: Manifold System is used for Bio-CNG filling in CNG Cylinders.
8. Outlet Chamber of Biogas Digester: The Dig estate slurry from the Main Digester is let into the outlet chamber through overflow pipe.
9. Slurry Dewatering: Dig estate slurry is passed through decanter/screw press to separate the solids and liquid. The recycled water from the decanter is used for raw material mixing.

10. Organic Manure Packaging: The separated solid from the decanter is mixing with rock phosphate to convert into PROM and packed in 50 kg bags as per market demand for agriculture/nursery purpose.

PROCESS DETAILS:

The process of Biogas process broadly can be classified into the following sections:

BioGas Plant

BioGas Purification BioGas Bottling

Slurry Processing and Utilization

BioGas Plant: The Main Machinery consists of:

Feed -Pre treatment

Pre-Digester

Bio Digester

BioGas Storage System

Bio Gas Refinery: The raw gas generated will be purified here, through Bio Gas Scrubbing and the Purification System

BioGas Bottling: The Purified Gas will be Bottled here as Cylinders through Booster Compressor

Slurry Processing System: The slurry Water will be separated in the Dewatering system by using Decanter.

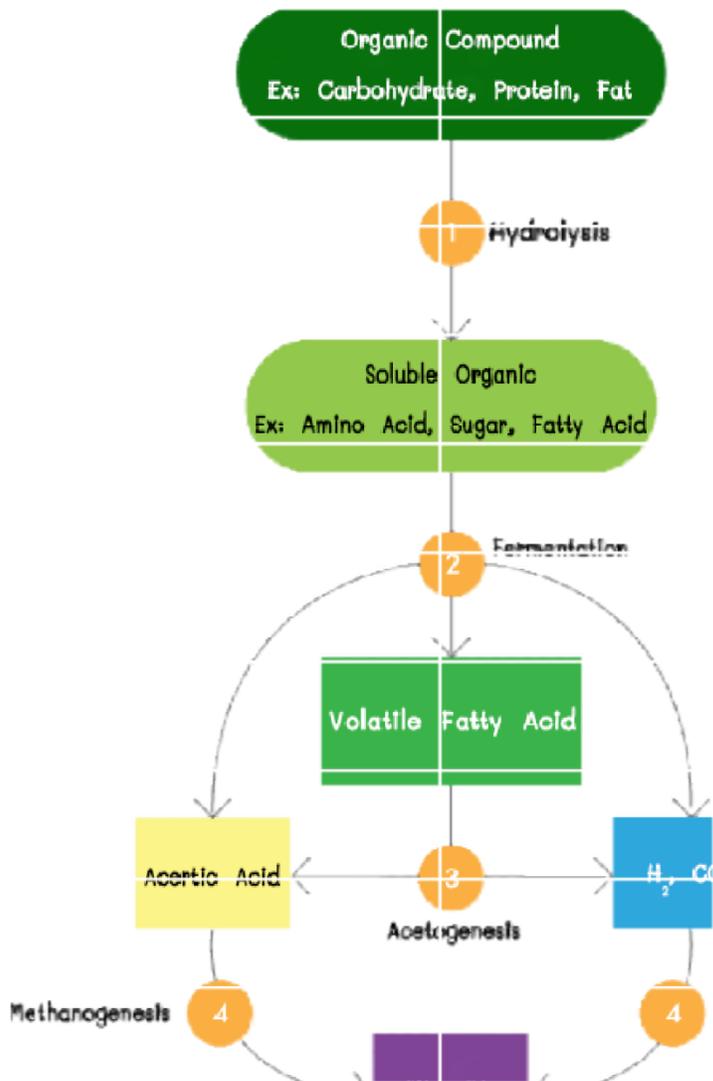
PROCESS DESCRIPTION:

The principle of Biogas Technology:

Biogas technology is two stage aerobic-anaerobic sequential biogas technology which uses two distinct digesters: One for thermophilic aerobic digestion (TAD) of complex organic substrates (Eg. Rice straw) and the other for anaerobic digestion resulting into methane production. Phase separation of anaerobic digestion into hydrolytic/acidogenic and the syntrophic/methanogenic stages of anaerobic digestion into two reactors may enhance the degradation of complex substrate.

The two-stage system is considered a promising process to treat organic wastes because of its high efficiency in terms of degradation and production of biogas. Two-stage system allows the selection, enrichment and growth of different bacteria in different digesters. The complex organic materials are degraded mostly aerobically in pre-digester by acidogenic bacteria to monomers, volatile fatty acids and alcohols, which are then metabolized into methane and carbon dioxide by methanogens in anaerobic chamber. These two distinct chambers provide different physical, biochemical and environmental requirements for acidogenic and methanogenic microorganisms.

The physical separation of the acid forming and methane forming microbial populations in two separate reactors allow the optimisation for each of the two distinct microbial consortia, that are physiologically and metabolically much different. The four steps of Biogas production process are as follows: 1) Hydrolysis 2) Acidification 3) Acetogenesis and 4) Methanogenesis.



Biogas Generation In Main Digester:

Principle involved: Anaerobic microbial digestion undergoing the following conversion i.e., acidification, acetogenesis and methanogenesis finally resulting in the production of methane. Acidification: Acid forming bacteria involved in the second step convert the intermediates produced in the hydrolysis step into acetic acid, hydrogen and carbon dioxide. These bacteria, of the genus *Bacillus*, are aerobic and facultative anaerobic and can grow under acidic conditions.

Acetogenesis: To produce acetic acid, the bacteria use the oxygen dissolved in the solution or bonded oxygen. Hereby, the acid producing bacteria reduce the compounds with low molecular weight into alcohols, organic acids, amino acids, carbon dioxide, hydrogen sulphide and traces of methane.

Methanogenesis: Methane producing bacteria, involved in the last step, decompose compounds with low molecular weight. Under natural conditions, methane producing microorganisms occur wherever anaerobic conditions are provided, for instance under water, in ruminant stomach and in marshes. They are anaerobic and very sensitive to environmental changes. It is advisable to circulate the generated biogas back into the system using small compressor. This would enhance the reduction of carbon dioxide to methane and enrichment of methane fraction in the Biogas.

Design:

The main digester is based on Modified KVIC model digester which is a conventional, consisting of partial ground tank with floating dome / balloon. Biogas is collected at the top of the tank and passed to a separate gas holder. The main digester is built with RCC.

The Digester is facilitated with multi-chambers digestion in its design to take multiple types of feeds for attaining maximum digestion with 30 days HRT@ 30 degree centigrade; the digesters are designed to operate in mesophilic range with the maximum yielding capability.

Main digester is designed to process any type of organic feed stocks like Dung, food waste, fruits, vegetables, other agricultural waste, municipal solid waste, weeds such as water hyacinth, water lettuce etc. Biogas is circulated back into the system using small compressor. This enhances the reduction of carbon dioxide to methane and enrichment of methane fraction in the Biogas.

RAW BIOGAS STORAGE:

The raw biogas from the biogas holder will be stored in biogasballoon

BIOGAS UPGRADATION/SCRUBBING

The main output which is Bio-Gas will be purified using water scrubbing/PSA technology & Membrane Technology and then compressed at high pressure in gas cylinders for further usage. The stored gas has more than 90% methane and can be used as an CNG for vehicles.

PROCESS

Each up gradation unit is designed for biogas @ 300 M3/Hr per unit and, The operating days are considered as 350 days per year. The Input raw biogas quality is considered as per Design Basis indicated in the Technical Section.

Gas analysis:

The device is used for process monitoring of individual stages and to measure the concentration of the following components in the gas

Methane CH₄

Carbon dioxide CO₂

Hydrogen sulphide H₂S

Oxygen O₂

Design Treated	- Particulars	- Details	data and compounds Biogas (Input to Upgradation system)
	- Raw Biogas Flow rate	- Max. 300 Nm ³ /hr	
	- Gas Temperature	- Ambient temperature (30 – 40 deg C)	
	- Inlet Pressure	- 0.2bar	
	Particulars of Raw Biogas	Details	
	Methane CH ₄	65%	

Carbon Dioxide	33%
Outlet-Gas from Upgradation System	
Methane	95%
Carbon Dioxide CO ₂	3%
Others	2%

The purified Gas passed to Buffer Tank.

BIO-GAS Boosting Compressing System

Each Compressing unit is designed for biogas @ 300 M³/Hr per unit and, hence,

The pure biogas shall then be sent to the buffer storage tank, from which it shall be sent to the booster compressor. Biogas Boosting System the purified biogas shall then be boosted to a pressure of 250 Kg/cm²g with the help of a booster compressor, which shall be complete with its flameproof motor, cooler and accessories. The compressor shall be a four stage, vertical, three- cylinder, oil lubricated, water cooled, methane gas compressor Bar and fed to the Bottling unit.

For filling of biogas in cylinders a manifold system shall be provided for manual filling of the cylinders. The manifold shall be complete with pressure release valves, check valves, pressure gauges, pressure switches, and other accessories.

Bottling Plant: Bottling part of the plant consists of a High-Pressure compressor, cascade of storage cylinders and a dispensing nozzle for filling the compressed purified gas in the vehicles. Dried and purified gas goes into the suction of High-Pressure Compressor, where it compresses the gas to desired working pressure (~250 Bar) and fill into the storage cylinder cascade. A CNG dispensing cable along with nozzle is used for filling of gas in the cylinders.

A. Specifications of the Cylinders:

The Compressed Natural Gas (CNG) cylinders are of cylindrical shape and are manufactured to withstand the working pressure up to 250b the digested slurry overflows from the digester in to the out let chamber. It can be taken up for dewatering and composting. The dewatering shall be carried out in Screw

Presses/Decanter. The Some part of digested slurry separated will be reused for feed preparation in PreDigester. Thus, by adopting this technology huge quantity of fresh water will be saved every day
MANURE / COMPOSTING:

The outlet of digester slurry is passed to decanter for separation of solids. The separated solids will be further processed by adding biofertilizer culture to increasing of N:P: K., humus and other Micronutrients and will be sold to farmers as manure. The application of such organic manure reduces the salinity/alkanity of the soil of the soil and increases the porosity and water holding capacity.

Composition of the organic manure:

Organic carbon : 18% Nitrogen : 1.6%

Phosphorous : 0.8%

Potassium : 0.8% pH
: 7.2

12.9. Production of PROM (Materials and Methods)

PROM is produced by the biochemical conversion of phosphate rock into soluble phosphates.

Feedstock: Pulverised refined phosphate rock (free from silica) of uniform size of around 75 microns blended with well—ground ADS (Anaerobic Digester sludge) or Biogas slurry in the ratio 1:2. Average particle size of the blend = less than 1 mm. The Biogas slurry used is that obtained by Biogas plant. After removal of the moisture by using decanter the outlet slurry is blended with the pulverised rock phosphate ore and screened through a set of Indian standard screens in a sieve shaker to ascertain the uniformity of size.

Substrate: solids ratio maintained is 7:3. Small amount of salt petre and gypsum are also added to make up nutrient deficiency and promote bacterial growth.

Bioreactor: Agitated stirred tank (slurry reactor).

Operating temperature (optimum): 30°C - 35°C Operating temperature (maximum): 60°C pH (optimum): 7.0

Operating pressure: 1 atm Microbial culture: *Bacillus megatherium* var *phosphaticum* (phosphorus solubilising bacteria)

Size of inoculum: 3% - 5% The process is conducted in two stages. During the first stage, the substrate slurry is added continuously to the bioreactor and is constantly agitated. The suspension is allowed to ferment for about 7 - 10 days (thermophillic stage). Since the consistency of suspension is maintained at (7/3), the pH of the medium remains at around 7.0. The operating temperature is maintained more or less constant and it seldom exceeds 60°C. At the end of the thermophillic stage, the bioreactor is seeded with an inoculum of phosphate solubilising bacteria (mentioned above) and the agitation is continued. Though the process is aerobic, since the reactor is kept open, atmospheric air/ oxygen diffuses into the substrate and transfer and dissolution of oxygen is further facilitated by agitation of the slurry. No air compressors are required to be employed. At the end of this aerobic stage, it is desirable to employ an additional stage during which the bioreactor is seeded with an inoculum of nitrogen fixing microbes such as *Azotobacter* and permit an additional residence time of about 5 - 10 days. This stage is, however, optional. We have employed all the three stages in our study.

Downstream processing: The product solution is filtered to separate the solid biofertiliser which is then dried, ground to the desired size, labeled and packaged. The biofertiliser (PROM) so obtained has been found to have the following composition:

Phosphorus content: 16.5% (as soluble P₂O₅) C:N ratio: 19:1.

It is fit for direct use in the agricultural field. The composition of PROM has been analysed by the standard procedure with the help of spectrophotometer.

As is the case with most biochemical processes, bioconversion of phosphate rock is also a slow process and thus demands a large residence time for the bioreactor. For a given capacity, the reactor volume required could be significantly large. It is, therefore, recommended to use two to three bioreactors with parallel feeding of substrate slurry.

Synthesis of phosphatic biofertiliser (PROM)

PROM can be successfully achieved starting from raw phosphate rock ore and an organic manure such as Anaerobic Digester Sludge (ADS). Microbial cultures such as those of *Bacillus megatherium* and *Azotobacter* could also be employed in second and third stages of preparation so as to enhance the quality of biofertiliser.

The phosphorus content of PROM is around 16.5% (as soluble P₂O₅) and is directly assimilable by plants.

Production of PROM is much more cost-effective than that of synthetic phosphatic fertilisers such as SSP, MAP, DAP since the entire manufacturing cost of phosphoric acid or elemental phosphorus from phosphate rock is eliminated. The starting material remains the same as raw phosphate rock ore. Though the process is relatively slow, it does not demand any high temperature or high pressure. No chemical catalyst is required and there is no consumption of any valuable chemicals such as sulphuric acid.

With respect to plant growth, PROM is equally effective as the synthetic fertilisers presently in market such as SSP and DAP

PROM production concomitant with biogas generation (from plants/animal solid wastes) is possible and this shall enhance the overall economy of the scheme.

Type of crop	Yield of crop, quintals/hectare				
	SSP	DAP	PROM	PROM with ADS (present study)	PROM with vermicompost (present study)
Wheat	28.9	-	29.5 [1]	29.0	28.8
Soybeans	10.37	-	11.69 [1]	11.55	11.0
Groundnut	-	30.29	31.08 [1]	31.33	30.67
Rice (kg/ha)	3000	3910	4385 [1]	4375	4250
Barley	-	56.23	69.69 [1]	70.20	67.25
Cabbage (q/acre)	-	46.66	54.44 [2]	53.75	54.50
Onion	-	165.19	167.16 [2]	166.66	164.55

Note: Reference Nos are given in square brackets.

12.10 Electrical system/control unit

Liquid and gas piping and valves system is as follows:

Gas pipeline with valves from all digesters to purification system. (MOC-HDPE,MS)

Liquid pipe line from water tank to feed preparation tank, feed slurry pipeline from feed mixture to slurry pumps and slurry pumps to all digester tanks.(MOC-HDPE)

Overflow slurry pipeline, drain pipe line with valves from digester to decanter, and solid liquid separator. Recycling water line from solid liquid separator to feed mixture tank.

Whatever valves and instruments required for controlling and automation shall also be provided. Like pressure gauge/ switch, temp gauge, pressure transmitter, temperature transmitter, Ph sensor and analyzer, or whatever.

2. Electrical equipment – PLC control panel, power panel shall be as per following details. Electrical feeder panel for all equipment's as per the list

Power panels for following equipments

i. all pumps and agitators, blowers and control valves,ii.

MMCC power panel for all equipments

Instruments and electrical cabling with cable tray from field to control room

13.1 ENVIRONMENT MANAGEMENT PLAN

The Environment Management Plan consists of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts as a result of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the site including fire.

Introduction:

The Environmental Management Plan (EMP) is aimed at mitigating the possible adverse impacts of a project and for ensuring to maintain the existing environmental quality. The EMP converses all aspects of planning, construction and operation of the project, which are relevant to environment. It is essential to implement the EMP right from the planning stage and then continuing it throughout the construction and operation stage. The Environmental management Plan (EMP) is always site specific plan developed to ensure that the project is implemented in an environmental sustainable manner where all contractors and sub-contractors, including consultants, understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage the risk. Therefore, the main objective of the Environmental Management Plan (EMP) is to identify the project specific activities that would have to be considered for

investigation of the significant adverse impacts and the mitigation measures required. EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate mitigative actions to reduce adverse environmental impacts during its life cycle. The plan outlines existing and potential problems that may adversely impact the environment and recommends corrective measures where required. Also, the plan outlines roles and responsibility of the key personnel and contractors who are charged with the responsibility to manage the project site. While evolving effective and feasible EMP, many parameters are considered on the basis of technological as well as economic aspects.

About the Present Project:

The present project is a Bio-CNG production plant for producing 2400 Kgs/day of Pure Bio-CNG using 150 Tons per day of animal dung.

This is among the first projects being set up in Jabalpur. The plant will produce maximum of 2400 kg CBG every day. The input of plant is majorly animal dung. The plant has the capacity of consuming around 150 tonnes of animal dung in a year which will be taken from 200 dairies of farmland in Jabalpur.

Bio manure produced from the plant as a by-product will be organic and can be used to grow organic food and vegetables.

The Environmental Management Plan:

The EMP follows the Guidelines laid out by the CPCB and

It was prepared in accordance with rules and requirements of the MOEFCC and the State Pollution Control Board.

Care will be taken to ensure that the components of facility are operated in accordance with design; All precautions should be taken to addresses public complaints during construction and operation of the facility Plan should be to ensure remedial measures are implemented immediately the plan always considered the treatments and discharge of unavoidable pollutant into the atmosphere, monitoring of physical environment external or internal, green belt development, housekeeping practices, the occupational health and safety concern, the socio -economic issues, energy conservation and recycling practices.

The benefits of Environment Management Plans are

It provides the infrastructure for managing its Environmental performance and continuous improvements.

It improves the quality of environment in the society EMP includes following major elements;

Commitment & Policy: The proposed BioCNG Production Unit will implement the environmental management plan that incorporates all issues related to air, land and water.

Planning: This includes identification of environmental impacts, statutory requirements and to find and set environmental objectives.

Implementation: These is being resources available to the developers, accountability and responsibility of contractors, training and awareness to operational staff associated with environmental control facilities and documentation of measures to be taken.

IMPLEMENTATION OF EMP: An Environmental Management Plan (EMP) is being required to mitigate and eliminate the adverse environmental impacts during construction and operation phase of the project and these are as below:

EMP FOR AIR ENVIRONMENT Construction Phase To mitigate the impact of SPM (dust) and other emissions during the construction phase of the proposed project, the following measures are recommended for implementation:

A dust control plan.

Procedural changes to construction activities.

Dust Control Plan: The most cost-effective dust suppressant is water, because a source of water tends to be readily available on a construction site. Water can be applied using water trucks, handheld sprays and automatic sprinkler systems. Furthermore, incoming loads could be covered to avoid loss of material in transport, especially if material is transported off-site. The following measures shall be put to practice to minimize the impact on the air environment as the construction activities are likely to generate dust due to

vehicular movement, excavation, emissions from the labor camp used by the construction workers. Provision shall be made for sprinkling of water on the roads used for transportation of materials; and speed of vehicle is being restricted to 15 Kms/hr.

Arrangements shall be made for sprinkling of water at the construction site; to suppress any kind of dust emission. Any excavation that is deep and large in nature shall be done using mechanical measures so that the same is over within a short period. The debris and unutilized construction material and earth from the construction site shall be used within the premises.

Controls of other Air Emissions:

It shall be ensured that vehicles which are employed by the Developers or by Contractor's ply with PUC Certificate.

Any generator to be installed by the Contractor at the site shall meet the guidelines as laid down by Central Pollution Control Board.

Reduction of On-site Construction Time: Rapid on-site construction would reduce the duration of traffic interference and therefore, reduce emissions from traffic delay.

Operation Phase To mitigate the impacts of pollutants from diesel generator sets and vehicular traffic during the operation phase of the site the following measures are recommended for implementation:

Process Emission Control Measures

Diesel generator set emission control measures

Vehicle emission controls and alternatives

Greenbelt development.

Emissions from bio-methanation:

The action of micro-organisms upon organic matter under anaerobic conditions produces biogas which is typically a mixture of methane and carbon dioxide as well as a many trace gases and vapours. This action is harnessed within a number of anaerobic bioprocesses such as Anaerobic Digestion (AD) for the stabilization of polluting organic matter and water or recycled water (water from existing Discharged process water treatment plant).

Within the anaerobic conversion of organic material over 90% of energy available in the organic pollutant is retained within the biogas as methane - very little is used to form sludge and this is a major benefit when compared with aerobic bioprocesses. A consequence of this is that the methane rich biogas has a high calorific value and will be used as a fuel. There are also serious safety and environmental considerations associated with biogas because methane is a potent greenhouse gas and forms explosive mixtures when mixed with air.

Therefore, for reasons of safety and in order to realize the full environmental benefit from these anaerobic bioprocesses the biogas must be collected and burned with the energy recovered. Energy recovery schemes may be direct where the gas is used to provide heat to meet a local demand or indirect where the biogas is utilized within engines to raise power or drive machinery or vehicles and in the present project, we will be converting the same to Bio CNG and it will be replacing LPG.

Hydrogen Sulfide, Carbon Dioxide, Carbon Monoxide are the major contaminants of the crude Biogas. These gases are scrubbed by installing a scrubbing system which reduces the contaminant gases to levels below the emission norms of the PCB. The scrubbed Carbon dioxide and Hydrogen sulfide will be recycled to the predigested tank to maintain the pH of the Raw material slurry and enhance the Total Volatile solids conversion in the Pre-digester step.

Biogas Flaring Unit:

A biogas flare system for burning extra biogas generated in the entire project or using the gas for combusting only when there will be any minor maintenance of the compressor or pipelines, we have taken care of the compressor major parts where it will be replaced within some hours of nonworking signals and hence the excess gas generated during these hours which might not be used by the compressor so needs to be flared at a proper height (i.e. above 5 meters), the single flaring unit system will be comprising:

A least one burner for igniting a mixture of biogas and air.

A main supply line for supplying the mixture of biogas and air to said burner;

A biogas supply line feeding into said main supply line for supplying biogas in a controlled, forced manner, said biogas supply line in fluid communication with the one of the landfills and the waste water treatment centre;

An air supply line feeding into said main supply line for supplying air in a controlled, forced manner; wherein said biogas and air are mixed, the ratio of biogas and air being selectively controlled such that there is 20% to 50% excess air;

A shell surrounding said burner and having an open top for exhaustion of combustion products; and At least one damper located in said shell for supplying quench air to said burner.

Hence utmost care has been taken in the project and no methane will be released ever in the atmosphere and will be converted into BNG and will be used to replace LPG without any leakages in the procedure and the excess gas if any will be flared as discussed.

FIRE FIGHTING EQUIPMENT :

The development of the BioCNG Plant shall follow all guidelines as per National Building Code of India.

For every 100 m² area of the Bio methanation plant, one DCP type and one CO₂ type fire extinguisher will be provided. Biogas enclosure, compressor enclosures, control room, laboratory etc. will have the fire extinguishers and sand bucket racks.

"Nonsmoking" and hazard/ danger warning stickers will be put up at appropriate places. All personnel deployed for the construction, erection and operation of bio-gas plant will be given proper training for fire drill. Emergency numbers will also be put up at appropriate places. Empty fuel drums / tanks and other inflammable material will be removed from the premises as soon as possible. Storage yard for chemicals and fuel lubricants will also be provided with fire extinguishers and bucket racks.

Safety Measures appropriate to the process: The general safety features adopted are - provision of fire extinguishers, over pressure relief devices, safest or age of all chemical and fuels, grounding of all electric equipment, safe location of auxiliary electric gear, proper building and equipment layout, instrumentation alarms, guard railings, security personnel. The biogas line will have pressure relief valves, flame proof motors with safety guards, flare pipe, flame arrester, water seals etc.

Vehicle Emission Controls and Alternatives PUC Vehicles: All vehicles with pollution under control certificate is being permitted in premises. Awareness campaign to disseminate knowledge on strategies and technologies for air emission controls.

Green belt Development: Increasing vegetation in the form of green belt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, act as a barrier to break the wind speed as well allows the dust and other particulate to settle out there. It also helps to reduce the noise level to some extent. A Green belt will be provided in an area equivalent to 33% of the total area of the plant.

EMP FOR NOISE ENVIRONMENT

Construction Phase To mitigate the impact of noise from construction equipment during the construction phase, following measures are recommended for implementation:

Time of operation - Noisy construction equipment should not be permitted during night hours.

Job Rotation and Hearing Protection – Workers employed in high noise areas are being rotated. Hearing protection such as earplugs/muffs is being provided to those working very close to the noise generating machinery.

Regular Maintenance: The mitigation measures shall include regular maintenance of construction machinery.

Operation Phase: To mitigate the impact of noise from diesel generator sets during the operational phase the following measures are recommended for implementation:

Noise emission control technologies; and Greenbelt development.

Noise Emission Control Technologies: It would be ensured that the manufacture provides acoustic enclosure as an integral part with diesel generator sets. Diesel generator sets is being enclosed in a suitable acoustic

enclosure so that noise level at a distance of 1 meter does not exceed 75 dB (A) at 75 % load as per CPCB standards or is meeting the ambient standard whichever is higher. The mitigation measures shall also include regular maintenance of DG Sets as advised by the manufacturer.

Greenbelt Development: The Following species can be used as in a greenbelt to serve as noise breakers: Ficus benjamina; Butea monosperma (palash); Leucanaleucocephala (Subabual); Mangifera indica (Mango) and Delbergia Sissoo (Shisham).

EMP FOR WATER ENVIRONMENT:

Construction Phase: To prevent degradation and maintain the quality of the water source, adequate control measures have been proposed to check the surface run-off, as well as uncontrolled flow of water into any water body.

Following management measures are suggested to protect the water quality during the construction phase. There will be very little excavation as foundations are on piles. Excavation during monsoon season is being avoided.

Care is being taken to avoid soil erosion.

Any area with loose debris within the site shall be planned.

Construction activities generate disturbed soil, concrete fines, oils and other wastes. On-site collection and settling of storm water, prohibition of equipment wash down, and prevention of soil loss and toxic release from the construction site are necessary to minimize water pollution. All stacking and loading areas should be provided with proper drains equipped with baffles to prevent runoff from the site to enter any water body. Operation Phase As discussed earlier, ground water would be main source of water supply. Hence to optimize use of water resources, a sustainable ground water extraction plan is being evolved with a careful look at the water demand of the project in its operational phase. Water conservation and development measures shall be taken including all possible potential for reuse and recycling of water. These could be in the form of following:

Development of water sources.

Minimizing water consumption

Promoting reuse of water after treatment

Water Source Development: Water source development shall be practiced by adoption of scientifically design rainwater harvesting system. The water is being used for recharge of aquifers. Rainwater harvesting promotes self-sufficiency and fosters an appreciation for water as a resource. Minimizing Water Consumption Water consumption is being minimizing by a combination of water saving devices and other domestic water conservation measures. Furthermore, to ensure ongoing water conservation, an awareness Programmed is being introduced for all the workers and staff.

Following section discusses the specific measures, which shall be implemented.

Domestic and Commercial Usage:

Use of water efficient plumbing fixtures (ultra-low flow toilets and urinals, low flow sinks, water efficient dishwashers and washing machines). Water efficient plumbing fixtures use less water with no marked reduction in quality and service.

Leak detection and repair techniques.

Sweep with a broom and pan where possible, rather than to use hose for external areas; Meter water usage; employ measurement and verification methods.

Monitoring Water use is a precursor for management.

Awareness campaign to disseminate knowledge on strategies and technologies that can be used for water conservation. Horticulture: Drip irrigation system shall be used for the lawns and other green areas. Drip irrigation can save between 15-40 % of the water use, compared with other watering techniques. Plants with similar water requirements shall be grouped on common zones to match precipitation heads and emitters. Use of low-volume, low-angle sprinklers for lawn area are being provided.

Place 3 to 5 in. of mulch on planting beds to minimize evaporation.

Storm Water Management: As discussed earlier most of the storm water produced on site is being harvested for ground water recharge, thus proper management of this resources is must to ensure that it is free of contamination. Contamination of storm water is possible from the following sources:

Silt from soil erosion in gardens

Spillage of sludge from sludge drying area of Sewage

A detailed "Storm Water Management Plan" is being developed. This will consider the above sources. The run-off from landscaped, roof top and complex's would be used for recharging

The deep strata from which groundwater is to be extracted in the proposed site. The design of pits is being done taking into consideration retention time for the run-off water in the harvesting pit. The plan will incorporate best management practices which will include following:

Regular inspection and clearing of storm drains and all covered drains. Cover waste storage areas. Avoid application of pesticides and herbicides before wet season. Secondary containment any dykes in fuel/ oil storage facilities Conducting routine inspections to ensure cleanliness

Preparation of spill response plan, particularly for fuel and oil storage areas. Provision of slit traps in storm water drains

Good housing in the above areas.

EMP FOR LAND ENVIRONMENT:

Construction Phase: As discussed earlier waste generated from construction activity includes construction debris, Biomass from land cleaning activities, waste from labour camp, and hazardous waste. Following section discusses management of each type of waste. Besides waste generation management of topsoil is an important area of concern. Construction Debris Construction Debris is bulky and heavy re-utilization and recycling is an important strategy for management of such waste. As concrete and masonry constitute the majority of waste generated, recycling of this waste by conversion to aggregate can offer benefits of reduced landfill space and reduced extraction of raw material for new construction activity. This is particularly applicable for proposed project as the construction is to be completed in progressive stages. Recycled aggregate is will be used for filter application, and as a sub-base for road construction. Mixed debris with highs gypsum, plaster if any, shall not be used as fill, as they are highly susceptible to contamination, and will be given to recyclers. Metal scarp from structural steel, piping, concrete reinforcement and sheet metal work shall be removed from the site by construction contractors. A significant portion of wood scarp can be reused on site. Recyclable waste such as plastics, glass fiber insulation, roofing etc. shall be sold to recyclers. Hazardous waste Construction sites are sources by many toxic substances, such as paints, solvents, wood preservatives, pesticides, adhesives and sealants. Hazardous waste generated during construction phase shall be stored in sealed containers, labelled, and disposed of as required by the Hazardous Waste Management and Handling Act Amendment Rules 2003 Management practices that shall be followed are:

Herbicide and pesticide will not be over applied (small-scale applications) and not applied prior to rain. Paintbrushes and equipment for water and oil based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, watercourses, or drainage systems.

Provide adequate hazardous waste storage facilities, hazardous waste collection containers are conveniently located and designed hazardous waste storage areas are away from storm drains or watercourses.

Segregate potentially hazardous waste from non-hazardous construction site debris. Clearly label all hazardous waste containers with the waste being stored and the date of generation. Preferably, these will return back to the manufactures. Educate employees and subcontractors on hazardous waste storage and disposal procedures.

Instruct employees and subcontractors in identification of hazardous and solid waste.

Even with careful management, some of these substances are released into air, soil and water, and many are hazardous to workers. For these reasons, the best choice is to avoid their use as much as possible by using low toxicity substitutes and low VOC (volatile organic compound) paints.

Top Soil Management:

To minimize disruption of soil and for conservation of top soil, the contractor shall take the top soil out separately and stockpile it. After the construction activity is over, top soil shall be utilized for landscaping

activity. Other measures, which would be followed to prevent soil erosion and contamination include: Maximize use of organic fertilizer for landscaping and green belt development. Removal of as little vegetation as possible during the development, and re-vegetation of bare areas after the project. Working in small area at a point of time (Phase wise construction) Architectural design:

Public areas will be cooled by natural ventilation as opposed to air conditioning. Maximize the use of natural lighting through design.

Energy Saving Practices:

Promoting use of solar/Biogas based water heating. Purchase of energy efficient appliances.

Constant monitoring of energy consumption and defining targets for energy conservation. Adjusting the settings and illumination levels to ensure minimum energy used for desired comfort levels.

Use of compact fluorescent lamps and low voltage lighting.

Behavioral change on consumption: Promoting staff awareness on energy conservation. Training staff on methods of energy conservation and to be vigilant to such opportunities. SAFETY MEASURES

Fire Protection System: For the building, engine room, substation and engine room, substation and control room's suitable portable fire extinguishers will be provided as per norms. For the outdoor areas like feed stock silage, digesters etc., fire hydrants as per norms will be provided.

Safety Earthing: A Safety Earthing system comprising of buried mild steel conductor earthing grid will be provided for the plant buildings, switch yard and other outlying areas. This will be connected to the earth grids in various buildings. The buried earthing grid will be further connected to the earthing electrodes buried in ground and located at representative points. All exposed earthing conductors will be galvanized steel.

All accessories will be mounted as per The Petroleum and Explosives Safety Organisation (PESO) Norms.

EMP for Solid Waste Management:

The Digested animal dung slurry from the Bio digester contains undigested solids which will be separated from the water through a decanter. Around 40-43 Tons of Organic manure will be generated after the bio digester and will be dried to 25- 30% moisture. The bio solids from the anaerobic digestion are a very good source of NPK(1.6, 0.9 and 0.8% w/w) for soil and no solid waste is generated in the manufacturing facility.

Unused plastic containers, bags and other solid wastes of inorganic origin such as used metal scrap shall be disposed through authorized vendors only for recycling.

Waste Oils and Lubricants: shall be disposed through authorized vendors only. Ash from Boiler shall be disposed to Brick manufacturers.

Office Wastes:

The Wastes Generated in the site office are mainly paper of which around 0.10-0.25 Kgs will be generated daily. As this waste is cellulosic in nature it will be sent to the Bio digester for bio meth nation. Any plastic wastes such as discarded plastic packaging, used printer cartridges, etc., shall be disposed off to registered recyclers.

ENVIRONMENTAL MANAGEMENT SYSTEM AND MONITORING PLAN

ENVIRONMENTAL MANAGEMENT CELL: Apart from having an Environmental Management Plan, it is also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring.

The major duties and responsibilities of person (normally Maintenance-In charge) shall be as given below: To implement the environmental management plan,

To assure regulatory compliance with all relevant rules and regulations, To ensure regular operation and maintenance of pollution control devices, To minimize environmental impacts of operations as by strict adherence to the EMP, To initiate environmental monitoring as per approved schedule.

Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.

Maintain documentation of good environmental practices and applicable environmental laws as ready reference, Maintain environmental related records.

Co-ordination with regulatory agencies, external consultants, monitoring laboratories. Maintaining log of public complaints and the action taken.

Proper Green belt & landscaping will be developed for better air environment, because man needs inhalation every moment, so also is Flora and Fauna dependent on it.

WATER POLLUTION MANAGEMENT

Construction Phase: Water requirement during construction phase is expected to be about 25 m³/ day, which will be primarily sourced through bore wells. The following control measures will be adopted in order to minimize the construction impacts on water quality of the area:

Monsoon season would be avoided for construction activity.

Appropriate sanitation facilities will be provided for the labors to reduce impact on water quality.

No construction wastewater will be discharged directly on land or into the river. A couple of Sediment traps with retention period of half an hour will be constructed during the construction stage, where all construction wastewater will be collected. After the sedimentation of the construction wastewater, the comparatively cleaner water will be reused for wetting of building materials & structures.

Operation Phase:

The total water requirement for the proposed 10000 Kg/Day Bio-CNG Plant is approximately 675 KLD including common utilities, Pre-digester, Bio-digester, floor washing, boiler blow downs and Domestic sewage. 80% of the water is recycled to fresh batch of Bio-digester directly and about 20% of the daily discharges accounting to 130-140 KLD are processed in a Settling tank to reduce the TSS which interferes with the Bio-digestion process. The settling tank cum clarifier system will remove the suspended fines and solids. The clarified water is treated in the tank using microalgae and the water is reused in the Bio-digestion process. The requirement for fresh water is drastically reduced and no effluent is generated in this process. As the process water is completely reused, there is no discharge of effluent into any streams.

Waste water disposal/Recycled

The adopted system will incorporate the system of separating solids and liquid with the help of a decanter. Daily 150 tons of animal dung + 150 m³ of water is fed to the digester and after digesting the Total solids and volatile solids in the feed daily 600 m³ of the process slurry water will be generated with 5-6% of solids which are not degraded and can be separated with the decanter and the same will be used as solid organic fertilizer which again constitutes to approximately 43 ton (with @25-30% moisture). Daily 500m³ of this slurry water will be directly recycled back without any treatment to the digester along with the animal dung and only balance 175 m³ needs to be treated further. The generated process slurry water discharge will have the BOD of 100-150 mg/lit and COD in the range of 400-450 mg/lit further with the help of biological cultures and the Algal bio-pond, which will treat the slurry water daily. Algal Bio-pond will be provided for this purpose, the BOD will be reduced to 20-30 mg/l and the COD will be reduced to 100-150 mg/lit. After treatment 140m³ of the slurry water is reused in the biodigester process. Around 35KLD of treated water will be used for on land irrigation in an extent of 3.3 acres of green belt developed in the industry.

Sewage and septage: These waste generated from 45 workers per day in the premises is around 1-1.2 KLD.

This will be treated in Septic Tank followed by Soak Pit.

Process Water Discharge Plan:

Approximately 675 KLD process discharge water will be generated from the proposed Bio-CNG project. The proposed project will adopt 100% recycling of treated slurry water. While 500 KLD is directly recycled back to the Process without any treatment, 175 KLD of the process discharge shall be collected in a settling tank and treated by using microalgae. The algal treated process water is recycled back to make up for the process water of 640-650 KLD. Balance 35 KLD treated water shall be used for green belt.

Characteristics of process slurry water from proposed BioCNG Production Unit will be as under;

Sl.No.	Parameters	Expected Conc. of Generated slurry water.
1	pH	7.0- 8.0
2	Suspended Solids mg/l	1000-2000 mg/l
3	BOD (3 days at 270C) mg/l	50-100 mg/l
4	COD mg/l	200-300 mg/l
5	Po; & Grease mg/l	10-15 mg/l

The Process Discharge treatment is based on algal remediation technology of a 600 KL collection cum algal bio pond will be installed for treatment and reuse of Process waste water.

In this process the discharge will flow via gravity through a bar screen chamber & Grit Chamber to an Algal Bio - pond. A bar screen shall be provided at the inlet point in the bar screen chamber and the waste water will flow through this bar screen in to the Tank. Bar screen shall be so designed that it can be cleaned manually from outside the Tank, the sand, mud and minute particles from the Grit Chamber would have to be removed manually.

Waste water from the equalization tank shall be transferred by pumps in to the primary clarifier where dirt, suspended solids will be separated in a tube settler. The clarified process slurry water shall then flow into the Algal Bio - pond where it will be mixed with microalgae in presence of air & air shall be introduced through paddle mixing system.

After achieving a complete mixing of algae over a retention period of 120hrs, the process water discharge is now devoid of BOD and COD. The algal biomass will add around 2-3% Bio-solids which will improve the Biogas yields while completely using the process water in the Bio gasification process. Any algal biosolids which may settle at the bottom of the Algal Bio-pond shall be intermittently pumped back in to the Bio digester tank by sludge recycle pumps. The sludge accumulated in the primary clarifier and algal biopond shall be transferred to the Bio-digester plant where the solids from the processing operations shall be mixed and additional methane is generated

P.S.: as all the process slurry water is recycled there is no discharge of effluent which makes our process very unique where valuable feed stock in the form of algal biomass is generated while water is treated to suit the process water standards.

Solid Waste Management Plan:

The recovered Bio-solids generated in the slurry water treatment plant after clarification will be used as nitrogen amendment to the anaerobic microbes in the anaerobic digester. The unique design of the Bio-methanation system consisting of a predigester converts the fibrous matter into organic acids which improve methane production. The predigester also reduces the insoluble matter as compared to conventional Bio-methanation systems. The solid sludge generated in the Bio-methanation plant is rich in humus, plant growth promoting microbes and is a nutrient rich manure. The liquid filtrate from the Bio-methanation system along with the concentrated solids shall be given to farmers as a soil amendment.

Management of Toxic and hazardous wastes:

The containers with toxic chemicals, oils and used batteries, plastics and polythene bags shall be stored in a separate area and disposed to manufacturers or recyclers authorized by the Government.

The proposed Bio-CNG Plant shall strictly abide by the regulations of the PCB and shall adopt advanced technologies for pollution abatement, waste management and optimal; use of resources to have a minimum impact on the surrounding environment. Also, continuous up-gradation in processing technologies, equipment and plant maintenance at scheduled intervals shall be adhered to strictly to ensure a pollution free process.

This Environmental management Plan has been prepared in accordance to the Regulations of the State Pollution Control Board of Madhya Pradesh.

Additionality:

Additionality is addressed by determining the most likely course of action, taking into account economic attractiveness and barriers. The project activity involves not only the extraction and subsequent use of CH₄, but also displacement of fossil fuel. In the context of meeting effluent standards, a Novel Algal Bio- pond system with settling and paddle mixing for proper mixing of the waste water contents for algal growth along with sufficient retention time (4 days) has been selected and change to a more costly technology is not been selected to avoid huge amount of electricity consumption and maintenance costs as well as water conservation.

Environmental Benefits:

Bio-gas systems diverts a large part of organic waste and captures the methane from the waste thus directly reduces emissions. Bio-mass combustion is considered as CO₂ neutral so it is not considered as a major producer of greenhouse gas linked to climate change. It is also not a major contributor of acid rains as due to very negligible outputs of sulphuric outputs. The ability to consume Bio-logical waste (in this case food waste) materials keeps water and land resources free from bacteria and diseases.

Tangible Environmental Benefits of the Project:

The project offers a solution to the serious pollution caused from stubble and straw burning in fields, thus reduces greenhouse gases and particulate pollution, helps stop the fertility loss of the soil. The organic manure produced from the solids is rich in Nutrients viz:

PROJECT SCHEDULE (BAR CHART):

The 6000 cum per day Bio-gas plant and upgrading 2400 kg per day Bio CNG unit completed in 8Months engineering, procurement, construction and commissioning of the project are given in the Project schedule

15.1. Implementation terms

Months	1	2	3	4	5	6	7	8	9
Project Documentation									
Construction									
Installation of the Machinery									
Trial Production									
Plant Commissioning									

BILL OF QUANTITIES:**Civil , Equipment & Machinery Items Involved Civil Items**

Sl No	Description	No' s	Unit	Size in m X m X m	Details
1	Loading Platform	2	Sqmt	10 m X 10 m	
2	Pre Digesters(169 cum m)	2	Cum	6x6x6m	Circular
3	Main Digester	2	Cum	27 m x2 7 m x7m ht	square type digester with internal walls with FRP Domes
4	Slurry Outlet Tank	2	Cum	6x6x6 m	Circular
5	Room for Solid liquid separator	1	Cum	4 m X 3 m	Room with RCC slab
6	Shed for Manure Storage	1	Sqmt	50m X 10 X 5 m	Open Shed
7	Shed for Bio-Gas purification, bottling and PLC Control room & office room	1	Sq/mt	50m X 10 m X5 m	Open Shed
8	Watchman room & Toilets	1	Sq/mt	4mx4m with 2 toilets	
9	Office Furniture			Lamsam	
10	Internal Roads		Sqmt	100x6m	Gravel Road

Equipment & Machinery Items Involved

Sl .No.	Equipment's	Description	Details	N of Unit	Capacity
1	Weigh bridge	To measure the weight of the Dung	MS	1 No	--
2	Bio CNG line to the Boiler	To convert the boiler from coal to Bio- CNG	MS	1	--
3	Agitator in pre digester for Mixing system	To mixing the slurry inside of the pre digester	MS	2	--
4	Pumps	To pump the slurry from the pre digester to main digester through bottom mixing unit	MS	2	80 cum/hr
	Mixing system in main	To mixing the surly from pre-Digester to main digester through pressure pump			

5	Digester		SS	2 Set	
6	Biogas Domes over Main Digester	To store the raw biogas generated within the digester	FRP	162 - Domes for 2 digesters	To cover digester
7	Pumps	To pump the slurry from outlet slurry tank to decanter	MS	2 NO	10 cum/hr
8	Decanter	To separate solids and liquids from the slurry	MS & SS	1 No	10 cum/hr
9	PROM unit for manure	To pack the manure in 25 kg bags	MS	1 NO	5 ton/hr
10	Biogas storage balloon	To store the raw biogas before purification	PVC coated fabric	2 No	500 cum/hr
11	Flare unit	To flare the excess biogas generated or to flare the gas if the up gradation unit is under maintenance	MS & SS	1 unit	300 cum/hr
12	H2S Scrubber with inlet blower	To Scrub the hydrogen Sulfide from the raw biogas	MS & FRP	1	300 Cum/hr
13	CO2 purification system	To Scrub the CO2 from the biogas	MS	2	300 cum/hr
14	High pressure compressor	To compress the clean biogas from 0.3 bar to 250 bars	G.I	1	150M3/hr
15	Manifold for bottling	To transport the clean gas from the high pressure compressor to the empty cascade (cylinders)	SS	1 Set	150 cum/hr
16	Piping for slurry and Gas	piping for the biogas plant slurry and Biogas	UPVC & PVC & SS	1 set	--
17	Panel boards	To divide an electrical feed into supplementary circuits of the plant and machinery	Wires	1 set	--
18	Electrical cabling	Entire cabling for the biogas plant	confirming to IS: 7098 (Part-II),	1 set	--
19	Electrical line to the exting Genset of the dairy plant				
20	Fire Fighting	Firefighting system for the entire plant	MS	1 set	--
21	Cylinders & Cascades (12 nos)	To store the Bio CNG	MS	240 No	15000 kg

23	Operation maintainers	To consider 3 months			
24	Consultancy fee for structural drawings, automation, PESSO license	To consider upto completion of the project and provide training 3 months to the workers			

List of Key Equipment's/Machines for Quality Control Labs

(Refer Annexure-II, Section 53 of CPWD Works Manual'12)

Minimum requirement			Available with the	
S.No	Name of Equipment/Machinery	Quantity	bidderName of Equipment/Machinery	Quantity
1.	Balances: i) 7-10KgCap.(Semi-Self Indicating type-Accuracy 10 gm.) ii) 500gmCap.(Semi-Self Indicating type-Accuracy 10gm.) iii) Pan Balance-5Kg (Accuracy 10gm.)	01Nos. 01Nos. 01Nos.		
2.	Ovens: Electrically Operated, Thermostatically Controlled upto 100°C-Sensitivity 1°C	01Nos.		
3.	Sieves-As per IS:460 *IS Sieves:450mm internal dia of size 100mm, 80mm, 63mm, 50mm, 40mm, 25mm, 20mm, 12.5mm, 10mm, 6.3mm, 4.75mm, complete with lid and plan. *ISSieves:200mm internal Dia (brass frame) consisting of 2.36mm, 1.18mm, 500microns, 425microns, 300microns, 212microns,	01Set		
4.	150microns, 90microns, 75microns Sieve shaker capable of 200mm and 300mm dia sieves, manually operated with riming switch	01Nos.		
5.	Equipment for slump test-Slump Cone, Steel plate, tamping rod, steel scale, scoop.	01Set		
6.	Dial gauges 25mm travel-0.01mm/division least count	01Nos.		
7.	Compression testing machine (100T),electrically operated	01Nos.		
8.	Graduated measuring cylinders 200ml capacity	01Nos.		
9.	Enamel trays (for efflorescence test for bricks)-300mmx250mmx40mm	01Nos.		
10.	Circular plates of 250mm dia	02Nos.		
11.	15 cm mold for concrete cubes	38Nos.		
12.	Micrometer Screw 25mm gauge	02Nos.		
13.	Re bound hammer for testing concrete, dynamic penetro meter	01Nos.		
14.	Moisture meter for timber	01Nos.		

FIELD TESTING INSTRUMENTS

(Refer Annexure-II, Section 53 of CPWD Works Manual '12)

S. No.	Minimum Requirement		Available with the Bidder	
	Name of Instrument	Quantity	Name of Instrument	Quantity
01.	SteelTapes– 3m,10m,15m,30m,50m,100m	02Nos.Each		
02.	Vernier Calipers	01Nos.		
03.	Good Quality Plumb Bob	01Nos.		
04.	Spirit Level (minimum 30cm long with 3 bubbles for horizontal and vertical)	03Nos.		
05.	Wire Gauge (circular type) Disc	02Nos.		
06.	Foot Rule	02Nos.		
07.	Long Nylon Thread	As required		
08.	Rebound Hammer for testing concrete	01Nos.		
09.	Dynamic Penetro meter	01Nos.		
10.	Magnifying Glass	01Nos.		
11.	ScrewDriver–30cmslong	01Nos.		
12.	BallPinHammer–100gms	01Nos.		
13.	Plastic Bags for taking samples	As required		
14.	Moisture Meter for timber	02Nos.		
15.	Earth Resistance Test (for Electrical Division)	As required		
16.	Meg gar (for Electrical Division)	As required		

Sub section-5.0 -BATTERY LIMITS

Item	Purchaser's Scope	Refrigeration system bidder's Scope
Civil works	NIL	All in the scope of bidder as per work scope and technical specifications
Water lines	Nearest/suitable location of soft/RO water main header of the dairy.	Tapping of soft/ RO water from the main header of dairy and distribution to all the equipment considered under refrigeration work as per the requirement Distribution to all the FDC for defrosting requirement.
Drain lines	Nil	The drains from all equipment shall be extended and terminated at the nearest drain point available.

Sub Section - 6 - **LIST OF APPROVED BRANDS AND MAKE****CIVIL WORK**

S. NO.	ITEM	MAKE
01.	Grey Cement	Ultratech, ACC, JK or equivalent make as approved by EIC and Architect.
02.	White Cement	JK, Birla or equivalent make as approved by EIC and Architect.
03.	HRC-TMT Reinforcement Bars – High Corrosion Resistant, Thermo Mechanically Tested (TMT) Hot Rolled Deformed Bars	Conforming to IS and TISCO, SAIL, RINL make or equivalent make as approved by EIC and Architect.
04.	Concrete Additive	FOSROC, CICO-TL, SIKA or equivalent make as approved by EIC and Architect.
05.	Flush Doors	GREEN, DURO, CENTURY or equivalent make as approved by EIC and Architect.
06.	Plywood / Block Board	ANCHOR, GREEN, CENTURY, DURO or equivalent make as approved by EIC and Architect.
07.	Pre-laminated Particle Board	NOVAPAN, ARCHIDLAM or equivalent make as approved by EIC and Architect.
08.	Laminates	CENTURY, GREENLAM, FORMICA or equivalent make as approved by EIC and Architect.
09.	Vitrified Tiles	KAJARIA, ASIAN, SOMANY or equivalent make as approved by EIC and Architect.
10.	Ceramic Tiles	KAJARIA, ASIAN, SOMANY or equivalent make as approved by EIC and Architect.
11.	Anti-skid tiles	KAJARIA, ULTRA, ASIAN or equivalent make as approved by EIC and Architect.
12.	Tiles & Stone fixing Adhesive	BAL, KARKQUALL or equivalent make as approved by EIC and Architect.
13.	All Paint, primer, oil bound distemper & synthetic enamel	Asian, ICI, Nerolac or equivalent make as approved by EIC and Architect.
14.	Water proof exterior paint	Asian, ICI, Nerolac or equivalent make as approved by EIC and Architect.
15.	Float Glass	MODI GUARD, SAINT GOBAIN, ASAHI or equivalent make as approved by EIC and Architect
16.	Water proofing compound Agency	As Approved by EIC and Architect
17.	Anti-termite Treatment Agency	As Approved by EIC and Architect
18.	Anodized Aluminum fittings	ZINDAL, INDAL, HINDALCO or equivalent make as approved by EIC and Architect.
19.	Hinges	EBCO, Flora or equivalent make as approved by EIC and Architect.
20.	Bricks	Best Quality Open Bhatta Bricks as approved by EIC.
21.	Sand	Narmada Sand as approved by EIC.
22.	Aggregate	Best quality locally available obtained from cone crusher as approved by EIC.
23.	Lock	Godrej Make or or equivalent make as approved by EIC and Architect.
24.	Automatic Door / Hydraulic Door Closer / Floor Spring	DORMA, GEZE or equivalent make as approved by EIC and Architect.
25.	Stone Texture Finish	UNITILE, ASIAN or equivalent make as approved by EIC and Architect.
26.	Door Fittings	DORMA, GEZE, EBCO or equivalent make as approved by EIC and Architect.
27.	Sanitary Ware	KOHLER, DURAVIT or equivalent make as approved by EIC and Architect.

28.	Bath Fittings	KOHLER, HANSGROHE or equivalent make as approved by EIC and Architect.
29.	ACP Sheet	ALSTRONG, ALCOBOND or equivalent make as approved by EIC and Architect.
30.	Gypsum board	As approved by EIC and Architect
31.	Polycarbonate sheet	As approved by EIC and Architect
32.	Colour coated sheet	As approved by EIC and Architect
33.	GI Pipes	TATA, JINDAL or Approved Equivalent
34.	CPVC Pipes / Fittings	ASTRAL or equivalent make as approved by EIC and Architect.
35.	PVC Pipes / Fittings	Finolex, Prince, Suprime or equivalent make as approved by EIC and Architect.
36.	CI Pipes	As approved by EIC and Architect.
37.	Nahai Trap PVC	Finolex or equivalent make as approved by EIC and Architect.
38.	SS Pipe 304 grade	As approved by EIC and Architect.
39.	Aluminium Panel Sun Louvres	Hunter Douglas India Pvt. Ltd. or equivalent make as approved by EIC and Architect.

NOTE:

This is a general indicative list of the materials for the brand and make of the material to be used by the contractor. The specification mentioned in the Schedule of Quantities shall take precedence. However, the contractor shall take approval of Architect and EIC regarding the make and type of each material before execution. The Architect and EIC's decision regarding the use of material mentioned above or mentioned in Schedule of Quantities or equivalent will be final and binding on the contractor. In case contractor wishes an alternative other than suggested by Architect, equivalent to those listed above or mentioned in Schedule of Quantities for economy and better quality, the name shall be submitted to Architect and EIC giving detailed specification, catalogue, price list along with the samples for approval from the Architect. All the necessary test shall be carried out at no extra cost and report be submitted to EIC and Architect. The Architect and EIC reserve the right to permit or nor permit the contractor for use of other alternate without any reasons and contractor is bound to follow the decision of the EIC and Architect in this regard.

LIST OF APPROVED MAKES FOR ELECTRICAL

S. NO.	ITEM DESCRIPTION	MAKES
01	Distribution Transformer, Star Rating	ABB, Tesla Transformer, Voltamp, Schneider
02	Power Transformer	BHEL, Crompton Greaves, ABB, Schneider
03	Vacuum Circuit Breaker, SF-6/Gas filled Circuit Breaker	ABB, Schneider, Siemens, crompton
04	ACB	ABB, Schneider, Siemens
05	PSS/CSS with HT/LT Switch Gear, Transformer and connected accessories	ABB, Schneider, Siemens, L&T
06	MCCB, MCB, ELCB, RCCB, DB, ICTPN, TP, HRC Fuse, Change over Switch, Switch Fuse Unit	ABB, Schneider, Siemens, L&T
07	XLPE Cable 11/33kV grade	CCI, Gloster, Finolex, Ravin cable
08	PVC/XLPE Power Cables up to 1.1kV grade	CCI, Gloster, Universal, Ravin cable
09	Instrument Voltmeter, Ammeter, PF meter	Schneider, Automatic Electric, Siemens, HPL
10	33/11kV Cable End Termination & Jointing Kits	Raychem, 3M, Mahendra
11	Relays	Siemens, Schneider, C&S
12	Lighting Fixtures	Phillips, Schreder, Crompton Greaves, Wipro CleanRay, GE
13	PVC insulated Elect. Wires Sheathed/ unsheathed, PVC flexible LT cable, multicore, single core, Flat cable for submersible pumps	Finolex, RRcable, HPL
14	Current Transformer	Schneider, Automatic Electric, Siemens, HPL
15	On line UPS, Servo Stabilizer, Inverter, CVT	APC, TATA Libert
16	Rotary Switches, Selector Switches	Kaycee, Siemens, Schneider
17	Exhaust fan/ Air Circulator/ Bracket & Pedestal fans/ Ceiling fan	Crompton Greaves, Polar
18	Electronic Energy Meter	Secure, ABB, Schneider
19	Capacitors- PF correction for Electrical General Services	BHEL, ABB, Schneider, EPCOS
20	DG Sets - Portable	Birla Yamaha, CGL, Shriram Honda,
21	DG Engine	Cummins, Kirloskar, Caterpillar, Ashok Leyland, Penta-Volvo
22	Alternator for DG set	KEC, CGL, Stampford, Leroy-Somer, Kirloskar-Green
23	LT Switchgear & control gears- Contactors & motor starters, Energy Efficient Soft Starter panel/ Earthing Switch, Single phase preventer	ABB, Siemens, Schneider, C&S
24	Timers - Electronic Solid State	ABB, Siemens, Schneider
25	Water Coolers	Blue Star, Fedders, Kelvinator, Shriram, Sidwal, Voltas
26	Electrical Accessories (Piano Switch, Plugs & Sockets, Ceiling Rose, Angle Holder, Holders)	Legrand, Schneider, Havells
27	Bell Buzzer	Schneider

28	Electronic Fan Regulator	Crompton Greaves
29	GI/MS Pipe	TATA, Jindal, TT Swastik, Prakash Surya
30	Geysers	Crompton Greaves, Recold
31	Lifts & Escalators	OTIS, ThyssenKrupp, Shindler, KONE, Mitsubishi.
32	Solar Water Heaters	As per MNES approved sources.
33	Solar Distilled Water Plants	Makes can be approved on the recommendation of divisions.
34	Battery Charger for battery room	Amar Raja, Exide, RS Power
35	PVC Conduit pipe & Casing capping for electrical wiring	A.K.G., Polycab, BEC
36	Aluminum Ladders	Sumer, Beatfire
37	LT Panels	From CPRI tested firms.
38	Air Curtain	Aircon, ALMONARD, CGL
39	Early Streamer Emission Lightening Conductor Air Terminal (ESELCT)	Ingesco (Spain)
40	33 KV Air break switch	Atlas (Bomay)
41	33 KV LA	Elpro, CGL
42	33 KV Drop out fuse	Atlas (Bomay)
43	Control and Relay Panel	ABB, AREVA, Schneider, Siemens
44	Batteries	Exide, Amco, Amar Raja, HBL Nife
45	Battery Charger	Chhabi, HBL, Caldine, Masstech, DUBAS, Statcon
46	Fire Protection System	Vijay, Unitech, Technofab, Mather & Platt, Steelage.
47	Wires - Copper Type	Finolex, RR
48	Telephone Wire	Finolex, Indoplast, RR, Delton
49	Telephone Cable	Finolex, Delton, Nicco, Indoplast, RR
50	Wall Brackets, Ceiling Light, Bollard	Philips, Wipro, Schredder
51	Coaxial TV Cable	Finolex, Havells, American North Star, RR
52	Octagonal Pole	Philips, Wipro, Schredder
53	Pump	KSB, Kirloskar, Grundfos
54	Advance Lightening System	Indelec, LPI, Ingesco

NOTE:-

This is a general indicative list of the material for the brand and make of the material to be used by the contractor. The specification mentioned in the Schedule of Quantities shall take precedence. However the contractor shall take approval of Architect and EIC regarding the make and type of each material before execution. The Architect and EIC decision regarding the use of material mentioned above or mentioned in Schedule of Quantities or equivalent will be final and binding on the contractor. In case contractor wishes an alternative other than suggested by Architect, equivalent to those listed above or mentioned in Schedule of Quantities for economy and better quality, the name shall be submitted to Architect and EIC giving detailed specification, catalogue, price list along with the samples for approval from the Architect. All the necessary test shall be carried out at no extra cost and report be submitted to EIC and Architect. The Architect and EIC reserve the right to permit or nor permit the contractor for use of other alternate without any reasons and contractor is bound to follow the decision of the EIC and Architect in this regard.

B. APPROVED MAKESFOR ELECTRICAL WORKS

1.	ELECTRIC MOTORS	KIRLOSKAR ELECTRIC / CROMPTON GREAVES
2.	BATTERY :	EXIDE / STANDARD / AMAR RAJA/ MINIMAX
3.	MOTOR CONTROL CENTRE/PANEL :	Approved quality and make/TAC APPROVED & IS STANDARD
4.	PVC SHIELDED ARMOUED/FLEXIBLE CONTROL / POWER CABLES	POLYCAB/HAVELL`S/ FINOLEX
5.	MCCB :	L&T/SIEMENS/SCHNEIDER / ABB
6.	CONTROL MCB :	L&T/SIEMENS/SCHNEIDER / ABB
7.	VOLT METER SELECT SWITCH :	L & T / KAYCEE/ SIEMENS
8.	VOLTMETER (AC / DC) :	TAC APPROVED
9.	AMMETER (AC / DC) :	TAC APPROVED
10.	POWER CONTACTORS :	L&T/SIEMENS/SCHNEIDER
11.	OVER LOAD RELAY :	L & T / SIEMENS
12.	MAIN SUPPLY SELECTOR – DPMCB :	L & T / SIEMENS
13.	SMOKE DETECTOR/HEAT DETECTOR :	SYSTEM SENSOR/APOLLO
14.	MANUAL CALL POINT :	AGNI SURKSHA/SYSTEM SENSOR
15.	ELECTRONIC SOUNDER/HOOTER :	AGNI SURKSHA/SYSTEM SENSOR
16.	RESPONSE INDICATOR	AGNI SURKSHA/SYSTEM SENSOR

Sub-Section 7- Responsibilities**RESPONSIBILITIES OF BIDDER**

1 Developing the process design, complete engineering design, manufacturing and/or supply of respective equipment/goods/services as per the technical specifications and ensuring best performance of individual equipment/systems/operation as a whole. The bidder shall avail the assistance of reputed specialists in the respective field wherever required as well as past experiences gained during installation/commissioning of the projects.

2. Providing technical data, technical literature

3. Arranging for approvals from various Statutory Authorities on behalf of the Purchaser. The statutory fees will be reimbursed by Purchaser on production of receipt.

4. First charge oil/lubricants.

5 Execution of project in accordance with prevailing Indian standards IER & IS wherever applicable & relevant to this project.

6. Testing and commissioning satisfactorily and performance of all equipment in bidder's scope and after sales service at mutually agreed terms.

7. Test equipment, test kits, instrumentation and materials required for establishing performance parameters.

8. Provide necessary manpower during positioning, pre-commissioning, testing and commissioning along with tests.
9. Testing, commissioning of the system under scope as per agreed performance parameters and utility consumption.
10. Training Purchaser's personnel in the field of instrumentation automation, management system, plant operation & control, maintenance & repair of systems & equipment.
11. Dry Chemical Powder type fire extinguishers shall be provided at strategic points by supplier as per requirement.

2. RESPONSIBILITIES OF BIDDER/PURCHASER

- 1 bidder to take approval of civil design, building layout and drainage and sewage details.
- 2 .Documents on local site conditions related to climate, access and communications by purchaser.
3. Water: Water shall be provided by Purchaser at Free of Cost at one Point. Power: The Power for erection has to be arranged from Contractor through DG/Obtaining Separate Temporary Line from Electricity Board.
4. water and power supply at the time of pre-commissioning of the plant by purchaser.
5. Adequate staff including operators, supervisors and engineers for product trials by purchaser
6. Raw products, packaging materials by purchaser.
7. Timely provision of personnel for training by purchaser.
8. Provide open storage area, lockable store during erection and commissioning of project by purchaser.
9. Suitable Site fabrication area.
10. Telephone and fax on chargeable basis.

Sub - Section 8

PROJECT MANAGEMENT

1. TIME SCHEDULE

- 1.1. Project execution shall be scheduled to mutually agreed time bound program, which should not exceed as specified in the IFB from the date of signing of contract to commencement of trials and service load trials. The Project Manager of bidder will provide all the details to the Project Manager of the Purchaser with timely expediting and progress reports, which clearly indicate the actual vs., planned progress and the new likely completion dates of supply, erection, and commissioning and product trials.
- 1.2. The bidder shall provide project-staffing pattern before commencement of work and should include sufficient personnel to meet the execution time schedule.

2. MANAGEMENT TEAM

- 2.1. A Project Manager/consultant of JDS who shall be adequately experienced in projects of similar magnitude and type shall head a competent executive team. Reputed experts in various fields who shall be responsible for satisfactory execution of the project shall assist the Project Manager. He shall be responsible for over all implementation of the project, from commencement to final takeover of the system executed.
- 2.2. A Project Engineer shall be appointed for day to day operation and co-ordination, and to ensure successful and satisfactory design, procurement, manufacture, inspection, erection, testing and commissioning of all the equipment/facilities/systems within the time bound schedule.
- 2.3. The Project Manager/consultant and Project Engineer shall attend technical and review through discussions/ if required in meeting between various parties involved in the project, and ensure implementation of all decision taken in the meetings.

2.4. The Project Manager of supplier shall also be responsible for detailed material accounting at site and management of project materials and equipment stored at site.

2.5. The JDS will nominate a Project Manager with whom the Project Manager of Supplier shall communicate/co-ordinate

3. APPROVAL

3.1. Purchaser shall give approval on technical documentation at the earliest after submission. Amendments, which are not in the original scope of work or due to changes in concept, shall be taken up by the supplier as per mutually agreed rates to be decided before execution, and shall be binding on the supplier.

3.2. Supplier shall obtain approval for purchase of specific makes of equipment

whose makes are not mentioned in his offer. If two or more makes of equipment are mentioned in the form of alternatives in the approved list, the supplier shall select any one of the particular make from the approved list after mutual discussions with the Purchaser.

4. INSPECTION

1. For equipments/accessories/items, the suppliers shall invite Purchaser for inspection and preliminary testing. Inspection may be required at various stages of installation/assembly for some items. The Purchaser will arrange to complete such inspection as may be necessary along with clearance within a reasonable time from the date of intimation by the supplier.

5. SITE WORK AND INSTALLATION

1. Protection of electronic equipment.

It is the responsibility of the bidder to ensure that all electronic equipment and control system shall be fully protected against hostile environment, humidity, heat and dust that will be encountered during storage and installation.

2. Temporary power supplies.

Power supply at site is normally very stable, but the bidder is responsible to ensure that delicate electronic equipment used during construction, such as welding machine, testing devices etc. are protected against damage from main supply. In the event of a major power failure in the system, it shall be the responsibility of the bidder to hire a diesel generator if this proves to be necessary.

3. COMMISSIONING

1. After satisfactory erection and testing, a competent team shall be deputed to commission the plant and to run operation trials and to establish performance parameters. However the commissioning of the complete plant will be done at an appropriate stage which shall be informed to the successful bidder. Bidder to participate in the entire plant commissioning activity and ensure that his

equipment is working as per the specifications and in the harmony with other equipment and design philosophy.

4. TRIAL AND PERFORMANCE GUARANTEE

1. On completion of the Commissioning period, the plant will be operated at full capacity to the satisfaction of the Project Authority for a period of seven days on the designed product.

2. Performance Guarantee: Performance and services consumption guarantees, and the relevant penalties for not meeting the rated capacities and efficiencies are covered in the tender.

5. TRAINING

1. The objective of the training is to provide selected staff members of the dairy with necessary knowledge of operation and maintenance to ensure sound and suitable operations of the plant. Emphasis will be given on application as well as operation and not on basics.

Electrical staff

Training on PCC and MCC

Training on control and power wiring diagram

Fault finding and maintenance

6. SERVICE COVER

The representative of the supplier shall attend the project for two days each month throughout the performance period following first operation trials. These visits will cover meetings, training, equipment adjustment and servicing. These visits will not cover guarantee work, which will be undertaken separately.

The objective of service covers are intended to ensure that the efficiency of the plant is maintained at the optimum level and:

1. To help improve operating and maintenance procedures.
2. To keep the plant adjusted for optimum energy efficiency, product quality and minimum product losses.
3. To arrange for service visits by specialists to inspect, service and carry out reports.
4. Spare parts during the services cover shall be supplied by the Purchaser

Sub –Section-9. Deviations from Technical Requirement

1. This tender document provides guidelines for the processes and equipment to be used in the tender package and the "basis of design" and the "standards and specifications", define the qualitative parameters against which equipment will be required to perform.

2. It is incumbent on the bidder to provide a fully detailed list of equipment and services, which they intend to provide to fully execute the contract in line with the tender document.

3. At various points in the tender the purchaser has stated that alternative processes or alternative equipment will be considered. The bidder as part of the bid document shall provide the fully detailed list of such alternatives, together with a clear rationale for employing such alternatives.

4. Items, which deviate from the tender proposal, shall be as per design specification of the bidder and shall be treated as a deviation from the text of this tender document. Deviated items should fulfill the minimum performance parameters as specified in the tender.

5. This tender does not allow bidders to make exclusions from any part of the tender packages for which they bid, and an incomplete list of equipment or an incomplete schedule of services to be provided would be considered as a non-responsive bid. Technical Deviation Statement Form

Sr.

No Clause

Reference Deviation Remarks (Justification)

Above are the particulars of deviations from the requirements of the tender specifications. The technical

specifications furnished in the bidding document shall prevail over those of any other document forming a part of our bid, except only to the extent of deviations furnished in this statement.

Date

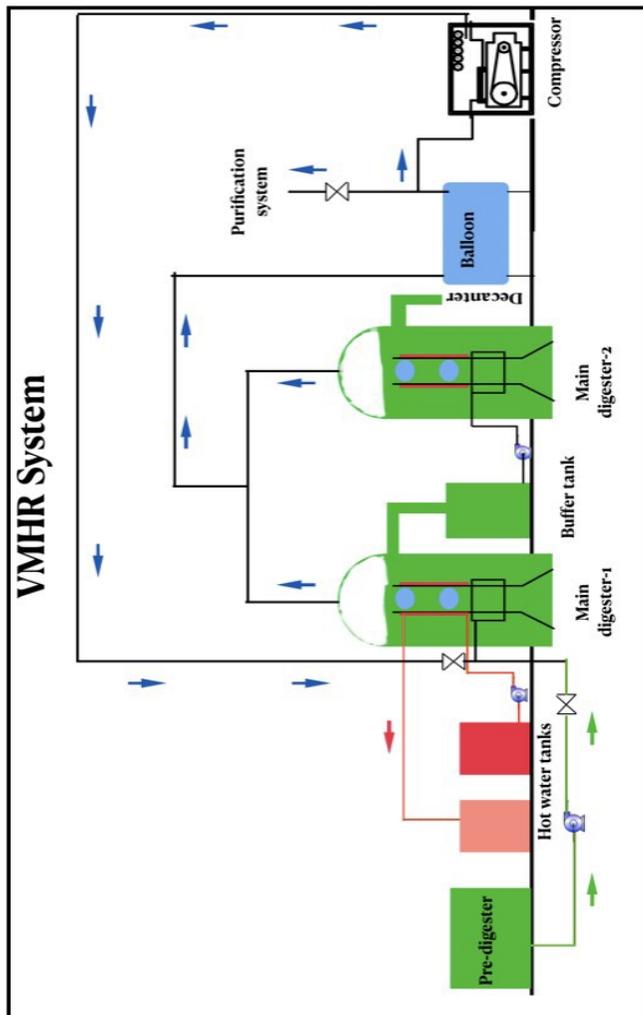
Signature of Authorized Signatory of Bidder/Supplier

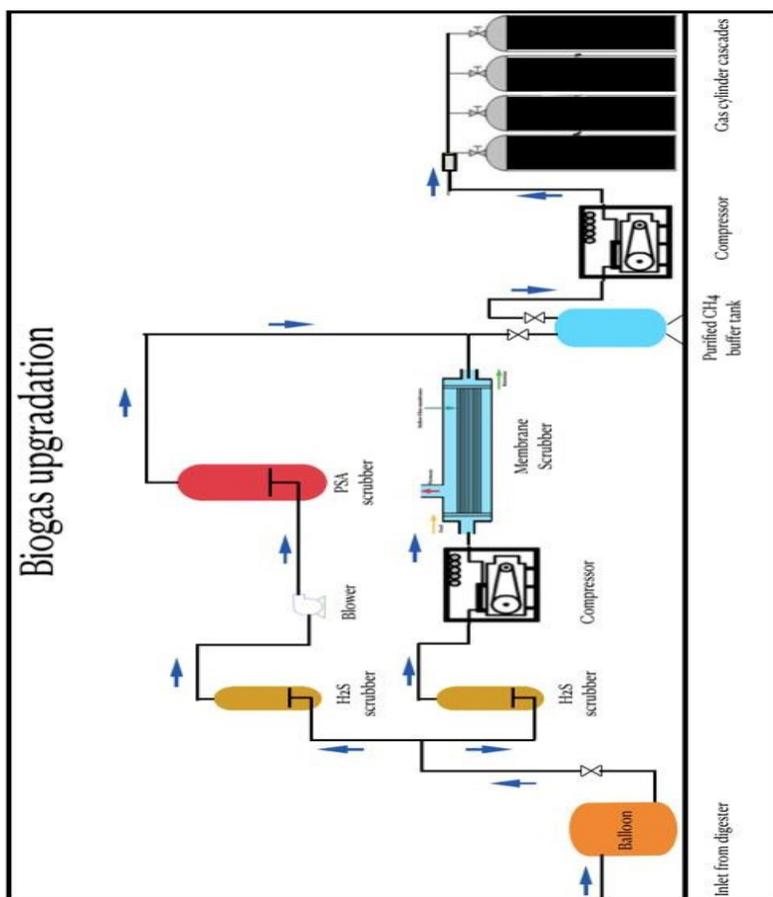
NOTE: Where there is no deviation, the statement should be returned duly signed with an endorsement indicating- No deviation

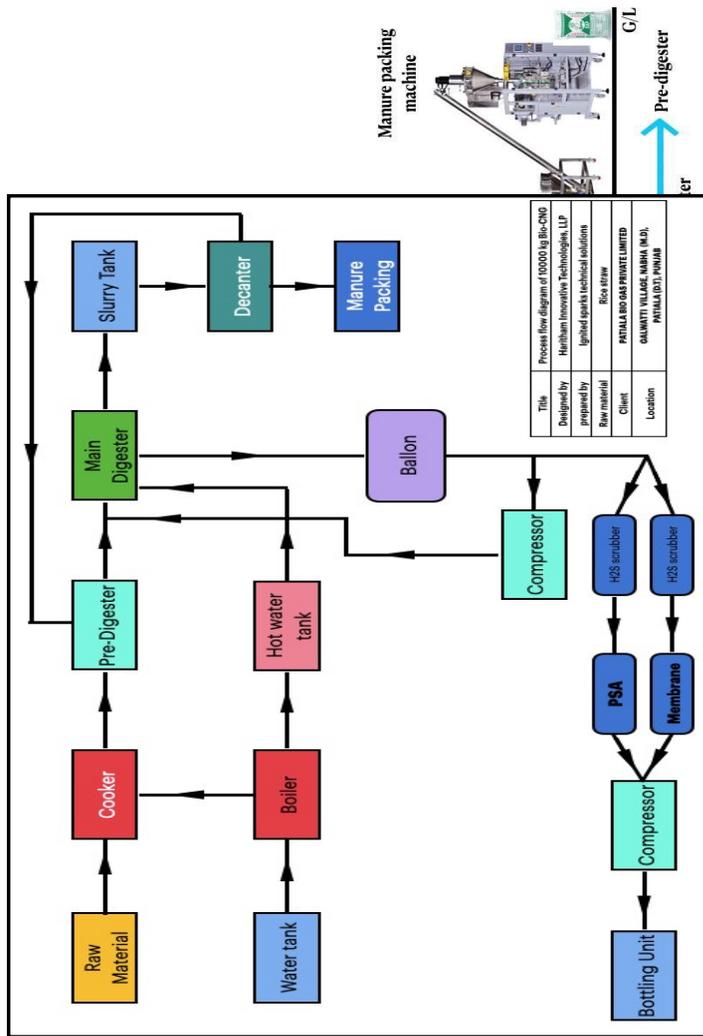
Sub -Section 10. DRAWING, DATA&DOCUMENTATION SUBMISSIO

FLOW DIAGRAMS AND ENGINEERING DRAWINGS OF PLANTS & MACHINERY

As given earlier for bidder's reference







DRAWING AND DOCUMENTS FROM BIDDER

The Bidder must enclose all Drawings related to installation of equipment including electrical with the Offer:

.Proposed layout for which is relevant.

. Utilities flow diagram including utility equipment, interconnection piping, controls, instruments, automation etc.Single line diagram for electrical distribution system.

. The bidder should follow the guideline for preparation of drawing as described in general. Any deviation in thickness of material of construction and general arrangement will be specifically mentioned in the drawing as remark.

Sub Section – 11 Criteria for Technical Evaluation of Bids

The purchaser will evaluate and compare the technical merits of the bids based on the information supplied by the bidders taking in to account

The following factors:

Suitability of the process with regards to ultimate product quality conforming to the standards specified in the tender.

Specifications of individual equipment as well as the system as a whole form a part of construction, throughput, operating parameters, level of automation etc.

Energy efficiency of individual equipment and system as a whole.

Determination of filling accuracy of the product packaging machines and product losses.

Product losses during processing and product manufacturing for individual equipment and ultimately in the effluent system.

Also mentioned in tender notification for bid weight age

Sub section-12. PERFORMANCE TESTS

The bidder is required to detail the documentation proposed for performance tests of all major items of equipment and all major processes and services plant. This shall detail the guaranteed vs. actual throughput or output or performance (as relevant) and the tolerance of accuracy. Also the test methods proposed to demonstrate that these guarantees have been met.

FORMATS OF GUARANTEES:

- . Guarantees for throughput of various sections of plant supplied.
- . Product quality.
- . Weight and Measurement tolerance.
- . Service consumption.
- . Formats for performance tests. Procedure for carrying out the .
- . Method of measurement
- .Test duration
- . Evaluation methodology

UTILITIES CONSUMPTION

The following tables are to be completed by the bidder and returned with bidding documents. This is mandatory and failure to comply may make the bid deemed non-responsive. Utilities Consumption Data

Power Peak Load kW

Total Load kWh/day

Tolerance \pm %

Air Peak Load Nm³/hr

Average Load: Nm³/Hr

Total Load Nm³/day

Tolerance \pm %

11.5 DETAILS OF CONSUMABLE MATERIALS

Bidder is to provide full details of all consumable materials and chemical used in the plant.

Details of Consumable Materials

Item

Sub section-13. MAXIMUM LIABILITY

The maximum liability of suppliers on all counts of penalties including above, Liquidated Damages clause and other liabilities of any kind shall not exceed 10% of Contract value.

Sub section-13 - Form of particulars of bidder's organization, contract agreement and bank guarantee for performance security and advance.

1. Particulars of organization.

I/We hereby furnish following particulars about our unit :

1. Name of the Unit :.....

2. Address of the Unit :.....

3. Name & Address of the :.....

Directors/Partners :.....

Name with Designation of other persons :.....

authorized to sign the documents on behalf

:..... of the Unit if anyway

:.....

Telephone /Fax No. Office..... Factory.....

Telegraphic Address Office.....

Factory

Particulars of the Registration certificate issued by the Directorate of Industries

..... Registration No. &

Date.....

GST No. & DateState..... ST No. &Date.....

9. GST and income tax Assessment /Clearance has been made for the year last two years..... (Enclose Return/Assessment/Clearance certificate)

10. Whether the unit or its sister concern unit or any unit of their proprietorship ,if any, has been Black listed/Debarred or Penalized by any central or state Govt./Organization at any Time.....

YESNO.....

If "YES", when and Why? Give Reasons in Detail :

11.Manufacturing Facility :..... 12.

Specification of the Plant :.....

:.....

(Please fill the Technical specifications in

Customers on current list : (separate sheet may be attached)

:.....

If you Propose to Diversify to Technological advancement if so, What is the expected time

.....

Name & address of service canters/engineers

No. of EQUIPMENTS supplied to coop. milk unions in last 5 years (separate sheet may be attached)

.....

Annual turnover of the firm from EQUIPMENT segment (attach proof)

Whether the EQUIPMENTS are being manufactured in India

EMD details : DD No.Date :

Amount Rs.

Name of bank.....

I/We undertake that the information furnished in this tender document is correct to the best of my/our Knowledge and belief .

Date :

Place :

Signature of authorized Signatory of the Unit

(with seal)

2.CONTRACT AGREEMENT FORM

(Referee clause 20(III) of General Terms and Conditions)

(On a Non-Judicial Stamp Paper of Rs.500.00)

THIS AGREEMENT is made at Jabalpur on the _____ day of _____ 20 between Chief Executive Officer, Jabalpur Sahakari Dugdha Sangh Maryadit, Jabalpur, MP, India (hereinafter called "JDS") of the one part and _____ (hereinafter called "the Contractor") of the other part.

WHEREAS JDS has appointed Supplier/Contractor to get work done under the contract of the bid which has been submitted by Supplier/ Contractor and who has accepted a bid in response to the JDS' Bidding Document Reference _____ with regards to undertaking of the Mechanical &

Electrical work, for a sum of Rs. _____ (Rupees)

(hereinafter called "the Contract Price").

NOW THIS AGREEMENT WITNESSTH AS FOLLOWS:

In this agreement words and expressions shall have the same meaning as in the Terms and Conditions and in respective Sections in the above referred Bidding Document.

The following documents shall be deemed to form and be read and construed as part of this Agreement, viz the offer and price schedule submitted by the Contractor:

b. the scope of work/ supply of items and the technical specifications in respective section of the above referred Bidding Document:

The General terms and conditions, special conditions of erection and commissioning in respective Sections in the above referred Bidding Document:

d. The JDS Work Order No. _____ dated _____ (Fileref.: _____)

In consideration of the payments to be made by the JDS to the Contractor, the Contractor hereby covenants with the JDS to undertake the.....
..... and to remedy defects therein in conformity in all respects with the provisions of the Work Order given by the Consultant and Bidding Document.

WITNESS whereof the parties hereto have caused this agreement to be executed in accordance with their respective laws the day and year first above written.

Signed, Sealed and Delivered by _____ Signed, Sealed and Delivered by the said the said

Authorized Signatory _____ Authorized Signatory
Chief Executive Officer, Jabalpur

Contractor Sahakari Dugdha Sangh Maryadit, Jabalpur,MP, India

In the presence of: In the presence of:

Witness

1)Signature1)

Signature

Name

Address

Address

2)Signature 2)Signature

Name Name

Address Address

2 (Form of Bank Guarantee for Performance Security)

(Refere clause 21-A(c) of General Terms and Conditions)

(On the Non-judicial Stamp paper as per the Stamp Act of Local State Govt.)

Bank Guarantee No..... Date:.....

This deed of performance guarantee made this _____ day of 20__ (Two Thousand _____) by _____(Name and address of the Bank) (herein referred to as the Bank) which expression shall unless repugnant to the context and meaning thereof includes its legal representatives, successors and assignees and the _Chief Executive Officer, Jabalpur SahakariDugdha Sangh Maryadit, Jabalpur,MP, India_(hereinafter referred to as "JDS") which expression shall unless repugnant to the context and meaning thereof include its legal representative, successors and assignees.

Whereas, JDS has awarded a Contract and Purchase order bearing No._____ dated _____ on M/s._____ (Name and address of the party) (hereinafter referred to as the 'Supplier') for the.....And whereas, the Supplier has agreed to submit a performance guarantee in the form of a Bank guarantee to the JDS as per terms and conditions of the Bidding Documents and the Contract which will be kept valid up to _____ calendar months from the date of Bank Guarantee (the period should be till end of warranty period).

In consideration to the above where in JDS has awarded the contract/purchase order to the Supplier, we _____ (name of the Bank), do hereby guarantee, undertake, promise and agree to with the Service Recipient, its legal representatives, successors and assignees that the within named _____(name of the Supplier) their legal representatives and assignees will faithfully perform and fulfill everything within the Bidding Document and the Contract/Purchase order on their part to be performed or fulfilled, at the time (time being the essence of the contract)and in the manner therein provided, do all obligations the reunder and we further undertake and guarantee to make payment to the JDS of Rs._____ (Rupees

_____ only) being the 10% of the contract value, without any demur in case the Supplier, their legal representatives and assignees do not faithfully perform and fulfill everything within the Bidding Document and the Contract/Purchase order on their part to be performed or fulfilled, at the time and in the manner therein provided and do not willfully and promptly do all obligations thereunder.

In case, the Supplier fails to perform or fulfill the Contract/ Purchase Order as per the terms and conditions agreed upon, the JDS is entitled to demand an amount equal to Rs. _____ being the 10% of the contract value from the Supplier and the demand made by the JDS itself will be conclusive evidence and proof that the Supplier has failed to perform or fulfill his obligations and neither the Supplier nor the Bank will be entitled to raise any dispute regarding the reasons for the failure of performance or fulfillment, on any ground.

We, _____ (name of the Bank), do hereby undertake to pay an amount equal to Rs. _____ being the 10% of the order value, being the amount due and payable under this guarantee without any demur, merely on a demand from the JDS which has to be served on us before the expiry date of Bank Guarantee i.e., _____ stating that the amount claimed is due by way of non-performance of the contractual obligations as aforesaid by the Supplier or by reason of the Supplier's failure to perform the said contractual commitments/Purchase Order, 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 Rs. _____ (Rupees _____ only) being the amount equal to 10% of the total order value.

We, _____ (name of the Bank), further, agree that the performance guarantee herein contained shall remain in full force and effect for a period of _____ calendar months from the date of Bank guarantee (the period should be till end of warranty period) and till the Service Recipient certifies that the terms and conditions of the said contract/ purchase order have been fully and properly carried out by the said Supplier and accordingly discharge the guarantee, unless a demand or claim under this guarantee is made on us in writing by the JDS on or before _____, we shall be

discharged from all liabilities under this performance guarantee thereafter.

We, _____ (name of the Bank), further agree with the JDS that the JDS shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said

Bidding Document and the Contract/Purchase order or to extend the time of performance by the said Supplier from time to time or postpone for any time or from time to time and any of the power exercisable by the JDS against the Supplier and to forebear or enforce any of the terms and conditions relating to the said Bidding Document and the

Contract/Purchase Order and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Supplier, or for any forbearance, or omission on the part of the JDS to the said Supplier by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

This guarantee shall be in addition to and without prejudice to any other securities or remedies which the JDS may have or hereafter possess in respect of the goods supplied/executed or intended to be supplied/executed and the JDS shall be under no obligation to marshal in favor of the Bank any such securities or funds or asset that the JDS may be entitled to receive or have a claim upon and the JDS at its absolute discretion may vary, exchange, renew, modify or refuse to complete to enforce or assign any security or instrument.

The Bank agrees that the amount hereby guaranteed shall be due and payable to the JDS on serving us with a notice before expiry of bank guarantee, requiring the payment of the amount and such notice shall be deemed to have been served on the Bank either by actual delivery thereof to the Bank or by dispatch thereof to the Bank by Registered Post at the address of the Bank.

In order to give full effect to the provisions of this guarantee the Bank hereby waives all rights inconsistent with the above provisions and which the Bank might otherwise as a guarantor be entitled to claim and enforce.

We, _____ (the name of Bank) , undertake to renew the Bank Guarantee provided the request for renewal is made by the supplier before the expiry of Bank Guarantee.

We, _____ (the name of Bank), lastly undertake not to revoke this guarantee during its currency except with the previous consent of the JDS in writing and the guarantee shall be a continuous and _____ irrevocable _____ guarantee _____ up _____ to _____ a sum _____ of Rs. _____ (Rupees _____ only).

Notwithstanding anything stated hereinbefore: (i) our liability under this guarantee is restricted to Rs. _____ (ii) the guarantee shall remain in force till _____ 20 ____ and (iii) The Bank is liable to pay the guarantee amount or any part thereof under this bank guarantee only if the JDS serves upon the Bank a written claim or demand on or before _____.

(SIGNATURE)

Place: SEAL

Date: CODE

NO

NOTE:

1 THE SUPPLIER SHOULD ENSURE THAT SEAL AND CODE NO. OF THE SIGNATORY IS PUT BY THE BANKERS, BEFORE SUBMISSION OF THE BANK GUARANTEES.

STAMP PAPER IS NOT REQUIRED IN CASE OF FOREIGN SUPPLIERS.

THE VALUE OF STAMP DUTY SHOULD BE AS PER THE LATEST STAMP

ACT OF LOCAL STATE GOVERNMENT FROM WHERE THE BANK GUARANTEE ISSUED.

1. **Form of Bank Guarantee for advance**

(On the Non-judicial Stamp paper as per the Stamp Act of Local State Govt.)

2. Bank Guarantee No. Date:

3. 1. In consideration of Chief Executive Officer, Jabalpur Sahakari Dugdha Sangh Maryadit, Jabalpur, MP, India (hereinafter called 'JSDS') having agreed to grant an advance of Rs. _____ (Rupees _____ only) to M/s. _____ (here in after called the said supplier) under the terms and conditions of an contract/purchase order No. _____ dated _____ made by IDS to M/s. _____ **Jabalpur Sah.Dugdha Sangh**(hereinafter called the `said contract/purchase order') on production of a Bank Guarantee for Rs. _____ (Rupees _____) only.

4. We _____ (here in after called `the Bank') do hereby undertake to pay the IDS an amount not exceeding Rs. _____ (Rupees _____ only) against any loss/damage caused to or suffered would be caused or suffered by the IDS by reason of any breach by the said supplier(s) of any of the terms and conditions contained in the said contract/ purchase order.

5. 2. We, _____(the name of Bank) , do hereby undertake to pay the amounts due and payable under this guarantee without any demur merely on a demand from the JSDS which has to be served on us before the expiry date of Bank Guarantee i.e., _____ stating that the amount claimed is due by way of loss or damage caused to our would be caused to or suffered by the JSDS by

reasons of any breach by the said supplier(s) of any of the terms and conditions contained in the contract/purchase order or by reasons of the supplier(s) failure to perform the said contract/purchase order, any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee shall be restricted to an amount not exceeding Rs. _____

6. (Rupees _____) only.

7. 3. We, _____(the name of Bank), 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 contract/purchase order and that it shall continue to be enforceable till all the dues of the JSDS, under, or by virtue of the said contract / purchase order have been fully paid and it's claims satisfied or discharged or till Service Recipient certifies that the terms and conditions of the said contract/Purchase Order have been fully and properly carried out by the said supplier(s) and accordingly discharge the guarantee unless a demand or claim under this guarantee made on us in writing on or before

_____, we shall be discharged from all liability under this guarantee thereafter.

8. 4. We, _____ (the name of Bank), further agree with the JSDS that the Service Recipient shall have the fullest liberty without our consent and without affecting in any manner our obligation here under to vary any of the terms and conditions of the said contract / purchase order to extend time of performance by the said Supplier from time to time or to postpone for any time or from time to time any of the power exercisable by the JSDS against the said supplier and to forbear or enforce any of the terms and conditions relating to the said contract/Purchase Order and we shall not be relieved from our liability by reason of any such variation, or extension or for any forbearance, act of omission on the part of the JSDS or any indulgence by the IDS to the said Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

9. 5 The Bank agrees that the amount hereby guaranteed shall be due and payable to the JSDS on serving us with a notice before expiry of Bank Guarantee requiring the payment of the amount and such notice shall be deemed to have been served on the Bank either by actual delivery thereof to the Bank or by dispatch thereof to the Bank by registered post at the address of the Bank.

10. 6. We, _____ (the name of Bank), lastly undertake not to revoke this guarantee during its currency except with the previous consent of the JSDS in writing.

11. 7. We, _____ (the name of Bank), undertake to renew the Bank Guarantee provided the request for renewal is made by the said supplier before the expiry of Bank Guarantee.

12. 8. Notwithstanding anything stated hereinbefore (i) our liability under this Bank Guarantee is restricted to Rs. _____ (Rupees _____ only) (ii) The guarantee shall remain in force till the _____ 20__ and (iii) The Bank is liable to pay the guarantee amount or any part thereof under this bank guarantee only if the JSDS serves upon the Bank a written claim or demand on or before _____.

13. Place: _____

14. Date :

15. (SIGNATURE)

16. SEAL

17. CODE NO.

18. NOTES:

1. SUPPLIERS SHOULD ENSURE THAT SEAL AND CODE NO. OF THE SIGNATORY IS PUT BY THE BANKERS, BEFORE SUBMISSION OF THE BANK GUARANTEES.

2. STAMP PAPER IS NOT REQUIRED IN CASE OF FOREIGN SUPPLIERS.

3. THE VALUE OF THE STAMP DUTY SHOULD BE AS PER LATEST STAMP ACT OF LOCAL STATE GOVERNMENT FROM WHERE THE BANK GUARANTEE ISSUED.